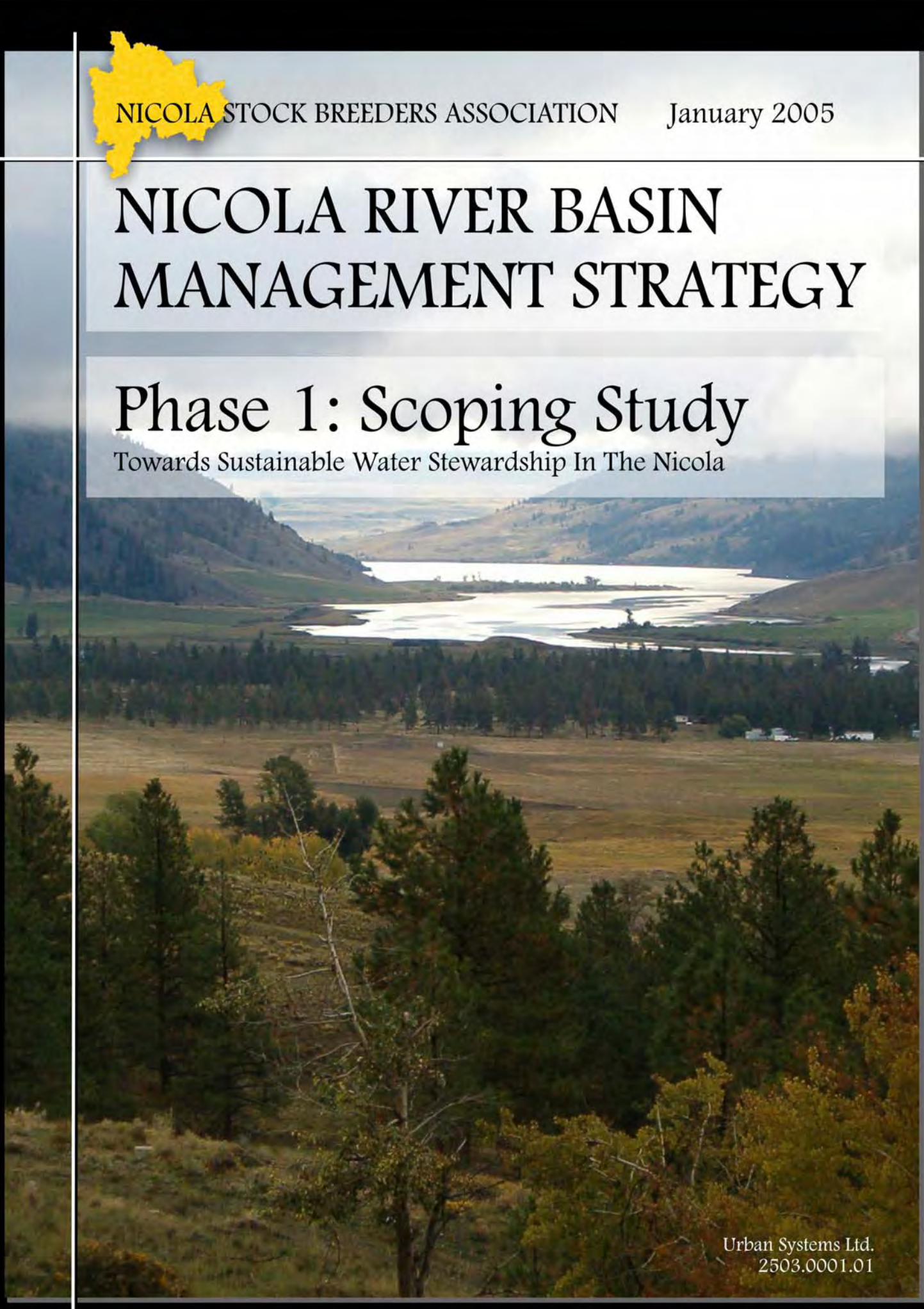
NICOLA STOCK BREEDERS ASSOCIATION January 2005

NICOLA RIVER BASIN MANAGEMENT STRATEGY

Phase 1: Scoping Study

Towards Sustainable Water Stewardship In The Nicola



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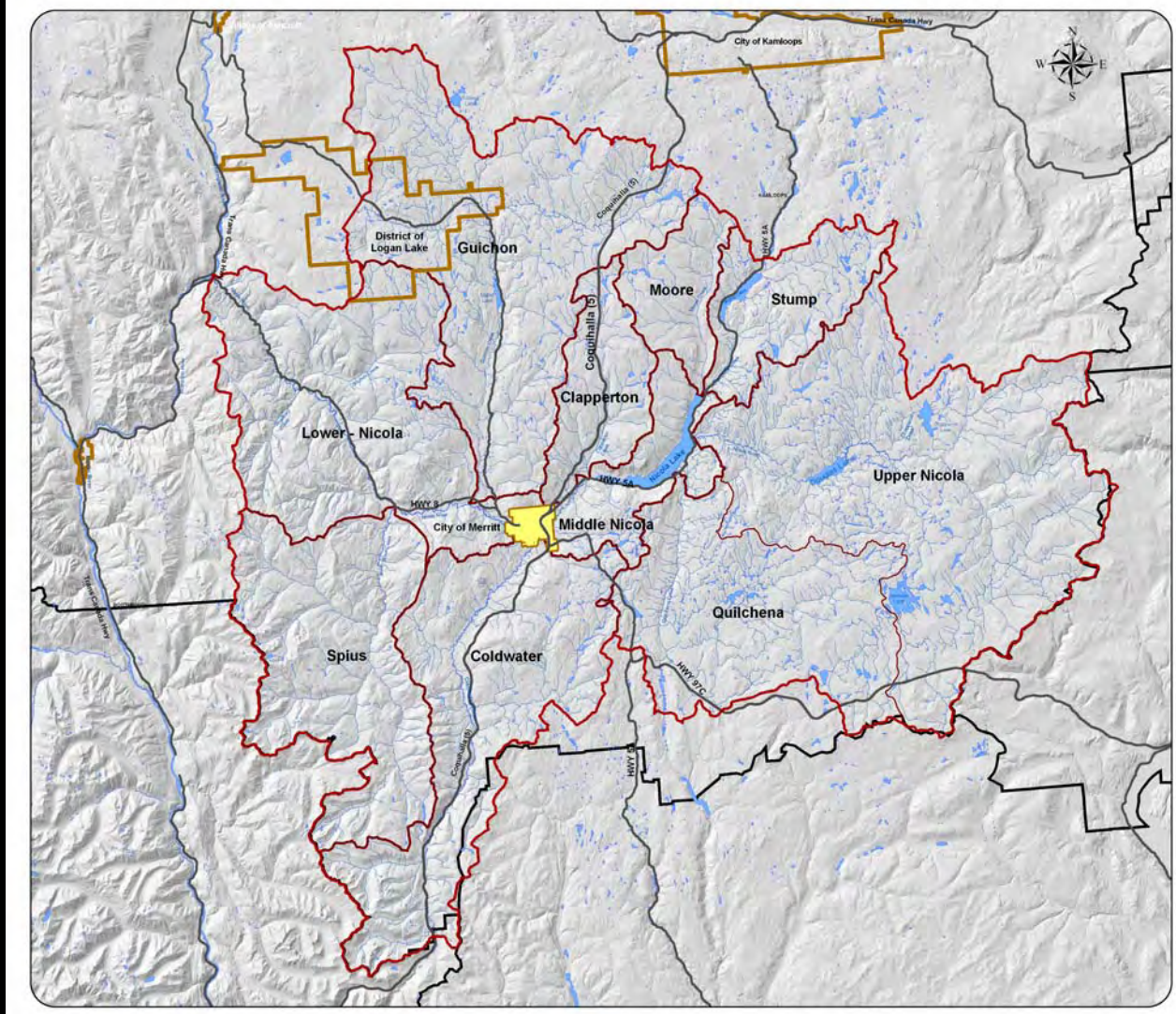

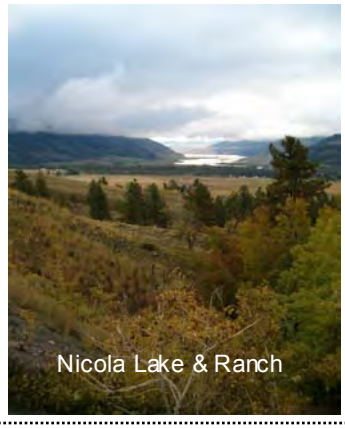

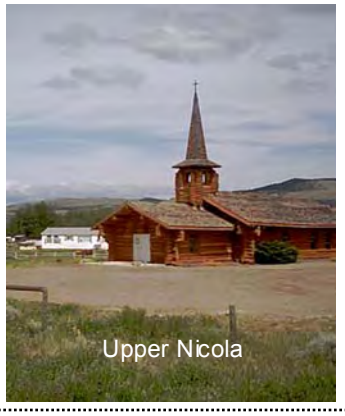

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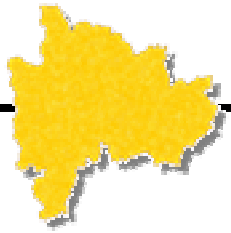


Setting The Stage

The Nicola River Basin, covers an area of approximately 7280 square kilometres (1.8 million acres) in the South Central Interior of British Columbia.

The river basin is mainly comprised of tree covered rolling hills with numerous small lakes. The south-western parts of the basin include the Cascade Mountains that receive reasonably high precipitation which is in stark contrast to the drier north-eastern parts of this river basin.

Extensive grasslands and sparse tree cover exist in the area between the four largest lakes in the basin (namely Nicola Lake, Stump Lake, Douglas Lake and Chapperon Lake) that lie in the upper drier Nicola River area in the eastern highlands.

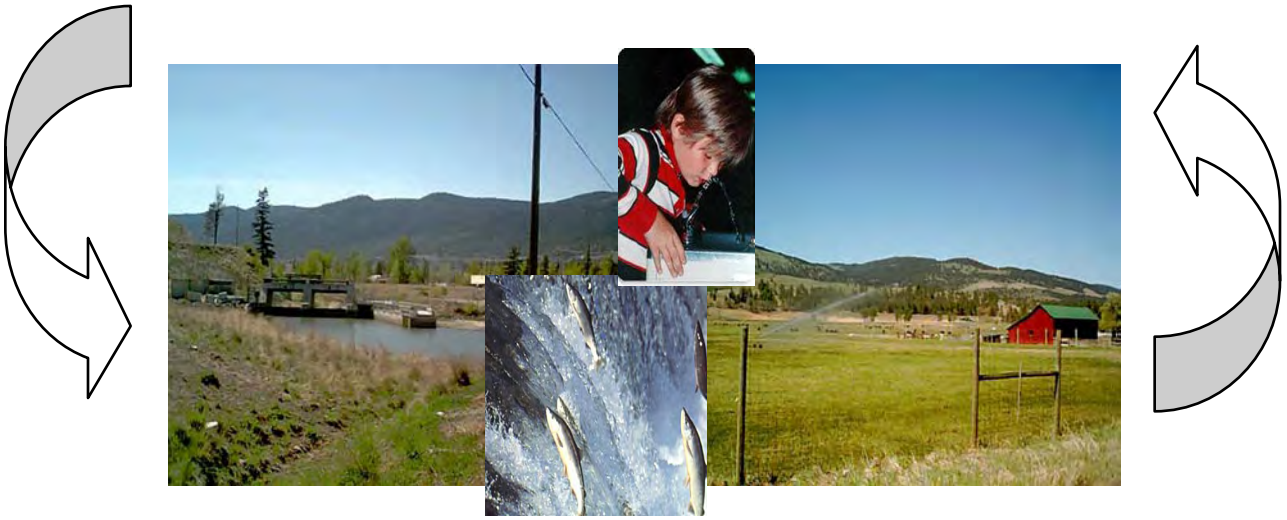
Human habitation is centered in the city of Merritt and the District of Logan Lake with widespread agricultural and First Nation communities that inhabit the river valleys along the Nicola River and its major tributaries. In the year 2000, the permanent population of the Nicola Basin was estimated to be 15,000. Recreation visitors staying at lakeshore and other dwellings throughout this area swell this number significantly during the summer.

The economy of the river basin relies primarily on natural resources. Forestry logging occurs throughout the area with manufacturing activities in Merritt. Agriculture, mainly ranching, focuses its operations (predominantly alfalfa growing) along the various watercourses with extensive summer rangeland cattle grazing taking place in the upland crown lands. Mining is mainly centered in the upper reaches of the Guichon Creek in the north west where one of the largest copper/molybdenum mines in the world is still in operation. Decommissioned mines occur in the vicinity of Merritt.

The Nicola River is one of the biggest tributaries of the Thompson River that in turn flows into the Fraser River. The Nicola stream length is approximately 193 km from its source on the plateau west of Okanagan Lake to where it joins the Lower Thompson River near Spences Bridge.

"Interdependency"

All living organisms are dependant on the environment around them for survival. We need sunlight, a favourable climate, a suitable atmosphere, water, food, shelter and many other communal and social processes to live. Human activity has a major impact on our natural and ecological environment which in turn could have a positive or negative impact on human life. All these interdependencies must be understood so that humans, as stewards of the environment in which we live, can make sound and rational management decisions.



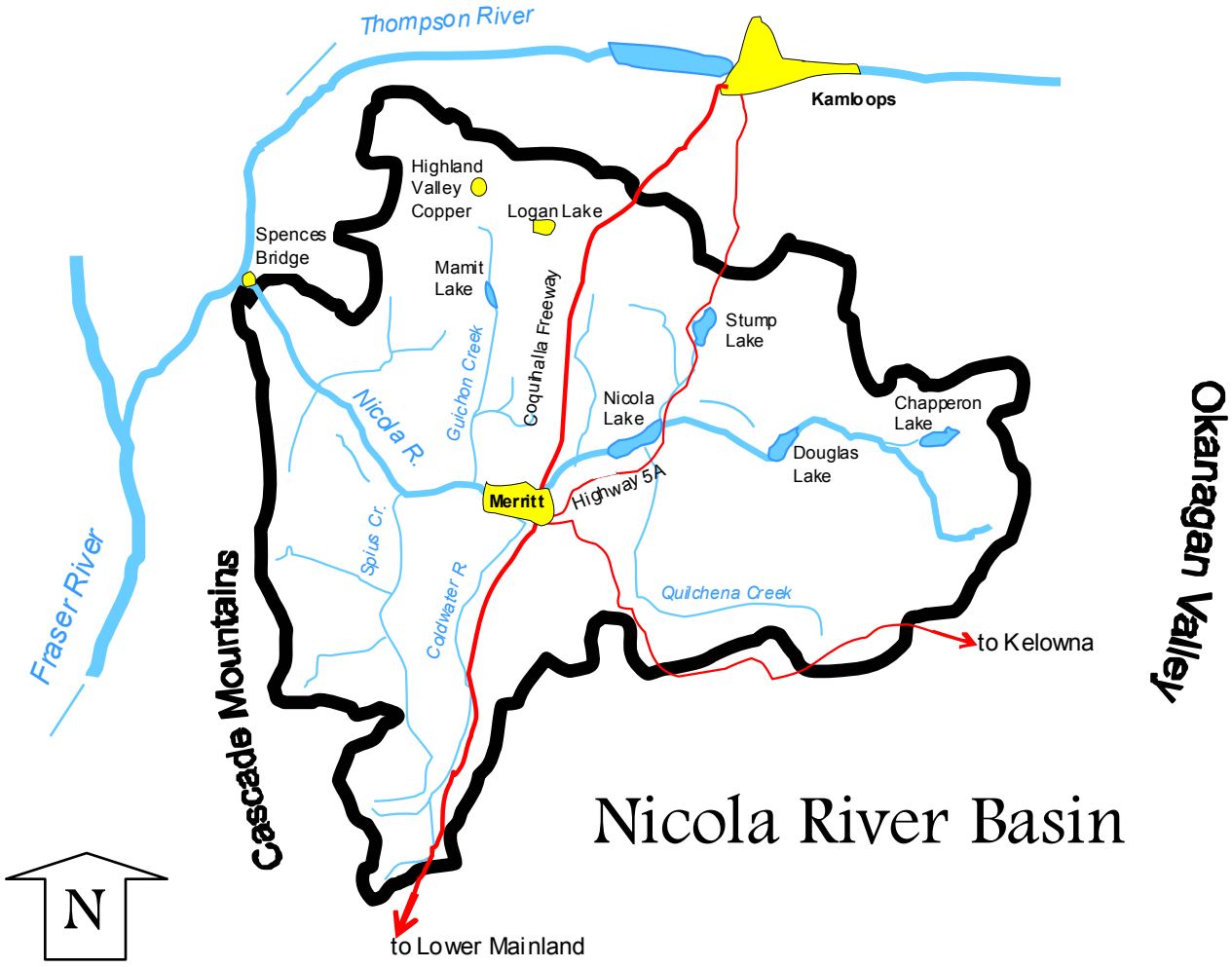
The Nicola, along with its major tributaries (the Coldwater, Clapperton, Guichon and Spius) form an important spawning and rearing ground for marine anadromous (coho, chinook and pink salmon) and other resident species such as kokanee, steelhead and trout.

Annual productivity of this important resource may have decreased due to: riverine habitat degradation; low water levels in dry years; floods in wet years; increases in river water temperature in both the Nicola River System and the Fraser River, and the perception that excessive harvesting of salmon stocks is occurring in the commercial fishery on the coast.

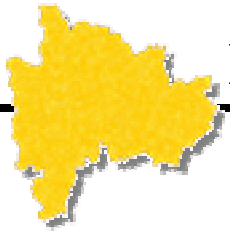
All components of the broader social and natural environment in the Nicola River System require adequate and reliable supplies of water in order to survive.

Conflict between these various water users can be managed if each group and their stewards understand and respect:

- the water needs of natural ecological processes and business activities,
- the values placed on water by each interest group,
- the scientific facts that describe the dynamics of the water system,
- the need to jointly develop optimal water storage, river flow operating rules, habitat maintenance and other water management practices and strategies,
- the need for institutional arrangements that adequately represent water use interest groups in the Nicola Basin, and
- a focussed effort by all parties to develop a water management plan that strives to achieve a balanced water situation in the Nicola Basin.



Process Adopted



'We must learn to respect each others values in life…. round table talks must be encouraged…'

'….we require a secure supply of water in terms of quantity and quality.'

'…we must set sustainable and equitable rules of the water game in the Nicola'

'…we need to envision what we would like to see as the ideal in the River Basin. Let's complete the statement "wouldn't it be great if…" '

Scoping process adopted in this study

- Conducted a public involvement program to inform stakeholders and to encourage participation in future river basin management planning.
- Prepared a broad-brush inventory of existing information related to natural and ecological processes, human activities, water use and water availability, and the water balance in the Nicola River Basin.
- A brief evaluation of this information to distil important water related data, concerns and issues. The identification of knowledge gaps and possible ways forward.
- The Nicola Watershed Community Round Table, which represents all residents and stakeholders in the Nicola River Basin, offered to host a two-day public workshop. The information referred to above was presented to the workshop, issues were raised, visions and objectives set, and discussions held as to how a water management plan should be prepared. 150 delegates attended the first day and 80 the second. First Nations (Nicola Tribal Association) and Agricultural leadership played a major role in calling for commitment from attendees. The workshop budget was set at $20,000.
- Recommendations regarding a course of action to address more in-depth investigations into specific priority issues and water practices with a view to formulating an integrated or sustainable water resource and water use strategic management plan for the Nicola River Basin. The whole scoping study budget was $29,000.

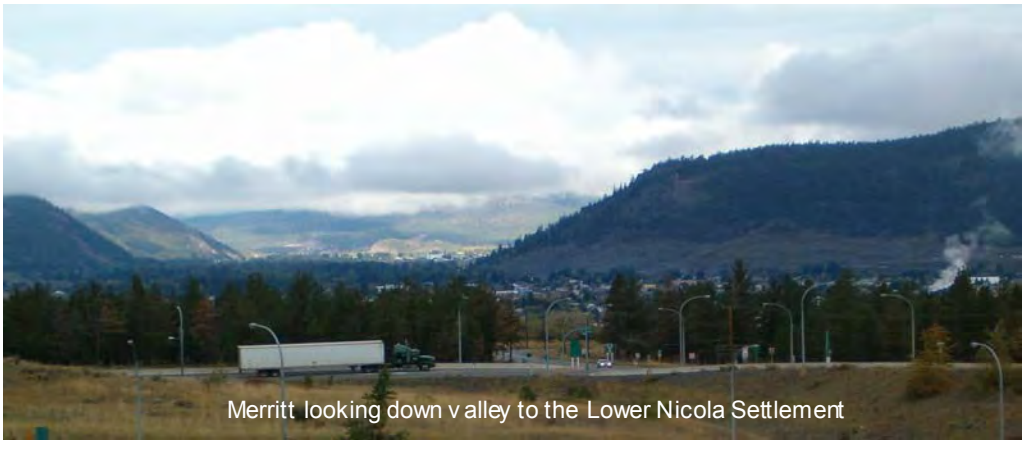
Public involvement is incredibly important to achieve the goals described above. With this in view, the Nicola Stock Breeders Association commissioned the firm Urban Systems Ltd. to conduct a brief scoping study to "put the facts on the table" and to focus scarce resources on priority issues that need to be addressed in the future in order to achieve a sustainable and equitable Water Management Strategy in the Nicola River Basin. This report is the main deliverable of the scoping study.

In order to promote public participation in this process, the Nicola Watershed Community Round Table hosted a workshop in October 2004 entitled "Charting our Water Future" to embark on the process of setting and implementing a roadmap strategy towards developing a Nicola River Basin Management Plan.

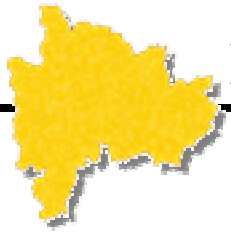
The following organizations have actively participated in the scoping study/workshop:

- Various individual residents of the Nicola River Basin and environs
- Aspen Planners, Merritt
- BC Federation of Flyfishers, Vancouver
- BC Rivers Consulting, Kamloops
- Canada-BC Water Supply Expansion Program, Kamloops/Dawson Creek
- Fisheries and Oceans Canada, Kamloops
- Doyle Engineering, Kamloops
- Ducks Unlimited, Kamloops
- Dump the Dump Coalition, Logan Lake
- Fraser Basin Council
- GGEM Consultants, Merritt
- Highland Valley Copper, Logan Lake
- Individual First Nations Resource Committees and Leadership via the Nicola Tribal Association
- Interior Health Authority
- Kala Groundwater Consulting Ltd., Kamloops
- Land and Water BC, Kamloops
- Mayor and Officials of the District of Logan Lake
- Mayor and Officials of the City of Merritt
- Merritt Herald Newspaper
- Ministry of Agriculture, Food & Fisheries
- Ministry of Forests
- Ministry of Sustainable Resource Management
- Ministry of Water, Land and Air Protection
- MLA for Yale-Lillooet
- Nicola Stock Breeders Association
- Nicola Tribal Association
- Nicola Valley Institute of Technology
- Nicola Watershed Community Round Table
- Nicola Watershed Stewardship & Fisheries
- Pacific Salmon Foundation, Vancouver
- Thompson Nicola Community Futures
- Thompson Nicola Regional District
- Thompson Rivers University, Kamloops
- Urban Systems Ltd., Kamloops

Due to the limited scope of the study, it was impossible to adequately consult all stakeholders, but it is hoped that the follow-up meetings to the public workshop will provide suitable opportunities.



Merritt looking down valley to the Lower Nicola Settlement



Natural Processes at Work in the River Basin

Physiography and Geology

The topography of the Nicola River Basin can be described as part of the Southern British Columbia interior plateau made up of rolling hills with deep alluvial valleys. The dominant features from a human and fish point of view are the valleys of the Nicola River and its major tributaries which include the Douglas and the Nicola Lakes. Also of importance from a water production perspective are the high lying Cascade Mountains in the south-western parts of the River Basin. The topographical and geographical mix that exists plays a major role in how the water cycle plays out in the Nicola Basin.

The plateau and higher lying areas contain a great geological diversity: granite rocks intrude through sedimentary and volcanic formations of the Palaeozoic age (about 300 million years ago). Flat-lying or gently dipping early Tertiary (Eocene – about 40 million years) lavas obscure large areas of older rocks. The so-called volcanic "red rocks" are associated with groundwater sources in the Nicola River Basin.

The basin was covered by Pleistocene ice. Sudden climate flips between warm and colder periods occurred throughout the last ice age – from about 70,000 to 11,500 years ago. At the height of these glaciations, vast ice sheets blanketed much of North America. Periodically the ice melted, then advanced again, until the final melting - the event that marks the beginning of the modern warm epoch known as the Holocene (less than 10,000 years).

Evidence of this ice age can be seen in the thick mantle of glacial till material that is found in this river basin. These deposits are deepest in the valley areas and tend to contain important groundwater aquifers.

The irregular melting of stagnant ice lobes in the larger valleys created numerous glacial lakes into which silt-laden streams discharged.

Many of the existing lakes are remnants of these features. Other lakes have been created more recently by damming of streams.

The soils in the river basin have developed from five major types of parent materials:

Morainal deposits are dominant in the area blanketing moderate slopes above the valleys. These soils tend to be stony and occasionally clayey.

Colluvial materials are products of mass wastage, found on steeper slopes and are usually very pervious.

Fluvial materials lie in all major valley bottoms and bench lands / terraces that are remnants of higher lying old valley bottoms. The main flood plains are limited to the Nicola and Coldwater confluence and area around Douglas Lake. Agriculture utilizes these areas.

Lactustrine soils occur on terraces south and north-east of Merritt and in the Quilchena Creek Valley south of Nicola Lake. These formed where old glacial lakes have dried up.

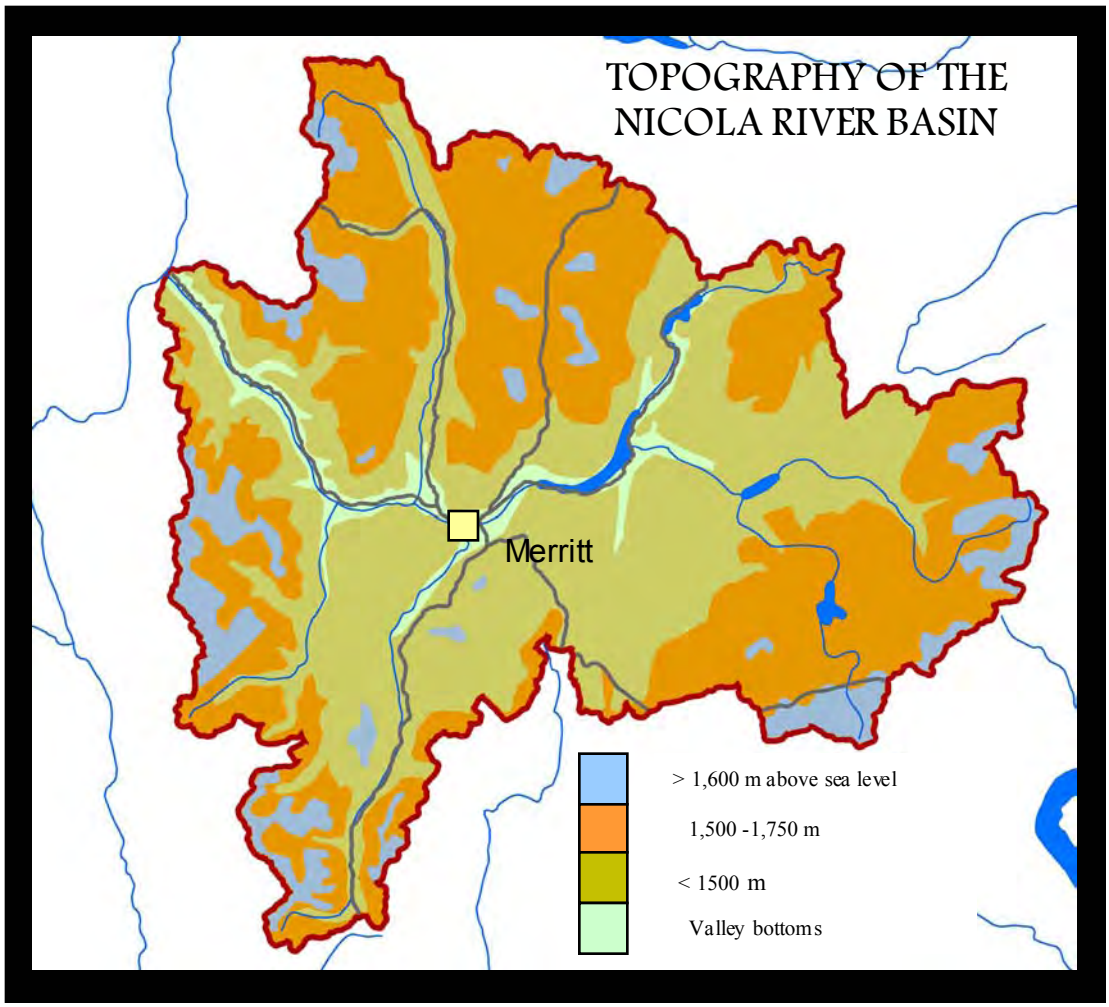
There are small localized pockets of ***organic soils*** near lakes and in hollows and depressions which are believed to provide important habitat for waterfowl.

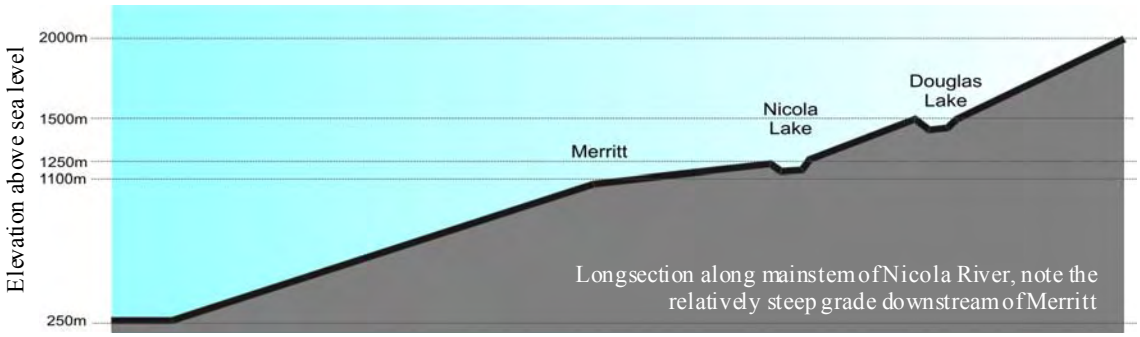
Some Groundwater Issues:

Most of the drilled wells in the Nicola River Basin are located in the river valleys. It is believed that some of these wells, especially those located directly adjacent to the main river course, are in fact extracting river water. The relationship between ground and surface water needs to be better understood and regulations need to be introduced that encourage wise and sustainable use of our groundwater resources.

Stakeholders have requested that maps be prepared which indicate the location of all aquifers in the basin.

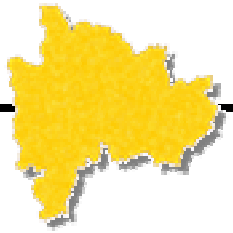
Aquifers are sensitive to pollution, which in some cases may render these important sources of water useless for many generations. Wise use of land must be practiced, especially in the areas surrounding important or sensitive aquifers. The City of Merritt continues to study and monitor its primary aquifers in and around the City.





Further reading and information:

- Bedrock Geology: Nicola (GSC Map No. 856A) and Ashcroft (GSC Map No. 1010A); reports by Cockfield (1948) and Duffell and McTaggart (1952); see Bibliography at the end of this report
- Surficial Geology: Merritt (GSC Map No. 1393A and GSC Map No. 1392A); report by Fulton (1975)



Climate Facts

Since ground level elevations in the Nicola Basin vary from around 230 m to 2,300 m, a broad range of climates occur. Low elevation areas on the lee side of the Cascade Mountains are dry (precipitation between 200 to 300 mm per annum) with hot summers and cool winters, whereas higher elevations are relatively wet (upwards of 400 mm per annum) and cool in all seasons. Continental air tends to predominate on the plateau areas, resulting in hot summers and cool winters. In the valleys, daytime temperatures of more than 16ºC are common for five months of the year and periods of hot weather with temperatures in excess of 32ºC are frequent during July and August. This usually corresponds with low rainfall, high evaporation rates, and low river flows that places stress on the natural riverine ecology and on agricultural crops due to large moisture deficits. Occasionally in winter, Arctic air enters the area bringing clear skies and cold temperatures, sometimes as low as -35ºC. Frost free periods range between 110-120 days in the Nicola Valley while growing degree days vary between 1500 and 1700. In the higher lying areas and in the Coldwater River Valley these values are about 10 to 20 percent lower.

Snow depths increase with elevation and have a significant influence on the potential supply of water in the Nicola River Basin. Generally, the largest snow packs and therefore water yields occur in the Spius Creek and Coldwater River, draining the Cascade Mountains. Lesser snow packs occur in the Guichon and Upper Nicola sub-basins. Snow accumulations of more than 40 cm (16 inches) per annum are rare at lower elevations.

Further issues raised by stakeholders:

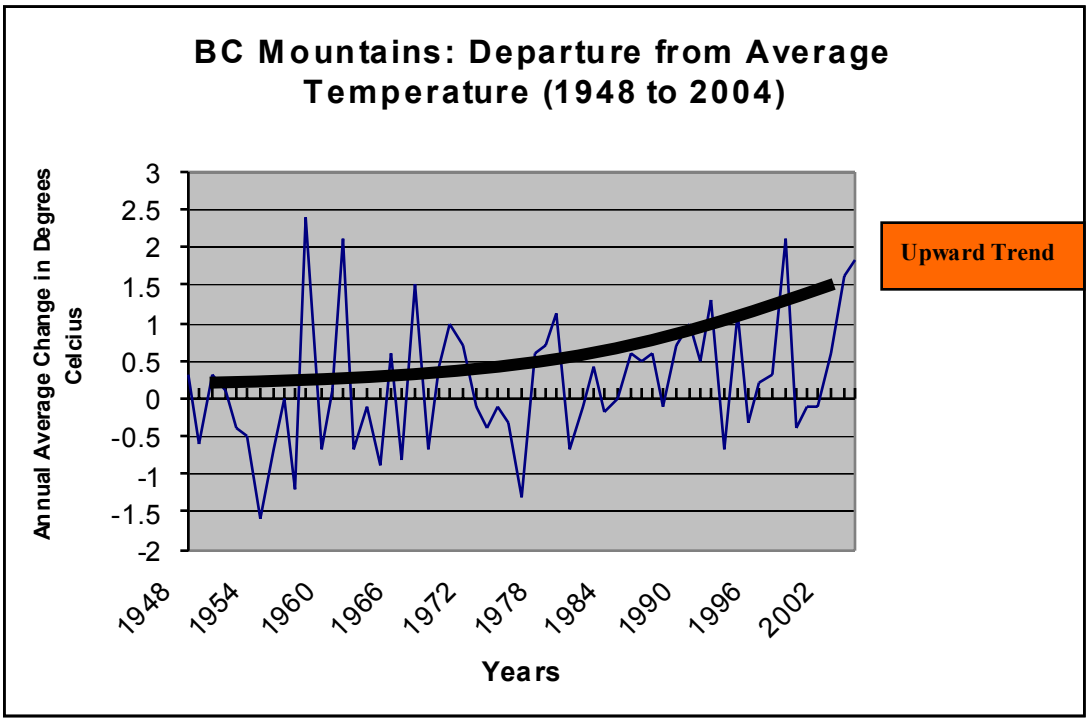
Climate change has been blamed for higher average temperatures, less rainfall and thinner snow packs.

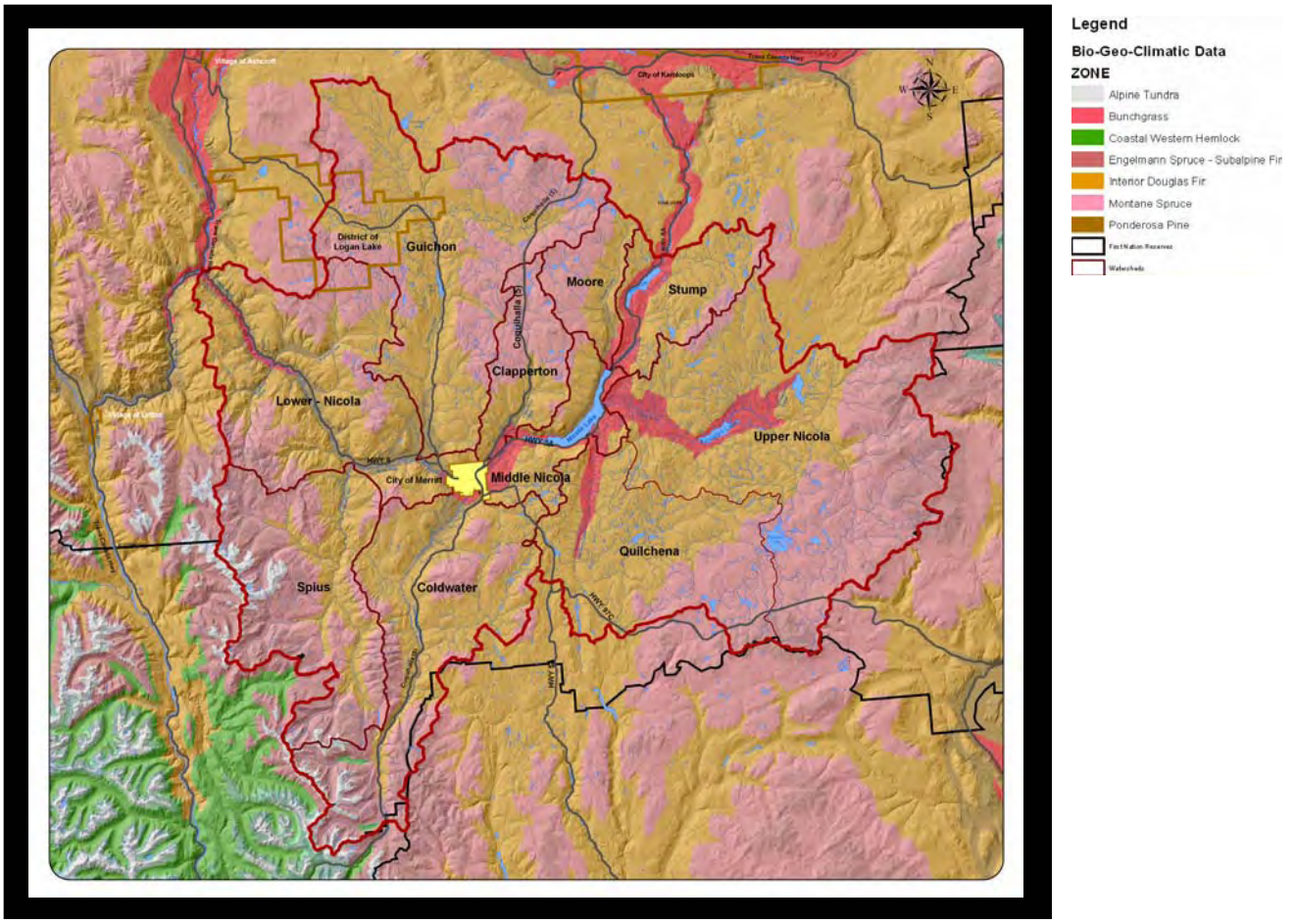
Further reading: National Geographic September 2004 Edition www.nationalgeographic.com\magazine\0409

Government of Canada website: www.climatechange.gc.ca

Dendrochronology and historic climate change: www.sonic.net/bristlecone/dendro.html

www.office.geog.uvic.ca/dept/uvtrl/uvtrl.htm





Vegetation

The climate and soils of this area have resulted in a high percentage of the landscape forming as grasslands and open forest parklands. Bunchgrass and grass-like species dominate the lower elevations of this area as they have adapted to survive in hot, dry climates with low precipitation. Cottonwood forests exist along the river courses and the open park-like forests have few widely spaced tree species such as the Ponderosa Pine and Douglas Fir.

The Ponderosa Pine (PP) zone (19% of basin) occupies the valleys below 360 m in elevation. The Interior Douglas Fir (IDF) zone lies between 360 m and 1000 m and constitutes about 33% of the land area. Above the zone (1000 m to tree line at around 1900 m) the Montane Spruce (MS) zone (45% of river basin) exists which gives way to the open meadows of the Alpine Tundra (AT) zone (3%).

Issue: How are human activities (forestry, agriculture, urbanization) and natural and ecological processes (beetle kill, climate change) affecting vegetation? What is the status of invasive alien vegetation and what is its affect on water resources? What do we want to see in the future? Apply Holistic Resource Management principles.

References: Grasslands Conservation Council of BC Website: www.bcgrasslands.org

Biodiversity Law and Policies in BC: www.wcel.org.wcelpub/10986.html

Ecological Processes

The water cycle plays a pivotal role in ecological processes. Since all life is interconnected, people in the Nicola basin rely on organisms lower down in the food chain (especially plants and animals) for their existence. Personal well-being could be affected if the environment in which we live is altered significantly. For example, if we over-extract water from ground wells, we may place our own livelihoods and the lives of various creatures in the natural environment at risk.

Due to the limited nature of this study, it has not been possible to investigate and present information on the whole ecosystem. Instead, focus has been placed on its main components which are related to water management.

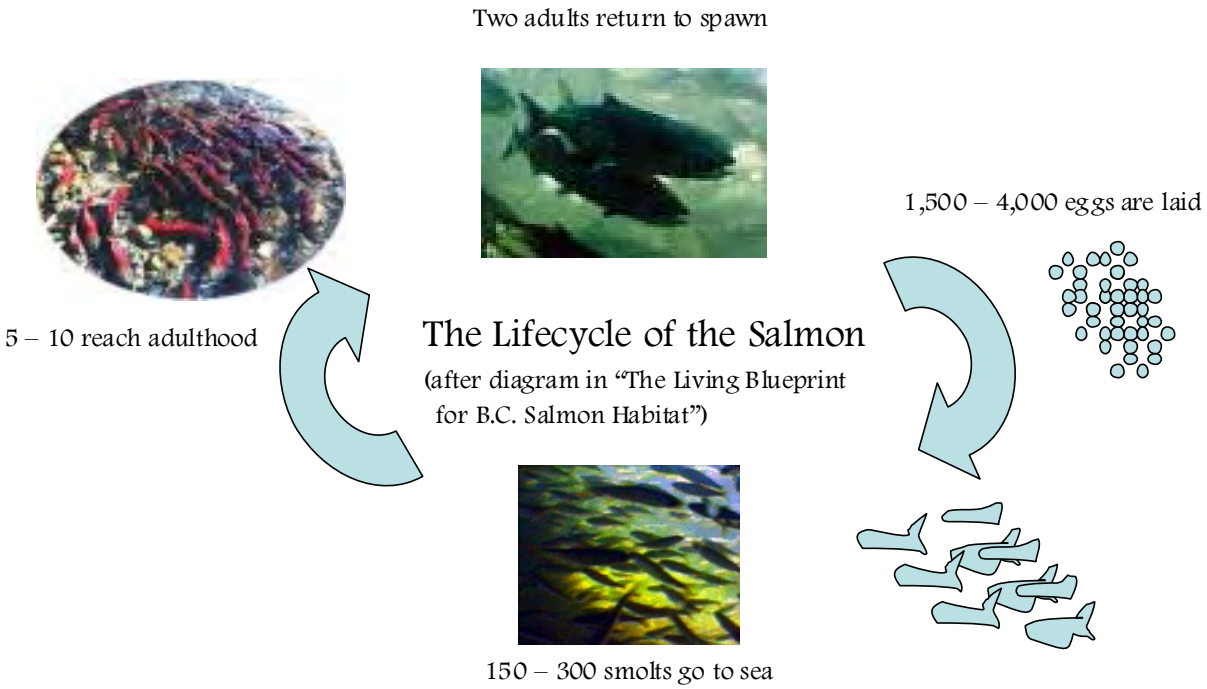
Anadromous Fisheries Management

The Nicola River Basin contains valuable stocks of both anadromous fish (coho, pink and chinook and steelhead) and resident sport fish (rainbow and brook trout, mountain white fish, burbot, kokanee and bull trout). There is a high existing and potential demand for both types of fisheries and considerable potential to restore and enhance these fisheries.

Put in a simplified way, these fish need the following conditions to survive and thrive:

- Better recruitment of spawners returning from the ocean.
- Optimal water resource maintenance flows and levels during critical spawning, rearing and incubation periods (water levels must cover eggs in rivers and lakes must remain covered; artificial floods limited to prevent scouring out of eggs).
- Water temperatures must remain within suitable ranges if the eggs and fish are to survive (climate change, removal of riparian trees and reduction of cold groundwater flow contributions to base flow, all have been cited as possible causes of water temperature increases in recent years).
- Major fluctuations in the lake levels to be avoided at certain times of the year.
- Water quality (particularly nutrient enrichment of river and lake waters) should be kept at suitable levels.
- Irrigation ditches and fish screens to extraction pumps must be maintained to limit fish kills.
- Riparian habitat must be protected.

In other words a sound balance must be kept between hydrology, geomorphology, biology, water temperatures and connectivity between the various elements of the river and riverbanks.



The following information has been gleaned from Fisheries and Oceans Canada publications including the 1982 Kosakoski and Hamilton report which deals with the water requirements for the fisheries resource in the Nicola River.

Pink salmon only spawn in the Nicola River mainstem below Spius Creek during odd numbered years. The number of spawners reported from the Nicola between 1957 and 1989 varied from a low of 216 fish in 1961 to a high of 6,853 in 1975. Although pink salmon stocks have been increasing in the Fraser River Basin as a whole, little is known about the Nicola River population.

Chinook salmon spawn mostly in the mainstem of the Nicola River, but also far up the Coldwater River and Spius Creek. Small numbers spawn in other tributaries (e.g. Guichon Creek). When averaged by 4-year periods, chinook salmon escapement in the Nicola basin dropped steadily from about 9,400 (in 1951 – 1953) to 2,900 (in 1966 – 1969). The population size then increased gradually to about 5,000 (between 1982 and 1993). Escapement was greater than 8,000 every year from 1994 through 1997. A record escapement of 17,800 occurred in 1996. However, escapement decreased sharply to 1,200 fish in 1998. The Spius Creek Fish Hatchery has helped to maintain (and perhaps increase) the size of chinook and coho populations in the Nicola River Basin.

Coho spawn most abundantly in the Coldwater River and Spius Creek, with smaller numbers in other tributaries and almost none in the mainstem of the Nicola. Escapement numbers declined steadily from an average of 4,000 per annum (from 1951 – 1953) to 400 (from 1982 – 1985). This pattern of decline persisted despite occasional peak years between 1966 and 1969 when the population size was greater than 4,000. Since 1985, escapement has increased again (average 2,000 – 4,000) but much of this increase is probably a result of hatchery enhancement.

Although there have been slight increases, and more recently, reductions in salmon production in the Nicola River Basin over the past 20 years, these levels remain below the actual potential production levels.




The Thompson Steelhead (now classified as a trout) is one of the most threatened fish species in the Nicola River system. Escapement numbers ranged from 549 (in 1992) to 3,284 (in 1985). The escapement of only 556 fish in 2000 is well below the potential adult population in this river basin (estimated potential around 24,000).

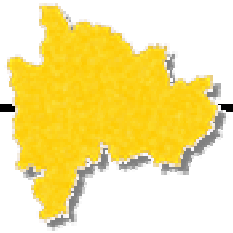
The Thompson Steelhead is known for their persistence. Unlike salmon, many live to spawn a second or third time. They fatten themselves in marine waters off Alaska before once again journeying towards the Fraser River and their distant spawning grounds.

Over the generations, the Steelhead has helped sustain aboriginal communities on the lower Thompson and Nicola Rivers who have fished salmon in winter as a rare fresh source of food. Diminishing steelhead numbers are threatening these traditional rights.

From a sport fishing point of view, anglers are drawn to the Spences Bridge area by the Steelhead run in summer. Although this fishery is now based on catch and release only, this financial income is critical to the economy of the Spences Bridge community.

Management of these anadromous fishery resources described above needs active participation of local stakeholders and government officials to ensure that optimum habitat conditions (water quality and quantity, temperature, riparian vegetation, stream widths), stock quality, stringent limitations in coastal and other fishery interceptions are understood, monitored and enforced. Similar studies to the Coldwater River Recovery Plan are recommended for the other sub-basins in the Nicola River Basin.

Since conservation and environmental stewardship is everyone's responsibility, it is believed that the Nicola River Basin Community should actively participate in developing solutions that provide all water users (including natural fish resources) with reliable and equitable supplies of water. Water requirements for fish and river system operating rules are discussed below in the "water use" section.



1. Timing (Arrival & Spawning of Anadromous Fish Species)

	Arrival	Start	Peak	End
Chinook	July	Early Aug.	Mid Sept.	End Sept.
Coho	Sept.	End Sept.	Late Oct.	Early Nov.
Pink (odd years)	Sept.	Late Sept.	Early Oct.	Late Oct.
Steelhead	April	Early May	Mid May	Early June

2. Timing (Emergence, Rearing, Migration of Anadromous Fish Species)

	Fry emerge	Rearing period	Smolts migrate to sea	Adults return after x years
Chinook	April	1 year	April	4
Coho	May	1 year	April	3-4
Pink	April	1-2 months	May	?
Steelhead	July-August	2-3 years	April-May	2

The 1983 "Nicola Basin Strategic Plan" published by the then BC Ministry of Environment provides a very comprehensive overview of instream flow requirements and other life cycle data for fish in the Nicola Basin. Updated studies and monitoring have been conducted in the interim. This information and any follow-up investigation should be incorporated into an updated document that can serve as a reference document for stakeholders and water resource managers in the Nicola. Other sources of information on anadromous fish species can be gleaned from the following websites:

- Pacific Salmon Foundation: www.psf.ca;
- Fisheries and Oceans Canada: www.pac.dfo-mpo.gc.ca
- FishWizard provides users with a graphical display of recent information about BC lakes and streams and the status of fish in these water bodies: www.pisces.env.gov.bc.ca

Resident Fisheries

The Nicola Basin is one of the major angling centres in the province. This is a result of the easy access from Kamloops and the Lower Mainland and the fact that a large portion of the numerous lakes (approximately 140 fishing lakes in the Nicola alone) are well managed and stocked annually. Unusual variety is available as anglers can fish trophy lakes, wilderness waters or popular resort areas all within close proximity to each other.

The factors that potentially limit production of sport fish in this river basin include:

- Few of the lakes are capable of being self-supporting and stocking is required.
- Water resource competition by various legitimate uses. In dry years, the amount of water extracted from the rivers and streams for irrigation, together with low seasonal flows, leaves insufficient quantities for fish spawning and rearing. Fluctuation of lake levels can also adversely affect fish production.
- Biological competition – some lakes are heavily populated with coarse fish which have little or no recreational or commercial value. These fish affect the recreational species and their habitat through competition for food or by predation. First Nations people also utilize these fish species.
- Oxygen deprivation – winter or summer kill are problems in the shallower lakes.
- Removal of vegetation and soil cover by forestry, mining, agriculture and lakeshore housing and development cause changes in the timing, extent and quality of natural runoff which can impact aquatic life.
- Overfishing can limit the fish population in the longer term.

It is expected that the number of angler days will continue to increase as more and more people move into the area. Management options and rules of the game will need to be crystallized, made known publicly and enforced between sport fishing, salmon recoveries and ecological integrity.

Other Issues:

- What fish populations are we aiming to achieve? How does income from these resident fisheries compare with other competing uses of water?
- Will original fish runs and die-offs create water quality problems for other fish (recreation) and other water uses?

Habitat For Birds

The Nicola River Basin is home to about 115 different species of birds including migratory birds. The numerous lakes that dot the basin (some man-made for storage as well as creating habitat for waterfowl) and vegetation zones (e.g. grasslands) are extremely important for survival of birds. Good co-operation and management between wildlife authorities, ranchers and recreational wildfowl hunters could lead to proactive creation of new and increased lake storage that would result in win-win solutions. Please refer to the excellent work being conducted by Ducks Unlimited at www.ducks.ca/province/bc.

Food Source For Animals

The grassland ecosystem provides valuable forage for grazing species of moose and deer species. This ecosystem is also of high value for grazing of domestic animals, which has lead to the establishment of the cattle industry as a key economic sector in the Nicola River Basin.

Grasslands & ravine areas also provide food and habitat for smaller mammals such as gophers, mice and marmots as well as many species of reptile and amphibians. Cultivated lands and competition for food sources may be concentrating these animals in certain areas which may be disturbing the natural vegetation balance (e.g. the riparian zone along main watercourses).

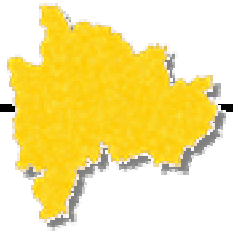
It is common knowledge that the activities of beavers impact on the runoff hydrology. On the one hand their tree felling activities may stabilize stream flow (e.g. slow flow down), prevent stream bed erosion, and create fish habitat. On the other hand, beaver's activities may cause flooding when their dams break and so affecting infrastructure, human activities and fish habitat. A management strategy in this regard will need to be formulated.

Some stakeholders have suggested that beaver dams be emulated (e.g. stable dam walls built) in the upper river basin areas to hold back water for a slower release down through the system. This possibility and other snow harvesting methods could be considered in order to re-establish equilibrium between nature's requirements and human water use.

Food Source For People

As mentioned above, the Nicola River Basin is home to a wide assemblage of plant and animal species. Historically, First Nations communities have made their entire living on the products of the natural environment including fish and animals as a primary food source. Traditional wisdom has pointed to the dire need to protect our environment in order to sustain all forms of life, especially human life for many generations to come.

Gathering of vegetative food sources is still practiced by many aboriginal and non-aboriginal people in the Nicola. Berries and mushrooms are the most commonly utilized foods. Forestry and agricultural practices may affect the abundance and availability of these food sources.



Water is cardinal to modern day agriculture in the Nicola which produces food for the growing urban population which is becoming almost entirely dependent on these and more so on other food sources throughout North America. Conservation of agricultural land and reliable supplies of water are required to ensure local food security, especially if food production elsewhere collapses due to disease, drought and other threatening factors.

Human Activities

One of the best initial overviews of the history of human habitation in the Nicola River Basin has been published in a book entitled "Merritt and the Nicola Valley: An Illustrated History" by the Nicola Valley Museum Archives Association. Photographs in this book as well as many more in the archives provide an interesting perspective regarding human activities as well as indications of historical vegetation cover and landscapes that may be seen in the backgrounds of certain photographs.

It is believed that some interesting historical information can be gleaned from the old photographs showing river scenes, water infrastructure development and fishing activities. A special effort will also need to be made to record the vast knowledge base that rests with a number of long time residents of the area. Their information and wisdom could prove to be invaluable when making water resource management decisions in the future.

This report is not intended to provide a detailed dissertation on human factors at work in the Nicola Basin but will rather highlight a few issues that have relevance to the water resources and water use in the area.

Forestry

The forest industry here utilizes Douglas fir, Lodgepole pine and Spruce species. Forest productivity is generally moderate due to moisture deficiency and poor soils. Pockets of higher productivity forest do occur on certain north-facing slopes in the Coldwater and Quilchena sub-basins.

Beetle kill is having a major impact on the local forests and cutting licences have been extended for larger quotas. Ranchers have also been allowed to continue harvesting their allocated woodlots, which has brought some welcome financial relief *in lieu* of the closed border / BSE crises that is ravaging the BC cattle industry.

The effect of clear cutting and removal of forest cut remnants on water runoff hydrology has been cited as an issue. The Ministry of Forests is currently studying this issue in the Okanagan basin. Preliminary indications show an increase in runoff in clearcut areas. The opposite phenomenon has been noticed once trees have been planted in much denser numbers.

Further issues:

How do the various vegetation forms in the Nicola River Basin affect runoff, infiltration and evapotranspiration?

What happens when vegetation is removed (harvesting, fire, disease)? For example, 75% of the forest cover in the Clapperton Creek is expected to be cut in the next few years due to beetle kill.

Forests along the Coldwater River

Most forestry companies in the Nicola River Basin have been very proactive in adopting sound environmental stewardship practices. This includes: road maintenance and road deactivation in order to limit erosion and siltation, conserving the riparian zone along streams and creeks, conducting numerous hydrological and other water related studies. This information should be collated and presented to the Nicola Watershed Community Round Table.

Agriculture

The agricultural economy in the Nicola River Basin is based on extensive ranching with beef cattle. Douglas Lake Cattle Company, one of the largest ranching operations in North America, is located in the Upper Nicola River Basin. This sector utilizes the upland forest areas and open grasslands for summer pasture with winter feed produced from alfalfa, oats and other hay grown during the summer on the lower lying valley areas.

It is this forage production that constitutes the largest offstream use of water in the Nicola River Basin. It must, however be noted that irrigation water is only drawn between the months of April to September each year. During the early part of this spring and summer growing season, snowmelt runoff (the freshet) usually provides sufficient water to adequately meet the needs of all offstream and instream water users in the system.

The opposite applies during the latter part of this season between July and September. Reduced run-of-river flows during this period become quite critical for both fish and irrigation requirements. Storage in the Nicola Lake is then called on to supplement these water requirements along the mainstem of the Nicola Lake. Most of the tributaries which do not have significant storage units experience serious low flow conditions during dry climatic years.

Apart from the competition for this scarce resource, this phenomenon has placed a constraint in agricultural expansion. This industry, as with other economic sectors in the Nicola, require some form of certainty with regard to its water supplies and water storage options.

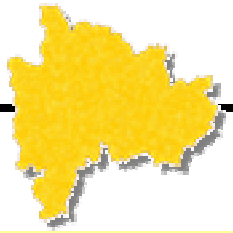
Some ranchers in the Nicola and Coldwater have been working with the Nicola River Watershed Stewardship and Fisheries Authority, and the Pacific Salmon Foundation to rehabilitate riparian zones (e.g. tree cover, river bank stabilization, fish screens at pump intakes). The benefits to agriculture are also being demonstrated in these projects.


Irrigation in Lower Nicola area

Another initiative by Ministry of Agriculture, Food and Fisheries and the Fraser Basin Council is that they have recently started investigating the possibility of establishing meteorological stations in the Nicola that will assist ranchers with irrigation scheduling (e.g. www.farmwest.com). The use of these methods (including soil moisture levels) and other water conservation methods (curbing water losses in infrastructure; part/early season water licences to use stream flows earlier in the season; alternative cropping patterns) could create significant water saving opportunities.

The issue of actual water use versus that allocated has also been placed under the spotlight (this is discussed below in the “water use” section).

Some concern is being expressed over the subdivision of ranches, especially around lakes, to take advantage of the growing demand for recreational properties and hobby farms. The attraction of large economic ranching units combined with unfavourable external agricultural market forces could have a major negative impact on the future of ranching in the area. The impacts of those projected settlement patterns on agricultural resources and consequently on the water resources of the Nicola Basin could be significant (e.g. overgrazing, weed control and water quality concerns).



Other issues (agriculture):

- The real impact of cattle on the riparian zone and water quality issues associated with cattle feedlots needs to be given attention in a future water management plan.
- Initiatives by organization (e.g. Ducks Unlimited) that promote off stream livestock watering works (i.e. to conserve riparian habitat and curb soil erosion by keeping cattle away from vegetation on river banks), are hindered by current water policy. River abstraction licences are usually fully subscribed and reallocation of this water to these projects would result in a loss of precedence in the realm of the water licencing "grand fathering" regime. These policies would have to be amended slightly in order to facilitate these types of conservation works.
- Numerous lakes have been created and developed for agricultural purposes over the past 100 years or so. The opportunity exists whereby certain of these and other natural lakes can be raised slightly to accommodate more storage. This could benefit agriculture and river low flows by holding back more water to release later in the season, and if selected properly could benefit wild fowl, fishing and hunting activities in the Nicola. Sufficient information exists to put together a management overview of these opportunities.
- The Nicola Lake Dam completion (i.e. access to water in the Nicola Lake that is being held back by a high point in the outlet channel) would make a significant volume of water available to create a reliable supply of water for agriculture and stream flow in the mainstem Nicola River. This option is discussed in more detail later on in this report.
- Over-extraction of groundwater from wells may be having an adverse effect on agriculture and the natural environment. This issue and the linkage between surface and groundwater must be better understood.
- Water management policy could be reviewed to allow producers the opportunity to decide which lands to irrigate. In other words, licences could stipulate peak withdrawal rates and annual allowable use. Part season licensing could be granted to optimize use of stream flows earlier when peak flows occur.
- Can reclaimed water be used in the Nicola Basin?
- The impact of the use of "biosolids" (solid by-product from sewage treatment as a means of crop fertilization) on agricultural fields is being tested at certain spots in the Nicola Basin.

The real issue is that there is currently not enough water to go around in the low flow period (July to September) especially during lower than average rainfall/snowfall years. Solutions need to be found!

Mining

An adequate and reliable supply of water is fundamental for successful mining operations.

Several small underground and open pit copper mines operated periodically in the Upper Guichon Creek area over the past 100 years. The most significant operation is where four of these mining companies amalgamated in the mid-1980's to form the current Highland Valley Copper Mine. Output from the mine in 2003 totalled 170,400 tons of copper and 3,312 tons of molybdenum in concentrate form from 49 megatons of ore mined.

The main uses of water at the mine are in the: mills which grind a total of 5,400 tons per hour; flotation processes to separate copper bearing minerals; and tailings transportation (i.e. moving waste to tailings dams).

Highland Valley Copper utilizes two times the volume of water required by a City the size of Kamloops (81,000 people). About 20% of this daily water use on the mine is retained in the tailings and finds its way back into the groundwater. The other 80% is recycled and reused in the milling process. The loss of water is supplemented from surface runoff, from Witches Brook, the Valley Pit groundwater wells, and Highmount Creek.

Interestingly enough, basal aquifer dewatering on the mine has recently proved to yield less water than originally envisaged. This has led to the mine recommissioning the Spatsum Pump Station in order to start pulling water from the Lower Thompson River to supplement process water.

Some residents of the Nicola River Basin believe that dewatering of these enormous open cast mining pits could have had a significant impact on ground and surface water in the Upper Guichon Creek area. An environmental impact study on water releases or lack thereof to

the Witches Brook, a tributary of the Guichon Creek, has recently been completed by the Highland Valley Copper.

A serious water quality issue has been identified on the mine. This is where molybdenum (Mo) is oxidizing and dissolving into the process water. This could have a detrimental health effect on ruminants (i.e. cattle, moose, deer). The real problem could occur some time after the mine is decommissioned, when the mine's open pits and other water storage units start filling up and start decanting into the Guichon Creek river system. The mine is environmentally conscious and has started evaluating options to deal with this problem even though it may be some 75 years off.

Craigmont Mines Ltd. was another very successful copper producer which operated between 1962 and 1982, in the Lower Guichon Creek area. The shares of this mining house were acquired by the Craigmont Mines Joint Ventures group in 1985 which then supplied media-grade magnetite to the Western Canada coal industry from stock piles until 1992.

In 1993, the focus shifted to the recovery of magnetite from the old mine tailings deposit created during the copper production days. To date production has been in excess of 600,000 tons of media-grade magnetite product. Significant proven reserves are present in the remaining unmined tailings deposit, which could translate to at least another decade of mining at Craigmont.

These Craigmont mining operations draw water from the Nicola River, from one on-site well, and from drainage from the old adit and only takes place during non-freezing weather. During recent years less water has been pumped during the critical months of September and October. The water used in the magnetite recovery process is maintained in a closed circuit, so there is no surface discharge from the operation.

Some old underground coking coal mines exist just south of Merritt. It is claimed that underground fires continue to burn in these old mines and that sinkholes are being formed on the surface above these old pillar mining operations. The exact impact of this situation on the water flow regime in the area is unknown.

Highland Valley Copper (Courtesy of Bob Hamaguchi)

Urban and Rural Land Use

The total year 2004 resident population of the Nicola River Basin has been estimated at around 16,000 people. These numbers increase significantly during the summer due to tourism and recreational/lifestyle activities.

Urban Settlement

The City of Merritt (population 7,400) is the hub of urban activity in the region. The Coquihalla Highway runs through town on its way to Kamloops in the north and the Okanagan Valley in the east.

Due to this easy access from the Lower Mainland, the pro-development policies of the Merritt leadership, and a reasonably favourable climate, the Nicola Valley in one scenario could become the next destination of choice for people migrating up from the Lower Mainland. This could place a major demand on the water resources of the area and water management planning should be cognizant of this scenario. This type of population growth would also place increasing pressures on sport fishing and hunting and discharge of effluent.

Merritt has recently introduced a very progressive Liquid Waste Management Plan. The City now treats it's sewage to a very high level and then discharges it into rapid infiltration ponds to the west of Merritt. Groundwater and river monitoring is on-going to make sure that little to no contamination of the environment occurs.

Merritt obtains its potable water from groundwater that is sourced in the main aquifer that lies below the City between the Coldwater and Nicola River confluence. The Coldwater River plays a major role in the recharging of this aquifer. The City is currently conducting extensive research into this groundwater/surface water interface and aquifer protection. Merritt also holds surface water licences in strategic abeyance in case of ground water shortages.

From a water management perspective it may be necessary to better understand the surface/ groundwater interrelationship in other major aquifers in the Nicola River System.

The City of Merritt has also been proactive in moving towards the implementation of water conservation measures in its water distribution system. More work on this and water demand management (including the reduction of system operating pressures and system leakages) is expected in the near future. Flooding carried by the Nicola and Coldwater rivers is a concern in Merritt.


Nicola Lake with the Nicola Settlement in the foreground

The next biggest urban settlement is that of the District of Logan Lake (population 2,300) which was mainly established to take care of the municipal needs of the relatively large mining community in the Upper Guichon Creek area. The main water sources of the main settlement are deep groundwater wells.


Merritt

Rural Settlements

The rest of the Nicola River Basin is managed by the Thompson Nicola Regional District with the exception of the First Nations settlements which are Federally and independently governed. The Nicola Tribal Association in Merritt plays a very active role in representing aboriginal peoples rights in the Nicola River Basin. Land and water issues are high on the agenda of First Nations leaders.

The Lower Nicola settlement at the confluence of the Nicola River and the Guichon Creek, is reported to be growing. Water is mainly sourced from groundwater wells and is managed by an Improvement District Committee. The Lower Nicola Band resides on land in this area and owns water rights. A new groundwater supply system is to be installed soon.

First Nations settlements (Shackan and Nooaitch communities) and numerous large ranching operations are resident down the Lower Nicola River Valley. Spences Bridge is located at the confluence of the Nicola and Lower Thompson rivers. This small community's economy is very closely linked to the river (e.g. tourism associated with sport fishing).

The Coldwater Band lives in the lower reaches of the Coldwater River Valley. Drinking water is mainly drawn from wells. The Band has significant irrigation water licences. The settlement of Brookmere in the Coldwater Valley is set to expand by 178 strata lots in the near future.

The Upper Nicola Band resides in the Douglas and Nicola Lake areas and remains reasonably active in agricultural practices and irrigation. They are neighboured by the Douglas Lake Cattle Company.

The rest of the Nicola River Basin area is comprised of ranching and forestry operations with the consequent relatively low population settlement densities. Although domestic water supplies are usually not a problem in these more rural areas, stockwatering (especially where small lakes dry up in poor rainfall/snowfall periods) has become an issue in recent years.

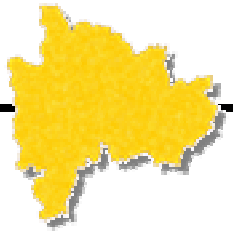
Recreation/Lifestyle Development

Moving to the Stump and Nicola Lake area, ranching has been the predominant activity on the vast grasslands and upland forest areas. This is now changing with land being split up and sold especially around these two major lakes and some of the smaller lakes (e.g. Peter Hope, Glimpse and Roche Lakes). The impacts of the area are not yet fully understood. "Rules of the Game" need to be put in place to encourage adequate stewardship of this land and its resources. It will be very important to contain lakeshore development in such a way that does not jeopardize water storage expansion when more lake reservoir capacity is required in future.

Recreation and tourism (e.g. outdoor adventure; agritourism; Country Music Festival) is expected to increase in future with consequent high spikes in population numbers in the summer months. This is believed to be due to the valley's proximity to the Lower Mainland, natural amenities, supply of land and social dynamics. These trends and their impacts need to be factored into water management planning.

Other Water Issues:

- Is there enough water for people? At the quality required by the Interior Health Authority in their 4-3-2-1-0 program?
- What is the state of current water supply infrastructure and can water conservation and water demand management measures be successfully implemented here?
- What institutional and legal frameworks (and stakeholder organizations) exist that have a direct bearing on water management in the Nicola Basin?
- We need to recognize and define the interrelationships between development and water resources. This calls for integrated planning and careful management to avoid potential negative impacts. The Thompson Nicola Regional District and its member municipalities/settlements have to play a major role in these efforts as very little development can take place without them being subject to their institutional bylaws and approvals.



Water Use

Based on the various components of the broader Nicola River Basin human and natural environment mentioned above, it has been possible to investigate water requirements at a scoping level in this study.

The departure point of this brief water use assessment has been to obtain a more accurate picture of actual water allocations/licencing. This approach was selected as it was felt that this would paint the more realistic picture of how much water is actually allowed to be used. Only diversion licences and not water storage licences have been considered. Diversion licences give a direct indication of water use.

As in the case of most other river basins in British Columbia, it has been found that in an average year slightly less water is being used than is allocated. This is mainly due to the fact that ranching and municipal operations usually vary with climate, economic and other factors, and that certain licence holders (including First Nations) only use what they need in the actual year depending on cropping areas and climatic conditions. This phenomenon is actually a "saving grace" in that more water is available in the river system than would be the case if all the water allocations were being fully used.

Needless to say it will be important to obtain an official quantification of the balance between water availability and allocations. The authors are in possession of more accurate information on water allocations and water use, but these numbers have not been confirmed by Land and Water BC who are the custodians of water storage and use licences. The numbers presented on the next few pages are referenced from the 1983 Ministry of Environment Strategic Report. They have been quoted since they correspond well with current day data.

A more detailed, on-the-ground investigation into actual water use and ways of optimizing water supply systems (irrigation and domestic) should be commissioned in the Nicola Basin, and should be tied to a more detailed water resource yield exercise that will allow higher resolution (both in terms of quantity and time) operating and extraction rules. It is firmly believed that this improved level of water management decision-support information will yield dividends both from a water resource reliability and economic point of view.

- **Water Allocations**

Two co-op students from Land and Water BC were utilized during the summer of 2004 to put together a reasonably detailed inventory of water allocations. The data has not been published by the Ministry and can therefore only be used as indicative in broad terms at this stage. A more detailed and official set of water allocations needs to be completed by Land and Water BC.

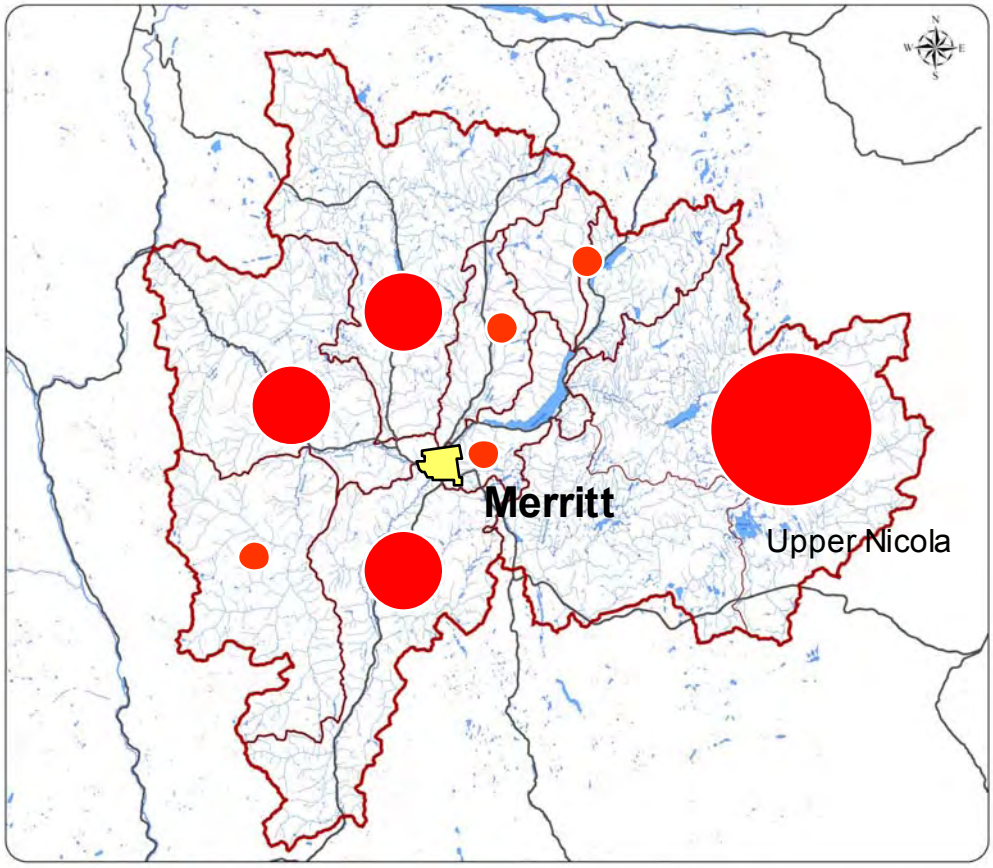
Please also note that different types of licences are expressed in different units (e.g., irrigation diversion in acre-feet; environmental use in cubic feet per second; urban use as gallons per year). In order to have a common unit of comparison these values have all been converted to millions of cubic metres per annum (million m^3/a). This broad unit is believed to be sufficient at this level of study. Any further work should be drawn down to monthly and daily resolutions. Environmental (fish) water requirements have also been converted to this global unit, but it must be remembered that a large portion of this instream water use actually "piggy-backs" on other river water transfers (e.g. releases for irrigation downstream).

- **Irrigation Licences and Actual Use Trends**

Approximately 12,000 hectares (30,200 acres) of land is irrigated in the Nicola River Basin. Referring to the adjacent water usage diagram, it is interesting to note that the Upper Nicola sub-basin has the highest irrigation demand, followed by the Lower Nicola and the Guichon. The linkage between water use and water availability will be discussed below in the "Water Balance" section.

It should be noted that irrigation only takes place between the months of April and September each year, with the most critical period being between late July to the end of September when river levels drop and water requirements increase (i.e. snowmelt freshet finished and hot dry climatic conditions prevail).

The typical irrigation cycle in the Nicola includes three cuts of forage crops. Irrigation is usually shutdown a few days before a drop is cut. The hay is left to dry on the field before baling takes place and irrigation is resumed. One cut could include a downtime in irrigation of about 14 days.



Relative indication of offstream water usage in the Nicola River Basin

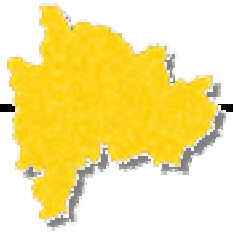
Example of actual irrigation use in 2004:

Annual allocation:

- 690 acre-feet (0.85 million m^3/a).
- April 01 to September 30 irrigation period on licence with fish clause (i.e. may be required to shutdown irrigation sooner than September 30 if flows in river are too low for fish requirements)
- Precedence 1977 (i.e. in the case of water rationing all other licences issued before 1997 would receive precedence when it comes to cutting back on water use in dry climate periods).

Actual use in 2004:

- Started irrigation on April 28, 2004.
- Pumping rate is 1,330 USgal/minute (5 m^3/minute or 0.084 m^3/s) full time.
- 24 hour rotation cycle.
- First cut June 10, 2004; shutdown irrigation on June 6, 2004 and restarted after baling on June 18, 2004.
- Second cut August 1, 2004; shutdown irrigation July 28, 2004 and restarted August 9, 2004.
- Due to rainfall, stopped irrigation on September 5, 2004.
- Other factors influencing temporary shutdown of irrigation during the summer season could be if 2 to 3 inches of rain has just fallen, a cold spring is experienced, or if seeding of a new crop is taking place.
- Total number of irrigation days in 2004 = 109 days.
- 1,330 USgal/minute x 60 minutes x 24 hours x 109
  = 208,756,800 USgal
  = 790,200 m^3 which was less than the annual volume authorized.



Therefore, out of the approximately 180 days it is usually assumed that only 120 of these days are irrigation days on a particular licence. In determining actual water use, a better estimate of this timing per area should be achieved. More accurate irrigation scheduling (e.g., the Farm West Program) could create water use savings and economic benefits for irrigators.

An example of actual water use was presented on the previous page. Samples taken from each of the sub-basins yielded similar trends. The water use representations presented above are relatively crude. More accurate values, although available, could not be published as they have not been officially released by Land and Water BC. These values should be available during 2005.

In portraying these water use values it is suggested that the various sub-basins such as the Upper Nicola be divided up into reaches (e.g., Chapperon Creek, Spahomin Creek, Lauder Creek and the main stem Nicola River above Douglas Lake and another reach below the lake). This will allow more accurate pinpointing of river diversions, river flow rates (determined by statistical and deterministic hydrological methods), fish flow requirement comparisons, and in general a more accurate representation of the river flow regime and river system water balances.

Most of the irrigation water use in the Upper Nicola Sub-basin (14,299 acre-feet; 37 licences) is mainly centered around the Chapperon Creek and Chapperon Lake (Douglas Lake Cattle Company) and the Spahomin Creek (Upper Nicola Indian Band), which are located above and around the Douglas Lake. During dry years such as in 2003, this use together with the inter-basin transfer of water (Westbank Irrigation District in the Okanagan Basin) has a severe effect on low flows between the Douglas and Nicola Lakes.

Offstream water use in the Stump-Moore Sub-basins (5,608 acre-feet; 32 irrigation diversion licences) are predominantly related to irrigation. These are generally concentrated upstream of the Stump Lake on the Frisken and Stump Lake Creeks (Stump Lake Cattle Company and the Frolek Cattle Company) and on the Frogmoore and Moore Creeks (Guichon Ranch) above Nicola Lake.

The Clapperton Sub-basin joins the Nicola River just downstream of the Nicola Lake. A volume of 5,054 acre-feet of irrigation water (7 licences) is required on this creek.

Similarly, water demands placed on the Quilchena Creek are relatively significant (3,690 acre-feet; 18 licences).

Moving down below the Nicola Lake to the Middle Nicola Sub-basin (4,240 acre-feet licenced for irrigation; 24 licences). Large volumes of groundwater abstractions feed irrigation systems just above Merritt. The relationship between ground and surface water in this area is now being studied by the City of Merritt.

Licenced irrigation in the Coldwater River Sub-basin amounts to 7,414 acre-feet (62 licences). Based on informal observations and discussions with local people, it does not seem that this surface water allocation is being fully utilized. Groundwater abstractions near Merritt seem to have been quite significant in the past, but no record can be found of this use.

The Guichon Creek Sub-basin (8,976 acre-feet) has a relatively large number of irrigation diversions (85 in total). Water is also diverted from the Tunkwa Lake at the upper end of this sub-basin into the Thompson River Basin. Further interbasin diversions have been opposed by government in order to safeguard instream flows.

The Spius Sub-basin has 29 irrigation diversion licences which draw only 1,665 acre-feet.

The Lower Nicola Sub-basin which for practical purposes starts just downstream of the confluence of the Guichon Creek, hosts 107 irrigation diversion licences which total to approximately 10,460 acre-feet of water.

Studies have shown that approximately 44,000 ha (approximately 97,000 acres) could support agricultural development in the whole Nicola River Basin. About 12,000 ha of these are currently worked, with the potential of around 4,200 ha that could be easily developed if there was sufficient water storage and consequently a reliable supply of water. About 30 licence applications for this additional water have been held in abeyance since the 1980's due to the lack of water storage and hence water availability in the Nicola Basin.

- **Instream Water Requirements (Fish)**

This instream use of water represents the second largest allocation of water in the Nicola Basin (i.e. licences issued for fish projects and storage releases from the Nicola Lake Dam. It cannot be directly compared with irrigation usage as water released from upstream for downstream irrigators can double up and count towards these fish flows.

On the other hand once irrigation has been shut down (6 months of the year), these flows are almost exclusively related to fish flow volumes. Although one major fish flow storage licence of 10,000 acre-feet exists (Nicola Lake water), there are very few allowances made for flows for fish in the Nicola River System. A few through-flow licences have been allocated to the Department of Fisheries and Oceans for specific fisheries projects.

Scientists believe that more can be done to ensure fish flows. This may require legislative changes to achieve. Another option would be to work together with other water users in the Nicola to arrive at a water balance and operating rules that suits all users. It is believed that the current water management planning process can achieve this if there is goodwill shown by all parties.

Conservation (or environmental instream) flow rates are usually expressed in cubic feet per second averaged out over the year (365 days). This unfortunately does not give an accurate picture of the actual needs of fish (i.e., for migration, spawning, rearing). Values are available from old reports (early 1980's). No consensus could be achieved on these numbers during this Phase 1 study and should be updated as part of the next phase of this initiative.

It is therefore recommended that a more accurate river reach by river reach assessment be made to set an annual flow regime that mimics fish requirements during average as well as dry climatic years. These more accurate flows hydrographs are expected to serve the dual purpose of providing sustainable fish flows and seeking to minimize total volumes of this very scarce water resource in the Nicola Basin. This initiative could be based on the previous work of Kosakoski and Hamilton (1982) of the Department of Fisheries and Oceans and on more recent work conducted on the Coldwater Recovery Plan.

- **Other Water Uses**

Mining water abstractions are mainly focussed on the Upper Guichon Creek (Highland Valley Copper) and the Lower Guichon/Nicola (Craigmont Mine), where they have localized impacts on river flows and groundwater tables.

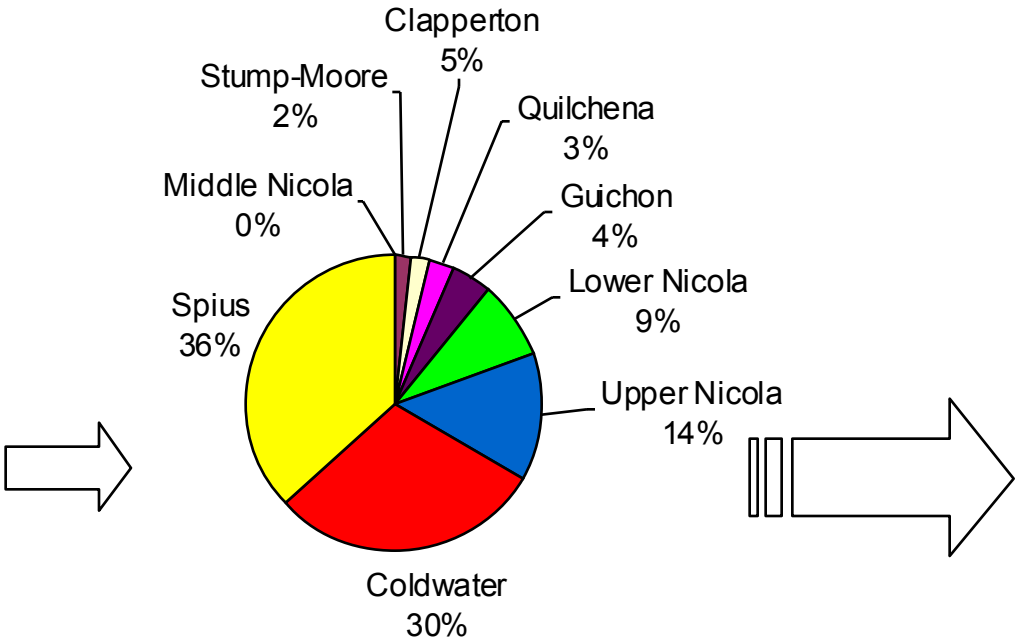
A large proportion of Highland Valley Copper's water requirement is met by recirculation of water in a closed system between its mills and its tailings dams. Groundwater resource predictions have proved to be less than expected and the mine is now considering the recommissioning of its existing pump station on the Lower Thompson River.

Urban and industrial water usage is concentrated around the Merritt and Logan Lake municipal areas, although development in the Lower Nicola Settlement is increasing significantly.

The City of Merritt currently draws its water requirement of around 3.5 million m^3/annum from groundwater wells in the City. The City still has a surface water licence on the Coldwater River for a similar volume.

Riverbank rehabilitation for fish (Coldwater River)

Water Availability



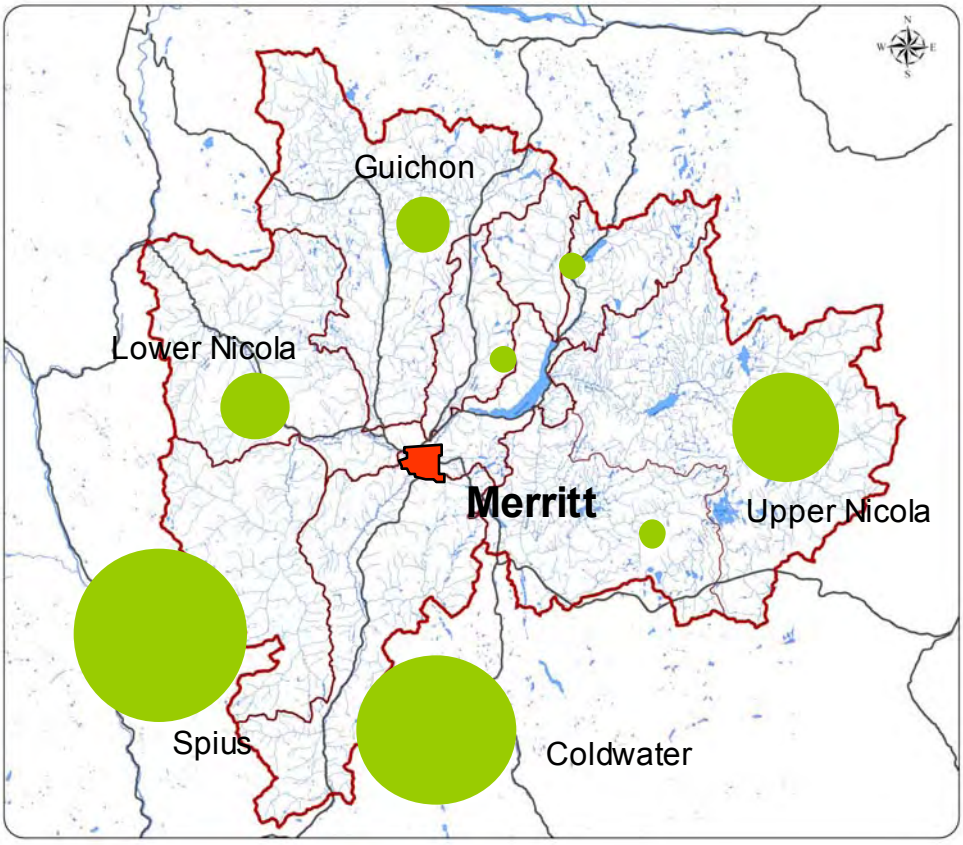
Traditionally water availability in the Nicola River Basin has been based on average annual values derived from historical flow records at the mouth of each major sub-basin. The 1983 BC Ministry of Environment Nicola Basin Strategic Plan uses this methodology to derive an annual average river basin wide flow volume of 947 million m^3 per annum. As far as can be determined, these flows are recorded <u>after</u> water use extractions have been made. An attempt was made to naturalize these flows, but it is believed that insufficient reliable information on actual water use is available to allow this adjustment. The author believes that this does not give an accurate indication of the actual water yield that is generated in this river basin. A proper system yield analysis is recommended in order to obtain accurate management level information in this

Surface Water

The annual flow regime in the Nicola Basin is typical of the Southern Interior of British Columbia with a sustained snowmelt runoff volume starting in April, peaking in June, and followed by stream flow recession throughout the summer. Cooler, wetter weather in the fall usually brings stream flow back slightly which then remains fairly steady until the spring freshet starts again. During dry climatic years (i.e. lighter snow pack and lower than average precipitation), it is possible to experience very low river flows during the periods July to September and again in February. This is where most of water management issues and problems start occurring (e.g. unsustainable flows and stream depths to maintain fish life cycles; no water for irrigation that threaten permanent forage crops).

Water availability in the Nicola River Basin varies significantly from sub-basin to sub-basin. The two main sub-basins draining the eastern sides of the Cascade Mountains, the Spius Creek and the Coldwater River, contribute over one half of the runoff of the Nicola River System (see pie chart above). The sub-basins draining the drier northern parts of the Nicola Basin have limited water yields.

Hydrometric stations and data have been well maintained in the past. Recent fiscal cutbacks have however resulted in the closure of almost all the stations in the Nicola Basin. The envisaged consequence of these actions on water management in the long-term could prove to be quite negative. The Federal Department of Fisheries and Oceans and the Provincial Ministry of Water Land and Air Protection have this last 2004 dry season allocated resources to monitor low flows in the Nicola



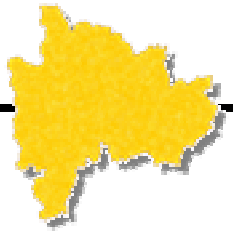
Relative indication of water availability per sub-basin

Basin. They also have lobbied various private organizations to have the very important Environment Canada hydrometric station at the mouth of the Coldwater River reopened.

Various water availability data exists in one or another form, but the only published data that could be used at the Nicola River Basin level was that which published by the Ministry of Environment in their 1983 Nicola Basin Strategic Plan.

Hydrological analyses recently conducted by various private and government sector partners needs to be collated and officially published for this area. This data will have to be augmented by further hydrological modelling to make sure that the whole river system is covered and that results are integrated and calibrated to the same level. Please see the issues table later in this report for more details.

It is also believed that the river flow data presented in this report is based on actual gauged flow after water abstractions have already been made. Various hydrological techniques should rather be employed to determine actual natural flows before abstractions so that water managers are able to quantify the actual size of the resource they are working with. This water availability can then be reconciled with water use to more accurately determine the water balance and water budget that will be required. A link needs to be made with groundwater (see next page).



Groundwater Resources

It is believed that groundwater resources in the Nicola River Basin originate from the upland areas. This phenomenon is evidenced by the high proportion of artesian wells that are drilled in the river basin and benchland areas. This poses a problem where incorrect drilling techniques are applied in that these wells cannot be capped. This results in the wells running continuously which may lower the water tables and have dire effects on water availability during dry climatic years. Some of these older artesian wells in the Lower Coldwater sub-basin are now running dry which could possibly indicate that we are over-exploiting these groundwater resources. This issue needs to be investigated as a matter of priority.

A further benefit of groundwater seeping down from the uplands is that it could be providing a significant contribution of colder water to baseflows in the rivers and creeks. Recent geothermal imagery along the Coldwater River showed that groundwater seeping into the river provides a much needed source of cold water that could keep surface water temperatures down.

Recent well records (Ministry of Land, Water and Air Protection studies) indicated that well levels have dropped quite significantly over the past decade. This could be attributed to climatic conditions that have been experienced, or it could partly be attributed to over-extraction of wells by various users.

The deep glacial sediments in the major valleys may contain several aquifers. The exact interaction with regard to recharge from river flows is not completely understood, but significant strides are being made by Kala Groundwater Consulting Ltd. in the Merritt area.

There are seven known areas where wells in aquifers yield relatively high water yields: Highland Valley; Logan Lake; Douglas Lake; near Pennask Lake (on the watershed with the Okanagan); Lower Moore Creek; at the confluence of the Guichon Creek and the Nicola River; and at the confluence of the Coldwater and Nicola Rivers.

Government control of groundwater extraction in British Columbia has only recently been promulgated. The roll out of this legislation is expected to take more than a decade though.

Water Quality

The quality of groundwater is generally quite good with the exception of where deeper wells penetrate carbonaceous (coal-bearing) strata.

Although surface water experts were consulted, there were not enough financial resources available in this Phase 1 study to collate suitable scientific information. It is recommended that this “information gap” be filled in follow up phases of this water management study. A good start would be the water quality section in the 1983 Ministry of Environment Strategic Report and a few subsequent reports listed in the Bibliography later on in this Scoping Report.

Most of the water quality issues mentioned in the 1983 Strategic Report (e.g. effluent discharge from Merritt; feedlots and access of cattle to river) have been addressed since the early 1980’s. The most recent concern refers to possible pollution associated with wastewater discharges and soil erosion that may be caused by the sudden surge in lakeshore developments in the basin.

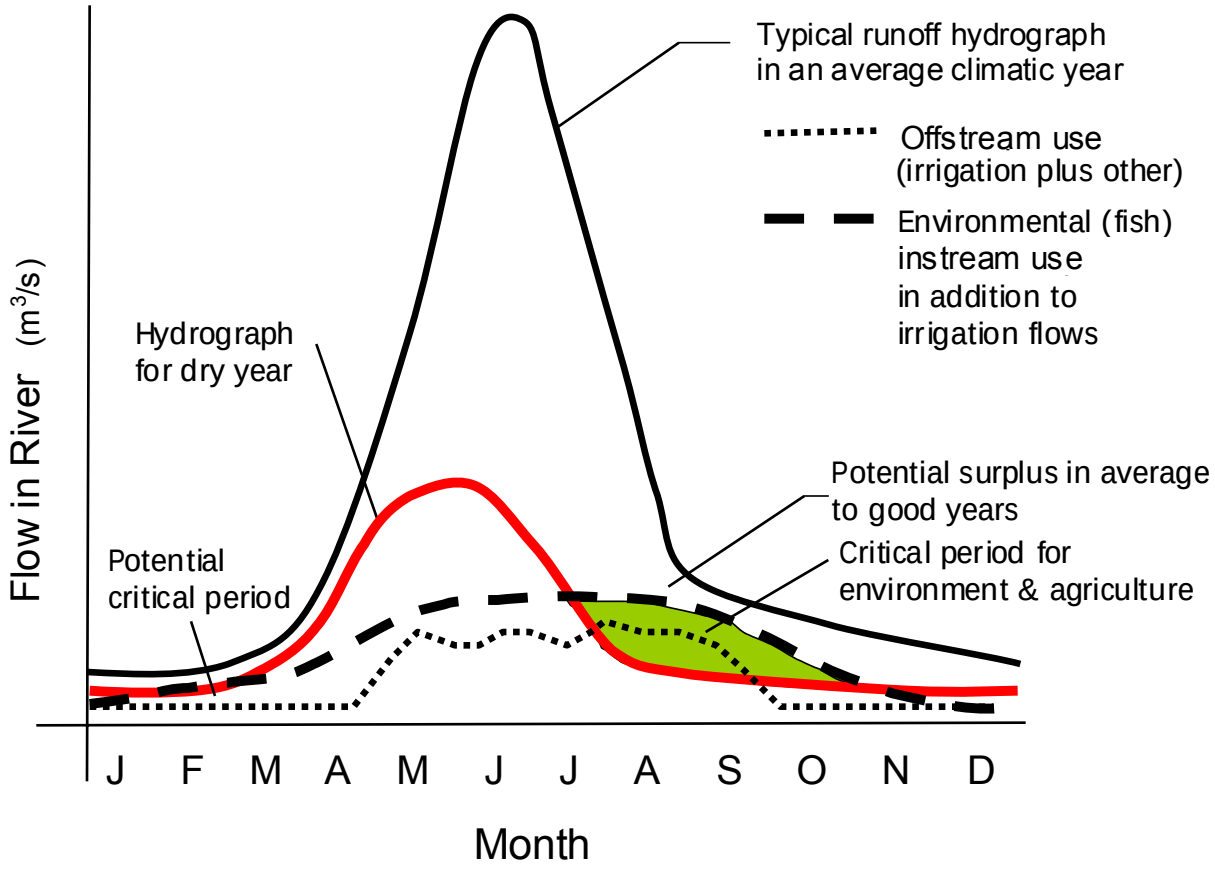
Water Balance

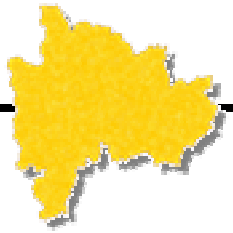
With the exception of releases from the Nicola Lake, it is very difficult to draw accurate conclusions between water "availability" data and water "use" information in the Nicola River System.

An updated hydrological analysis and a revised operations plan for the Nicola Lake Dam is being prepared by Mr Jep Ball, PEng. for Land and Water BC. This will serve as the most up to date analysis of this section of the Nicola River System. It is recommended that this operations analysis be used as the starting point and that modelling inputs be refined in due course (e.g. higher resolution fish flows; accurate irrigation uses; decision support criteria for drought flows). It is hoped that a model similar to the daily one used for the Okanagan Lake be implemented in the Nicola. The Okanagan operations model has achieved the fine balance between saving water and providing adequate stream flows for fish.

All the other sub-basin rivers and creeks should eventually also be modelled and a full system analysis conducted in order to determine the optimum regime in which water in the whole basin should be stored and released to optimize the availability of this scarce natural resource. This reasonably complex investigation can then culminate in an estimate of how much water can safely be used in each section of the basin during good and bad climatic years.

From the preceding chapters of this Scoping Report it may have become clear that the critical period during most years is between July and September at the end of the summer season when water use is at its peak. Critical low flows for fish can also occur during February. This phenomenon showing a typical water balance or budget is shown in the diagram below. Note that most of the volume of water passing down the river occurs between April and July.





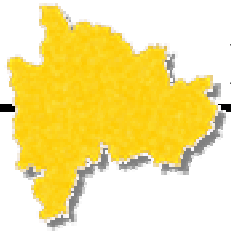
The following general observations can be made about water balances using the available water use and water availability information presented above:

- The potential water usage (including instream fish flows – 'piggy-backing" or not during irrigation and non-irrigation seasons) amounts to just over 100 million m^3 per annum according to allocation and official river system documentation. Not all this water is being used due to a variety of reasons. Actual water usage can be determined, but should be handled very carefully – forcing people to use water or loose it would be counter productive to responsible and community orientated water management planning.
- Water availability (at a conservative estimate: 1983 BC Ministry of Environment Nicola Basin Strategic Plan) in an average climatic year averages out at 947 million m^3 per annum.
- Looking at these numbers very superficially, it can be deduced that only about 11% of available water is actually allocated. In a crude sense this is true since the bulk of the water flows down the river during the period April to July each year. Water is not held back or "slowed down" to make more water available during the critical low flow and high water usage months of July to September. There is therefore merit in finding ways to increase water storage or employ water retention strategies to assist in meeting the water needs during various climatic years. This may include changes to legislation to include multi-year storage and could possibly include recharging aquifers artificially during high flow periods.
- Looking at these numbers in more detail though, water availability in the Nicola Basin is unfortunately skewed both geographically and in time in this river basin (i.e. most of the water flows off via the Spius Creek and the Coldwater River; the bulk of the volume of water flows off during the spring freshet which only lasts a few months). Storage would therefore have to focus on the higher yielding parts of the basin with innovative ways of creating water security in other areas by creating conveyance infrastructure or by employing the concept of "virtual water" (i.e. moving irrigation needs to other more well watered areas; using more water on more land during the high runoff period; or diversifying agribusiness to more water efficient or intensive cropping).
- It is therefore recommended that the more detailed river system yield analyses (historic and stochastic) referred to above, be conducted to pinpoint where more water can be made available. Further geohydrological work and engineering planning should take place to analyze increased storage units and infrastructure requirements to transport this water. This work should be preceded by the implementation of sound water conservation and water demand management measures to reduce water use to practical and economic minimums.
- Storage in ponds and small lakes could be increased in the upper river basin areas to "hold-back" more water for slow release during the rest of the summer season. Various studies have been conducted in this regard, but need to be consolidated to provide practical solutions.
- The Nicola Lake Dam can yield about another 5,000 to 13,000 acre-feet of storage if an obstruction in the Lake's outflow channel can be removed. This will support existing water use (including instream needs) in the middle and lower Nicola River and may even make some water available for further water use expansion. (i.e. possibly allowing the issuing of existing licence applications that have been in abeyance since the 1980's)
- Once the instream flow regime has been optimized, adequate water conservation measures implemented, and the hydrological system yield analysis completed, it should be possible to revisit the water allocation and water use issues that currently exist. Special solutions will need to be found to improve the low flow conditions during the drier months of the year.
- A general issue associated with the various quoted flow rates and volumes needs to be put on the table and respectfully debated. These numbers need to be tested and a general consensus achieved by the community institution (made up of stakeholders and government officials) responsible for water management in the Nicola River Basin in future. For instance a misinterpretation of facts presented at Nicola Watershed Community Round Table workshop in February 2004 sparked a controversy that local basin residents felt was unwarranted. For example, it was quoted that 95% of water was being diverted out of the Coldwater River during a 7-day low flow period during August 2003. The figures presented at the workshop were as follows: the Mean Annual Flow of the Coldwater was estimated at 7.42 m^3/s; the mean monthly flow in August = 2.02 m^3/s; the mean 7-day summer low flow = 1.16 m^3/s; licenced demand for diversion from the Coldwater = 0.79 m^3/s; the remaining flow, after extraction and during the 7-day low flow period, was calculated to be (1.16 – 0.70) = 0.37 m^3/s, or 32% of this low flow at the time. For some unknown reason this number of 0.37 m^3/s was compared to the Mean Annual Flow (or discharge) of 7.42 m^3/s, which would translate to 5%

of the mean annual flow rate. The logical deduction that certain activists drew, was that 95% of the Coldwater River's water was being diverted for irrigation, which was not the case. The other information left out was: that 26% of that surface water allocation is held by the City of Merritt (plus unutilized irrigation licences) – this water is not extracted by the City or the irrigators; the fact that 2003 was a very dry climatic season; and that water levels in the Coldwater continued to drop even after irrigation ceased.

The bottom line here is that information collated by any stakeholder should be well researched and presented in an unambiguous way so that all stakeholders can mutually agree on the findings and work towards solutions. Furthermore it is realized that low flow conditions during dry year on rivers without adequate storage are a real problem to all sectors and that communally solutions need to be found as part of the water management planning process.

All these and other issues need to be debated and formulated into a water management plan that should be drawn up by local stakeholders and government officials over the course of the next few years.



Evaluation of Issues

The background presented in the report so far has painted the context or framework in which the various water issues and management decisions need to be assessed.

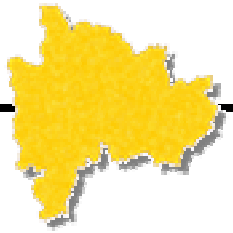
From the October 2004 public workshop it was soon realized that the various stakeholders had a mutual respect for one another's opinions and values regarding water management in the Nicola River Basin. With this in view it has been deemed necessary to move towards a common vision and set of management objectives that are to be mutually instituted and managed corporately by local stakeholders and government authorities.

The following table presents an abbreviated assessment of the various issues that can then be used as a starting point in developing future local water management strategies.

Issues/Practices	Ideal/Realistic Goals and Objectives	Potential First Steps Towards Solutions (Strategies)
1. Institutional capacity		
The need for strong local leadership, stakeholder buy-in, and government and other organization involvement as part of the team	Interim local management group with representation from all stakeholder groups Longer term permanent water institution refereed by government	Nicola River Watershed Community Round Table to set up interim management structure Identify local, regional, provincial and federal government roleplayers and other stakeholders; Develop communications strategy; Work towards a 2005 drought management plan that incorporates a longer term water management vision and mission
2. Natural Processes		
Geology and groundwater knowledge	Geological map showing: location of aquifers; potential water yields; status of current abstractions Integrated planning information that shows the ways in which groundwater can best be used in the bigger scheme of things	Obtain map (electronic and hardcopy) from groundwater specialists Some work will need to be done by specialists to integrate the current knowledge and to recommend sustainable management options
Soils/vegetation	Locations of sensitive soils and areas where future development can or cannot take place	Soil/vegetation maps from authorities and other organizations such as the BC Grasslands Conservation Council, forestry companies Include holistic resource management principles in land and water use management strategies Investigate linkage with invasive plants
Climate change/global warming	Having explored climate change scenarios and their potential impacts on water supply, to be in a position to formulate drought contingency plans	Through presentations, to better understand the work that is being done in the Okanagan Valley and further afield and if possible to transpose these results into the Nicola with a view to creating longer term contingency plans

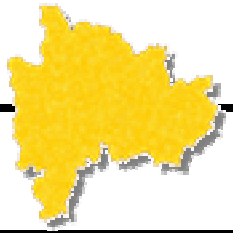



Forestry	Work together with Ministry and private sector forestry companies to understand all the work being done by these organizations regarding water issues, river basin management, beetle kill strategies, *et cetera*	Via presentations, gain a better understanding of the issues involved and what has been and what still needs to be done Set up working group to synthesize this information and to come up with rules of the game regarding river basin and water management
Topographical maps	Sufficient mapping which can be used in management planning	Obtain electronic copies of the maps and satellite images already produced by Urban Systems and work on producing other appropriate maps that can be used by the various working groups
3. Ecological Processes		
Anadromous fish	Fish stocks built up (maybe not to original numbers) in a river basin where riparian/riverine habitat has been restored and a secure water supply created where climatically possible	Education of public regarding fish life cycles, river flow regime and water quality requirements, and importance of this resource Improve flow rates, depth and volume values for fish/invertebrate/habitat Instream Flow Requirements. Determine normal and drought flow regimes that can be built into river system analyses and water storage operating rules Relevant river flow gauging and monitoring exercises to be supported Use Okanagan Lake operation modelling technology in the Nicola Identify projects that can be used to encourage cooperation between riparian land owners re habitat restoration (e.g. John Anderson project) and to possible develop off channel fish habitat. There should be a mutual benefit to ranchers and fish populations



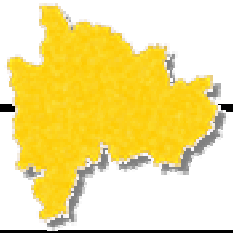
Issues/Practices	Ideal/Realistic Goals and Objectives	Potential First Steps Towards Solutions (Strategies)
Resident fisheries	Healthy ecological and limnological environments that support natural and stocked fish populations with the view to enhancing subsistence, recreation and tourism opportunities	Collate information from the Ministry of Water Land and Air Protection with regard to where these fish populations can best be conserved. Linkages with initiatives to increase pond/lake water storage should be coordinated to create synergy between various water use activities. Develop rules of the game as to how the various water bodies should be managed to create this synergy. Will need to be enforced by regional and Provincial government
Birds and animals	Healthy populations of selected indicator and listed species at risk.	In similar fashion to fish species, work together with Ducks Unlimited, hunting groups, government officials to optimize water storage and habitat opportunities. List sensitive lake, wetland and other aquatic areas which should not be touched by land use and water storage development
Food and water sources for humans	Must ensure the protection of sufficient land and water resources to sustain human life in the Nicola River Basin	Public education regarding water quality and water quantity issues. Could include media material such as the films “Thirst” and “Erin Brockovitch” in order to make the point. This especially since land and water resources in the basin could be threatened by further migration to the area and activities such as coal-bed methane abstraction. Must however avoid villianizing these types of developments as they could have major positive economic benefits (e.g. establishment of sustainable new water storage, increased economic well-being) if they are implemented in an environmentally sustainable manner. Identify where food is produced in the river basin and its relative dependence on water resources Linkage to water conservation and groundwater studies being conducted by the City of Merritt

4. Human Activities		
Livelihoods	Provision of all sectors of our local society with a secure supply of water (quality and quantity) in a way that is in harmony with the natural environment and its processes	Collate maps showing location of all water users, their land use, and from where they abstract their water supplies Obtain official inventory of water licences from Land and Water BC Identify potential water conflicts between users, and between users and the environment. Develop strategies to deal with these issues
Riparian corridors	In future, the goal is to have the integrity of these riparian corridors protected (i.e limit erosion, illegal dumping, artificial canalization, and abnormal flooding)	Identify sensitive areas, determine conservation status and prioritize restoration and conservation projects. Assist in drafting and policing by laws
Forestry	See section 2 above	See section of forestry above
Agriculture	A thriving agri-business sector supported by a reliable supply of water that is of a suitable quality. Diversification and expansion of agriculture possible.	Water storage is urgently required in certain parts of the Nicola River Basin. These storage sites (new or increased storage) must be identified on maps and plans formulated to developed the water resources of this area. Liability for these dams/lakes should be shared with all beneficiaries of this water and not just the agricultural community. A strategy in this regard needs to be developed. Sustainable groundwater abstraction should be encouraged. Irrigation water conservation and water demand measures should be studied in this area and implemented. Actual water use should be confirmed in order to assist management decisions. Irrigation scheduling projects should also be encouraged to save water and electricity. Future agricultural water use projections (including First Nations aspirations) should be confirmed. The application of treated biosolids to agricultural fields in the area is being assessed. Water quality issues (especially groundwater pollution) must be understood. Proper fish screens at pump intakes should be encouraged.



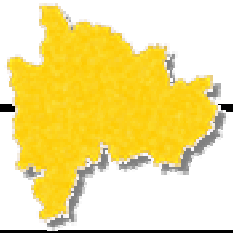
Issues/Practices	Ideal/Realistic Goals and Objectives	Potential First Steps Towards Solutions (Strategies)
Mining	A reliable supply of water to maintain this vital part of our regional economy. Water quality issues must be addressed to maintain the integrity of our environment and to avoid threats to human health.	Maintain contact with mines and work together to obtain mutually acceptable solutions to water quality and quantity issues.
Lakeshore development / recreation / tourism	Sustainable development along shorelines that do not pollute water sources and that allow future managed reservoir (water level) fluctuations Careful management of these activities to ensure minimal impact on the environment and water resources. Good quality water is important to these activities as well.	Identify all potential and planned lakeshore and other developments, as well as all water-related and environmentally sensitive areas. Work together with the Thompson Nicola Regional District and private developers to implement good stewardship practices in all cases. Develop guidelines and bylaws. Rules of the game need to be set for tourism and recreational activities in order to maintain the integrity of the various River Basins (e.g. ATV; mountain bikes; Country Music Festival).
Urban and rural settlements	Healthy water environments for all settlements (i.e. cost effective and adequate supply of good quality water; limited flooding; limited mosquito problems, *et cetera*).	Identify, evaluate current and longer term water resources that are available to these settlements. Consider water conservation and water demand management measures. Assess liquid waste management practices. Evaluate the impact of the new 4-3-2-1-0 drinking water regulations to be enforced by the Interior Health Authority. Identify ways in which better conjunctive use of ground and surface water can be realized. Apply Smart Growth BC principles to current and future human settlement and other activities.
5. Water Use		
Allocations	Require an official inventory of water use allocations/licences that can be used to accurately assess the water balance in the Nicola River Basin.	Land and Water BC (LWBC) has recently conducted a full review of the water licences in the Nicola River Basin as part of this Phase 1 study. This information should be confirmed by LWBC and released as a public document.

Actual water use	Require an accurate assessment of actual water use that can be used to make sound water management decisions.	Preliminary work was conducted in this regard during this study. Water use at a river basin level was found to be less than that allocated. This may change in future when more and more people start exercising their water rights. Current and future water use projections need to be confirmed.
Best use practices	Optimal use must be made of this scarce natural resource.	River system and storage operations must be optimized to hold back as much water as possible to release during dry or low flow periods. LWBC to release a new operating rule for the Nicola Lake Dam. Potential water conservation and water demand management measures should be identified and implemented where possible. A more accurate instream flow requirement (or water flow regime for fish) should be developed and used in the operations of the river system and storage.
6. Water Availability		
Existing information	An accurate picture of water availability is needed in the Nicola River Basin. Existing water availability is based on river flow gauging information post water use and abstraction. This information is required in order to quantify actual water resource availability.	Utilize deterministic, statistical and empirical modelling methods supported by old anecdotal evidence (e.g. pre-Nicola Dam flow records; historic photographs of the rivers and creeks from archives). Obtain recent extensive Nicola Subbasin / river basin hydrology results from forestry company studies (i.e work conducted by Henderson Environmental Consulting). This information will be very valuable in building up an accurate picture of water availability in the basin.
Ground/surface water	Obtain a good understanding of the relationship between ground and surface water sources.	Over-exploitation of groundwater sources (e.g. uncapped artesian wells draining aquifers) may be affecting current and future surface flows. These relationships must be studied as a matter of priority. The aquifers in the Merritt area are currently being studied, but more effort will be required to define longer term sustainable water abstraction management solutions. The potential threat to ground and surface water resources in the Middle …/ continued



Issues/Practices	Ideal/Realistic Goals and Objectives	Potential First Steps Towards Solutions (Strategies)
		…(continued from bottom of previous page) Nicola by the proposed development of coal-bed methane abstraction fields should be be better understood. The positive spinoffs of such development should also be assessed at the same time (e.g. the building of a major dam in the upper Coldwater River sub-basin may be beneficial to
Impact of climatic change	Contingency plans should be put in place to mitigate the climate change projections of severe reductions in available water during the next century.	Identify and record possible consequences based on current work being conducted in the Okanagan River Basin. Identify potential management strategies to circumnavigate potential water availability problems in future.
Water storage/protection	All sources optimally used (i.e. a good balance between maintaining environmental integrity and optimal use of this renewable resource).	Identify current and potential storage units (including increasing water storage by raising certain lake and dam levels). Protect options to raise these storage levels in future by implementing guidelines and by laws to limit lakeshore development where necessary and to protect water quality for all users.
Interbasin transfers/diversions	Optimize these diversions/transfers.	Review necessity of current transfers out of the Nicola River Basin. Also investigate the potential for transfers into the river basin from other river systems or within the basin from high water volume areas such as the Spius Creek. This may include the construction of storage units with transfer pipelines or canals.
Impact of land use/population growth	Strict control of water usage by new development so that existing users (including fish) are not negatively impacted.	As mentioned above, population and land development growth is inevitable in this region. Careful planning and prior assessment of water requirements and water availability for specific developments must be conducted in order to limit negative impacts on existing water users. The Thompson Nicola Regional District together with the local water management body still to be established will play a major role in this management role.

Water quality	Strict control of all existing and new development and other human activities to ensure that water quality standards are maintained for the benefit of all water users. Groundwater quality is a major concern since it takes many generations to "clean out" an aquifer once it has been polluted.	Numerous studies have been conducted in the Nicola River Basin and adjacent areas. This information needs to be collated and specific management strategies formulated to achieve the stated objectives.
Monitoring	River flow, groundwater levels, water quality, and many more parameters can be measured to provide management and decision support information.	Monitoring is conducted by various government and private sector agencies in the Nicola River Basin. An inventory of these activities should be drawn up and a strategy put in place to coordinate these activities with a view of making the best use of limited human and financial resources. The river flow hydrometric station should be reinstated at the mouth of the Coldwater River and at other key locations in the basin. This will assist in monitoring fish flows and also in managing the basin wide river flow regime.
7. Water Balance		
Reconciliation of use and availability	Water managers in the Nicola should be provided with an accurate reconciliation of water availability and water demand. Ideally this water balance would be generated at various resolutions ranging from small river basins to sub-basin level. This will assist in setting up a water budget that can be managed to yield the optimum supply of water to all users.	State of the art hydrological and river system yield analyses should be conducted to provide this information. Hydrologists should be employed to provide this information. This will for example help quantify where and how much water can be stored for various water uses. It will also assist in setting operating rules that store and release water at the right times in order to optimize how much water is harvested (yield) instead of it running down to the sea prematurely.
System operations	Based on the above water balance and water budget analysis, to determine the best operating rules for managing this scarce natural resource.	After determining actual water requirements, it will be possible to fine tune dam (and water use) operating rules that release, store and allow proper water use at the appropriate times of the year. This will both save water and provide added security for various water users so that they have adequate supplies when they actually need this water. These operations will more than likely require increased storage at various points in the Nicola River Basin.



Issues/Practices	Ideal/Realistic Goals and Objectives	Potential First Steps Towards Solutions (Strategies)
Nicola Lake Dam Completion	It has been clearly identified that the need exists to access water storage behind the Nicola Lake Dam that has already been allocated. A small "hump" in the lake outlet channel is currently limiting access to 13,000 acre-feet of water storage.	Stakeholders have unanimously agreed that the completion of this project that was originally conducted in the 1980's should be studied and prepared for implementation if it is found to be feasible. The Nicola Stock Breeders Association is planning to conduct this study in 2005. This study will include: the assessment of the technical viability of the project; potential environmental impacts; cost benefits analyses, *et cetera*.
8. Integration of issues		
Multi-disciplinary	All the above issues and others should be assessed with each of the other ones involved in order to identify overlaps and how each could influence the other during the decision-making process.	The various sub-committees that will be appointed in the new river basin water management institution or body, will have to assess their specific tasks (e.g. monitoring; research; water storage; hydrology; project implementation; fundraising,…) in the context of the bigger picture. This integration should also be managed by the leaders of this organization.
Geographically	Stakeholders in the various sub-basins should come together to tackle specific issues relevant to their water course and area.	Similar integration and mobilization of resources as mentioned above, but just at a local level.

Way Forward

During the course of this study, it has become quite evident that all water users in the Nicola River Basin have similar objectives regarding the management of their water resources. These include:

- A secure supply of good quality water to maintain their livelihoods and life cycles;
- The need to establish unambiguous "rules of the game" with regard to managing water resources; the way in which land and water is actually used; and the way, that these rules can be enforced by government authorities.
- The inherent need to be good stewards of our water resources and our natural environment. This also related to self preservation (i.e. living in a healthy and safe environment drinking good quality water) in addition to our role of protecting nature (e.g. fish and other creatures and the habitat they require to live in).
- The provision of a healthy regional economy that, within environmental reason, benefits the whole Nicola Basin Community.

These and other objectives were confirmed at the October 2004 public workshop held in Merritt. This workshop, hosted by the Nicola Watershed Community Round Table (NWCRT), also proved that there is a mutual respect between various community groups for each others values with regard to the importance of water.

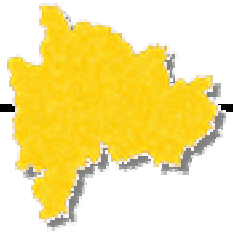
There was also an overwhelming resolve by all workshop attendees to proceed towards the production of a water management institution and water management plan for the Nicola River Basin. First Nations leadership (Nicola Tribal Association) were amongst the strongest advocates for advancing this water stewardship process.

An associated workshop report and a full video record of the proceedings are available from the NWCRT.

Numerous follow up meetings (November 2004 through January 2005) have been held by the NWCRT to explore the way forward and the structure of the stakeholder water management authority that is envisaged.

The following broad strategy (road map) has been recommended by the authors of this report:

- This scoping level study has produced a broad-brush overview of what has believed to be relevant water management information. It has only been possible to collate existing information and to identify important knowledge gaps. It has attempted to identify as many Nicola River Basin water management issues and concerns as possible. The process has also focussed on creating partnerships and facilitating communication amongst various stakeholders.
- The next step for the Nicola Stock Breeders Association would be to present this report to the various stakeholders for review and debate.
- There is the important need to set up a water management institution or framework that can run with the process of developing a water management plan and that can deal with the various day to day water management issues that will arise in future. Clear roles and responsibilities must be defined for all participants.
- A clear vision of what has to be achieved by this group of stakeholders will be fashioned by the various mandates and personal values that will be shared with the group. The reason for gathering (i.e. the mission of the group) will also have to be articulated.
- The vision and mission together with the technical information presented in this and other reports should enable these stakeholders to develop specific water management objectives and goals that they wish to obtain.
- After setting the course of action, it will then be necessary to prioritize the various water management issues. Prioritization is typically linked to: individual mandates and personal and corporate values; to where the best value will be obtained for money spent; where the best and easiest successes can be achieved; and others.



- After prioritizing these issues, it will be necessary to agree on the information gaps and what actions need to be taken to obtain this management decision support information.

- The group will then be in a position to identify the strategies (game plan or roadmap) needed to proceed towards the formulation of a water management plan for the Nicola River Basin. These strategies will include various management options such as dealing with: the Nicola Lake Dam; water conservation issues; creating additional storage; determining optimum river system operating rules that go towards meeting the water security needs of most of the sectors represented.

- Specific tasks can then be determined and specific actions assigned to certain people or sub-committees. Human and financial resource requirements can be linked to these tasks and actions. It is believed that senior government officials would like to see a water management institution successfully developed that can be used as a prototype in other parts of British Columbia.

- The overall coordination of the assignments will have to be conducted by a leadership (or planning) team that continually reviews, directs and integrates the findings of the various assignments. This evaluation and tracking exercise should continually stimulate the stakeholder group as a whole. In other words, fresh facts and information must be provided at meetings. Credit should be given where it is due and social interaction should be encouraged in order to make this water management experience enjoyable and communally rewarding. Success must be celebrated.

- It will be more than likely that the water management plan will be developed incrementally in stages. It is recommended that a Drought Management Plan be drafted by mid-year 2005 (this can be motivated in that most of the water management issues occur during dry periods). This would be a game plan that deals with issues such as what we are going to do communally if we have a dry, low flow period during July 2005. Are we going to wait for antagonistic letters from government authorities or are we going to work together with these officials to voluntarily find solutions to low fish flows? It is hoped that this Drought Management Plan would form the framework which can then be further developed into a fully fledged Water Management Plan over the ensuing years.

Conclusion

Over the past number of years, it has been noted that water flows in the Nicola River basin have been diminishing. This has caused serious concerns for anadromous fishery managers and the agricultural sector alike.

Although a lot of strategic water management work was conducted during the early 1980's, very little has been accomplished since then. At the beginning of 2004, the Nicola Stock Breeders Association decided to take the lead in ensuring that something was done to start collating scientific facts and to encourage the Community to work towards formulating a Water Management Plan for the whole Nicola River System.

The Association approached Urban Systems Ltd. in Kamloops to assist them in this process, and funding was sourced from:

- the Canada-British Columbia Water Supply Expansion Program ($20,000);
- the Pacific Salmon Foundation ($5,000); and
- the Stock Breeders Association itself ($4,000).

The Expansion Program later increased this budget by another $10,000 to cover half the costs of the public workshop. The Nicola Watershed Community Round Table, who hosted the October 2004 workshop, sourced the other half of the funding.

It is felt that within this relatively small Phase 1 budget that a lot has been achieved. The fruit of these efforts have been as follows:

- the wealth of information analyzed and presented at the workshop;
- a Workshop Report;
- this Scoping Study Report; and
- a 60 person Multi-stakeholder Committee that now meets monthly under the strong leadership of Mr John Anderson and Ms Salomon-de-Friedberg of the Nicola Watershed Community Round Table. It is believed that this committed public participation and the management framework/institution that is developing will be the key to sustainability of this water management planning initiative.

It is hoped that this brief Scoping Report may be used by the Multi-stakeholder group as a foundation (information, issues and solutions) on which to formulate a more comprehensive Water Management Plan over the course of the years to come.

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