Participatory Integrated Assessment of Water Management and Climate Change in the Okanagan Basin, British Columbia

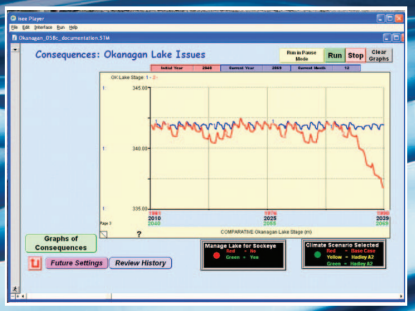
FINAL REPORT



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Cover Photo Captions

Clockwise from top left:

1. *Drip irrigation and mulching, Pacific Agri-Food Research Centre, Summerland, BC (Tina Neale)*

2. *Installation of water intake at Okanagan Lake, Penticton BC. (Bob Hrasko)*

3. *Systems model output screen, Okanagan Lake stage scenarios (see Figure F.17).*

4. *View across Okanagan Lake near Ellison Provincial Park (Wendy Merritt).*

NOTICE TO READERS

Previous reports published in this research series are:

Cohen, S., and T. Kulkarni, eds. 2001. *Water Management & Climate Change in the Okanagan Basin*. Vancouver: Environment Canada & University of British Columbia.

Cohen, S., and T. Neale, eds. 2003. Expanding the Dialogue on Climate Change & Water Management in the Okanagan Basin, British Columbia. *Interim Report, January 1, 2002 to March 31, 2003*. Vancouver: Environment Canada and University of British Columbia.

Cohen, S., D. Neilsen, and R. Welbourn, eds. 2004. Expanding the Dialogue on Climate Change & Water Management in the Okanagan Basin, British Columbia. *Final Report, January 1, 2002-June 30, 2004*. Vancouver: Environment Canada, Agriculture and Agri-Food Canada & University of British Columbia.

Several manuscripts from the 2004 study have been published in refereed journals, or are in press. These are:

Cohen, S.J., D. Neilsen, S. Smith, T. Neale, B. Taylor, M. Barton, W. Merritt, Y. Alila, P. Shepherd, R. McNeill, J. Tansey, and J. Carmichael. 2006. Learning with local help: Expanding the dialogue on climate change and water management in the Okanagan region, British Columbia, Canada. *Climatic Change*. 75:331-358.

Merritt W., Y. Alila, M. Barton, B. Taylor, S. Cohen and D. Neilsen. 2006. Hydrologic response to scenarios of climate change in subwatersheds of the Okanagan Basin, British Columbia. *Journal of Hydrology*. 326, 79-108.

Neilsen, D., Smith, C. A. S., Frank, G., Koch, W., Alila, Y., Merritt, W., Taylor, W. G., Barton, M., Hall, J. W. and Cohen, S. J. 2006. Potential impacts of climate change on water availability for crops in the Okanagan Basin, British Columbia. *Canadian Journal of Soil Science*. 86:921-936.

Shepherd, P., J. Tansey, and H. Dowlatabadi. 2006. Context matters: the political landscape of adaptation in the Okanagan. *Climatic Change*. 78:31-62.

Papers from the 2006 study are still in preparation, and will be submitted for review later this year.

Opinions expressed in this report are those of the authors and not necessarily those of Environment Canada, University of British Columbia, Natural Resources Canada, or any collaborating agencies.

STUDY TEAM

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Stacy Langsdale (left) facilitating model building break-out group at the second model building workshop, April 15, 2005, Kelowna BC.

Acknowledgements

This study is a follow-up to earlier research projects, cited as Cohen and Kulkarni (2001) and Cohen et al.(2004) (see Chapter 1.0). The authors of this report are members of a collaborative research team, some of whom also contributed to these earlier publications.

This project was made possible with financial support from the Government of Canada's Climate Change Impacts and Adaptation Program (Project A846). The authors would also like to acknowledge support and cooperation from: Environment Canada, Smart Growth on the Ground, University of British Columbia, and BC Ministry of Environment. We would also like to thank Denise Neilsen and Grace Frank from Agriculture and Agri-Food Canada, and Wendy Merritt from Australian National University, who assisted with data transfer from their components (see Cohen et al. 2004) to this study.

The group-based model building process, led by Stacy Langsdale, was a crucial component of this research effort. We would like to express our appreciation to Jeff Carmichael, Craig Forster, Brian Symonds, Allyson Beall, Barbara Lence and Jessica Durfee, for their advice and participation in the design of this year-long process of interactive workshops and dialogue. We would like to acknowledge and thank the following individuals who participated in this process, and helped to shape the structure and content of the model: Diana Allen, Des Anderson, Greg Armour, Darryl Arsenault, Jeptha Ball, Lorraine Bennest, Vicki Carmichael, Kristi Carter, Al Cotsworth, Corui Davis, Anne Davidson, Don Degan, Shannon Denny, Rod Drennen, Phil Epp, Don Guild, Brian Guy, Leah Hartley, Rob Hawes, Robert Hobson, Bob Hrasko, Nelson Jatel, Mary Jane Jojic, Stephen Juch, Jessica Klein, Steve Losso, James MacDonald, Deana Machin, Lloyd Manchester, Wenda Mason, Don McKee, Rick McKelvey, Siobhan Murphy, Denise Neilsen, Tim Palmer, Toby Pike, Barbara Pryce, Steve Rowe, Gord Shandler, Tom Siddon, John Slater, Ron Smith, Mike Stamhuis, Brian Symonds, Sonia Talwar, Jillian Tamblyn, Ted van der Gulik, Peter Waterman, Mark Watt, Adam Wei, Bruce Wilson, and Howie Wright.

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The authors would like to thank the reviewer, Jim Bruce, for his thoughtful comments on this report.

Executive Summary

This is the final report of the study, "Participatory Integrated Assessment of Water Management and Climate Change in the Okanagan Basin, British Columbia." This study was made possible with financial support from the Government of Canada's Climate Change Impacts and Adaptation Program (project A846). The research activity described in this report is a collaborative, interdisciplinary effort involving researchers from Environment Canada, Smart Growth on the Ground, the University of British Columbia, and the BC Ministry of Environment, as well as many local partners and researchers from Agriculture and Agri-Food Canada and Australian National University, who participated in our 2002-2004 study.

Previous research on climate change and Okanagan water resources since 1997 has provided a potential damage report. Impacts on water supply and water demand have been described, and a dialogue on adaptation options and challenges has been initiated. This study offers a participatory integrated assessment (PIA) of the Okanagan water system's response to climate change. The goal of the PIA is to expand the dialogue on implications of adaptation choices for water management to include domestic and agriculture uses and in-stream conservation flows, for the basin as a whole as well as for particular sub-regions. This has been accomplished through collaboration with ongoing studies in these areas, and builds on the results of earlier work.

The major components of this study are:

1. **Residential water demand:** developing future demand scenarios for residential users, factoring in population growth and adaptation options;
2. **Adaptation costs:** expanding the inventory of various supply and demand management measures and incorporating water treatment costs;
3. **Decision support model:** building a system model, using a group-based process with local experts, which enables learning on impacts of climate and population changes, and the effects of implementation of various adaptation measures;
4. **Adaptation policy – residential design:** bringing climate change into community design through Smart Growth on the Ground's process for creating a water-smart community plan in the Town of Oliver and surrounding area;
5. **Adaptation policy – agricultural water use:** exploring growers' views on regional water policy.

Residential Water Demand

Previous studies in the Okanagan Basin have found that average daily residential water use in the region is highly variable, ranging from approximately 470 to 789 litres per capita per day (Lpcd). Drought year residential water use in the Lakeview Irrigation District has been

estimated as high as 1,370 Lpcd. When compared to municipal water use across Canada, water use in the Okanagan is relatively high.

The Okanagan has experienced dramatic population growth, from approximately 210,000 in 1986 to 310,000 in 2001. The population is expected to continue to grow, reaching nearly 450,000 by 2031. This increase in population and associated development will result in increased municipal water demands. Planning for future municipal water demands must take into account not only the future population of the region, but also urban development patterns, and changes in water demand resulting from a warming climate.

Building on earlier work reported in the 2004 study, three case studies were chosen for this research: the Town of Oliver, City of Penticton and City of Kelowna water utility. This study was a multi-attribute analysis that used scenarios, constructed with available data, to explore the combined impacts of population growth, residential form, climate change and demand side management on municipal water demand. The scenarios approach aimed to create depictions of future water demand that were plausible given a range of development, climate change and water management trends that could occur in the future. Scenarios of future water demand for each case study were calculated in a spreadsheet model at annual time steps for the period 2001 to 2069, corresponding with the 2020s and 2050s periods typical of climate change scenarios.

Three scenarios of population growth (low, medium and high) were defined for each case study based on population growth projections published in available planning documents. "Current preferences" and "smart growth" housing scenarios were defined as lower and higher density development patterns. The six climate change scenarios developed in the 2004 study were applied to determine the impacts of climate change on outdoor residential water use. A literature search was conducted to compile a list of residential demand side management (DSM) options along with their expected water savings. The information was then used to define seven DSM options for testing in the water demand scenarios. DSM options were selected to reflect a range of possible water savings approaches including economic incentives, educational programs, and mechanical or technological solutions.

For Kelowna, population and dwelling demand growth in the current preferences scenario accounted for average increases in water use by 41-99% in the 2020s and 115-360% in the 2050s. The maximum increase in water use determined in the current preferences housing scenarios, without the impacts of climate change or additional DSM, ranged from 163% in the low growth scenario to 570% in the high growth scenario.

The climate change impact on water use in the 2020s ranged from approximately 6% to 10%. The climate change impact became more pronounced in the 2050s increasing water use by 10 to 19%. When combined with population and current preferences dwelling growth, the climate change impact on water use was magnified. This is due to the increased number of ground-oriented dwellings and hence, increased outdoor water use. In the high population growth scenario, the combined effects of climate change and population growth increased water use between 111 and 119% in the 2020s and 407 to 446% in the 2050s over the 2001 baseline. This was 12 to 21% more than population growth alone in the 2020s and 45 to 86% more in the 2050s.

The implication for climate change in water management planning is that annual water demands predicted without climate change occur several years earlier in the climate change scenarios. For example, in the 2030 to 2039 period, annual water demand with "average" climate change occurred approximately four years earlier than in the no climate change scenario. In the 2040 to 2059 period, this increased to an average of six years earlier.

A combined DSM portfolio, including public education, metering with increasing block rate tariffs, xeriscaping and high-efficiency appliances, was assessed in several scenarios. For climate change scenarios, residential water use increased by only 2 to 5% in the 2020s and 81 to 92% in the 2050s, compared with 2001. With low population growth, 2020s water use was actually reduced below 2001 levels by 10 to 13% in the 2020s and increased only 24 to 32% in the 2050s. With high population growth, 2020s average water use increased by 20 to 24% and 2050s use by 165 to 182%. Similar savings were reported for the Penticton and Oliver case studies.

The untapped potential of demand side management in the Okanagan region offers significant flexibility in dealing with changing supply and demand regimes without impacting quality of life for water users. In the scenarios, DSM resulted in dramatic reductions in water use, even in the cases where demand management programs were already in place. Water metering can significantly reduce demand, but the combined effects

of full retrofits and xeriscaping would reduce water use far more than metering.

It is also important to note that DSM measures have benefits beyond water use efficiency to the overall sustainability of the Okanagan. Demand management reduces the sensitivity of water management systems to external influences such as climate change and development patterns. Regardless of what the future brings in terms of climate change and population growth, demand management is relevant to the present and represents a "no regrets" option for dealing with a variety of concerns.

Adaptation Costs

The focus of this component was on measures that individual utilities could undertake to adapt to the changing hydrology of the basin and to increased water demands due to climate warming. These measures, aimed at increasing the reliability of the system's water supply to meet its needs, are not conceptually new and the engineering and management issues are well understood.

Historically, developers of new water supply have relied on surface water in the Okanagan, concentrating first on gravity fed systems from upstream storage and subsequently on pumped water from the mainstem system when tributary storage was not adequate. Groundwater development followed, but mostly as a secondary or small local source of supply. All of the major communities, with the exception of Osoyoos rely primarily on surface water as their main supply.

Groundwater development costs can be relatively low compared to other alternatives. A recent development by the Glenmore-Ellison Improvement District illustrates the cost effectiveness of groundwater. The well, currently under construction, has an estimated capital cost of $258,000 with an annual supply of 1200 megalitres (ML), resulting in a per-unit cost of $206 /ML. This represents an extremely low cost compared to other options. However, problems exist that will affect the use of this option in the future.

Upstream storage is another supply option. Costs are dependant on site specific factors and vary considerably from project to project. Dam height is particularly important, resulting in more stringent construction requirements and higher costs. Costs of recent storage projects range from $418/ML to $4988/ML.

Mainstem pumping, including pumping from Okanagan Lake, has a probable cost range of about $800 to $3200 per ML depending on the height required for pumping, the length of intake pump required and the ability to use existing balancing reservoirs versus new construction. In this study, some newer projects costs' have been determined, and these range from $114/ML to $1375/ML, however, the lower cost projects only present costs for the lake intake pipe portion and do not include conveyance costs, and none of these studies include reservoir or water treatment costs. Since the quality of mainstem water is often better than the quality upstream, water treatment costs can also be lower. Given the possibility of significant new mainstem pumping developments, it is worth considering some of the micro and macro scale issues. For example, if service is required more than 130 metres above the lake, an additional pumping station may be required.

When calculating the costs of any supply side adaptation options, the costs of water treatment should also be considered. In most supply options, the costs of treating the water are at least as great as the costs of developing the supply. The various filtration technologies, often required to meet regulatory standards, range from $2,700 to over $5,000 per ML treated. UV disinfection and clarification have a much lower cost range. As a result, water treatment costs become even more important in adaptation decisions.

Previous work on DSM options outlined the range of costs of a number of options including public education, irrigation scheduling, high efficiency irrigation systems, leak detection and domestic water metering. Irrigation scheduling ($400 – 700 per ML) and public education ($700 per ML) were the two lowest cost options. Leak detection and high efficiency irrigation systems were in the $1200 to $1400 cost range, while costs of domestic metering ranged from $1500 to $2200 per ML saved. Costs for each of the various measures varied based on assumptions about the size and location of the system.

Data from recent conservation case examples is available for the central Okanagan including the Black Mountain Irrigation District (BMID), the South East Kelowna Irrigation District (SEKID) and the City of Kelowna. The cost of the meters in SEKID is about $450 per ML. A proposed domestic metering program by SEKID would have a higher cost of about $2500 per ML saved. At BMID, the cost per ML saved is estimated to be approximately $600 for the agricultural metering. The City of Kelowna implemented a domestic metering program in 1996-97 which included a public education component. This program resulted in a 20 percent

reduction in water use by domestic users. The costs per ML saved are approximately $2000.

Water conservation will often be a first choice option for individual utilities given its cost advantages, particularly when considering the cost of water treatment for new supply sources. Despite the cost advantages, conservation efforts by individual utilities may not be sufficient to meet the joint challenges of population growth and climate change. The potential 20-30% water savings from conservation by municipalities may represent only a few years of growth in demand from increasing population. The larger absolute gains achievable through agricultural metering will take longer to implement. Utilities are thus forced to look at options for developing new supplies.

There are a few upstream storage developments in the proposal stage, which are advantageous from both a basin wide and an individual utility's perspective. The more cost effective upstream storage sites have already been developed, limiting further development by municipalities and irrigation districts. Given the cost advantages, utilities will be looking to develop groundwater supplies where feasible.

Decision Support Model

The purpose of this component was to assist the Okanagan water resources community in incorporating climate change in their planning and policy development and to evaluate their water resources in a system context. This was done through a Participatory Integrated Assessment (PIA) process centered on the development of a System Dynamics model. The study did not only focus on climate change, but on a wide range of issues co-defined by the participants and researchers. The products of this process are: (1) A shared learning experience for the participants and the research team; and (2) The resulting simulation model, a decision support tool for increasing knowledge about the system, and for exploring plausible future scenarios and adaptation opportunities.

Participants in the group model building process were recruited by invitation, with the intention of achieving a diverse and balanced representation of the various organizations and responsibilities related to water resources management in the Okanagan Basin. Affiliations included First Nations, Federal, Provincial (BC), Regional District, and Local Governments; Environmental Non-Governmental Organizations; Academia; Irrigation Districts; Agricultural Association (BC Fruit Growers Association); Consultancy; and Local Initiative (The Okanagan Partnership).

Participants provided a wealth of ideas about the Okanagan system, particularly in the areas of hydrology, imported water, instream flow, water quality, land use (Agricultural Land Reserve), forestry, population & urban , development, residential water use, and crop water demand.

The software used in the construction of this model was the stock and flow STELLA™ software. Participants became familiar with STELLA™ through a year-long series of workshops and individual sessions. Previous research conducted on climate change and hydrologic scenarios, and crop water demand and residential demand, served as an important foundation for the model. However, the participants provided the information to link what these scenarios mean to the Okanagan context. The software became the medium for expressing these linkages. Because the participants did not actually create the model code themselves, generating a feeling of ownership and trust in the model was challenging. The workshops provided the best opportunity for education about the model through hands-on interaction and dialogue with the modeling team.

The long-term significance of this participatory modeling process to policy development cannot be measured during the timeframe of this phase of the project. Since we do not have a control group, we may never be able to measure what changed as a result of our efforts. Regardless, we are optimistic that the process did make a difference to the participants, who were quite positive about the experience. Throughout the process, participants recommended that this work be shared with a wider community, particularly to elected officials and the public.

Only one climate scenario was tested in this version of the model: Hadley A2. Of the six scenarios evaluated in the 2004 study, Hadley A2 is a moderate to worst climate scenario depending on the evaluation criteria and the period of interest. Based on this climate scenario, and a range of regional population growth scenarios, model results show that without interventions, regional water demands will not be met in the future. ***Demand will exceed supply by the 2050s, and as early as the 2020s in relatively dry years.*** Aggressive implementation of residential conservation measures could reduce total demand in the 2050's by about 8-12% (low growth and high population growth scenarios, respectively). In any event, this is not enough on its own to offset the supply-demand gap.

The components of supply and demand respond differently to the stressors of population growth and

climate change. According to the Hadley A2 scenario that was built into the model, natural flow into the basin from precipitation will decrease from historic rates, more gradually in the 2020's by about 5%, then more drastically in the 2050's, by about 21%. At the same time, agricultural demand across the basin will increase with climate change. Residential demand will increase with climate change as well; however, residential demand appears to be more sensitive to growth rate than climate change, within the range of growth rates tested. Instream ecosystem demand rates are more challenging to define. In this work, they are based on established policies. Since these policies allow adjustments to the requirement during low flow years, the instream flow demand level appears to decrease with climate change. This is a result of the increased incidence of low flow years, and does not reflect the actual needs of the ecosystem in warmer climates.

Aggregating these three needs, the total average demand is 79-82% of total inflow in the 2020's, and 82-113% of total inflow in the 2050's. Low values in the range correspond to slow residential growth and the upper values correspond to rapid population growth. Aggressive implementation of residential adaptation measures can at least partially compensate for the increase in demand due to the population expansion. Additional conservation measures in the agricultural sector will also help to offset the increase in demand due to climate change; however, the combination of all of these conservation policies may not be sufficient to maintain the level of system reliability that was experienced in the 1961-1990 simulation period.

Supplemental use of Okanagan Lake would be of benefit to meeting future agricultural and residential user demands. However, system performance for meeting future instream flow requirements significantly deteriorates, and Okanagan Lake levels would decline. This indicates that on its own, additional withdrawal from Okanagan Lake would lead to mining of the lake and increased risks to aquatic ecosystems. This does not mean that supplemental use of the lake should be rejected as a possible adaptation option. If used in conjunction with DSM, overall system performance could improve.

Adaptation—residential design

One approach to design and implementation of adaptation responses, within the context of local and regional development, is a process known as "Smart Growth", being promoted by Smart Growth on the Ground (SGOG). Smart Growth on the Ground (SGOG) is a unique initiative, helping BC communities to plan and implement more sustainable forms of urban growth.

In 2005/2006, the Oliver BC region was the focus of SGOG work. The SGOG partners formed links with the Participatory Integrated Assessment team to gain experience in connecting climate change research and urban design within an ongoing SGOG design process taking place in Oliver.

A key activity in the SGOG process is a Design Charrette. A charrette is an intensive, multi-stakeholder design event. Citizens, elected officials, government staff, and other experts are brought together with professional designers. In a collaborative atmosphere, charrette team members undertake an "illustrated brainstorm." The team created land use, transportation, urban design, and other design plans for the particular geographic area under study. The design brief included a target of a 38% reduction in residential water use by 2041. The team was also encouraged to explore "greener" building standards to conserve water. The charrette team made a number of recommendations on water management and actions to address climate change, including "thickening" (increasing residential density), xeriscaping, greening of streets and buildings, and expanded use of residential water saving devices.

Adaptation – agriculture

The goal of this component was to improve understanding of both the process of autonomous adaptation to climate change and the factors that must be considered in the development of agricultural water policy in the Okanagan. To accomplish this goal, this study explored the ways in which Okanagan wine-grape growers use water and are likely to respond to future scarcity. Understanding how grape-growers make decisions to manage multiple risks and how actions taken to mitigate one risk affect exposure to others is an integral part of understanding the types of adaptations farmers do and will make, and the policy initiatives they are willing to support.

Information on growers' views on current and future water use were obtained through interviews in the South Okanagan. Previous research has indicated that wine-grape growers in the South Okanagan are more vulnerable to climate change and more dependent on water to manage risk than those in the central or northern parts of the region. Growers were interviewed in January 2006 using a semi-structured questionnaire with a mix of open and closed questions, designed to

facilitate comparison between responses and provide growers with the flexibility to answer unpredictably.

Examination of operators' choice of irrigation technology indicates that there is a preference for irrigation systems which allow the grower to strictly control water application to the vines. A majority use drip, or drip in combination with overhead sprinklers. Overhead irrigation is generally perceived to be less water efficient than other technologies. The most widely perceived benefit of using a drip system is the ability to grow a very high quality grape. Deficit irrigation is easy to practice because the system is highly controlled. A majority of respondents commented that the most effective way to increase profit margins is to focus on grape quality through deficit irrigation.

Warmer summer and winter temperatures are perceived as an advantage from an industry perspective because they are associated with a northward shift in the geographic extent of grape-growing in the valley. Warmer winter temperatures might also be a benefit if the incidence of 'extreme' cold events (below -30 Celsius) decreases because this would minimize vine damage. However, growers in this study expressed concern about increased temperature variability because in the autumn and spring, vines are very sensitive to frost events immediately preceded by mild temperatures. Warmer temperatures were also associated with declining snowpack but growers were uncertain if this would be offset by greater precipitation at other times of year.

Other risks identified by producers include decision-making by local, provincial and federal governments, selling through the liquor distribution branch, increasing regulation of wineries, escalating urban-rural conflict, and local land development planning. Some individuals mentioned climate extremes and variability as a big risk they face. These risks are associated with extreme cold, mild weather that increases vulnerability to spring and fall frost, excess moisture and pests. Risks associated with climate change and water shortage were identified by only a small number of respondents.

Growers' perceptions of the future of their personal water source and that of the basin system are widely variable. Notably, individuals' perceptions of their personal water security are less related to their philosophies about hydrologic change than to their level of personal control over their water supply. Many of those with greater than ten years in the valley commented that snowpack has decreased steadily in the last ten to fifteen years and climate is warmer, more variable, and prone to extremes. Growers voiced mixed opinions about the implications of climate variability for basin supply. Four individuals suggested that climate patterns are cyclical and that today's warming trend will have cooled somewhat by 2031. In this scenario, water supply will remain the same in the future. Others believe that a diminished snowpack is indicative of climate warming, either on a short-term or a long-term scale, and will probably reduce basin supply further by 2031.

Agricultural adaptation research indicates that adaptation to climate change occurs in an environment characterized by multiple stressors, and farmers confront difficult trade-offs in their attempt to maximize diverse objectives. Since climate change is only one of numerous challenges managed by farmers, anticipatory adaptation policy should address existing problems without compromising the ability of farmers to manage other risks.

Lessons and Moving On

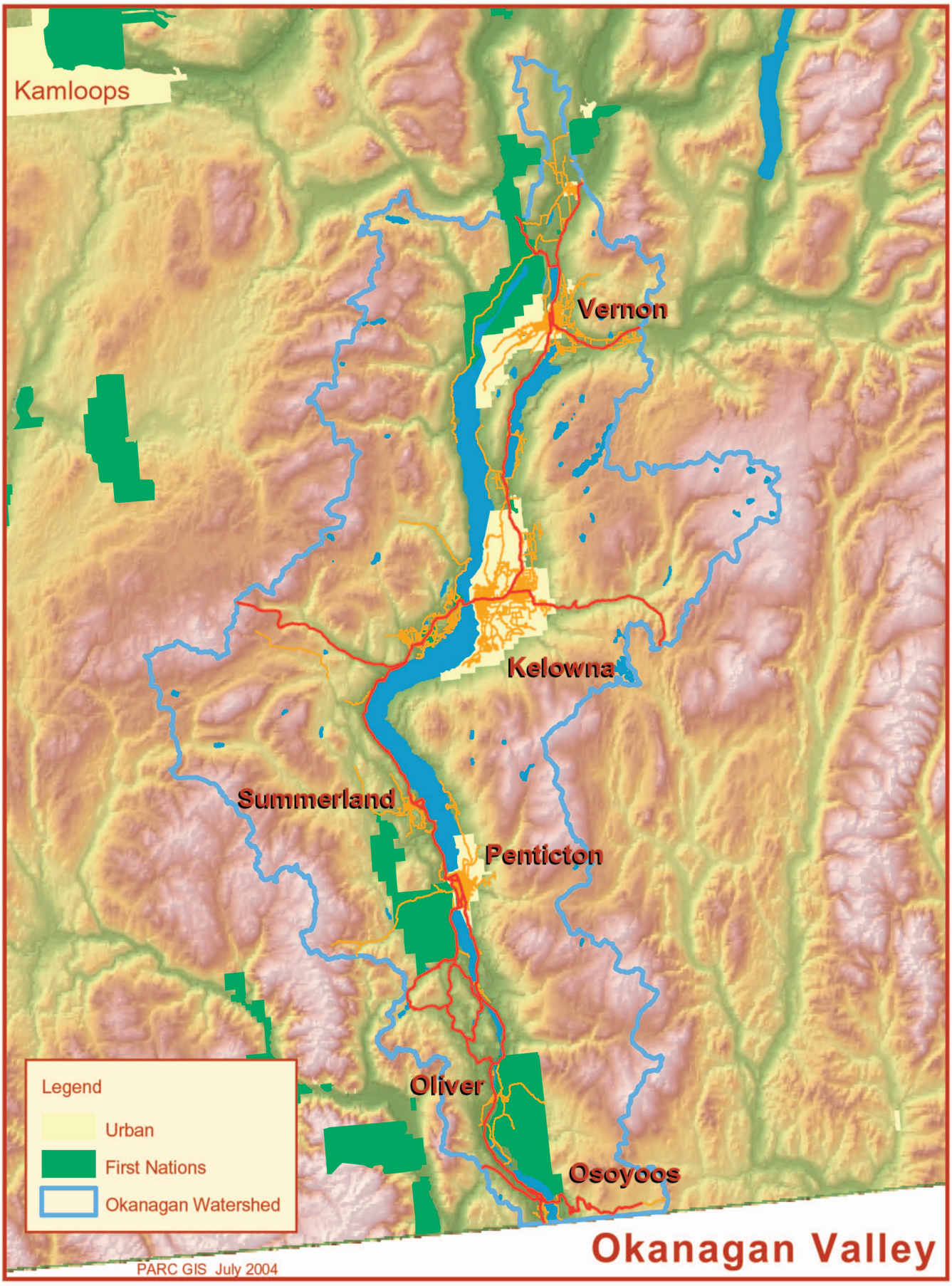
As the Okanagan grapples with its water resource challenges, there will be important questions regarding future demands and how these demands may be shaped by various forces. Our *quantitative* research has focused on climate change itself, and has included population growth scenarios, but we have not explicitly considered (or modeled) alternative development pathways. Our *qualitative* dialogue-based studies have offered some insights into the interplay between recent climate experiences and responses by individuals and institutions. We conclude, not surprisingly, that future climate change can expose some vulnerability, exacerbate existing risks, and possibly create new risks as well as new opportunities. However, we also need to ask questions about the potential effects of development paths themselves.

Moving beyond the climate change "damage report" requires an approach that explicitly integrates climate change response and sustainable development initiatives. Our study may have originated as an assessment of climate change impacts on water resources, but impacts on water supply and demand have considerable implications for regional development. In addition, this is not a one-way street. Development choices will also affect the water supply-demand balance. Some development choices could exacerbate climate-related water problems, while others could ameliorate them. But what are the practical aspects of a long-term sustainable development pathway for the Okanagan? How would this pathway

incorporate potential climate change impacts and adaptation without inadvertently creating new vulnerabilities?

The Adaptation and Impacts Research Division of Environment Canada and the Institute for Resources, Environment and Sustainability at the University of British Columbia are collaborating to propose a research strategy to address the linkages between global climate change and regional sustainable development. The project, referred to as AMSD (Adaptation-Mitigation-Sustainable Development), employs an integrative approach in which the focus is on potential synergies of response measures, and on defining the response capacity of regions to address these challenges. The niche of the proposed Okanagan AMSD case study would be the explicit linkage of climate change response measures and regional development actions. The study would be looking for synergies that would be mutually beneficial to achieving both objectives of enhancing sustainability and reducing climate-related vulnerability. The Okanagan case study would begin with water resource issues, building on past and ongoing research, but with the goal of extending this to the exploration of alternate development paths already being considered within the region.




Kamloops
Vernon
Kelowna
Summerland
Penticton
Oliver
Osoyoos
Legend
Urban
First Nations
Okanagan Watershed
PARC GIS July 2004
Okanagan Valley

