Produced for the Okanagan Basin Water Board
by CLPA Consulting, Ltd.

2009

Okanagan Basin Master Wastewater Management Plan Update

3/9/2009

EXECUTIVE SUMMARY

This report updates the Master Wastewater Management Plan completed in 1994 by Reid Crowther and Associates with current information and recommendations regarding water quality, community planning, wastewater management planning, the Okanagan Basin Water Board Sewage Facilities Grants Program, and issues ancillary to these. Valley wide sewage infrastructure projects have been prioritized in terms of health and environmental concerns, largely based on the potential for phosphorus reduction through wastewater treatment and collection. In addition, further options for the future of this grants program are proposed.

While better control over point source phosphorus loadings since the 1970's and 80's has resulted in much improved basin water quality, there are still some areas where further improvements can be made. Specifically, management of non-point source phosphorus loading through, research, awareness, and a basin wide strategy should be made a priority.

Community planning and wastewater management planning can assist with controlling non-point source loadings by careful planning of areas that do not have access to community sewers. Avoiding sprawl by clustering developments and locating them adjacent to existing sewered areas, providing buffer zones around sewage treatment plants to allow for expansion, cost sharing with aboriginal communities, and working with adjacent municipalities and regional districts to create urban containment boundaries and manage rural areas are some of the ways this can be approached. Further, property owners should be required to connect to sewer when it is available.

While there are some communities in the valley that have taken advantage of the Sewage Facilities Grants, there are others that have not yet had the opportunity to do so although they have been contributing to the fund throughout the life of the program. The program should be continued so that valley communities can continue to draw upon this resource to make further sewer infrastructure improvements intended to lead to improved basin water quality. It is also recommended that consideration be given to expanding the program to include stormwater infrastructure projects.

New contaminants such as pharmaceuticals and endocrine disruptors have been discovered in the basin lakes in recent years. It is recommended that continued research and monitoring of these potential contaminants to the watershed be continued in order to evaluate whether there is a threat to human or environmental health and what mitigation measures are necessary.

Finally, many examples of innovative use of reclaimed water were noted during the research undertaken for this report. As water conservation issues take on a growing importance throughout the basin maximizing the use of reclaimed water for offsetting fresh water demands could assist with drought management. Support for changes to reclaimed water use is an area which could be supported by the Okanagan Basin Water Board through policy changes or through grant funding.

TABLE OF CONTENTS

List of Appendices

List of Tables

List of Figures

List of Maps

SECTION 1.0 – INTRODUCTION

1.1 General

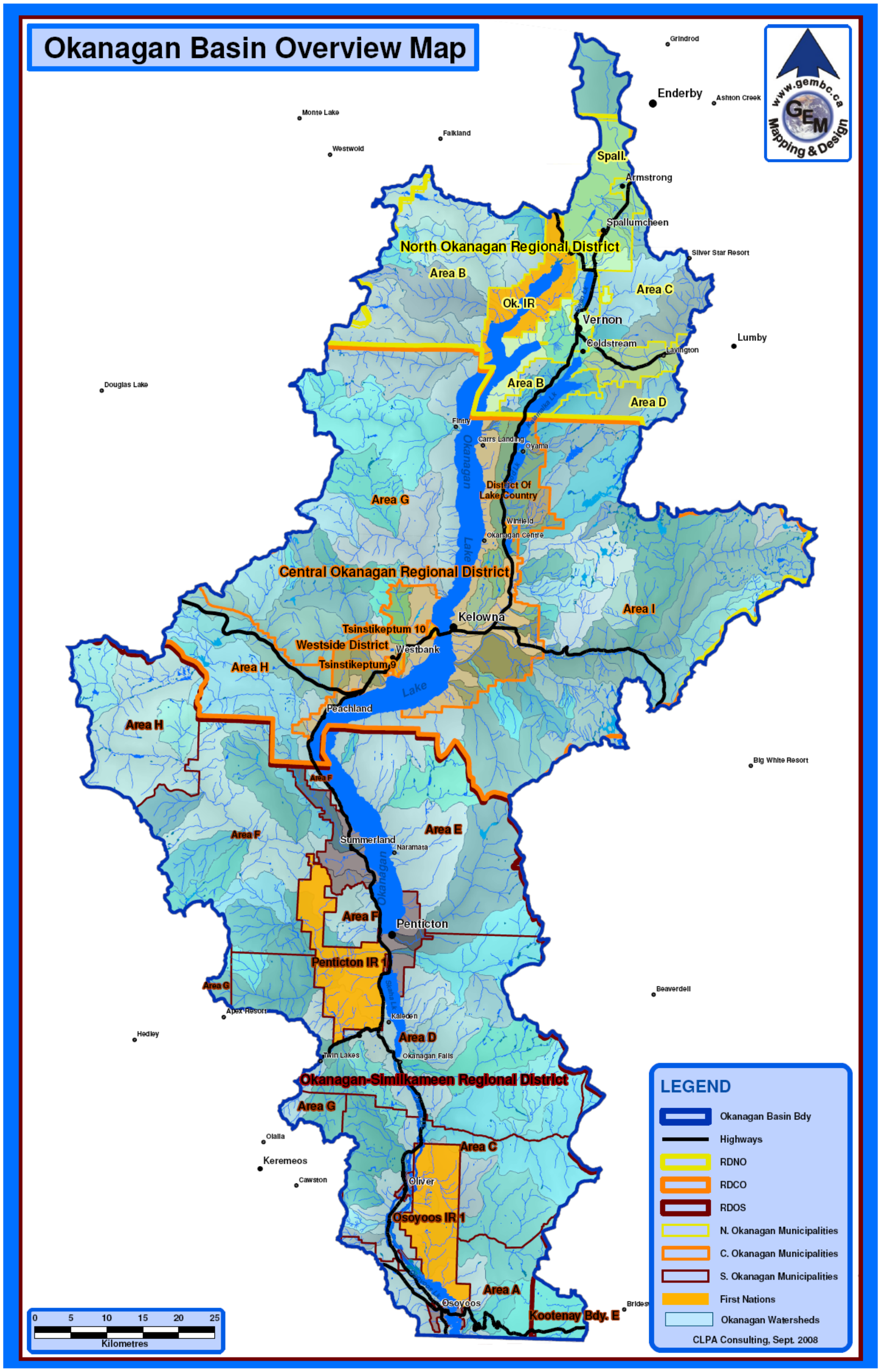
Okanagan Lake is arguably one of the most valuable lakes in British Columbia, serving as the cultural and economic centre for the region.[1] The Okanagan Basin is a relatively small watershed (8,200 km^2). The lower elevations have a semi-arid climate and are dominated by large mainstem lakes. Precipitation increases with increasing elevation into the forested plateau, and subalpine and alpine highlands. Most of the water in the Okanagan Basin is derived from the higher elevations of the basin, remote from the population centers at the valley bottom[2].

In the years since the last Master Wastewater Management Plan (MWMP) was completed in 1993, the Okanagan has experienced rapid population growth. The wastewater management plans and official community plans for valley communities have changed substantially and growth management has become a new focus. The purpose of this 2008 update to the MWMP is to anticipate the next 20 year horizon for sewage treatment and collection works in the Okanagan Basin.

The provincial government designated the Okanagan Basin as a Special Environmental Zone in 1985. In order to protect the sensitive water resources in the Okanagan Basin, a concerted effort has been made to reduce pollutant loadings from effluent discharges to the valley lakes. Water quality objectives were set for spring total phosphorus (TP) loading with the goal to reduce loading by 90%. Since 1985, a significant portion of the infrastructure development which qualified for Okanagan Basin Water Board (OBWB) grants, such as upgrading plants to tertiary treatment systems and funding systems for linking properties on septic systems to community sewers, has been completed. In addition, many sewage treatment plants (STP's) have been upgraded and expanded to deal with increasing loads and stricter effluent regulations. These successes in dealing with nutrient pollution are an example of how an integrated valley-wide plan can safeguard water quality under pressures of growth and emerging sources of contamination.

This MWMP provides an updated summary of liquid waste management plans (LWMP's) in the valley and identifies remaining eligible projects for the OBWB grants program, along with a timeframe for their completion. Projects have been prioritized in terms of health and environmental concerns, largely based on the potential for phosphorus reduction through wastewater treatment and collection. In addition, further options for the future of this grants program are proposed.

In total, sixteen plans were commissioned, each detailing the requirements and priorities specific to its area. The first (Vernon and Westbank) were completed in 1985 while the last few

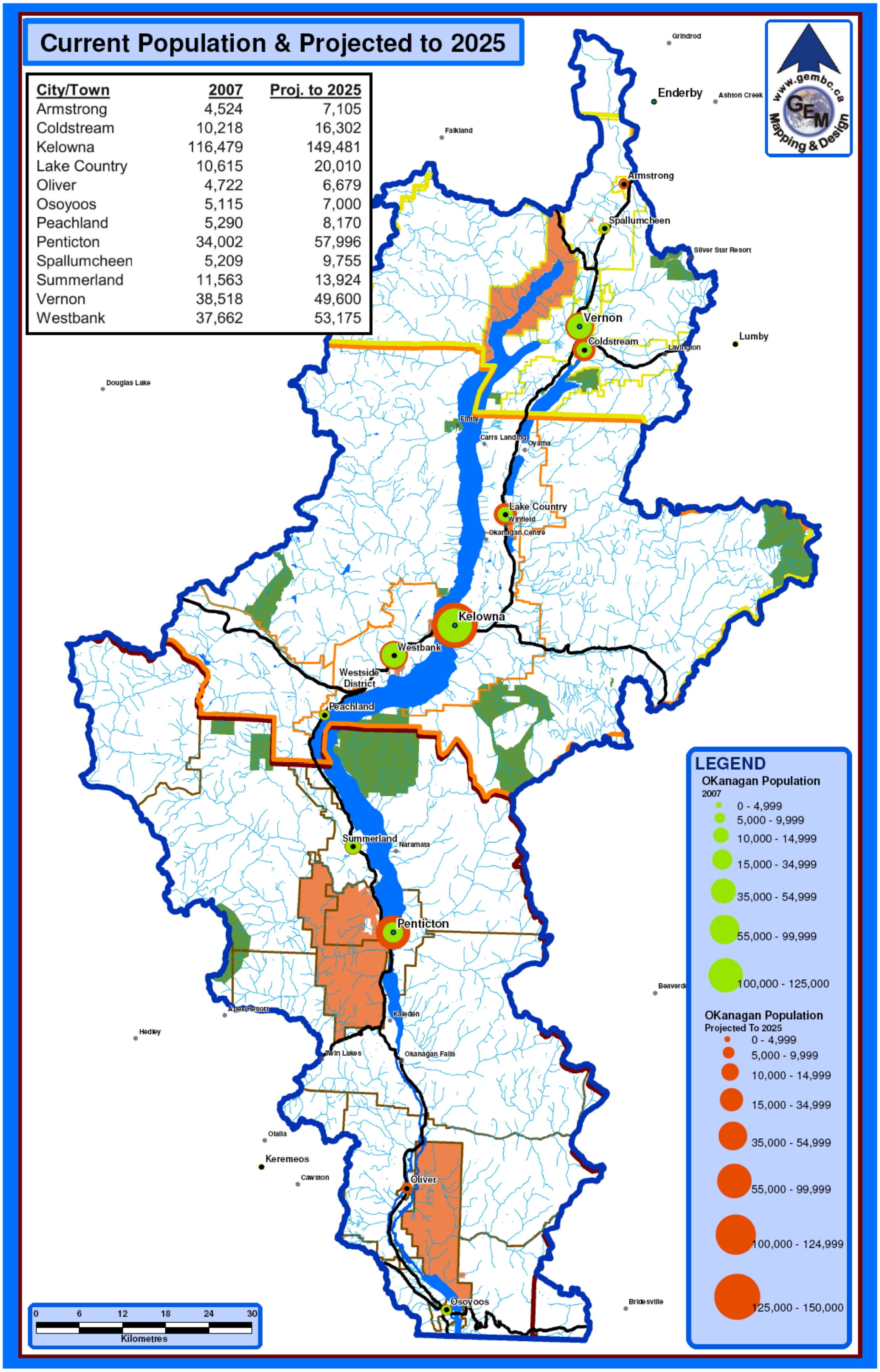

Okanagan Basin Overview Map
www.gembc.ca
GEM
Mapping & Design
Grindrod
Enderby
Ashton Creek
Monte Lake
Falkland
Westwold
Spall.
Armstrong
Spallumcheen
Silver Star Resort
North Okanagan Regional District
Area B
Area C
Ok. IR
Vernon
Coldstream
Lavington
Lumby
Douglas Lake
Area B
Area D
Finty
Carrs Landing
Oyama
Okanagan
District Of Lake Country
Area G
Winfield
Okanagan Centre
Lake
Central Okanagan Regional District
Area I
Kelowna
Tsinstikeptum 10
Westside District
Westbank
Area H
Tsinstikeptum 9
Lake
Peachland
Area H
Big White Resort
Area F
Area F
Summerland
Area E
Naramata
Area F
Penticton
Penticton IR 1
Area G
Apex Resort
Beaverdell
Hedley
Kaleden
Area D
Twin Lakes
Okanagan Falls
Okanagan-Similkameen Regional District
Area G
Olalla
Area C
Keremeos
Cawston
Oliver
Osoyoos IR 1
Area A
Osoyoos
Kootenay Bdy. E
0 5 10 15 20 25
Kilometres
LEGEND
Okanagan Basin Bdy
Highways
RDNO
RDCO
RDOS
N. Okanagan Municipalities
C. Okanagan Municipalities
S. Okanagan Municipalities
First Nations
Okanagan Watersheds
CLPA Consulting, Sept. 2008

(Spallumcheen, Coldstream and Regional District of Okanagan Similkameen (RDOS) areas E and F) were completed in 1993-94. The Basin Overview Map on the previous page delineates the individual areas that were studied. This Master Wastewater Management Plan report provides an overview comparison of the individual plans and uses this information as a basis for setting future priorities valley-wide.

It is important to note that each Wastewater Management Plan is a legal document. The approved plans are intended to replace discharge permits. As such, emphasis in this document is placed on approved plans only. Proposed changes to plans are documented for reference, however these changes cannot be evaluated until they have received technical, public, and ministerial approval.

Population Projections

Since as recently as 1939, the human population of the Okanagan Basin has tripled every thirty or forty years[14]. Possibly the greatest exceedence of Okanagan Basin Study (1974) recommendations is the population growth[13], as cities like Kelowna have among the highest rates of growth in Canada, increasing 10.6% between 2001 and 2006 (BC Stats). The total estimated population for the Okanagan Basin by the year 2025 is 413,920 according to BC Stats (Table 1.0). This estimate suggests an additional 69, 029 people will reside in the region from the 344,891 recorded in 2007 – an increase of 17% over this period. Another growth projection suggests the population doubling in the next 20 years (CMHC website), while a third projection is that if the present annual growth rate (2.5%) continues, the 2023 population would be one million (Hall *et al.* 2001).



Current Population & Projected to 2025

City/Town	2007	Proj. to 2025
Armstrong	4,524	7,105
Coldstream	10,218	16,302
Kelowna	116,479	149,481
Lake Country	10,615	20,010
Oliver	4,722	6,679
Osoyoos	5,115	7,000
Peachland	5,290	8,170
Penticton	34,002	57,996
Spallumcheen	5,209	9,755
Summerland	11,563	13,924
Vernon	38,518	49,600
Westbank	37,662	53,175

www.gembc.ca
GEM
Mapping & Design
Grindrod
Enderby
Ashton Creek
Falkland
Armstrong
Spallumcheen
Silver Star Resort
Vernon
Lumby
Coldstream
Lavington
Douglas Lake
Fintry
Carrs Landing
Oyama
Lake Country
Winfield
Okanagan Centre
Kelowna
Westbank
Westside District
Peachland
Summerland
Naramata
Penticton
Beaverdell
Apex Resort
Hedley
Kaleden
Twin Lakes
Okanagan Falls
Olalla
Keremeos
Cawston
Oliver
Osoyoos
Bridesville
LEGEND
OKanagan Population
2007
0 - 4,999
5,000 - 9,999
10,000 - 14,999
15,000 - 34,999
35,000 - 54,999
55,000 - 99,999
100,000 - 125,000
OKanagan Population
Projected To 2025
0 - 4,999
5,000 - 9,999
10,000 - 14,999
15,000 - 34,999
35,000 - 54,999
55,000 - 99,999
100,000 - 124,999
125,000 - 150,000
0 6 12 18 24 30
Kilometres

1.2 Project Objectives

The primary objectives of the Master Wastewater Management Plan Update are as follows:

- To consolidate information collected on updates to LWMP's, interviews with local government staff, and reviews of Official Community Plans into one document providing a comprehensive overview of sewage infrastructure needs in the Okanagan Valley to 2025;
- To identify communities projected investment needs to 2025; including debt retirement projections for already funded projects;
- To review the effects of existing legislation, bylaws, and land-use policies on water and liquid waste treatment requirements;
- To summarize current water quality information for Okanagan main stem lakes and the Okanagan River;
- To identify areas with greatest need for infrastructure improvements;
- To rank the importance of remaining projects in terms of health and environmental concerns, and assess progress on the 1993 Plan's prioritized projects;
- To provide recommendations for appropriate benchmark technological standards for wastewater treatment in the Okanagan;
- To provide recommendations for land-use decision making tools that minimize infrastructure costs and promote water quality.

Although based on valley-wide concerns for pollution control, the impact of nutrient loadings on the environment and over thirty years of Okanagan research, the first priority for each wastewater management plan is to concentrate on the specific wastewater management needs of individual sub-areas. Each has been prepared independently through a consultative process with local area managers, and only limited overlap between adjacent areas is apparent or to be expected.

In order to provide the valley with an integrated and coordinated approach to wastewater management, the Master Plan incorporates the individual plan proposals, as presented, into a cohesive technical, and financial framework to best serve the needs of all existing and future residents of the valley.

Wastewater management concerns are driven not only by the need to address existing problems but also by the additional pressure generated by new development and associated population growth. A satisfactory strategy must incorporate effective land use planning techniques.

Table 1.0 – Population Projections for Okanagan Basin Communities

Area	2000 Population	2005 Population	2007 Population	2010 Pop. Projections (from OCP's)	Notes	2015	2020	2025
North Okanagan	76,056	79,817	83,063	84,745	Bc stats	89,418	93,539	97,461
Armstrong	4,388	4,496	4,524	5,278	2010+@2% based on OCP, 1996)	5,828	6,435	7,105
Coldstream	9,478	9,794	10,218	12,113	2010+@2%, 2011,2016,2021,2026 from OCP	13,374	14,765	16,302
Spallumcheen	5,383	5,301	5,209	7,250	2011, 2016 & 2026 @ 2% (OCP)	8,005	8,838	9,755
Vernon	34,657	36,925	38,518	41,400	2011, 2016, 2021, 2026 (Sheltair Group, 2006)	44,300	47,200	49,600
Unicorporated areas	17,491	18,661	19,778	20,989	Calculated from 2007 pop @2%	23,173	25,585	28,248
Central Okanagan	152,060	165,355	176,996	182,409	Bc stats	197,234	210,438	222,542
Kelowna	99,278	108,559	116,479	117,351	Kelowna ocp	128,803	139,581	149,481
Lakecountry	8,498	9,895	10,615	13,230	@3% in OCP – 2011, 2016, 2020	15,337	17,262	20,010
Peachland	4,796	5,030	5,290	6,147	@2% from OCP (2003)	6,786	7,400	8,170
Westside			28,793		http://www.regionaldistrict.com/docs/boards_committees/2007AR.pdf			
Unicorporated areas	38,500	41,871	44,612	47,342	@2% to 2012 and 1.6% after (will overlap with Westbank)	51,658	55,925	60,514
Okanagan Simikameen	79,723	81,822	84,832	85,294	Bc stats	88,473	91,413	93,917
Oliver	4,405	4,553	4,722	5,100	2011, at 1.5% as per LWMP	5,413	6,200	6,679
Osoyoos	4,440	4,807	5,115	5,200	2%	5,800	6,400	7,000
Penticton	32,318	32,120	34,002	40,044	2.5% growth (pop w/o band)	45,306	51,260	57,996
Summerland	11,101	11,350	11563		2013,2018,2023 (Interior Health, 2007)	12,655	13,295	13,924
Unicorporated areas	23,437	24,908	25,222	26,766	@2% to 2012 and 1.6% after based on central Ok.	29,206	31,618	34,230
OIB					1% growth/yr			
Naramata					1.5% growth/yr			

1.3 Methodology

In order to revise the LWMP to meet the stated objectives, the project was divided into four stages. The background review included all relevant Official Community Plans, Liquid Waste Management Plans, bylaws and provincial regulations. Further information was then gathered through personal interviews with representatives from regional sewage treatment facilities, regional planners and engineers, Ministry of Environment, Interior Health and the Okanagan Basin Water Board. The data was then reviewed and the various projects recommended by the individual wastewater management plans evaluated and prioritized using the selected criteria. Issues were identified and recommendations made regarding environmental, operational, health, social, financial, land use planning, institutional, land and lake assimilative capacity and other related concerns. Finally, the results were documented using the 1993 Master Wastewater Management Plan as a base. This updates the introduction, basin water quality, project prioritization and ancillary issues sections. The sections on wastewater management plans, updates, land use planning, finance and conclusions have been rewritten. This document consolidates previous interim project reports and provides recommendations.

1.4 Project Team

Updates to the Master Wastewater Management Plan in 2008 have been undertaken by CLPA Consulting, Christine LeFloch and Patrick Allen along with Linda Decker of GEM Mapping and Design who has provided maps throughout this plan. CLPA has also worked closely with numerous government agencies within the Okanagan Valley in ensuring that current Wastewater Management data and information is accurately represented in this plan.

This Master Wastewater Management Plan was originally undertaken in 1993 by a consulting team formed by Reid Crowther & Partners Ltd. working closely with numerous government agencies within the Okanagan Valley. In addition to Reid Crowther technical and administrative staff, the following sub-consultants worked on this assignment:

Dr. W. Oldham, P.Eng.

Dr. A. Smith, Norecol Environmental Consultants Ltd.

Mr. D. Witty, MCIP, Witty Planning Consultants

Mr. E. Lalonde, Municipal Management Services

Mr. C. Woodward

Mr. M. Powell, P.Eng., Holmes, Powell & Dendy Ltd.

1.5 References

1. Nordin, Richard, N. (2005). Water Quality Objectives for Okanagan Lake – A First Update. Limnos Water Associates. Prepared for The Ministry of Land, Water and Air Protection, Penticton and Kamloops BC.

2. Curtis, Jefferson P. (2005). Water Quality in the Okanagan Basin: Dependence on spatial and temporal drivers. Water – Our Limiting Resource. Canada Water Resource Association. 287 – 295

SECTION 2.0 – WATER QUALITY MONITORING OF MAIN LAKES IN THE OKANAGAN BASIN

2.0 Basin Water Quality

The 2005 update of water quality objectives for Okanagan Lake[14] provides objectives for a variety of measures to guide water quality protection of Okanagan Lake. The proposed objectives were designed with consideration of three major uses: recreation and aesthetics, drinking water and aquatic life as necessary factors for long-term management and protection of valley lakes. Water quality objectives are based on an evaluation of historical norms for a particular water body as well as the BC approved and working guidelines and national water quality guidelines. The key indicator is the spring phosphorus concentration for each of the lakes (Table 2.0).

Water quality guidelines are safe limits of the physical, chemical, or biological characteristics of water, biota (plant and animal life) or sediment which protect water use. Objectives are established in British Columbia for water bodies on a site-specific basis. They are derived from the guidelines by considering local water quality, water uses, water movement, waste discharges and socio-economic factors.

Water quality objectives are set to protect the most sensitive designated water use at a specific location[14]. Designated water uses include:

- raw drinking water, public water supply, and food processing
- aquatic life and wildlife
- agriculture (livestock watering and irrigation)
- recreation and aesthetics
- industrial water supplies.

Table 2.0 – Status of Lakes with respect to Spring Total Phosphorus Objectives

Lake	Trophic Category [a]	Spring TP Objective (mg/L)	1970-75 Total P (mg/L)	1985 Total P (mg/L)	1992 Total P (mg/L)	2007 Spring Total P (mg /L)	2007 Seasonal mean [b] Chl *a* (mg/L)	2007 Seasonal mean Secchi (m)	30 yr overall water quality trend [c]
Ellison	eutrophic	none	0.087	0.080	0.041	0.031	0.0116	1	none
Wood	mesotrophic	0.015 [d]	0.0100	0.075	0.036	0.059	0.0054	6.4	improving
Kalamalka	oligotrophic	0.008	0.010	0.010	0.0007	0.005	0.0043	7.3	none
OK Armstrong Arm	mesotrophic	0.010	0.020	0.020	0.016	0.017	0.0032	4.4	none
OK Vernon Arm [e]	oligotrophic	0.010	0.019	0.0012	0.006	0.006	0.0025	8.75	none
OK N Basin [f]	oligotrophic	0.008	0.008	0.010	0.006	0.006	0.0011	9.1	none
OK S Basin [g]	oligotrophic	0.007	0.009	0.010	0.008	0.005	0.0013	9.7	none
Skaha	oligotrophic	0.015	0.026	0.025	0.013	0.007	0.0036	5.8	improving
Osoyoos [h]	mesotrophic	0.015	0.024	0.030	0.024	0.016	0.0054	3.7	improving [i]

* mg/L refers to miligrams per litre of water or parts per billion

[a] Trophic status is determined from total phosphorus, Secchi depth, and phytoplankton chlorophyll-a

[b] Seasonal mean values are for period March through September

[c] Trends were determined graphically; many lakes show cyclical patterns related to year to year variation in precipitation and run-off.

[d] Wood Lake has a long term water quality objective of 0.015mg/L and an interim objective of 0.040 mg/L

[e] Vernon Arm of Okanagan Lake last sampled in 2003

[f] Okanagan Lake north basin data for site 0500730 near Okanagan Centre

[g] Okanagan Lake south basin data for site 0500454 near Summerland

[h] Osoyoos Lake data for central site in north basin at site 0500728

[i] Osoyoos Lake assessment based on spring and fall TP only.

We dropped the limiting nutrient column as most freshwaters are limited by phosphorus; seasonal limitation by nitrogen (briefly) or more likely both nutrients may occur in Osoyoos and Ellison lakes and perhaps Wood. However, determining the limiting nutrient is a difficult process, and the most effective water quality control is always through phosphorus control[16].

Municipalities throughout the Okanagan employ a variety of wastewater treatment technologies and processes so that it can be reused safely in the environment. Section 2 of this document provides background on the type of treatment technology applied by each community in the basin. The majority of Okanagan communities provide tertiary treatment using Biological Nutrient Removal (BNR) processes and disinfection of effluent before discharging to the lake system. A few municipalities provide secondary treatment, using aerated lagoons, storage reservoirs and spray irrigation to designated lands. In the case of Vernon, which practices land based discharge, effluents receive tertiary treatment and reservoir storage before being used for irrigation purposes. Seven out of eight respondents to a survey of engineers and treatment plant managers conducted as part of this MWMP update indicated that BNR is the treatment technology that should be used as a benchmark for wastewater polishing in the basin.

All Okanagan municipalities adhere to the Municipal Sewage Regulation enacted by the BC Ministry of Environment[18] which identifies the rules for treating sewage, generating and using reclaimed water, and disposing of effluent that cannot economically or practically be reused. Section 10 and Schedule 2 of the regulations applies to the use of reclaimed water and section 11 along with Schedule 3 applies to discharges to water. The Municipal Sewage Regulation can be found at http://www.qp.gov.bc.ca/statreg/reg/E/EnvMgmt/129_99.htm.

2.1 Introduction

This section of the report provides background on the water quality of lakes in the Okanagan basin, and discusses the capacity of Okanagan lakes and soils to receive loadings of chemicals without undergoing undesirable changes. Data on the water quality for each of the main lakes in the Okanagan basin is then presented and reviewed, followed by recommendations for the future direction of wastewater management in relation to water quality in the basin.

2.1.1 Background

In the mid to late 1960's algal blooms and decreasing water clarity signaled water quality problems in Skaha Lake, in the Vernon Arm of Okanagan Lake, and in Wood Lake. In response to public concern over water quality (particularly in Skaha Lake), the federal and provincial governments undertook the Okanagan Basin Study completed in 1974, which identified elevated phosphorus loadings as a major source of the problems.

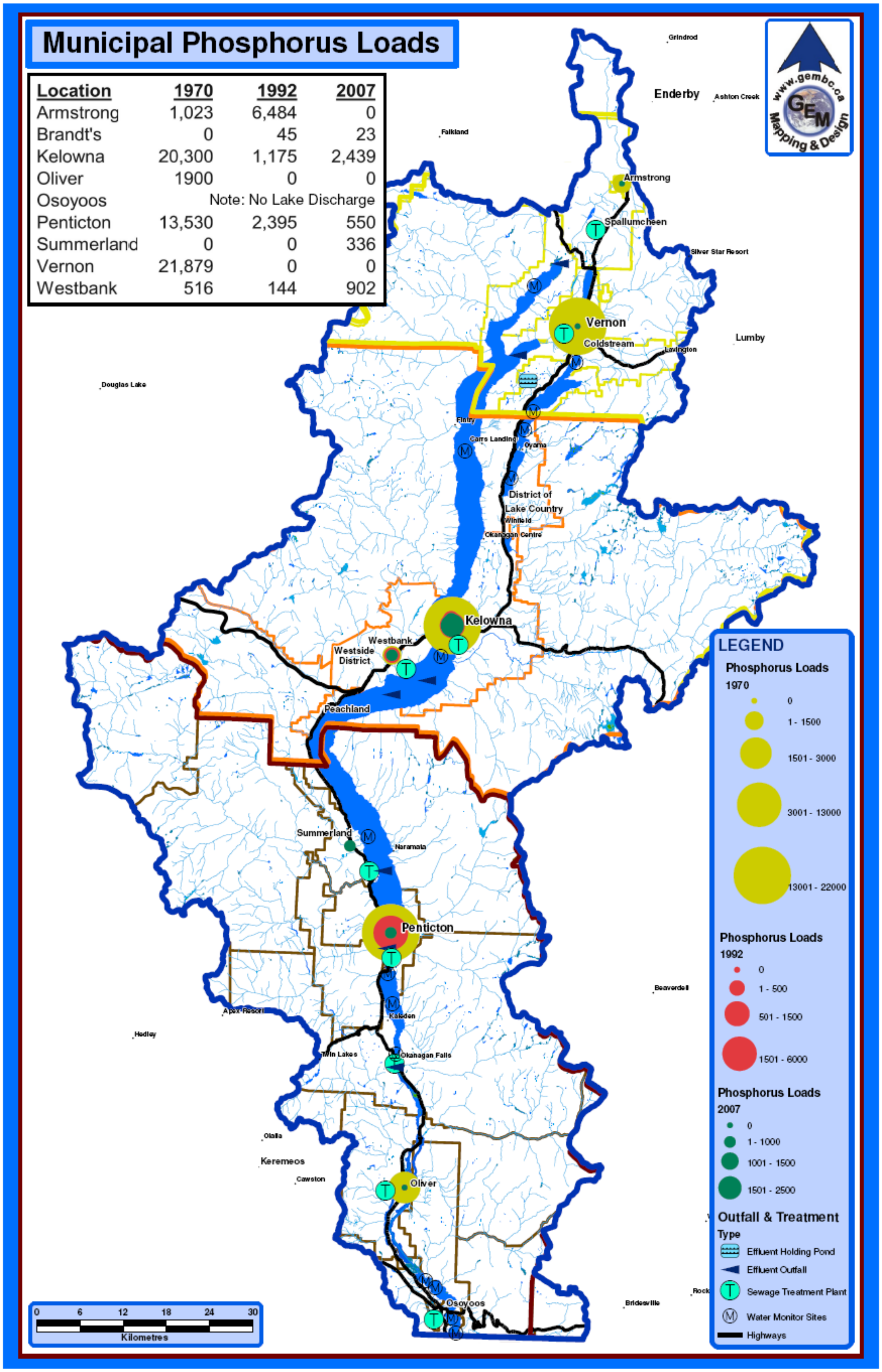
2.1.2 Limiting Nutrients

Phosphorus

Phosphorus is a nutrient chemical in short supply in most oligotrophic (low productivity) lakes and therefore limits algal growth. "Cultural" phosphorus loadings from such sources as sewage treatment plants (STPs), septic tanks, and agricultural and logging activities can increase the phosphorus supply and stimulate algal blooms, which in turn cause decreased water clarity and oxygen depletion in deeper waters. This process is referred to as eutrophication.

The Okanagan Basin Study identified discharges from STPs as a major, controllable source of phosphorus loading. Other potentially controllable phosphorus sources included septic tanks, agriculture (livestock manure and, to a lesser degree, fertilizers), and logging (erosion of phosphorus-containing soils). Additional diffuse sources include miscellaneous sources (pets and lawn fertilizer), dustfall and precipitation and watershed sources (natural and upstream lakes). Point source nutrient loads were quantified with relative accuracy through regular measurements of volumes and concentration in the discharges during the 1974 study and are the basis of the management policies that have been followed since (with highest priority being the reduction of nutrients from sewage treatment plants)[15].

The Okanagan Basin Implementation Study in the early 1980's, which arose from the Okanagan Basin Study, specified a 90% reduction in phosphorus loadings from STPs discharging to the Okanagan Basin lakes and tributary streams or rivers. The Okanagan Water Quality Control Program, established subsequently to manage water quality by controlling nutrients, has required 95% phosphorus removal by any municipality discharging effluent to the lakes. In order to achieve these targets, many communities (see Municipal Phosphorus Loads map on page 13) implemented progressive approaches to point source control of phosphorus. For example, the City of Vernon diverted effluent to spray irrigation disposal in 1977, the City of Kelowna converted their sewage treatment plant to a biological nutrient removal (BNR) process in 1982, and subsequent sewage treatment plant upgrades took place throughout municipalities in the basin. As a result, point source reductions have been very successful, with annual phosphorus loading from sewage treatment plants having decreased from 59,148 kgs in 1970 to 4250 kgs in 2007 (Figure 2.1). Skaha Lake and to a lesser extent Osoyoos Lake have undergone nutrient reduction and there have been no algal blooms in Skaha Lake since the early 1970's, thereby responding to initial public concern over water quality which initiated phosphorus loading restrictions. Reductions in nutrient loading to Okanagan Lake have resulted in maintaining the lake nutrient concentrations despite population increases in surrounding municipalities[15].



Municipal Phosphorus Loads

Location	1970	1992	2007
Armstrong	1,023	6,484	0
Brandt's	0	45	23
Kelowna	20,300	1,175	2,439
Oliver	1900	0	0
Osoyoos	Note: No Lake Discharge		
Penticton	13,530	2,395	550
Summerland	0	0	336
Vernon	21,879	0	0
Westbank	516	144	902

Figure 2.1 - Annual STP Phosphorus Load to the basin in 1000's of kg compared to flow of effluent to the basin by year

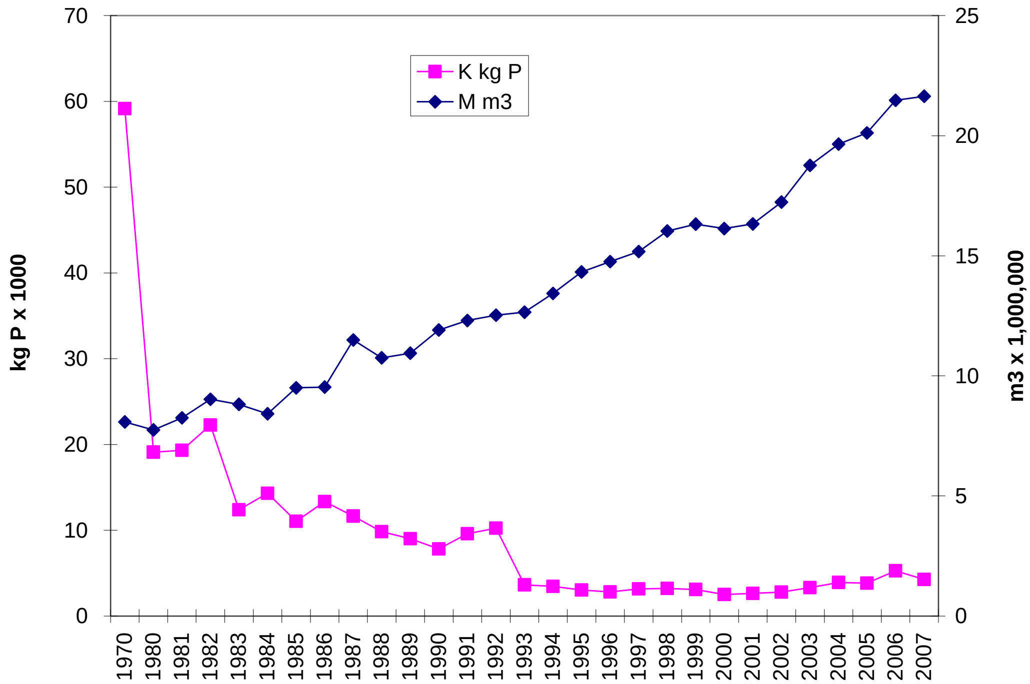


Table 2.1 - Overall Annual Phosphorus Load to the Okanagan Basin (1000's of kg)

Source	**1970**	**1980**	**1990**	**2000**
Sewage treatment plants	59.15	19.11	7.82	2.503
Septic tanks	8.00	11.50	16.92	15.67
Agriculture	4.50	11.93	2.50	2.50
Forestry	8.40	8.40	8.40	8.40
Watershed	41.90	41.90	41.90	41.90

*According to the Ministry of Environment, there has been no recent monitoring of non-point sources and it is not possible to make current estimates of these sources of phosphorus to the lake system.

Decreases in overall phosphorus loadings have not been as significant as the decrease in loadings from STPs (Table 2.1). Increased loadings from non-point sources (septic tanks, agriculture) have somewhat offset the gains achieved by improved sewage treatment. These sources of phosphorus contributions have increased from about 60,000 kg/yr in the 1960's to about 70,000 kg/yr in the 1990's[6]. Nevertheless, overall phosphorus loading (including non-point sources) to the basin decreased by approximately 42% from the 1970's to the year 2000 (Table 2.1).

The Okanagan Basin Implementation Agreement emphasized control of phosphorus discharges from STPs because this was the most cost effective phosphorus control measure available. Efforts to reduce phosphorus loadings from septic tanks, agriculture, and logging practices, while recommended, were minimal prior to the mid 1980's. There has been no change for phosphorus reductions from logging practices to the year 2000, while septic tank loading has increased and agriculture decreased (Table 2.1). In 1985, the Ministry of Environment Waste Management Branch made recommendations for reducing phosphorus loadings from forestry, septic tanks, and agriculture, including detailed recommendations for controlling loadings from feedlots and other livestock operations. The current phosphorus management program includes strategies for forestry (more stringent harvesting guidelines), septic tanks (waste management plans and expanded sewer systems, restrictions in sensitive areas), and agriculture (education, enforcement of runoff control programs). As of 2002, non point source management efforts in the Okanagan Basin are thought to have collectively reduced phosphorus loading from agriculture, forest harvest and septic tanks by 5,000 to 10,000 kg[14].

Nitrogen

Nitrogen is required along with phosphorus for algal growth. Depending upon which is in shorter supply, either phosphorus or nitrogen can be the factor limiting growth. For example, in a phosphorus-limited situation, algae will respond with increased growth to an increase in phosphorus but will not respond to an increase in nitrogen.

Total nitrogen to total phosphorus (N:P) ratios can indicate which nutrient is the limiting factor. When the ratio (by weight) is significantly above an ideal N:P of 7:1, for example 15:1, phosphorus is clearly the limiting nutrient, and when it is below ideal ratio, for example 5:1, nitrogen is the limiting nutrient[15]. At intermediate ratios either nitrogen or phosphorus can be limiting. Often in this situation the limiting nutrient will shift seasonally. Measurements of N:P ratios[2,5] indicate the following limiting nutrients for the Okanagan Basin Lakes:

- Ellison – phosphorus or periodically nitrogen (in summer or late fall)
- Wood – phosphorus or periodically nitrogen (in summer or late fall)
- Kalamalka - phosphorus
- Okanagan, Armstrong Arm - phosphorus
- Okanagan, Vernon Arm - phosphorus
- Okanagan, main basins - phosphorus
- Skaha - phosphorus
- Osoyoos – phosphorus or periodically nitrogen (in summer or late fall)

In most cases, the oligotrophic lakes are phosphorus-limited while the mesotrophic and eutrophic lakes can be limited by either nitrogen or phosphorus. In part, this reflects the higher phosphorus concentrations in the mesotrophic and eutrophic lakes. To the extent that phosphorus control effectively reduces phosphorus concentrations, it eventually should shift the lakes into phosphorus limitation.

Present N:P ratios in Okanagan Lake indicate a reasonable balance, with a phosphorus limitation in spring and early summer[15]. There is no evidence that the concentrations of N and P have changed significantly over the past 30 years, however variations occur as a result of inter-annual changes in hydrology, with higher ratios during periods of lower run-off[15]. As a result of wet and dry runoff years and differential effects of hydrologic input between N and P, it is anticipated that the N:P ratio might be expected to decrease in wet years and increase in dry years[15]. The Ministry of Environment proposes a water quality objective for Okanagan Lake of maintaining an N:P ratio of greater than 25:1 (weight ratio), evaluated at spring overturn using total nitrogen and total phosphorus concentrations at the three index station in the three main basins plus Armstrong Arm (Table 2.2).

Table 2.2 - Water Quality Objectives for Okanagan Lake (see reference 15 for complete list)

	North Basin	**Central Basin**	**South Basin**	**Armstrong Arm**
Total Phosphorus (mg/L) (maximum at spring overturn)	0.008	0.008	0.007	0.010
Total Nitrogen (mg/L) (maximum)	0.230	0.230	0.230	0.250
Contaminants in fish tissue and Mysis tissue	Below human consumption and wildlife protection guidelines	Below human consumption and wildlife protection guidelines	Below human consumption and wildlife protection guideline	Below human consumption and wildlife protection guidelines

2.1.3 <u>Assimilative Capacity of Lakes and Soils</u>

Definition of "Assimilative Capacity"

The assimilative capacity of a lake is the ability to receive loadings of a chemical (in this case, phosphorus) without undergoing undesirable water quality changes. Assimilative capacity is not an absolute value; rather, it depends upon the definition of acceptable water quality, which will vary depending upon uses or desired uses of the water.

Therefore, to determine assimilative capacity of the Okanagan lakes, it is first necessary to define acceptable or unacceptable water quality. The Okanagan Basin Study Report defined "maximum desirable concentrations" of phosphorus in the basin lakes. Subsequently, the Ministry of Environment established site-specific objectives for phosphorus in individual lakes (Table 2.0). The levels established are based on the assumption that if the objective is met, the water quality in the lake will be protected for important local uses such as recreation, drinking water, aesthetics, or the production of salmonid fish. Thus, for the purposes of this report "acceptable water quality" will be defined as water quality which meets the site-specific objective for phosphorus. In this context, assimilative capacity is the ability of a lake to receive phosphorus loadings without in-lake phosphorus levels increasing above the established objective.

Determination of Assimilative Capacity

There are two ways to determine assimilative capacity of lakes in the Okanagan Basin. The first approach is an operational definition which involves monitoring water quality and comparing the results with established objectives. Management actions can be taken when the measured phosphorus approaches or exceeds the objective concentration. The B.C. Ministry of Environment has been using this approach to manage phosphorus. The second approach is a predictive approach which involves determining a "critical loading" of phosphorus beyond which the assimilative capacity of a lake would be exceeded. In theory, this approach could be useful for long-term planning.

The predictive approach involves mathematical modeling. A number of models exist which relate phosphorus loadings to in-lake phosphorus concentrations[7,8,9,10]. Other models relate phosphorus loadings to algal growth. The simplest use of mathematical models to predict "critical loadings" would be to set the in-lake phosphorus concentration equal to the site-specific objective and solve for the loading term.

Unfortunately, general phosphorus loading models do not account for many of the factors which are specific to the Okanagan Basin lakes, and for these reasons, the Ministry of Environment[2] has chosen to go with water quality objectives to guide nutrient control efforts. The Okanagan Basin Implementation Study Report similarly did not establish "critical loadings".

It may be possible to develop a phosphorus loading model or models specifically for the Okanagan Valley lakes. A long term database is available which seems to include water quality samples from the lake inlets and outlets and from deep water. Supporting hydrology and phosphorus loading data are also available. However, further studies would likely be necessary to quantify the effects of such lake-specific processes as marl precipitation and internal phosphorus loading. The accuracy of such a model would be limited by the accuracy of estimates of phosphorus loading from diffuse sources.

Treated Effluent and the Assimilative Capacity of the Land Base

Alternatives to discharging treated sewage effluent to the Okanagan Basin lakes and rivers include on site disposal, spray irrigation and agricultural drip irrigation for crops with treated effluent (reclaimed water). The effectiveness of these methods in reducing phosphorus

loadings to the lakes depends upon the ability of the soil to bind phosphorus rather than transmit it to watercourses and ultimately to the lakes.
The ability of the land base to "assimilate" sewage disposal can be defined operationally in terms of phosphorus transmissivity of the soils. The B.C. Ministry of Environment [11] produced detailed maps (1:20,000 scale) of phosphorus transmissivity in 1970 for the Okanagan Basin Implementation Study. In 1986 information was refined by the B.C. Ministry of Environment and applied to new computerized soils maps and data. The model considered soil texture, depth to water table, depth to bed rock, depth to other restricting layers, soil coarse fragment content (by volume), and soil pH. It also considered horizontal phosphorus transport based on horizontal distance to surface water (lakes or streams).

The maps classified transmissivity into the following categories based on estimated percentage phosphorus transmission to receiving waters:

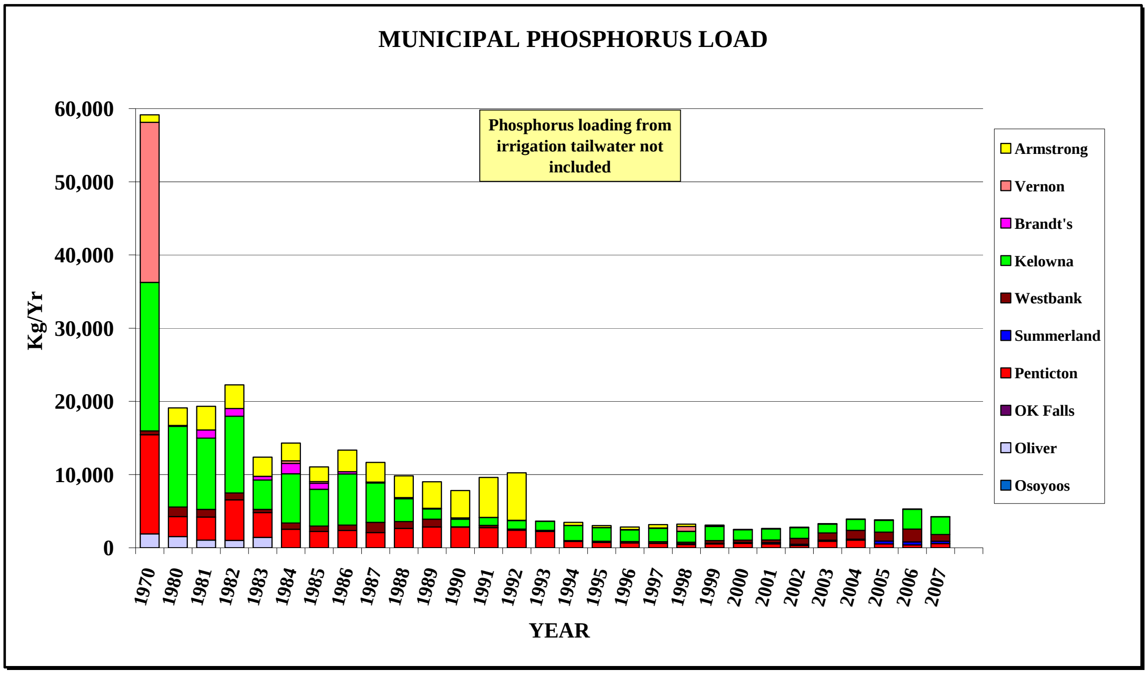
- very high - 75 to 100%;
- high - 50 to 75%;
- moderately high - 30 to 50%;
- medium - 15 to 30%;
- moderately low - 5 to 15%;
- low - 0 to 5%.

This classification can be used to identify the assimilative capacity of the soils in any given area. The following approach is suggested. Soils with moderately high to high phosphorus transmissivity can be considered to have little or no assimilative capacity for phosphorus. Conversely, soils with moderately low to low phosphorous transmissivity have high assimilative capacity.

Using this classification of assimilative capacity, maps such as these could provide a useful tool for waste management planning throughout the basin. Areas mapped in the moderately low to low phosphorus transmissivity category are potential candidates for onsite disposal or spray irrigation. Areas having moderately high to very high transmissivity should be avoided for these purposes. Furthermore, these areas should be given priority for receiving sewer system extensions.

At the time of the original MWMP, the Ministry of Environment was using this type of approach in their phosphorus management strategy. Areas having unacceptably high phosphorus transmissivity were designated Environmental Control Zones (ECZ), factoring the depth of porous soil, percolation rates and the distance from water bodies into the design parameters. Previously, construction of new septic tanks was restricted within these areas, however, amendments to the Sewage Disposal Regulations in 2005 have removed reference to ECZ’s. Within current legislation, locating and construction of septic tanks and tile fields are determined on a site by site basis by registered professionals.

Figure 2.2 – Phosphorus Loading to Okanagan Basin by Municipality



2.2 Current Lake Water Quality Status

2.2.1 Introduction

In 1972-73, the British Columbia provincial Environment Ministry established an ongoing water quality monitoring program in the Okanagan Basin. Several reports[1,2,3,14,15] have summarized the results of this program and evaluated the current water quality status of the lakes and the success of phosphorus controls.

In 1985, phosphorus was the only water quality objective specified by the provincial Environment Ministry to measure nutrient status for each of the Okanagan lakes[2]. Springtime lake total phosphorus objectives were based on review of scientific literature which relates phosphorus concentrations to algal growth, and assessment of existing P levels and eutrophication issues in the Okanagan and elsewhere. The objectives then specified total phosphorus concentrations which, if not exceeded, should maintain the desired levels of algal growth to protect sensitive water uses such as recreation, drinking water, aesthetics and salmonid fish production (Table 2.0).

A review of changes in relative phosphorus loading by percent from different sources for the Okanagan Basin by Jensen and Epp in 2002[14] concluded the following:

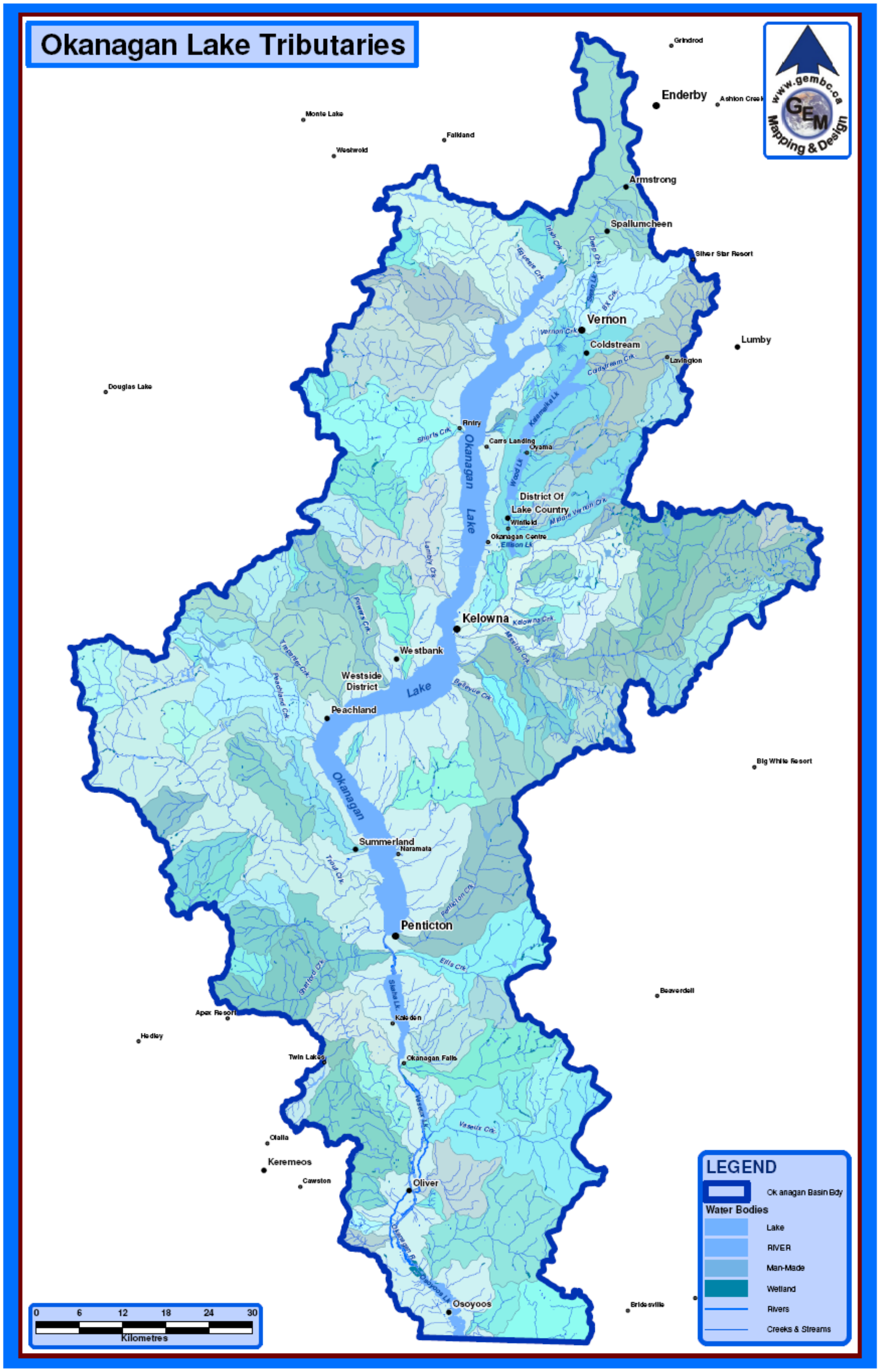
1. the total phosphorus loadings to Okanagan Lake have decreased by 42% since 1970 (Table 2.1).
2. the portion of phosphorus derived from sewage treatment plants (the point sources of P) have decreased from about half of the total loading to less than 3%.
3. the contribution from septic tanks has doubled in relative terms and may now represent about a quarter of phosphorus inputs into the lakes.
4. the contribution by agriculture and forestry are low and are not increasing according to the best available estimates.
5. background loadings (watershed runoff, precipitation and dustfall) represent about 60% of the loading to the lake, while non-point anthropogenic inputs (septic tanks, agriculture and forestry) represent about 40% of the phosphorus input.

Changing climate patterns also may be affecting water quality, in that it is currently uncertain how phosphorus loading varies between wet and dry years. A graphical analysis of the B.C. Environment Ministry water quality monitoring data[14] supports the theory of flow related phosphorus concentrations and suggests that the variation in phosphorus concentrations in lakes such as Okanagan, Kalamalka and Skaha Lake may reflect a trend throughout the Okanagan Basin.

Site Specific Water Quality Trends

The following sections discuss the water quality status of each of the major Okanagan Basin Lakes. They identify whether water quality objectives have been met and consider the extent to which reductions in phosphorus loadings have improved water quality in the lakes. The lakes are discussed in order of their occurrence in the chain from upstream to downstream. Table 2.0 summarizes the water quality status of each lake and the Okanagan Lake Tributaries map on Page 21 indicates the locations of the lakes.

Water quality monitoring stations have diminished in recent years with the expectation that municipalities monitor water quality at sewage outfall locations. There are currently 4 stations on Okanagan Lake monitored by the Ministry of Environment (please see Outfalls Map in Section 3 for locations of monitoring stations throughout the basin).


Okanagan Lake Tributaries
www.gembc.ca
GEM
Mapping & Design
Grindrod
Enderby
Ashton Creek
Monte Lake
Falkland
Westwold
Armstrong
Spallumcheen
Silver Star Resort
Vernon
Coldstream
Lumby
Lavington
Douglas Lake
Okanagan
Lake
Carrs Landing
Oyama
District Of
Lake Country
Winfield
Okanagan Centre
Kelowna
Westbank
Westside
District
Peachland
Big White Resort
Summerland
Naramata
Penticton
Beaverdell
Apex Resort
Hedley
Kaleden
Twin Lakes
Okanagan Falls
Olalla
Keremeos
Cawston
Oliver
Osoyoos
Bridesville
LEGEND
Okanagan Basin Bdy
Water Bodies
Lake
RIVER
Man-Made
Wetland
Rivers
Creeks & Streams
0
6
12
18
24
30
Kilometres

2.2.2 Ellison Lake

In 1985, Ellison Lake was described as eutrophic with an average total phosphorus (TP) concentration of 0.080 mg/L and a range of 0.030 to 0.160 mg/L (Table 2.2). From 1979 through 1984 there was a trend to increasing phosphorus concentrations during spring overturn at a monitoring site near the inlet of Vernon Creek. As of spring 2007, Ellison Lake is still described as eutrophic and average total phosphorus concentration has decreased to 0.031 mg/L. Though total phosphorus concentration has decreased, no other parameters show any significant trends, so the 30 year overall trend in Table 2.0 shows as no improvement[16].

The Ministry of Environment did not establish any water quality objectives for Ellison Lake. They felt that the high phosphorus values did not limited use of the lake at that time and reductions in phosphorus would be difficult to achieve. A report by the Ministry of Environment in 2001[18] found no consistent trend with total phosphorus for Ellison Lake over the past two decades.

2.2.3 Wood Lake

Wood Lake which was eutrophic in the 1970's, was only mildly eutrophic by the mid 1980's and is mesotrophic today with an overall 30 year water quality trend that is considered to be improving (Table 2.0). The spring phosphorus concentration decreased through the 1980's. In 1985, the average phosphorus concentration was 0.075 mg/L, while in 1988 the average concentration was 0.052 mg/L. Water clarity also improved, and phytoplankton (algae) biomass decreased.

Phosphorus concentrations decreased further during the latter 1980s. Diffuse (non-point) sources were estimated to contribute all the controllable phosphorus loading to Wood Lake in 1980[2]. According to the previous MWMP, the largest diffuse source was septic tanks, particularly at Oyama and Winfield, which at that time contributed nearly 42% of the phosphorus loading. Animal wastes and logging were also important contributors.

Consequently, the control of phosphorus from STPs had no effect on Wood Lake. Rather, a major factor in the improvement of Wood Lake water quality was the diversion of cooling water from the Hiram Walker Distillery through the lake in the late 1970's and 80's, causing a dilution and flushing of nutrients in Wood lake down the adjoining chain of lakes. This cooling water originated in Okanagan Lake and carried relatively low concentrations of phosphorus. When Hiram Walker closed the plant in early 1990's, the drop in pumpage resulted in increasing phosphorus concentrations in Wood Lake. Phosphorus concentrations have not increased to pre-1990 conditions possibly due to reductions in phosphorus loading from other sources, such as septic systems being replaced by modern treatment plants[13]. Changes in Wood Lake are also consistent with wet and dry cycle effects seen on lakes throughout the basin, so it is difficult to separate these two drivers[16].

Despite the improvement during the 1980's, phosphorus and phytoplankton levels in Wood Lake remained high by comparison with the other Okanagan Lakes. By 1988, the phosphorus level still failed to meet either the Ministry of Environment's interim or long term objective (0.040 mg/L and 0.015 mg/L respectively). From 1990 to 1992 the average phosphorus concentrations of 0.028 to 0.036 mg/L met the interim objective, but in spring 2007, the TP has risen again to 0.059 mg/L.

2.2.4 Kalamalka Lake

Kalamalka Lake is oligotrophic. The average spring total phosphorus concentration was 0.010 mg/L in 1985[2] exceeding the lakes water quality objective of 0.008 mg/L. Phosphorus levels have met the objectives since 1987 and are currently at 0.005 mg/L but based on a 30 year overall water quality trend, there has been no change (Table 2.0).

Phosphorus concentrations increased from 1977 to 1985 but declined from 1986 to 1988. Phytoplankton increased in the years when spring phosphorus levels were high and decreased when phosphorus levels decreased.

Kalamalka Lake receives all of its phosphorus loadings from diffuse sources. Environment Canada is expected to report on agricultural effects on Coldstream Creek in this coming year which should give insight into the relative impacts of agriculture on water quality. Coldstream Creek which feeds into Kalamalka Lake is high in nitrates and phosphorus, likely due to agricultural activities along the creek, or septic tanks[16].

In addition, the discharge of large volumes of low-nutrient cooling water from the Hiram Walker distillery into Wood Lake, caused an increase in nutrient levels and productivity in Kalamalka Lake as waters are flushed down the chain of lakes. Closure of the distillery in the early 1990's coincides with observed decreases in phosphorus levels in Kalamalka Lake[13]. Wet and dry year cycles confound this analysis and make it difficult to determine trends related to cultural sources of phosphorus.

It is unclear which, if any, of these sources was responsible for the changes in phosphorus concentrations in Kalamalka Lake. Kalamalka Lake is a marl lake, which means that calcium and phosphorus may precipitate from the water column. It is possible that changes in phosphorus concentration resulted from an in-lake process, that is, marl precipitation removes some phosphorus from the water column over time and any changes to that process could have an influence on the lake[16]. Changes in this process could have a significant impact on phosphorus concentrations in the water.

2.2.5 Okanagan Lake

Okanagan Lake is a long narrow large lake in which the water quality is not homogeneous. The lake consists of three separate basins and two "arms" (Armstrong Arm and Vernon Arm). There is relatively low biological productivity in the main basins, however the two shallower reaches (Vernon Arm and Armstrong Arm) have reduced water circulation resulting in higher nutrient levels and greater phytoplankton abundance[15]. Armstrong Arm, Vernon Arm, and the main basins of Okanagan Lake are discussed separately.

Armstrong Arm

Phosphorus concentrations in Armstrong Arm are higher than in the rest of Okanagan Lake and it is considered mesotrophic[2,3]. Phosphorus concentrations in Armstrong Arm varied considerably among years. No significant trend was observed from 1975 through 1988[3], but levels appear to have decreased since 1989. The average phosphorus concentration remained near 0.020 mg/L from 1985 to 1989, consistently failing to meet the 0.010 mg/L water quality objective[1,2,3]. Prior to 1992, The City of Armstrong discharged secondary treated effluent into Deep Creek which flows into the Armstrong Arm of Okanagan Lake. Effluent from Armstrong is now used for spray irrigation in the municipality of Spallumcheen and there have been no discharges since 1999. In the early 1990s through to 2007 phosphorus continues to exceed the objective, but average concentrations are lower, ranging from 0.012 to 0.017 mg/L (Table 2.0).

Significant phosphorus inputs from Equesis and Deep creeks, apparently of natural and agricultural sources, may have some effect on achieving spring TP objectives, but it is expected that the concentration of P in Armstrong Arm should continue to decline and approach the main lake concentration[15]. Zooplankton and phytoplankton are elevated relative to most other parts of Okanagan Lake, and water clarity is lower. In addition, Armstrong Arm experiences oxygen depletion in autumn. Under low oxygen conditions, phosphorus could be released from the sediments to the water column, thus contributing to elevated phosphorus concentrations, as is also the case in Wood Lake, and parts of Osoyoos Lake.

Vernon Arm

Vernon Arm is oligotrophic, tending toward mesotrophy[2]. The water quality in this arm has improved significantly since the 1970's. Prior to 1977, the City of Vernon discharged secondarily treated sewage into Vernon creek which flowed to Vernon Arm, measured at 21,879 kg in 1970 (Table 2.3). At that time, spring phosphorus concentrations were about 0.025 mg/L. Since 1977, all sewage has been used for crop irrigation, and there have only been discharges of sewage effluent to the lake in 1984, 1985 and 1998 due to insufficient storage capacity at that time. Average phosphorus concentrations decreased to 0.012 mg/L in 1985 and 0.007 mg/L in 1988 and 1989[1,2,3]. Water clarity, phytoplankton, and periphyton (attached algae) levels have also improved[1]. Since 1986, phosphorus levels met the water quality objective of 0.010 mg/L, maintaining a spring TP recording of approximately 0.006 mg/L between 1992 and 2007 (Table 2.0). Phosphorus concentrations in Vernon Arm should respond to wet weather nutrient loading from Kalamalka Lake and non point sources in the Vernon area, but concentration should not exceed the objective for the north basin[15].

Table 2.3 Phosphorus Loadings in Effluent from Sewage Treatment Plants to Lake System

Table data in Kilograms/year of Total Phosphorus

*Data was obtained from Ministry of Environment and was not available for all areas. This is due to spray effluent (Osoyoos, Oliver, Vernon) or ground disposal (Summerland) in some areas.

Year	Kelowna	Penticton	Armstrong	Westbank	OK Falls	Brandt's	Summerland	Osoyoos	Oliver	Vernon	Kg P
1970	20,300	13530	1,023	516					1,900	21,879	59,148
1980	11,030	2725	2,411	1,312		111			1,525		19,114
1981	9,750	3135	3,228	1,040		1,120			1,050		19,323
1982	10,500	5581	3,255	913		1,030			980		22,259
1983	4,020	3375	2,630	438		491			1,420		12,374
1984	6,739	2536	2,431	831		1,416				348	14,301
1985	5,014	2215	1,982	741		865				217	11,034
1986	6,993	2354	2,963	742		289					13,341
1987	5,360	2082	2,681	1,397		133		NOTE: loadings from			11,653
1988	3,111	2619	2,980	959		167		irrigation tailwater			9,836
1989	1,384	2823	3,620	1,077		98		not included			9,002
1990	1,034	2794	3,740	70		175			3		7,817
1991	1,055	2736	5,455	333		23					9,602

Year	Kelowna	Penticton	Armstrong	Westbank	OK Falls	Brandt's	Summerland	Osoyoos	Oliver	Vernon	Kg P
1992	1,175	2395	6,484	144		45					10,243
1993	1,241	2219	0	145		23					3,628
1994	2,047	862	417	113		9					3,448
1995	1,871	707	256	174		19					3,027
1996	1,616	658	332	184		24					2,814
1997	1,822	617	446	218		50					3,154
1998	1,462	443	315	222		42	85			651	3,220
1999	1,920	523	99	359		106	93				3,100
2000	1,426	597	0	330		38	112				2,503
2001	1,513	508	0	374		72	175				2,642
2002	1455	291	0	815		51	185				2,797
2003	1200	889	0	965		77	165				3,296
2004	1518	1053	0	1,199		34	118				3,922
2005	1610	515	0	1,233		70	387				3,815
2006	2695	373	0	1,744		34	437				5,283
2007	2439	550	0	902		23	336				4250

Main Basins

The main basins of Okanagan Lake are oligotrophic. From 1985 to 1992 phosphorus levels varied from 0.005 to 0.010 mg/L[1,2,3] (Table 2.0). Since 1992, it has been recognized that further gains from point source reductions were limited and that eventually population growth increases would exceed technological advances allowing further phosphorus reductions[14]. This trend indicates that point source reductions may have run their course, and is noted by findings such as TP levels remaining around 0.006 mg/L in the north basin and decreasing to 0.005 mg/L in the south basin in 2007.

Despite phosphorus reductions to Okanagan Lake from municipal sources, total average phosphorus levels (Table 2.0), as recent as 2001 for the North basin and 1999 in the South basin are higher than averages in the 20 years previous to 2001. Average phosphorus concentrations were approximately 0.009 mg/L in 1971, increased to 0.012 to 0.014 mg/L in the early 1980's and then declined to 0.005 to 0.008 mg/L in 1986 to 2007. For the past 7 years however, average phosphorus levels have been met or been lower than water quality objectives.

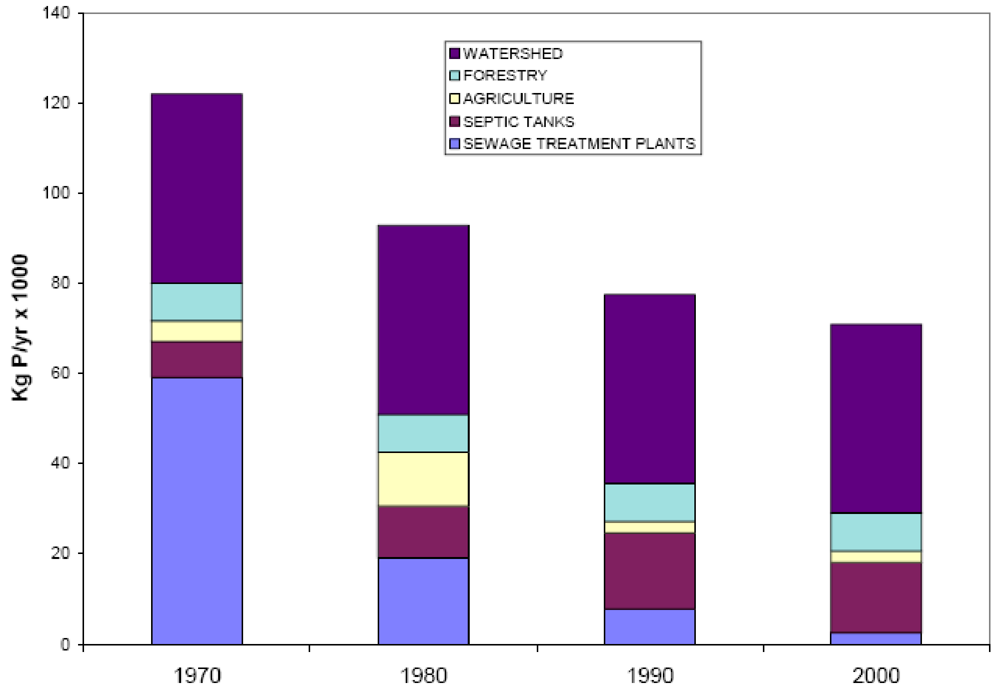
A major contributor to the improvement in Okanagan Lake water quality has been the implementation of tertiary treatment (phosphorus removal) at the Kelowna STP and the shift to a spray irrigation program in Vernon. Phosphorus loading to the lake system from Kelowna has been reduced to 2439 kg/year in 2007 from 20,300 kg/year in 1970, while Vernon has reduced loading from 21,879 kg/year in 1970 to zero almost every year since (Table 2.3). With the success of point source reductions in phosphorus loading to Okanagan Lake, greater emphasis now shifts to diffuse sources of phosphorus loading. The very nature of diffuse source nutrient release makes direct measurement of loading very difficult and forces reliance on estimates (Figure 2.3)[14].

2.2.6 Skaha Lake

Skaha Lake is oligotrophic, having shifted from mesotrophic conditions due to declining phosphorus levels over the past 25 years. Phosphorus concentration trends in Skaha Lake appear similar Okanagan Lake but lag by several years. Spring total phosphorus levels for Skaha Lake have decreased noticeably from 0.026 mg/L in the 1970’s to 0.007 in 2007 and have met the water quality objective over the past decade[14]. There have been no reported algal blooms in Skaha Lake since the early 1970’s.

Improvements in Skaha Lake are largely due to the implementation of tertiary treatment at the Penticton STP which resulted in reducing phosphorus loading from approximately 13,530 kg in 1970 to 550 kg in 2007 (Table 2.3).

Figure 2.3 - **Phosphorus loading estimates* from various source sectors to Okanagan surface waters**



* Ron Townson: personal communication

2.2.7 Osoyoos Lake

Osoyoos Lake contains three distinct basins. The northern basin of the lake is undergoing nutrient reduction and water quality improvement similar to Skaha Lake, however Osoyoos Lake is still classified as mesotrophic. In 1989 the overall average phosphorus concentration was 0.030 mg/L[2] and average concentrations in the 1990s ranged from 0.022 to 0.024 mg/L, improving to 0.016 mg/L in 2007, close to the 0.015 mg/L objective set for this lake (Table 2.0). The reduced response of Osoyoos Lake was anticipated due to lower direct point source contribution[14] and morphometrics of the basin. A history of nutrient enrichment or eutrophication and on-going release of P from lake sediments, results in generally higher phosphorus concentrations and lower dissolved oxygen levels in the bottom waters of the central and south basins, than in the north basin.

Since effluent spray irrigation was implemented by the towns of Oliver and Osoyoos in 1984, diffuse sources are the only remaining controllable phosphorus loadings to Osoyoos Lake. Stormwater runoff (where rain washes road dust, soil sediments, animal wastes, fertilizers, etc. directly into the lake) is considered the number one polluter of Osoyoos Lake by the Osoyoos Lake Water Quality Society[17]. In this regard, initiatives to manage stormwater runoff in the Town of Osoyoos are gaining greater attention. Most runoff from Osoyoos' Main Street (which currently exits directly into the lake via storm drains) is now planned to be directed into specially made catch basins and drainage fields as part of the new Watermark Beach Resort development at the foot of Main Street. Many orchardists and vineyards are also switching from overhead to drip irrigation, reducing waste and leaching of fertilizers and pesticides from these sites into the water system[17].

Osoyoos Lake also receives additional phosphorus loading from upstream sources, via the Okanagan River. As with the delayed water quality improvements noted in Skaha Lake in the 1980s, the decrease in point source phosphorus loading following the implementation of spray irrigation in Oliver and Osoyoos did not coincide with a corresponding improvement in water quality for Osoyoos Lake. Decreases in phosphorus concentrations did not become apparent until 1989[6], with no clear trend apparent at the time of the 1993 MWMP. Since the early 1990's, average phosphorus concentrations have gradually decreased indicating as with Skaha Lake, a lag of many years before improvement is measurable.

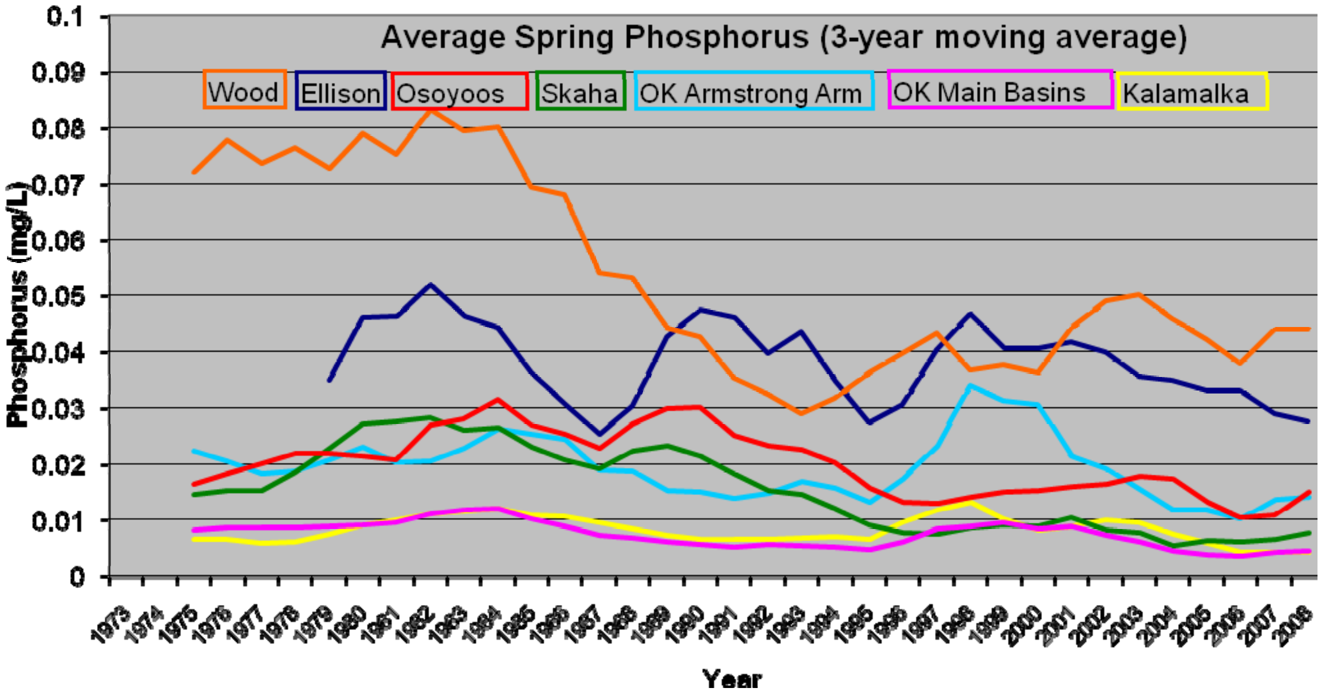
Interviewees during the 2008 Master Wastewater Management Plan Update also commented on the potential for the shallow depth of Osoyoos Lake and frequent winds in the area to cause phosphorus stored in the sediments of the lake to be regularly stirred up affecting overall water quality. The overall 30 year water quality trend for Osoyoos Lake is that it is slowly improving, reflecting the trend observed in upstream lakes.

2.3 Conclusions and Recommendations

2.3.1 Summaries of Water Quality in Okanagan Lakes

The water quality of the Okanagan basin lakes is variable due to lake size, flushing rates, phosphorus loading, influence of upstream lakes and basin morphology. Phosphorus reduction strategies have been successful in reducing phosphorus loads to Okanagan lakes and protecting water quality. Phosphorus concentrations have been clearly reduced in some lakes such as Skaha, and Okanagan foreshores where point source phosphorus load was historically a large portion of the load. Variable flushing rates of the lakes, and release of phosphorus from sediments has delayed water quality improvements in some lakes, with longest delays experienced in Osoyoos Lake. A graphical representation of spring phosphorus trends is provided in Figure 2.4. Overall phosphorus loading to the lake system has been reduced from 59,148 kg/year in 1970 to 4250 kg/year in 2007 (Table 2.3), a reduction of 93% in spite of an increase in population from 106,000 in 1970, to 344,891 in 2007.

Figure 2.4



* Kalamalka and Skaha Lakes and the Vernon Arm of Okanagan Lake have recently achieved their objectives for phosphorus and on-going efforts are required to ensure long term phosphorus loadings to these water bodies should not exceed their current levels.

In 1987-1988 only the main basins and Vernon Arm of Okanagan Lake and in Kalamalka Lake met site-specific receiving water objectives, but all lakes except Wood Lake, Osoyoos Lake and the Armstrong Arm of Okanagan Lake met their objectives in 2007. There was a significant decrease in phosphorus in Wood Lake, and the interim objective of 0.040 mg/L was achieved in 1990 and 1991. Phosphorus concentrations in Skaha Lake reached the 0.015 mg/L water quality objective in 1990 and 1992. In Osoyoos Lake the 1990-1992 phosphorus levels were lower than they had been for most of the previous decade, and continue to improve, reaching 0.016 mg/L in 2007, but they remain just above the 0.015 mg/L objective for that lake.

It has been estimated that watershed sources and the remaining non-point source component constitute the majority of phosphorus loading now entering the Okanagan Lake system[14]. Limitations to non-point source estimates, however, make it difficult to determine loading influence, particularly in relation to wet and dry year cycles.

2.3.2 Assimilative Capacity Conclusions and Recommendations

In the absence of the phosphorus loading model which is specific to the Okanagan Basin, it is possible to use water quality objectives to operationally asses the "assimilative capacity" of the lakes and provide recommendations regarding long-term phosphorus loadings. Comparison of existing phosphorus levels to site-specific objectives results in the following conclusions to be made about assimilative capacity of the Okanagan Basin lakes.

- **Reductions in diffuse, controllable phosphorus loadings are needed.** Wood and Osoyoos Lakes and the Armstrong Arm of Okanagan Lake continue to have higher than desirable phosphorus concentrations and thus operationally are considered to have exceeded their "assimilative capacity" for phosphorus. In the context of waste management planning, this means that septic tanks in areas of high phosphorus transmissivity (see Section 2.1 - Treated Effluent and the Assimilative Capacity of the Land Base) should be replaced with sewers. In some cases (particularly Osoyoos Lake) this action may be insufficient to shift phosphorus concentrations to the objective levels. Water quality of Armstrong Arm, and Kalamalka lake are largely driven by diffuse sources of phosphorus such as agriculture.

- **Efforts should be focused on better understanding non-point source loading so control measures can be put in place.** Kalamalka Lake, Skaha Lake and the Vernon Arm of Okanagan Lake have notably reduced phosphorus concentrations, however they remain at or near their objective levels and long term phosphorus loadings to these water bodies should not exceed their current levels. As communities expand and densify in the basin, non-point sources such as stormwater may continue to add greater loads to these water bodies.

- **Long-term phosphorus loadings should not increase substantially above present levels**. Waste management plans should also continue to strive for phosphorus reductions where possible, otherwise phosphorus loading will incrementally increase and water quality objectives may be exceeded. Phosphorus concentrations in the main basins of Okanagan Lake, particularly in the deeper basins are currently below the objective levels. Based on a comparison of recent water quality data to the water quality objectives established in 1985, and updated for Okanagan Lake in 2005, there is little or no assimilative capacity for phosphorus in the Okanagan Basin lakes.

- **Recreate assimilative capacity mapping for soils in Okanagan Basin.** Soils classified as having moderately low to low phosphorus transmissivity[10] are considered to have good assimilative capacity for phosphorus. Phosphorus transmissivity maps would be a useful tool for waste management planning to target low transmissivity areas for land-based waste disposal. Conversely, septic tanks in areas with moderately high to very high phosphorus transmissivity should be given priority for replacement with sewers. Maps originally created by the Ministry of Environment in 1970 should be recreated. These maps were stored on floppy disk and although they can be accessed and associated polygons and spreadsheets from this initial project could serve as a base for revisions, they are now out of date and no updates have been made since the 1980's. Recreating these maps would require current soil maps for the regions within the basin, on which a layer with horizontal distance to surface waters could be added, showing distances of less than 60 metres, between 60-150metres and greater than 150m. Cadastral maps would then be used to locate buildings, cross referencing with recent air photos to confirm that dots are houses and to identify recent housing developments since air photos.

2.3.3 Non-Point Source Conclusions and Recommendations

- **Re-evaluate non-point source (NPS) estimates**. Since the 1970's, the phosphorus loading from STPs has decreased from 59,148 kg/year to 4250 kg/year in 2007, approximately 93%, but the overall reduction in phosphorus loading to the Okanagan Basin lakes has only been about 42%. Therefore, future phosphorus control measures must also focus on diffuse (non-point) sources. Given the uncertainty of non-point source (NPS) estimates, in order to meet water quality objectives throughout the lake system, a re-evaluation of these estimates is warranted. Considerable resources will be required to update both non-point source, and watershed loads.

- **Raise awareness of non-point sources of phosphorus**. As storm drainage systems increase in size due to development growth in the basin, storm water loading could be several times greater than anticipated, also warranting specific control strategies[14]. Furthermore, water quality protection within the Okanagan basin must also promote measures to control phosphorus loadings from agriculture and logging through best management practices, erosion control, setbacks, compliance with regulations etc.

- **Create a basin wide strategy for managing non-point sources**. Diffuse source strategies should be approached from a basin wide best management practices view with multiple resource benefits as an objective. Non-point source nutrient control must be re-examined to determine where multiple benefits are available to protect habitat and reduce overall contaminant loading to surface and groundwaters of the Okanagan Basin[14].

2.3.4 General Conclusions and Recommendations

- **Update Total Phosphorus Objectives**. 1985 spring TP objectives were based on the best available information at the time. These objectives are not set in stone and can be amended as new information comes along. Objectives for Okanagan Lake have been amended by lowering spring TP to levels that are believed to more adequately represent long term means and new objectives have been added for parameters like nitrogen, chlorophyll and water clarity. This makes water quality objectives a more comprehensive process in determining sustainability, status and trends. The Ministry of Environment intends to update objectives for all the lakes but this will require local government to take an active role in collaborating on this process to make it happen. Water quality objectives with validation and management targets are needed even if a lake specific loading model is developed. A rationalized, current, monitored and reported set of objectives for each lake provides reassurance that water quality management is on the right track and provides early warning if conditions change that are unrelated to climate cycles.

Updated and multi-parameter water quality objectives for each lake would provide more certainty of on-going lake status and trends, provide continued input to waste management planning, and help to validate any assimilative modeling exercise undertaken in the future.

- **Water quality monitoring programs should be maintained and increased** through an updated and expanded water quality objectives assessment, monitoring and reporting process to assess the effectiveness of the waste management strategies and identify emerging issues requiring additional action.

- **Promote adherence to water quality guidelines and encourage the on-line reporting** of water quality indices for wastewater treatment plants. Programs such as OBWB could assist in educating the public regarding the availability of the reports.

- **Reduce non-point source loading of phosphorus to the lakes.** Wood and Osoyoos lakes and the Armstrong Arm of Okanagan Lake do not meet receiving water objectives. As populations continue to increase in the valley, further efforts to minimize non-point sources of phosphorus from agriculture, septic tanks and storm-water will benefit water quality in the basin lakes. As agriculture is likely the largest source of phosphorus loading to Armstrong Arm, this is an example of how reviewing local farmers compliance with Agricultural Waste Control Regulations could be a good way to ensure the implementation of best available practices are in place.

- **Examine influence of wet year cycles on phosphorus concentrations.** Phosphorus concentrations in Kalamalka Lake and all parts of Okanagan Lake increased from the late 1970s to the mid 1980s and subsequently declined. The phosphorus pattern was similar to the pattern of flows in the Okanagan River but was displaced by two to three years (that is, the peaks in phosphorus concentrations and flows did not occur at the same time but were out of synchrony by two to three years). Further examination of the influence of wet year cycles is warranted to better understand the relationship of associated hydrologic and nutrient loading cycles in the Okanagan basin. Modeling lake response to phosphorus reductions could be instructive and clarify the component related to changing water residence times with wet and dry year cycles[14]. Predictions of significant changes in water supply, such as lower summer flows and increased fall flows may have important consequences for the quantity and timing of input of nutrients and the processing of nutrients in Okanagan lakes[15].

This concludes the findings and recommendations of this report related to water quality data for the Okanagan basin. Section 6, Ancillary Issues provides further water quality related recommendations based on discussions with government agencies throughout the Okanagan.

2.4 References

1. Nordin, R. N., J. E. Bryan, and E. V. Jensen. 1990. Nutrient controls and water quality in the Okanagan Lakes 1969·1989, pp. 335-346 in R. Y. McNeil and J. E. Windsor, eds. Innovations in River Basin Management, Proceedings of the 43rd Annual Conference of the Canadian Water Resources Association, Penticton, British Columbia.

2. British Columbia Ministry of Environment, Water Management Branch. 1985. Phosphorus in the Okanagan Valley Lakes: Sources, Water Quality Objectives and Control Possibilities. British Columbia Ministry of Environment.

3. Bryan, 1. E. 1990. Water Quality of Okanagan, Kalamalka, and Wood Lakes. British Columbia Ministry of Environment.

4. Stockner, J.G. and T.G. Northcote. 1974. Recent limnological studies of Okanagan Basin lakes and their contribution to comprehensive water resource planning. J. Fish. Res. Board Can. 31: 955-976.

5. Nordin, R. N. 1983. Changes in water quality of Skaha Lake, British Columbia, following reduction in phosphorus loading, pp. 166·170 in Lake Restoration and Management. USEPA, Washington, D.C. EPA 440/5-83-001.

6. Dayton and Knight. 1995. City of Vernon, Liquid Wastewater Mangement Plan. 1995 Update. Stage 1 Report in Updating Process.

7. Vollenweider, R. A. elementares Modelle Hydrobiol. 66: 1-36. 1969. Moglichkeiten and Grenzen der Stoffbilanz von Seen. Arch.

8. Dillon, P. J. and F. H. Rigler. 1974. A test of a simple nutrient budget model predicting the phosphorus concentration in lake water. J. Fish. Res. Board Can. 31: 1771-1778.

9. Reckhow, K. H. and J. T. Simpson. 1980. A procedure using modelling and error analysis for the prediction of lake phosphorus concentration from land user information. Can. J. Fish. Aquat. Sci. 37: 1439-1448.

10. Canfield, D. E. and R. W. Bachmann. 1981. Prediction of total phosphorus concentrations, chlorophyll a, and Secchi depths in natural and artificial lakes. Can. J. Fish. Aquat. Sci. 38: 414423.

11. British Columbia Ministry of Environment. 1987. Phosphorus Transmission from Septic Tank Effluent, 1:20,000 map series. Available from: Maps B.c., Surveys and Resource Mapping Branch, Victoria, British Columbia.

12. British Columbia Health Act, Sewage Disposal Regulations, B.C. Reg. 411/85 amended Jan. 17th, 1992, Order in Council No. 85.

13. Curtis, Jefferson P. (2005). Water Quality in the Okanagan Basin: Dependence on spatial and temporal drivers. Water – Our Limiting Resource. Canada Water Resource Association. 287 – 295.

14. Jensen E.V. and P. F. Epp. 2002. Water Quality Trends in Okanagan, Skaha and Osoyoos Lakes in Response to Nutrient Reductions and Hydrologic Variation. Ministry of Water Land and Air Protection. Penticton, British Columbia.

15. Nordin, Richard, N. (2005). Water Quality Objectives for Okanagan Lake – A First Update. Limnos Water Associates. Prepared for The Ministry of Land, Water and Air Protection, Penticton and Kamloops BC.

16. Jensen, E.V. 2008. Phone and email conversations.

17. Osoyoos Lake Water Quality Society. http://www.olwqs.org/pollution.html

18. Jensen, E.V. and Bryan, J.E. (2001). Water Quality Trends in Kalamalka, Wood and Ellison Lakes 1969 to 1999. Ministry of Water, Land and Air Protection, Southern Interior Region. Technical Report. http://www.env.gov.bc.ca/wat/wq/trendstuff/kalwood/index.html

SECTION 3.0 – LAND USE PLANNING, WASTEWATER MANAGEMENT PLANS AND UPDATES

3.1 Introduction

This section of the plan summarizes the various Official Community Plans, Regional Growth Strategies, wastewater management plans (also referred to as liquid waste management plans) and any updates that have been undertaken since the original plans were adopted. It also covers other wastewater planning documents which include important projects. Focus is given to sewer projects and treatment plant upgrades which may qualify for funding through the OBWB. Other projects such as sewer extensions to areas developed after 1977 and upgrades to treatment plants which are not eligible for funding have been omitted. Some details such as disposal and level of treatment are included for the sake of interest. The information was provided in a variety of formats reflected by the presentation. Plans are grouped by regional district and sub-grouped by municipality or electoral area. Some land use plans and wastewater management plans group electoral areas together differently. For example in the Okanagan Similkameen Regional District there is one wastewater management plan covering Electoral Areas A, C and D but the official community plans are broken up into Electoral Area A, Electoral Area C, Electoral Area D1 and Electoral Area D2.

3.2 Wastewater Management Plans - General

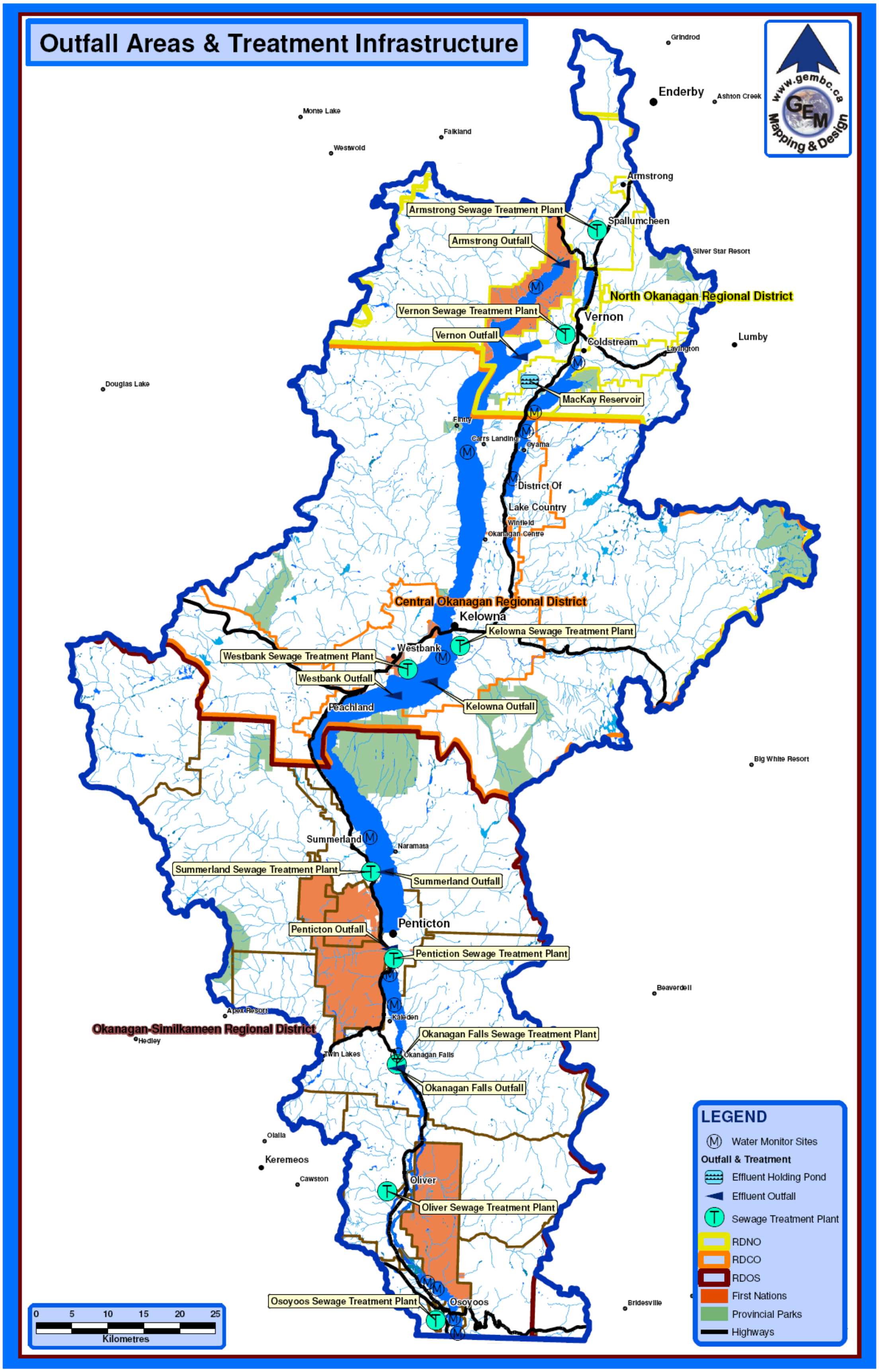
At this time, wastewater management plans (WMP) have been completed or initiated for all areas in the Basin. Table 3.1 presents a summary of the various plans' status. With the exception of Osoyoos, which presented its entire plan in one volume, all plans were prepared in a three-stage format. Stage 1 identified concern areas, Stage 2 evaluated feasible alternatives to address those concerns, and Stage 3 presented an overall summary of the plan including recommendations.

From Table 3.1, a number of points warrant discussion. 75% of the plans are 100% complete and almost 90% of the plans have at least completed Stage 1. More importantly, however, Table 3.1 illustrates the long time frame over which plans have been prepared. The earliest plans (Vernon, Westbank) were completed in 1985, while RDOS (E, F) and Spallumcheen were completed in 1994 and 1999. This lengthy span means that data are presented in different formats. Summaries of all of these original plans can be found in the 1993 Master Wastewater Management Plan. Updates that have been made to the plans are addressed in this section. For simplicity, the plans are discussed geographically, from the north end of the valley to the south. Cost estimates presented were current for the year the updates were completed unless otherwise indicated.

Table 3.1 - Individual Wastewater Management Plan Status

		Completion Date		
Plan Area	***Status***	***Stage 1***	***Stage 2***	***Stage 3***
Spallumcheen	Complete	1993	1999	1999
Armstrong	Complete	1986	1987	1987
NORD (ABC)	Underway	1990		
Vernon	Complete	1985	1985	1985
Coldstream	Complete	1991	1992	1994
CORD (Winfield)	Complete	1988	1990	1990
Kelowna	Complete	1990	1990	1990
CORD (G,H)	Complete	1990	1991	1991
Westbank	Complete	1985	1985	1985
Peachland	Complete	1991	1991	1992
Summerland	Complete	1988	1991	1991
RDOS (E, F))	Complete	1993	1993	1994
Penticton	Complete	1986	1986	1987
RDOS (A,C,D)	Complete	1988	1989	1989
Oliver	Complete	1990	1992	1992
Osoyoos	Complete	1987	1987	1987

Note: The NORD plan was terminated following completion of Stage 1.


Outfall Areas & Treatment Infrastructure
www.gembc.ca
GEM Mapping & Design
Grindrod
Enderby
Ashton Creek
Monte Lake
Falkland
Westwold
Armstrong
Armstrong Sewage Treatment Plant
Spallumcheen
Armstrong Outfall
Silver Star Resort
North Okanagan Regional District
Vernon Sewage Treatment Plant
Vernon
Vernon Outfall
Coldstream
Lavington
Lumby
Douglas Lake
MacKay Reservoir
Finity
Carrs Landing
Oyama
District Of
Lake Country
Winfield
Okanagan Centre
Central Okanagan Regional District
Kelowna
Kelowna Sewage Treatment Plant
Westbank Sewage Treatment Plant
Westbank
Westbank Outfall
Peachland
Kelowna Outfall
Big White Resort
Summerland
Naramata
Summerland Sewage Treatment Plant
Summerland Outfall
Penticton
Penticton Outfall
Penticton Sewage Treatment Plant
Beaverdell
Apex Resort
Kaleden
Okanagan-Similkameen Regional District
Hedley
Okanagan Falls Sewage Treatment Plant
Twin Lakes
Okanagan Falls
Okanagan Falls Outfall
Olalla
Keremeos
Cawston
Oliver
Oliver Sewage Treatment Plant
Osoyoos Sewage Treatment Plant
Osoyoos
Bridesville
0 5 10 15 20 25
Kilometres
LEGEND
Water Monitor Sites
Outfall & Treatment
Effluent Holding Pond
Effluent Outfall
Sewage Treatment Plant
RDNO
RDCO
RDOS
First Nations
Provincial Parks
Highways

Section 3.3 Official Community Plans - General

This plan update includes a review of all of the Official Community Plans for the Basin, as well as provincial legislation governing sewage disposal.

The land use planning review consisted of obtaining copies of Official Community Plans for the following communities: Armstrong, Spallumcheen, Coldstream, Vernon, Regional District of North Okanagan Electoral Areas B&C – Rural Vernon, Silver Star Mountain, Electoral Area B - Westside, and Electoral Areas D&E, Lake Country, Kelowna, Peachland, Regional District of Central Okanagan Electoral Area G – Westside and North Westside Road, Electoral Area I – Ellison, Summerland, Penticton, Oliver, Osoyoos, Electoral Area A – Osoyoos Rural, Electoral Area C – Oliver Rural, Electoral Area D1 – Kaleden/Apex/SW Sector, Electoral Area D2 – East Skaha/Vaseux, and Electoral Area E – Naramata. Rural land use bylaws for Electoral Area I – Joe Rich and Electoral Area F – Okanagan Lake West/Westbench were also reviewed. Most of these documents were available via the respective municipal websites. Other documents included were Land Use Contracts as noted in the various OCP's and the Regional Growth Strategies for each regional district.

Each OCP was reviewed for information pertinent to wastewater management planning including policies regarding liquid waste disposal, population, urban growth projections and density provisions for rural areas utilizing on-site septic systems. Conversations were undertaken with planning staff from the various municipalities to confirm details where necessary.

3.4 Regional District of North Okanagan

3.4.1 <u>North Okanagan Regional Growth Strategy</u>

The Regional District of North Okanagan has recently embarked on a planning process to develop a Regional Growth Strategy. To date the terms of reference have been established and a planner hired to coordinate the planning process.

3.4.2 <u>Township of Spallumcheen</u>

Official Community Plan

The primary goal for Spallumcheen as outlined in their OCP is to preserve the rural, farming nature of the community while allowing for development that does not compromise this overarching goal. This includes allowing economic opportunities for farmers and encouraging industrial expansion. Recent amendments to the OCP allow increased rural residential development of 1 ha (Small Holding) parcels on lands located outside the ALR. There is also a

Neighbourhood Plan under preparation for the currently undeveloped Southeast Sector of the Township. The area is being considered for potential residential and industrial expansion, however there are challenges to development of this area including thin soils over bedrock which preclude the use of onsite septic systems in most cases. Community sewer is being investigated as an option for the area.

Wastewater is dealt with in Section 15.2 and includes the following policies:

- The Township does not support the creation of new lots of less than 1.0 hectare which are proposed to be serviced by septic disposal systems in recognition that the province has repeatedly cautioned local governments in British Columbia that such approvals threaten a community's eligibility for senior government grants for community sewer infrastructure. Legitimate homesite severance subdivisions which are approved by the Agricultural Land Commission may be exempt from this policy.

- It is the policy of the Township of Spallumcheen that when considering a rezoning or subdivision application, that sewage effluent absorption field lengths should follow the septic tank standard for both package treatment plant systems or conventional septic tank systems and any relaxation of standard disposal field site selection criteria is not supported.

- The Township reaffirms its intention to pursue the possibility of a community wastewater system to service the existing Spallumcheen Industrial Park which could entail connection to the Armstrong Sewer Utility or an independent treatment facility. The Township recognizes that servicing the Industrial Park or other areas with waste water treatment systems would be of benefit to agriculture if such servicing enables increased volumes of reclaimed water to be utilized for irrigation. The Township continues to explore servicing options, cost reduction strategies, and may undertake further study as a follow-up to the Liquid Waste Management Plan.

- The Township of Spallumcheen will cooperate with North Okanagan Regional District to identify means to dispose of septage material after December 31, 2004 when the City of Vernon stops accepting the holding tank waste at its wastewater treatment facility. (Since adoption of this OCP a Regional Septage Facility was constructed in Vernon to deal with holding tank waste on a regional scale.)

Updates to the Wastewater Management Plan

This plan was updated in 1999 to address issues and alternatives pertaining specifically to the Udy Subdivision and Industrial Park area. There have been several reported septic field failures in the Udy subdivision, though none reported in the Industrial Park where most properties utilize holding tanks. Two options were considered for providing community sewer to this area. The first was to provide a communal wastewater collection/treatment/disposal system for the entire Udy Subdivision, trailer park and Industrial Park. Treatment options include connecting to the City of Armstrong Thomas Hayes wastewater treatment plant or constructing a new community treatment/disposal system. A decision on this was to be confirmed at a future date as a detailed engineering assessment is required and the City of Armstrong was unable to confirm whether the Thomas Hayes facility was able to accept additional flows.

Assuming a connection to City of Armstrong treatment facility the connection cost was estimated in 1999 at $26,000 per connection. Assuming a communal treatment system, the connection cost was estimated at $28,000 per connection. Connecting to Armstrong's system was chosen as the more viable and cost effective option. To date no progress has been made towards providing sewer to these areas due to a lack of public interest in pursuing this project.

3.4.3 City of Armstrong

Official Community Plan

The City of Armstrong is bounded by the Township of Spallumcheen and the Agricultural Land Reserve on all sides, which provides a strong Urban Containment Boundary. The OCP contains policies encouraging infill of vacant and underutilized parcels within developed areas and projects modest population growth capping at around 5700 people. OCP Policies with respect to liquid waste management reflect this population cap. The intention is to facilitate growth for the term of the Plan within the current municipal and Provincial (ALR) boundaries. However, there are also policies respecting amalgamation with the Township of Spallumcheen, subject to the positive outcome of an independent and objective restructuring study with broad community support.

The growth rate used in formulating population projections was 3.5 %. Based on this growth rate a population of 4973 persons was predicted by 2007. The 2007 population according to BC Stats was 4524 persons, suggesting that population growth did not happen as rapidly as predicted. This suggests that it may take longer for the City of Armstrong to reach buildout than originally anticipated.

Wastewater is dealt with directly in Section 19. - Municipal Services, which provides a summary of the liquid waste management plan. The main objectives of the LWMP are:

a) To provide adequate and efficient sewer collection, treatment and storage facilities in order to accommodate a projected residential infill population, and modest growth for low discharge commercial and industrial operations.

(b) To complete studies, testing, modeling and assessment of the collection, treatment, storage and spray irrigation distribution system, and accordingly develop a long term maintenance and repair plan.

(c) To ensure the continued production of high quality wastewater for spray irrigation in balance with current and projected demand.

(d) To minimize creek discharge and to promote water conservation

Waste Management Plan Updates

The Armstrong treatment plant uses an aerated lagoon process with a winter storage reservoir. Reclaimed water is used locally for agricultural irrigation.

In the early 1990's the City switched from discharge to Deep Creek to a spray irrigation program as the accepted means of effluent disposal in Armstrong. Discharge to Deep Creek is now only used as a backup and would now only occur after several consecutive wet years which would prevent disposal of effluent due to soil saturation. The LWMP was updated in 1998 to include the spray irrigation information.

An interview with the Public Works Manager indicated that they are looking into relocating the treatment plant to the Thomas Hayes reservoir site in Spallumcheen. The time horizon for this project is 2-10 years. The treatment plant is currently located on Adair Street in the urban area and it is not believed to be an ideal location for the plant.
The city is looking at the possibility of using the site for other potential uses such as parks and recreation. The project is estimated in a 2005 report by Earthtech at approximately 2.5 million dollars. It is believed that the costs are likely to have increased significantly since then due to the rising cost of construction. This project is not yet included in their 5 or 10 year capital plans. It should be noted that this project does not include any plant upgrades which means that it would remain a secondary treatment facility.

It is noteworthy that the closure of the Dairyworld (Saputo) plant in 2002 increased the capacity of the system to accommodate more residential growth. This is due to the elimination of large volumes of industrial effluent formerly coming into the treatment plant from Dairyworld. This closure also increases the length of time before treatment plant expansions would be necessary.

The current aeration system is considered secondary treatment. However, Armstrong's effluent disposal is 100% spray irrigation. A potential for occasional discharge to Deep Creek in wet years does exist. The City has not had to utilize the Deep Creek discharge option in 10 years and there is currently a waitlist of farmers interested in participating in the spray irrigation program. Staff from the City reported that farmers who previously were getting one crop of barley/straw per season are now getting up to 3 crops of alfalfa without needing fertilizer. This wait list is expected to provide spray irrigation area for up 10 to 15 years of growth in Armstrong.

3.4.4 City of Vernon

Official Community Plan

The original OCP for the City of Vernon was adopted in 2002, however a new plan has been adopted that is likely to present a significant change in direction for the City. Policies in the original plan allow for urban growth areas in the highlands on both sides of Vernon Arm and in the Silver Star Foothills area. The original plan also included a Waterfront Plan which encourages tourist commercial development in the Okanagan Landing area and an ultimate growth boundary for Vernon which takes in portions of Electoral Areas B and C (BX/Swan Lake) up to Vernon Hill and the Silver Star foothills, the Commonage area fronting Kalamalka Lake, and the area on both sides of Swan Lake.
The new plan has removed some of these areas from urban growth designation and instead encourages development to concentrate within the downtown core and existing nodes where there are services available. Residential reserve areas are designated for future growth and new residential reserve areas cannot be designated until the current stock of developable land is used up. This change will help to reduce the distance that infrastructure must be extended to service new development and limit leapfrog development. The Ultimate Vernon Boundary continues to be recognized within the new plan.

The section on wastewater management describes the sewage infrastructure system for the city and outlines the proposed upgrades to the plant and proposed pipe extensions along the shoreline areas of Okanagan Lake in Vernon Arm much of which has been upgraded and extended since adoption of the OCP. This is described further in the next section which outlines the Liquid Waste Management Plan and updates.

Wastewater Management Plan Updates

Vernon's treatment plant is BNR with secondary clarification, filtration and ultra violet disinfection. Blended primary and secondary solids are dewatered and composted then sold as a garden product. 100% of wastewater is pumped to the Mackay Reservoir near Vernon and used as reclaimed irrigation water by local users such as golf courses, grazing lands and forestry programs.
http://www.vernon.ca/services/utilities/reclamation/index.html

The City of Vernon updated their Liquid Waste Management Plan in 1995. At that time seven alternatives were evaluated for future liquid waste management. Most of these involved expanded reclaimed wastewater use including dual distribution systems.


Spray Irrigation

Stage 2 of the update recommended an alternative for the new LWMP which involves no normal lake discharges, additional agricultural irrigation and finally dual distribution (potable and irrigation quality respectively). All alternatives included water supply as well as Liquid Waste Management.
The elected officials endorsed Alternative 5 which provided time for the implementation of dual distribution in urban areas and also time for further studies by the North Okanagan Water Authority and Coldstream of some of the aspects. However, Coldstream in early 1998 decided to implement its own LWMP and the endorsed course of action then became Alternative 7.

Alternative No. 5 – Expanded agricultural irrigation followed by dual distribution, no new water supply required – Kalamalka Lake water in No. 1 quality system. Reclamation plants near Giant Industries site (secondary) and existing site to be used by Vernon, Coldstream and NOWA.

Alternative No. 7 – Expanded Agricultural irrigation followed by dual distribution in City and NOWA. No new water supply sources required for the City and NOWA. Reclamation plants near Giant Industries landfill and at existing site (secondary). City and NOWA wastewater included in Alternative 7 (Coldstream on its own for water and wastewater).

An independent peer review of the LWMP was requested by the City of Vernon in 2000, and was completed by a panel of Professional Engineers. This review found that although the various recommendations for treatment and management alternatives were commendable and defensible, the costs provided for many of the alternatives were underestimated.

Table 3.2 – Cost Discrepancies of Vernon LWMP

Alternative	LWMP estimate (mill $)	Review Panel estimate (mill $)
1a	98.4	103
1c	80.1	94
2a	100.4	112
2b	89.3	107
3a	70.8	106

Alternative	LWMP estimate (mill $)	Review Panel estimate (mill $)
3b	59.7	99
4	83.3	125
5	62.2	106
6	85	140
7	68.3	116

* This chart shows the total capital cost comparisons of the various alternatives to 2020.

Interviews with the City of Vernon representatives indicated that the dual water distribution system idea was abandoned in the early millennium due to political issues and none of the alternatives outlined in the LWMP were chosen. However, the City is now looking at expanding reclaimed water use to the Bella Vista area and Coldstream Ranch, so there is still some commitment to the concepts identified in the plan amendment. This would be an expansion of the spray irrigation program. It is also noted that Marshall Fields (recreational) and the DND grounds are currently being used for the spray irrigation program.

Infrastructure projects completed by the City to date include construction of a new BNR treatment plant at the existing site in south Vernon, and extension of sewer trunk mains out to the Blue Jay subdivision in north Vernon, the Okanagan Landing area and Bella Vista. The City has plans to initiate a LWMP amendment in the fall of 2008. Prioritized sewer line projects (including tons of phosphorous removal estimated at the time) from the 1993 MWMP included the following (Table 3.3).

Table 3.3 – Completion Status of Vernon Sewer Projects Prioritized in the 1993 MWMP

Area	Tons Phosphorous removed (kg/yr)	Completion Status
Beachcomber	77	Partially
Blue Jay	15	Yes
Goose south	4	Yes
*Herry Road	44	No
*South BX/Pottery Road	87	No
*Swan Lake	154	No
Bella Vista	280	Yes
Ellison	53	Yes
*Goose/Vernon NW	58	No
*Silver Star	24	No
Sunset/Okanagan	597	No
*Vernon East – Mueller/Barker	130	No

*Lands still under RDNO jurisdiction.

These projects were all under the jurisdiction of the Regional District North Okanagan at the time the 1993 Master Wastewater Management Plan was written. Since that time many areas have been annexed by the City of Vernon. The rest are still within the jurisdiction of the RDNO. The RDNO does not operate any sewer utilities and the City of Vernon has a policy that restricts sewer connections to properties lying within City boundaries.


City of Vernon Water Reclamation Plant

It is important to note that although trunk mains have been extended to service some areas, the City of Vernon does not currently have bylaws in place requiring property owners to connect when the service becomes available. City staff report that the numbers of older properties that have connected to the sewer line are relatively low which reduces the effectiveness of the sewer extension for phosphorus management.

3.4.5 District of Coldstream

Official Community Plan

The District of Coldstream is divided between rural medium and large lot development that is serviced by onsite sewage disposal and suburban style city lot residential development that is serviced by community sewer. Much of the rural area is within the Agricultural Land Reserve (ALR) along the valley bottom, while the remainder is located on the hillsides. The Rural areas make up the largest percentage of Coldstream's land base. Residential growth areas identified in the OCP include the hillside above Coldstream Valley Estates along Buchanan Road up to the Grey Canal, Middleton Mountain, and the Spicer Block. Areas that are located in the ALR are designated as Agricultural and are meant to be retained in 30 ha or larger parcels. Areas not in the ALR that have steep slopes, wildfire hazard, environmental or geotechnical concerns are designated to be retained as 30 ha parcels as well. Areas without these limitations that are not in the ALR are designated for 2 ha minimum lots. The OCP contains a policy limiting parcel size to a minimum of 1 hectare for areas that are not connected to a community sewer line.

Approximately half of the homes located in the District of Coldstream are currently connected to the community sewer system. This includes all properties west of McClounie Drive. The system connects to the City of Vernon treatment plant where wastewater is treated and discharged. Coldstream currently has an agreement with Vernon to treat and discharge all flows generated by Coldstream. All new development in the District of Coldstream is happening within a sewage disposal area. Areas that have been identified as requiring sewer in the future have been ranked in terms of priority.

Wastewater Management Plan Updates

An update to the WMP was completed in 2001. This update confirmed the partnership between the City of Vernon and the District of Coldstream with respect to sewage treatment and disposal via the Vernon STP. The previous preferred option of rerouting the Coldstream collection system to a satellite treatment plant located in the centre of Coldstream was abandoned and a Memorandum of Understanding was signed with the City of Vernon to continue to direct the collection system to the City for treatment and to work with the City to facilitate beneficial reuse of reclaimed water in the agricultural areas of Coldstream.

A Sanitary Sewer Investigation was completed in 2004 and an assessment of sewage disposal systems in the central Coldstream area was also done by Golder and Associates in August of 2007. The Sanitary Sewer Investigation broke the service area plan into four priority zones based on how the system could best be expanded in relation to each adjacent area and to the density of development within each area.

Priority Area #1 – Kalamalka Lake Road from McLounie Drive to Aberdeen Road to the east and to Wisbey Drive along Aberdeen Road to the north.

Priority Area #2 – Aberdeen Road from Wisbey Drive to Inverness Road to the north.

Priority Area #3 – Buchanan Road from Hwy No. 6 to Midland Drive to the east and Cypress Drive to the north.

Priority Area #4 – Sarsons Road between Inverness Drive and Highway No. 6.
Preliminary costs and cost per property for servicing each area were provided. These are outlined in Tables 3.4 and 3.5.

Table 3.4 – District of Coldstream - Preliminary Costs (based on 2002 estimates)

Service Area	Trunk Main	Lateral Main	Road Reconstruction	Total
Priority Area #1	626,000	1,403,000	588,000	2,617,000
Priority Area #2	1,220,000	841,000	461,000	2,522,000
Priority Area #3	640,000	3,157,000	1,054,000	4,851,000
Priority Area #4		404,000	101,000	505,000
Total	**2,486,000**	**5,805,000**	**2,204,000**	**$10,495,000**
% of Total	**24**	**55**	**21**	**100**

Table 3.5 – District of Coldstream - Cost per Property (including ALR properties) (2002)

Service Area	# of services	Cost/property ($) (Trench zone patching only)	Cost/property ($) (Full width road replacement)
Priority Area #1	176	11,600	14,900
Priority Area #2	119	17,400	21,200
Priority Area #3	288	13,200	16,900
Priority Area #4	72	5,700	7,000
Total	**655**		
Average		**12,700**	**16,100**

Staff at the District of Coldstream report that trunk sewer servicing has been completed for Priority Area #1, however, to date very few hookups have occurred. It is currently optional for existing residences to connect to the system. However, connection is required for all newly subdivisions that create lots under 1 ha in size, and also in cases where a septic system fails and sewer service is available. The trunk currently extends up Aberdeen Road as far as Wisbey Drive and it is intended to eventually extend as far as Highway 6 and up into Coldstream Valley Estates (trunk to extend up Buchanan Road) where it will service all of the properties under 1 ha in size.

New projects in capital works plans include lift stations at the west end of Coldstream Creek Road (approximately $700,000 project), Lachine and Kalavista Drive ($800,000 project). The District anticipates that provincial grants will help cover these costs. A new lift station and force main will also be required when properties develop near the corner of Aberdeen Road and Highway 6. As this requirement would be development driven, they hope to have most of the cost borne by the developer and latecomers.
Priority areas from the 1993 Master Wastewater Management Plan and their completion status are included in Table 3.6.

Table 3.6 – Completion Status of Coldstream Sewer Projects Prioritized in the 1993 MWMP

Area	Phosphorus Load*	Completion Status
Buchanan Road	35	No (but is planned to be done)
Coldstream Centre	55	Yes
Coldstream East	82	No
Lavington	266	No
Lavington West	107	No
Middleton Mountain	2	Yes

3.4.6 Electoral Areas B & C

Rural Vernon Official Community Plan

The Rural Vernon OCP covers portions of Electoral Areas B and C of the Regional District of North Okanagan. Specifically, it covers the BX area, both sides of Swan Lake including the Commercial area, Cosens Bay on Kalamalka Lake, and the portions of the Commonage that are not within the City of Vernon boundaries. It is noted that this plan does not include portions of Area B that are located on the west side of Okanagan Lake or Silver Star Mountain which both have their own OCP. Since the Master Wastewater Management Plan was written in 1993, all of Electoral Area A was annexed into the City of Vernon, and portions of Electoral Area B and C including the Foothills and Blue Jay subdivisions, and most recently much of The Commonage area were also annexed. As a result the electoral area boundaries have changed significantly.

The Rural Vernon OCP recognizes that urban residential style development should be directed towards the City of Vernon and District of Coldstream, leaving the plan area as a predominantly rural agricultural area with a majority minimum lot size standard of 2 ha and 1 ha being the absolute minimum for new subdivisions outside of the ALR. There are a few historic small lot subdivisions within the plan area that are currently utilizing on-site septic systems and are zoned Residential 1. The plan contains policies limiting further expansion of small lot development without connection to community sewer. The plan also recognizes that these areas and the Swan Lake Commercial area should be annexed by the City of Vernon so that they can be serviced with community sewer.

The OCP provides a policy structure for creating Local Service Areas for those existing historical residential areas that require sewer service. However, it also recognizes that the City of Vernon has a policy that permits connection their sewer line only if a property is annexed into the City. The RDNO does not support this concept and sees provision of sewer service and annexation as two different issues which can be addressed separately. To date there has not been a resolution to this conflict and sewer services have only been extended to those properties which choose to be annexed.

Westside Official Community Plan

The Westside OCP covers portions of Electoral Area B of the RDNO that are located on the west side of Okanagan Lake and should not be confused with the OCP that covers the District of West Kelowna in the Central Okanagan. It does not cover lands located within the Okanagan Indian Band IR #1. The nature of the plan area is rural, with a small portion of privately owned lands within 3 narrow valleys, surrounded by large areas of Crown lands. Irish Creek, Six Mile Creek and Beau Park Ranch are the primary settled areas. The population of the plan area is low. At the time of the current OCP which is quite dated, having been adopted in 1989 the population of the plan area was 88 persons. It is not likely to have increased very much since that time. Based on the existing land use designations the plan indicates that even at a 2.5%

growth rate there is a sufficient supply of land to accommodate growth in the area for up to 50 years. The current designations are all rural and the area is serviced entirely by on-site sewage disposal systems. Regional District staff report that subdivision activity in the area over the past 20 years has been minimal and that there has been no urgent need to update the Official Community Plan.

Silver Star Mountain Official Community Plan

Silver Star Mountain Resort is located within Electoral Area C of the RDNO, 22 km east of Vernon. It is a rapidly developing ski resort with a commercial business core as well as rapidly expanding residential development areas. The Official Community Plan was adopted in 2004 and includes a number of future development areas. At the time of writing, the two newest residential areas The Ridge and Alpine Meadows subdivisions had received approval and the first building season is underway. The mountain community is served by Silverhawk Utilities which is a private utility company based out of Calgary, Alberta. Community sewer and water are provided to all properties and further developments are not permitted without connection to these services. Most of the population in the area is seasonal, with winter being the time of year when most residences are occupied.

Electoral Areas A, B, C Liquid Waste Management Plan (Stage 1 Completed 1990)

Electoral Area 'A' was annexed to the City of Vernon in 1993. Information and updates for the City of Vernon will reflect this annexation.

The Wastewater Management Plan for this area was terminated at the conclusion of Stage 1 and there have been no updates to report.

3.4.7 Electoral Area D

Rural Lumby Official Community Plan

There is a small portion of the Basin that extends into Electoral Area D of the RDNO. The Areas D and E OCP covers only a small portion of the private lands south of the District of Coldstream on the hillsides north of the Aberdeen Plateau. These lands are primarily rural resource lands and some rural residential holdings. They are mainly designated as Large Holdings and Non-Urban with minimum parcel sizes of 30.5 ha and 7.2 ha respectively. There are no plans for urban expansion in this area. Servicing is by on-site sewage disposal.

3.5 *Regional District of Central Okanagan*

3.5.1 Regional Growth Strategy

The Regional Growth Strategy was adopted in 2000. It was developed by a coordinated effort from the municipalities of Peachland, Lake Country, Kelowna and the Regional District Central Okanagan and represents a commitment to cooperation around regional issues between these groups.

The General Policies of the strategy that all partners are to adhere to in creating bylaws and policies within their individual communities are:

1. All local governments shall use appropriate tools to place greater emphasis on containing urban growth to Town Centres and those areas already fully serviced, toward realization of Official Community Plan objectives. Growth and redevelopment in existing settlement areas with full services will be supported prior to supporting growth and development elsewhere.
2. Residential development in existing or new urban areas should include a range of housing type, density, and affordability options.
3. Urban services, including an adequate supply of potable water, an appropriate means of sewage treatment and solid waste disposal, and an appropriate means of access must be available before development is permitted to occur.
4. Proposals for new growth areas, major OCP Amendments and major infrastructure projects shall assess the following:
    - The impact on existing services and facilities, and the ability of local governments and agencies to provide services in a timely, affordable, and effective manner;
    - The short and long-term fiscal impact of the development on the community.
5. Require an environmental review of developments deemed to impact the ability of the land, watershed, and other natural resources to accommodate the proposed development.
6. Urban development is to be directed away from hazardous areas, sensitive environmental areas, resource extraction areas, and farmlands, to reduce land use conflicts and development encroachments.

3.5.2 District of Lake Country (*formerly RDCO Winfield/Oyama)

Official Community Plan

Since the writing of the last Master Wastewater Management Plan the areas of Oyama, Winfield, Carrs Landing and Okanagan Centre previously governed by the Regional District of Central Okanagan as Electoral Area A were incorporated as the District of Lake Country in 1995.

The first OCP was adopted in 1996, a revised version was adopted in 2001, and at the time of writing the plan is again under review. The population in 2007 was 10,217 people and population is projected to increase to around 17,000 by 2020. In 2001 housing in the District was comprised of 90% single family and 10% multi-family residential.

Many infrastructure changes have occurred since the plan was adopted in 1996 including completion of Phase 1 of the Winfield sewer system, design and construction of Phase 1 of Main street, Phase 2 and 3 of the sewer system expansion into Woodsdale and Clearwater, and completion of the Regional Septage Facility. Planning for joint servicing with the City of Kelowna is also underway. It should be noted, however that most areas within the District are still utilizing on-site sewage systems, many of which are at the end of their life span.

Rural Residential designations are applied to Moberly Road Extension area, Barkley/Commonage Road area, Ribbleworth Road, Juniper Cove, and the Old Mission Road Extension. Lots in these areas are not to be less than 1 ha in order to support onsite sewage disposal or 0.5 ha with a satellite sewer system. Urban Residential areas are those that are connected to full city servicing including water, sanitary and storm sewers. Urban Residential growth areas are identified where existing services can be expanded to meet the needs of new development. These include: Clearwater Extension around Peter Greer School, Pretty Road Extension to Lodge Road/Hwy 97 intersection, McGowan Rd, Middleton Road Extension, Southwest Winfield/Tyndall Road, Pollard's Pond, Woodsdale infilling, Trask Road, Lang Court, and Kalamalka Plateau/Pier Mac properties.

Wastewater Management Plan Updates

At the time of writing the District of Lake Country was undertaking a review of their Liquid Waste Management Plan and developing a sewer servicing model. Earthtech has been hired to complete both of these tasks. They did not have any data on infrastructure costs available to contribute to this Master Wastewater Management Plan review.

3.5.3 <u>City of Kelowna</u>

Official Community Plan

The City of Kelowna OCP was adopted in 1996 with major updates in 2002 and 2004. It is currently being revised under the project name: Kelowna 2030 – Greening Our Future with intent to make the plan more sustainable. Since the writing of the last Master Wastewater Management Plan in 1993 the City of Kelowna has annexed Rutland, the Kelowna International Airport, Glenmore and the Ellison Lake area into its boundaries. The population of the City of Kelowna in 2007 was 117, 479 and was the fastest growing community over 100,000 in BC and the largest city within the Okanagan Basin.

The OCP provides the overlying policy context for a number of Area Structure Plans which outline in further detail the land use designations for each area of the city. The OCP includes a number of policies to guide future residential and commercial growth and redevelopment in existing settlement areas that have full urban services in order to develop a compact urban form. There are also policies requiring that adequate and appropriate urban services must be present before development is permitted to occur. Preference is given to new housing in areas where servicing already exists or can be provided economically and efficiently.

The OCP also includes policies regarding the use of impact assessments for major OCP amendments and infrastructure projects, including fiscal impacts to the community. These include ensuring that DCC's accurately reflect off-site costs of development, monitoring financing structures to ensure developments in Urban Centres benefit from cost advantages from developing in built up areas and implementing a density gradient approach to DCC's.

The section on Future Land Uses also provides for the development of Area Structure Plans (ASP's), which are more detailed land use and servicing documents prior to major developments or amendments to the OCP. ASP's must include an analysis of the servicing implications of the proposed development.

Wastewater Management Plan Updates

The Kelowna treatment plant technology is Biological Nutrient Removal (BNR). Effluent is pumped from secondary clarifiers to dual media gravity fed filters, and receives disinfection by low pressure medium intensity UV radiation system. Sludge from primary clarifiers is mixed with wood waste, composted and then sold as a soil conditioner called Ogogrow.
http://www.eocp.org/plants-kelowna.html

Rather than doing a full LWMP amendment, because it required an extensive Stormwater Plan that the City didn't have resources to complete, the City completed a Wastewater Master Plan in 1997 which established a 50-year sewering plan for the City.

Table 3.7 outlines the status of priority sewer projects outlined in the 1994 Master Wastewater Management Plan and indicates that these have all now been completed. This represents a significant reduction in Phosphorus load from the City of Kelowna.

Table 3.7 – Completion Status of Kelowna Sewer Projects Prioritized in the 1993 MWMP

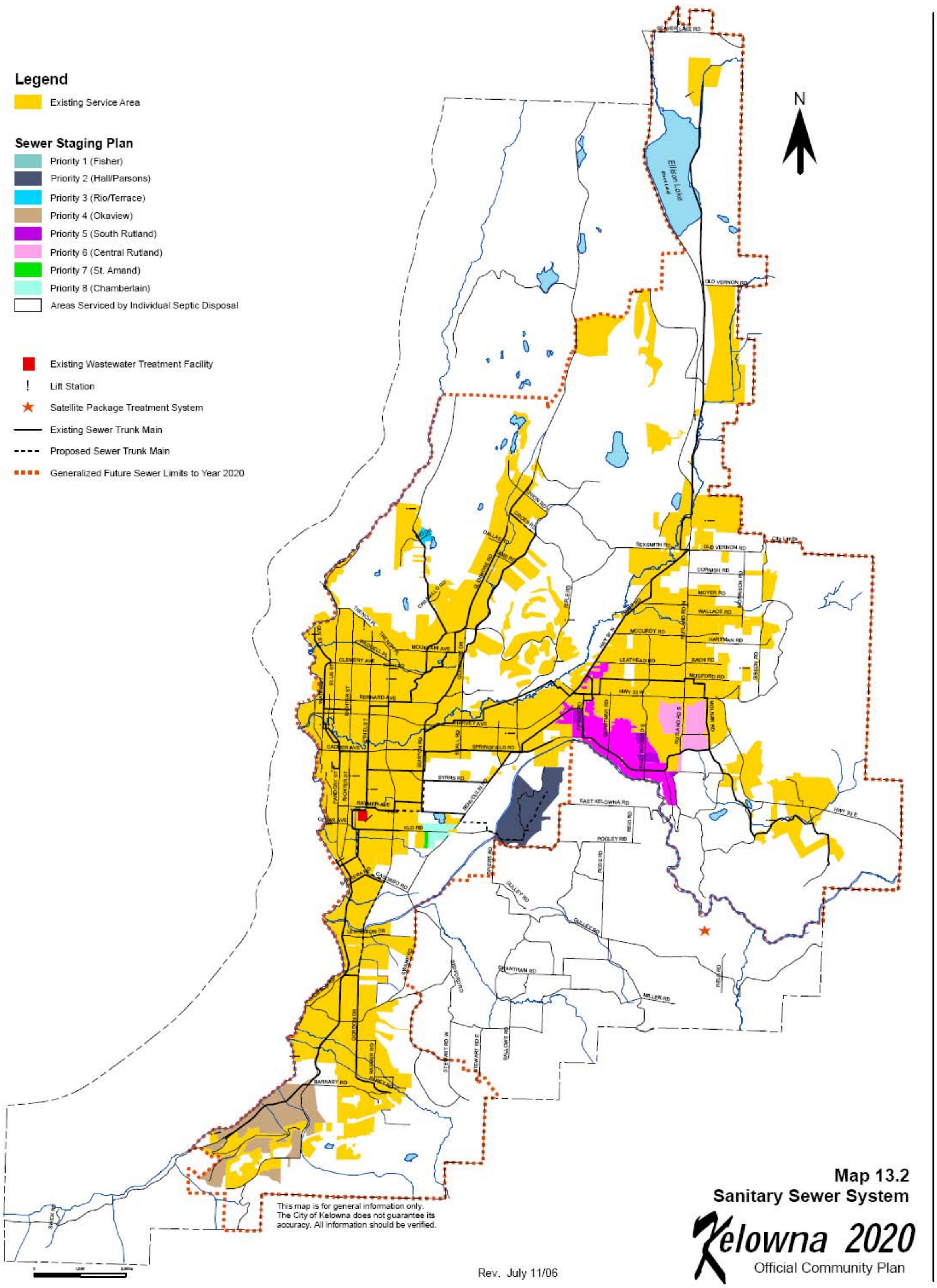
Area	Phosphorus Load*	Completion Status
Belgo/Molnar Road	27	Yes
Poplar Point	71	Yes
Belgo/Black Mountain	220	Yes
Henkel/Scenic Road	7	Yes
Mission Flats	1020	Yes

*new numbers on Phosphorus loading and costs for connections were not done in the recent planning documents.

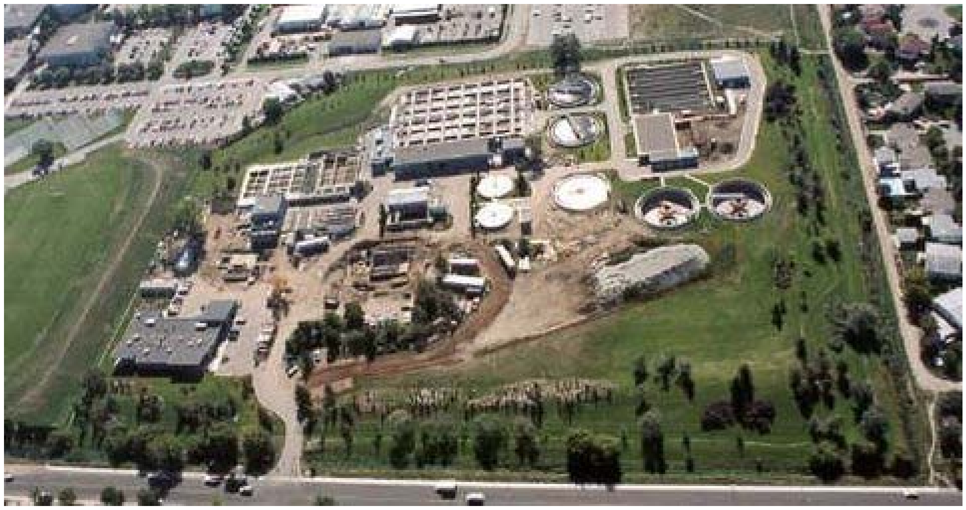
The City of Kelowna developed a priority list for sewer extensions that utilized the information from the Kelowna Wastewater Master Plan and the list was based on a review of potential health issues, environmental concerns and land utilization. This list is now used to establish the priority for the City's efforts in obtaining funding assistance for the installation of sewers in the areas. The list was reviewed and adopted by City Council and is outlined in map form in the City's Official Community Plan. It has been reproduced for convenience on the following page. City staff have indicated that they have completed everything up to and including Priority Area #4. Priority Area #7 was also completed (out of order) because the area residents chose to proceed with the sewering project without waiting for senior government funding assistance.

Table 3.8 – Sewer Service Connection Area Charges – Kelowna (2007 $ estimates)

Connection Charge Area	**Area #**	**Total Area Cost**	**Total Area SFE's**	**Cost/SFE (if prepaid)**	**Potential (but definitely not guaranteed) Year of construction**
Rio/Terrace	16	$ 905,983	58	$ 15,600	? 2011
Rutland – North	20	Set to the LAS No. 20 commutation price		$ 6,900	Done
Rutland – McKenzie Bench	21	Set to the LAS No. 21a commutation price		$ 7,100	Done
Rutland – Central	22	$ 7,021,762	567	$ 12,400	? 2015-2016
Rutland – South-West	23	Set to the LAS No. 23 commutation price		$ 7,300	Done
St. Amand/Chamberlain	25	$ 901,354	42.4	$ 21,300	? 2016
Hall/Parsons	27	$ 9,767,231	360.2	$ 27,100	? 2009-2010
Okaview	28	$10,365,104	471.9	$ 22,000	? 2012-2014
Boppart	31	$ 291,330	15	$ 19,400	? 2017
North End Industrial	32	$ 3,850,000	1491	$ 2,600	? 2020
Cary Road	33	$ 185,427	33	$ 5,600	? 2018
Sexsmith Road	35	$ 3,075,311	64.8	$ 47,500	? 2019
Clifton Road North	36	$ 439,178	34	$ 12,900	Done


Legend
Existing Service Area
Sewer Staging Plan
Priority 1 (Fisher)
Priority 2 (Hall/Parsons)
Priority 3 (Rio/Terrace)
Priority 4 (Okaview)
Priority 5 (South Rutland)
Priority 6 (Central Rutland)
Priority 7 (St. Amand)
Priority 8 (Chamberlain)
Areas Serviced by Individual Septic Disposal
Existing Wastewater Treatment Facility
Lift Station
Satellite Package Treatment System
Existing Sewer Trunk Main
Proposed Sewer Trunk Main
Generalized Future Sewer Limits to Year 2020
N
Ellison Lake
Map 13.2
Sanitary Sewer System
Kelowna 2020
Official Community Plan
This map is for general information only.
The City of Kelowna does not guarantee its
accuracy. All information should be verified.
Rev. July 11/06

A pre-design study for upgrading the sewage treatment plant was done by Reid Crowther and Associates in 1992-93. Stage 2 of the plant upgrade outlined in this is currently underway. Stage 3 of this upgrade is now estimated to be required by 2035.



City of Kelowna Wastewater Treatment Plant

3.5.4 Electoral Area East (Ellison and Joe Rich areas)

Electoral Area I – Ellison Official Community Plan

The Ellison Official Community Plan generally covers the area lying to the east of the City of Kelowna airport east of the City boundary, north of the City of Kelowna, and southeast of First Nation Reserve #7, and south of the District of Lake Country. It is characterized by rural acreages and agricultural uses with scattered pockets of residential development and crown lands on the hillsides to the east.

In 2001 the population estimate for Electoral Area I, which includes the Ellison and Joe Rich areas was approximately 4100 people. There are 3 residential enclaves in the plan area that were developed under historic Land Use Contracts. These include Scotty Creek, Spencer Road and Sunset Ranch. Although some development has happened fairly recently, this is due to old existing contracts as opposed to recent decisions. The quality of sewage disposal in these areas varies depending on the requirements that were in place at the time of development. Sunset Ranch provides a community sewer service via a connection with the City of Kelowna sewage utility. The Scotty Creek subdivision uses on-site individual in-ground septic field systems while Spencer Road is covered by a local private sewage utility. The small lot residential development and rental mobile home park, located on Old Vernon Road next to the Scotty Creek subdivision, both use in ground septic field systems. The OCP indicates that there is currently no overall assessment for stormwater and sewage treatment for the area.

Much of the plan area is designated as Rural or Agricultural with lot sizes of 2 to 4 ha as a minimum standard. Much of this area is within the ALR. The plan recognizes that development in the residential areas must be serviced by community water and sewer or existing onsite sewage disposal meeting the requirements of the Ellison Stormwater and Wastewater Management Plan.

Electoral Area I – Joe Rich Rural Land Use Bylaw

The Joe Rich area uses a Rural Land Use Bylaw (RLUB) instead of an OCP and Zoning Bylaw to control the land use for the area. A RLUB is essentially a document that is specific to rural areas and contains information and regulations normally found within an OCP, zoning bylaw and subdivision bylaw. The bylaw was adopted in 2007.

The Joe Rich RLUB area covers the Mission Creek valley to the east of the City of Kelowna in the vicinity of Highway 33. The population according to the 2001 Census was 1025, and is expected to have increased slightly since that time. Future land use goals for the area include retaining the rural character, lot sizes and uses. Properties less than 1 ha in size must be connected to a community sewer system and the plan encourages this type of development to be focused in the urban centre of Kelowna. Lands designated for future rural residential use will reflect a minimum lot size of 4 ha. The bylaw supports the development of a liquid waste management plan (stormwater and wastewater) with the general intent being to evaluate current conditions, establish objectives, discuss options, and make recommendations.

3.5.5 Electoral Area West

(portions of Electoral Areas G & H not included in the District of West Kelowna)

Electoral Area G – North Westside Road Official Community Plan

The North Westside Road OCP was adopted in 1999 and covers the area of Electoral Area G of the Regional District of Central Okanagan along the west shoreline of Okanagan Lake from Bear Creek Provincial Park to Westshore Estates. The area is characterized by moderate to steep treed slopes interrupted by pockets of gentle terrain and deltas. The main communities include Traders Cove, Wilson's Landing, Ewing, Fintry, Killiney Beach, Valley of the Sun and Westshore Estates. This area is somewhat isolated with challenging terrain and limited services. As such it has not been affected by the tremendous growth that has occurred in other parts of the Okanagan Valley.

The dominant land use in the area is rural with pockets of residential and recreation commercial development in the areas cited above. There are also four Land Use Contracts in place which predate the OCP and zoning bylaw for the area. Land Use Contracts (LUC) supercede zoning and cannot be discharged or amended without the consent of both parties. One of these LUC's has been developed (Lake Okanagan Resort) and a second has begun construction. The LUC for Lake Okanagan Resort permits up to 500 units, while LUC 258 also permits 500 units. The other two LUC's permit 72 units and 150 campsites. Although these are generally seasonal use resorts, they amount to a significant population increase for the Plan area during the summer months.

Onsite septic systems are the predominant method of sewage disposal for the area. The plan recognizes that this is not sustainable in the long term. With respect to sewage disposal, the plan contains policies directing the RDCO to investigate the possibility of placing small scale or package treatment plants in areas that are known to have failing septic systems or high levels of phosphorus and other nutrients are identified. This would not be intended to encourage increased development of these areas, simply to rectify existing problems. This type of program would be subject to available funding.

3.5.6 District of West Kelowna (formerly part of Electoral Areas G)

RDCO Electoral Area G – Westside Official Community Plan

The District of West Kelowna was incorporated in the fall of 2007 and takes in much of the area formerly included within Electoral Area G of the Regional District of Central Okanagan including Westbank, Glenrosa, Lakeview Heights, Gellatly, and West Kelowna Estates. The boundaries extend from the City of Peachland boundary north to Rose Valley and Bear Creek. It is a rapidly growing community situated on the western shore of Okanagan Lake. It should be noted that the OCP does not cover the Westbank First Nation reserve lands IR # 9 and 10. At the time of writing the RDCO Westside OCP was still in effect for this area and was still being administered by the RDCO. In 2002, the Westside and Lakeview areas were combined and a new OCP written to cover these areas which are now known as the District of West Kelowna municipality.

Prior to 1990, the residential neighbourhoods of the Westside area were served by on-site sewage disposal systems. Expansion of sewer throughout the 1990's coupled by policies limiting densification to areas serviced by sewer allowed neighbourhoods to grow where sewer lines were available. Residential areas now comprise 35% of the plan area (65% of the private land base) and the area serves as a bedroom community to the City of Kelowna. The main urban area is Westbank Town Centre and the adjacent commercial lands on IR 9. Commercial development is anticipated on IR 10 as well. There are also small town centres in the Lakeview and Mt. Boucherie areas. Industrial activity is concentrated near Stevens Road and Hwy 97 and at Gorman's Mill south of Westbank. There is also a large industrial area located on the north side of Highway 97 between Daimler and Westlake Roads. This is one of the largest contiguous intact industrial areas in the Regional District as a whole, including Kelowna.

As of 2002, population growth in West Kelowna over the next 20 years was expected to be significant, with the population increasing to more than 55,000 people. With this is a need for about 8000 new housing units. However, the average age of the population will increase and there is expected to be fewer persons living in each household. Between 1989 and 2003 the number of sewer connections increased from 750 to 6889 and continues to grow. OCP policies encourage residential housing to expand and densify within existing areas to make efficient use of available land and infrastructure.

Policies contained in the Plan with respect to sewer infrastructure include limiting development serviced by septic systems to a minimum lot size of 1 ha, directing growth to areas currently serviced and designated expansion areas, and implementing a buffer zone around the sewage treatment plant to ensure that the new development will not impact existing service or future expansion of the facility. Stage 2 of the Westside STP is designed to serve 35,000 equivalent single family homes within the communities of Westside, Peachland and IR's 9 and 10. The planned extension is coordinated with the areas designated for growth within the OCP. The OCP also supports the provision of satellite community sewage systems (under the operating jurisdiction of the Regional District) designed to fulfill equivalent or better standard of treatment only where a designated new neighbourhood is situated outside of the Westside Sewer service area, and where the Regional District is satisfied that extension of community sewer to that area is untenable.

Updates to the Westbank and Electoral Areas G, H Liquid Waste Management Plans

The Westbank sewage treatment plant consists of Biological Nutrient Removal (BNR) with secondary clarification, fermentation and ultra violet disinfection. Treated effluent is then discharged via a deepwater outfall into Okanagan Lake.
http://www.regionaldistrict.com/departments/engineering/engineering_services_wastewtrtreat.aspx

At the time of writing many of the projects that had been initiated by the Regional District of Central Okanagan for sewer servicing on the Westside had been placed on hold due to the incorporation of the District of Westside municipality. The RDCO website and an interview with RDCO staff provided the following information.

The Regional District of Central Okanagan Sewer System is servicing, or will service, the following areas on the west side of Okanagan Lake:

- Westbank
- Glenrosa
- Smith Creek
- Lakeview Heights
- Casa Loma
- Westside Industrial Park
- West Kelowna Estates

- District Municipality of Peachland
- Tsinstikeptum Indian Reserves 9 and 10

Trunk mains have been extended into all the areas listed above except Peachland where a force main was required to provide sewer service. The trunk and force mains bring sewer closer to the individual neighborhood. Collection systems will branch out from these trunk and force mains to extend the sewers further into these areas to individual properties. There are more than 176 kilometres of sewer mains and 22 lift stations servicing the Westside. In addition there is one major treatment plant that services the entire area. It is located in Gellatly.

Link to Engineering Water and Sewer Maps on RDCO website

Westside Regional Wastewater Treatment Plant

The Regional District has focused on expanding the sewer system in the Glenrosa and Lakeview Heights areas. It was anticipated that this work would take approximately 7 to 10 years. The order in which these areas will be serviced depends on public pressure, environmental and health concerns, the financial burden on the taxpayers, and the proximity of an area to the nearest trunk main. It is anticipated planning and direction of this sewer servicing program will be undertaken during 2008 by District of West Kelowna.

The following summarizes the projects in West Kelowna that were underway as of 2007 as noted on the RDCO website (2008). As of March 2007, pending a review of budgets, cost estimates and funding options by the Engineering Services Department, all future sewer projects are on hold, including the following projects. As of sometime in 2008, it was anticipated the West Kelowna Municipality will consider all or some of these projects as responsibility transfers from the Regional District:

Applegreen Court/Cameron Road Sewer Project

Issues regarding septic systems in the Applegreen Court/Cameron Road area forced the Regional District to hold a public information meeting in June 2008 on a proposal to seek resident support for plans to create a service area for installation of sewer services for approximately 28 properties in the area, which is within the West Kelowna Municipality. A petition to determine support from area residents will soon be underway.

Glenrosa Phase 2 Sewer Project

At its meeting July 10, 2006, the Regional Board adopted four bylaws authorizing the second phase expansion of sewer service in Glenrosa. This will extend sewer to approximately 139 properties in the Ranch Road/Country Pines neighbourhoods. The Regional District will borrow up to $1.3 to be repaid over 20 years through property owner contributions of an estimated $7,210 per unit.

Lakeview Phases 2 and 6 Sewer Projects

It is anticipated that this project will extend sewer service to approximately 243 properties in the Hayman Road and Thacker Drive north areas. Pending the review by Engineering Services construction could begin in 2009 for completion in 2010.

Pineridge Place Sewer Project

Property owners living along Pineridge Place in Westbank have supported a petition to extend their area into the Westside Sewer Service Area to service 25 properties. Bylaws have been passed, but the project is on hold pending a review of budgets and funding options. Depending on information from Engineering Services, it is possible construction could begin and be completed in 2007.

Upper Glenrosa Sewer Servicing Strategy

On April 26, 2004 a public meeting was held to present the Glenrosa Sewer Servicing Strategy. It is the proposed plan for providing sewer service to the more than 1,400 households in the Upper Glenrosa area between 2005 and 2008.

Table 3.9 – West Kelowna Proposed Projects and Costs including # of lots and proposed financing where it has been determined

Project	Projected Cost	# of Lots	Financing
Glenrosa Phase 2 – Ranch Rd/Country Pines	$1,105,000	144	Borrow
Applegreen Crt/Cameron Road	Not available	28	Not available
Lakeview Phase 2 & 6 – Hayman Rd/Thacker Dr North	$3,100,000	243	Borrow
Pineridge Place	$300,000	25	Under review
Upper Glenrosa	Not available	1400	Under review

Table 3.10 – Completion Status of West Kelowna Sewer Projects Prioritized in the 1994 MWMP

Priority Group	Phosphorus Loading (kg/yr)	Completion Status
Whitworth Road	140	Yes
Pritchard Road	250	Yes
Green Bay	162	Yes
Casa Loma	98	Yes
Hitchner Road	30	Yes
West Kelowna Estates	30	Yes
Sunnyside	8	Yes
Sunnyview	12	Yes
Lakeview	8	Yes
Collens Hill	4	Yes
Trevor Drive	25	Yes
Lower Glenrosa	40	Yes
Ponderosa Road	12	Yes
McCartney Road	7	Yes
Boucherie Road	12	Yes
Witt Road	7	Yes
Elliot Road	5	Yes
Gellatly/Angus Road	2	Yes
North Thacker	15	Yes

3.5.7 Westbank First Nation

Sewer service was extended to IR 9 in the early 1990's and IR 10 in 2004 and covers portions of these areas. The sewer service maps on the RDCO website show which areas have been serviced. The Westbank First Nation and the RDCO have a memorandum of understanding to work toward a common vision for economic development of the West Kelowna community.

Link to Engineering Water and Sewer Maps on RDCO website

3.5.8 District of Peachland

Official Community Plan

The District of Peachland has an OCP and a Town Centre Concept Plan. Peachland is unique in that it is located on the lower benches of two mountains. Much of the land area is too steep for development and as a result development is concentrated on the lower areas and is spread out in a linear fashion along the shores of Okanagan Lake. The population of Peachland in 2007 was approximately 5000 and is projected to grow to about 7900 by 2020. The current OCP was adopted in 2002 and a review is currently underway. The plan outlines the desire of the community to maintain the water quality of Okanagan Lake. The first phase of a sanitary sewer system was introduced to the community in 1999 in the downtown core and waterfront area where septic systems were seeping effluent into the lake. Additional phases are to be completed over the next 20 years. OCP policies require that growth within the community be phased in keeping with available infrastructure and that proposals for new growth areas assess impacts on existing services and facilities and the ability to provide new services.

The OCP's land use strategy incorporates sanitary sewer as a key concept in directing and managing the growth of Peachland. The plan outlines that the "fan area" is to be serviced with sanitary sewer as a first priority and that concentrated multi-family housing be developed there. Commercial development including mixed commercial/residential is to be concentrated in the existing downtown area. Lower Princeton Avenue and Pincushion Ridge are identified as Sector Plans. Development on slopes above 30% is discouraged.

Liquid Waste Management Plan Updates

It is noted that the significant problem areas in the District of Peachland which are all located along the shoreline of the community have been connected to community sewer. This represents a significant reduction in Phosphorus loading due to septic systems from Peachland and takes care of nearly all of the areas developed prior to 1977. Staff from the District note that 40% of the community has now been provided with sewer and the rest will be phased over the next 50 years. All sewage from the District of Peachland is pumped to the Westside Regional Wastewater Treatment Plant in West Kelowna. The District is currently in the process of working on a Sewer Distribution Master Plan which is anticipated to be completed in late 2008.

Table 3.11 – Completion Status of Peachland Sewer Projects Prioritized in the 1993 MWMP

Area	Phosphorus Load (tons/yr)*	Completion Status
Antlers Beach	419	Yes
Downtown	156	Yes
South Downtown	149	Yes
North Downtown	53	Yes
North District of Peachland	1	No
South District of Peachland	7	No

3.6 Regional District of Okanagan Similkameen

3.6.1 <u>South Okanagan Regional Growth Strategy</u>

The Regional Growth Strategy (RGS) is a broad based policy document that covers a large area of the South Okanagan. Communities within the plan area are expected to develop their plans in accordance with the vision and policies contained within the RGS.

The process of developing a Regional Growth Strategy for the south Okanagan began in 2007 and is expected take 3 years. It is a long term planning project that deals with broad planning issues over a 20 year time horizon. The process involves collaboration and consultation between local, provincial and federal governments, first nations and the public. Second Reading was given to the Regional Growth Strategy bylaw on January 10, 2008.

The draft RGS Bylaw contains policies relating to the promotion of water sustainability through conservation and related best management practices, directing human settlement to existing centres using growth boundaries, and maximizing the efficient use of infrastructure where it already exists. With respect to infrastructure, the plan encourages collaboration and use of economies of scale and also preferentially directs development to existing areas where public infrastructure and services are already available, and improvement of coordinated planning and management efforts on a regional and inter-regional level for infrastructure upgrades and services.

3.6.2 <u>District of Summerland</u>

Official Community Plan

The District of Summerland is located on the west shore of Okanagan Lake between Peachland and Penticton. It is a primarily a rural agricultural community and in 2007 is home to 11, 563 people. Population growth has been slightly slower than the 2% per year projected in the OCP. Historical residential and industrial development is spread throughout the District, however ALR boundaries and policies now restrict this. The current OCP was adopted in 1996. Interviews with Planning Department staff have allowed for new information to be included here as noted.

In 1996, all properties in Summerland disposed of wastewater via on-site septic disposal and the plan notes that the municipality had received funding from the federal/provincial sewage infrastructure grants program to establish a sewer system. The intention was to provide sewer to the areas most in need. The Lower Town, downtown core, Trout Creek and Crescent Beach were identified as being a first priority for provision of sewage infrastructure. The treatment plant was to be located in Trout Creek. The plan anticipates that less than 500 units could be added to this area over the next 20 years.

An urban growth boundary was implemented in this plan to encourage new development to occur in existing developed areas (infill and redevelopment) in order to protect the ALR lands and limit servicing issues. A new urban node is encouraged in the North Prairie Valley subject to servicing. If it was to occur in advance of servicing it was to be dry sewered. A second growth area called the Jersey Lands is subject to a developer paying for any infrastructure required for development of the area. Existing suburban and rural residential developments are recognized by the plan including Paradise Flats, Garnet Valley, Happy Valley, Front Bench, Crescent Beach, Dale Meadows, and lands east and west of Hwy 97 in the Trout Creek area. Infill is encouraged. Lot sizes for new development in rural areas (Country Residential Zone) are limited to 1 ha. Commercial development is encouraged to locate in the downtown core and future development adjacent to Hwy 97 is not supported by the plan. At the time of adoption the plan supported industrial development locating in one of the 4 existing industrial parks in Summerland.

The plan identifies Future Residential Reserve lands which would be used to accommodate future residential growth. It is recognized that these lands would need to be comprehensively planned through Neighbourhood Planning processes prior to development occurring there. Much of this proposed new development would occur on surrounding hillsides in order to preserve agricultural lands.

Wastewater Management Plan Updates

Summerland currently uses a Biological Nutrient Removal (Barden-Pho) system with secondary clarification, dual media filtration and ultra violet disinfection. Some reclaimed water is used for irrigation at the treatment plant site and the remainder of the effluent is discharged to Okanagan Lake via a deepwater outfall. Waste sludge is composted at the local landfill.

The LWMP for the District of Summerland was adopted in 1991 however, they did not implement any of the recommendations and were still utilizing 100% on site disposal by 1994. An amendment was commissioned in 1994 and adopted in 1995. The amendment was initiated due to Official Community Plan and Comprehensive Development Plan reviews that were occurring at the same time. These plans changed the focus for future development in Summerland, and the previous LWMP was no longer adequate to meet the future development goals of the community. The focus of the amendment was to alleviate environmental problems in two of the larger existing areas and to provide access to sewer infrastructure for the largely undeveloped area where growth was to be directed. Many of the elements of this plan have been completed including the construction of a BNR treatment plant and deep lake outfall, and installation of community sewers throughout the majority of the higher density areas of Summerland that were identified as priorities in the 1993 MWMP.

Table 3.12 – Completion Status of Summerland Sewer Projects Prioritized in the 1993 MWMP

Area	Phosphorus Load (tons/yr)	Completion Status
Cartwright/North Prairie	4	No
Garnett Valley	147	No
Hwy 97	92	Design is done but would be picked up by new dev.
Paradise/SW Summerland	36	No
Prairie Valley	9	No, but would be picked up by Summerland Hills Golf Course
Front Bench	118	No
Upper Trout Creek	83	No, mostly ALR lands
Peach Orchard Road	116	Yes
Town Centre	550	Yes
Lower Town	126	Yes
Crescent Beach	138	Yes
Lower Trout Creek	335	Yes

A new amendment is currently being developed for the RDOS Electoral Area F LWMP which could affect Summerland. A 400 unit development is being proposed at the Greata Ranch property and the recommended option for sewage disposal is to pump from Greata Ranch to the Summerland STP for treatment and disposal. This proposal would allow for older developments along the shoreline between Greata Ranch and Summerland to connect as well. At the time of writing no decisions have been made regarding the proposal. Conversations with the Public Works Superintendant for Summerland indicate that if the proposed connection to Greata Ranch goes ahead the plant will have to be upgraded to accommodate the additional flows over time.

3.6.3 <u>City of Penticton</u>

Official Community Plan

The City of Penticton is located at the southern end of Okanagan Lake and sits between it and Skaha Lake to the south. The channelized Okanagan River runs through it west of downtown. The population of Penticton in 2007 is about 34,000 people with a significant portion of the population over age 65. The average growth rate over the past 15 years (to 2002) has been approximately 2.1 %. At this rate, the OCP projects that the population could grow by approximately another 14,000 residents by 2021.

Summerland Wastewater Treatment Facility

Developable land in Penticton is limited due to its geographic location between the 2 lakes, an Indian reserve to the west, and ALR lands on the eastern benches. The portions of the eastern areas that are not within the ALR have or are in the process of being developed. Infill is one of the only options left for development within the City boundaries. A Comprehensive Development Plan was prepared in 2005 to assess the 20 year development capacity of the City and determine the servicing capacities and financing strategies required to accommodate that growth. It was estimated that there is long term capacity within the existing boundaries for another 5500 dwellings in the new growth areas of Upper Columbia, Upper Wiltze and the Northeast Sector, and another 6000 units by infilling and densifying the existing urban areas. Amendments to the OCP in 2007 provide for additional high density residential and mixed use commercial in the downtown core that would provide an addition 4500 new dwelling units. Thus, over the long term the city can accommodate 16,000 new units or about 33,000 new population.

The City operates an advanced wastewater treatment facility which is located adjacent to the Channel Parkway at the south end of Waterloo Avenue. It is a Biological Nutrient Removal facility with tertiary treatment that exceeds the provincial standards for environmental health. As part of the treatment facility the city operates a bio-solids recycling facility at the Campbell Mountain Landfill site that provides compost for public and commercial use. OCP policies respecting infrastructure are general in nature, outlining the intent of the City to review the wastewater management plan periodically.

Wastewater Management Plan Updates

Penticton has a Biological Nutrient Removal plant since the early 1990's. It includes secondary clarifiers, sand media filters and de-chlorination by sulfur dioxide. In 2007 12.2 % of total plant flow was used for irrigation and remainder is discharged to the Okanagan river channel.
http://www.penticton.ca/city/public_works/wastewater/default.asp

The LWMP for the City of Penticton was updated in January of 2007 by Stantec. The plan recommends new primaries for the wastewater treatment plant and maintenance of the existing disposal system. The selected waste management option would also include:

- Source control (effluent volumes per capita are higher than other municipalities)

- Extending sewers to areas with onsite disposal
- Maintaining existing sewer systems and replacements as necessary

It is noted that stormwater management is also included as a goal within the LWMP for improving the quality of the watercourses within the City. The improvements that have been identified would cost close to ten million dollars and implementation would be dependent on access to senior government grants.

Penticton Wastewater Treatment Plant

Table 3.13 - High Priority Sewer Collection Projects in Penticton (2007)

Project	Description	Estimated Cost
2	Waterford Ave Trunk Diversion	$391,000
3	South Penticton Interceptor – Fairview Road to Treatment Plant Section	$822,000
4	South Penticton Interceptor – Skaha Lake Road to Fairview Road Section	$3,497,000
6	North Penticton Inteceptor – Fairway Ave to Treatment Plant Section	$1,539,000
Total Cost		**$6,249,000**

The projects outlined in Table 3.13 will not connect pre-1977 development. Funding for these projects will come from shared costs between DCC's and existing users. Existing users contributions would come from senior government grants, taxes or tolls. In 2005 the total cost for all three stages was estimated to be close to $18 million.

Wastewater Treatment System Upgrade

Category A

Stage 1 – upgrades to the headworks, bioreactor aeration, addition of a secondary clarifier, new filters, new sludge handling facility

Timing – Preliminary/detailed design in 2007, construction in 2008

Stage 2 – Primary clarifiers and UV disinfection

Timing – preliminary/detailed design in 2007, construction in 2009/10 (or could be combined with stage one construction to provide economies of scale and minimize length of disruption of the plant.)

Stage 3 – addition of secondary clarifier, filters, digester and fermenter upgrades.

Timing – after 2014, subject to growth of the City

Funding for the project will be obtained from DCC's, contributions from PIB, senior government grants and taxes/tolls.

Table 3.14 – Cost Sharing Among Users for Sewage Treatment Plant Upgrades

UPGRADE ITEM	EXISTING USERS	FUTURE DEVELOPMENT
1) Increase capacity only	0%	100%
2) Increase capacity & replace existing*	30.5%	69.5%
3) Replace existing equipment with excess capacity	65%	35%

**The calculation is based on the project being upgraded 50% for capacity increase and 50% for new equipment. The 50% for capacity increase is funded 100% by new growth. The 50% for new equipment is shared between existing users and new development based on flows.*

The City of Penticton recently signed a memorandum of understanding with the Penticton Indian Band which will allow the City to receive and treat liquid waste from the reserve lands. It is anticipated that the reserve lands will be connected to the sewer system within the next 5 years.

3.6.4 Town of Oliver

Official Community Plan

The Town of Oliver is located midway between Vaseux and Osoyoos Lakes about 24 km north of the Canada-U.S. border. The population in 2007 was 4722 people with an aging demographic. It is notable that over 33% of Oliver's population is over age 65. Using the medium population projection of 2% growth based on the 2002 population, the town is expected to grow to about 6200 people by 2020 (figures from Oliver Official Community Plan).

Much of the area surrounding Oliver is in the ALR, and this constrains the growth of the town. However, in consultation with the ALC, the area west of Tucelnuit Lake has been identified for future residential growth and a neighbourhood plan has been developed. Lands near the airport have also been identified as a residential growth area and the plan supports preparation of an Airport Development Plan, although this has not yet been initiated. In order to efficiently utilize existing infrastructure and minimize costs OCP policies encourage infill and redevelopment of the downtown core and surrounding areas for higher density residential uses. This includes mixed residential/commercial in the downtown core. The plan also states that subdivision activity shall not occur in advance of sanitary sewer servicing.

The Town operates an effluent treatment and storage facility and at the time of OCP adoption (2002) the treated effluent was used to irrigate the Fairview Mountain Golf Course. Additional properties were identified for reclaimed water use in the 2001 Liquid Waste Management Plan.

Liquid Waste Management Plan Updates

The Oliver treatment plant uses an aerated lagoon process with a winter storage reservoir. Reclaimed water is used for a local golf course and spray irrigation for agricultural and recreational field uses. Town is now supplying reclaimed water back into the municipality for irrigation use on the cemetery, the airport, parks and some vineyards.
http://www.oliver.ca/siteengine/ActivePage.asp?PageID=71

The LWMP for Oliver was most recently updated in 2002 by TRUE Consulting. However there were a few other updates that occurred in between the original plan and the newest one. The 1992 LWMP recommended the use of an activated sludge plant and disposal of effluent has been via spray effluent of the Fairview Golf Course since 1983. In 1995, a plan amendment recommended aerated lagoons be constructed for wastewater treatment and these were located on the west hill above the town.

Oliver Sewage Treatment Plant

Oliver Purple Hydrant

The 1992 liquid waste management plan identified land near the Fairview golf course for irrigation. This was to be considered an option for disposal when more space was required and had been approved by the Ministry of Environment. By 1998 the town realized there was a surplus of reclaimed water. MOE then raised new concerns about habitat loss and the Fairview golf course lands were no longer approved as a possible spray irrigation expansion area.

Some of the projects completed that had been identified in the 1992 plan included:

1993 – Sanitary sewer system extended to service the Tuc-El-Nuit Lake area
1995 – Sanitary sewer system extended to service the Rockcliffe area
1994-1995 – Aerated lagoon treatment system was constructed at the winter storage site and the treatment plant at the Public Works yard was abandoned. These have all been completed.

In 2002 the LWMP was revisited again to reconsider options for wastewater disposal. It was recommended that the water be directed back downtown to irrigate the airport, school grounds, cemetery and public works areas. This involved installing a 14 inch line to pump the sewage to the treatment site and then pipe reclaimed water back to the community via the existing 10 inch line. There are discussions underway regarding the use of reclaimed water for the Town's parks and recreation lands. Federal infrastructure grants were obtained to do this work. Reclaimed water is also now available to farmers via purple hydrants in the rural area near the treatment plant.

There are also plans in the works to expand the equalization site which would include construction of a second equalization basin. This is not currently included in the LWMP. The Town intends to apply for a 'Towns for Tomorrow' grant to help cover this project. They are also interested in constructing another winter storage reservoir and an infiltration basin that would be used in the event of a surplus of wastewater. These projects are intended to be done over the next 4 years. The following chart provides the projected costs and sources of funding.

Table 3.15 – Proposed Projects and Sources of Funding for Oliver (2008)

Project	Year	Projected Cost ($)	Source of Funding
2nd Equalization Basin	2008	$484,000	Grant ($387,2000) DCC ($69,000) Reserve ($27,8000)
Rapid Infiltration System at Town sand pit	2008	$40,000	Reserve ($40,000)
Aeration Cell #1	2010	$500,000	Reserve ($128,700) Borrow ($871,300)
2nd Winter Storage Reservoir	2010-11	$2,000,000	DCC ($455,400) Borrow ($1,544,600)

There were no projects from the Town of Oliver on the 1993 MWMP priority list.

3.6.5 Electoral Area C - Oliver Rural

Official Community Plan

The plan area for Oliver Rural encompasses the rural areas to the east, west, north and south of the Town of Oliver and the Osoyoos Indian Band lands. The area to the west of the Town of Oliver is largely private lands in smaller holdings while the areas to the east of the Osoyoos Band lands are mainly large Crown holdings. The OCP for Oliver Rural was adopted in 2002. Using historical growth rates of 1.5 and 2.5 % annually, it is estimated that the population of Rural Oliver will be between 6091 and 7707 by the year 2020.

The broad intent of the OCP is to maintain low to medium population growth in the Plan area in order to uphold the rural values and lifestyle. Infill of vacant parcels and development of those lands with existing development approvals is encouraged rather than designating new lands for development purposes. Lots of less than 1 ha in size are required to connect to community sewer. Urban residential growth is directed toward existing urban centres that have the services necessary to accommodate it. Boundary expansions may be considered where services are necessary to deal with identified problem areas near the boundary. Clustering of development is supported to protect larger areas of land from development

As with the Osoyoos Rural area, much of the land in the Plan area is in the ALR or is Crown land. Designations of Agricultural and Rural Resource are respectively given to these lands recognizing their rural nature. Rural Resource designations carry a 20 ha minimum parcel size to provide a level of control should Crown lands be released to private ownership and also over Crown leases. Other rural designations include Small Holdings and Large Holdings with the former maintaining parcel sizes between 0.4-2.0 ha and the latter generally maintaining parcels greater than 10 ha. A number of Low Density Residential subdivisions exist in the plan area including south of Vaseux Lake, the Gallagher Lake area, south end of Island Road, Inkameep

Provincial Park area and along 91st Street (Sawmill Road). The Residential designation also includes mobile home parks such as those located at McIntyre Bluff, Gallagher Lake and along the north boundary of the Town of Oliver. Currently there are no Medium Density Residential designations (multi-family) in the Plan area. Availability of community water or sewer is one of the determining factors in designating new lands for Residential standard of development.

Commercial development in the Plan area is currently limited to developments along Hwy 97 and a few campgrounds and tourist commercial uses near Vaseux and Gallagher Lakes. OCP policies generally direct major commercial uses to locate within the Town of Oliver where services are available. Industrial policies protect existing industrial uses and support the establishment of home occupations on most rural lands provided they are not considered noxious or emit large amounts of pollutants.

OCP Policies respecting sewage disposal:

- Will coordinate efforts with the Ministry of Health through a referral process to ensure that development follows the septic tank disposal field setbacks within environmentally sensitive areas.
- Works with the Ministry of Water, Land and Air Protection to assess the need for alternative systems and consider evaluating the feasibility of a future community system in the Sawmill Road and Gallagher Lake areas.
- Will consider amending the RDOS servicing bylaw to allow alternative sewerage system evaluation studies done at the time of subdivision.
- Co-operates with the Town of Oliver and government agencies to consider future options and proposals regarding the need for expansion of the Town's reclaimed water irrigation system.

3.6.6 <u>Town of Osoyoos</u>

Official Community Plan

Osoyoos is located at the southern end of the Canadian portion of the Okanagan Valley near the Canada-U.S. border, at the north end of Osoyoos Lake. The Town of Osoyoos adopted their most recent OCP in March of 2007 and updated it in January of 2008. The population in 2007 is 5115 people, a substantial increase from the 4483 people recorded in the 2001 census. It is expected that the population will grow to about 8140 over the next 20 years as Osoyoos is an increasingly popular retirement and resort area.

It is projected that 563 dwelling units (mixed low, medium and high density) can be accommodated by infilling existing urban areas. After that, 80 ha of new lands will have to be opened up for development to accommodate growth over the next 20 years. Expansion is to occur over the west benchlands into Dividend Ridge and Strawberry Creek, and the Town boundary may be expanded up onto Kruger Mountain if necessary. There are also 5 areas proposed for future expansion that are on ALR lands and subject to approval of the ALC. Areas along the lakeshore in all directions located in Electoral Area A of the RDOS are also being considered for boundary expansion. The Plan contains an Urban Growth Boundary that takes in areas currently urbanized and proposed for future urban expansion. Proposals to extend services outside of municipal boundaries will only be considered if they are in the public interest and compatible with the Town's own servicing needs, after the proponent undertakes an impact assessment addressing any issues of concern addressed by the town.

All developed areas within the Town are serviced with sanitary sewer with the exception of one rural residential area. The Town has a servicing agreement with Osoyoos Indian Band and currently provides sewer servicing to the Nk'mip developments on IR #1, which abuts the northeastern boundary of the town and is home to a number of commercial tourist attractions. Servicing is also provided to the Canada-U.S. border facilities and Haynes Point Provincial Park. The infrastructure section of the OCP includes policies for utilizing a 'user pay' system for provision of new servicing, and utilizing DCC's and latecomer fees to fairly apportion infrastructure costs to newer developments.

Collected wastewater is pumped to the Town's treatment and disposal facilities on the West Bench, where it is treated by means of a three-cell aerated lagoon system constructed in 1979. Since 1990, the Town has introduced phased aeration and, as the service population expands, further phased upgrading of the wastewater treatment system will be implemented. Following treatment, wastewater is directed to two storage reservoirs sized to store treated effluent over the winter for use during the irrigation season. The treated wastewater is re-used for irrigation on the Osoyoos Golf and Country Club, the Desert Park Complex, and the Town's West Bench ball diamonds. In 2007, the Town intends to reconstruct and expand winter effluent storage cell No.1 and the post-storage reclaimed water disinfection system, which will increase service capacity to an equivalent of about 8000 persons.

The Town's sewer policies are:

- Continue to fully recycle wastewater for irrigation purposes by expanding treatment facility and disposal area capacities to keep up with servicing demands.
- Consider additional wastewater treatment and effluent storage needs generated by future growth areas, including the West Benchlands and the Kruger Mountain Extension Area.
- Consider treatment expansion options, including a possible new facility in the West Benchlands/Kruger Mountain area, and new disposal areas such as the high school playing fields and some portions of the Desert Park complex.
- Carefully assess any future applications for extending sanitary sewer service extensions beyond our municipal boundaries from the Regional

District, the Osoyoos Indian Band (OIB), and property owners to ensure the Town's own growth plans are not compromised.

Liquid Waste Management Plan Updates

Osoyoos uses an aerated lagoon treatment process including storage lagoon and chlorination. Reclaimed water is used for irrigation purposes such as a golf course, orchards, playing fields and tree farms.
(Urban Systems – 1987, Town of Osoyoos Waste Management Plan)

Osoyoos Golf Course and Treatment Plant

Osoyoos staff report that they have been able to follow the original plan without the need for updates. Sewage treatment plant effluent is currently disposed of by spray irrigation at the Osoyoos Golf Club and other recreational lands including ball fields below the treatment plant. Staff at the Town of Osoyoos anticipate that the plant will accommodate considerable growth in the area for a number of years. Projections in the LWMP show a population of 8000 by the year 2026. It is noted however, that the summer population could be much higher than this and may affect available capacity in the years to come. Another factor which may affect plant capacity is the possible connection of the new Willow Beach development to the Osoyoos treatment plant. The proposed Willow Beach development property is located in Electoral Area A of the RDOS. Due to the densities proposed (1000 units) and the sensitive location along the north shore of Osoyoos Lake, negotiations are in the works to provide a connection to the Osoyoos sewage treatment plant.

The Town recently constructed the new winter storage reservoir and it has just come online. Additional future projects include installation of 2 new blowers for the aeration ponds ($50,000) and lift station upgrades including a new generator ($710,000) to deal with peak season flows. The Town also intends to connect the Industrial Park to sewer in the near future.

The 1993 Master Wastewater Management Plan did not include any prioritized projects from Osoyoos.

3.6.7 Electoral Area A – Osoyoos Rural

Official Community Plan

The Rural Osoyoos Plan area surrounds the Town of Osoyoos and Osoyoos Indian Band lands on the west, north and east sides and abuts the U.S. border to the south. The 2001 population including the OIB lands was 1897 with a projected annual growth rate of 1% per year. The Osoyoos Rural area is capable of handling this rate of population growth with its existing land use designations and subdivision standards within the planning horizon of 20 years. Policies include requiring all new development of lots less than 0.2 ha (.5 acres) to connect to community sewer or utilize a package treatment plant for sewage disposal. This policy does not meet the standards recommended by Provincial health agencies and OBWB and may jeopardize chances of receiving sewer infrastructure grants. New urban growth is directed to the existing urban areas in the region where services are available, however boundary extensions may be considered where necessary to service existing developments that require servicing.

Much of the land in the Plan area is in the ALR or is Crown land. Designations of Agricultural and Rural Resource are respectively given to these lands recognizing their rural nature. Rural Resource designations carry a 20 ha minimum parcel size in order to provide a level of control should Crown lands be released to private ownership and also over Crown leases. Other rural designations include Small Holdings and Large Holdings with the former maintaining parcel sizes between 0.4-2.0 ha and the latter generally maintaining parcels greater than 10 ha. Low and Medium density residential designations occur mainly along the shore of Osoyoos Lake. The plan encourages new residential developments to occur away from Osoyoos Lake in order to protect water quality. New Low Density Residential developments are supported in the rural area but must be connected to community water and sewer or an alternative system as approved by Interior Health. New Medium Density Residential developments are encouraged to locate in urban areas with urban services. Clustering of development is supported in order to protect larger land holdings from development.

Policies respecting Industrial development encourage only light industry and direct heavier industries to locate within the Town of Osoyoos. They also encourage industrial properties along Osoyoos Lake to reduce their impact on the lake in order to improve water quality and habitat.

Sewage Disposal Policies:

- Continue to fully recycle wastewater for irrigation purposes by expanding treatment facility and disposal area capacities to keep up with servicing demands.
- Consider additional wastewater treatment and effluent storage needs generated by future growth areas, including the West Benchlands and the Kruger Mountain Extension Area.
- Consider treatment expansion options, including a possible new facility in

the West Benchlands/Kruger Mountain area, and new disposal areas such as the high school playing fields and some portions of the Desert Park complex.

- Carefully assess any future applications for extending sanitary sewer service extensions beyond our municipal boundaries from the Regional District, the Osoyoos Indian Band (OIB), and property owners to insure that the Town's own growth plans are not compromised.

3.6.8 Electoral Area D

D1 – Kaleden/Apex Southwest Sector Official Community Plan

The Plan area is comprised of the non-reserve lands located in Electoral Area D of the RDOS that are located on the west side of Skaha and Vaseux Lakes. The predominant communities in the Plan area are Kaleden, Apex Resort, Farleigh Lake, Twin Lakes and St. Andrews. Since the time of the last MWMP the OCP's for Kaleden, Southwest Sector, and Farleigh Lake/Shatford Creek, plus the Southwest Sector Zoning Bylaw (which were all adopted in 1987) have been consolidated into the Kaleden/Apex Southwest Sector OCP and the Kaleden/Apex Southwest Sector Zoning Bylaw (adopted in 1999).

The dominant land use and zoning designations in the Kaleden-Apex Southwest Sector can be described as rural residential holdings and resource areas. Commercial areas are limited to general commercial uses in communities such as Kaleden; highway commercial areas along Highways 97 and 3A; and resort commercial areas in communities such as Kaleden and Apex. There are also four Land Use Contracts within the Plan area which take precedence over the OCP and zoning. These are located at Trout Lake, St. Andrews, Twin Lakes and south of Okanagan Falls. The plan area contains the Dominion Radio Astrophysical Observatory (a.k.a. White Lake Observatory). The facility influences land use planning from Twin Lakes to the St. Andrews area due to its sensitivity to electromagnetic interference and light pollution from human settlement and development.

The population of Electoral Area D (which includes the plan area) was 6005 in 1996. The population is anticipated to double every 20 years which would put it at 12,010 by 2016. About 40% of this population is located outside of the unincorporated communities of Kaleden and Okanagan Falls.

The plan encourages containment of sprawl by directing rural residential development to infill developed areas and areas where servicing is available. Improvement of utility services is identified as a goal. Designations of Agricultural and Rural Resource are respectively given to ALR lands and private and Crown resource lands recognizing their rural nature. Rural Resource designations carry a 20 ha minimum parcel size in order to maintain the rural nature of the area. Other rural designations include Small Holdings and Large Holdings with the former maintaining parcel sizes between 0.4-2.0 ha and the latter generally maintaining parcels greater than 10 ha. Clustering of development is supported in order to protect larger areas of land from development.

Residential development in the Kaleden-Apex Southwest Sector has occurred in four primary locations: Kaleden, St. Andrews, Twin Lakes and Apex Resort. The predominant low density housing form in these settlement areas is single detached dwellings on lots. Other forms of low density residential housing include semi-detached, and manufactured homes. Low density lot sizes for residential housing is from 505 m^2 in the smallest zone to 2,020 m^2 in large lot zones. The plan area contains a limited amount of medium density residential housing located in the Apex Resort area. The Future Land Use Plan illustrates this area as Mixed Use Apex Alpine. The form of housing found in this designation is buildings containing a mixture of ground floor commercial with residential on the upper levels, single family dwellings, duplexes and multi unit residential buildings such as apartments and townhouses. The Twin Lakes Golf Resort also contains lands which are designated Medium Density Residential, but which are not yet developed beyond a golf course and small R.V. Park.

The Land Use Contracts in the Plan area provide a range of housing types and densities. The Land Use Contracts include such developments as St. Andrews by the Lake, Trout Lake, and Twin Lakes. These Land Use Contracts may generally be described as developments clustered along or around amenity features such as lakes and/or golf courses.

The predominant sewage disposal method in the Kaleden-Apex Southwest Sector area is individual on-site septic systems. Individual septic systems are not viewed as a long-term sustainable method of sewage disposal.

OCP Policies respecting sewage disposal:

- Require all new residential developments to be serviced by community sewer and collection systems as specified in the Regional District's *Subdivision Servicing Bylaw*;
- Review opportunities to implement long-term sustainable sewage collection and disposal methods for existing communities (e.g. Kaleden) where appropriate;
- Investigate, where a community sewer system is being installed, to ensure the system is adequate to allow for servicing of existing subdivisions that do not have community sewer (e.g. Twin Lakes); and
- Encourage the Ministry of Environment and the Ministry of Health to investigate alternate methods of wastewater treatment that provide an alternative to individual on-site disposal systems or large scale community systems.

D2 – East Skaha/Vaseux (Okanagan Falls) Official Community Plan

The East Skaha/Vaseux OCP covers the area of Electoral Area D that is south and East of Skaha Lake, and the lands between Skaha and Vaseux Lakes including the unincorporated Okanagan Falls townsite. Much of the area is Agricultural and Rural with Small Holdings designations allowing parcel sizes down to 0.2 ha in areas that have community water and are designated as sewer specified areas that are not yet connected to the sewer provided there is enough area for 2 septic disposal tile fields. Where community water is available but there is no sewer the minimum parcel size is 0.4 ha, and where no community water or sewer is available the minimum parcel size is 2 ha. These policies are not in compliance with the Ministry of Health and OBWB policies regarding 1 ha minimum lot sizes where on-site sewage disposal is being utilized. The Upper Carmi area is distinguished by a minimum parcel size of 4 ha with only one residence permitted. All new Low Density Residential development shall be connected to community water and community sewer or alternative systems as approved by Ministry of Environment or Interior Health. The gross density permitted is 15 units per ha. Clustering is encouraged for Small Holding and Residential areas. All Medium Density Residential development is directed to the Okanagan Falls townsite. Existing mobile home parks are recognized, but no new ones are being considered.

The majority of Commercial development is directed to the Okanagan Falls townsite where servicing is available. There are also Tourist Commercial and limited Specialized Commercial designations outside this area where land requirements demand a larger parcel size. Industrial development is directed specifically to the Okanagan Falls industrial area and discouraged elsewhere. Special Planning areas may receive different treatment than other areas due to their location within an environmentally sensitive area.

Regional Growth Strategy context statements pertaining to sewage disposal:

The Regional Board will discourage extension of sewer services to new residential areas unless infill has occurred on 65% - 75% of the existing residential parcels within the sewer service area, or unless the extension is required to alleviate a significant health or environmental concern.

The Regional Board will require at least about 0.4 hectares (about 1 acre) per parcel for residential subdivisions serviced with community water, and on-site sewage disposal (septic tanks and tile fields). Sewage disposal policies include the following:

1. Recognize that the Okanagan Falls Sewage Treatment Plant is nearing capacity.
2. Encourage water conservation measures in order to reduce flows to the Sewage Treatment Plant.
3. Study the sewage treatment plant to identify options for increasing the capacity of the plant and to identify other locations for an enlarged plant.
4. If possible, relocate the enlarged sewage treatment plant from its current location to one outside of the Okanagan Falls townsite residential area.

5. When identifying a new location for the sewage treatment plant, consider the following criteria:

    - amount of land available at the site;
    - soil conditions;
    - water table;
    - wind effects and direction;
    - environmental sensitivity;
    - availability of utilities;
    - accessibility;
    - visibility;
    - distance from service area;
    - proximity to residential development;
    - amount of site preparation required;
    - treatment options available at the site.

6. Ensure that the future sewage treatment facility is located far enough from existing or future residential development to minimize negative impacts of the plant on residential use.

7. Work with the Ministry of Environment and the Ministry of Health to ensure that any development follows the septic tank disposal field setbacks within Environmental Control Areas as set by the Province.

8. Work with the Ministry of Health to ensure that minimum parcel sizes in areas not on a community sewer system must allow for two sites for septic tanks and tile fields that can actively function at all times of the year.

9. As discussed in other sections of this Plan, ensure that development on parcels smaller than 0.4 ha. (1 ac.) are connected to a community sewer system, or a package sewage treatment plant approved by the Ministry of Environment or the Ministry of Health.

    *It is noted here that this policy should be changed to meet the 1 ha minimum parcel size requirement for properties serviced by on-site sewage disposal required by the Province and by the OBWB to be eligible for sewage infrastructure grants.

10. Encourage the Ministry of Health to educate residents about the requirements for maintaining a septic tank and tile field in this area.

*A wastewater management plan is being initiated for Okanagan Falls.

3.6.9 Electoral Area E – Naramata

Official Community Plan

Electoral Area E is located north of Penticton along the east shore of Okanagan Lake and is bounded to the north by Okanagan Mountain Provincial Park. Much of rural Naramata is located on the fertile benchlands above Okanagan Lake. The Naramata Townsite is located below these benchlands on a ~60 ha alluvial fan formed by Naramata Creek. The majority of the roughly 2000 people (2001 census) living in the area live on the benchlands and in the townsite. The other areas of human settlement include Falcon Ridge, Indian Rock, Glenfir, and Chute Lake. The remaining upland land base is managed by the province as Crown lands. Population is expected to increase by about 1.5% per year and that the current land use designations should be adequate to accommodate the growth expected to occur by 2026 using infill capacities. If the growth rate increases land use designations may need to be changed.

Naramata townsite is intended to be the focus of commercial, low and medium density residential development. At this time, some areas are serviced with community water, however there is no community sewer system so sewage disposal for the entire area is by septic field or package treatment plant.

Large and Small Holdings designations are similar in nature to the others in the OSRD with Small Holdings minimum parcel size between 0.4 to 4 ha and Large Holdings greater than 4 ha. Creation of additional rural holdings will consider the ability of the lands to accommodate onsite sewage disposal and provision of water. Low and Medium Density Residential designations exist mainly within close proximity of the Naramata townsite with a few exceptions as noted above. *The 1 ha minimum lot size requirement for parcels not connected to community sewer has not been implemented in this area. Regional District staff have indicated that they are aware of septic failures occurring in this area.*

Official Community Plan Sewage Disposal Policies:

The Regional Board:

1. Will coordinate efforts with the Province through a referral process to ensure that development follows the septic tank disposal field setbacks within ESAs.
2. Will consider amending the RDOS Servicing Bylaw to allow alternative sewerage system evaluation studies done at the time of subdivision.
3. Supports the recommendations and on-going review and updating of the 1994 Liquid Waste Management Plan for Naramata.
4. Encourages the development of a community sewer system where economically feasible.
5. Recognizes that on-site treatment (treatment plants and septic) is the existing type of sewage disposal in the Plan area.
6. Recognizes that residential density increases will require servicing upgrades, especially in the Naramata townsite area, and will work with the Provincial and Federal governments, District of Summerland, and City of Penticton to consider a future community sewer system.

7. Will consider suitable locations for community waste water treatment plant should such a plant prove to be desirable within the community.

3.6.10 Electoral Area F – Okanagan Lake West/Westbench

Rural Land Use Bylaw

There is no OCP for this area. Instead a Rural Land Use Bylaw which incorporates elements of an OCP and a Zoning Bylaw covers Electoral Area F. Area F is located on the western benchlands of Okanagan Lake, west of Summerland. The RDCO lies to the north, the City of Penticton and Penticton IR #1 to the south and Electoral Area H to the west. Sage Mesa/Westbench and Faulder and Meadow Lake Valley are the two main settlement areas while Husula Highlands and Greata Ranch areas have the highest development potential.

At the time of writing there is a development proposal underway for Greata Ranch that includes a sewer component. The recommended option for sewage disposal is to connect the proposed development to the Summerland sewage treatment plant. This would provide the opportunity to connect pockets of development including North Beach and the Provincial campground along the lakeshore between Greata Ranch and Summerland. The cost for the recommended option is $4.8 million including Summerland DCC's of $1387 per connection. Summerland Council voted on the proposal in July 2008 and it was resolved that the area would have to be annexed to the District of Summerland in order for the proposal to move forward. At the time of writing no further information was available.

Minimum parcel sizes range from 4 ha for Large Holding designations down to 1115 m^2 for Residential designations. It is noted here that the 1 ha minimum parcel size for non-sewered lots has not yet been implemented for this area. Low Density Residential designations are limited to the Sage Mesa, Westbench and Husula Highlands areas, while the Medium and High Density Residential designations are specific to the Greata Ranch property only. Future residential designations would be assessed based on the capability of the lands for sewage disposal, the availability of community water and sewer. This plan does not provide any policies on infrastructure.

3.6.11 Electoral Areas - Wastewater Management Plan Updates

Okanagan Falls currently uses an extended aeration activated sludge treatment plant and a rapid infiltration site for effluent disposal. http://rdos.bc.ca/index.php?id=57

An update to the Area F plan is currently underway and updates to the A, B & C plan and Areas D & E plan are anticipated in the near future.

A number of projects in the RDOS were included in the priority list from the 1994 plan. These are outlined in Table 3.16 with an indication as to whether or not they have been completed. In most cases sewer has not yet been provided to these areas, however in recent years grant funding has been obtained to undertake the studies required to determine the feasibility of providing community sewers.

Table 3.16 – Completion Status of RDOS Sewer Projects Prioritized in the 1993 MWMP

Priority Area	**Completion Status**
Sawmill Road	No (Grant awarded to study this area)
Osoyoos SW	No (Grant awarded to study this area)
South Vaseux Lake	No
Osoyoos NW	No (Grant awarded to study this area)
Tugulnuit Lakeshore	No (Grant awarded to study this area)
Osoyoos SE	No
East Vaseux Lake	No
Gallagher Lake	No (Grant awarded to study this area)
Kaleden Lakeshore	No (amendment to LWMP proposed)
Skaha Estates	No (amendment to LWMP proposed)
East Penticton Fringe	Area may have been annexed by City of Penticton
Kaleden Bench	No (amendment to LWMP proposed)
OK Falls Rural	No (amendment to LWMP proposed)
North Oliver Rural	No
Penticton Indian Reserve	Will be connecting to City of Penticton

The RDOS is expecting to do an amendment to the Electoral Areas D & E LWMP in order to address onsite sewage disposal problems occurring in the Kaleden, Skaha Estates and Okanagan Falls areas. These areas are primarily historic developments that have never been connected to a community sewer and as such, these projects may be eligible for sewage infrastructure grants.

In 2004 a committee was formed to consider sewer servicing options for the Skaha Estates and Kaleden lakeshore areas. This committee determined that as both areas have aging septic systems and are in close proximity to Skaha Lake, provision of community sewer is imperative. A report by Earth Tech presented four options including a satellite secondary treatment plant in each community, a satellite tertiary treatment plant in each community, a common secondary treatment plant located in either community or tie-in to the new Okanagan Falls treatment plant. The most cost effective option was to pump sewage from the Kaleden lakeshore and Skaha Estates areas to the new Okanagan Falls treatment plant. Due to the high costs, sewer service is unlikely to proceed without senior government grant funding. Table 3.17 outlines the capital cost per parcel to provide sewer to Kaleden and Skaha Estates, while Table 3.18 compares both capital costs and individual user fees for providing sewer to these areas.

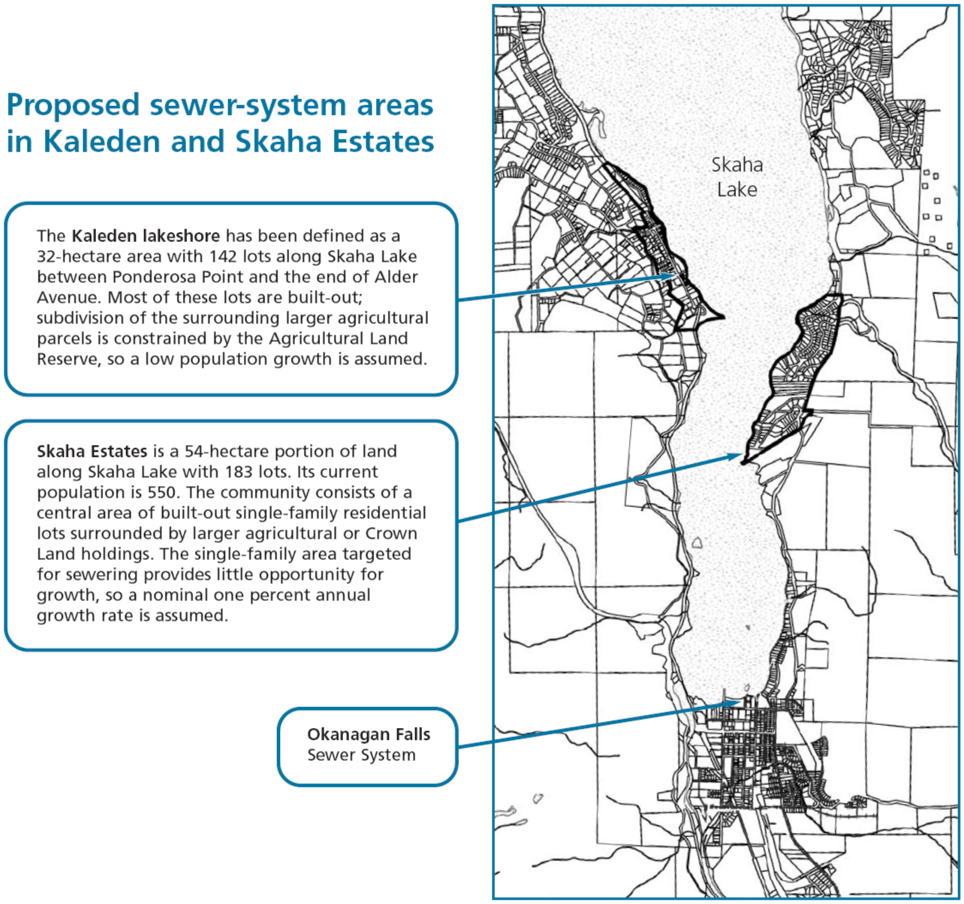
Table 3.17 - Capital cost per parcel to provide sewer to Kaleden and Skaha Estates (2004)

Option	Kaleden	Skaha Estates
Satellite RBC treatment plant	$37,500	$33,000
Satellite BNR treatment plant	$49,400	$42,500
Common RBC treatment plant	$33,500	$35,500
Tie-in to OK Falls treatment plant	$33,400	$29,000

Table 3.18 – Funding Options for Sewering Kaleden and Skaha Estates (2004)

Funding Option	Kaleden Lakeshore		Skaha Estates	
	Total Capital Cost	Approximate Annual Financing Cost & Sewer User Fee	Total Capital Cost	Approximate Annual Financing Cost & Sewer User Fee
No grant Funding	$33,400	$2800	$29,000	$2,460
With Federal/Provincial Infrastructure Grant (66.7%) and OBWB grant (18%)	$5,120	$610	$4,446	$560
*Assumes a 20 year loan to finance the capital cost				

The Okanagan Falls sewage treatment plant utilizes old technology, is poorly located and is currently operating at capacity. An upgrade to the plant is necessary to be able to take in more areas, control odour and improve water quality. In summer of 2007 a decision was made to reconstruct the plant using BNR technology on a new site, provided that senior government covers two-thirds of the cost. $8.9 million in funding has been applied for and a site has been found, however purchase is contingent upon rezoning for the proposed use. In 2008, the zoning application was midstream. Should zoning be successful an amendment to the LWMP will be required. Design and construction of the plant will commence when funding is finalized.



**The above map was taken from the RDOS website (2008).*

Okanagan Falls Sewage Treatment Plant

The RDOS is working towards elimination of lake discharges from the Okanagan Falls treatment plant through the development of a spray irrigation program and/or creation of wetlands. One option being considered for the Okanagan Falls area is to partner with Ducks Unlimited to maintain and increase the size of constructed wetlands using treated wastewater. Ducks

Unlimited currently pumps water from the Okanagan River to maintain this project and must pay for this water. An agreement with the RDOS would be of mutual benefit as it would provide capacity for reuse of treated wastewater from the Okanagan Falls sewage treatment plant. This project is currently under consideration and is not yet included in capital works plans. They are also working towards developing a land base for spray irrigation and there are a few local farmers interested in participating in such a program.

The RDOS has also been awarded grants from the Province to conduct feasibility studies for providing sewer to the Gallagher Lake area. Earth Tech was hired to conduct this study in 2007. The study evaluated 4 options and recommends that the Gallagher Lake area connect to the proposed OIB treatment plant and that negotiations be initiated with the band to facilitate this project. The estimated capital cost for implementing this project is $1,663,000.

Naramata Bench

The Electoral Area F plan is currently undergoing an amendment to address a 400 unit proposed development at the Greata Ranch. Due to the density of this development it will be required to hook up to sanitary sewer. Options for doing this include pumping effluent north to the Westbank sewage treatment plant and outfall or pumping the effluent south to the Summerland sewage treatment plant and outfall. Benefits of both options include connecting older waterfront developments along the way that are currently utilizing onsite effluent disposal. The portion of the project that would connect these older developments would be eligible for grant funding through the Sewage Infrastructure Grants Program. At this time, a decision has not yet been made on which option will be chosen.

Naramata was not identified in the 1994 plan as a priority area. Conversations with staff from the RDOS indicate that sewage disposal in this area is becoming a problem. The Naramata townsite is a historic small lot subdivision that currently uses onsite septic systems. Originally, most property owners utilized more than one lot in order to accommodate both a house and a tile field. Due to the increasing property values in the Okanagan many property owners have sold their “extra” lots and these are now being constructed upon. In many cases small package treatment systems are necessary on these small lots. The densification and age of the older septic systems is resulting in reports of failures in the area. The RDOS is considering the possibility of connecting this area to community sewer.

3.6.12 Osoyoos Indian Band (OIB)

The Osoyoos Indian Band is planning to develop an Industrial/Business Park on their lands near Gallagher Lake. In order to facilitate this project they are also intending to construct a sewage treatment plant. As noted above, a report by Earthtech in 2007 recommended that the OSRD negotiate with the OIB regarding provision of a sewer connection to the Gallagher Lake area which could connect to this treatment plant.

Section 3.7 Conclusions and Recommendations

The following recommendations are provided with the intention of reducing the need for on-site sewage disposal in new developments, reducing the overall cost for providing community sewers and for connecting problem areas that still use on-site disposal. It is recommended that the OBWB encourage careful, sustainable planning that considers the long term health of the basin's water resources as a priority. The OBWB may wish to consider adopting policies supporting the following planning initiatives. Some could be considered as criteria for grant applications.

- **Clustering** - clustering is a provision that may be contained in a zoning bylaw which permits a development to develop a portion of a site more intensively while preserving the remainder of the site as natural area or parkland. Clustering can be beneficial as it may reduce the length of infrastructure required for servicing while also preserving natural areas which can assist in natural rainwater retention and reduced stormwater runoff.

- **Intergovernmental cooperation regarding provision of community sewer to areas outside of municipal boundaries** - Cooperation between rural areas surrounding municipalities with regard to sewage disposal practices and use of regional sewage treatment plants is imperative if these historic small lot developments are to receive sewer connections. Many of these developments are currently outside municipal boundaries but cannot receive sewer connections due to prohibitive policies. The OBWB could advocate for changes to municipal policies where they complicate this process.

- **Cost sharing with Aboriginal communities** – Many of the local First Nations are working toward development of their communities but do not have sewage treatment plants on their lands. Some are located near rural subdivisions which could also benefit from connection to a small treatment plant if it was available. Local governments could pursue cost sharing for infrastructure improvements with aboriginal communities to mutual benefit. Some communities such as Osoyoos and Penticton are pursuing such arrangements.

- **Promote compact urban form** – A compact urban form for the valley's cities and towns can be supported through Regional Growth Strategies and Official Community Plans. Tools such as density bonusing (allowing increased density in exchange for certain amenities to be provided by the developer) can be used to achieve this, as can Urban Containment Boundaries which delineate the geographical extent to which urban development will be permitted.

- **Encourage/advocate for industrial and commercial developments to locate within existing urban centres** – Commercial and industrial developments can often contribute large effluent volumes to the basin. When they are located in rural areas serviced by on-site septic this effluent often does not get treated.

- **Buffer zone around sewage treatment plants** – Providing adequate buffers through OCP's and zoning regulations may allow for future expansion of sewage treatment plants with reduced effect on neighbouring residential and commercial areas. It may also reduce the possibility of needing to relocate sewage treatment plants when they have outgrown their current sites.

- **Discretionary allowances for new development** – Some new developments could be permitted in strategic locations where they can help to pay for sewer extensions that run through older developments which can be connected along the way as latecomers. This should not be taken to mean advocating for developments that are clearly sprawl and outside of an established Urban Containment Boundary.

- **Require property owners to connect** – Some areas of the valley have provided community sewers to older areas but have made it optional for property owners to connect. In order to reduce Phosphorus loads it is important for properties to connect to a community sewer when it becomes available. Remaining on septic, especially in areas located near surface waters should not be optional. The OBWB should advocate for this as it is a clear water quality initiative.

SECTION 4.0 – PROJECT PRIORITIZATION

4.1 Introduction

One of the objectives of this plan update is to assess which projects are still to be completed from the original Master Plan and rank their importance in terms of health and environmental concerns. This section of the plan will provide an update on the progress made to date on completing the projects listed in the previous plan, and will include new projects that have been identified through this update process.

The 1993 Master Wastewater Management Plan by Reid Crowther and Associates provided an overview of a number of ranking systems that could be used to prioritize sewer infrastructure projects in order to provide a more manageable investment program. The recommended approach was to identify those projects which provide the greatest benefit to valley-wide water quality. This was based on the greatest amount of Phosphorus removed for the least amount of money. This was termed the Phosphorus Removal-Cost Approach. It is recommended that this method continue to be used to prioritize the remaining sewer infrastructure projects in the valley. An overview of this approach as outlined in the 1993 Master Wastewater Management Plan is included as Appendix A.

4.2 Status of Priority Projects

Through interviews with local managers and a review of sewer infrastructure maps for certain areas the completion status for each of the identified priority projects has been determined. Table 4.1 lists these priority projects as outlined in the 1993 Plan and provides an indication as to the completion status. This list was created in terms of priority with the highest priority areas closest to the top of the list.

Table 4.1 – Status of Priority Sewer Projects from the 1993 Master Wastewater Management Plan

Region	From WMP document	Present Jurisdiction	Present P load kg/yr	Proposed P load kg/yr	P removal kg/yr	Capital cost $/kg P	Unit Cost $/kg P	Completion status
Pritchard Dr	CORD G&H	Westside	250	19	231	0.370	1,600	Yes
Sawmill Rd	RDOS A,C,D	RDOS	191	47	144	0.400	2,800	No*
Green Bay	CORD G&H	Westside	162	9	153	0.435	2,850	Yes
Whitworth Rd	CORD G&H	Westside	140	8	132	0.425	3,220	Yes
Osoyoos SW	RDOS A,C,D	RDOS	145	83	62	0.210	3,390	No*
Tuc-el-nuit Lakeshore	RDOS A,C,D	Oliver	277	79	198	0.700	3,540	Yes
Ellison Lake	CORD Winfield/Oyama	RDCO	189	109	80	0.311	3,900	No
S.Vaseux Lake	RDOS A,C,D	RDOS	51	12	39	0.155	3,980	No

Region	From WMP document	Present Jurisdiction	Present P load kg/yr	Proposed P load kg/yr	P removal kg/yr	Capital cost $/kg P	Unit Cost $/kg P	Completion status
Osoyoos NW	RDOS A,C,D	RDOS	263	57	206	1,100	5,340	No
Carrs Landing	CORD Winfield/Oyama	Lake Country	144	86	58	0.326	5,600	No
Hitchner Rd	CORD G&H	Westside	30	2	28	0,180	6,430	Yes
Antlers Beach	Peachland	Peachland	149	9	140	0.960	6,860	Yes
Osoyoos SE	RDOS A,C,D	RDOS	100	24	76	0.525	6,900	No
E. Vaseux Lake	RDOS A,C,D	RDOS	70	39	31	0.245	7,900	No
Gallagher Lake	RDOS A,C,D	RDOS	91	14	77	0.680	8,830	No*
Lower Trout Crk	Summerland	Summerland	335	36	299	2,700	9,030	Yes
Oyama N	CORD Winfield/Oyama	Lake Country	323	173	150	1,360	9,100	No
Downtown	Peachland	Peachland	419	48	371	4,380	11,800	Yes
Kaleden Lakeshore	RDOS A,C,D	RDOS	81	4	77	0.910	11,820	No**
Mission Flats	Kelowna	Kelowna	1020	190	830	10,000	12,050	Yes
Skaha Estates	RDOS A,C,D	RDOS	159	29	130	1,650	12,700	No**
Winfield	CORD Winfield/Oyama	Lake Country	676	161	515	6,600	12,800	Yes
OK Centre	CORD Winfield/Oyama	Lake Country	229	202	27	0.354	13,100	No
Crescent Beach	Summerland	Summerland	138	8	130	2.000	15,400	Yes
Belgo/Molnar Rd	Kelowna	Kelowna	27	8	19	0.300	15,800	Yes
Poplar Point	Kelowna	Kelowna	71	7	64	1.050	16,400	Yes
Lower Town	Summerland	Summerland	126	8	118	2,300	19,500	Yes
Casa Loma	CORD G&H	Westside	98	18	80	1.645	20,600	Yes
Town Centre	Summerland	Summerland	550	212	338	9.000	26,600	Yes
S. Downtown	Peachland	Peachland	156	118	38	1.095	28,800	Yes
Peach Orchard Rd	Summerland	Summerland	116	7	109	3.200	29,360	Yes
Upper Trout Ck	Summerland	Summerland	83	14	69	2,800	40,600	No
Lower Glenrosa	CORD G&H	Westside	40	9	31	1.385	44,700	Yes
N. Downtown	Peachland	Peachland	53	22	31	1.670	53,900	Yes
Belgo/Black Mtn	Kelowna	Kelowna	220	104	116	7.950	68,500	Yes
Trevor Dr.	CORD G&H	Westside	25	12	13	0.920	70,800	Yes
Front Bench	Summerland	Summerland	118	118	0	0.000		No
Beachcomber	NORD A,B,C	Vernon	77					Partially
Bella Vista	NORD A,B,C	Vernon	280					Yes
Blue Jay	NORD A,B,C	Vernon	15					Yes
Boucherie Rd	CORD G&H	Westside	12			1.335		Yes
Buchanan	Coldstream	Coldstream	35	0	35	See note A		No
Cartwright/N. Prairie	Summerland	Summerland	4	4	0	0.000		No
Coldstream Centre	Coldstream	Coldstream	55	0	55	See note A		Yes
Coldstream E	Coldstream	Coldstream	82	82	0	0.000		No
Collens Hill	CORD G&H	Westside	4			0.675		Yes
E. Penticton Fringe	RDOS A,C,D	RDOS	14	14	0	0.000		No
Eagle Rock	Spallumcheen	Spallumcheen	20					No
Elliott Rd	CORD G&H	Westside	5			0.440		Yes
Ellison	NORD A,B,C	Vernon	53					Yes

Region	From WMP document	Present Jurisdiction	Present P load kg/yr	Proposed P load kg/yr	P removal kg/yr	Capital cost $/kg P	Unit Cost $/kg P	Completion status
Tolko(Fletcher Challenge)	Spallumcheen	Spallumcheen	131					No
Garnett Valley	Summerland	Summerland	147	147	0	0.000		No
Gellatly Rd	CORD G&H	Westside	2			0.370		Yes
Goose South	NORD A,B,C	RDNO	4					No
Goose/Vernon NW	NORD A,B,C	RDNO	58					No
Grandview Flats	Spallumcheen	Spallumcheen	10					No
Henkel/Scenic Rd	Kelowna	Kelowna	7	7	0	0.800		Yes
Herry Rd	NORD A,B,C	RDNO	44					No
Highway 97	Summerland	Summerland	92	92	0	0.000		No
Kaleden Bench	RDOS A,C,D	RDOS	84	84	0	0.000		No
Lakeview Dr	CORD G&H	Westside	8			1.180		Yes
Lavington	Coldstream	Coldstream	266	266	0	0.000		No
Lavington W	Coldstream	Coldstream	107	107	0	0.000		No
McCartney Rd	CORD G&H	Westside	7			0.780		Yes
McLeod Subdiv.	Spallumcheen	Spallumcheen	2					No
Middleton Mt.	Coldstream	Coldstream	2	0	2	See Note A		Yes
N. Oliver Rural	RDOS A,C,D	RDOS	194	194	0	0.000		No
N. Thacker Rd	CORD G&H	Westside	15			2.015		No
North DOP	Peachland	Peachland	1	1	0	0.000		No
OK Falls Rural	RDOS A,C,D	RDOS	59	59	0	0.000		No**
Oyama E	CORD Winfield/Oyama	Lake Country	64	64	0	0.000		No
Paradise/SW Summerland	Summerland	Summerland	36	36	0	0.000		No
Penticton IR	RDOS A,C,D	Federal/PIB	389	389	0	0.000		No
Ponderosa Rd	CORD G&H	Westside	12			1.520		Yes
Prairie Valley	Summerland	Summerland	9	9	0	0.000		No
Remainder	Spallumcheen	Spallumcheen	130					No
S. Oliver Exterior Fringe	RDOS A,C,D	RDOS	231	231	0	0.000		No
Silver Star	NORD A,B,C	RDNO	24					Yes
S. BX/Pottery Rd	NORD A,B,C	RDNO	87					No
South DOP	Peachland	Peachland	7	7	0	0.000		No
Stepping Stones	Spallumcheen	Spallumcheen	26					No
Sunnyside	CORD G&H	Westside	8			1.420		Yes
Sunnyview	CORD G&H	Westside	12			1.035		Yes
Sunset/Okanagan	NORD A,B,C	Vernon	597					No
Swan Lake	NORD A,B,C	RDNO	154					No
Vernon E – Mueller/Barker	NORD A,B,C	RDNO	130					No
W Kelowna Estates	CORD G&H	Westside	30			7.525		Yes
Witt Rd	CORD G&H	Westside	7			0.600		Yes

*Grant has been awarded for servicing studies this area.
**Sewers are proposed for this area subject to funding.

It is obvious that great progress has been made over the last 15 years in sewering many areas of the basin. In particular, West Kelowna, Kelowna, Peachland, Summerland, Vernon and Lake Country have sewered all or some of their priority areas. The Okanagan Similkameen Regional District has not yet sewered any of their priority areas, however there are currently plans in the works for some key areas. The only areas of the North Okanagan Regional District Electoral Areas that have been sewered are those that have been annexed by the City of Vernon, while Spallumcheen has not yet provided sewer anywhere in the Township.

Some areas such as Naramata Townsite and the Westbench/Sage Mesa areas were not included in the original priority list because the LWMP for the area recommended continuing with the status quo of onsite sewage disposal for those areas. However, through this process new areas have been identified by municipal managers as priorities and these have been added to the list outlined in Table 4.2 as shown in green. These are unranked with reference to the others, but are current priorites.

Table 4.2 – Remaining projects plus new projects (in green) with rankings as given in the 1993 MWMP

Region	From WMP document	Present Jurisdiction	Present P load kg/yr	Proposed P load kg/yr	P removal kg/yr	Capital cost $/kg P	Unit Cost $/kg P	Completion status
Sawmill Rd	RDOS A,C,D	RDOS	191	47	144	0.400	2,800	No*
Osoyoos SW	RDOS A,C,D	RDOS	145	83	62	0.210	3,390	No*
Ellison Lake	CORD Winfield/Oyama	RDCO	189	109	80	0.311	3,900	No
S.Vaseux Lake	RDOS A,C,D	RDOS	51	12	39	0.155	3,980	No
Osoyoos NW	RDOS A,C,D	RDOS	263	57	206	1,100	5,340	No
Carrs Landing	CORD Winfield/Oyama	Lake Country	144	86	58	0.326	5,600	No
Osoyoos SE	RDOS A,C,D	RDOS	100	24	76	0.525	6,900	No
E. Vaseux Lake	RDOS A,C,D	RDOS	70	39	31	0.245	7,900	No
Gallagher Lake	RDOS A,C,D	RDOS	91	14	77	0.680	8,830	No*
Oyama N	CORD Winfield/Oyama	Lake Country	323	173	150	1,360	9,100	No
Kaleden Lakeshore	RDOS A,C,D	RDOS	81	4	77	0.910	11,820	No**
Skaha Estates	RDOS A,C,D	RDOS	159	29	130	1,650	12,700	No**
OK Centre	CORD Winfield/Oyama	Lake Country	229	202	27	0.354	13,100	No
Upper Trout Ck	Summerland	Summerland	83	14	69	2,800	40,600	No
Front Bench	Summerland	Summerland	118	118	0	0.000		No
Buchanan	Coldstream	Coldstream	35	0	35	See note A		No
Cartwright/N. Prairie	Summerland	Summerland	4	4	0	0.000		No
Coldstream E	Coldstream	Coldstream	82	82	0	0.000		No
E. Penticton Fringe	RDOS A,C,D	RDOS	14	14	0	0.000		No
Eagle Rock	Spallumcheen	Spallumcheen	20					No
Tolko(Fletcher Challenge)	Spallumcheen	Spallumcheen	131					No

Region	From WMP document	Present Jurisdiction	Present P load kg/yr	Proposed P load kg/yr	P removal kg/yr	Capital cost $/kg P	Unit Cost $/kg P	Completion status
Garnett Valley	Summerland	Summerland	147	147	0	0.000		No
Goose South	NORD A,B,C	RDNO	4					No
Goose/Vernon NW	NORD A,B,C	RDNO	58					No
Grandview Flats	Spallumcheen	Spallumcheen	10					No
Herry Rd	NORD A,B,C	RDNO	44					No
Highway 97	Summerland	Summerland	92	92	0	0.000		No
Kaleden Bench	RDOS A,C,D	RDOS	84	84	0	0.000		No
Lavington	Coldstream	Coldstream	266	266	0	0.000		No
Lavington W	Coldstream	Coldstream	107	107	0	0.000		No
McLeod Subdiv.	Spallumcheen	Spallumcheen	2					No
N. Oliver Rural	RDOS A,C,D	RDOS	194	194	0	0.000		No
N. Thacker Rd	CORD G&H	Westside	15			2.015		No
North DOP	Peachland	Peachland	1	1	0	0.000		No
OK Falls Rural	RDOS A,C,D	RDOS	59	59	0	0.000		No**
Oyama E	CORD Winfield/Oyama	Lake Country	64	64	0	0.000		No
Paradise/SW Summerland	Summerland	Summerland	36	36	0	0.000		No
Penticton IR	RDOS A,C,D	Federal/PIB	389	389	0	0.000		No
Prairie Valley	Summerland	Summerland	9	9	0	0.000		No
Remainder	Spallumcheen	Spallumcheen	130					No
S. Oliver Exterior Fringe	RDOS A,C,D	RDOS	231	231	0	0.000		No
S. BX/Pottery Rd	NORD A,B,C	RDNO	87					No
South DOP	Peachland	Peachland	7	7	0	0.000		No
Stepping Stones	Spallumcheen	Spallumcheen	26					No
Sunset/Okanagan	NORD A,B,C	Vernon	597					No
Swan Lake	NORD A,B,C	RDNO	154					No
Vernon E – Mueller/Barker	NORD A,B,C	RDNO	130					No
Naramata Townsite	RDOS, E,F	RDOS	313.81	*15.69	*298.12	0.000	20,360	No
Ok Lake Prov. Park & adjacent developments	RDOS E,F	RDOS	73.84	*3.69	*70.15	0.000	*92,751	No
Husula Highlands	RDOS E,F	RDOS	12.32	*0.62	*11.7	0.000	*92,751	No
Westbench/Sage Mesa	RDOS E,F	RDOS	11	*0.55	*10.45	0.000	*92,751	No

*Data assumes BNR standard treatment with 95% P removal
**Assumes connection to a regional sewerage system with connection to Penticton.
***Projects highlighted in green are new and have not been ranked

4.3 Conclusions and Recommendations

The tables provided in this section provide an overview and priority list of sewer projects that have been identified by the communities of the Okanagan Basin. It is recommended that this list be used to determine the best use of grant funding. Over the past several years it has been possible to requisition more funding than has been needed to cover grant requests received by local governments (this is explained further in Section 5). As such it is understood that all applications received that meet the criteria for funding have been funded. However, this situation could change. If it does, the priority list may be needed to determine the higher priority areas where funding should be directed to best improve valley wide water quality.

SECTION 5.0 – FINANCE

5.1 Introduction

The Sewage Facilities Grants Program provides grants to municipalities and regional districts throughout the Okanagan Basin in the form of debt repayment. Local governments are eligible to receive assistance in the amount of 18% payment of annual debt charges for projects eligible under the program. The local government is expected to pay the first 2.5 mills of annual debt charges which are subtracted from the total debt. The OBWB then pays 18% of the remaining debt per year for a 20 year period. These grants are tied to a Municipal Finance Authority issue.

"The grant program is intended to address point source pollution from treatment plants utilizing old technology and to fund qualifying projects extending sewer service to subdivisions created prior to 1977 that are still on septic. New sewage treatment plants, expansions, or refits made necessary by growth or replacements due to age or outmoded technology are not eligible for OBWB grants. These works should be funded by DCCs and other mechanisms put in place by local government so that new infrastructure is paid for by the component causing the infrastructure needs. (1994) Lots on septic at the time of the original grant program (1977) will be eligible for funding when sanitary sewers are installed – providing infilling does not exceed the average annual growth rate for the community."[1]

5.2 Debt Retirement Projections

The end point to the Sewer Grant Program will occur when project debt is retired from all tertiary treatment plant construction and extension of sewers to developed areas that were present at the time of the grant program commencement in 1977[2].

Table 5.1 *(included as a separate file, pages 98-102)* provides current debt retirement projections for all grants existing at the time of this plan update. The numbers indicate that debt will be retired for a few communities such as Armstrong and Oliver within the next 3-5 years, while other communities such as Vernon and Peachland will still have debt into 2030. The majority of valley communities however, will see their current debt retired between 2020 and 2026. If no new Sewage Facilities Grants were approved as of 2008, the program would officially see its debt retired in the early 2030's.

However, interviews with municipal engineers and treatment plant managers throughout the Okanagan Basin indicate that several communities foresee doing projects within the coming years that would qualify for grants, and there is strong interest in continuation of the program.

It is also important to note that some communities have drawn significantly more funds from the program and have had the opportunity to complete more projects. Other communities have not drawn any funds to date and are currently planning to undertake projects which would qualify for funding.

The philosophy of the program is to improve the quality of the valley's lakes for the benefit of all communities. As such, if a program is implemented in Peachland (for example), its benefits can be felt throughout the entire basin through improved water quality. The inverse is also true, as contaminated beaches in one community would have negative economic impacts throughout the Okanagan.

5.3 Sewerage Facilities Assistance Reserve Fund

In 1993, concerns were raised through the Master Wastewater Management Plan regarding the amount of money raised through taxation for the grants program. There was concern that the amount requisitioned was not sufficient to cover projected financial demands of the member communities. As such, a new method of raising funds which would increase the dollars collected towards the grant program was designed and recommended for implementation. This program was called a "Development Impact Levy (DIL)", which would be similar to a DCC in that it would be levied on all new subdivisions and building permits. However, rather than dealing with specific infrastructure, it would go towards addressing the greater need of cumulative growth effects in the Okanagan.

However, since that time population and property values in the valley have increased dramatically. Also, many of the projects outlined in the various Liquid Waste Management Plans have been substantially completed. As such, for the past 15 years the OBWB has not needed to requisition the full authorized amount to operate the program. The OBWB is allowed to requisition 21 cents/$1000 of assessed property value from each Regional District to be used toward this program. Staff report that in recent years they have been requisitioning around 4 cents per $1000. Clearly, at the present time the current system allows for a considerable increase in grant funding should it be required. Although the DIL idea is a good one, it requires new legislation to be implemented. Under current circumstances the work required to implement the DIL may not be warranted. Should the situation change in the future, the DIL idea should be revisited.

5.4 Conclusions and Recommendations

- **The Sewage Facilities Grants Program should be continued** so that valley communities can continue to draw upon this resource to make further sewer infrastructure improvements intended to lead to improved basin water quality.

- **The DIL model should be considered for future implementation**. If the economic climate in the Okanagan changes in the future and the currently legislated requisition amounts are not enough to cover the grant applications the DIL model should be revisited as an option for raising additional program funds.

5.5 References

1. Okanagan Basin Water Board, Sewage Facilities Grants Terms of Reference
2. Okanagan Basin Water Board, Sewage Facilities Grants Terms of Reference

SECTION 6.0 – ANCILLARY ISSUES

6.1 Introduction

The main goal of the MWMP has been to prioritize wastewater projects throughout the Okanagan Basin based on achieving the greatest effect on reducing nutrient pollution from effluent discharges to the valley lakes. As of the time of this update, a significant portion of the infrastructure development which qualified for OBWB grants has been completed. This section of the plan will look at other issues which impact the quality of water in the basin as considerations for future directions of the grants program.

Through the course of the interviewing phase of this project, the following issues were brought forward, divided below between point source and non point source issues. Each issue could involve greater research so as to explore the potential to contribute towards advancements in wastewater treatment and water quality in the basin.

6.2 Future Point Source Issues

6.2.1 Control of Pollutants Other Than Phosphorus

As discussed in Section 4.0, it has been possible to focus on phosphorus as a measure of the degree of lake water quality protection offered by end-of-pipe treatment. Municipal contacts in many of the communities throughout the basin indicated that they have many more projects scheduled to improve wastewater infrastructure and subsequently reduce phosphorus loading to the lake system. Continued focus on phosphorus as a measure of water quality protection is a worthwhile practice to continue in the basin, as long as:

- Municipal discharges consisting primarily of domestic sewage are the only point sources;
- end-of-pipe treatment techniques selected continue to be broad-effort based - that is, the very effective removal of phosphorus continues to ensure that all other impurities of concern are also very effectively controlled.

If industrial wastes become a significant fraction of any municipal discharges, or if separate industrial waste discharge permits are considered, then very careful consideration of the required removal efficiency of other pollutants must be carried out. Research is scheduled to take place in the Okanagan, beginning in 2008 on levels of endocrine disruptors within basin waterways and their potential impacts. Findings of this research will determine the need for further management decisions around this issue.

Source control of specific impurities to mitigate against the need for specialized end-of-pipe treatment is covered in a future subsection of this report.

6.2.2 Regulation of Nutrient Discharges

Nitrogen and phosphorus control techniques have now been developed to the point where municipal effluents discharged to surface water have average annual phosphorus concentrations below 0.3 mg/L. The alternate waste management practice of designed land application has been proven to give at least the same degree of protection to lake water quality.

In areas like the Okanagan Basin, where water supply can be short and there are environmental concerns related to discharge, water reclamation can make sense. High costs for initial water reclamation infrastructure can be offset by long term savings in water costs, discharge costs and environmental protection benefits[4]. By using treated effluent, also referred to as reclaimed water, for non-potable uses such as irrigation stream augmentation or toilet and urinal flushing, potable water can be conserved for end-uses such as showering, cooking and drinking[4]. The Municipal Sewage Regulation stipulates which uses of reclaimed water are permissible.

Land application of treated effluent (reclaimed water) is a practice that has been well received by municipalities such as Oliver, Osoyoos and Armstrong, where there is growing interest in access to treated effluent by farmers and other users for restricted uses of this low cost water source. As an example, Oliver's treated effluent customers now include a golf course, a vineyard, a hobby farm, a municipal park, a municipal cemetery, a public works yard and an airport hayfield. Even the Cities of Kelowna and Penticton which both practice lake discharge of treated effluent have continued to take steps over the years to increase reuse opportunities for their reclaimed water. Penticton has expanded use of reclaimed water for such purposes as irrigation and use as secondary water for construction projects, while Kelowna extracts heat from effluent for their treatment plant and wishes to increase irrigation opportunities. Vernon, which has now practiced land-based irrigation for over 20 years, was the only community to indicate that there are still problems in the community with public perception over reclaimed water use. From a basin perspective, it would be beneficial for land application to be looked at in further detail in order to compile locally relevant information on such issues as cost effective alternatives for reclaimed water use, provincial regulations, mapping of assimilative capacity of the land base and how to best share information on this issue throughout the basin.

Efforts to reduce point source loading to the lake system have been successful and should continue, bearing in mind population growth impacts on mass loading of nutrients. The result of this newly achieved control of point-source municipal sewage is that other than replacement of outdated technology (such as the Okanagan Falls STP) the only room left for further reductions of nutrient loadings from this source is by improvements to modern treatment technology or land application. With current levels of understanding, there is no easy or inexpensive way to achieve such further advances. What is more, the impact of such further reductions would be essentially unnoticeable, since the best improvement would only reduce loadings to the lakes by perhaps 4%. What is much more important is that the levels of nutrient removal that are currently being achieved should not be eroded as the population impacts on the basin increase.

Despite the overall improvement to lake water quality it should be noted that the impacts of pollution from onsite septic systems are often greatest in small streams and tributaries that feed the lake where dilution is minimal. In these situations damage is localized in terms of stream health and water quality.

Increased monitoring and research of nutrient contributions to the lake is needed for accurate estimates of nutrient discharges to the lake from point sources and other sources. This information will support answers to necessary on-going considerations such as:

- What mechanisms are available to reduce contributions from the various sources, and how costly are they?
- How critical is it to maintain or reduce existing total impacts of nutrients to the lake system?
- What changes in nutrient contributions might occur in the foreseeable future with the current levels of regulation and enforcement?

It is clear from Section 3.0 of this report on Water Quality, that the capability of the lake system to cope with increases in nutrient loadings without significant impacts is marginal at best. It is also clear from Figure 6.1 that the mass loading of phosphorus entering the lake system from sewage treatment plants has decreased dramatically over the past twenty years (from 59,148kg/yr to 2503 kg/yr}, and the percent of total loading from this source has changed from approximately 49% to approximately 4%.

Table 6.1 - Overall Annual Phosphorus Loadings to the Okanagan Basin (1000's of kg)

	1970	**1980**	**1990**	**2000**
Sewage treatment plants	59.15	19.11	7.82	2.503
Septic tanks	8.00	11.50	16.92	15.67
Agriculture	4.50	11.93	2.50	2.50
Forestry	8.40	8.40	8.40	8.40
Watershed	41.90	41.90	41.90	41.90

6.2.3 Source Control Bylaws

Source control bylaws can be used to limit discharges of specific effluents to sewage systems, to charge for emissions in excess of specific limits, or to ban the sale of products that lead to unwanted impurity discharges. Several communities in the Okanagan with sewage collection and treatment systems have some level of bylaw protection, especially with respect to allowable limits on such contaminants as oils and greases, certain heavy metals, BOD and suspended solids.

It is imperative that treatment plant effluents be regularly (and properly) sampled and analyzed for a broad range of organic and inorganic pollutants to ensure that any trends in pollutant loadings are determined in advance of potential impacts on the sensitive receiving waters of the valley.

Increased understanding of other contaminants to the lake system is needed. In the past, the question of banning the sale of certain products has been raised, especially with respect to phosphorus in detergents, but the success of end-of-pipe treatment appears to have made this unnecessary. There are a variety of other more subtle contaminants that enter the lake through sewage outfalls. At the time of writing, phosphorus controls continue to be the focus of waste management efforts in the Okanagan Basin. Interviews with STP administrators throughout the valley indicate that concerns have been raised in recent years over contaminants such as endocrine disruptors and pharmaceuticals, however little data exists and studies led by Health Canada, the Ministry of Environment and University of British Columbia – Okanagan, are only just getting underway within the Okanagan Basin on this topic.

In particular, as pharmaceutical use increases so does the occurrence of pharmaceuticals and their derivatives in wastewater. Attention is beginning to be directed towards chemicals like endocrine disruptors and pharmaceuticals in the basin, however no data on these chemicals are available for Okanagan Lakes. These substances are designed to be bioactive, and have unintended effects in the environment. The likelihood that substances having short environmental lifetimes (eg. estrogen), would pose threats to lake water quality is diminished somewhat by the hydrology of the basin and the location of population centres. Rapid environmental degradation will limit levels of these substances in long residence time lakes. In contrast, rapidly flushed lakes will limit levels by dilution. The most significant threats to Okanagan Basin water quality could come from soluble and persistent substances. The Okanagan Basin is sensitive to such contaminants because water supplies are low relative to the population. We owe much of our present high water quality to the capacity for the main stem lakes to “purify” and dilute the water they receive[1].

Source control bylaws could be created for pharmaceuticals at the municipal level, however enforcement of such bylaws would be challenging. For example a bylaw which made it illegal to flush pills would be reliant on voluntary compliance and a public education program would be needed to encourage adherence through understanding. However, a bylaw alone would not be adequate to deal with the problem. It would need to become part of a bigger program to deal with "leftover" drugs as there would have to be a safe place to dispose of them established. Also, a consideration on the side of the precautionary principle, may be the expansion of land based discharge systems in the basin, to reduce potential contamination of the water system if these substances are found to be a threat.

Heavy metals, like mercury, which may have been partially contributed through the sewage outfalls, were identified as a concern in the Okanagan Basin Study, as high concentrations were seen in some larger fish at the top of the food chain. Recent data have shown the concentrations are lower than during the Okanagan Basin Study. Organic chemicals such as pesticide residues, DDT, PCBs were also raised as a concern at one time but there is only limited monitoring data of these persistent organic pollutants and no results that show particular problems. These contaminants can also be contributed by non-point source inputs (storm sewers, stream inflows, dustfall) and that may be the major pathway by which these persistent chemicals end up in fish[2].

6.3 Non-Point Source Control Issues

A recent report on water quality trends in Okanagan, Skaha and Osoyoos Lakes[3] points to the need for implementing diffuse source controls to achieve further reductions in phosphorus, stating that point source reductions appear to have run their course for these lakes, going from 47,000 kg in 1970 to 2600 kg in 2001. For purposes of this report, non-point sources are limited to those that are potentially controllable. They include on-site ground disposal systems, agricultural sources, forestry sources, and storm water runoff.

Non-point source loading of phosphorus requires more accurate measurements in order to define nutrient reduction strategies for forestry, agriculture, septic tanks etc. As shown in Figure 6.1, the estimated situation in 1990 shows that forestry, agriculture, and on-site ground disposal of sewage contributes some 27,820 kg/yr. of phosphorus to the lake system. The other potentially controllable source, storm water runoff, is very difficult to quantify, because of its very diffuse origins and its interaction with sources such as fertilizer use (agriculture) and other sources of nutrients (and perhaps of additional pollutants). A better understanding and control plans are necessary for managing stormwater so that the loading to the lake system can be kept at today's levels as the population of the valley grows. During the interview phase of this project, stormwater management was identified as an area that could be improved upon to protect water quality in streams and lakes. Stormwater management infrastructure should be looked at in depth.

Monitoring of potential contaminants to watershed. At the time of writing, we are aware of a proposed golf course at Silver Star Mountain resort located at the headwaters of BX Creek watershed which feeds into the Okanagan Basin. The golf course is proposed to be irrigated with spray irrigation from the Silver Star Resort community. With the growth of resort destinations in the upper water sheds of the Okanagan Basin, developments such as this require monitoring to determine their impacts on basin water quality.

There is little doubt that there is sufficient information to allow action to be taken on control of on-site ground disposal systems, even though the accuracy of calculated loadings is somewhat less than for municipal discharges. However, when the time comes to consider implementing control strategies for other non-point sources, it will be necessary to have considerably more data on the extent of loadings and the available control methods that will be both successful and acceptable.

Given the uncertainty of non-point source estimates, any management action to further control Phosphorus from these sectors should adopt a conservative management approach based on a better understanding of nutrient sources. There is a lot of uncertainty in the current status of diffuse source loading, and re-evaluation of the diffuse source estimates is warranted[3].

6.4 References

1. Curtis, PJ. (2005). Water quality in the Okanagan Basin: Dependence on spatial and temporal drivers. Water – Our limiting resource. Canadian Water Resource Assoc. 287 - 295.
2. Nordin, Richard, N. (2005). Water Quality Objectives for Okanagan Lake – A First Update. Limnos Water Associates. Prepared for The Ministry of Land, Water and Air Protection, Penticton and Kamloops BC.
3. Jensen E.V. and P. F. Epp. 2002. Water Quality Trends in Okanagan, Skaha and Osoyoos Lakes in Response to Nutrient Reductions and Hydrologic Variation. Ministry of Water Land and Air Protection. Penticton, British Columbia.
4. B.C. Ministry of Environment (1999). Municipal Sewage Regulation. Environmental Management Act. BC Reg 129/99. Queens Printer. Victoria, BC. http://www.qp.gov.bc.ca/statreg/reg/E/EnvMgmt/129_99.htm.

SECTION 7.0 – CONCLUSIONS

In the years since the inception of the sewage facilities grants program a dramatic change in the Okanagan lake system has been achieved with respect to reducing Phosphorus levels and overall water quality. This is primarily due to greater controls over point source pollution from sewage treatment plants and the connection of historic developments to sanitary sewer. As such, the program should be considered a success with respect to achieving its goal of a reduction in overall Phosphorus loading to the lake system by 95% in each municipality. However, as noted in this report there are other non-point sources of Phosphorus which could still be addressed to potentially reduce total Phosphorus levels even further. Some of these sources which have the potential for improvements include on-site septic systems and stormwater runoff.

A water quality issue that is beginning to receive local attention and research is the influence of pharmaceuticals and in particular endocrine disruptors, and their potential effects on human health and the environment. It is recommended that the OBWB continue to support research efforts to quantify and qualify this issue as it pertains to the Okanagan Basin.

Contributions to the sewage facilities grants program are made by all local governments in the Okanagan Basin and all are eligible to apply for grant funding. This funding is intended to assist with sewage infrastructure projects that will connect historic developments to a community sewer or upgrade treatment plants to a tertiary level. While many valley communities have taken advantage of the program and made substantial improvements over the years there are still a number of communities that have not utilized this funding but intend to apply over the next few years. Further, it has been suggested by a number of municipal managers that if funding was available for stormwater infrastructure improvements they would be interested in utilizing it to make improvements in that area as well. Staff at the Ministry of Environment have emphasized the need for additional monitoring and studies related to stormwater as a contributor of nutrient loading to basin lakes.

As such, this report recommends that the sewage facilities grant program be continued in order to accommodate the communities that have not yet had the opportunity to utilize the available funding, and further that the OBWB consider expanding the program to include applications for innovative stormwater management infrastructure and research that is intended to reduce non-point source Phosphorus entering the lake system through stormwater.

Land based irrigation with treated effluent is practiced throughout the Okanagan basin, serving a variety of commercial and agricultural purposes. The authors of this update have noted that municipalities in the south Okanagan are taking a strong leadership role in integrating a diverse assortment of reclaimed water use alternatives into practice in their communities. As water conservation issues take on a growing importance throughout the basin, the south Okanagan offers a local example of maximizing the use of reclaimed water for offsetting fresh water demands. Support for changes to reclaimed water use is an area which could be supported by the OBWB through policy changes or through grant funding.

Appendix A - PHOSPHORUS REMOVAL - COST APPROACH

(Reid Crowther and Associates)

The Phosphorus Removal – Cost Approach as developed by Reid Crowther and Associates for the 1993 Master Wastewater Management Plan is referenced in Section 4.0 – Project Prioritization. It is included here in full for reference purposes.

A primary objective of the prioritization criteria is to identify those projects which provide the greatest benefit to valley-wide water quality. Defining the term "benefit" then becomes the task at hand. For the Okanagan Lake system, it has been shown conclusively that phosphorus reduction provides a very high "benefit" to overall water quality. Hence the level of phosphorus reduction that can be achieved is a major criterion for setting priorities. If a project is capable of removing 1,000 kg/yr of phosphorus (P) at a cost of $1000/kg, it is less effective than two other projects that can remove 500 kg/yr each at a combined cost of $850/kg. Hence cost per unit P removed is the second major criterion.

It is considered imperative that some mechanism be available to recognize the importance of local conditions when assigning priority to expenditures recommended in the Wastewater Management Plans. Examples of local conditions that would be important to recognize might be: a collection of septic tanks close to the foreshore which give rise to local P concentrations capable of supporting attached algal growths on gravel beaches; measurable coliform counts along beach areas near septic tanks; potential health problems due to septic tank effluents surfacing on public property.

A reasonable method of achieving this recognition is to establish a "local switch" that, when triggered by unacceptable conditions, would move a project higher up on the priority ladder. There are, of course, many other quality characteristics that have an effect on the overall health of the lakes in the Okanagan Basin. These may range from the obvious pollutants such as suspended solids and oxygen-consuming organics to the more subtle impurities such as dissolved heavy metals and trihalomethanes. However, trying to build such impurities into the criteria matrix is neither necessary nor technically justified.

Although it is generally recognized that any number of impurities are not considered "good" for sensitive receiving water, it is difficult if not impossible for relative evaluation of their importance to overall water quality to be determined for inclusion in a priority matrix. Secondly, and probably more importantly, any proposed project that will be successful in removing phosphorus from wastewater would also be effective in substantially reducing the discharge of most other impurities concurrently.

What makes this approach unique is how it is proposed to be applied, not the specific criteria. The proposed approach is to evaluate individual projects on a year-by-year basis. Should adequate levels of funding be available, and all projects meet certain minimum criteria, all such projects could receive funding in a specified year. The prioritization approach would only need to be applied when insufficient budgets were available to fund all submitted projects. This recognizes that within each **WMP,** some projects are more important than others. The **WMP** documents then become an overall budgeting tool only. A basic assumption in this approach is that additional funding will be available in addition to normal provincial levels. If a project does not meet the criteria presented here, it can still apply for normal provincial funding.

The simple phosphorus removal/cost approach is recommended for use in prioritizing expenditures identified by the 16 Wastewater Management Plans completed or in progress. There are three reasons for this:

- it is simple yet effective in protecting the water quality of the main valley lakes;
- it still allows local problems to be factored into the prioritization, and;
- it can be easily modified if another criterion is found to be important as the information base expands.

It is our recommendation that this approach for prioritizing wastewater management projects be used under the following conditions.

• Where an existing unsewered area is proposed to be converted from septic tanks to a formal sewage system with separate end-of-pipe treatment. All costs (collection, treatment, and disposal) could be used to determine the unit cost ($ per kg) of phosphorus removal. The mass of phosphorus removed would be calculated by taking the estimated lake loading derived from the phosphorus transmission model and subtracting the phosphorus loading expected from the proposed treatment method.

• Where an existing unsewered area is proposed to be converted from septic tanks to a formal sewage collection system that will discharge into an existing wastewater treatment facility. In this case, the capital costs will include collection, transportation, and the marginal cost of the treatment plant expansion required to accommodate the extra load.

• Projects involving expansion of existing facilities are **not** prioritized. All such expansion projects must be funded as the consequences of exceeding plant capacity (i.e. effluent quality deterioration) cannot be tolerated. The only other option would be to put a moratorium on growth which is not seen as an acceptable solution. It is therefore, imperative that the financial strategy generate sufficient revenue to allow expansion projects to proceed as necessary **and** to allow for resolution of all existing problems within a realistic timeframe. Otherwise, this approach would be perceived to favour development rather than existing problem areas.

Two hypothetical examples of prioritization calculations follow which illustrate the recommended methodology.

Case 1 - An existing septic tank area proposes a collection and treatment system. The system will serve 5,000 people and is estimated to cost $15,000,000. The P transmission model for the area predicts the existing ground disposal system will provide 82% removal of P load before reaching surface waters.

- total P generation = 5,000 people x 1 kg/yr/ea = 5,000 kg/yr
- anticipated P reaching surface waters = 5000 x 0.18 = 900 kg/yr
- anticipated P reaching surface waters from new sewerage facilities = 5000 x 0.05 = 250 kg/yr
- net improvement in P removal = 900 - 250 = 650 kg/yr
- unit cost of removal = *$15,000,000/650* kg/yr = *$23,000/kg*
- local switch = "off"

Case 2 - An existing septic tank area proposes a collection system and subsequent transportation of sewage to an existing treatment plant in a neighbouring community. The foreshore area has some attached algae growing on pebbles below the lake water level, thus indicating local "high" concentrations of P**.** The P transmission model for the area predicts that 75% of the P will be removed by the ground disposal system. The system will serve 3,500 people.

- total P generation = 3,500 people x 1 kg/yr/cap = 3,500 kg/yr
- anticipated P reaching surface waters = 3,500 x 0.25 = 875 kg/yr
- anticipated P reaching surface waters from new sewerage facilities = 3,500 x 0.3 = 105 kg/yr
- net improvement in P removal = 875 - 105 = 770 kg/yr
- cost of facilities = 8,000,000 for collection and trunk sewers + 3,000,000 for addition to treatment plant
- unit cost of P removal = $11,000,000+ 770 = $14,300/kg/yr
- local switch = “on”

In this hypothetical situation, it is obvious that Case 2 has a higher priority than Case 1, even though a smaller population is involved. It removes a higher mass of phosphorus from the lake system at a lower unit cost, and in addition, has a situation that turns the local switch to the "on" condition.

Project prioritization by the cost/efficiency of phosphorus removal with the use of a local switch is the recommended approach.

Appendix B - TERMINOLOGY

Aerated lagoon is a holding and/or treatment pond provided with artificial aeration to promote the biological oxidation of wastewaters.

Activated sludge - atmospheric air or pure oxygen is bubbled through primary treated sewage combined with organisms to reduce organic content of the sewage.

Critical load - a quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge.

Discharge - the total amount of a solid, liquid or gaseous waste introduced into the environment from works, including effluent and reclaimed water

Disinfection - the destruction, inactivation or removal of pathogenic microorganisms by any means

Effluent - the liquid resulting from the treatment of municipal sewage

Endocrine Disruptor Compounds (EDC's) – these are substances that are capable of affecting the endocrine systems of biological organisms resulting in reproductive and immune system dysfunction, neurological, behavioural and developmental disorders, and possibly certain forms of cancer. Sources of EDC's include natural estrogens, animal hormones, alkylphenols (used in the manufacture of plastics), phytoestrogens (natural plant excretions), pharmaceuticals (therapeutic compounds and birth control pills) and detergents. Interest in this class of compounds started in the late 1990's with the advent of equipment able to detect the chemicals at extremely low levels in the environment.

Research has been directed towards understanding the risks posed by these compounds, their fate in the environment and development of wastewater treatment processes to remove EDC's.

Eutrophication - the process by which a body of water becomes enriched in dissolved nutrients (as phosphates) that stimulate the growth of aquatic plant life usually resulting in the depletion of dissolved oxygen.

Filtration - the removal of solid particles from an effluent by passing the effluent through a filtering medium such as sand, membrane, anthracite, or any other comparable filter medium or combination of filter media, or any physical barrier or device or septum onto which the solids are deposited.

Mesotrophic - having a moderate amount of dissolved nutrients.

Non-Point source (NPS) - pollution comes from a variety of different locations such as storm drains, road salt washed into rivers, leaching of pesticides and fertilizers through the soil from agriculture etc.

Oligotrophic - having a deficiency of plant nutrients that is usually accompanied by an abundance of dissolved oxygen.

Point source - where contamination can be traced to a single point or location such as outflow pipes, wastewater treatment plants, discharge from industry etc.

Precautionary principle - a moral and political principle which states that if an action or policy might cause severe or irreversible harm to the public or to the environment, in the absence of a scientific consensus that harm would not ensue, the burden of proof falls on those who would advocate taking the action. The principle implies that there is a responsibility to intervene and protect the public from exposure to harm where scientific investigation discovers a plausible risk.

Primary treatment means any form of treatment, excluding dilution, that consistently produces an effluent quality with a BOD_5 not exceeding 130 mg/L and TSS not exceeding 130 mg/L.

Reclaimed water - effluent from a sewage facility that is suitable for a direct designated water use or a controlled use.

Secondary treatment - any form of treatment, excluding dilution, that consistently produces an effluent quality with a BOD_5 not exceeding 45 mg/L and TSS not exceeding 45 mg/L, except for lagoon systems for which the effluent quality is not to exceed a BOD_5 of 45 mg/L and a TSS of 60 mg/L.

Tertiary treatment - provides a final stage to raise the effluent quality before it is discharged to the receiving environment (sea, river, lake, ground, etc.). More than one tertiary treatment process may be used at any treatment plant. If disinfection is practiced, it is always the final process. It is also called "effluent polishing".

Transmissivity - an act, process, or instance of transmitting.

Appendix C – MASTER WASTEWATER MANAGEMENT PLAN SURVEY

Responses to these questions have been used to guide the MWMP update.

1. What is the name of your local government? Responses below are from:

    Municipal engineers and sewage treatment plant managers for the following communities: City of Armstrong, Township of Spallumcheen, District of Coldstream, City of Kelowna, District of Summerland, City of Penticton, Town of Oliver, Town of Osoyoos, (some District of Peachland responses added after survey compiling date)

2. What is the date of adoption of your current Liquid Waste Management Plan (LWMP)?

    Responses incorporated into Section 2 of report.

3. Are there any anticipated wastewater infrastructure projects that are not included in your current LWMP?

    Responses incorporated into Section 2 of this report.

3. Are there any anticipated wastewater infrastructure projects that are not included in your current LWMP?

	Response Percent	Response Count
Yes	62.5%	5
No	37.5%	3
If "Yes" please list these projects and projected costs		5
answered question		8
skipped question		0

4. Are there existing "old developments" (pre-1977) in your area that are not currently connected to a community sewer line? *Details provided in Section 2 of this report.*

4. Are there existing "old developments" (pre-1977)in your area that are not currently connected to a community sewer line?	Response Percent	Response Count
Yes	75.0%	6
No	25.0%	2
If "Yes" please list the areas in order of need based on community health and local water quality concerns		5
answered question		8
skipped question		0

5. What type of wastewater treatment technology is currently in use in your area?

   Details provided in Section 2 of this report and combined with #6 below.

6. What type of effluent discharge is in use in your area?

   City of Armstrong – *aerated lagoons and spray irrigation*
   Township of Spallumcheen – *n/a*
   District of Coldstream - *septic fields, and connected to City of Vernon's BNR treatment plant with discharge by spray irrigation*
   City of Kelowna – *BNR and lake discharge*
   City District of Summerland – *BNR, on site holding tanks and lake discharge*
   City of Penticton – *BNR and river discharge and irrigation of parks, golf course, WWTP site*
   Town of Oliver – *aerated lagoons and spray irrigation and reclaimed water reuse*
   Town of Osoyoos – *aerated lagoons and spray irrigation*
   District of Peachland – BNR and lake discharge

7. Please describe any significant gaps in your LWMP that you feel should be addressed at this time.

   City of Armstrong (no response)
   Township of Spallumcheen (no response)
   District of Coldstream – *being updated in 2008/09*
   City of Kelowna – *effluent re-use requirements in our O.C are presently hindering our ability to use our effluent to a good secondary purpose*
   District of Summerland – *some areas were skipped due to high costs*
   City of Penticton – *oxbow discharges into Okanagan River and Skaha Lake*
   Town of Oliver - *addition of effluent from Vincorp will likely affect the timelines projected in the plan as they will reach capacity sooner*.
   Town of Osoyoos (no response)
   District of Peachland – *any shortfalls addressed through development*

8. Please describe any health, environmental or operational concerns for your area.

City of Armstrong (no response)
Township of Spallumcheen (no response)
District of Coldstream – *old developed lots may need sewer as tile fields begin to fail, impact on local health as well as quality of Coldstream creek.*
City of Kelowna (no response)
District of Summerland - *no concerns, in fact there have been big improvements made. The trout hatchery now sees a reduction in flows to the creek and it is expected that this is due to no more septage leaching.*
City of Penticton – *stormwater discharges into the OK & Skaha lakes, oxbows discharges into OK River, development along east & west benches that use septic systems*
Town of Oliver (no response)
Town of Osoyoos - *nutrient loading, water quality in Osoyoos Lake. There are areas outside town boundaries that should be connected to sewer but politics is preventing this from happening.*
District of Peachland – *no improvement since sewer installed*

9. Please tick off the methods used by your municipality to offset wastewater infrastructure costs incurred by new development.

9. Please tick off the methods used by your municipality to offset wastewater infrastructure costs incurred by new development. Tick all that apply.

	Response Percent	Response Count
Development Agreements	42.9%	3
Development Cost Charges (DCC's)	100.0%	7
Latecomer Bylaws	71.4%	5
Development Contracts	0.0%	0
Other (please specify)		2
answered question		7
skipped question		1

10. Please rate the following wastewater issues in order of importance as they affect your local area with 1 being of highest importance and 4 being of lowest

importance.

10. Please rate the following wastewater issues in order of importance as they affect your local area with 1 being of highest importance and 4 being of lowest importance.						
	1	2	3	4	Rating Average	Response Count
Keeping pace with rapid urban growth	71.4% (5)	0.0% (0)	14.3% (1)	14.3% (1)	1.71	7
Phosphorus reduction	42.9% (3)	42.9% (3)	0.0% (0)	14.3% (1)	1.86	7
Upgrading plants to deal with endocrine disruptors	0.0% (0)	40.0% (2)	20.0% (1)	40.0% (2)	3.00	5
Water conservation through wastewater reuse programs	14.3% (1)	57.1% (4)	14.3% (1)	14.3% (1)	2.29	7
Public perception	16.7% (1)	33.3% (2)	33.3% (2)	16.7% (1)	2.50	6
					Other issues which you feel should be included here	2
					answered question	8
					skipped question	0

11. Please rate the following wastewater issues in order of importance for the whole Okanagan Basin with 1 being of highest importance and 4 being of lowest importance.

11. Please rate the following wastewater issues in order of importance for the whole Okanagan Basin with 1 being of highest importance and 4 being of lowest importance.						
	1	2	3	4	Rating Average	Response Count
Keeping pace rapid urban growth	62.5% (5)	12.5% (1)	25.0% (2)	0.0% (0)	1.63	8
Phosphorus removal	25.0% (2)	50.0% (4)	25.0% (2)	0.0% (0)	2.00	8
Upgrading sewage treatment plants to treat for endocrine disruptors	0.0% (0)	33.3% (1)	0.0% (0)	66.7% (2)	3.33	3
Water conservation through wastewater reuse programs	16.7% (1)	33.3% (2)	33.3% (2)	16.7% (1)	2.50	6
Public perception	0.0% (0)	0.0% (0)	0.0% (0)	100.0% (2)	4.00	2
					Other issues which you feel should be included here	0
					answered question	8
					skipped question	0

12. In your opinion, what type of tertiary treatment technology should be used as the benchmark for wastewater polishing in the Okanagan Basin?

City of Armstrong (no response)
Township of Spallumcheen - *tertiary*
District of Coldstream - *BNR*
City of Kelowna - *BNR*
District of Summerland - *BNR*
City of Penticton - *BNR*
Town of Oliver - *BNR for centres that use deep lake discharge, if spray irrigation used then secondary is fine*
Town of Osoyoos – *BNR for deepwater outfall areas*

13. Are you dealing with any significant public perception issues with respect to wastewater management? Please describe:

City of Armstrong – *spray irrigation – perception that treated effluent is harmful to the farmland, yet farmers will spray raw pig waste slurry, some public education would be helpful*
Township of Spallumcheen (no response)
District of Coldstream – *cost sharing with new development*
City of Kelowna (no response)
District of Summerland - *reclaimed water use is not popular*
City of Penticton (no response)
Town of Oliver - *no*
Town of Osoyoos – *used to be an issue but not anymore*

Appendix D – WATER QUALITY REGULATIONS AND STANDARDS

Schedule 2

[am. B.C. Reg. 321/2004, s. 31 (z) to (cc).]

Permitted Uses and Standards for Reclaimed Water

(Section 10 of this Regulation)

Reclaimed Water Category and Permitted Uses (1)	Treatment Requirements (2)	Effluent Quality Requirements (3)	Monitoring Requirements (5)
UNRESTRICTED PUBLIC ACCESS			
URBAN - Parks (6) - Playgrounds - Cemeteries - Golf Courses (6) - Road Rights-of-Way - School Grounds (6) - Residential Lawns - Greenbelts - Vehicle and Driveway Washing - Landscaping around Buildings - Toilet Flushing - Outside Landscape Fountains - Outside Fire Protection - Street Cleanings AGRICULTURAL - Aquaculture - Food Crops Eaten Raw - Orchards and Vineyards - Pasture (no lag time for animal grazing) - Frost Protection (17), Crop Cooling and Chemical Spraying on crops eaten raw - Seed Crops RECREATIONAL (18) - Stream Augmentation - Impoundments for Boating and Fishing - Snow Making for Skiing and Snowboarding	Secondary (7) Chemical Addition (8) Filtration (4) Disinfection (9) Emergency Storage (2)	pH = 6 - 9 ≤ 10 mg/L BOD_5 ≤ 2 NTU (10) number of fecal coliform organisms ≤ 2.2/100 mL (11) (12) General (13) (14) (15)	pH - weekly BOD - weekly Turbidity - continuous Coliform (16) - daily
RESTRICTED PUBLIC ACCESS			
AGRICULTURAL - Commercially processed food crops (19) - Fodder, Fibre - Pasture (20) - Silviculture - Nurseries - Sod Farms - Spring Frost Protection (17) - Chemical Spray - Trickle/Drip Irrigation of Orchards and Vineyards URBAN/RECREATIONAL (18) - Landscape Impoundments - Landscape Waterfalls - Snow Making not for Skiing and Snowboarding CONSTRUCTION - Soil Compaction - Dust Control - Aggregate Washing - Making Concrete - Equipment Washdown INDUSTRIAL (24) - Cooling Towers - Process Water - Stack Scrubbing - Boiler Feed ENVIRONMENTAL (18) - Wetlands (25)	Secondary (7) Disinfection (9)	pH = 6 - 9 ≤ 45 mg/L BOD_5 ≤ 45 mg/L TSS (26) number of fecal coliform organisms ≤ 200/100 mL (11)(21)(22) General (14)(23)	pH - weekly BOD - weekly TSS - daily Coliform - weekly

Numeric values in parentheses refer to numbered explanations in the explanatory notes, Appendix 1 to Schedule 2. ≤ means less than or equal to ≥ means greater than or equal to
> means greater than

Appendix 1 to Schedule 2

Explanatory Notes

1. The type of reclaimed water use permitted must be one of those indicated on this Schedule. Other proposed types of reclaimed water use will be assessed by the director on an individual basis and must, in consultation with the Ministry of Health Services, be approved in writing by the director.

2. Reliability must be provided for all treatment processes as set out in Schedule 7. For the unrestricted public access category, emergency storage must satisfy the requirements of section 10 of this regulation.

3. Effluent quality limits must be calculated as running mean values and apply to the reclaimed water at the point of discharge from the treatment facility or, if storage is provided, at the point of distribution or use.

4. Sixty day storage after secondary treatment is acceptable in lieu of filtration provided the final effluent quality requirements are met and the discharger demonstrates to the satisfaction of a director that no short circuiting is occurring or likely to occur and that no viruses at levels of concern to local health authorities are detected in the reclaimed water.

5. Subject to Note 1 Appendix 1 to Schedule 6, these requirements take precedence over the requirements of Schedule 6.

6. Remote areas of parks, school grounds during vacation periods, and golf courses may be considered under the restricted public access category, provided: a minimum of 60 days storage is provided; the discharger demonstrates to the satisfaction of a director that access is controlled, that environmental concerns are addressed and that any concerns of the local health authorities are resolved; and, the director, in consultation with the local health authorities, approves the use in writing.

7. Secondary treatment as defined by section 1 of this regulation.

8. Chemical addition includes coagulant or polymer prior to filtration. Use is restricted to those coagulants and polymers shown to be non-toxic.

9. For distribution of reclaimed water, the discharger must ensure that minimum total chlorine residual of 0.5 mg/L is maintained at the point of initial use. This requirement may be waived by a director, provided the discharger demonstrates, to the satisfaction of the director and local health authorities, that fecal coliforms remain below levels prescribed by this Schedule

at the point of use and that the users are adequately informed regarding appropriate use of the reclaimed water.

10. Turbidity limit must be met prior to disinfection. The average turbidity must be based on a 24-hour time period. The turbidity must not exceed 5 NTU at any time. If TSS is used in lieu of turbidity, the average TSS must not exceed 5 mg/L.

11. The median value, as determined from the bacteriological results of the last 7 samples for which analyses have been completed, must not exceed the coliform limits specified.

12. For unrestricted public access use, the number of fecal coliform organisms must not exceed 14/100 mL in any sample.

13. The reclaimed water provider must demonstrate that reclaimed water does not contain pathogens or parasites at levels which are a concern to local health authorities. Reclaimed water must be clean, odourless, non-irritating to skin and eyes and must contain no substances that are toxic on ingestion.

14. Where available agricultural (crop) limits must govern criteria for metals. High nutrient levels may adversely affect some crops during certain growth stages. Crop limits and season must govern nutrient application.

15. The reclaimed water provider must obtain monitoring results, and confirm that water quality requirements are met, prior to distribution.

16. Based on an initial 60 days of compliance with the quality limit, the discharger must conduct weekly presence or absence testing for coliform monitoring. If presence of any coliform is detected daily fecal coliform testing must be reinstated until the quality limit is in compliance. Fourteen tests must be conducted to demonstrate that the discharge is back in compliance and then weekly presence/absence testing must be resumed.

17. Discharger must consult with the Ministry of Agriculture, Food and Fisheries regarding the difference between spraying for frost protection and spring frost protection techniques.

18. If chlorine is used as a disinfectant then dechlorination is necessary to protect aquatic species of flora and fauna. The use of alternative disinfection methods is recommended. Possible effects on groundwater must be evaluated. Receiving water quality requirements may necessitate additional treatment. The temperature of the reclaimed water must not adversely affect the ecosystem. Nutrient removal may be necessary to limit algae growth in impoundments.

19. Commercially processed food crops are those that, prior to sale to the public or others, have undergone chemical or physical processing such as, but not limited to, canning, heat treatment, fermentation and pickling, sufficient to destroy pathogens.

20. Milking animals must be prohibited from grazing for 6 days after irrigation ceases. Other cattle must be prohibited from grazing for 3 days after irrigation ceases unless the meat is inspected under the Federal Meat Inspection Program.

21. For restricted public access use, the number of fecal coliform organisms must not exceed 800/100 mL in any sample.

22. Worker contact with reclaimed water must be minimized. A higher level of disinfection to achieve the number of fecal coliform organisms < 14/100 mL must be provided where frequent worker contact with reclaimed water is likely.

23. Setback distance to potable water well must be > 30 m. A provider of reclaimed water must ensure that windblown spray will not exceed the boundaries of the property to which the reclaimed water is being applied and that windblown spray must not reach areas accessible to the public.

24. A provider of reclaimed water must consult specific industry's recommended water quality limits for make-up water.

25. Notwithstanding note 21, for wetlands where no diving, swimming, or wading activities occur, the number of fecal coliform organisms must not exceed 1 000/100 mL as determined in accordance with note 11 to this Appendix and the number of fecal coliform organisms must not exceed 4 000/100 mL in any sample.

26. For lagoon systems, the maximum TSS level must not exceed 60 mg/L.

Schedule 3

[am. B.C. Reg. 321/2004, s. 31 (dd) and (ee).]

Standards for Discharges to Water

(Section 11 of this Regulation)

Portion of Effluent Being Discharged	**Receiving Water (1)(5)(6)**					**Parameter**
	Streams, Rivers & Estuaries with Dilution Ratio (2)			*Marine*		
	Column A ≥40:1 (3)	***Column B*** ≥10:1 (3)	***Column C*** Lakes (surface area ≥ 100 ha)(7)	***Column D*** Open Marine Waters	***Column E*** Embayed Marine Waters	***Column F***
	Maximum Daily Flow ≥ 50 m^3/d					
Treatment requirement for daily flows up to 2.0 times ADWF	Secondary	High Quality Secondary	Secondary	Secondary	Secondary	
Effluent Quality for daily flows up to 2.0 times ADWF (4)	45	10	45	45	45	BOD_5, mg/L
	45	10	45	45	45	TSS, mg/L (13)
	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0	pH
	(8) (11)	(8) (11)	(8) (11)	(8) (11)	(8) (11)	Disinfection, Coliforms
	1.0 (10)	1.0 (10)	1.0 (10)	—	1.0 (10)	Total phosphorus (P), mg/L
	0.5 (10)	0.5 (10)	0.5 (10)	—	0.5 (10)	Ortho phosphate as (P), mg/L
	(12)	(12)	(12)	(12)	(12)	Ammonia
Interim Treatment requirement for daily flows greater than 2.0 times ADWF (4)	Primary	High Quality Secondary	Primary	Primary	Primary	
Interim Effluent quality for daily flows greater than 2.0 times ADWF (4)	130	10	130	130	130	BOD_5, mg/L
	130	10	130	130	130	TSS, mg/L
	(8) (11)	(8) (11)	(8) (11)	(8) (11)	(8) (11)	Disinfection,

						Coliforms
	(12)	(12)	(12)	(12)	(12)	Ammonia
Maximum Daily Flow <50 m^3/d and $\geq$10 m^3/d						
Treatment requirement	Secondary	High Quality Secondary	Secondary	Primary	Secondary	
Effluent quality for all flows	45	10	45	130	45	BOD_5, mg/L
	45	10	45	130	45	TSS, mg/L (13)
	(8) (11)	(8) (11)	(8) (11)	(8) (11)	(8) (11)	Disinfection, Coliforms
Maximum Daily Flow < 10 m^3/d						
Treatment requirements	Secondary	High Quality Secondary	Secondary	Septic Tank (9)	Septic Tank (9)	
Effluent quality for all flows	45	10	45	—	—	BOD_5, mg/L
	45	10	45	—	—	TSS, mg/L (13)
	(8) (11)	(8) (11)	(8) (11)	—	—	Disinfection, Coliforms

Numeric values in parentheses refer to numbered explanations in the explanatory notes, Appendix 1 to Schedule 3. < means less than $\leq$ means less than or equal to $\geq$ means greater than or equal to

Appendix 1 to Schedule 3

Explanatory Notes

1. Effluent quality standards for all receiving water discharges are based on the use of an outfall which provides a combination of depth and distance to produce a minimum 10:1 initial dilution within the initial dilution zone.

2. For estuaries, the stream flow is the fresh water content.

3. If the dilution ratio is less than 100:1 the environmental impact study must determine if effluent quality needs to be better than that shown in Schedule 3. If the dilution ratio is below 40:1 and the receiving stream is used for recreational or domestic water extraction within the influence of the discharge or for seasonal discharge, discharge is not authorized unless an environmental impact study shows that the discharge is acceptable, and, in the opinion of a director, no other solutions are available and written authorization from the director is obtained. For seasonal discharges or where the receiving stream is not used for

recreational or domestic water extraction, the director may in writing authorize a minimum dilution ratio of 20:1 for column A.

4. Treatment and effluent quality requirements are determined by daily flow multiples which require secondary treatment for all flows up to and equaling 2.0 times the ADWF. As set out in condition 17 to Schedule 1, a liquid waste management plan or specific study and implemented measures are required if flows exceed 2.0 times ADWF during a storm or equivalent snowmelt event with a less than 5-year return period. In the interim, if flows exceed 2.0 times ADWF, a lesser standard of treatment may be allowed for existing discharges, but must not be less than primary. For areas of the province where permafrost or freezing ground conditions require, in accordance with a practice approved by the local building inspector or equivalent, connection of roof drains to the sanitary sewer system, a director may, in writing, increase the factor from 2.0 times to a maximum of 3.0 times.

5. All outfalls must be marked on shore with an appropriate sign. Information required is the length and depth of the outfall. The minimum size of the sign is 1.0 m^2 and the colours of the lettering and the background must be of sufficient contrast that the wording is clearly visible. The wording on the sign must be to the satisfaction of a director.

6. The discharger must also ensure that requirements of Schedule 5 are met, if applicable.

7. See requirements of Schedule 5.

8. The allowable number of fecal coliform organisms in the effluent is dependent on the use of the receiving water. For discharges to shellfish bearing waters the number of fecal coliform organisms outside the initial dilution zone must be less than 14/100 mL ("the median number of fecal coliform organisms in a water sample does not exceed 14/100 mL, with not more than 10% of the samples exceeding 43/100 mL", from "Canadian Shellfish Sanitation Program, Manual of Operations"). For discharges to recreational use waters the number of fecal coliform organisms outside the initial dilution zone must be less than 200/100 mL. Where domestic water extraction occurs within 300 meters of a discharge the median number of fecal coliform organisms must be less than 2.2/100 mL in the effluent with no sample exceeding 14/100 mL. The geometric mean, as determined from the bacteriological results of the last 5 samples for which analyses have been completed over the last 30 days, must not exceed the coliform limits specified, and for this purpose, **"geometric mean"** means the anti-logarithm of a calculation in which the logarithms of a series of numerical measures are summed and divided by the number of numerical measures.

9. Septic tank treatment requires a hydraulic capacity of at least 2 days minimum detention time at the design maximum daily flow. An effluent filter, screen or equivalent measures to protect pumps and prevent discharge of solids and floatables is required. For small, remote, seasonal discharges a director may waive the requirement for an effluent filter.

10. The total and ortho phosphorus criteria may be waived, by a director in writing, if it can be shown by an environmental impact study that receiving waters would not be subject to an undesirable degree of increased biological activity because of the phosphorus addition. Alternatively, an environmental impact study may show that lower effluent concentrations than are tabulated are necessary, or that a mass load criteria may be needed.

11. If required to satisfy section 8 of this regulation.

12. The maximum allowable effluent ammonia concentration at the "end of pipe" must be determined from a back calculation from the edge of the initial dilution zone. The back calculation must consider the ambient temperature and pH characteristics of the receiving water and known water quality guidelines.

13. For lagoon systems, the maximum TSS level must not exceed 60 mg/L.

Appendix E –SUMMARIES OF ORIGINAL WASTEWATER MANAGEMENT PLANS

Included here for reference are summaries of the original wastewater management plans adopted by valley municipalities and regional districts between 1985 and 1999. In many cases these include historic cost projections. All dollar values were current at the time each plan was written.

Township of Spallumcheen Liquid Waste Management Plan – 1999

All wastewater was treated by individual septic tanks with disposal to tile fields. The Township completed Stage 2 of its wastewater management plan but opted not to proceed to Stage 3. Priority concern areas were identified based on phosphorus loading and health issues. Each of the areas listed below were investigated in detail:

- Riverside Forest Products/UDY subdivision/Mobile Home Parks – This area represented the highest priority in terms of both phosphorus loading and health. The total phosphorus transmission to Okanagan Lake was estimated at 131 kb/yr or 40% of the total area contribution;
- Stepping Stones – This was the second highest phosphorus loading area at 26 kg/yr;
- Eagle Rock – This area had a total phosphorus loading of 20 kg/yr. Some concerns over hydraulic failures were also noted;
- McLeery/McLeod Subdivisions– These two areas had low phosphorus loadings (in fact, McLeery drains into the Shuswap Basin), however, concerns over failing septic systems were noted.

The three main options to address these concerns were identified as: construction of a new sewage treatment facility in Spallumcheen, connection of the Spallumcheen sewage collection system to the Armstrong treatment facilities, or no new treatment facilities combined with strict land use management.

City of Armstrong Liquid Waste Management Plan – 1987

At the time of its wastewater management plan, the City of Armstrong was collecting 100% of its wastewater for treatment in an aerated lagoon. The treatment facility included phosphorus removal via alum addition, and chlorine disinfection prior to discharge to Deep Creek.

Average effluent characteristics were as follows:

- Biological Oxygen Demand (BOD) 25-30
- Total Suspended Solids (TSS) 30 mg/L
- Phosphorus (P) 4 mg/L

The rated capacity of the facility was 1,950 $m^{3/d}$ with 1987 flows at 1,400 $m^{3/d}$. The primary concerns were lack of dilution in Deep Creek, and high phosphorus loading to Okanagan Lake (2,431 kg/yr in 1984). The Wastewater Management Plan evaluated various options to address the above concerns and also to deal with Armstrong and Spallumcheen growth. In this regard, design horizons were identified as shown in Table E.1.

Table E.1 - Armstrong Design Criteria

	Total Population				
Year	**Armstrong**	**Spallumcheen**	**Total**	**Total Flow (m^3/day)**	**Projected Plant Capacity (m^2/day)**
1986	2,900	0	2,900	1,400	---
2006	4,300	1,000	5,300	2,420	2,840
2026	6,400	1,500	7,900	3,530	4,130

As shown, the Armstrong plan allowed for a total contribution by 1,500 persons from Spallumcheen. The options considered included various combinations of treatment plant upgrading, creek disposal and effluent irrigation. The recommended option was to incorporate effluent storage with spray irrigation designed for an average precipitation year. This option required supplemental fresh water to satisfy irrigation demands in a dry year, and discharge to Deep Creek in wet years. The total capital cost of this option was estimated at $3,800,000 for the 2006 design horizon. The total irrigation area required was calculated at 200 hectares in 1986 and 350 ha in 2006. Concept 12 is the accepted means of disposal (spray irrigation) in Armstrong.

City of Vernon Liquid Waste Management Plan – 1985

In 1985, the City of Vernon sewage system served the developed areas within the City boundaries as well as the core developed area of the District of Coldstream. In 1983, flows were calculated at 10300 $m^{3/d}$ serving an estimated sewered population of 24,600 persons.

Prior to completion of the waste management plan, the treatment facility included primary clarifiers, trickling filters, final clarifiers, sludge digesters and effluent irrigation works. The facility also included an emergency outfall to Vernon Creek. The rated capacity of the plant was 18,200 $m^{3/d}$ although a number of components were in need of replacement or improvement. Other plant problems included treatment capacity limitations, lack of phosphorus removal in the event that the lake outfall was used and an inadequate land base for total effluent disposal by irrigation. Chemical phosphorus removal facilities were subsequently added to provide additional effluent treatment in the event discharge to Vernon Creek was required.

Future growth allowances included additional input from Coldstream, as well as from Areas A, B, C are shown in Table E.2.

Table E.2 – City of Vernon Population Growth Areas

	Sewered Population		
Area	**1981**	**2001**	**2021**
Vernon	20,000	44,600	-
Coldstream	3,200	6,300	-
Area A	-	1,300	-
Area B	-	1,200	-
Area C	-	2,900	-
Total	23,200	54,300	90,000

The options evaluated included upgrading the existing plant, constructing a new advanced wastewater treatment plant, continued irrigation in Commonage Area and lake disposal. The recommended option was to continue to irrigate the commonage to its maximum capacity, update the existing plant to serve 40,000 people, provide tertiary treatment prior to creek discharge, and to add a deep lake outfall. The plan also recommended the construction of a Biological Nutrient Removal (BNR) facility to serve a population of 60,000 by 1995. Total capital costs were estimated at $55,000,000 as detailed in Table E.3.

Table E.3 – City of Vernon Capital Programs

Year	Capital Cost $
1985-1987	10,165,000
1987	1,241,000
1992	26,290,000
1993	1,670,000
2002	10,910,000
2011	4,650,000

In addition to the costs listed above, $11,860,000 was estimated for trunk sewers to service Silver Star, Turtle Mountain, Northeast Commonage and City infilling by 2001.

District of Coldstream Wastewater Management Plan – 1994

In 1994 approximately 50% of the District was sewered with flows discharging to the City of Vernon system. All of the Kalamalka area was serviced by sewers along with the majority of Middleton Mountain.

Table E.4 - District of Coldstream – Phosphorus Loading

Area	Population	Phosphorus to Lake (kg/yr)
Middleton Mountain	36	2
Coldstream Centre	762	55
Buchanan	261	35
Coldstream East	825	82
Lavington West	534	107
Lavington	840	266

Table E.5 - District of Coldstream Area Growth

Year	Total Population	Sewered Population
1991	7,590	3,920
2011	11,600	6,600
2031	17,200	12,700

As shown, the sewered fraction was expected to increase from 50% to almost 75% by the year 2031. Sewering was expected to include infilling in Kalamalka and Middleton Mountain, followed by sewer extension to Coldstream Centre and the western portion of Buchanan. The remainder of the District was expected to remain with on-site septic systems.

The two options for treatment and disposal evaluated in the plan were to continue discharging to the Vernon system or to construct a new secondary facility with disposal by effluent irrigation in Coldstream. The latter option assumed all discharge to the Vernon system would cease. Continued discharge to Vernon was recommended as the preferred option. No capital costs were associated with this option whereas a new facility was estimated at $12,500,000.

In terms of phosphorus removal, only 2 kg/yr would be removed by 2011 (i.e based on existing loadings to the lake). By 2031, all loading from Coldstream Centre would be removed (55 kg/yr existing) along with some reduction of current loadings from Buchanan.

<u>District of Lake Country Liquid Waste Management Plan – 1990</u>

The wastewater management planning area was divided into six subareas: Oyama-North, Oyama-East, Carrs Landing, Okanagan Centre, Winfield, and Ellison Lake. The total population was estimated to be 7,250 in 1985 and projected to be 15,294 by 2008. The total phosphorus loading to the lake was determined to be 1,625 kg/yr in 1985.

Table E.6 – Regional District of Central Okanagan (Winfield/Oyama) – Phosphorus Loading

Area	Equivalent Population	Phosphorus to Lake (kg/yr)
Oyama-North	1,111	323
Oyama-East	720	64
Carrs Landing	564	144
Okanagan Centre	1,321	229
Winfield	3,121	676
Ellison Lake	709	189

Six options were evaluated in the plan:

- Regional sewerage system
- Lake disposal
- Effluent irrigation
- Combined irrigation/lake disposal
- Small scale community land disposal
- Enhanced on-site disposal/land use control.

The first option involved connection to the City of Kelowna system while the next three options assumed a new full scale facility for the entire area. The fifth option addressed only the priority areas and Option 6 assumed continued use of septic disposal systems.

The fifth option, small scale community land disposal, was recommended at a total capital cost of $8,100,000. The cost of the sewage collection component was $6,000,000. The concept included a community sewer system for the south shore of Wood Lake and the Clearwater subdivision in east Winfield. The total design population of the system was 3,470. The option also included enhanced on-site systems for Oyama, Carrs Landing, Okanagan Centre and Vernon Creek. The treatment component was based on aerated lagoons with disposal by rapid infiltration. In 1998 a decision was made to implement Option 5, however the decision also involved going beyond the recommended treatment and a BNR plant was constructed.

With over 50 percent of the Winfield area sewered by 2010 the total phosphorus reduction achieved would be an estimated 1,034 kg/yr.

City of Kelowna Wastewater Management Plan – 1990

The LWMP divides the City of Kelowna into six sectors. The associated phosphorus contribution to the lake is outlined in Table E.7. The total of 4,350 kg/yr represents the loading from on-site systems only and does not include the loading from the existing treatment plant.

Table E.7 – City of Kelowna – Phosphorus Loading

Sector	Population	Phosphorus Loading (kg/yr)
Central	1,960	835
Rutland	7,010	931
Belgo/Black Mountain	4,170	392
Southeast Kelowna	3,450	386
Okanagan Mission	7,010	1,643
Glenmore/McKinlay	1,830	163

The existing treatment plant served an estimated population of 39,000 persons or about 60% of the total area population. The facility incorporated biological nutrient removal technology and consistently achieved a very high quality effluent. At the time of the WMP, effluent phosphorus concentrations were consistently below 0.4 mg/L. Although the facility was rated at 22.5 ML/d, it was determined that the actual capacity could be as high as 30-35 ML/d.

The WMP also examined the condition and capacity of the existing trunk sewer system and outfall to Okanagan Lake. The trunk sewer conditions were generally identified as good but the outfall was determined to be undersized. In addition, an evaluation of the Brandt's Creek trade waste treatment plant was conducted. This extended aeration facility discharged effluent to Brandt's Creek; possible connection to the City sewer system was discussed.

The WMP considered an extension of the sewerage boundary on a prioritized approach based on existing problems as follows:

- Mission Flats
- Henkel/Scenic Road
- Belgo/Black Mountain
- Belgo/Molnar Road
- Poplar Point

Other areas considered for sewer extensions included St. Armand/Fisher Road, Hall Road, North Rutland and South Rutland. The first group of areas were proposed to be sewered between 1990-1993 along with new development in the Glenmore Valley and Clifton Road. The second group of areas would be sewered between 1994 – 2000. Additional sewer extensions were detailed for 2001-2030.

The total cost of sewering the Group One areas was estimated at $18,322,000 including treatment and disposal, as defined in Table E.8(a).

Table E.8(a) – City of Kelowna - Total Capital Cost of Sewering Group One Areas

Area	Total Capital Cost $
Mission Flats	9,140,000
Henkel/Scenic Road	726,000
Belgo/Black Mountain	7,266,000
Belgo/Molnar Road	279,000
Poplar Point	951,000

In order to deal with increasing flows, a treatment plant expansion program was developed according to the schedule shown in Table E.8(b).

Table E.8(b) – City of Kelowna - Area Growth

Year	Sewered Population	Total Population
1990	43,000	71,500
2000	66,000	100,700
2010	98,000	134,000
2020	136,000	171,000
2030	185,000	220,000

Three options were evaluated in detail: Lake Disposal, Lake Disposal/Effluent Irrigation, and Rapid Infiltration/Effluent Irrigation. The second option was recommended at a total cost of $71,200,000 (Table E.8(c)). Treatment plant expansion was broken down into three stages as follows:

- Stage 1 – 75,000 person capacity; 1993
- Stage 2 – 150,000 person capacity; 2003
- Stage 3 – 225,000 person capacity; 2023

Table E.8(c) – City of Kelowna – Capital Programs

Year	Capital Cost $
1991	1,500,000
1992	2,600,000
1993	10,400,000
1994	2,300,000
1996	2,000,000
2000	2,100,000
2003	48,100,000
2005	2,200,000

Implementation of the Effluent Irrigation System was scheduled for 1996. Outfall replacement was planned for 1992.

Westbank Liquid Waste Management Plan – 1985

The Stage 1 document focused primarily on the upgrading of the existing aerated lagoon facility. At the time of the WMP, the population of the sewered areas was 1600 persons. Upgrading options were based on the following staging concept:

- Stage 1 (treatment facility/outfall) 3,500 persons
- Stage 2 (addition to treatment facility) 7,000 persons
- Potential 11,000 persons

Options evaluated included advanced treatment and discharge to Okanagan Lake (new mechanical facility with biological or chemical nutrient removal, or advanced lagoon facility with chemical nutrient removal) and ground infiltration. Based on a comprehensive review of the options, a biological nutrient removal facility (Bardenpho) was selected as the preferred option. The total capital cost of the facility was estimated at $2,100,000 and subsequently updated to $2,590,000.

RDCO Electoral Areas G, H (District of Westside) Liquid Waste Management Plan - 1991

Approximately 87% (16,000 people) of the area population was serviced by individual on-site septic systems. It was estimated that 10% (2,000 people) were connected to the Westbank sewerage system and that the remainder were serviced by small systems operated under Waste Management Branch permits.

Table E.9 – Regional District of Central Okanagan (Areas G, H) – Priority Groups identified based on Phosphorus Loading (kg/yr)

Priority Group	Population	Phosphorus Loading (kg/yr)
Group 1		
Whitworth Road	200	140
Pritchard Road	450	250
Green Bay	270	162
Casa Loma	350	98
Hitchner Road	54*	30
West Kelowna Estates	1,020	30
Sunnyside	350	8
Sunnyview	600	12
Group 2		
Lakeview	500	8
Collens Hill	162*	4

Trevor Drive	200	25
Lower Glenrosa	600	40
Group 3		
Ponderosa Road	450	12
McCartney Road	250	7
Boucherie Road	400	12
Witt Road	300	7
Elliot Road	180	5
Gellatly/Angus Road	105*	2
North Thacker	600	15

*Note: Based on 3 people per lot.

Each area was evaluated on possible connection to the Westbank system, a new small community system or individual on-site systems. Details were provided on possible sewer alignments as well as trunk sewer requirements. Westbank Treatment Plant upgrading requirements were also addressed in some detail. It was recommended that all Priority 1 areas, including West Kelowna Estates, be connected to the Westbank facility. Similarly, it was recommended that all Priority 2 and 3 areas also be connected to the Westbank facility. In terms of implementation, it was recommended that all Priority 1 areas be serviced by 1997, Priority 2 areas between 1995 and 2005, and Priority 3 areas between 2000 and 2010.

To accommodate the increased load, a three stage treatment plant expansion program was proposed.

Table E.10 – Estimated Costs for Westbank Treatment Plant Expansion Program

Module	Year	Capital Cost
2	1991	$ 2,000,000
3	1995	4,000,000
4	2002	8,000,000
		$ 14,000,000

Trunk sewer costs were estimated as follows:

- East Trunk – Phase 2 $ 600,000
- West Kelowna Estates Trunk 700,000
- Casa Loma Trunk 1,500,000
- Glenrosa Trunk 1,150,000

$ 3,950,000

The trunk costs were apportioned according to the number of priority lots served. Treatment plant costs were determined at $1,700/lot.

Table E.11 – Regional District of Central Okanagan (Areas G, H) – Projected Cost Estimates

Priority Group	No. Lots	Average Cost/Lot $	Total Cost $
Group 1	1,293	9,030	11,675,136
Group 2	480	7,860	3,773,900
Group 3	883	7,250	6,405,010
			21,854,046

District of Peachland Liquid Waste Management Plan – 1992

Six subareas described in Table E.11 were identified in the wastewater management plan based on phosphorus loading.

Table E.12 – District of Peachland Subareas Based on Phosphorus Loading

Area	Phosphorus to Lake (kg/yr)	No. Lots
Downtown	419	294
South of Downtown	156	124
Antlers Beach	149	50
North of Downtown	53	56
North End of DOP	1	-
South of DOP	7	-

All areas in Peachland were serviced by individual on-site septic systems. The WMP looked at three options to address the environmental concerns: pumping to Westbank, two small plants for downtown and Antlers Beach, and one main plant located near Trepanier Creek. The recommended option was to connect to Westbank. The total cost of the project was estimated at $7,726,000 broken down into two phases as follows:

Phase 1 - $5,768,000 (Downtown & North of Downtown)
Phase 2 - $1,958,000 (South of Downtown and Antlers Beach)

Included in the evaluation was the impact of the proposed 400 unit Pincushion Ridge Development. Phase 1, therefore, would serve 360 existing lots (Downtown, 1st Avenue, North of Downtown and along forcemain) and 400 from Pincushion. Phase 2 would serve 174 existing lots from South of Downtown and Antlers Beach. A breakdown of the costs is presented in Table E.13 below.

Table E.13 – District of Peachland – Project Cost Estimates

Phase	Collection $	Costs Trunks & Forcemains $	Total $
1	2,268,000	3,500,000	5,768,000
2	925,000	1,033,000	1,958,000
Total	3,193,000	4,533,000	7,726,000

District of Summerland Wastewater Management Plan – 1991

Existing wastewater management in District at the time of the plan was through individual on-site septic systems.

Table E.14 – District of Summerland – Subareas based on Phosphorus Loading

Area	Population	Phosphorus Loading (kg/yr)
Lower Trout Creek	555	335
Upper Trout Creek	214	83
Paradise Valley/S.W. Summerland	405	36
Front Bench	778	118
Prairie Valley	400	9
Town Centre	3,600	550
Lower Town/Peach Orchard Road	970	242
Crescent Beach/Highway 97	480	230
Garnett Valley	345	147
Cartwright Mountain/N. Prairie Valley	23	4

The priority areas were determined to be:

- Lower/Upper Trout Creek
- Town Centre
- Lower Town/Peach Orchard Road
- Crescent Beach
- Garnett Valley

Front Beach, Prairie Valley and Cartwright Mountain were considered to be of secondary importance.

Seven options were investigated: regional sewerage system (i.e. connection to Penticton), lake disposal, effluent irrigation, land disposal, cluster systems and enhanced on-site disposal. The options were narrowed down to the regional system or combined irrigation lake disposal. The latter option was recommended. The detailed components included a biological nutrient removal facility located in Upper or Lower Trout Creek, a deep lake outfall, and an irrigation system. The total cost of the project was estimated at $20,900,000; $13,300,000 in Phase 1 (1994) and $7,600,000 in Phase 2 (2006).

Table E.15 – District of Summerland – Project Cost Estimates

Phase	Collection $	Transmission $	Treatment & Disposal $	Total $
Phase 1	3,750,000	1,950,000	7,600,000	13,300,000
Phase 2	7,600,000	-	-	7,600,000
Total	11,350,000	1,950,000	7,600,000	20,900,000

Table E.16 - District of Summerland – Project Summary

Area	Program Timing
Lower Trout Creek	Sewer Phase 1
Upper Trout Creek	Sewer Phase 2
Paradise Valley/S.W. Summerland	Remain on-site
Front Beach	Remain on-site
Prairie Valley	Remain on-site
Town Centre	Commercial core Phase 1, Remainder Phase 2
Lower Town/Peachland Orchard Road	Lower Town Phase 1, Peach Orchard Road Phase 2
Crescent Beach/Highway 97	Crescent Beach Phase 1, Highway 97 remain on-site
Garnett Valley	Remain on-site
Cartwright Mtn./N. Prairie Valley	Remain on-site

City of Penticton Liquid Waste Management Plan – 1987

All areas within the City were serviced by community sewer system. In 1986, it was estimated that 24,000 people were connected to the system with average sewage flows of almost 9,000 $m^{3/d}$. A design value of 18,200 $m^{3/d}$ was selected and was expected to be reached by 2006.

The existing sewage treatment plant was an activated sludge process with chemical phosphorus removal and effluent discharge to Okanagan River upstream of Skaha Lake. The plant also included waste primary and secondary sludge anaerobic digesters, flow equalization, primary settling, final clarifiers and chlorine gas disinfection. The permitted capacity of the existing facility was 8,181 $m^{3/d}$. Concerns with the existing facility focused on low phosphorus removal efficiency and inadequate dilution in the Okanagan River.

In terms of plant upgrades, the primary options evaluated were:

- Discharge to Skaha Lake
- Discharge to Okanagan River
- Discharge to Okanagan River and Land Application
- Land Application to Forage Crops – White Lake; and
- Discharge to Okanagan Lake

The third option, discharge to Okanagan River and land application, was chosen with the following components:

- Fine screening
- Aerated grit removal
- Primary settling
- Biological nutrient removal
- Final settling
- Effluent filtration
- Gas chlorination
- Sludge thickening
- Anaerobic digestion
- Sludge composting
- Effluent irrigation

The total capital cost of the project was estimated at $14,468,000. This included construction of Phase 1 only (1987) which would increase capacity to 14.5 ML/d. Phase 2 was scheduled for 1992 and included expansion of the irrigation facilities. Phase 3 would expand the treatment plant to 18.2 ML/d (1997) and Phase 4 would further increase irrigation capacity (2002). The Phase 3 expansion was estimated at $6,773,000 (1997).

<u>Town of Oliver Liquid Waste Management Plan – 1992</u>

All wastewater generated in Oliver was treated at a facility located adjacent to the Okanagan River. The plant was a modified activated sludge type plant with comminution, aeration, secondary clarification, aerobic sludge digestion and sludge drying beds. The facility disposed of 100% of its effluent by spray irrigation to Fairview Golf Course. The irrigation system included flow equalization, a pumping station, a winter storage reservoir and a chlorination system. An emergency overflow to the Okanagan River was also present although it had not been used since the irrigation works were commissioned in 1984, except for a brief period in 1990. Phosphorus loadings from this discharge in 1990 are provided in Table 2.3. The permitted capacity of the plant was 1,550 $m^{3/d}$. At the time of the WMP, the average daily sewage flow was 1,250 $m^{3/d}$ (1990) based on a population of 2,050.

The WMP evaluated the existing treatment facility in detail and identified a number of deficiencies including influent pumping capacity and effluent booster pumps. The plan further evaluated the impact of possible growth areas including expanded municipal boundaries.

Table E.17 – Town of Oliver – Area Growth

Year	Population	Flow (m^3/d)	Comments
1990	2,050	1,250	Growth based on 2% per year
1995	3,020	1,750	Tugulnuit Lake serviced
2000	3,630	2,020	Sawmill Road serviced
2005	4,800	2,520	Fairview-Rockcliffe serviced
2010	5,300	2,740	--
2020	6,400	3,210	--
2030	7,800	3,800	--

Note: Includes 90 m^3/d from Indian Reserve from 1993.

The WMP evaluated expansion options based on flows for the year 2010 and 2030. The options evaluated included:

- BNR plant with Okanagan River discharge
- Expand existing facility with rapid infiltration
- Expand existing facility and alternate irrigation areas
- Phased expansion of existing facilities.

Two sub-options of the last alternative (ie: phased expansion) were then analyzed in detail in Stage 2 namely:

- Upgrade and expand existing facility
- Construct new facility at effluent reservoir site

The new facility was recommended as the preferred option for a total cost of $1,193,000. The facility was based on an aerated lagoon system with detailed components as shown in Table E.18.

Table E.18 – Town of Oliver – Project Cost Estimates

Year	Component	Cost $
1991	Upgrade influent pumps	111,000
1992	Construct aerated lagoons	972,000
1998	Expand facility	221,000
	Total to year 2010	**1,193,000**

A primary consideration in the evaluation was the desire to continue with an effluent irrigation system. The design population used was 5,300 persons (2010).

Town of Osoyoos Wastewater Management Plan – 1987

At the time of the Liquid Waste Management Plan wastewater from Osoyoos was conveyed to a treatment plant located on the Osoyoos West Bench. The facility included aerated lagoons, effluent storage, disinfection, and spray irrigation facilities on the Osoyoos Golf and Country Club. A rapid infiltration basin was also present for disposal in wet years. The capacity of the treatment plant was 2,160 $m^{3/d}$ or an equivalent population of 5,000 persons, although the permitted capacity at the time was only1,500 $m^{3/d}$. Actual flows in 1986 were measured at 1,326 $m^{3/d}$ from 3,200 people. The irrigated area included 39 ha of spray irrigation and 6.2 ha of trickle irrigation. It was determined that an area of 42 ha was required for a population of 3,000. A reserve area of about 80 ha was set aside as potentially irrigable land.

Because current treatment and disposal practices were well accepted, it was decided to concentrate the WMP efforts on expansion of existing facilities. Utilizing a growth rate of 2% and recognizing possible expansion into fringe areas, design projections were made.

Table E.19 – Town of Osoyoos Design Criteria

Year	Sewered Population	Flow (m^3/d)
1986	3,200	1,375
2006	5,000	2,150
2026	8,000	3,440

Various options for expansion of individual plant components were examined for both design horizons. The 5,000 person expansion would include increased aeration capacity, a second winter effluent storage reservoir and an additional 40 ha of irrigation land. Expansion to 8,000 people would require additional winter effluent storage, treatment plant expansion and 50 ha more irrigation area.

Table E.20 – Town of Osoyoos – Project Cost Estimates

Year	Population	Component	Cost $
1987	3,200	Winter storage	1,340,000
1991	3,700	Expand Irrigation	295,000
1995	3,900	Expand treatment plant	250,000
2000	4,500	Expand irrigation	161,000
Total to 5,000 people (2006)			2,046,000

2006	5,000	Expand storage and pumping	2,225,000
2010	5,500	Expand treatment plant	1,250,000
2015	6,500	Expand irrigation	250,000
Total to 8,000 people (2026)			3,725,000

OSRD Electoral Areas A, C, D - Wastewater Management Plan -1989

The Wastewater Management Plan included population centres in the fringe areas of Osoyoos, Oliver, Gallagher Lake, Vaseux Lake, Okanagan Falls, Skaha Estates and Kaleden. The WMP focused on the existing unsewered areas which accounted for a total phosphorus loading of 2,000 kg/yr.

Table E.21 – Regional District of Okanagan Similkameen (Area A, C, D) – Subareas based on Phosphorus Load

Area/Priority	Population	Phosphorus Loading (kg/yr)
Group 1		
Osoyoos Northwest	687	263
Tugulnuit Lakeshore	1,088	277
Sawmill Road	396	191
Group 2		
Osoyoos Southeast	571	100
South Vaseux Lake	89	51
East Vaseux Lake	110	70
Group 3		
Gallagher Lake	224	91
Kaleden Lakeshore	117	81
Skaha Estates	348	159
Osoyoos Southwest	710	145

Various alternative sewerage systems were evaluated for each area including to neighbouring facilities, individual systems, etc. The recommended programs, phosphorus reduction and associated cost for each area are presented in Table E.22.

Table E.22 – Regional District of Okanagan Similkameen (Areas A, C, D) – Project Summary

Area	Population Serviced	Phosphorus Reduction (kg/yr)	Capital Cost $	Program Description
Group 1				
Osoyoos Northwest	376	206	955,000	Connect to Osoyoos
Tugulnuit Lakeshore	252	198	611,000	Connect to Oliver
Sawmill Road	207	144	360,000	Connect to Oliver
Group 2				
Osoyoos Southeast	93	76	452,000	Connect to Osoyoos
South Vaseux Lake	47	39	135,000	Community disposal field
East Vaseux Lake	101	31	211,000	Community disposal field
Group 3				
Gallagher Lake	220	77	588,000	Treatment and Disposal
Kaleden Lakeshore	117	77	788,000	Connect to Okanagan Falls
Skaha Estates	312	130	1,428,000	Connect to Okanagan Falls
Osoyoos Southwest	85	62	187,000	Connect to Osoyoos

The total costs presented included allowances for associated treatment plant upgrading.

OSRD Electoral Areas E & F (Naramata/Westbench)Wastewater Management Plan - 1994

The Wastewater Management Plan included population centres in the fringe areas of Penticton and Summerland including Naramata, Husula Highlands, Sage Mesa, and West Bench, as well as the pocket communities of Indian Rock, Demuth, Faulder, and Glenfir Greata. The WMP focused on the existing unsewered areas which accounted for a total phosphorus loading of 613.58 kg/yr.

Table E.23 – Regional District Okanagan Similkameen (Areas E & F) Priority Areas

Area	***Reason for Priority***
Downtown Naramata	Phosphorus loading High ground water Small lot sizes Septic tank failures
Westbench/Sage Mesa	Geological concerns
Okanagan Lake Provincial Park – adjacent developments	Phosphorus loadings

Downtown Naramata and Westbench/Sage Mesa were identified as areas that should be serviced with a community sewer system. Various alternative sewerage systems were evaluated for each area including to neighbouring facilities, individual systems, etc.

Table E.24 – Regional District of Okanagan Similkameen (Areas E & F) – Project Summary

Area	***Population Serviced**	**Phosphorus Reduction (kg/yr)**	**Capital Cost $**	**Program Description**
Downtown Naramata	920	unknown	0	**Onsite disposal
Westbench/Sage Mesa	2790	unknown	0	***Status quo/onsite disposal

*Projected populations possible under current zoning not including the PIB lands.

**There were also recommendations for maintenance of on-site systems, public education program on reducing Phosphorus loads, legislation on phosphates in laundry detergents and modifications to septic systems to chemically precipitate Phosphorus.

***It was also recommended that no further development should take place in this area if this option is implemented.