DISTRICT OF SALMON ARM

LIQUID WASTE MANAGEMENT PLAN

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Consulting Engineers

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DISTRICT OF SALMON ARM
LIQUID WASTE MANAGEMENT PLAN

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DISTRICT OF SALMON ARM
LIQUID WASTE MANAGEMENT PLAN

EXECUTIVE SUMMARY

The District began the preparation of a Liquid Waste Management Plan (LWMP) in December 2001. In accordance with provincial guidelines, the District engaged a technical consultant (Dayton & Knight Ltd., Consulting Engineers), and formed a project technical team, a Steering Committee, and a Joint Advisory Committee. The Joint Committee included representatives of various government agencies, local members representing a cross section of the community, District staff, and Council.

The technical team and the Joint Advisory Committee developed a number of draft liquid waste management options for consideration by the community. Important issues central to wastewater collection and treatment included the location of the existing treatment plant at Narcisse Street, the possibility of relocating the treatment plant, and the best approach for dealing with onsite (septic tank) systems in areas with poor conditions for ground disposal of wastewater. Other important issues included source control of contaminants, wastewater volume reduction through water conservation, reclamation and reuse of treated wastewater, beneficial reuse of the solid residuals (biosolids) produced by wastewater treatment, and management of stormwater runoff. All of these issues were considered in developing the draft LWMP options.

Public input was obtained by conducting open house meetings, to explain the draft LWMP options to members of the community and to ask for their comments and suggestions. Feedback from the public was considered by the Joint Advisory Committee in refining the draft options and in identifying the preferred options. The LWMP was submitted to the Kamloops office of the Ministry of Water, Land and Air Protection for review, and was subsequently adopted by Council on November 22, 2004, before being submitted to the Minister for approval.

The recommended approach for the District of Salmon Arm Liquid Waste Management Plan follows the Official Community plan in that there are no immediate plans for servicing of areas outside the Urban Containment Boundary (UCB) with sanitary sewers. This option is recommended because of the high costs (greater than $10 million) associated with servicing areas outside the UCB. The recommended approach includes continuing to expand the existing central treatment facilities located at Narcisse Street, since this will conserve the District's investment in the existing sewer collection systems. However, to secure the District's long-term needs (20 to 50 year time frame and beyond), it is recommended that an alternative site more distant from the urban core be identified. The primary issue associated with relocation of the central treatment facilities in the long term is reducing the risk of problem odours near the downtown area and the growing residential and hotel development along the shore near the existing plant.

To address the above issues in an iterative approach over the short and long term future, it is recommended that the District begin developing an alternative site during the next (Stage IV) upgrade to the facilities at Narcisse Street. That is, the solids handling and treatment facilities will be relocated to the new site during the Stage IV expansion. This will remove the primary odour sources from the location at Narcisse Street, while continuing to utilize the existing facilities for wastewater collection and liquid treatment. The new site can ultimately serve as the location for both liquid and solids treatment for the long-term future. The recommended approach is to begin by undertaking a site selection study that includes public and stakeholder consultation.

The effects of extending the outfall pipe from the wastewater treatment plant to deeper water in Salmon Arm Bay were reviewed in the LWMP.   An environmental impact assessment of the outfall discharge was conducted as a condition of the discharge permit in 2002. The primary issue from an environmental standpoint is algae growth in Salmon Arm Bay, which is driven mainly by phosphorus inputs. The environmental impact assessment, which included limited modeling of phosphorus impacts in the Bay, indicated that removal of the effluent discharge from Salmon Arm Bay would probably not reduce algae growth, due to the high phosphorus loading from the Salmon River. In light of the costs of extending the outfall to deeper water ($3.4 million) and the results of the environmental impact assessment, as well as comments from Fisheries and Oceans Canada regarding habitat impacts associated with construction of the outfall extension, and comments from Interior Health regarding the proximity of drinking water intakes to an extended outfall, extension of the outfall is not recommended at this time. Additional comprehensive environmental studies would be required to further evaluate the possible benefits of outfall improvements. It is important to note that completion of the Stage IIIB upgrade currently underway at the wastewater treatment plant will further reduce the concentration of phosphorus in the outfall discharge.

Reclamation and reuse of treated wastewater in the short term will be evaluated by completing a pre-design study for onsite use at the wastewater treatment facilities. For the long term, use of reclaimed effluent for agricultural irrigation in the Salmon River Valley should be considered. This will require extensive public and stakeholder consultation. Use of reclaimed water from the wastewater treatment plant for agricultural irrigation would reduce or eliminate the outfall discharge from Salmon Arm Bay.

The recommended approach relies on servicing only areas within the UCB with sanitary sewers. Areas lying outside the UCB will continue to rely on onsite systems (mainly septic tanks), provided that environmental monitoring conducted as a component of the LWMP does not identify environmental contamination or public health risks associated with the onsite systems. Estimated costs for developing and conducting the monitoring program are included in the LWMP. If contamination issues associated with onsite systems are identified as a result of the monitoring program, detailed site-specific studies will be required, to determine whether the development of a comprehensive management structure for onsite systems can be used to protect the environment; or satellite (community) sewer collection and treatment systems will solve the problem; or extension of the main sanitary sewer system is necessary. Additional elements of onsite systems management (e.g., certification of system designers and installers, development and enforcement of inspection and performance standards, etc.) may be added to the onsite systems monitoring program if site-specific studies determine that this approach is needed to adequately protect public health and the environment. This would require setting up a Local Service Area (LSA) or similar body, to oversee and manage the program.

Environmental initiatives such as water conservation and reuse to reduce wastewater volumes, beneficial use of the solid byproducts of wastewater treatment (biosolids), and stormwater management are also included in the LWMP. Recommended water conservation measures include the adoption of a water use efficiency policy, an education and awareness education program, a bylaw to require low-flush toilets for new construction, audits of large commercial/industrial/institutional water users, a program to retrofit low use water fixtures to existing buildings, and universal water metering.

Beneficial use of biosolids produced at the wastewater treatment facilities was extensively explored by the District prior to beginning the LWMP. As a result, the District has developed a long-term strategy that includes both short term and long term applications. Current applications include topsoil production, soil remediation at the Shuswap Regional Airport, and agricultural applications in the Salmon River Valley. Potential future applications include reclamation of a local forest fire burn, additional agricultural use, and gravel pit reclamation. Public/stakeholder education and source control of contaminants are essential support programs for biosolids reuse.

Source control initiatives are used top prevent the discharge of harmful contaminants to the sanitary sewer and storm drainage systems. Initiatives for the Salmon Arm LWMP include updating and revising the District's sanitary sewer protection bylaw, conducting an inventory of industrial/commercial/institutional dischargers, a public education program, and a monitoring and enforcement program for the sanitary sewer protection bylaw.

Stormwater management initiatives included in the LWMP are ongoing maintenance and repair of the storm drainage system, the development of a Master Drainage Plan, upgrading and expansion of the storm drainage system, the development of a storm drainage bylaw, review of the District's development application procedures to ensure that drainage issues are considered at the outset of the land use planning process, and a review of the Official Community Plan to ensure that important natural components of the local hydrology and drainage are protected.

It is recommended that the elements of the LWMP be integrated with other environmental initiatives and approaches currently developing in the District of Salmon Arm and elsewhere (e.g. Salmon Arm Round Table, Columbia Shuswap Regional District LWMP).

The budget and schedule for the recommended LWMP components are summarized in Table A.

TABLE A
LWMP FINANCIAL COMMITMENTS AND SCHEDULE

LWMP Component	Budget Amount (2003 $)	Funding Source	Schedule
1. Update LWMP			
Review LWMP Progress, Update and Revise as Required	$50,000	General Revenues	2009
2. Upgrade WWTP			
a. WWTP Stage IIIB Upgrade	$7,360,000	Infrastructure Grants, DCC, Sewer Utility	2003 to 2004
b. Site selection study for relocation of WWTP	$75,000	Infrastructure Grants, Sewer Utility	2008 to 2009
c. WWTP Upgrade Pre-Design Studies and Audits for Stage IV	$100,000	DCC & Sewer Utility	2011 to 2012
d. WWTP Stage IV Upgrade, incl. relocate Wharf Street PS and replace Canoe forcemain.	$13,900,000 (annual O&M $800,000/yr)	DCC & Sewer Utility	2013 to 2014
e. Item c plus cost to construct solids handling at remote site during Stage IV Upgrade (from Option 2)	$5,500,000 (annual O&M per Item c plus $120,000/yr)	DCC & Sewer Utility, Infrastructure Grants	2013 to 2014
3. Environmental Monitoring and Onsite Systems Management (from Option 5).			
a. Consultant assistance to design environmental monitoring program	$20,000	General revenues, apply for provincial support funding	2006
b. Monitoring Program • Sample collection and analysis, data management, review and reporting	$25,000/yr	General revenues, apply for provincial support funding to expand program	2007 to 2008
4. Sewer Collection System			
a. Sewer Inspection, Maintenance and Repair	$220,000/yr	Sewer Utility	2004 to 2009
b. Infiltration and Inflow Reduction	$10,000/yr	Sewer Utility	2004 to 2009
c. Upgrade deficiencies in existing sewer system.	$50,000-$100,000/yr	Sewer Utility	2004 to 2009
d. Expansions to existing system	Varies subject to development	DCC & Sewer Utility	2004 to 2009

TABLE A (cont'd.)
LWMP FINANCIAL COMMITMENTS AND SCHEDULE

LWMP Component	Budget Amount (2003 $)	Funding Source	Schedule
5. Wastewater Flow Reduction (see Water Use Efficiency Report)			
a. Adopt water use efficiency policy.	Minimal	Water Utility	2005
b. Education program	$25,000/yr	Water Utility	2003 to 2009
c. Adopt bylaw requiring ultra low flush toilets for all new buildings.	Minimal	Water Utility	2005
d. Audit large Industrial, Commercial and Institutional water users.	$210,000	Future	Future
e. Program to retrofit low water use fixtures.	$115,000	Future	Future
f. Program to retrofit low flush toilets.	$1,350,000	Future	Future
g. Universal water metering program.	$1,700,000 plus $110,000/yr	Future	Future
6. Reclaimed Water Use			
a. Pre-design study for onsite use at WPCC.	$15,000	Provincial Study Grant $10,000 and Sewer Utility $5,000	2005
b. Agriculture Irrigation (begin public/stakeholder consultation)	Future	Future	Future
7. Biosolids Management			
a. Topsoil production by private contractors.	$14,000/yr $21,000/yr	Sewer Utility (WWTP O&M Budget)	2003 2014
b. Public education and outreach.	$5,000/yr	Sewer Utility or General Revenues	2004 to 2009
c. Soil remediation at Airport (contingency)	$28,500/yr	Sewer Utility (WWTP O&M Budget)	2014
d. Agricultural applications (contingency).	$24,000/yr	Sewer Utility (WWTP O&M Budget)	2014
e. Forest fire burn site.	Future	Future	Future

TABLE A (cont'd.)
LWMP FINANCIAL COMMITMENTS AND SCHEDULE

LWMP Component	Budget Amount (2003 $)	Funding Source	Schedule
f. Gravel pit reclamation (discussions with Highways to develop pilot project)	Minimal	--	Future
8. Source Control			
a. Review and revise Bylaw No. 1410.	Minimal	--	2006
b. Inventory of Industrial, Commercial and Institutional Sector (see Section 5)	$10,000	Sewer Utility or General Revenues	2005
c. Education program		Sewer Utility or General Revenues	
i. develop program	$15,000		2006
ii. facilities & materials	$3,000/yr		2006 to 2009
iii. public program	$2,000/yr		2006 to 2009
d. Source control monitoring and enforcement program.		Sewer Utility or General Revenues	
i. develop program	$15,000		2006
ii. ongoing monitoring and enforcement	$10,000/yr		2006 to 2009
9. Stormwater Management			
a. System inspection, maintenance and repair	$180,000/yr	General Revenues (consider Drainage Utility)	2004-2009
b. Master drainage plan.	$75,000	General Revenues	2005
c. System upgrades and expansion	$75,000-$125,000/yr	General Revenues	2005-2009
d. Develop storm drainage bylaw.	$20,000	General Revenues	2005
e. Review and revise development application approval procedures.	$20,000	General Revenues	2008
f. Review OCP land use.	$20,000 (plus $10,000 for public consultation if substantial changes needed)	General Revenues	2008
g. Public education.	See Item 8b	See Item 8b	2006 to 2009
h. Inventory ICI sector.	See Item 8d	See Item 8b	2004
10. Sewer and Drainage Management			
a. Complete/continue GIS program	$20,000/yr	Utility	2003 to 2015

TABLE A (cont'd.)
LWMP FINANCIAL COMMITMENTS AND SCHEDULE

LWMP Component	Budget Amount (2003 $)	Funding Source	Schedule
b. Develop computer maintenance management systems	$50,000 $50,000	Utility	2007 2008
c. Develop sinking fund for facility replacement and upgrades (asset management)	$150,000	Utility	2007
11. Agricultural Waste Management a. Pressure provincial government and agricultural area plan committee to undertake the following agricultural area plan: • Promote water quality monitoring in Salmon River. • Develop program with beef and dairy livestock associations to reduce P load to Salmon River. • Develop education program for small beef producers. • Require development of environmental farm plans and nutrient management plans. • Increase budget for enforcement of violations. • Liaise with MWLAP to develop sustainable regulations (OMRR) to promote land application.	Minimal	-	2005 to 2009

DISTRICT OF SALMON ARM
LIQUID WASTE MANAGEMENT PLAN

1.0 INTRODUCTION

1.1 Background

The District of Salmon Arm has undertaken the preparation of a Liquid Waste Management Plan (LWMP) for the following reasons:

- a LWMP provides a comprehensive and long-term examination of wastewater management needs for the entire community;
- a LWMP considers reduction, reuse and recycling opportunities that are essential to a pollution prevention strategy rather than simply limiting wastewater management to treatment and disposal;
- a LWMP is designed to minimize the adverse environmental impact resulting from existing and future development under the Official Community Plan;
- a LWMP involves extensive opportunities for public participation in the planning process and consequently fosters public acceptance and ownership of the plan; and
- the provincial government has indicated that grant applications for municipal infrastructure funding will be more favourably reviewed when a LWMP is undertaken and adopted.

1.2 LWMP Process and Objectives

Guidelines for developing a LWMP have been produced by the B.C. Ministry of Water, Land and Air Protection (MWLAP). The guidelines (currently under review/revision) require a three-stage process, each involving meaningful public consultation (B.C. Environment, 1992a). Stage 1 identifies existing conditions, projects development and considers a range of treatment, reuse and disposal options. The treatment, reuse and disposal options that pass an initial technical evaluation and public review are advanced to Stage 2 for more detailed evaluation. Finally, the selected option is described and costed, the implementation schedule is developed, and draft operational certificates are prepared in Stage 3. When the Stage 3 plan is approved by the MWLAP, the District has the authority to implement the LWMP.

The District of Salmon Arm had already undertaken much of the preliminary work typically included in a Stage 1 LWMP before it was decided to undertake the LWMP. Accordingly, it was discussed and agreed with the MWLAP that Stage 1 and Stage 2 be combined for the District of Salmon Arm LWMP (MWLAP, 2001a). Stage 3 was completed after review of the Stage 1 and 2 work by the MWLAP Kamloops office.

The MWLAP Guidelines suggest the following outline for a LWMP report (B.C. Environment, 1992a):

- Introduction – outline of study area, existing environmental, social and economic conditions, existing and proposed land use;
- Projected Growth – residential, commercial, industrial;
- Estimated Wastewater Facilities and Waste Quantities – residential, commercial, industrial present and future;
- Capacities of Water and Land to Accept Waste – surface water, land, groundwater, hazards (environmental and other);
- Source Control and Waste Volume Reduction – reduction of waste volumes and toxicity, infiltration control;

- Waste Recycling and Utilization – recycling treated sewage effluent and treated solid residuals;
- Options for Treatment and Disposal of Waste – treatment, source control, stormwater management, solid residuals, pump station overflow control, proposed effluent quality, disposal and reuse options, on-site (septic tank) systems;
- Site Location Options – treatment and disposal facilities, effects on land use and ALR;
- Financial Aspects – capital and operating costs of options; and
- Recommended Course of Action – selected options, implementation schedule, environmental impacts, benefits.

To ensure broad representation in the LWMP process, the District is required to inform the following agencies that a LWMP is being undertaken and to solicit their input (B.C. Environment, 1992a):

- Ministry of Water, Land and Air Protection (formerly B.C. Environment and the Ministry of Environment, Lands and Parks);
- Ministry of Agriculture, Fisheries and Food;
- Ministry of Health;
- Regional Districts and Municipalities adjacent to Plan area (in this case the Columbia Shuswap Regional District);
- Ministry of Community, Aboriginal and Women's Services (formerly the Ministry of Municipal Affairs, Recreation and Housing);
- Ministry of Tourism;
- Ministry of Finance and Corporate Relations;
- Regional Director of Parks; and
- Environment Canada.

Advisory committees must be established to represent community/stakeholder interests and technical/regulatory interests. These committees may be combined if desired, to facilitate communications between technical and community/stakeholder representatives. The

LWMP was developed by the combined efforts of the project team, the Advisory Committee, and the Public as summarized below.

- *Project Team*: The Project Team was composed of District staff and consultants. The objective of the Project Team was to undertake the work required to prepare and produce the LWMP, and to incorporate input from the Liquid Waste Advisory Committee and the public.

- *Liquid Waste Advisory Committee (LWAC)*: The objective of the LWAC was to provide public, technical and regulatory input into the planning process. The LWAC was composed of representatives of various interest groups, geographic areas, stakeholders, municipal staff and senior government agencies. The LWAC Membership List is included in Appendix 1. The technical and public LWACs were combined for the District of Salmon Arm LWMP.

- *Public*: A key objective was that interested members of the public become informed about the LWMP process, so that they could provide input into the development and selection of waste management alternatives.

1.3 Conduct of Study

The District of Salmon Arm issued a request for proposals to prepare a LWMP on November 9, 2001. The process commenced on December 18, 2001.

Information advertisements were published in the local newspaper to advise the public about the LWMP, and to invite participation from the public and from local stakeholder groups as members of the Liquid Waste Advisory Committee (LWAC). The meetings of the LWAC were open to the general public.

A consulting team led by Dayton & Knight Ltd. was retained by the District to assist the project team responsible for providing the technical input and analysis for the study. The team included specialty assistance from sub-consultants in the fields of environmental protection (ARC Environmental Ltd.), groundwater/soils (EBA Engineering Ltd.), and, agriculture/biosolids reuse (R. McDougall Consulting).

The work was initially undertaken through the development of a series of draft chapters for the Stage 1 and 2 report. The draft chapters were circulated to the members of the LWAC for review. After a review period, the draft material was discussed at follow up meetings of the LWAC; the draft material was then revised as required based on discussion at the meetings and written comments from committee members. After approval by the LWAC, the draft material was presented at two open houses to gain input from the public. The LWMP report was then submitted to the MWLAP Kamloops office for review. After being endorsed by MWLAP Kamloops, the LWMP was adopted by District Council on November 22, 2004, and was subsequently submitted to the Minister for approval.

1.4 Report Structure

Section 1 of this report contains introduction and background material. Public and stakeholder consultation is discussed in Section 2. Section 3 contains a summary of existing and projected land use and population. Descriptions of the existing wastewater collection and treatment facilities are contained in Section 4. The estimated quantity and quality of wastewater (domestic and commercial/industrial), septage, and biosolids based on existing and projected populations are developed in Section 5. Environmental resources and the capacities of the water and land to accept wastes are described in Section 6. Proposed criteria for evaluating the LWMP options are described in Section 7. Source control and wastewater volume reduction options are described in Section 8. Treatment and reuse options for wastewater and biosolids are contained in Section 9. Management of urban surface runoff and agricultural waste management issues are described in Sections 10 and 11, respectively. The LWMP implementation plan is contained in Section 12.

1.5 Acknowledgements

We thank the members of the Liquid Waste Advisory Committee for their participation in developing this LWMP, and for their many valuable comments and suggestions. The committee members together with their associations are listed in Appendix 1.

We are also indebted to the technical staff at the District of Salmon Arm, for providing information on existing and planned land use, infrastructure, and water quality data (where available). Information regarding domestic and industrial waste discharge permits was provided by the B.C. Ministry of Water, Land and Air Protection Kamloops office. General problem areas for ground disposal of septic tank effluent were identified by the Salmon Arm Health Unit (B.C. Ministry of Health).

2.0 PUBLIC AND STAKEHOLDER CONSULTATION

Effective public consultation is essential to the success of the LWMP process. The public consultation program for the Salmon Arm LWMP commenced with the formation of the Steering, Technical and Public Advisory Committees and continued throughout the LWMP through newspaper and radio advertisements, published information linked to the District website, committee meetings, and public open house meetings.

A summary of the public consultation program undertaken during the LWMP is outlined in this section.

2.1 Committee Meetings

The MWLAP guidelines for developing a LWMP require the District to strike a Technical Advisory Committee comprised of municipal staff and representatives from senior government agencies, including the MWLAP, the Ministry of Community, Aboriginal and Women's Services, the Ministry of Health, and other as applicable e.g., Environment Canada).

The guidelines also require the formation of a Local Advisory Committee. In addition to District staff, this committee normally involves at least one elected official, First Nations representatives, community leaders, and representatives from ratepayer associations, environmental groups and special interest groups. The following efforts were undertaken by the District in developing the Local Advisory Committee:

- advertised – 3 times in local paper;
- announced at Salmon Arm Environmental Society meeting (2 times);
- announced at DSA Environmental Management Advisory committee meeting and continued to ask;
- called stakeholders; and
- canvassed business community.

A Steering Committee, comprising District Council members and staff was established to guide the Advisory Committees and to make recommendations to Council.

In order to minimize the number of meetings and to provide a wider expression of views, the District elected to hold joint Technical/Local Advisory Committee meetings. Meetings of the Advisory Committees are summarized below.

1. <u>Technical Advisory Committee Meeting No. 1</u>

The first meeting of the Technical Advisory Committee was held on February 28, 2002 to initiate the combined Stage 1 and Stage 2 work. The terms of reference and scope for the LWMP were reviewed, and comments were received from federal and provincial regulatory agencies. It was determined at the meeting that the Technical and Local Advisory Committees would hold joint meetings, to improve communication and to streamline the work effort.

It was agreed at the meeting that the stormwater and agricultural components of the LWMP would be limited in scope.

2. <u>Local Advisory Committee Meeting No. 1</u>

Local Advisory Committee Meeting No. 1 was held March 12, 2002. The committee terms of reference, meeting protocols, the LWMP process, the roles of the Committees, and the expectation of the Committees were reviewed. Councillor Greg Husband was appointed chair of the Joint Committee in advance of the meeting.

The work plan and schedule were presented by the consulting team, followed by a presentation describing the fundamentals of wastewater collection and treatment, including centralized facilities, community (satellite) systems, and onsite systems.

Preliminary information regarding the membership and roles of the committees as well as the scope and process of developing a LWMP was made available to the public on the District's website in advance of Meeting No. 1. The Joint Committee resolved to open the LWMP meetings for attendance by members of the public as interested observers.

Meeting No. 1 was followed by a guided tour of the Salmon Arm Water Pollution Control Centre.

3. <u>Committee Meeting No. 2</u>

Following Meeting No. 1 of the Technical and Local Advisory Committees, Committee Meeting No. 2 was held on May 29, 2002. From Meeting No. 2 onward, the Technical and Local Advisory Committees sat as a Joint Committee. The purpose of Committee Meeting No. 2 was to receive Committee comments and direction regarding the preliminary draft of the following LWMP components:

- existing and projected land use, development and population;
- existing and projected wastewater facilities and service areas;
- existing and projected wastewater and biosolids quantity and quality; and
- capacities of land and water to accept waste.

The draft sections of the LWMP report describing the above components were developed by the consulting team and circulated to the Committee members for review in advance of the meeting. The consulting team presented a summary of the draft report sections at the meeting, and received verbal comments and suggestions from the Committee. The members of the Committee were also invited to submit written comments subsequent to the meeting.

4. Committee Meeting No. 3

Committee Meeting No. 3 was held August 14, 2003. The purpose of Committee Meeting No. 3 was to review changes made to the draft LWMP report as a consequence of Committee input received at and subsequent to Meeting No. 2, as well as to present and discuss new draft components to be included in the LWMP. The LWMP components were drafted in advance of the meeting and circulated to the Committee, and then presented by the consulting team at the meeting as follows:

- review of changes to draft LWMP report sections presented at Committee Meeting No. 2;
- review of proposed approach for source control to protect sanitary sewer collection system from discharge of harmful and hazardous wastes; and
- review of agricultural waste management issues and practices, as well as proposed approach for managing agricultural wastes.

Committee comments and suggestions on the draft material were received verbally at the joint meeting and in writing subsequent to the meeting.

5. Committee Meeting No. 4

Committee Meeting No. 4 was held on October 23, 2002 and was similar in structure to Committee Meeting No. 3. The LWMP components presented by the consulting team for discussion at Meeting No. 4 were as follows:

- review of changes to draft LWMP report sections presented at Committee Meetings No. 2 and No. 3;

- proposed LWMP criteria; and
- review of proposed approach for stormwater management.

6. Committee Meeting No. 5

Committee Meeting No. 5 was held on May 15, 2003. The new Committee Chair, Councillor Kevin Flynn, was introduced at this meeting. Prior to Meeting No. 5, the consulting team and District staff developed five concept options for wastewater collection and treatment as follows:

- Option 1 – expand existing WPCC and serve outlying areas where conditions for ground disposal from onsite systems have been identified as poor;
- Option 2 – Option 1 with remote solids handling site;
- Option 3 – Option 1 except move WPCC to a new location;
- Option 4 – two treatment plants with sewering of outlying areas per Option 1; and
- Option 5 – existing WPCC with onsite systems and satellite systems in outlying areas.

Draft descriptions of the above concept options were circulated in advance of Committee Meeting No. 5, together with draft options for reclamation and reuse of treated wastewater and biosolids. The consulting team presented this material at the meeting, and received Committee comments. The Committee requested additional information with respect to the following issues:

- feedback from Fisheries and Oceans Canada regarding consideration of construction of a wetland on the lake foreshore near the WPCC for disposal of the treated effluent;
- agricultural irrigation options;
- forest irrigation options; and
- feasibility of deep well disposal for treated effluent.

7.

Committee Meeting No. 6

Committee Meeting No. 6 was held on October 2, 2003. Written comments received from regulatory agencies on the LWMP concept options were reviewed, together with other additional information requested at Meeting No. 5. A draft questionnaire designed to obtain public feedback at the First Public Open House was tabled for discussion.

Committee consensus was obtained regarding the material to be presented at Public Open House No. 1. The draft LWMP material was then made available on the District's website, and the Open House was scheduled for November 4, 2003. The District undertook to contact the local news media to publicize the Open House.

8. Committee Meeting No. 7

Committee Meeting No. 7 was held on February 5, 2004. The results of Public Open House No. 1 were discussed. The draft LWMP resulting from input from the Committee and Public Open House No. 1 was presented. Committee consensus was obtained regarding the material to be presented at Public Open House No. 2, which was scheduled for Wednesday, March 31, 2004.

9. Committee Meeting No. 8

Committee Meeting No. 8 was held on June 9, 2004. The results of Public Open House No. 2 were discussed.

There was a general consensus that the proposed management of onsite systems be amended to a reduced scale paid for through general revenues. There was a recommendation that the District work with Interior Health to establish the scope and location of environmental monitoring. It was further recommended that the District initiate a site selection study including public/stakeholder consultation for relocating the

WPCC. Similarly, stakeholder/public input was recommended as the initial step in evaluating agricultural irrigation using reclaimed water.

The above studies were included as components of the District's LWMP.

2.2 Public Open House No. 1

The First Public Open House was held on November 4, 2003 at the Prestige Harbour Front Resort and Convention Centre, Salmon Arm. The Open House was advertised in the local newspapers and on local radio, as well as on the District's website. The Open House included pictorial displays with accompanying explanatory text describing LWMP options, as well as informational videos and a continuous slide presentation summarizing the LWMP options. District staff and members of the consulting team were present at the Open House to offer detailed explanations and to answer questions. Approximately fifty people attended the Open House, and twelve people submitted questionnaires.

Public feedback regarding the Open House material was generally positive, with all residents agreeing that it was important for the District to have a plan for managing liquid wastes. Several of the questionnaire responses and verbal comments received at the Open House indicated a preference for relocating the WPCC in the long term, primarily due to odour issues. Owners of onsite systems indicated that they were willing to have their systems dye tested, but most expressed resistance to paying an annual fee to ensure that onsite systems did not damage the environment. Source control, water conservation, and the impacts of storm runoff were identified as important issues by the majority of respondents.

Opinion was divided on which were the best options for wastewater collection, treatment and reuse. However, all residents agreed that District residents should contribute financially to improved environmental protection, and all respondents expressed the intention of attending the next Open House.

2.3 Public Open House No. 2

Public Open House No. 2 was held on March 31, 2004. The format was similar to Open House No. 1 (see above). In addition, a power point slide and oral presentation was given to summarize the draft LWMP. An estimated 100 people attended the open house, and 41 people submitted questionnaires.

Nearly all of the respondents agreed that it was important to have a LWMP. Most were rural residents, and all but one were served by septic tanks with ground disposal. The majority agreed that there are problems with some of the existing ground disposal systems in the District. However, the majority did not agree with the recommended option of an annual fee of $35/lot to support water quality monitoring to determine if these systems are damaging the environment.

A small majority of the respondents preferred outfall discharge of treated wastewater to Shuswap Lake, and a majority preferred spray irrigation on forest or agricultural land.

The majority agreed that the environmental impact of stormwater runoff was an issue, that source control of contaminants was an important part of the LWMP. Most supported water conservation as an important component of the LWMP.

Beneficial use of treated biosolids as a soil conditioner was supported by the majority of respondents.

About half of the respondents agreed that District residents should contribute financially to improved environmental protection.

Representatives of the agricultural community expressed strong opposition to locating wastewater treatment facilities at Minion Field.

2.4 Media Coverage

During the course of the LWMP work display advertisements and news articles were published in the local newspapers to keep citizens informed on the progress of the work and to notify citizens of Open Houses.

3.0 EXISTING AND PROJECTED LAND USE, DEVELOPMENT AND POPULATION

3.1 Land Use and Development

3.1.1 <u>Sewage and Drainage Facilities</u>

Sewage and drainage facilities must be planned for the long-term future. Long term planning particularly applies to the selection and siting of wastewater treatment plants and the main interceptor and trunk sewers that lead to the plants. A lack of long term planning may lead to the need to duplicate gravity interceptors, trunk sewers, and storm drains at great expense well before the useful life of these pipelines has expired. Should a treatment plant site become too small for future development or should the site become inappropriate with respect to future development, then substantial costs and public opposition may be incurred to reconstruct interceptors and trunk sewers and to locate a new plant site.

It is generally accepted in the municipal wastewater field that treatment plant sites should be secured for a minimum 100 year planning horizon, or the full development of the service area. Interceptors and trunk sewers are generally sized for a minimum 40 year design period, while pumped mains are generally restricted by hydraulic conditions to a 20 year design period before duplication is needed.

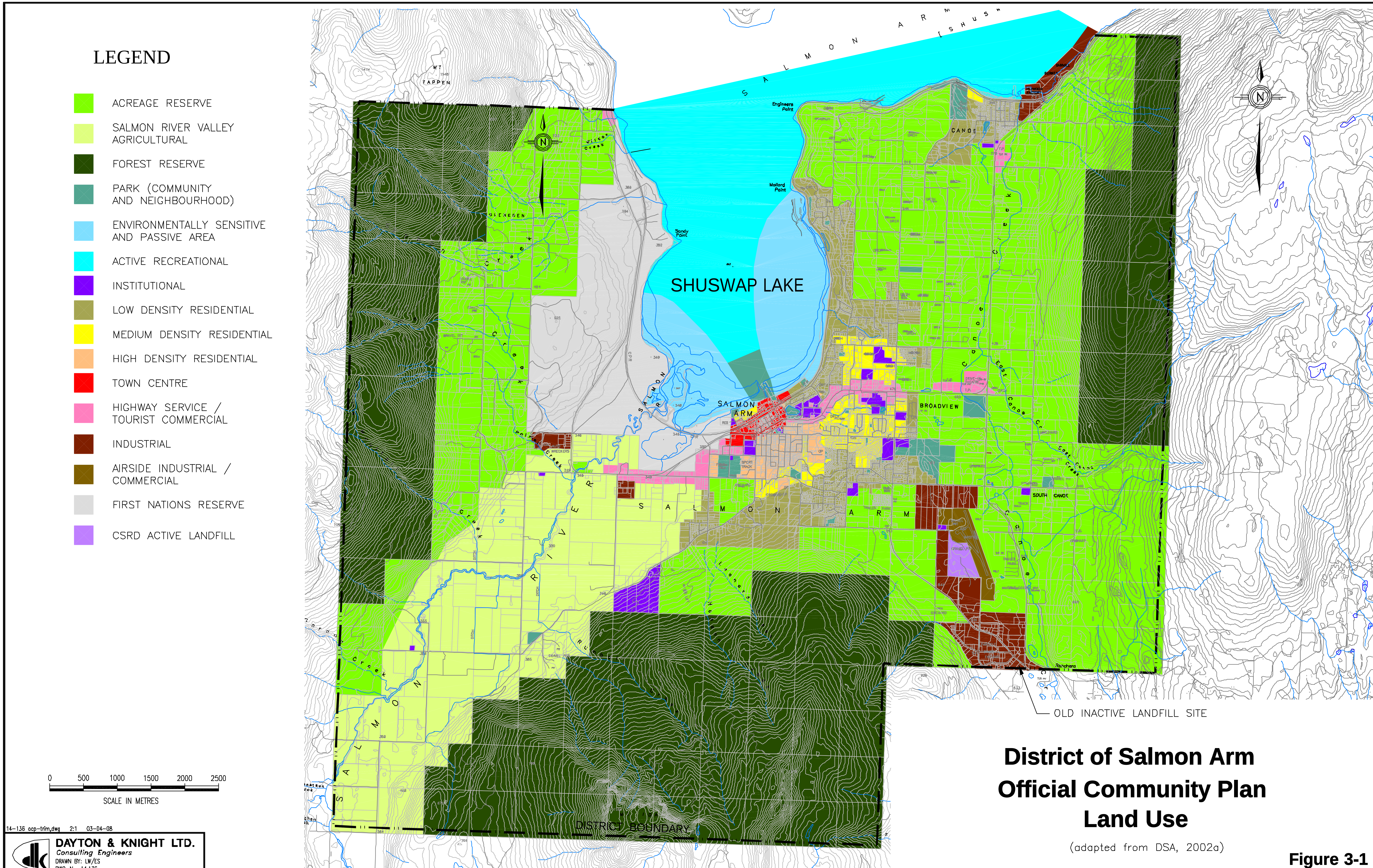
Land use planning and development also has an impact on stormwater management. Development tends to increase the amount of impervious land area, reducing the amount of rainwater that infiltrates into the ground, and increasing the amount of surface runoff. Protection of key natural components of the drainage network, as well as drainage and detention facilities constructed to control flooding downstream of developments and/or to remove contaminants from surface runoff, can require significant amounts of space. Land use planning and development should include consideration of the space requirements for protected areas and drainage facilities.

3.1.2 Development and the Official Community Plan

In order to properly plan for wastewater facilities, it is necessary to project future land use and populations within the Plan area. The LWMP guidelines require that the Official Community Plan (OCP) completed by the municipal or regional government form the basis of the LWMP (B.C. Environment, 1992a). The LWMP should then be incorporated as part of the OCP.

The OCP for the District of Salmon Arm and other relevant information was reviewed during the Stage 1 and 2 study, to determine land use planning and population growth projections in the study area (DSA, 2002a and DSA, 2002b). The OCP confirms the community's vision for development to the year 2020. The planning horizon to 2020 was also adopted for the LWMP. The study area (District) boundary and land use planning within the study area according to the OCP are shown on Figure 3-1.

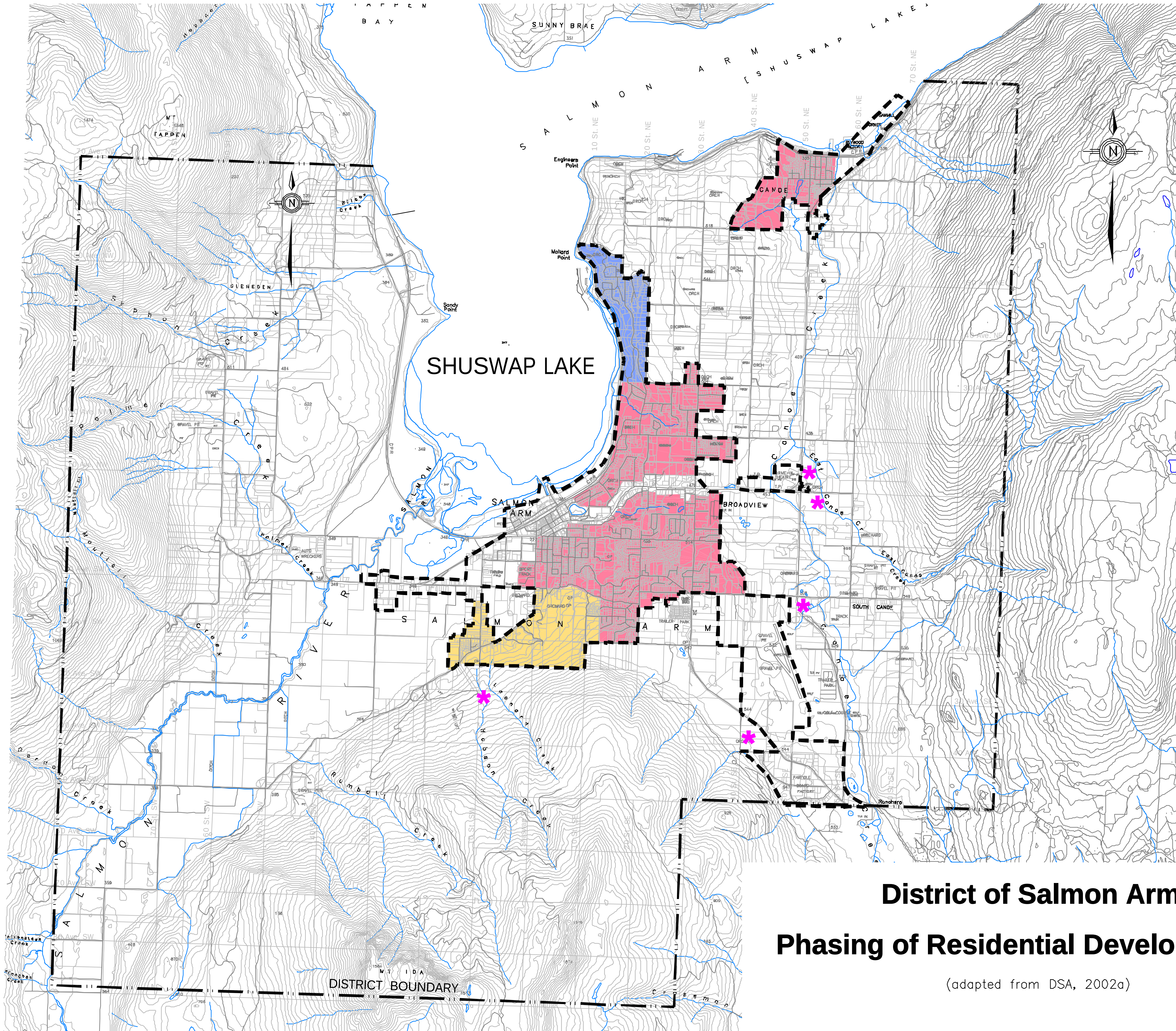
According to the OCP, the District's growth management strategy is to emphasize infill and intensification of land use, in order to maximize the use of existing infrastructure and to reduce the environmental and financial costs of growth. To focus development within existing areas, an Urban Containment Boundary (UCB) has been established; this is illustrated on Figure 3-2. The UCB closely follows the boundary of the Agricultural Land Reserve (ALR), so that most of the area outside the UCB is within the ALR. Urban development outside the UCB will not be supported.



District of Salmon Arm Official Community Plan Land Use

(adapted from DSA, 2002a)

Figure 3-1



LEGEND

RESIDENTIAL DEVELOPMENT AREA A

RESIDENTIAL DEVELOPMENT AREA B

RESIDENTIAL DEVELOPMENT AREA C

URBAN CONTAINMENT BOUNDARY

* POTENTIAL EXPANSION OF URBAN CONTAINMENT BOUNDARY

0 500 1000 1500 2000 2500

SCALE IN METRES

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District of Salmon Arm

Phasing of Residential Development

(adapted from DSA, 2002a)

Figure 3-2

As shown on Figure 3-1, Rural and agricultural lands cover the majority of the area within the District; the three land use categories for these lands identified in the draft OCP are Acreage Reserve, Salmon River Valley Agricultural Area, and Forest Reserve. The draft OCP supports retention of the existing land use pattern in rural and agriculture lands; additional development (particularly at urban densities) is to be discouraged in these areas. Municipal services are not to be extended to the Forest Reserve and Salmon River Agricultural Area, and municipal services are unlikely to be extended to the Acreage Reserve, due to high costs. Subdivision to accommodate additional small agricultural holdings may be permitted within the Acreage Reserve west of both the Salmon River and the Trans Canada Highway, subject to criteria set out in the OCP. Golf courses may be permitted within the Acreage Reserve, and these may include resort residential development subject to access to municipal servicing.

According to the OCP, the District has adequate residential land to support long-term growth to about 32,000 people. The majority of new residential development within the District is to be within the UCB. The three categories of residential development identified in the OCP (Figure 3-1) are low density (up to 22 units/ha), medium density (up to 40 units/ha), and high density (up to 100 units/ha). Single family homes currently represent over 80% of residential development within the District, with the remaining 20% attributed to medium and high density; this is expected to change to about 60% single family and 40% medium to high density by the year 2020. Residential development is to occur on a phased basis as illustrated on Figure 3-2; Area A is the highest priority for development, followed by Area B and then Area C. Infrastructure expenditures are to be directed mainly to the current priority area.

According to True Consulting (2001), the existing developed commercial floor area is about 123,200 square metres, and development of the available supply of commercial land would increase the commercial floor area to about 210,000 square metres (70% increase), assuming 20% site coverage. Under the low (1.5%) growth scenario, the developed commercial floor area would be about 163,500 square meters by the year 2020. Under the high (3%) growth scenario, the developed floor area would be about

216,000 square metres by 2020. According to the OCP, there is sufficient commercial land available in the Town Centre and Waterfront areas to meet the demand to the planning horizon of 2020. However, demand may exceed the current inventory of commercial land along the Trans Canada Highway by about 2010, and expansion of the commercial corridor may be needed. The OCP identifies five potential areas for future expansion of the UCB to include additional commercial development (see Figure 3-2). It is recognized in the OCP that there are designated commercial areas both east of 30th Street NE and west of 30th Street SW that are not serviced by the municipal sewer system, and that these areas may be served by private sewer systems.

The OCP notes that Salmon Arm has a limited supply of large, vacant industrial lots, and that the current inventory of such lots is almost entirely located within the Industrial Park. According to True Consulting (2001), the amount of developed industrial land at the Industrial Park (excluding the Airport) is about 80 hectares, with other developed industrial areas totaling about 75 hectares. This is projected to increase by the year 2018 to about 110 hectares at the Industrial Park (again excluding the Airport), and to about 86 hectares in other industrial areas. The Airport currently occupies about 74 ha, with about 14 ha available for future development as Airside Industrial/Commercial. An additional 107 hectares adjacent to the Industrial Park is designated industrial, but is presently occupied by agriculture or rural land uses. Except for the waterfront areas, none of the industrial areas are served by the municipal sewer system. Some of the lands designated for long-term industrial development outside of the Industrial Park are located in scenic rural areas, and are expected to be developed for rural residential use. Improved highway exposure is identified as an important factor in successful industrial development. To maximize the use of existing industrial areas, the District will use appropriate zoning to minimize the intrusion of commercial development, and to encourage infilling of these areas with purely industrial development. Rezoning of properties for industrial use will not be encouraged where municipal services are not available. The District may initiate an ALR block exclusion application, depending on the outcome of a recommended land use review.

The OCP identifies potential conflicts between the OCP and existing zoning, particularly for waterfront commercial and industrial zones, and it recommends review of these issues.

The District recently initiated a Parks and Open Space Plan, to provide specific objectives to identify, preserve, acquire, restore, develop, and manage parks, open spaces, and linear corridors over the next 20 years. The broad directives of the Plan have been incorporated into the OCP where appropriate. The four parks designations identified in the OCP are Community Parks, Neighborhood Parks, Linear Parks (Greenways and Bikeways), and Open Space. All four parks designations are permitted within all land use designations.

The waste management options developed in Section 12 are designed to be compatible with and minimize the environmental impact of development according to the OCP.

3.1.3 Landfills

The Columbia Shuswap Regional District (CSRD) is responsible for management of the primary landfill in the District of Salmon Arm. The location of the landfill is shown on Figure 3-1. The OCP states that the life of the landfill is expected to exceed the OCP planning horizon of 2021. The OCP further states that the District of Salmon Arm will continue to work cooperatively with the CSRD regarding operation and management of the landfill.

There are no leachate collection or treatment works at the CSRD landfill. However, there are groundwater monitoring wells upgradient and downgradient of the landfill. Monitoring to date has not detected any impacts on groundwater quality caused by the landfill (CSRD, 2003).

There is also an old inactive landfill site located at the Industrial Park (see Figure 3-1). This landfill was closed in the mid 1970's (CSRD, 2003).

3.2 Population Projections

3.2.1 Effects of 2001 Census

The District of Salmon Arm population growth rate from 1976 to 1996 was about 3% per year. This 3% growth trend was used to project population increases from 1996 to 2001 and into the future in District planning documents and in studies conducted by consultants prior to the 2001 Census.

The 2001 Census showed that growth from 1996 to 2001 was less than 1% per year, indicating that growth slowed drastically over this period compared to previous trends. The 2001 Census population was used to develop population projections for the LWMP. This means that the 2001 and future service populations for the District water and sewer systems contained in this report are generally lower than those contained in documents published prior to the 2001 Census.

3.2.2 Projected Population to 2020

The draft OCP describes projected long-term population growth for the Salmon Arm area for both low growth (1.5% annual population increase) and high growth (3% annual population increase) scenarios. The projected population growth for the District of Salmon Arm from the last Census in 2001 to the year 2020 for both 1.5% and 3% annual growth is shown in Table 3-1. The estimated service populations for the water supply and wastewater collection systems are included in Table 3-1 (from DSA, 2002b). As described in Section 3.2.1 above, the numbers contained in Table 3-1 are generally lower than those contained in documents published prior to the 2001 Census (e.g., Dayton & Knight Ltd., 2001a).

TABLE 3-1
DISTRICT OF SALMON ARM
POPULATION PROJECTIONS

Year	Projected Population					
	Total District		Water Service Area		Wastewater Collection Area	
	1.5% Growth	3% Growth	1.5% Growth	3% Growth	1.5% Growth	3% Growth
2001	15,388[1]	15,388[1]	13,100	13,100	11,900	11,900
2005	16,300	17,300	14,300	15,200	12,900	13,700
2010	17,600	20,100	15,800	18,100	14,300	16,300
2015	19,000	23,300	17,500	21,500	15,500	19,100
2020	20,400	27,000	19,400	25,600	16,900	22,400

[1] Census Population

As shown in Table 3-1, the District total population at the planning horizon (year 2020) is projected to be approximately in the range 20,000 (1.5% annual growth) to 27,000 (3% annual growth). The population served by the wastewater collection system in the year 2020 is projected to be approximately in the range 17,000 (1.5% annual growth) to 22,000 (3% annual growth). This represents overall increases of about 30% to 75% in total population, and 40% to 90% in the WPCC service population from 2001 to 2020. Waste quantity projections in light of projected population increases are discussed in Section 5.

4.0 EXISTING AND PROJECTED WASTEWATER FACILITIES AND SERVICE AREAS

Wastewater (sewerage) facilities include collector sewers, trunk and interceptor sewers, pump stations, treatment works, and reuse and disposal facilities. Disposal can be either to ground (via surface or subsurface application) or to surface water (normally via an outfall pipe). Treated wastewater may also be reused as washdown water for in-plant use, irrigation, industrial process water, etc.

Wastewater facilities generally include public and privately owned systems, which are regulated either by the Ministry of Health (MOH) or the Ministry of Water, land and Air Protection (MWLAP), depending on the nature and volume of the discharge (see Section 7).

In the year 2001, 15,388 people resided in the study area, and an estimated 11,900 people (about 77%) were connected to the Salmon Arm Water Pollution Control Centre (WPCC) sewerage system (see Table 3-1 in Section 3). The people not serviced by the WPCC (approximately 3,500) can be assumed to rely principally on individual treatment and disposal systems, mainly septic tanks. As described in Section 3.2, the projected District population in 2020 is in the range 20,000 (1.5% annual growth) to 27,000 (3% annual growth). An estimated 83% of the District population (i.e. 16,900 to 22,400 people) will be serviced by the WPCC by 2020. Under the low (1.5%) growth scenario, this would result in the number of people on septic tanks remaining at about 3,500 until the year 2020. Under the high (3%) growth scenario, the number of people on septic tanks would increase to about 4,600 by the year 2020.

The facilities and service areas for the WPCC and on-site systems are described in the following sections.

4.1 Background Planning for Wastewater Treatment

Prior to amalgamation of the Village of Salmon Arm and the District of Salmon Arm in 1971, two small systems were used for wastewater collection. The first, in Canoe, was built in the 1930's and discharged to a small physical treatment works (spirogester) before discharging to Shuswap Lake. The Permit for this system expired in 1970. The second, for the Village, was a collection of sewerage, septage, drainage pipes and ditching built in 1966 and 1967, which discharged wastewater and storm runoff without treatment to Shuswap Lake along Narcisse Street NW, where the existing WPCC is located.

A Permit (PE 1251) was obtained in 1972 by the District of Salmon Arm to discharge treated effluent to Shuswap Lake. As well as standard secondary (biological) treatment requirements, the Permit stipulated chemical phosphorus removal, ammonia stripping, and denitrification. A Master Sewerage Plan was developed to investigate collection, treatment and disposal options for a future 25,000 service population (Dayton & Knight Ltd., 1972). The following three plans for treatment and disposal were evaluated:

Plan A: treatment and discharge to Shuswap Lake through a deep outfall (discharge 30 metres below low water elevation);

Plan B: treatment with effluent storage, followed by ground disposal and spray irrigation to forest soils near the airport; and

Plan C: treatment with effluent storage, followed by spray irrigation to crop land in the Salmon River Valley and to forest soils on Mount Ida.

Plan C was recommended, and it received final approval by the District on January 16, 1975. The following three sites were subsequently investigated for spray irrigation:

Site 1: Harrington farm – 32 hectares (80 acres), District owned;

Site 2: Mt. Ida – 136 hectares (340 acres), District owned; and

Site 3: Gleneden – 320 hectares (800 acres), privately owned.

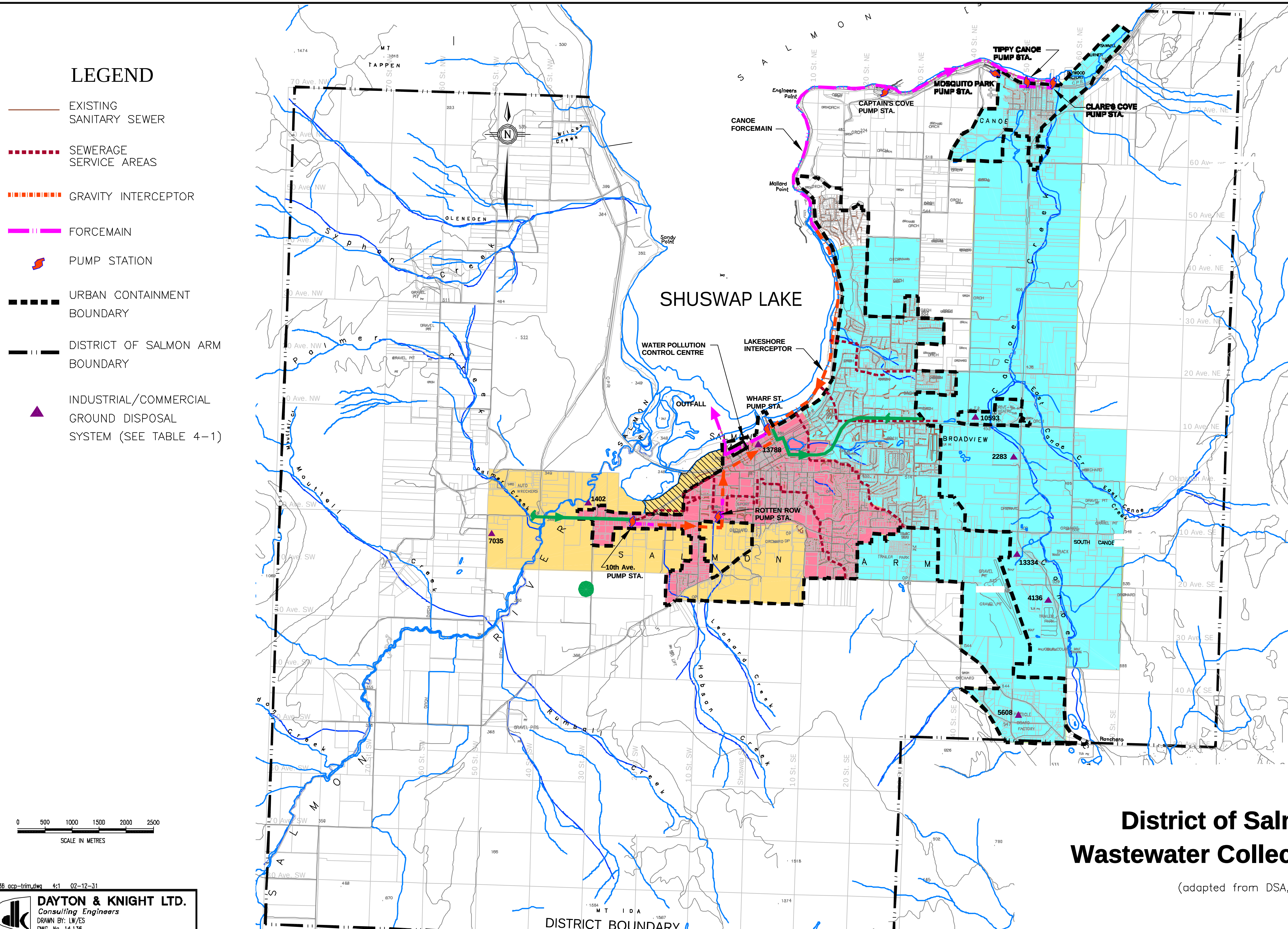
The land commission refused permission to build treatment works on a 7 acre parcel on the Harrington farm, and on February 27, 1975, the farming community rejected the irrigation concept unless extensive drainage schemes were undertaken in the Valley farmlands. The Permit was then amended in June 1976 to allow either lake or land discharge, and the existing WPCC was constructed.

4.2 Salmon Arm Water Pollution Control Centre

4.2.1 Service Area and Collection

The wastewater collection system in Salmon Arm was constructed in stages. The first collection system was built in the 1930's in the Canoe sub-area. The second system, for the Salmon Arm downtown area, was constructed in 1966 and 1967. Since 1970, sanitary sewers have been constructed for most of the developed areas in Salmon Arm. Most of the developments in Salmon Arm are located within 20th Avenue S.E. to 30th Avenue N.E. between 10th Street S.W. and 40th Street S.E. The Canoe sub-area (75th Avenue S.E. and the 50th Street N.E.) and Raven sub-area (50th Avenue N.E. and 20th Street N.E.) are distinct subdivisions separate from the main urban area. The total developed area consists of approximately 1600 hectares.

The existing WPCC collection system in Salmon Arm consists of sewage pump stations, forcemains, a gravity interceptor along Lakeshore Road N.E., and collection sewers. These are illustrated on Figure 4-1. The Official Community Plan (OCP) states that extensions of the sanitary sewer may be supported within the Urban Containment Boundary (UCB), with priority given to the Development Areas (A, B and C) shown on Figure 3-2 in Section 3. The UCB shown on Figure 4-1 therefore represents the potential service area boundary for the WPCC, although individual (onsite) or community systems are also possible on a case-specific basis. Comparison of Figure 4-1 with Figure 3-1 shows that the industrial areas,



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District of Salmon Arm Wastewater Collection System

(adapted from DSA, 2002a)

Figure 4-1

with the exception of the waterfront, are not serviced by the WPCC. Commercial areas for the most part are serviced by the WPCC, except for at Canoe and the area near the junction of Highway 97B and the Trans Canada Highway.

The District continues to carry out infrastructure analysis to determine the age, capacity and condition of the sanitary sewer system; this information is used to identify priorities for upgrading and improving the system. A computer model of the wastewater collection system is currently being developed to identify bottlenecks, and to allow evaluation of the effects of new development on the system (Dayton & Knight Ltd., 2002c). Efforts to reduce inflow and infiltration of storm runoff and groundwater are described in Section 5.2 of this report.

4.2.2 Treatment Facilities

The Stage I WPCC was commissioned for a service population of 6,250 on May 14, 1977. Since the plan at that time was still to examine the use of spray irrigation, only a short outfall to Salmon Arm Bay was constructed, and the provisions for phosphorus and nitrogen removal were not included.

In 1977, an investigation of alternate sites on First Nations lands (Adams Lake) for effluent irrigation was unsuccessful. Following a request to the Province for assistance, the Resources Recovery Branch in April 1980 concluded that continued surface water discharge with phosphorus reduction would be a cost effective solution for Salmon Arm.

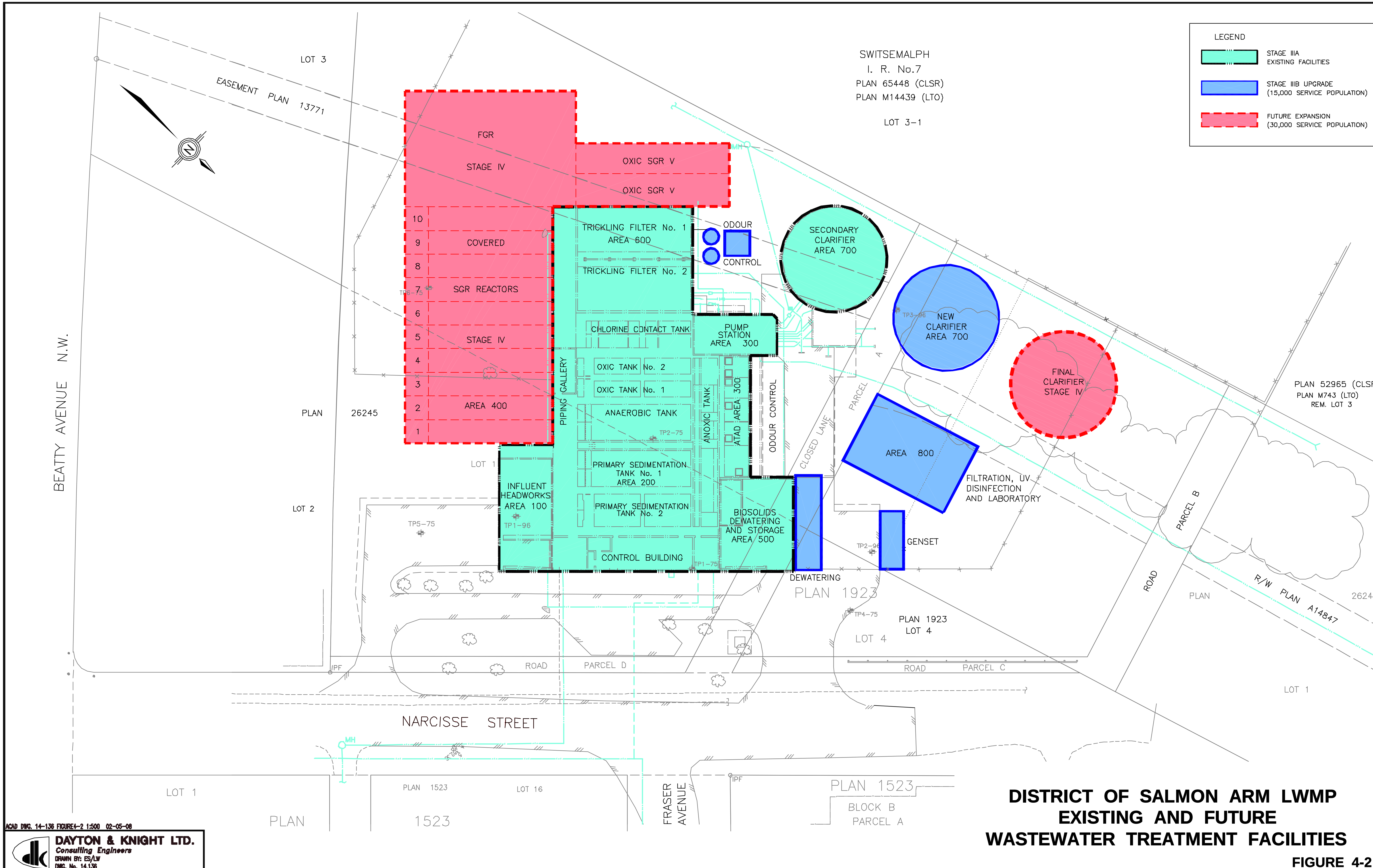
Plans for a treatment plant upgrade and expansion were developed in 1982 (Dayton & Knight Ltd., 1982); this provided the basis for the Stage II WPCC upgrade. The use of land for irrigation was further considered, but was dismissed in favour of a continued lake discharge.

In 1982, a chemical feed system was installed to assist in phosphorus reduction, and in 1986, the Stage II upgrade was undertaken. The existing (Stage I) activated sludge process was converted to the Trickling Filter/Solids Contact Process, and modifications were added to biologically remove phosphorus and eliminate the need for chemical addition for phosphorus removal (Dayton & Knight Ltd., 1986). The biological phosphorus removal capacity of the 1986 (Stage II) plant was designed for 6,250 people. Design of solids digestion and sludge thickening improvements was subsequently undertaken (Dayton & Knight Ltd., 1989), with construction of these improvements during 1990 and 1991.

A pre-design study in 1996 (Dayton & Knight Ltd., 1996) identified wastewater treatment upgrade requirements for several expansion stages to allow an eventual 30,000-population treatment capacity. The Stage IIIA upgrade undertaken in 1998 was intended to provide capacity for an average sewage flow of about 5,000 cubic metres/day (about 12,500 people) in all components of the treatment system. Some of the planned Stage IIIA improvements (e.g., upgrading of the Wharf Street Pump Station) were deferred to Stage IIIB. A site plan of the existing (Stage IIIA) WPCC facilities is shown on Figure 4-2.

For the current (Stage IIIA) WPCC capacity, the construction cost for a replacement facility would be about $14 million. (Note that an additional $2 million for a 1.5 km extension to the outfall would increase the replacement cost to about $16 million.). The annual operating budget for the existing WPCC in 2001 was about $525,000. This equates to an operating cost (not including capital cost repayment or costs associated with the sewage collection system) of about $0.32/cubic metre of wastewater treated or $52/capita/year. These costs are typical for a facility of this nature (Dayton & Knight Ltd., 2001a).

In the existing (Stage IIIA) facility, flow enters the treatment plant in a 300 mm diameter forcemain sewer from the Wharf Street Pump Station. The untreated sewage is routed through flow measurement, and subsequently through a screening process. Screened flows are conveyed to a vortex grit separator. Screenings and grit are trucked to the regional landfill.



DISTRICT OF SALMON ARM LWMP
EXISTING AND FUTURE WASTEWATER TREATMENT FACILITIES

FIGURE 4-2

The wastewater flow leaving the grit chamber is separated into equal streams to each of two primary sedimentation tanks, where gravity separation of settleable crude (primary) solids and floatable material occurs. Settled primary solids are pumped to the digester, and floatable materials are sent to landfill.

The settled sewage leaving the primary tanks flows to the biological treatment process. The biological process includes a series of mixed basins and a two-cell trickling filter tower. Suspended and attached growth bacteria cultured in the biological treatment process remove dissolved contaminants from the wastewater; these include oxygen-demanding organic compounds, phosphorus, and ammonia nitrogen. More detail regarding the fundamentals of biological treatment is provided in Appendix 2.

The process liquid leaving the biological treatment facilities flows to the final settling tank (clarifier), where the process bacteria settle to the bottom, and the treated (clarified) effluent flows over a surface weir to the disinfection chamber. After disinfection by chlorine injection, the effluent is dechlorinated by sulphur dioxide injection and discharged to Salmon Arm Bay via the outfall. Some of the settled bacterial solids are recycled to the biological process; excess bacterial solids are thickened in a rotating screen facility and are then pumped to the digester along with the primary solids from the primary sedimentation tanks.

The primary and biological waste solids from the liquid treatment processes at the WPCC are discharged to the autothermal thermophilic aerobic digester (ATAD) for stabilization. Patented Turborator aspirating aerators provide aeration and mixing in the digester. Treated biosolids discharged from the ATAD are dewatered in a centrifuge facility to a consistency of about 30% to 35% total solids by weight process (the remaining 65% to 70% by weight is water). The separated liquid (centrate) is returned to the liquid treatment processes. The dewatered biosolids are currently trucked to the regional landfill for disposal, where the biosolids are used at the landfill for temporary cover. The District is currently investigating alternatives for reuse of the biosolids (see Section 9).

The need to proceed with the Stage IIIB upgrade at the WPCC is now considered necessary. Stage IIIB is to provide standby power, a second final clarifier, additional odour treatment (see Section 4.2.3), final effluent filtration, and replace chlorine disinfection with ultraviolet light. Stage IIIB will also increase the capacity of all WPCC components to serve 15,000 people. The Stage IIIB upgrade requirements were identified in previous studies (Dayton & Knight Ltd., 1996, 2000 and 2001a). Increased capacity for waste biological solids thickening and biosolids dewatering are also now needed. A site plan for the proposed Stage IIIB facilities and the future facilities required to ultimately increase the WPCC to a service population of 30,000 people is shown on Figure 4-2.

Estimated capital costs for the Stage IIIB upgrade are summarized in Table 4-1. Under the 1.5% low growth scenario, the Stage IV upgrade would be required around the year 2018. Under the 3% (high growth) scenario, expansion of the WPCC beyond Stage IIIB (i.e., Stage IV) would be required around the year 2010.

TABLE 4-1
CAPITAL COSTS FOR STAGE IIIB WPCC UPGRADE

Description	Approximate Cost
Influent Pumping Station Upgrade and Odour Control	$535,000
Waste Biological Sludge Thickening and Skimmings Expansion	$310,000
Sludge Digester Expansion and Digester Odour Control	$645,000
Biosolids Dewatering Expansion	$480,000
Emergency Power (Genset)	$325,000
Odour Control for Biological Treatment Basins	$65,000
Trickling Filter Odour Control and Header/Flushing/Media Improvements	$1,420,000
Additional Final Clarifier (Settling Tank)	$950,000
Effluent Filtration and UV Disinfection	$2,320,000
Laboratory	$205,000
Heating, Ventilating and Air Conditioning	$105,000
TOTAL	**$7,360,000**

It should be noted that the Ministry of Water, Land and Air Protection (MWLAP) may require the extension of the outfall to deeper water. The addition of a diffuser may also be required. The outfall extension remains an uncertainty (see Section 6.1.2); detailed design parameters and costs for outfall improvements have not been developed to date.

4.2.3 Odour Control

Odour in wastewater collection systems comes mainly from degrading organic wastes in sewer pipes and pump station wet wells. There is currently no odour control on the collection system at Salmon Arm, other than a small aerosol odour masking system at Wharf Street Pump Station. Odour in the collection system has not normally been a problem.

The principal odour sources at the Salmon Arm WPCC are the headworks area (screening and grit removal), the solids digestion (ATAD) facility, and the dewatered biosolids storage bay. All of these areas are enclosed, with foul air being collected and routed to the trickling filter, which acts as a scrubbing tower for biological removal of odorous compounds. This provides limited odour removal, and an additional stage of odour treatment is now needed. Other areas of the plant in need of odour control include the trickling filter, the primary sedimentation tanks, and the overflow weir at the biological treatment process.

To meet the highest level of odour control, all tanks should eventually be covered and the collected foul air should be treated in two or more stages. This was understood to be financially impractical during the initial Stage III expansion cost estimates, although the existing WPCC open tankage is well suited to allow covering. Residential development is planned for the near future immediately adjacent to the WPCC, and this highlights a need to review odour control requirements. An odour management committee should be considered to ensure that daily audits are undertaken, and quarterly reviews should be made to ensure that adequate treatment and operational care are being exercised.

A meteorological station was recently added at the WPCC and connected to the plant computer, to allow recording of daily records of wind speed, wind direction, humidity, barometric pressure, precipitation, and temperature. This information will be beneficial in assessing the migration of odours generated at the WPCC.

As currently planned, Stage IIIB will include two stages of treatment for the worst foul air, and result in about 50% of the plant being covered. Anticipated odour treatment for Stage IIIB is as follows (from Dayton & Knight Ltd., 2001a):

- cover the trickling filter and provide treatment, or make provisions to provide future treatment in subsequent expansion stage;
- collect exhaust from pump gallery Area 200 and apply subsequent treatment with trickling filter foul air;
- collect foul air from lower level of dewatering building, improve fresh air supply to biosolids storage bin and undertake subsequent treatment by biofiltration or other means;
- treat the centrate and/or expand odour treatment to upper floor of dewatering building;
- collect foul air by a hood and exhaust fan above primary and anoxic weirs and provide treatment;
- add second stage of treatment for the ATAD foul air; and
- examine use of seasonal treatment for lowest odour sources.

4.3 Other Wastewater Collection and Treatment Systems

Onsite systems are those designed for treatment and disposal of wastewater within the boundaries of individual parcels. These systems normally include a septic tank for settling and partial digestion of crude solids. The partially treated wastewater leaving the septic tank flows to a buried network of perforated pipes, normally referred to as a disposal field, tile field, or drain field. As the wastewater percolates through the soil, solids are captured in the soil pores, and soil bacteria remove dissolved contaminants. Accumulated solids (typically called septage) must be periodically removed from the septic tank. More detail regarding onsite systems is provided in Appendix 2.

As described earlier, the residential areas within the District that are not served by the Salmon Arm WPCC can be assumed to be served by onsite systems; these include mainly single-home systems with a small number of residents served by community ground disposal systems in mobile home (RV) parks. An estimated 3,500 people were served by onsite systems in 2001, and an estimated 3,500 to 4,600 people will be served by onsite systems by the year 2020, depending on population growth. Single-home systems are under the jurisdiction of the Ministry of Health (MOH). The Salmon Arm Industrial Park is also served by onsite systems under the jurisdiction of the MOH. The Industrial Park area is reported to be mainly sand, and according to the Salmon Arm Health Unit is not known to be problematic for ground disposal systems, although the area is affected by spring runoff. There is an old landfill site in the area, but this has not caused any known problems to date. The Salmon Arm Health Unit reports that the exact number of on site systems within the study area administered by the MOH is unknown, because records are incomplete (SAHU, 2002).

The MWLAP has not identified any permitted publically owned community wastewater collection and treatment systems in the study area other than the WPCC, although there are a number of private commercial/industrial onsite systems. These are summarized in Table 4-2, and the locations are shown on Figure 4-1(based on information received from MWLAP). The commercial systems under permit to MWLAP are mobile home/RV parks or campgrounds, and the industrial systems are related to food processing (2 abattoirs, 1 cheese plant). Information regarding the operational characteristics and effluent quality of these systems was requested from the MWLAP, but had not been received at the time of publication of this report.

TABLE 4-2
SUMMARY OF WASTEWATER DISCHARGES REGULATED BY MWLAP

Permit Number	Discharger	Type	Details	Max. Allowable Discharge (m^3/d)
1251	District of Salmon Arm	Permit	Sewage treatment plant	8,200
1402	Petty, Bernard and Linda	Permit	Abbatoir[1]	6
2283	Salmon Arm KOA	Permit	Campground[2]	36
4136	Brock Estates Ltd.	Permit	RV Park[2]	50
5608	Danapa Holdings Limited	Permit	Abbatoir[1]	4.6
7035	Pambeni Farm	Permit	Cheese Plant[4]	1.5
10593	Collestone Enterprises Ltd.	Permit	RV Park[2]	24
11402	District of Salmon Arm	Permit	Beneficial Reuse of Biosolids as Organic Soil Amendment	1,500 m^3/yr
13334	Salmon Arm Golf Club	Permit	Tile Field[1]	23
13788	Petro-Canada	Regulated Site	Stormwater Runoff[3]	

1 Septic Tank to Ground Disposal.
2 Package Plant to Ground Disposal, max BOD_5 45 mg/L, maximum TSS 60 mg/L.
3 Oil – Water Separator to Ground Disposal.
4 Storage Lagoon and Spray Irrigation to Farmland.

5.0 EXISTING AND PROJECTED WASTEWATER AND BIOSOLIDS QUANTITY AND QUALITY

As described in Section 3.1.1, long term planning for the management of domestic wastewater collection and treatment is necessary to avoid costly duplication and/or relocation of existing facilities to deal with future population increases and development. Reasonably accurate projections of the quantity and quality of domestic wastewater are necessary to determine future needs, so that trunk sewers can be designed with sufficient capacity to handle future development, and so that sufficient space is set aside for the construction and expansion of treatment works.

Sanitary sewer systems are primarily intended to collect and transport wastewater to treatment facilities. However, most sanitary sewer systems are subject to the entry of stormwater during rainfall events, through infiltration of subsurface water into defects in the collection system, and through inflow of surface water through manholes and surface drainage systems that are connected to the sewer. Inflow and Infiltration (I&I) can significantly increase the flow rate to collection and treatment facilities during wet weather; in some cases, this may cause spills of untreated wastewater, reduce treatment efficiency, or even lead to the contents of the treatment plant being “washed out” with the effluent. Wastewater volumes and character within the study area are described in the following sections. This information was used in developing and evaluating the waste management options described later in this report.

5.1 Wastewater Quantity and Quality

The recorded average day wastewater flows at the Salmon Arm Water Pollution Control Centre (WPCC) for the years 1999, 2000 and 2001 are shown in Table 5-1. Flow data prior to the installation of the new plant flow meter during the Stage IIIA upgrade in late 1998 have been determined to underestimate actual flows by 30% to 35% (Dayton & Knight Ltd., 2001a). The (inaccurate) flow data collected prior to the installation of the new flow meter in 1998 were not included in this study.

TABLE 5-1
WPCC INFLUENT FLOWS 1999 TO 2001

Year	WPCC Service Population	WPCC Influent Flows							
		Average Day[2]		Average Dry Weather[3]		Average Wet Weather[4]		Maximum Day[5]	
		cubic metres /day	litres/capita/ day	cubic metres/ day	litres/capita /day	cubic metres/ day	litres/capita /day	cubic metres /day	litres/capita /day
1999[1]	11,600	4,590	396	4,330	373	4,950	427	5,900	509
2000	11,750	4,370	372	4,120	351	5,110	435	6,100	519
2001	11,900	4,280	360	4,120	346	4,480	376	4,800	403
Average	11,750	4,410	376	4,190	357	4,845	413	5,600	477

1 Extrapolated from Table 3-1
2 Average daily flow from January 1 to December 31 of each year
3 Minimum 30-day moving average flow for each year
4 Maximum 30-day moving average flow for each year
5 Highest recorded single day flow from January 1 to December 31 for each year

It should be noted that the 2001 service population of the WPCC was estimated at about 11,500 people before the 2001 Census was conducted (based on 3% annual population growth from 1996 to 2001 – see Section 3.2). Based on the actual population growth recorded in the 2001 Census (<1% per year from 1996 to 2001), the estimated 2001 service population of the WPCC was about 11,900 people, and this figure was used in developing waste volume projections.

The data in Table 5-1 show that the average day influent flow was about 380 litres per capita per day (litres/capita/day) over the three-year period of record. The dry weather flow, which was calculated as the minimum 30-day moving average flow for each year, was about 360 litres/capita/day over the three years of record. The maximum day flow recorded during this period was about 520 litres/capita/day in 2000. The projected wastewater flows to the planning horizon of 2020 based on the above per capita flow rates for the low growth and high growth scenarios (1.5% and 3%, respectively - see Section 3.2) are summarized in Table 5-2. As shown, plant average day flow is projected to increase into the range 6,400 cubic metres/day to 8,400 cubic metres/day by the year 2020, and the maximum day flow is projected to be in the range 8,800 cubic metres/day to 11,500 cubic metres/day, depending on population growth. This represents an increase of about 40% to 90% in wastewater volumes over the next 20 years, depending on population growth.

TABLE 5-2
PROJECTED WPCC WASTEWATER FLOWS TO 2020

Year	Average Day Flow (m^3/d)		Maximum Flow (m^3/d)	
	1.5% Growth	3% Growth	1.5% Growth	3% Growth
2000*	4,400	4,400	6,100	6,100
2005	4,900	5,200	6,700	7,100
2010	5,400	6,200	7,400	8,500
2015	5,900	7,700	8,100	9,900
2020	6,400	8,500	8,800	11,600

* actual flows recorded at WPCC

Studies show that the values shown in Table 5-3 are typical for the WPCC influent quality (Dayton & Knight Ltd., 1996). The WPCC per capita mass loadings of contaminants were developed previously (Dayton & Knight Ltd., 2001a). These are summarized in Table 5-3, together with projected total mass loadings to the year 2020 for both the low growth and high growth population scenarios.

TABLE 5-3
WPCC PROJECTED MASS LOADINGS

Parameter	Untreated Sewage Concentration (milligrams/ litre)	Per Capita Load[1] (grams/capita /day)	WPCC Mass Loading (kilograms/day)		
			2001	2020	
				1.5% Annual Growth	3% Annual Growth
Total Suspended Solids	150	72	850	1,210	1,590
Total BOD_5	200	80	940	1,340	1,770
Soluble BOD_5	100	44	520	740	970
Total Kjeldahl Nitrogen (as N)	28	11	130	180	240
Total Phosphorus (as P)	6	2.4	30	40	50

[1] from Dayton & Knight Ltd. (2001a)

The WPCC Discharge Permit (PE-1251) specifies the following effluent requirements:

- maximum rate of discharge 8,200 m^3/d;
- 5 day biochemical oxygen demand (BOD_5) – maximum 30 milligrams/litre;
- total suspended solids (TSS) – maximum 40 milligrams/litre;
- chlorine – maximum 0.01 milligrams/litre; and
- total phosphorus – maximum 1.0 milligrams/litre.

As shown earlier in Table 5-1, the maximum recorded flow at the WPCC since the Stage IIIA upgrade was completed in 1998 was 6,100 cubic metres/day, well under the allowable maximum of 8,200 cubic metres/day. The effluent average concentrations of BOD_5, TSS, and total phosphorus over the three year period 1999 through 2002 were 18 milligrams/litre for BOD_5 and TSS, and 1.0 milligrams/litre for total phosphorus, which are within the allowable maximum permit values. Occasional process upsets have caused effluent BOD_5, TSS, and total phosphorus to exceed the maximum permitted levels on some occasions. Effluent filtration is needed to consistently meet the maximum allowable total phosphorus concentration of 1.0 milligrams/litre, and additional facilities are needed to provide emergency standby capacity (see Section 4.2.2).

5.2 Inflow and Infiltration

Inflow and Infiltration (I&I) into the sewer collection system can substantially increase the volume of wastewater arriving at treatment facilities. I&I vary depending on antecedent weather, soil moisture, groundwater levels, and the duration and intensity of storm events.

Infiltration can be divided into two components. Groundwater infiltration (GWI) enters the system through defects in pipes, which are located below the water table; GWI is relatively constant in intensity and is of long duration. Rainfall-derived infiltration (RDI) occurs during and immediately after rainfall events, and is caused by the seepage of percolating rainwater into defective pipes which lie near the ground surface; RDI is typically of relatively short duration and high intensity, compared to GWI.

Inflow can also be divided into two components. Dry weather inflow (DWI) results from surface water not caused by rain that enters the sewer system (e.g., street and vehicle washing). Stormwater inflow (SWI) results from the diversion of storm surface runoff into sanitary sewers (e.g., roof downspouts that are connected to the sanitary sewer and surface runoff entering manholes).

5.2.1 Wet Weather I&I

The Municipal Sewage Regulation (MSR) for British Columbia states that, where 2.0 times the average dry weather flow (ADWF) is exceeded at the treatment plant during rain or snowmelt events and if the contributory population exceeds 10,000 persons, the discharger should show how I&I can be reduced as part of a LWMP (MELP, 1999). The ADWF at the Salmon Arm WPCC for the three year period from 1999 to 2001 is summarized in Table 5-1 in the previous section, together with the maximum day flows (MDF) for the same period. The recorded daily flows at the WPCC, the 30-day average flow, and the ADWF are illustrated on Figure 5-1. The ADWF is the minimum 30-day moving average of the daily flows recorded in a given year. As shown on Figure 5-1, the ADWF normally occurs during the late autumn. The MDF at the WPCC did not exceed 1.4 times the

ADWF during the period of record (1999 through 2001); this is well below the MSR criteria of 2.0 times ADWF, and it shows that wet weather I&I in the WPCC collection system as a whole is not excessive. This is confirmed by the relatively small difference between the average dry weather (minimum month) flow of 425 litres/capita/day and the average wet weather (maximum month) flow of 492 litres/capita/day (see Table 5-1). In addition, analysis shows that daily flows in excess of the average dry weather flow accounted for only about 5% of the total volume of wastewater treated at the WPCC from 1999 to 2001.

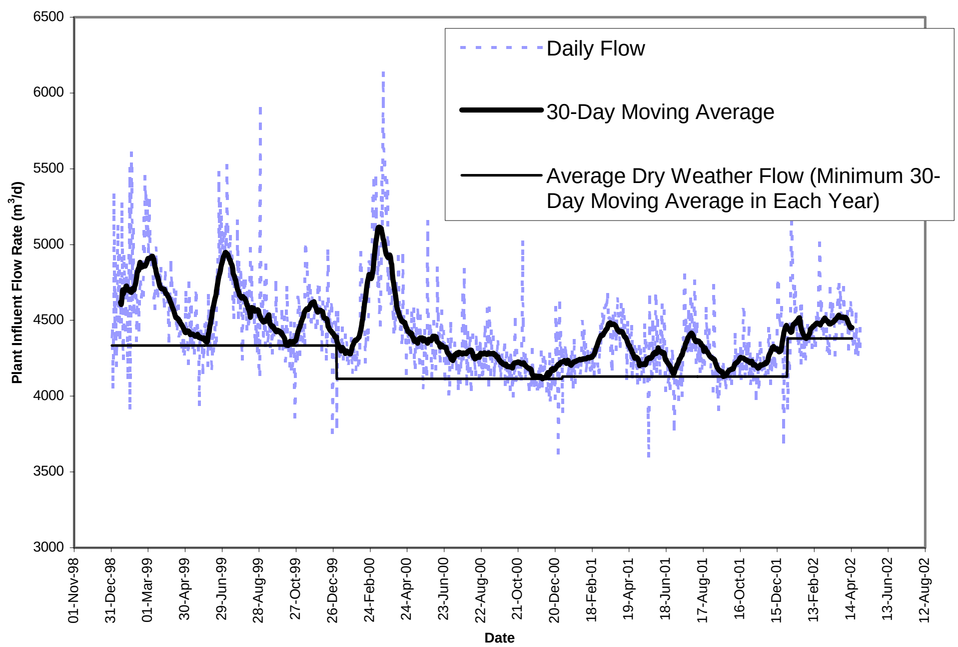


FIGURE 5-1 – WPCC INFLUENT FLOWS

5.2.2 Dry Weather I&I

As described above, the Salmon Arm WPCC does not appear to be subject to sharp increases in flow during wet weather. This indicates that wet weather inflow to the collection system is not a serious problem. However, recorded flows at the plant indicate that continuous infiltration during both wet and dry weather may be significant. Plant staff reported that influent flows at the WPCC during the early morning hours of October 30 and

October 31, 2002, (2:00 a.m. to 6:00 a.m.) was in the range 1,500 m^3/d to 1,700 m^3/d. The main sewage interceptor, which is used for flow equalization, was emptied during the previous day on the occasions when the above flows were recorded. These flows represent 35% to 40% of the WPCC average dry weather influent flow of about 4,200 m^3/d (from Table 5-1), during a time of day when wastewater generation by residents should be near zero. This indicates that there may be a significant amount of groundwater infiltrating into the wastewater collection system, even during times of dry weather and low lake levels. Continuous infiltration into the collection system during both wet and dry weather should be further investigated.

5.2.3 I&I Studies

The District is committed to limiting I&I on an ongoing basis, and to maintaining the wastewater collection system in good working condition. Two I&I studies were recently conducted, to investigate I&I in the wastewater collection system (Dayton & Knight Ltd., 1997a and Dayton & Knight Ltd., 2001b).

The 1997 study focused on the wastewater collection areas at Canoe and Rotten Row. Together these two collection areas provide about 30% of the total flow to the WPCC. The ratios of MDF:ADWF for Canoe and Rotten Row were found to be 2.3:1 and 1.8:1, respectively, which is significantly higher than the ratio of 1.4:1 for the collection system as a whole. Accordingly, I&I reduction measures were recommended for these two areas. The study found that I&I at Canoe was mainly due to inflow, but at Rotten Row was mainly due to infiltration. Field inspections and smoke testing revealed cross connections with storm sewers, inflow through manhole covers, and pipe defects (misaligned joints, roots, holes). The total cost of recommended improvements was estimated at about $70,000 (Dayton & Knight Ltd., 1997a).

The Lakeshore Interceptor sewer conveys wastewater flows from the WPCC collection system to the Wharf Street pump station (see Figure 4-1 in Section 4.2). The Wharf Street pump station pumps all wastewater flows to the WPCC. The 2001 I&I study investigated flows in the Lakeshore Interceptor sewer and inflows at the lateral connections to the Interceptor, to identify if an infiltration component was present due to high groundwater elevations. The lower sections of the interceptor are typically below the water table about 30% of the time. The study could not confirm the absence of high groundwater infiltration, but early morning water levels indicated that it was likely minimal. The study identified a major continuous inflow from the lateral conveying wastewater from the South Broadview and Lakeshore Terrace sewerage areas. This remains to be confirmed by the District. The 2001 I&I study recommended further investigations with video inspections and flow monitoring of these sewerage areas to identify areas in the collection system with high I&I (Dayton & Knight Ltd., 2001b).

5.2.4 Recommendations for I&I Reduction

The District should continue with the ongoing program to identify and eliminate sources of I&I during routine sewer maintenance, including elimination of cross connections between the storm and sanitary sewer systems. Further investigation is needed to assess the degree and location(s) of continuous groundwater infiltration into the collection system during both wet and dry weather.

5.3 Biosolids Quantity and Quality

Biosolids is the name given to the solid residuals produced by wastewater treatment, after the solids have been sufficiently treated so that they can be beneficially reused as a soil conditioner and natural fertilizer. Untreated wastewater solids are generally referred to as sludge.

Biosolids production can be expected to increase more or less in direct proportion to the WPCC service population. Plant records show that the annual total mass of digested biosolids produced at the WPCC from 1999 to 2001 was about 220 tonnes dry solids per year. This is in close agreement with a solids production of about 200 tonnes/yr based on theoretical calculations and plant operating data for liquid treatment (assuming 30% total solids reduction in the digester, 95% BOD_5 removal, influent total BOD_5 concentration 200 milligrams/litre, and total solids yield of 1 kg solids/kg BOD_5 removed). Laboratory testing shows that the bulk density of the digested dewatered biosolids is typically about 0.5 tonne/cubic metre. The estimated annual mass of dewatered biosolids produced in 2001 was about 660 bulk tonnes (assuming 33% total solids by weight), and the volume was about 1320 cubic metre (at a bulk density of 0.5 tonnes/cubic metres). The estimated future biosolids production to 2020 for both the low growth and high growth scenarios is summarized in Table 5-4.

TABLE 5-4
WPCC PROJECTED BIOSOLIDS QUANTITIES

Year	Low Growth Scenario (1.5% Annual Growth)			High Growth Scenario (3% Annual Growth)		
	Dry Wt.[1] (tonnes/year)	Bulk Wt.[2] (tonnes/year)	Volume [3] (cubic metres/year)	Dry Wt.[1] (tonnes/year)	Bulk Wt.[2] (tonnes/year)	Volume [3] (cubic metres/year)
2001	220	660	1,320	220	660	1,320
2005	240	720	1,440	250	750	1,500
2010	260	780	1,560	300	900	1,800
2015	290	870	1,740	350	1,050	2,100
2020	310	930	1,860	410	1,230	2,460

1 assumes increase directly proportional to WPCC service population
2 assumes 67% moisture content (33% total solids by wt.)
3 assumes bulk density of 0.5 tonnes/cubic metre

As described later in this report (Section 7), the quality of biosolids can limit potential reuse applications. The results of biosolids quality sampling from August 1998 to December 2001 are summarized in Table 5-5. The data in Table 5-4 are compared to regulatory requirements in Section 7.4 of this report.

TABLE 5-5
WPCC BIOSOLIDS QUALITY
AUGUST 1998 TO DECEMBER 2001

Parameter	Avg.[1]	Max.[1]	Min.	No. of Samples[1]
Moisture Content (% by weight)	67	73	63	21
Volatile Fraction of Solids (%)	65	78	55	21
Total Nitrogen (% by weight)	4.1	5.6	2.1	19
Total Phosphorus (% by weight)	3.8	5.6	0.8	18
Total Potassium (% by weight)	0.3	0.5	0.1	19
Arsenic (milligrams/kilogram)	<4.0	10	<0.4	18
Cadmium (milligrams/kilogram)	2.1	3.1	1.5	18
Cobalt (milligrams/kilogram)	<3.5	6.0	2.0	18
Chromium (milligrams/kilogram)	36	43	22	18
Copper (milligrams/kilogram)	819	1070	594	18
Lead (milligrams/kilogram)	<57	<100	<50	18
Mercury (milligrams/kilogram)	5.5	14.1	3.0	18
Molybdenum (milligrams/kilogram)	8.1	14	<4.0	18
Nickel (milligrams/kilogram)	20	26	14	18
Selenium (milligrams/kilogram)	<2.4	3.4	<2.0	18
Zinc (milligrams/kilogram)	630	857	499	18
Fecal Coliforms in digested biosolids (per gram dry solids)	<1,221	11,500	<1	16

[1] excludes one anomalous sample taken July 20, 2000 where metals concentrations were unusually high.

5.4 Onsite Systems and Commercial/Industrial Wastewater

As described in Section 4.3, onsite systems are those designed for treatment and ground disposal of wastewater within the boundaries of individual lots or parcels. These systems typically include a septic tank followed by a subsurface disposal field. Accumulated solids (normally referred to as “septage”) must be periodically removed from septic tanks by pumper trucks, to prevent clogging of the disposal field. Pumper truck discharges can include industrial and commercial wastes as well as septage generated in onsite systems. Pumper truck discharges are not currently accepted at the WPCC. Collected septage is currently trucked to a privately owned lagoon treatment facility located outside of the District boundary.

There are a number of residential septic tank systems in the Salmon Arm area, as well as commercial/industrial onsite systems (see Section 4.4). Flow rates of wastewater through onsite systems are not normally monitored. For residential systems, the per capita generation of wastewater should be similar to that in the central WPCC system (i.e. dry weather flow of 360 litres/capita/day), assuming that I&I into the WPCC collection system is minimal (this remains to be confirmed – see Section 5.2.2). Detailed records describing the amounts of trucked waste generated from residential development within the study area were not available. The United States Environmental Protection Agency (USEPA, 1984) suggests that in the absence of site-specific data, an average per capita septage generation rate of 230 litres/capita/year be used for planning purposes. Projected volumes of liquid effluent and septage from residential onsite systems based on the above per capita flows are summarized in Table 5-6.

TABLE 5-6
WASTEWATER AND SEPTAGE VOLUMES FOR ONSITE SYSTEMS

Year	Liquid Effluent (cubic metres/day)				Septage (cubic metres/year)			
	Residential[1]		Industrial Park[2]	Other Industrial[3]	Residential[4]		Industrial Park[2,5]	Other Industrial[3,5]
	1.5% Growth	3% Growth			1.5% Growth	3% Growth		
2001	1,260	1,260	80	75	800	800	90	80
2005	1,260	1,340	90	78	800	850	100	84
2010	1,260	1,450	100	80	800	920	115	88
2015	1,260	1,550	120	83	800	990	125	92
2020	1,260	1,660	130	85	800	1,060	140	95

1 assumes 360 litres/capital/day (WPCC dry weather flow)
2 assuming total area of 80 ha in 2001, increasing to 124 ha in 2020 – includes future development of Airside Industrial/Commercial (see Section 3.1.2) – assumed wastewater generation 1 m^3/ha/d
3 assuming total area of 75 ha in 2001, increasing to 86 ha by 2020 (see Section 3.1.2) – assumed wastewater generation 1 m^3/ha/d
4 assumes 230 litres/capita/year (from USEPA, 1984)
5 assumes 1.1 cubic metres/hectare developed area/day

No information regarding the volume of wastewater and septage generated by commercial land use outside the WPCC service area was available. The per capita flows developed for the WPCC service area include commercial flows.

Maximum allowable daily discharge volumes of liquid effluent for commercial/industrial onsite systems permitted by the MWLAP are shown in Table 4-2 (total maximum discharge approximately 145 m^3/d). Actual discharge flows are not monitored. Discharge volumes for onsite systems at the Industrial Park regulated by the MOH are unknown. Urban Systems (1995) suggested that wastewater generation at the Industrial Park based on historical water consumption around 1995 was about 1,800 m^3/d (based on the assumption that about 13% of the total available area is used for roads, 65% lot coverage with buildings, and 5 liters/day/square metre building area). However, a wastewater flow of 1,800 m^3/d represents an equivalent population of about 5,000 people, which seems unreasonably high for the Industrial Park, since the industries of Salmon Arm are not generally heavy water users, and wastewater generation is mainly from employee washrooms. According to the District, there were about 72 businesses at the Industrial Park in 2003, within a total of 820 employees. Allowing a maximum per wastewater generation for factory employees of 100 L/c/d (from Metcalf & Eddy, 1991), the total wastewater volume generated at the Industrial Park in 2003 would be about 82 m^3/d, for a developed area of about 80 ha (i.e., about 1 m^3/ha/d). This would equate to a total wastewater generation of about 130 m^3/d when the Industrial Park is fully developed (i.e. total developed area including Airside Industrial/Commercial about 124 ha – see Section 3.1.2).

For the most part, industrial areas designated in the OCP are not within the existing WPCC service area. Records are not kept regarding the volume of wastewater and septage generated by industrial and commercial properties within the District of Salmon Arm. The local pumper truck/lagoon facility owner estimates that about 90 cubic metres/year of septage was removed from systems located at the Salmon Arm Industrial Park during 2001. According to True Consulting (2001), the developed area at the Industrial Park at that time was about 80 hectares (see Section 3.1.2). The amount of septage generated by industry will vary according to the type of business. Based on area, the 2001 generation of septage was about 1.1 cubic metres/hectare/day at the Industrial Park.

The projected volumes of industrial wastewater and septage based on the above unit flows and on the industrial growth described in Section 3.1.2 are included in Table 5-6.

No data regarding the characteristics of discharges from onsite systems or septage in the study area were available. Typical characteristics for liquid discharges and septage from properly functioning residential onsite systems are shown in Table 5-7. It is important to note that, under the existing regulatory structure, the quality of discharges from onsite systems permitted by the MOH is not monitored. Many of the onsite systems in the study area are reported by MOH to be located in areas unsuitable for ground disposal (see Section 6.2.1), and effluent quality may be significantly poorer than that shown in Table 5-7.

TABLE 5-7
TYPICAL CHARACTERISTICS OF DISCHARGES FROM RESIDENTIAL ONSITE SYSTEMS (FROM METCALF & EDDY, 1991)

Parameter	Liquid Discharge (milligrams/litre)		Septage (milligrams/litre)
	Septic Tank Effluent	1 Metre Below Bottom of Disposal Field Trench	
BOD_5	140-200	0	6,000
Total Suspended Solids	50-90	0	15,000
Total Nitrogen	35-80	NR	700
Ammonia Nitrogen	7-40	NR	400
Nitrate Nitrogen	<1	40	NR
Total Phosphorus	10-27	1	250
Grease	NR	NR	8,000
Heavy Metals (primarily iron, zinc, and aluminum)	NR	NR	300
Fecal Coliforms	10^6 - 10^{10}	0	NR

NR means not reported

According to USEPA (1984), “Septage facility designers should be cognizant of the fact that highly contaminated industrial sludges, sometimes disposed of together with domestic septage, can severely upset treatment processes. Monitoring programs aimed at detecting such illegal discharges should be strongly encouraged. The treatment facility should be designed to minimize the effects of such upsets”. Pumping of septic tanks typically exhibits a seasonal pattern, with the most activity occurring during the warmer months. USEPA (1984) suggests a summer loading factor of 1.5 times the average annual load for septic tank pumping in North America.

6.0 CAPACITIES OF LAND AND WATER TO ACCEPT WASTE

Treated wastewater and collected storm surface runoff (urban and agricultural) that cannot be reused are discharged to surface water or land. Discharges to surface waters are usually via outfall pipes, which may include diffusers to maximize dilution in some cases. Discharges to land are generally distributed by surface or subsurface piping systems, and the water is allowed to percolate through the soil and eventually reach surface or sub-surface water (groundwater).

6.1 Discharges to Surface Waters

The Salmon Arm Water Pollution Control Centre (WPCC) is the only permitted discharge of treated wastewater to surface waters within the study area, and is under MWLAP jurisdiction (all other permitted discharges are to ground - see Section 4). Surface discharges of storm surface runoff within the District are to the Salmon River and its tributaries, to a number of smaller streams, and directly to Salmon Arm Bay on Shuswap Lake. Storm runoff is discussed in Section 10. The Salmon River and Shuswap Lake incorporate a number of diverse and productive ecosystems. Water quality in the Salmon River and Shuswap Lake in the vicinity of the study area are discussed below.

6.1.1 Salmon River

The study area lies at the mouth of the Salmon River, where it empties into Salmon Arm Bay on Shuswap Lake. Specific water quality objectives for the Salmon River have been developed (MWLAP, 2001b). These are summarized in Table 6-1.

Water uses for the Salmon River include domestic water supplies, irrigation, livestock watering, recreation (e.g., fishing, swimming, canoeing, bird watching), and use by aquatic life and wildlife. The Salmon River and its tributaries provide habitat for salmon (chinook, coho, sockeye), rainbow trout, and mountain whitefish (MWLAP, 2001b).

TABLE 6-1
WATER QUALITY OBJECTIVES FOR THE SALMON RIVER
(FROM MWLAP, 2001b)

Parameter	Objectives	30-Day Mean Objectives
Temperature	• max. 15.6ºC Dec. 1 to Sept. 30 • max. 12.8ºC Oct. 1 to Nov. 30	max. 14.2ºC year round
Dissolved Oxygen	• min. 9 mg/L long-term • min. 5 mg/L short-term	• min. 11 mg/L long-term • min. 8 mg/L short-term
pH	6.5 to 8.5	6.5 to 8.5
Total Suspended Solids	not applicable	• max. 10 mg/L over background long-term • max. 20 mg/L over background short-term
Turbidity	not applicable	• max. 5 NTU over background long-term • max. 10 NTU over background short-term
Total Phosphorus	• max. 10 ug/L Tappen Bay long-term • max. 15 ug/L Tappen Bay short-term	not applicable
Total Ammonia	not applicable	depends on water temperature and pH
Chlorophyll-a	max. 50 mg/m^2	not applicable
Fecal Coliforms	• max. 10/100 mL 90^{th} percentile long-term • max. 100/100 mL 90^{th} percentile short-term	not applicable
E.coli	max. 10/100 mL 90^{th} percentile	not applicable
Entercoccus	max. 3/100 mL 90^{th} percentile	not applicable

Water quality monitoring over more than 25 years in the Salmon River Watershed shows that water quality in the Salmon River is degraded, and does not fully support the designated water uses in the basin. Parameters known to exceed water quality guidelines within the watershed include the following (MWLAP, 2001b):

- total suspended solids;
- turbidity;
- nutrients (phosphorus, total ammonia);
- total metals (arsenic, cadmium, chromium, copper, lead, mercury, zinc);
- microbial indicators (fecal coliforms); and
- temperature (during summer months).

Water quality monitoring done during the mid 1980's showed that there was a higher load of nitrogen, phosphorus and pathogens at the mouth of the river than at the headwaters, indicating that nutrients are entering the river along its course. Other parameters that show an increasing trend along the length of the Salmon River are pH, suspended solids, and fecal coliforms. Concentrations of phosphorus and total ammonia are highest near Bolean Creek. Elevated concentrations of suspended solids have been attributed to erosion, and elevated nutrient levels (phosphorus and ammonia) have been attributed to cattle feed lots. Two recent studies indicate that water quality conditions are not exhibiting any environmentally-sensitive long-term trends (MWLAP, 2001b).

6.1.2 Shuswap Lake

The Salmon River empties into Salmon Arm Bay on Shuswap Lake, adjacent to the community of Salmon Arm. The Salmon Arm WPCC also discharges tertiary-treated effluent to Salmon Arm Bay. An Environmental Impact Study (EIS) was recently conducted on the WPCC outfall discharge to Salmon Arm Bay in fulfillment of the requirements of the WPCC discharge permit (Dayton & Knight Ltd., 2002a). The report is summarized briefly in this section.

The objectives of the EIS were to evaluate the effects of phosphorus loading to the lake at the current WPCC discharge of about 4,500 cubic metres/day and at the maximum permitted discharge of 8,200 cubic metres/day, as well as to evaluate the toxicity of the effluent and its potential impacts on aquatic life. Tappen Bay to the north, which receives phosphorus inputs from White Creek and Tappen Creek, was also included.

Assessments of water quality have shown that algae growth in Shuswap Lake is phosphorus-limited. Salmon Arm Bay is relatively shallow and highly developed, and it experiences greater water quality impacts (algae growth) than other areas of the lake. Potential sources of phosphorus inputs to Salmon Arm Bay and Tappen Bay include apatite minerals in soils and rocks, seepage from agricultural activities (manure from feedlots and dairies, fertilizers), failing septic tanks, and urban runoff. The Salmon River and the Salmon Arm WPCC are significant sources of phosphorus loading to Salmon Arm Bay, while White Creek and Tappen Creek to the north represent additional nutrient inputs to Tappen Bay and thus to Shuswap Lake.

The conclusions developed during the EIS are summarized as follows:

1. There are three distinct periods of flow for the streams entering Salmon Arm Bay in Shuswap Lake. The same pattern applies to White Creek and Tappen Creek, which are the major streams entering Tappen Bay to the north. The three flow periods are freshet (May and June), intermediate stream flow (March, April and July), and low stream flow (August through February).

2. The volume of flow contributed to Salmon Arm Bay by the Water Pollution Control Centre (WPCC) is insignificant compared to the flow contributed by the Salmon River at all times of the year.

3. Salmon Arm Bay exhibits some of the characteristics of eutrophication (phosphorus enrichment, nuisance algae and aquatic plants). However, there is evidence that water quality has been improving in Salmon Arm Bay over the past few years. The cause of this apparent improvement is not known. Further monitoring is necessary to determine if this is a long term trend or an anomaly.

4. Mass balance calculations show that the Salmon River currently (year 2000) contributes about 96% of the annual total phosphorus load to Salmon Arm Bay, with the WPCC contributing about 4% (this excludes other sources that cannot be quantified such as urban runoff). The annual WPCC contribution would rise to about 11% at the maximum permitted discharge, with the remaining 89% contributed by the Salmon River. Relative phosphorus contributions from the WPCC are greatest during low stream flow, when the WPCC contributes about 20% of the total phosphorus load at 2000 flows, and would contribute 40% of the total phosphorus load at the maximum permitted discharge. Annual average phosphorus mass load contributed by the WPCC will be reduced to less than half of the present loading when effluent filtration is added in Stage IIIB upgrade.

5. Mass balance calculations extended to include Tappen Bay as well as Salmon Arm Bay show that the Salmon River currently (year 2000) contributes about 86% of the annual average total phosphorus load to the two bays combined, followed by White Creek at 9%, the WPCC at 4%, and Tappen Creek at 1%. The annual WPCC contribution would rise to 10% of the total at the maximum permitted effluent discharge. Relative phosphorus contributions from the WPCC are greatest during low stream flow, when the WPCC contributes about 17% of the total load to Salmon Arm/Tappen Bay at 2000 flows, and would contribute 34% at the maximum permitted discharge.

6. Modeling based on limited data shows that efforts directed at lowering phosphorus concentrations in the WPCC effluent and/or extending the outfall into deeper water would not significantly impact the trophic status of Salmon Arm Bay (i.e., algae growth in the Bay would not be significantly reduced). The results show that, unless substantial effort is placed on lowering total phosphorus transportation from the Salmon River (which supplies the bulk of phosphorus loading – see Item 4), little change can be expected in the trophic status of Salmon

Arm Bay. It was recommended that further study of the WPCC impacts be considered in the LWMP.

7. Computer dilution modeling showed that the existing outfall may not result in sufficient dilution to prevent 30-day chronic ammonia toxicity at the edge of the initial dilution zone (100 metre radius) during periods of extremely high water temperature (25ºC) and pH (8) for the existing WPCC discharge of about 4,500 m^3/d and for the maximum permitted discharge of 8,200 m^3/d. The modeling also showed that extension of the outfall by about 1800 metres to deeper water off Sandy Point and the addition of a multi-port diffuser should result in sufficient dilution to prevent 30-day chronic ammonia toxicity at the edge of the initial dilution zone at all times of the year. It was recommended that the need for improvements to the outfall and/or improved ammonia removal at the WPCC be considered in the LWMP.

8. Extension of the outfall to deeper water near Sandy Point would result in discharge of the WPCC effluent into an area of the lake where adult salmon are reported to hold before entering the Salmon River to spawn, and would move the WPCC discharge closer to a number of potable water supply intakes located on Shuswap Lake, including the District of Salmon Arm intake at Canoe.

6.2 Application to Land

6.2.1 Soil Suitability for Absorption of Effluent

Discharges of wastewater to land within the study area are mainly septic tank effluent discharges to subsurface drainfields, typically known as onsite systems. As described in Section 4.3, these include systems administered by both the MWLAP (those discharging more than 22,750 L/d) and the MOH (those discharging less than 22,750 L/d). Estimates of the population served by onsite systems were discussed in Section 4.3 (approximately 5,200 people in 2001, remaining in the range 4,000 to 6,000 until 2020).

It should be noted that the current MOH regulations address only evaluation of site characteristics and minimum design requirements for onsite systems. The actual functioning and performance of onsite systems once installed is only addressed if a homeowner requests assistance with a problem, or if a formal complaint is lodged with the MOH.

Considerable research has been conducted on the use of drainfields for sewage disposal. A report for the Ministry of Health (Dayton & Knight Ltd., 1994) provided a review of some of the research on septic tanks and drain fields. A summary of some important findings are as follows:

- septic tanks remove about 20% of suspended solids and 50% of BOD_5 from raw household wastewater;
- biological clogging of the liquid-soil interface is the most important factor in the reduction of infiltration capacity of the ground disposal system;
- intermittent dosing of drainfields is important to maintain drainfield life;
- soil moisture is the most important factor affecting the survival of bacteria and viruses in soil - in dry soils, bacteria die quickly (a few days), in wet soils and in cool weather, bacteria can survive for long periods (over 40 days) and travel long distances (more than 100 metres);
- the useful life of absorption fields is typically in the range 10-30 years; and
- typical problems encountered with failed absorption fields include unsuitable soil conditions, high water table, faulty design and/or construction, overloading (under design), damage to the field, inadequate or no maintenance, and steep slope.

Factors which affect the capacity of land to accept surface and subsurface discharges include surface slope, soil type and permeability, depth to groundwater, presence of artesian water, susceptibility to flooding, and proximity of sensitive surface water bodies. Area soils and drainage as well as general problem areas for land disposal of wastewater effluent within the study area were identified by a review of available soils and groundwater data and by information provided by the Salmon Arm Health Unit.

The surficial geology shows a wide variation of soils in the District that is comprised predominantly of lacustrine deposits, with some recent alluvial and fluvial deposits, glacial deposits, bedrock and minor terrace deposits. The area soils were subdivided into two categories, based on their presumed infiltration capacity (or percolation rate) as follows:

- potentially suitable for subsurface effluent disposal; and
- unlikely to be suitable for subsurface effluent disposal.

Detailed descriptions of surficial geology units and their potential suitability for effluent disposal is described as follows:

Potentially Suitable for Subsurface Effluent Disposal

- Modern Alluvim: Sand, gravel, silt and minor mulch and peat; at/or near present base-level (floodplain, channel, delta, and shoreline deposits)
- Fan Deposits: Poorly sorted gravel, sand, silt and clay.
- Stream Terrace Deposits: Gravel, sandy gravel and sand.
- Kettle Terrace Deposits: Gravel, sandy gravel, and sand; terrace form broken by kettle holes; includes kettled steam terrace; kame terrace; and kettled delta terrace
- Humocky Gravels: Poorly sorted gravel and sand, characterized by irregular hummocks and kettles; includes kames and eskers
- Drift Benches: Glacial drift and older deposits, discontinuous benches of undetermined origin.

Unlikely to be Suitable for Subsurface Effluent

- Lacustrine Deposits: Silt with minor clay and sand.

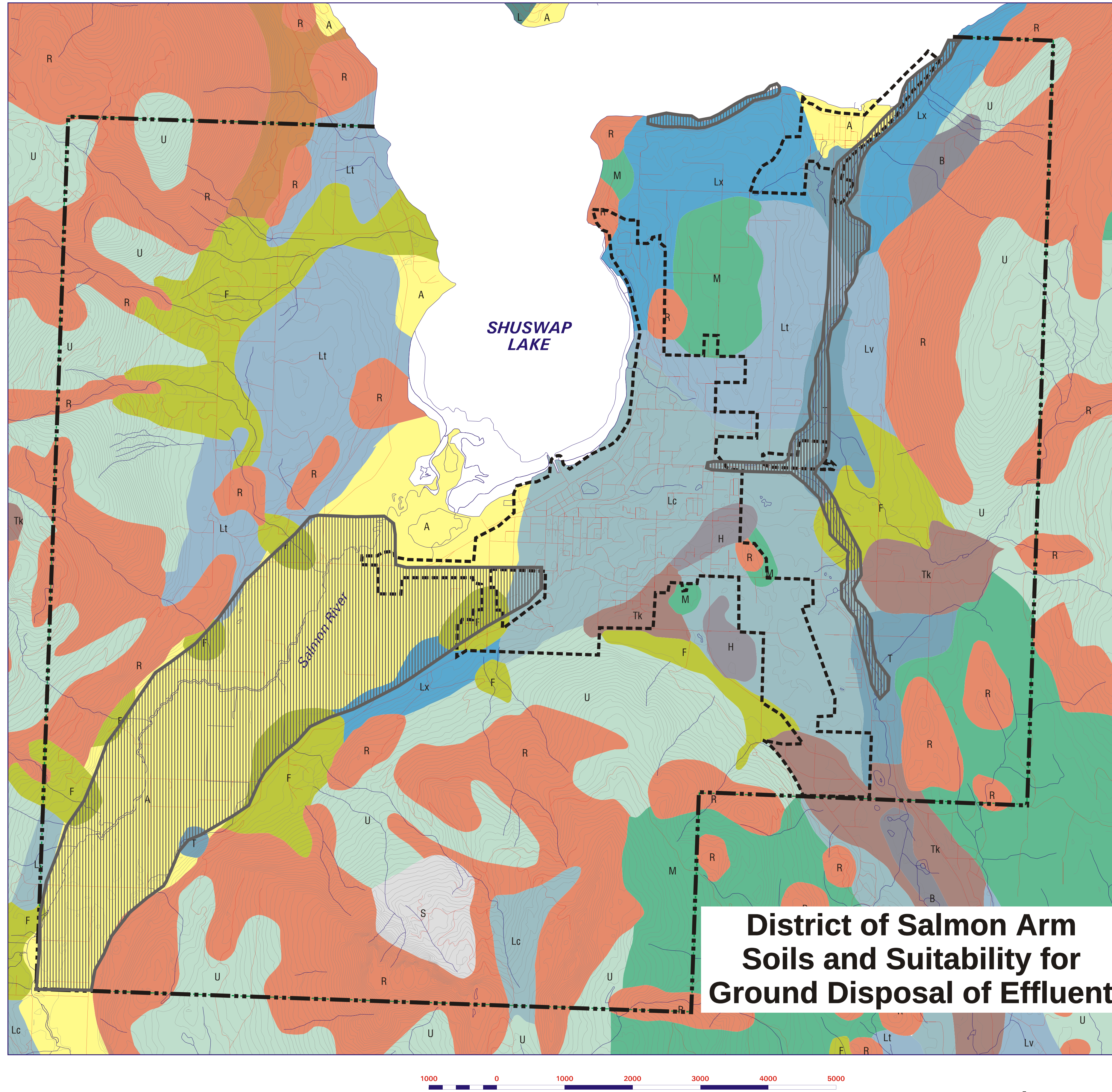
- Lacustrine Complex: Silt, sand and gravel; complex of deep water and shoreline deposits and features
- Collapsed Lacustrine Deposits: Silt, sand, clay, and minor gravel; ridged and kettled deposits, disrupted by melting of underlying ice
- Morainal Deposits: Glacial till with minor sand, gravel and silt.
- Bog Deposits: muck, mucky peat, marl and peat.
- Bedrock

The surficial geology of the study area and the areas likely to be suitable and unsuitable for ground disposal of effluent are shown on Figure 6-1. Other problem sites may also exist, depending on site-specific conditions. The general problem areas identified by the Health Unit are listed below (SAHU, 2002). These areas are illustrated on Figure 6-1.

1. *The strip of unsewered high density developed areas along both sides of the Trans-Canada Highway from 30 Street NE to the Canoe Federated Co-op sawmill/plywood plant. Most of this area has a high water table (especially the low lying areas along Canoe Creek) and dense silty-clay soil. There are many old (over 25 years) existing sewage disposal systems in this area.*

2. *The strip along both sides of Canoe Creek from the Salmon Arm Golf Club (3641 Highway 97B SE) to Canoe is an area that tends to have saturated clay soils and a high water table. This area has many old on-site sewage systems and a lot of hobby farms. The Salmon Arm Health Unit is concerned that sewage and farming wastes may be entering the Canoe Creek drainage basin and ultimately Shuswap Lake (at Canoe).*

3. *The area on the waterfront west of the Canoe Beach Park has some very small lots which make it difficult to find room for replacement sewage disposal fields. This area has several small lots with old existing sewage disposal systems (many of the lots cannot meet the current requirement for a 30 metre separation distance between the lake high water mark and the nearest sewage absorption trench). These small parcels are a high priority* (for action).



District of Salmon Arm Soils and Suitability for Ground Disposal of Effluent

LEGEND

TRIM DATA

- ROADS
- WATER
- DISTRICT BOUNDARY
- CONTOUR (20m)

QUATERNARY

- U — *UNDIVIDED DEPOSITS*

POTENTIALLY SUITABLE FOR SUBSURFACE EFFLUENT DISPOSAL

- A — *MODERN ALLUVIUM*
- F — *FAN DEPOSITS*
- S — *LANDSLIDE DEPOSITS*
- Db — *DRIFT BENCHES*

FLUVIAL ENVIRONMENT

- T — *TERRACE DEPOSITS*
- Tk — *KETTLE TERRACE DEPOSITS*
- H — *HUMMOCKY GRAVELS*

UNLIKELY TO BE SUITABLE FOR EFFLUENT DISPOSAL

- R — *BEDROCK*
- B — *BOG DEPOSITS*

LACUSTRINE ENVIRONMENT

- L — *LACUSTRINE DEPOSITS UNDIFFERENTIATED*
- Lt — *LACUSTRINE DEPOSITS*
- Lx — *LACUSTRINE COMPLEX*
- Lc — *COLLAPSED LACUSTRINE DEPOSITS*

GLACIAL ENVIRONMENT

- M — *MORAINAL DEPOSITS*

URBAN CONTAINMENT BOUNDARY

DISTRICT OF SALMON ARM BOUNDARY

PROBLEM AREAS FOR GROUND DISPOSAL IDENTIFIED BY SALMON ARM HEALTH UNIT (HIGH WATER TABLE, POOR SOILS, OLD SYSTEMS, OR SMALL LOTS)

MAP CREATED BY:

TECFOR RESOURCES LTD.
#102 - 1383 McGill Rd
KAMLOOPS, BC V2C 6K7
PHONE (250) 319-3508

Map Projection: ZONE 11 UTM NAD83

REFERENCE:
Fulton, R.J. 1974. Surficial Geology, Shuswap Lake Map 1391A, Geological Survey of Canada.

Dayton & Knight Ltd.
CONSULTING ENGINEERS
14-136 figure 6-1.cdr 02-12-31

Figure 6-1

4. *The area on the waterfront east of the Canoe Federated Co-op mill is also a concern. This area has several small lots with existing sewage disposal systems (many of the lots cannot meet the current requirement for a 30 metre separation distance between the lake high water mark and the nearest sewage absorption trench). The water table tends to be very high in the area around the mill. These small parcels are a high priority for connection to the District's sanitary sewer system. The Federated Co-op bulk fuel station uses holding tanks for sewage disposal (pump and haul).* (Note that most of these lots are located outside the District of Salmon Arm.)

5. *The strip of small (under 0.2 ha) lots along the north side of Foothill Road SW (west of Shuswap Street) has presented some problems due to a high water table and aging sewage systems.*

6. *The Salmon River floodplain north of Foothill Road SW to the* (First Nations) *Reserve is a concern. Of particular concern, the more densely developed area between 10th Avenue SW and 1st Avenue SW has a very high water table (generally, less than 2.4 metres below grade) and small parcel sizes. Fortunately, most of this developed area has newer buildings zoned for light industry that generate low daily sewage flows. The motel north of the Trans-Canada Highway (immediately west of the Salmon River) is of greater concern because it has an old sewage system and a much higher daily sewage flow.*

6.2.2 Spray Irrigation of Reclaimed Water

Discharge of reclaimed water to land by spray irrigation is subject to many of the same limitations described above for subsurface absorption of effluent. Reclamation and reuse of treated effluent by spray irrigation also requires a substantial amount of land. This can be illustrated by way of example. For the City of Vernon with a contributing population of about 36,000 (average flow 13,000 cubic metres/day), a land area of 970 ha is needed in the dry local climate, and about 925 ha-m of seasonal storage is necessary to store the effluent during the non-irrigation season (City of Vernon, 2002). The storage volume is sized to accommodate approximately 2 years of effluent discharge, to allow for continued storage during years with unseasonably wet summer weather when it is not possible to irrigate. Land area requirements in general depend on local soils, topography, and crops as well as climate.

The potential for reuse of wastewater for irrigation in the study area would likely be limited to seasonal irrigation of land that is situated near the treatment plant, since pumping the water over long distances would incur substantial costs. This would require a substantial amount of storage or discharge of effluent to the lake during the non-irrigation season. Suitable irrigation sites could include golf courses, farm land, boulevards and parks. Reuse of treated effluent for spray irrigation would require a higher level of treatment than is currently practiced at the Salmon Arm WPCC. The impending Stage IIIB upgrade could include considerations to produce effluent of the required quality (depending on cost). Treatment requirements for spray irrigation of effluent and other effluent reuse applications are discussed in Section 7 of this report.

6.3 Characteristics of Groundwater

The potential for contamination of groundwater is a major concern in liquid waste management, particularly where ground disposal and/or spray irrigation is practiced. Unconfined aquifers underlying or partly underlying the study area are shown on Figure 6-2, together with the Urban Containment Boundary. Unconfined aquifers are those in which the groundwater table forms the upper boundary, making the aquifer vulnerable to contamination from water percolating down from above. Confined aquifers are those in which the upper boundary is composed of an impermeable layer such as rock or compacted till.

LEGEND:

TRIM DATA

ROADS

WATER

DISTRICT BOUNDARY

CONTOUR (20m)

GROUND MATERIAL

BEDROCK

UNCONSOLIDATED

VULNERABILITY

LOW

MODERATE

HIGH

URBAN CONTAINMENT BOUNDARY

DISTRICT OF SALMON ARM BOUNDARY

Map Projection: ZONE 11 UTM NAD83

Aquifer Data: From Ministry WATER, LAND, and AIR PROTECTION

WEB SITE: http://wlapwww.gov.bc.ca/wat/gws

MAP CREATED BY:

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Dayton & Knight Ltd.
CONSULTING ENGINEERS

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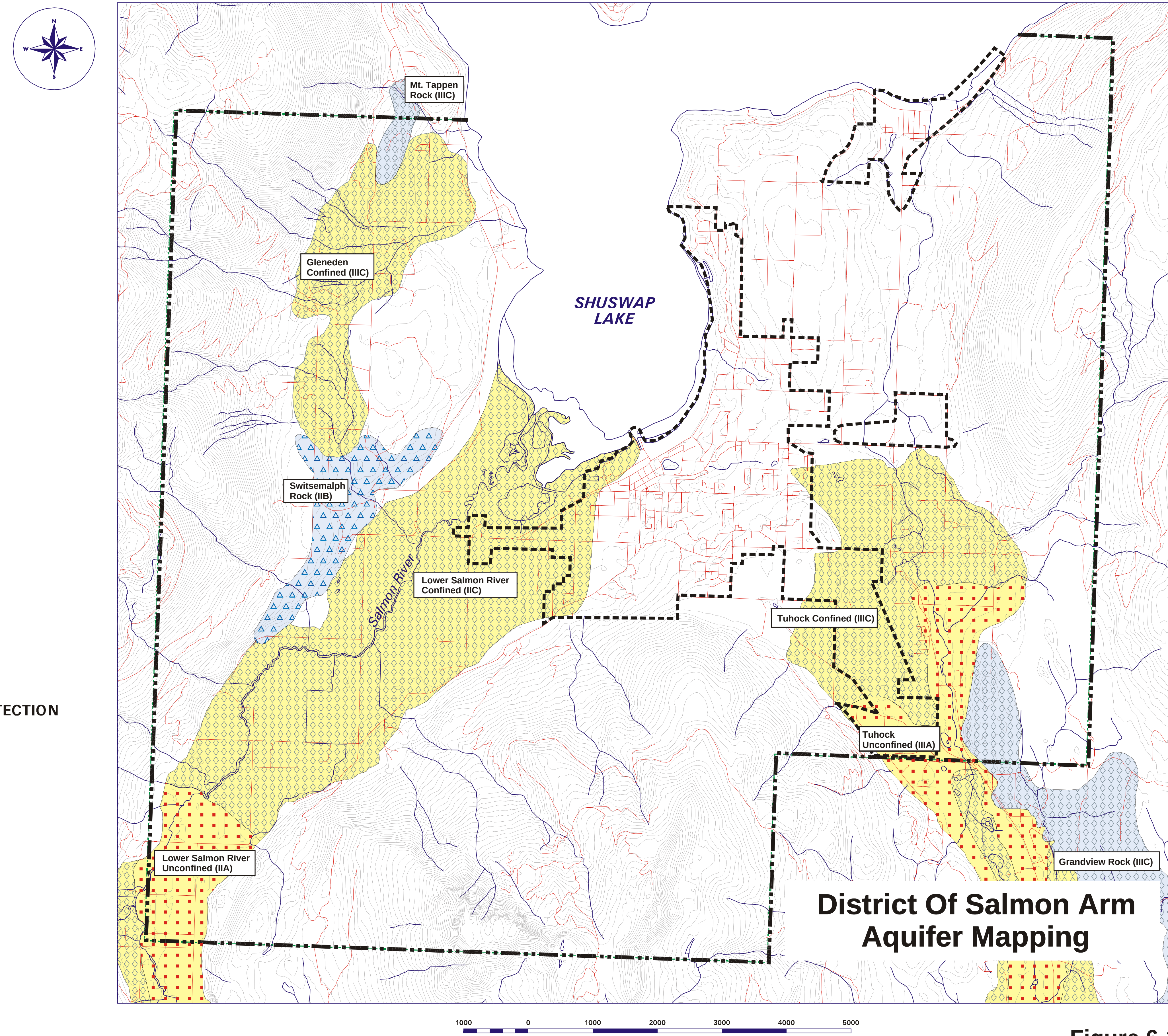

District Of Salmon Arm Aquifer Mapping

Figure 6-2

LEGEND

- DISTRICT BOUNDARY
- DOCUMENTED FISH BEARING STREAM
- SUSPECTED FISH BEARING STREAM
- DOCUMENTED NON–FISH BEARING STREAM
- SUSPECTED NON–FISH BEARING STREAM
- 3 ILP (INTERIM LOCATION POINT) NUMBER – SEE TABLE 6–6

EXISTING INFORMATION:

BD 8-27 — FISH OR FEATURE CODE; REFERENCE No. (SEE FOOTNOTE TABLE 6–6)

REACH BREAK

1 REACH NUMBER

FEATURE CODES:

BD – BEAVER DAM
CV – CULVERT
CW – COMMUNITY WATERSHED
D – DAM
* – SPAWNING

FISH CODES:

ANADROMOUS SALMONIDS

CHINOOK	CH
COHO	CO
PINK	PK
SOCKEYE	SK

SALMONIDS

BULLTROUT	BT
KOKANEE	KO
MOUNTAIN WHITEFISH	MW
RAINBOW	RB

NON–SALMONIDS

BURBOT	BB
CARP	CP
LAKE CHUB	LKC
LARGESCALE SUCKER	CSU
LEOPARD DACE	LDC
LONGNOSE DACE	LNC
NORTHERN PIKEMINNOW	NSC
PEAMOUTH CHUB	PCC
PRICKLY SCULPIN	CAS
REDSIDE SHINER	RSC
SLIMY SCULPIN	CCG

NOTE:

1. WIDTH OF ENVIRONMENTALLY SENSITIVE WATERCOURSES IS NOT TO SCALE REFER TO POLICY 3.5.1
2. ALL DESIGNATIONS ARE CONCEPTUAL ONLY. SUBJECT TO SITE SURVEY.
3. INVENTORY OF STEEP SLOPE HAZARDOUS AREAS IS NOT COMPLETE. ADDITIONAL DETAILED MAPPING IS REQUIRED.

0 500 1000 1500 2000 2500

SCALE IN METRES

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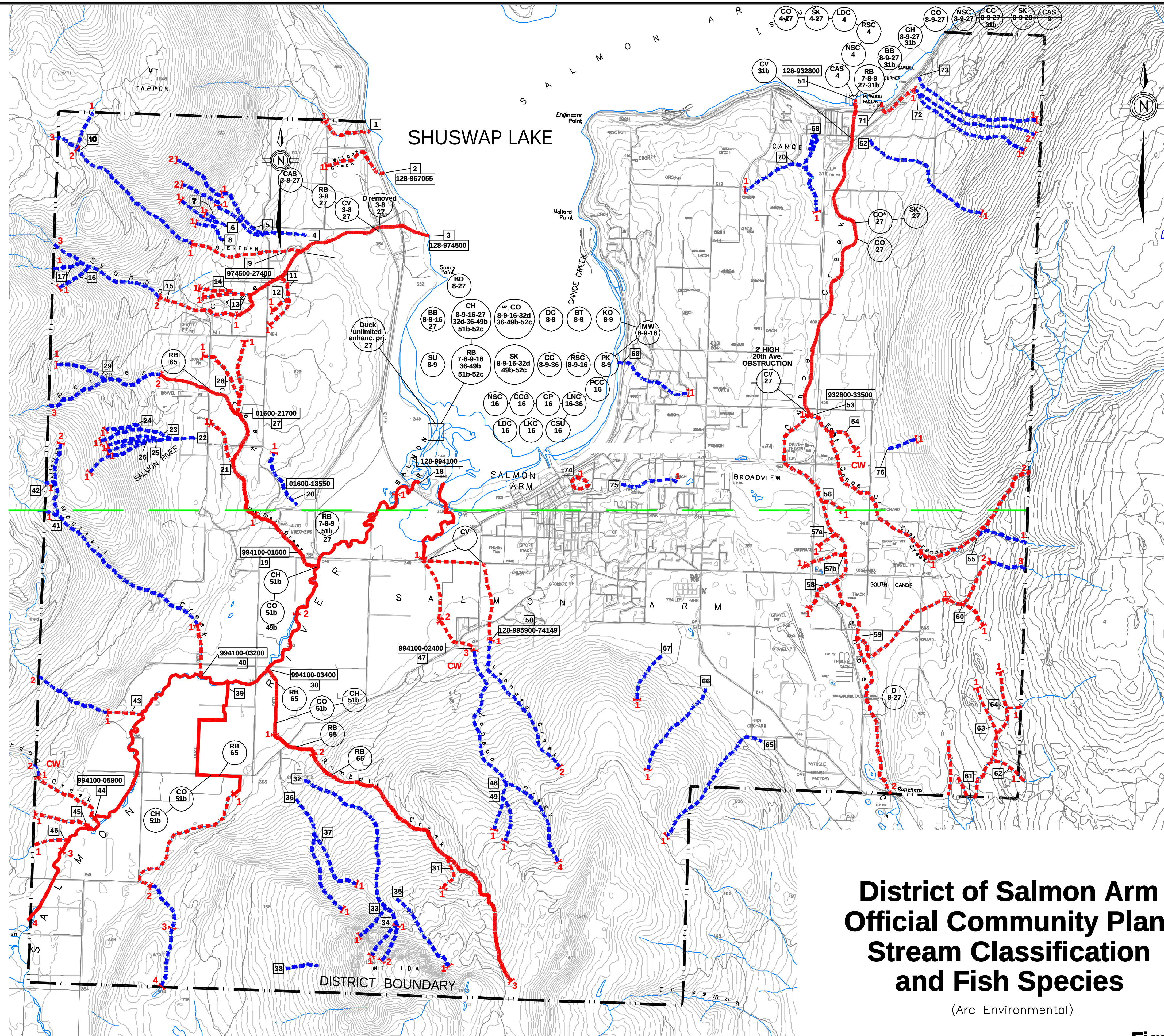
DWG. No. 14.136



District of Salmon Arm Official Community Plan Stream Classification and Fish Species

(Arc Environmental)

Figure 6-4

6.4 Environmentally Sensitive and Hazardous Areas

The District of Salmon Arm Official Community Plan identifies four categories where Development Permits will be required. The four categories are listed below. The areas identified for Categories 1, 3, and 4 are illustrated on Figure 6-3. Category 2 (Environmentally Sensitive Watercourses) is identified on Figure 6-4.

1. Environmentally Sensitive and Passive Areas
2. Environmentally Sensitive Watercourses
3. Environmentally Sensitive Hazardous Areas (Salmon River Flood Plain)
4. Environmentally Hazardous Areas (Steep Slopes)

The Environmentally Sensitive and Passive Areas include the riparian and littoral areas of Salmon Arm Bay. The Environmentally Sensitive Watercourses include the majority of the stream network and the associated riparian areas within the boundary of the Salmon Arm District. The Environmentally Sensitive Hazardous Areas (Salmon River Flood Plain) and Environmentally Hazardous Areas (Steep Slopes) include those areas which will require specific engineering considerations, such as flood control issues associated with development within the Salmon River flood plain and geo-technical issues associated with development on steep slopes. Of note within the Environmentally Sensitive Hazardous Areas (True Consulting, 2002) is the flood plain of the delta area of the lower Salmon River (Quadra Planning Consultants Ltd., 1996); the significant environmental issues within this area are addressed through consideration of the Environmentally Sensitive and Passive Areas.

It is the environmental values associated with the first two categories that require consideration should development occur in and around these areas. These two categories are discussed below.

6.4.1

LEGEND

ENVIROMENTALLY SENSITIVE AND PASSIVE AREAS

ENVIROMENTALLY SENSITIVE WATERCOURSES

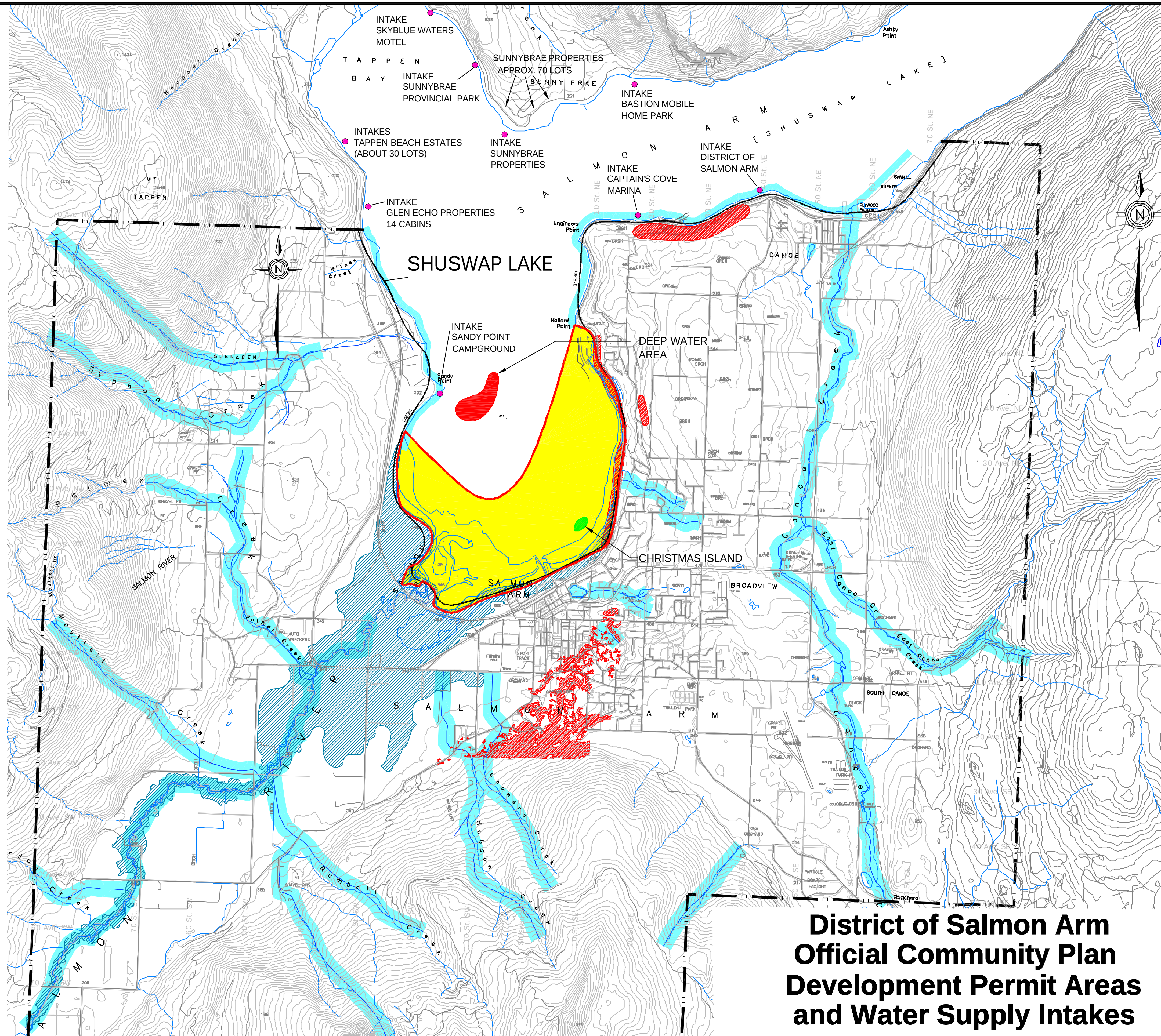
ENVIRONMENTALLY HAZARDOUS AREAS – STEEP SLOPES

ENVIRONMENTALLY HAZARDOUS AREAS – FLOOD PLAIN

WATER SUPPLY INTAKE (LOCATION APPROXIMATE)

DISTRICT OF SALMON ARM BOUNDARY

348.3m ELEVATION



NOTE:

1. WIDTH OF ENVIROMENTALLY SENSITIVE WATERCOURSES IS NOT TO SCALE REFER TO POLICY 3.5.1
2. ALL DESIGNATIONS ARE CONCEPTUAL ONLY. SUBJECT TO SITE SURVEY.
3. INVENTORY OF STEEP SLOPE HAZARDOUS AREAS IS NOT COMPLETE. ADDITIONAL DETAILED MAPPING IS REQUIRED.

0 500 1000 1500 2000
SCALE IN METRES

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DWG. No. 14.136

District of Salmon Arm Official Community Plan Development Permit Areas and Water Supply Intakes

(adapted from DSA, 2002a)

Figure 6-3

Environmentally Sensitive and Passive Areas

The Environmental Sensitive and Passive Areas (Figure 6-3) include the riparian and littoral areas of Salmon Arm Bay. These areas are host to numerous fish species, wildlife species, and plant species. Of particular importance are those species that are presently identified by municipal, provincial and/or federal agencies as warranting special attention.

Table 6-2 includes the fish species that have been identified in the area. Of particular importance are the occurrences of coho salmon (*Oncorhynchus kisutch*) and bulltrout (*Salvelinus confluentus*). Interior Fraser River coho stocks, which include those within the Shuswap River watershed, have recently been designated endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The endangered designation refers to "any indigenous species of fauna or flora that is threatened with imminent extirpation or extinction throughout all or a significant portion of its Canadian range, owing to human action." Bulltrout are currently Blue Listed by the B.C. Conservation Data Centre (CDC). The Blue listed designation normally refers to species that have a scattered distribution with low population sizes in B.C. However, in the case of bulltrout, which in B.C. are widely distributed, they are Blue Listed because they are critically endangered in most areas outside of B.C., and they have been petitioned for endangered species status in the U.S. Salmonid habitat use in the area is likely restricted to adult and fry migration, and juvenile rearing. Salmonids likely do not spawn in Salmon Arm Bay due to the lack of suitable spawning substrates in the area. Of particular importance may be the pool located off Sandy Point, where it has been suggested that adult salmon, and perhaps bulltrout, hold prior to their migration up the Salmon River (Grace, 2002).

TABLE 6-2
FISH SPECIES IDENTIFIED WITHIN THE STUDY AREA

Common Name		Species	Species Code	Status
Anadromous Salmonids				
	Coho	***Oncorhynchus kisutch***	**CO**	**COSWECI - Endangered**
	Chinook	*Oncorhynchus tshawytscha*	CH	
	Pink	*Oncorhynchus rorbuscha*	PK	
	Sockeye	*Oncorhynchus nerka*	SK	
Salmonids				
	Bulltrout	***Salvelinus confluentus***	**BT**	**CDC - Blue Listed**
	Rainbow	*Oncorhynchus mykiss*	RB	
	Kokanee	*Oncorhynchus nerka*	KO	
	Mountain Whitefish	*Prosopium williamsoni*	MW	
Non-Salmonids	Burbot	*Lota lota*	BB	
	Redside Shiner	*Richardsonius balteatus*	RSC	
	Northern Pikeminnow	*Ptycheilus caurinus*	NSC	
	Slimy Sculpin	*Cottus cognatus*	CCG	
	Prickly Sculpin	*Cottus asper*	CAS	
	Longnose Dace	*Rhinichthys cataractae*	LNC	
	Leopard Dace	*Rhinichthys falcatus*	LDC	
	Peamouth Chub	*Mylocheilus caurinus*	PCC	
	Lake Chub	*Couesius plumbeus*	LKC	
	Largescale Sucker	*Catostomus macrocheilus*	CSU	
	Carp	*Cyprinus carpio*	CP	

Table 6-3 includes the important and/or prominent bird species identified within Salmon Arm Bay (Madrone Consulting, 1990). Of particular importance are the presence of Red, Blue, and Yellow Listed species. These listed species include the Western Grebe (*Aechmophorous occidentalis,* Red Listed), the Short-eared Owl (*Asio flammeus,* Blue Listed) and the Bald Eagle (*Haliaeetus leucocephalis,* Yellow Listed). The significance of Blue Listed species is provided above. Red Listed species include those that have been legally designated Endangered or Threatened under the Wildlife Act, and Yellow Listed species although not at risk may be vulnerable during times of seasonal concentration (e.g. breeding season). The Western Grebe colony in Salmon Arm Bay is significant as it may represent one of three active breeding colonies in B.C. The Western Grebe appears to have traditionally utilized the southwestern portion of the Bay; however, recently the colony appears to be expanding into the southeastern portion of the Bay (Madrone, 1993 and Howie, 2002). Of additional local importance is the use of Christmas Island, a man-made island formed from material dredged for the federal government boat harbor project, by Ring-Billed Gulls (*Larus delawarensis*e) (Howie, 2002). Ring-Billed Gulls are a management concern because of their tendency to become a “nuisance bird” when populations increase; however, the annual lake level rise during their nesting period appears to be controlling the population on Christmas Island (Quadra Planning Consultants Ltd., 1996).

Table 6-4 includes the important and/or prominent wildlife species in the study area (Madrone Consulting, 1990). Of particular importance is the presence of Blue Listed species. These species include the Western Big-eared Bat (*Corynorhinus townsendii*), Fisher (*Martes pennanti*), Painted Turtle (*Chrysemys picta*), the Racer (*Coluber constrictor*) and Bighorn Sheep (*Ovis canadensis*). Although Bighorn Sheep are included in the list of important and/or prominent wildlife species in the District of Salmon Arm, their significant distribution is likely outside the District of Salmon Arm boundaries. In addition, ungulate winter range, although an environmental issue, is outside the District of Salmon Arm boundaries (Quadra Planning Consultants Ltd., 1996).

TABLE 6-3
IMPORTANT AND/OR PROMINENT BIRD SPECIES IDENTIFIED WITHIN THE STUDY AREA
(ADAPTED FROM MADRONE CONSULTANTS LTD., 1990)

	Common Name	Species	Status
Grebes	**Western Grebe**	***Aechmophorous occidentalis***	**CDC - Red listed**
	Clark's Grebe	*Aechmophorous clarkii*	
Geese	Canada Goose	*Branta canadensis*	
Ducks	Mallard	*Anas platyrhynchos*	
	Eurasian Wigeon	*Anas penelope*	
	American Wigeon	*Anas americana*	
	Northern Pintail	*Anas acuta*	
	Green-winged Teal	*Anas crecca*	
	Wood Duck	*Aix sponsa*	
	American Coot	*Fulica american*	
Shore birds	Lesser Yellowleg	Tringa flavipes	
	Western Sandpiper	Calidris mauri	
	Least Sandpiper	Calidris minutilla	
Raptors	**Bald Eagle**	***Haliaeetus leucocephalus***	**CDC - Yelow listed**
	Red-tailed Hawk	*Buteo jamaicensis*	
	Osprey	*Pandion haliaetus*	
	American Kestrel	*Falco sparverius*	
	Northern Harrier	*Circus cyaneus*	
	Short-eared Owl	***Asio flammeus***	**CDC - Blue listed**
	Snowy Owl	*Nyctea scandiaca*	
	Northern Pygmy Owl	*Glaucidium gnoma*	
Other	Great Blue heron	*Ardea herodias*	
	Belted Kigfisher	*Ceryle alcyon*	
	Red-winged Blackbird	*Agelaius phoeniceus*	
	Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	
	Marsh Wrens	*Cistothorus palustris*	
	Virginia Rail	*Rallus limicola*	
	Sora Rail	*Porzana carolina*	
	Ring-necked Pheasant	*Phasianus colchicus*	
	Bank Swallows	*Riparia riparia*	
	Cliff Swallow	*Hirundo pyrrhonota*	
	Barn Swallow	*Hirundo rustica*	
	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	
	Violet-green Swallow	*Tachycineta thalassina*	
	Tree Swallow	*Tachycineta bicolor*	
	Ring-billed Gull	*Larus delawarensis*	

TABLE 6-4
IMPORTANT AND/OR PROMINENT MAMMALIAN, REPTILIAN, AND AMPHIBIAN SPECIES IDENTIFIED WITHIN THE STUDY AREA
(ADAPTED FROM MADRONE CONSULTANTS LTD., 1990)

	Common Name	Species	Status
Mammals	Dusky Shrew	*Sores obscurus*	
	Masked Shrew	*Sorex cinereus*	
	Navigator Shrew	*Sorex palustris*	
	Boreal Redback Vole	*Clethrionomys gapperi*	
	Heather Vole	*Phenacomysintermedius*	
	Meadow Vole	*Microtus pennsylvanicus*	
	Long-tailed Vole	*Microtus longicaudis*	
	Deer Mouse	*Peromyscus maniculatus*	
	Short-tailed Weasel	*Mustela erminea*	
	Yellow-bellied Marmot	*Marmota flaviventris*	
	Coyote	*Canis latrans*	
	Mink	*Mustela vison*	
	River otter	*Lutra canadensis*	
	American Beaver	*Castor canadensis*	
	Racoon	*Procyon lotor*	
	Western Big-eared bat	***Corynorhinus townsendii***	**CDC - Blue Listed**
	Porcupine	*Erethizon dorsatum*	
	Marten	*Martes americana*	
	Fisher	***Martes pennanti***	**CDC - Blue Listed**
	Bighorn Sheep	***Ovis canadensis***	**CDC - Blue Listed**
Reptiles and Amphibians	**Painted Turtle**	***Chrysemys picta***	**CDC - Blue Listed**
	Western Garter Snake	*Thamnophis elegans*	
	Common Garter Snake	*Thamnophis sirtalis*	
	Racer	***Coluber constrictor***	**CDC - Blue Listed**
	Alligator Lizard	*Gerrhonotus coeruleus*	
	Western Skink	*Eumeces skiltonianus*	
	Pacific Treefrog	*Hyla regilla*	
	Western Toad	*Bufo boreas*	

Table 6-5 includes the important and/or prominent plant species identified within Salmon Arm Bay (Madrone Consulting, 1990). Of particular importance are the presence of Red Listed species. These species include Mosquito Fern (*Azolla mexicana*), *Coleanthus subtilis*, and the Pepperwort (*Marsilea vestita*). Although not a CDC Listed species, Cottonwoods (*Populus balsamifera*) located along the southwestern shoreline of Salmon Arm Bay are of regional interest due to such habitat elements as nesting sites for such birds as the Bald Eagle (Howie, 2002). Madrone (1990) identified six vegetation bands of Salmon Arm Bay; mixed terrestrial vegetation, *Phalaris*, *Carex*, *Polygonum*, Mudflat, and *Typha* band. The current mixed terrestrial band is mainly the result of past disturbances and includes Cottonwoods and the Mosquito fern within the southwestern portion of the Bay. The *Phalaris* band is relatively stable. The *Carex* and *Polygonum* bands are more sensitive due to their dependency on water levels. The Red Listed *Coleanthus subtilis* and the Pepperwort inhabit the Mudflat band. The *Typha* band is dependent on marshy substrate and would be sensitive to alterations in water flows over the area.

TABLE 6-5
IMPORTANT AND/OR PROMINENT PLANT SPECIES IDENTIFIED WITHIN THE STUDY AREA
(ADAPTED FROM MADRONE CONSULTANTS LTD., 1990)

Band	Common Name	Species	Status
Mixed Terrestrial Vegetation	Rose	*Rosa nutkana*	
	Snowberry	*Symphorocarpus albus*	
	Hawthorn	*Cretaegus douglassi*	
	Trembling Aspen	*Populus Tremuloides*	
	Cottonwood	***Populus balsamifera***	**Provides nesting sites for Bald Eagle**
	Mosquito Fern	***Azolla mexicana***	**CDC - Red listed**
	Forbs		
	Grasses		
Phalaris	Reed Canary Grass	*Phalaris arundinacea*	
Carex	Sedge	*Carex lenticularis*	
		Helenium autumnale	
		Deschampsia cespitosa	
		Astert spp.	
Polygonum	Water Smartweed	*Polygonum amphibium*	
Mudflat		***Coleanthus subtilis***	**CDC - Red Listed**
	Pepperwort	***Marsilea vestita***	**CDC - Red Listed**
	Spiked Rush	*Eleocharis acicularis*	
		Limnosella aquatica	
Typha	Bulrush	*Typha latifolia*	

6.4.2 Environmentally Sensitive Watercourses and Environmental Values

A key item in the study Terms of Reference was classification of area streams according to fisheries resources. The Environmentally Sensitive Watercourses include the 1:20,000 TRIM stream network within the boundaries of the District of Salmon Arm (see Figure 6-4). For the purposes of this study, the stream network was delineated into reaches. Each reach was designated fish bearing or non-fish bearing, and the sensitivity of each reach was ranked (Figure 6-4 and Table 6-6). The province has assigned a Watershed Code (WSC) number to a few of the streams in the study area. However, most of the streams do not have a WSC number. For identification purposes in this study, an Interim Locator Point Number (ILP No.) was adopted to identify each stream; these are illustrated on Figure 6-4 and are listed in the first column of Table 6-6. The second column of Table 6-6 contains the Provincial WSC number for streams that have such a number.

The reaches shown on Figure 6-4 have been assigned the following designations:

- fish bearing (solid red) when fish presence has been documented;
- suspected fish bearing (dashed red) where although fish presence has not been documented, stream reach gradients suggest they could be present, and the reach is contiguous with or downstream of a documented fish bearing reach;
- non-fish bearing (solid blue) where fish absence has been documented; and
- suspected non-fish bearing (dashed blue) where gradients suggest that fish could not inhabit the reach, and/or where reaches are upstream of documented non-fish bearing reaches.

Of particular importance is to minimize the impacts to the sensitive reaches. The stream reaches discussed above have been ranked according to sensitivity of the fisheries resource as follows:

- Rank 1: includes fish bearing and suspected fish bearing reaches, and particularly those which contain fish species that are presently identified by either municipal, provincial and/or federal agencies as warranting special attention;

- Rank 2: moderately sensitive non-fish bearing reaches and suspected non-fish bearing reaches which flow directly into fish bearing reaches; and
- Rank 3: least sensitive non-fish bearing reaches which are either within isolated systems, or flow into non-fish bearing reaches.

As part of the designation of the fish bearing status of a reach, the historical distribution of fish was considered. This consideration involves continuing fish distribution upstream of culverts, even though the culverts may currently represent obstructions/barriers to fish passage. Examples of such culverts include the 1700 mm diameter culvert along 10th Avenue, which presently represents sections of Leonard and Hobson Creeks, as well as the two culverts identified within Reach 1 of Canoe Creek (i.e. one located upstream of the mouth associated with the highway and the other located on 20th Avenue NE). In addition to the above sensitivity classification, three watersheds (Hobson, East Canoe and Gordon Creeks) are designated Community Watersheds and as such, consideration should be directed towards ensuring that water quality is not significantly impacted through development activities within the boundaries of these community watersheds.

Table 6-2 in Section 6.4.1 includes the fish species which have been identified in the area. Similar to the Environmentally Sensitive and Passive Areas, the occurrences of listed coho salmon and bulltrout are of importance. The watercourses potentially provide adult spawning, egg incubation, and juvenile rearing habitats. Adult coho tend to begin their migration into the watercourses in October, spawning from late October through November. Egg incubation continues through to emergence in April (Quadra Planning Consultants Ltd., 1996). The coho juveniles may migrate out of the streams to seek overwintering habitat elsewhere and/or overwinter within their natal streams. Bulltrout are fall spawners (August to November), where fry emergence occurs in the April to May period. They may exhibit one of three life history strategies; resident, adfluvial, or fluvial. Resident populations are often found in small headwater streams where they spend their entire lives in one area (Rieman and McIntyre, 1993), and overwinter in deeper pools (Berry, 1994). Adfluvial populations rear in smaller tributaries for one to six years before migrating downstream into lakes or reservoirs as adults. Fluvial populations also rear in smaller tributaries from one to six years; however, adults migrate into larger main stems and tributaries to mature. As adults, bull trout from both migratory life history strategies usually reside in rivers or lakes from two to three years before returning to the smaller tributaries to spawn (McPhail and Baxter, 1996; and Goetz, 1989).

TABLE 6-6
STREAM REACHES, FISH BEARING STATUS AND SENSITIVITY RANK

ILP No.[1]	WSC[2]	Gazetted Name	Stream Reach Number[3]								Comments
			1		2		3		4		
			Fish Presence[4]	Rank[5]	Fish Presence[4]	Rank[5]	Fish Presence[4]	Rank[5]	Fish Presence[4]	Rank[5]	
1	-	-	(F)	1	-	-	-	-	-	-	
2	128-967055	Wilcox Creek	(F)	1	-	-	-	-	-	-	
3	128-974500	Syphon Creek	F	1	(F)	1	(NF)	2	-	-	Reach 3 enters fish bearing Reach 2
4	-	-	(NF)	3	(NF)	3	-	-	-	-	isolated
5	-	-	(NF)	3	(NF)	3	-	-	-	-	isolated
6	-	-	(NF)	3	-	-	-	-	-	-	isolated
7	-	-	(NF)	3	-	-	-	-	-	-	isolated
8	-	-	(NF)	3	-	-	-	-	-	-	isolated
9	128-974500-27400	-	(F)	1	(NF)	2	(NF)	3	-	-	Reach 2 enters fish bearing Reach 1
10	-	-	(NF)	3	-	-	-	-	-	-	Enters Non-Fish bearing reach
11	-	-	(F)	1	-	-	-	-	-	-	
12	-	-	(F)	1	-	-	-	-	-	-	
13	-	-	(F)	1	-	-	-	-	-	-	
14	-	-	(F)	1	-	-	-	-	-	-	
15	-	-	(NF)	3	-	-	-	-	-	-	isolated
16	-	-	(NF)	3	-	-	-	-	-	-	Enters Non-Fish bearing reach
17	-	-	(NF)	3	-	-	-	-	-	-	Enters Non-Fish bearing reach
18	128-994100	Salmon River	F	1	F	1	F	1	F	1	
19	128-994100-01600	Palmer Creek	F	1	F	1	(NF)	2	-	-	Reach 3 enters fish bearing Reach 2
20	128-994100-01600-18550	-	(NF)	3	-	-	-	-	-	-	isolated
21	-	-	(F)	1	-	-	-	-	-	-	
22	-	-	(NF)	3	-	-	-	-	-	-	isolated
23	-	-	(NF)	3	-	-	-	-	-	-	isolated
24	-	-	(NF)	3	-	-	-	-	-	-	isolated
25	-	-	(NF)	3	-	-	-	-	-	-	isolated

TABLE 6-6 (cont'd.)
STREAM REACHES, FISH BEARING STATUS AND SENSITIVITY RANK

ILP No.[1]	WSC[2]	Gazetted Name	Stream Reach Number[3]								Comments
			1		2		3		4		
			Fish Presence[4]	Rank[5]	Fish Presence[4]	Rank[5]	Fish Presence[4]	Rank[5]	Fish Presence[4]	Rank[5]	
26	-	-	(NF)	3	-	-	-	-	-	-	isolated
27	128-994100-01600-21700	-	(F)	1	-	-	-	-	-	-	
28	-	-	(F)	1	-	-	-	-	-	-	
29	-	-	(NF)	3	-	-	-	-	-	-	Enters Non-Fish bearing reach
30	128-994100-03400	Rumball Creek	F	1	F	1	F	1	-	-	
31	-	-	(F)	1	-	-	-	-	-	-	
32	-	-	(NF)	3	(NF)	3	-	-	-	-	isolated
33	-	-	(NF)	3	-	-	-	-	-	-	isolated
34	-	-	(NF)	3	-	-	-	-	-	-	isolated
35	-	-	(NF)	3	-	-	-	-	-	-	isolated
36	-	-	(NF)	3	-	-	-	-	-	-	isolated
37	-	-	(NF)	3	-	-	-	-	-	-	isolated
38	-	-	(NF)	3	-	-	-	-	-	-	isolated
39	-	-	F	1	(F)	1	(NF)	2	(NF)	3	Reach 3 enters fish bearing Reach 2
40	128-994100-03200	Mouttell Creek	F	1	(NF)	2	-	-	-	-	Reach 2 enters fish bearing Reach 1
41	-	-	(NF)	3	-	-	-	-	-	-	Enters Non-Fish bearing reach
42	-	-	(NF)	3	-	-	-	-	-	-	Enters Non-Fish bearing reach
43	-	-	(F)	1	(NF)	2	-	-	-	-	Reach 2 enters fish bearing Reach 1
44	128-994100-05800	Gordon Creek	(F)	1	-	-	-	-	-	-	Community Watershed
45	-	-	(F)	1	-	-	-	-	-	-	
46	-	-	(F)	1	-	-	-	-	-	-	
47	128-994100-02400	Hobson Creek	F	1	(F)	1	(F)	1	(NF)	2	Reach 4 enters fish bearing Reach 3. Community Watershed
48	-	-	(NF)	3	-	-	-	-	-	-	Enters Non-Fish bearing reach
49	-	-	(NF)	3	-	-	-	-	-	-	Enters Non-Fish bearing reach

TABLE 6-6 (cont'd.)
STREAM REACHES, FISH BEARING STATUS AND SENSITIVITY RANK

ILP No.[1]	WSC[2]	Gazetted Name	Stream Reach Number[3]								Comments
			1		2		3		4		
			Fish Presence[4]	Rank[5]	Fish Presence[4]	Rank[5]	Fish Presence[4]	Rank[5]	Fish Presence[4]	Rank[5]	
50	128-995900-74149	Leonard Creek	(F)	1	(NF)	2	-	-	-	-	Reach 2 enters fish bearing Reach 1
51	128-932800	Canoe Creek	F	1	(F)	1	-	-	-	-	
52	-	-	(NF)	3	-	-	-	-	-	-	isolated
53	128-932800-33500	East Canoe Creek	(F)	1	(F)	1	-	-	-	-	Community Watershed
54	-	-	(F)	1	-	-	-	-	-	-	
55	-	-	(NF)	2	-	-	-	-	-	-	Reach 1 enters Reach 2 of East Canoe Creek
56	-	-	(F)	1	-	-	-	-	-	-	
57a	-	-	(F)	1	-	-	-	-	-	-	
57b	-	-	(F)	1	-	-	-	-	-	-	
58	-	-	(F)	1	-	-	-	-	-	-	
59	-	-	(F)	1	(F)	1	(NF)	2	-	-	Reach 3 enters fish bearing Reach 2
60	-	-	(F)	1	-	-	-	-	-	-	
61	-	-	(F)	1	-	-	-	-	-	-	
62	-	-	(F)	1	-	-	-	-	-	-	
63	-	-	(F)	1	-	-	-	-	-	-	
64	-	-	(F)	1	-	-	-	-	-	-	
65	-	-	(NF)	3	-	-	-	-	-	-	isolated
66	-	-	(NF)	3	-	-	-	-	-	-	isolated
67	-	-	(NF)	3	-	-	-	-	-	-	isolated
68	-	-	(NF)	2	-	-	-	-	-	-	Reach 1 enters Salmon Arm Bay
69	-	-	(NF)	3	-	-	-	-	-	-	isolated
70	-	-	(NF)	3	-	-	-	-	-	-	isolated
71	-	-	(F)	1	(NF)	2	-	-	-	-	Reach 2 enters fish bearing Reach 1

TABLE 6-6 (cont'd.)
STREAM REACHES, FISH BEARING STATUS AND SENSITIVITY RANK

ILP No.[1]	WSC[2]	Gazetted Name	Stream Reach Number[3]								Comments
			1		2		3		4		
			Fish Presence[4]	Rank[5]	Fish Presence[4]	Rank[5]	Fish Presence[4]	Rank[5]	Fish Presence[4]	Rank[5]	
72	-	-	(NF)	2	-	-	-	-	-	-	Reach 1 enters fish bearing Reach 1 of ILP 71
73	-	-	(NF)	2	-	-	-	-	-	-	Reach 1 enters Salmon Arm Bay
74	-	-	(NF)	3	-	-	-	-	-	-	isolated
75	-	-	(NF)	3	-	-	-	-	-	-	isolated
76	-	-	(NF)	3	-	-	-	-	-	-	isolated

Legend:
1. Interim Locator Point Number, adopted for identification purposes – see Figure 6-4 for locations of streams
2. Provincial Watershed Code number
3. Stream reach number – see Figure 6-4 for location
4. F: fish present, (F): Fish suspected, NF: No fish, (NF): No fish suspected - see Figure 6-4 for locations
5. Sensitivity Rank: Rank 1 – Sensitive, Rank 2 – Moderate Sensitivity, Rank 3 – Low Sensitivity

References: Neskonlith Fisheries Indian Band 1993.(49b) - ARC Environmental Ltd. 1998.(3) - Lewis and Levings 1988.(36) - Quadra Planning Consultants Ltd. 1996.(52c) - ARC Environmental Ltd. 1999.(4) - Galesloot 1999.(31b) - BC Conservation Data Center (BC CDC) 2001.(6) - BC Ministry of Fisheries. 2001(7, 8, 9) - Department of Fisheries and Oceans 2001.(27) - Galesloot 2001.(31d) - Ministry of Sustainable Resource Management 2002.(46) - Trumbley Environmental Consulting Ltd. 2002.(65) - Pehl and Bennett 2002 (51b) - R.Howie MWLAP-Kamloops 2002 pers.comm.

6.4.3 Regulatory Issues

The main regulatory issues which apply to development, maintenance, and/or operational activities within the study area are summarized in Table 6-7. A more complete list can be found in Chilibeck (1992). Of particular relevance are the B.C. Wildlife Act, the Fisheries Act, the Water Act, the Land Development Guidelines, the Fish-stream Crossing Guidebook, and, although not currently applicable, the provincial Fish Protection Act Streamside Protection Regulations. In addition, during the period of instream activities associated with development, maintenance, and/or operational activities, the activities will be influenced by the established "least risk instream work windows", and the provincial Water Quality Guidelines.

The B.C. Wildlife Act, with respect to development issues, focuses on the protection of listed species and their habitat, as well as on habitats and species that regional agencies may consider critical. Based on the Fisheries Act and the regional initiative, no development is to occur below the 348.3 m elevation contour, and proposed development adjacent to and above this elevation would be subjected to the "Land Development Guidelines" (Chilibeck 1992). For proposed activities/developments that may be addressed through Development Waivers (True Consulting, 2002) and/or may not meet the various guidelines (e.g., for development to proceed below the 348.3 m elevation contour and/or within 0 to 15 metres above the contour for low density development and 0 to 30 metres above the contour for high density development), an environmental impact assessment would likely be required as part of a Water Act Section 9 application and a Canadian Environmental Assessment Act (CEAA) review. The CEAA review would conclude whether the activities/ developments could proceed as proposed. Ultimately, the regulatory agencies determine the requirement for an environmental impact assessment and the corresponding trigger for a CEAA review.

TABLE 6-7
LIST OF APPLICABLE REGULATORY ISSUES.

Regulatory Issue	Federal	Provincial	Comment
Acts	Fisheries Act		Section 22 and 26 - Obstruction of fish migration
			Section 32 - Destruction of fish
			Section 35 - Harmful Alteration Disruption Destruction (HADD) of Fish Habitat
			Section 36 - Deposition of deleterious substance
			Policy for the management of fish habitat - guiding principal - "No net habitat loss"
		BC Wildlife Act	Protection of wildlife species and their habitats
		Fish Protection Act: Streamside Protection Regulations	Streamside Protection Regulations presently in limbo
	Canadian Environment Assessment Act (CEAA)		May come into play should regulatory agencies determine that a proposed development results in a significant impact to the environment.
		Water Act	Section 9 application for works in and about a stream - see sections 40 through 44. Section 44 details exemptions from a section 9 application
Guidelines	Land development guidelines		Riparian leave strips
		Water quality guidelines	May be over-ridden by regional/local guidelines
		Fish-stream crossing guidebook	Use of open and closed bottom structures
Regional Initiatives	348.3 m EL on Shuswap Lake		Establishes the boundary that the "Land development guidelines" are applied to
	Instream work windows	Instream work windows	Salmon Arm Bay: July 15 - April 1 (no sockeye or char spawning)
			District of Salmon Arm streams: July 15 - August 15

Summaries of the main Acts, policies and guidelines are provided below.

Fisheries Act

The Fisheries Act influences any activity in and about watercourses that may affect fish and/or fish habitat. The Act defines fish habitat as the spawning grounds, nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes. Therefore, fish habitat would include fish bearing watercourses and may include non-fish bearing watercourses if they contribute (e.g., food and or other features that maintain water quality for downstream fish bearing watercourses). Fish habitat not only includes the stream channel but may also include upland areas associated with streamside vegetation.

The Fisheries Act, among other issues, makes it an offence to conduct activities which may result in the obstruction of fish migration, the deposition of a deleterious substance, and/or the harmful alteration, disruption, or destruction (HADD) of fish habitat.

Water Act

The Water Act influences any activities in and about watercourses that may affect water quality, habitat, and/or other water users. Generally for works in and about a watercourse a Section 9 application must be made. There are conditions that allow for an exemption of a Section 9 application and these conditions are outlined in Section 44 of the Water Act.

Land Development Guidelines

The *Land Development Guidelines* (Chilibeck, 1992) recommend the width of buffer (leave) strips adjacent to watercourses, as well as other measures to ensure that that quantity and quality of fish habitat is maintained. Generally the guidelines suggest that a

15 metre wide leave strip be maintained on streams where Residential/Low Density development is proposed, and a 30 metre wide leave strip be maintained where Commercial/High Density development is proposed. The leave strip guidelines are suggested minimum widths and may be altered by FOC/MWLAP staff (e.g., increased to protect critical fish habitat). Critical habitat may be defined as habitat that is critical in sustaining a subsistence, commercial, or recreational fishery, or species at risk because of relative rareness, productivity and sensitivity. Critical habitat may be represented by high-value spawning or rearing habitat (Ministry of Forests, 2002).

Fish-Stream Crossing Guidelines

The *Fish-Stream Crossing Guidelines* (Ministry of Forests, 2002) recommend the type of crossing for fish bearing streams. If a closed bottom structure such as a culvert is proposed for a fish bearing stream, the gradient of the stream should be less than 6%, the stream channel width should be less than or equal to 2.5 metres, and the culvert should be a minimum of 1.5 metres in diameter and embedded. For stream channels greater than 1.5 metres in width but less than or equal to 2.5 metres in width, the culvert diameter should equal the stream channel width. For culverts up to 1.5 metres in diameter, the culvert should be embedded to a minimum depth of 0.6 metres and infilled with substrate similar to that found in the stream. Culverts greater than 1.5 metres in diameter should be embedded to a depth of 40% of the culvert diameter and infilled. Open bottom structures are required where stream channels are greater than 2.5 metres wide; the open bottom structure should span the stream channel width.

Although the *Fish-Stream Crossing Guidelines* were developed for the forestry sector, it is likely that similar recommendations will be made by the regulatory agencies for other activities such as urban development that involve stream crossings.

Streamside Protection Regulations

The *Streamside Protection Regulations* are currently in the developmental/review stages and may or may not proceed. If the Regulations were to proceed, the standards for leave strips are such that for fish bearing watercourses a 15 to 30 metre width is required, and for non-fish bearing watercourses a 5 to 30 metre width is required. The ranges in leave strip width requirements are based on the existing and potential status (i.e. width) of stream side vegetation. The *Streamside Protection Regulations* also address leave strips associated with ravines, where, if the ravine is less than 60 metres wide from the top of bank, then the conditions outlined above apply from the top of ravine bank, or if the ravine is greater than 60 metres wide from the top of bank, then a 10 metre wide leave strip is required from top of ravine bank.

Water Quality Guidelines

The *Water Quality Guidelines* (MELP, 1998) provide guidelines for numerous parameters (see Section 6.1). The parameters frequently encountered during works in and around watercourses pertain to the generation of sediment and in turn increases in the total suspended solids (TSS) and turbidity in the receiving waters.

Total Suspended Solids Guidelines

- 25 mg/L in 24 hours when background is less than or equal to 25 mg/L
- mean of 5 mg/L in 30 days when background less than or equal to 25 mg/L
- 25 mg/L when background is between 25 and 250 mg/L
- 10% of background when background is greater than or equal to 250 mg/L

Turbidity Guidelines

- 8 NTU in 24 hours when background less than or equal to 8 NTU
- mean of 2 NTU in 30 days when background less than or equal to 8 NTU
- 8 NTU when background is between 8 and 80 NTU

- 10% of background when background is greater than or equal to 80 NTU

6.4.4 Proposed Development and Environmentally Sensitive Watercourses

Table 6-8 outlines the Environmentally Sensitive Watercourses that may be potentially impacted by proposed residential development areas and the potential expansion of the urban area. The proposed development areas are designated as Residential Development Areas A, B and C and areas within the potential expansion of the Urban Containment Boundary in the Official Community Plan (see Figure 3-2 and Section 3.1). No watercourses appear associated with Residential Development Area C; however, this area is adjacent to the Environmentally Sensitive and Passive Areas of Salmon Arm Bay (Figure 6-3). There appear to be twelve stream reaches associated with Development Areas A and B and the potential expansion of the urban boundary. Of the twelve stream reaches, five are fish bearing (Rank 1), two are non-fish bearing but flow directly into fish bearing waters (Rank 2), and five are non-fish bearing isolated reaches (Rank 3). As well, of the twelve stream reaches, three are within two creeks from Community Watersheds (Hobson and East Canoe Creeks, both of which are Rank 1).

As described in Section 3.1, development activity is to be focused on Areas A, B and C in that order according to the OCP. The five Rank 1 and two Rank 2 stream reaches within Areas A and B are therefore the most likely streams within the District to be adversely affected by development under the OCP, and these areas should receive the highest priority for protection as discussed later in this report.

TABLE 6-8
STREAM REACHES WITHIN PROPOSED RESIDENTIAL DEVELOPMENT AREAS AND POTENTIAL AREAS OF URBAN BOUNDARY EXPANSION

Interim Locator Point Number[1]	WSC	Residential Development Area[6]	Gazetted Name	Stream Reach Number[3]								Comments		
				1		2		3		4				
				Fish Presence[4]	Rank[5]	Fish Presence[4]	Rank[5]	Fish Presence[4]	Rank[5]	Fish Presence[4]	Rank[5]			
47	128-994100-02400	B, P	Hobson Creek	F	1	(F)	1	(F)	1	P	2	Reach 4 enters fish bearing Reach 3	Community Watershed	10th Avenue 1700m CV is a section of the stream
50	128-995900-74149	B	Leonard Creek	(F)	1	(NF)	2	-	-	-	-	Reach 2 enters fish bearing Reach 1		10th Avenue 1700m CV is a section of the stream
51	128-932800	A	Canoe Creek	F	1	(F)	1	-	-	-	-			2 culverts (CV) have been identified as obstructions to upstream fish migration in Reach 1
53	128-932800-33500	P	East Canoe Creek	(F)	1	(F)	1	-	-	-	-		Community Water Supply	
58	-	P	-	(F)	1	-	-	-	-	-	-			
65	-	P	-	(NF)	3	-	-	-	-	-	-	Isolated		
68	-	A	-	(NF)	2	-	-	-	-	-	-	Reach 1 enters Salmon Arm Bay		
69	-	A	-	(NF)	3	-	-	-	-	-	-	Isolated		
70	-	A	-	(NF)	3	-	-	-	-	-	-	Isolated		
74	-	A	McGuire Lake (common name)	(NF)	3	-	-	-	-	-	-	Isolated		
75	-	A	-	(NF)	3	-	-	-	-	-	-	Isolated		

Legend:

1. Interim Locator Point Number, adopted for identification purposes – see Figure 6-4 for locations of streams
2. Provincial Watershed Code number
3. Stream reach number – see Figure 6-4 for location
4. F: fish present, (F): Fish suspected, NF: No fish, (NF): No fish suspected - see Figure 6-4 for locations
5. Sensitivity Rank: Rank 1 – Sensitive, Rank 2 – Moderate Sensitivity, Rank 3 – Low Sensitivity
6. A-Residential Development Area A, B-Residential Development Area B, P- Potential Expansion of Urban Containment Boundary – see Figure 3-2

7.0 PLAN CRITERIA

This section contains the criteria used for developing and evaluating liquid waste management alternatives.

7.1 Population

The present and projected future design populations serviced by the water and sewer systems in the District of Salmon Arm are contained in Table 3-1 in Section 3.2 of this report.

Of the 15,388 people (according to the 2001 census) residing in the study area in the year 2001, an estimated 11,900 were serviced by a sanitary sewer collection system and the Water Pollution Control Centre (WPCC). The remaining people were assumed to rely principally on individual treatment and disposal systems, mainly septic tanks. As described in the Official Community Plan (see Section 3), development is to be concentrated in areas served by the WPCC. The number of people using onsite systems is projected to remain at about 3,500 from 2001 to 2020 under the low (1.5%) growth scenario, but would increase to about 4,600 under the high (3%) growth scenario.

7.2 Wastewater Quantity

The per capita flow rates for wastewater proposed for use in the LWMP (developed from historical WPCC flows) are summarized in Table 5-1 of this report. Proposed wastewater flows to 2020 for the WPCC service area based on the per capita flows and OCP population projections are shown in Table 5-2. Proposed volumes of wastewater from residential and industrial onsite systems to 2020 are shown in Table 5-6.

7.3 Wastewater Quality

The typical characteristics of untreated wastewater in the District of Salmon Arm (as determined at the WPCC) are shown in Table 5-3 of this report, together with projected mass loadings to the year 2020. The characteristics of discharges from onsite systems are shown in Table 5-7. These values are proposed for use in estimating wastewater character and loads for the LWMP.

Criteria for treated wastewater quality set out in this section are based on existing provincial regulations. The Municipal Sewage Regulation (MSR) administered by the Ministry of Land, Water and Air Protection (MWLAP) applies to all discharges to surface water and to discharges to ground in excess of 22.75 m^3/d (MELP, 1999). The MSR designates special requirements for sensitive receiving environments, including Shuswap Lake (see Section 7.3.1). The Sewage Disposal Regulation (SDR) administered by the Ministry of Health (MOH) applies to discharges to ground less than 22.75 m^3/d (MOH, 1985). The SDR is currently under review/revision (MOH, 2000). Within a LWMP, it is possible to propose treatment standards other than those contained in the MSR, as long as it can be shown that the public health and the environment are protected.

Regulations applying specifically to discharges of collected storm surface runoff (urban and agricultural) have not yet been developed for B.C., although provincial guidelines for environmental protection are available (e.g., B.C. Environment, 1992b; DFO/MELP, 1992 and EC/MWLAP, 2001). Some restrictions of the federal Fisheries Act apply to stormwater discharges where fish or fish habitat are endangered.

7.3.1 Discharges to Surface Water

The effluent criteria for discharges of treated wastewater to surface waters (based on the MSR) are summarized in Table 7-1.

TABLE 7-1
EFFLUENT REQUIREMENTS FOR DISCHARGES TO SURFACE WATERS (MELP, 1999)

Parameter	Effluent Criteria for Discharges to Fresh Waters[1]					
	Maximum Daily Flow 50 m^3/d or greater			Maximum Daily Flow less than 50 m^3/d		
	Streams, Rivers & Estuaries		Lakes (surface area 100 ha or greater)	Streams, Rivers & Estuaries		Lakes (surface area 100 ha or greater)
	Dilution 40:1[2]	Dilution 10:1[2]		Dilution 40:1[2]	Dilution 10:1[2]	
Treatment Requirement	Secondary	High Quality Secondary	Secondary	Secondary	High Quality Secondary	Secondary
BOD_5 (milligrams/litre)	45	10	45	45	10	45
TSS (milligrams/litre)	45	10	45	45	10	45
pH	6.0-9.0	6.9-9.0	6.0-9.0	--	--	--
Disinfection	see[4]	see[4]	see[4]	see[4]	see[4]	see[4]
Total Phosphorus (mg P/L)	1.0[5]	1.0[5]	1.0[5]	--	--	--
Orithophosphate (mg P/L)	0.5[5]	0.5[5]	0.5[5]	--	--	--
Toxicity, acute	100% LC_{50}, 96h	100% LC_{50}, 96 hr	100% LC_{50}, 96 hr	--	--	--
Ammonia	see[6]	see[6]	see[6]	--	--	--

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 mixing zone.

2 Dilutions less than 100:1 will require an environmental impact study to determine if effluent quality needs to be better than tabulated. Where 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, discharge will not be permitted unless an environmental impact study shows that the discharge is acceptable and no other solutions are available.

4 For discharges to recreational use waters, fecal coliform < 200 MPN/100 mL. Where domestic water extraction occurs within 300 m of a discharge, fecal coliform < 2.2 MPN/100 mL with no sample exceeding 14 MPN/100 mL. Where chlorine is used, dechlorination will be required. Wherever possible alternate forms of disinfection to chlorine should be implemented.

5 The total and orthophosphate criteria may be waived if it can be shown from 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.

6 The allowable effluent ammonia concentrations 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.

Schedule 5 of the Municipal Sewage Regulation specifies geographical areas requiring advanced treatment. Shuswap Lake is designated by the MWLAP as an area where "the discharger must conduct an environmental impact study with the terms of reference to be established in consultation with the manager and must demonstrate to the satisfaction of the manager that advanced treatment will protect the receiving environment." An environmental impact study was recently conducted on behalf of the District (see Section 6.1.2). One of the main water quality concerns in Salmon Arm Bay is the growth of algae and nuisance aquatic vegetation, which is driven by phosphorus loading. The largest source of phosphorus loading to Salmon Arm Bay is the Salmon River. The second largest source is the Salmon Arm WPCC. The Stage IIIB upgrade includes the addition of tertiary effluent filtration, which will significantly reduce the phosphorus content of the WPCC discharge.

Tertiary filtration of the effluent from biological (secondary) wastewater treatment processes is undertaken to remove residual suspended and colloidal solids that escape gravity separation in the final clarifier. For processes that incorporate biological phosphorus removal (e.g., the Salmon Arm WPCC), the process suspended solids typically contain about 5% phosphorus by weight. Therefore, an effluent total suspended solids (TSS) concentration of 20 mg/L would carry 1 mg/L phosphorus bound in the TSS; this phosphorus carried within the solids is additional to any dissolved phosphorus present in the effluent. Filtration of the effluent to reduce the TSS concentration to 5 mg/L would reduce the effluent phosphorus carried by the TSS to 0.25 mg/L. This would allow a dissolved phosphorus concentration of 0.75 mg/L while still meeting the current Permit standard of 1 mg/L total phosphorus (solid plus dissolved). Dissolved phosphorus in the WPCC effluent is typically well below 0.75 mg/L, and total phosphorus would normally be less than 0.5 mg/L, provided that effluent TSS were not greater than 5 mg/L.

Completion of the LWMP will result in replacement of the WPCC Permit PE-1251 with an Operational Certificate. The draft Operational Certificate is attached as Appendix 11. The effluent quality criteria contained in the draft WPCC Operational Certificate were based on initial discussions with the MWLAP. The effluent criteria contained in the draft Operational Certificate are compared to the existing Permit PE-1251 criteria in Table 7-2.

TABLE 7-2
PROPOSED WPCC EFFLUENT CRITERIA

Parameter	Existing Permit PE-1251	Proposed for Operational Certificate
Daily Flow	Maximum 8,200 m^3/d	Maximum 8,200 m^3/d
BOD_5	Maximum 30 mg/L	Maximum Carbonaceous BOD_5 15 mg/L
TSS	Maximum 40 mg/L	Maximum 20 mg/L
Chlorine	Maximum 0.01 mg/L	Not Applicable
Total Phosphorus	Maximum 1.0 mg/L	12-month 96 Percentile not to exceed 1.5 mg/L 12-month 88 Percentile not to exceed 1.0 mg/L 12-month moving average not to exceed 0.5 mg/L
Fecal Coliforms	Not Specified	Maximum 200 per 100 mL

The proposed effluent standards for total phosphorus shown in Table 7-2 reflect the existing weekly sampling schedule at the WPCC. That is, 96 percentile means that 96 percent of all weekly values through the preceding 12 months (2 samples out of 52) are not to exceed 1.5 mg/L total phosphorus.

7.3.2 Discharge to Land

Disposal of treated wastewater effluent to land is normally accomplished by the use of a network of buried, perforated pipes (commonly referred to as drain fields, disposal fields, or tile fields) that allow the effluent to seep into the surrounding soil. This type of system is designated “onsite”, since wastewater is treated and disposed of within individual lots or parcels. The level of treatment required prior to ground disposal depends on the nature of the site and on the sensitivity of the receiving environment (e.g., the potential for groundwater contamination). Treatment systems vary in complexity from simple septic tanks to small off-the-shelf treatment facilities (commonly called “package plants”). Package plants are typically based on biological treatment processes similar in nature to those used at the WPCC. Additional treatment of the septic tank or package plant effluent occurs due to filtering of solids and the action of soil bacteria as the effluent percolates down through the soil profile (see Appendix 2 for more detail regarding onsite treatment systems).

Municipal Sewage Regulation

Discharges to ground in excess of 22.75 cubic metres/day are regulated by the MWLAP under the Municipal Sewage Regulation (MSR). Onsite systems exceeding 22.75 cubic metres/day are relatively large, normally servicing residential communities of at least 50 people or larger commercial, industrial, or institutional operations. They are used where connections to a larger centralized collection and treatment system such as the Salmon Arm WPCC are not available. The required size of the disposal field depends in part on the quality of the treated wastewater to be disposed of. The MSR specifies four effluent classes as shown in Table 7-3. The length of perforated pipe and the area of the disposal field specified in the MSR are greater for poorer quality effluents (e.g., Class D effluent would require a larger disposal field than a Class C effluent, and so forth). The disposal field requirements also depend on unsaturated soil depth and soil percolation rate.

Class D effluent requires only a septic tank followed by a disposal field. Classes A, B and C require additional treatment prior to discharge to the disposal field. This is normally accomplished using small, self-contained treatment facilities that are supplied as a complete package. These "package" plants are essentially scaled down versions of larger facilities such as the WPCC, and they rely on the same physical, biological and chemical treatment processes as large central facilities (see Appendix 2 for more detail).

TABLE 7-3
EFFLUENT CLASS DEFINITION FOR DISCHARGES TO GROUND GREATER THAN 22.75 CUBIC METRES/DAY (MELP, 1999)

Effluent Class	Description	Effluent Quality Parameters (maximum values)				
		BOD_5 (milligrams/litre)	TSS (milligrams/litre)	Fecal Coliform (number of fecal coliform organisms per 100 millilitre)	Turbidity (NTU)	Nitrogen (milligrams/litre)
A	high quality secondary (drinking water well within 300 metres)	10	10	median 2.2 any sample 14	average 2 any sample 5	Nitrate-N 10 Total N 20
B	high quality secondary	10	10	400[1]	N/A	N/A
C	secondary	45	45[2]	N/A	N/A	N/A
D	typical septic tank	N/A	N/A	N/A	N/A	N/A

N/A means not applicable.
1 applies under specified conditions
2 for lagoon systems maximum TSS is 60 mg/L

Sewage Disposal Regulation

Discharges to ground up to 22.75 m^3/d are regulated by the Ministry of Health (MOH) under the Sewage Disposal Regulation (SDR). These relatively small systems (commonly referred to as on-site systems), normally consist of a septic tank followed by a ground disposal field. Onsite systems are typically designed to dispose of the wastewater from individual buildings (residential, institutional, commercial, and industrial) within the lot boundary. Alternatively, septic tank/ground disposal systems may serve small groups of homes or other buildings.

Similar to the MSR requirements for larger ground disposal systems, the size of the disposal field for systems administered under the SDR depends on site conditions. On-site evaluation is required to determine whether conditions are suitable for ground disposal. Where site conditions are difficult or lot size is not adequate for a conventional septic tank/disposal field system, the size of the disposal field may be reduced if small treatment facilities (i.e., package plants as described above) that are approved by the MOH are installed between the septic tank and the disposal field. Approved package plants must produce an effluent not exceeding 45 milligrams/litre BOD_5 and 60 milligrams/litre total suspended solids. Mounded disposal fields using imported soil material may also be used where native soils are unsuitable for ground disposal.

7.3.3 Reclaimed Water

Historically in British Columbia, and generally throughout North America, the emphasis in wastewater management has been to provide sufficient treatment to allow disposal of effluent in order to protect public health and the environment. With the exception of some southern states in the U.S., the emphasis has been on disposal of effluent to water or to land.

In British Columbia and throughout North America, wastewater is now being looked upon as a resource that should be beneficially reused where feasible. This evolving approach contrasts with wastewater disposal practices that currently prevail. An appropriate level of treatment and monitoring for various reuse applications is important to the protection of public health and the receiving environment. With effective source control programs coupled with adequate and reliable treatment, effluent can be beneficially reused. Treatment plants designed for water reuse are more appropriately classified as water reclamation plants.

Municipal Sewage Regulation

Standards for reclaimed effluent reuse in British Columbia were adopted in July 1999, and are administered by the MWLAP. These standards are set out in the Municipal Sewage Regulation (MSR) under the Waste Management Act. (The MSR standards for reclaimed water do not apply to rainwater collection and reuse.)

The MSR standards for water reuse in British Columbia dictate that effluent used as reclaimed water must meet either of the two requirements described in Table 7-4, depending on the use of the reclaimed water.

TABLE 7-4
RECLAIMED WATER CATEGORY AND PERMITTED USES

Unrestricted Public Access Category	Restricted Public Access Category
EFFLUENT QUALITY REQUIREMENTS $6 \geq pH \leq 9$ $BOD_5 \leq 10$ milligrams/litre Turbidity ≤ 2 NTU Fecal coliforms $\leq 2.2/100$ millilitres	EFFUENT QUALITY REQUIREMENTS $6 \geq pH \leq 9$ $BOD_5 \leq 45$ milligrams/litre TSS ≤ 45 milligrams/litre TSS Fecal coliforms $\leq 200/100$ millilitres
URBAN - Parks - Playgrounds - Cemeteries - Golf Courses - Road Rights-of-Way - School Grounds - Residential Lawns - Greenbelts - Vehicle and Driveway Washing - Landscaping around Buildings - Toilet Flushing - Outside Landscape Fountains - Outside Fire Protection - Street Cleaning	AGRICULTURAL - Commercially processed food crops - Fodder, Fibre - Pasture - Silviculture - Nurseries - Sod Farms - Spring Frost Protection - Chemical Spray - Trickle Drip Irrigation of Orchards and Vineyards
AGRICULTURAL - Aquaculture - Food Crops Eaten Raw - Pasture (no lag time for animal grazing) - Frost Protection, Crop Cooling and Chemical Spraying on crops eaten raw - Seed crops	URBAN/RECREATIONAL - Landscape Impoundments - Landscape Waterfalls - Snow Making not for skiing or snowboarding - Golf Courses (providing health and environmental issues resolved to manager's satisfaction)
RECREATIONAL - Stream Augmentation - Impoundments for Boating and Fishing - Snow Making for skiing and snowboarding	CONSTRUCTION - Soil Compaction - Dust Control - Aggregate Washing - Making Concrete - Equipment Washdown
	INDUSTRIAL - Cooling Towers - Process Water - Stack Scrubbing - Boiler Feed
	ENVIRONMENTAL - Wetlands

Environmental impact studies are required for both categories of reclaimed water. Use of reclaimed water must be authorized in writing by the local health authority having jurisdiction.

The proposed effluent quality standards for the Stage IIIB WPCC shown in Table 7-2 meet the MSR requirements for reclaimed water for use in areas with restricted public access. This includes onsite reuse at the WWTP, agricultural applications, golf course irrigation (providing health and safety issues are resolved to MWLAP's satisfaction), industrial applications, landscape impoundments and wetlands.

In addition to the basic treatment requirements listed above, the use of reclaimed water requires the following:

- in the absence of seasonal storage, the provision of at least 20 days emergency storage (the storage volume may be reduced to 2 days if multiple treatment units are used);
- the system for conveying reclaimed water must incorporate safeguards to prevent cross connection with the potable water system;
- provide in addition to seasonal storage an alternative method of disposing of the reclaimed water or satisfy the manager that no such alternative is required to assure public health protection and treatment reliability.
- authorization in writing by the local health authority or the establishment of a local service area under which a municipality, or a private corporation under contract to a municipality, assumes responsibility for the system;
- the provision of user information when Unrestricted Public Access Category uses are proposed;
- where frequent worker contact with reclaimed water occurs, disinfection must achieve a fecal coliform level of <14/100 millilitres;
- 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;
- 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; and

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

Methods of treatment for reclaimed water other than those specified in the MSR will be considered by the MWLAP if equivalent treatment, public health protection and treatment reliability can be demonstrated.

According to definitions contained in the MSR, water-carried wastes from liquid or non-liquid culinary purposes, washing, cleansing, laundering, food processing or ice production (i.e., grey water) are classified as domestic sewage, regardless of whether or not toilet wastes (black water) are included. As such, the MSR standards for use of reclaimed sewage effluent apply to treated and recycled grey water as well as to reclaimed sewage. According to the MSR, water reuse projects must be approved in consultation with the MOH. For complex in-house wastewater collection, treatment and reuse facilities, it is regarded by the MOH as beyond the scope of the average householder to adequately operate, maintain, and monitor these systems. This is supported by experience elsewhere as well as in British Columbia. The MOH has serious concerns with the reuse of any reclaimed wastewater at the residential level, due to the potential for cross-connections with the potable water system. The risk to public health is regarded by MOH as unacceptably high in areas of B.C. where a relatively plentiful renewable potable supply is available.

The MOH has allowed demonstration projects for grey water recycling (e.g., CK Choi Building and Quayside Village in North Vancouver). These projects required special permission from health authorities. Procedures and facilities must be in place to ensure that systems will be monitored and operated properly, so that it can be demonstrated that there is no danger to the public health. Each demonstration project is carefully considered on a case-by-case basis, before receiving approval.

Sewage Disposal Regulation

Similar to the MSR, the Sewage Disposal Regulation (SDR) administered by the MOH does not distinguish between grey water and wastewater that contains human excretion. Therefore, treatment and disposal requirements under the SDR are the same for both grey water and black water as far as MOH requirements are concerned. Onsite treatment and disposal of grey water requires the same type of septic field and/or package treatment plant as sewage (black water) for discharges under MOH jurisdiction (i.e., less than 22.75 cubic metres/day). Treated effluent from systems regulated under the SDR must be discharged to a ground disposal field, and must not discharge to surface water or reach the surface of land. This appears to specifically prohibit reuse of untreated and treated wastewater for systems regulated under the SDR (e.g., for irrigation of gardens and lawns, toilet flushing, etc.). As with other regulations, there is some flexibility within the SDR for allowing exceptions on a case-by-case basis. However, the MOH is not supportive of wastewater reuse systems that rely on individual homeowners for monitoring and operation, regardless of the level of treatment and the reuse application.

B.C. Plumbing Code

Requirements for plumbing in British Columbia are contained in the B.C. Building Code (Part 7, Plumbing Services). The B.C. Plumbing Code, which is based on the National Plumbing Code of Canada (NPC), contains no specific guidance regarding water reuse. A national survey of government agencies identified the following technical issues which, if addressed in the NPC, would facilitate the implementation of on-site water reuse systems (Soroczan, 1997):

- colour coding of pipe material to identify water reuse plumbing components;
- guidance on appropriate backflow preventers specific to reuse systems;
- guidance on cross-connection prevention specific to reuse systems;
- pressure differences between potable and non-potable systems; and
- location of water reuse pipes within a building.

The B.C. Plumbing Code contains the following clauses that might be interpreted to prohibit on-site water reuse.

Provisions of the* B.C. Plumbing Code – *1998

7.1.4.2 Sanitary Drainage Systems

1) Every *sanitary drainage system* shall be connected to a public *sanitary sewer*, a public *combined sewer*, or a *private sewage disposal system.*

7.1.4.3 Water Distribution Systems

1) Every *water distribution system* shall be connected to a public watermain or a private potable water supply system.

7.1.4.2 Connections to Sanitary Drainage Systems

1) Every *fixture* shall be directly connected to a *sanitary drainage system* (note – exceptions are listed, but none would apply to grey water).

7.7.3.2 Outlets

1) An outlet from a non-potable water system shall not be located where it can discharge into

a. a sink or lavatory

b. a fixture into which an outlet from a potable water system is discharged, or

c. a fixture that is used for the preparation, handling or dispensing of food, drink or products that are intended for human consumption.

The B.C. Plumbing Code includes the definition that any liquid waste other than clear-water or stormwater is classified as sewage. There are no provisions in the B.C. Plumbing Code for installing equipment to collect grey water for recycling purposes. However, the NPC (upon which the B.C. Plumbing Code is based), does not prevent innovative approaches. A survey by the American Water Works Association (AWWA, 1997) found that most proponents agree that more concrete guidance in the NPC is needed before water reuse systems can gain widespread acceptance.

Draft changes to the section on non-potable water and to other applicable parts of the B.C. Plumbing Code are currently being prepared to specifically allow in-building collection, treatment and reuse of grey water. In any case, the B.C. Ministry of Community, Aboriginal and Women’s Services (formerly Municipal Affairs) feels that the B.C. Plumbing Code as it currently stands is not an impediment to the installation of in-building grey water collection, treatment and reuse (Kuhnert, 2002).

7.4 Biosolids Reuse

The Federal Fertilizer Act has a provision that allows for the sale of biosolids that meet certain criteria, which are principally restrictions on trace metals concentrations. Within this Act is a provision that allows the Provinces to put in place any additional legislation they may chose to further regulate reuse of biosolids.

The reuse and disposal of biosolids in British Columbia is regulated by the MWLAP under the recently adopted Organic Matter Recycling Regulation (OMRR). The OMRR defines allowable uses for treated biosolids in British Columbia. Before the OMRR was passed, biosolids could be land applied under an Approval or a Permit. The OMRR does not apply to land application of biosolids that is authorized by a Permit, Approval, or Operational Certificate.

Before the adoption of the OMRR, a Permit or an Approval was required for land application of biosolids. An approval was typically issued for one-time applications of biosolids during a restricted time period of up to fifteen months. Approvals did not usually require as extensive public or stakeholder review as did Permits, and were often issued in a shorter time period than Permits.

Permits usually allowed an annual application of biosolids to a site, with maximum limits established for dry solids, nitrogen, metals, and perhaps other parameters depending upon product quality and receiving environment conditions. Environmental monitoring and reporting were also prescribed. A Permit application required a proactive public and stakeholder agency review, often including posting of signs at the biosolids application site, notification in the B.C. Gazette and one or more local papers, possibly door to door notification of neighbours, public meetings and a much broader review by other government agencies. The MWLAP had broad discretionary powers in determining the extent of the public input required. The District of Salmon Arm currently holds Permit PE-11402 (copy attached in Appendix 7) for biosolids application at the Shuswap Regional

Airport (Salmon Arm), as well as other locations subject to written authorization from the MWLAP (see Section 9.4).

For a one-time application of biosolids in certain situations, the MWLAP sometimes allowed biosolids applications under a letter of authorization extending the existing Operational Certificate for the wastewater treatment plant that generated the biosolids. In most regions of the Province, the biosolids supplier was required to apply for the Permit or Approval.

7.4.1 Organic Matter Recycling Regulation

The MWLAP developed the Organic Matter Recycling Regulation (OMRR) in concert with various stakeholders, to establish requirements for the reuse of treated biosolids. The requirements contained in the recently adopted OMRR are summarized in this section.

The OMRR defines three products that incorporate biosolids, with different quality classifications for each product. Biosolids are defined in the OMRR as: "*stabilized municipal sewage sludge resulting from a municipal waste water treatment process or septage treatment process which has been sufficiently treated to reduce pathogen densities and vector attraction to allow the sludge to be beneficially recycled in accordance with the requirements of this regulation.*"

The three biosolids products described in the OMRR are designated "biosolids" (treated wastewater organic soils), "compost" (biosolids composted with or without other organic wastes), and "biosolids growing medium" (topsoil manufactured using treated biosolids). Compost and biosolids are further designated Class A or Class B, with the higher quality product being Class A. Classification depends on trace element (metal) concentrations, treatment method, pathogen content, and vector attraction reduction. Vectors are carriers (e.g. insects) capable of transmitting disease-causing organisms (pathogens). According to the definitions contained in the OMRR, Class A compost and biosolids growing medium are defined as "retail grade organic matter". Class B compost, Class A biosolids and

Class B biosolids are defined as “managed organic matter.”

The trace metals standards contained in the OMRR for the various biosolids products are shown in Table 7-4. The standards developed by the United States Environmental Protection Agency (USEPA) are included for comparison. A summary of the metals content of the biosolids samples taken at the Salmon Arm WPCC (summarized earlier in Table 5-4) is included in Table 7-4. As shown, the Salmon Arm WPCC biosolids samples were well within the OMRR metals standards for Class A biosolids, except for occasional exceedances of mercury. Mercury concentrations of 13.3 milligrams/kilogram and 14.1 milligrams/kilogram recorded in September, 1998 exceeded the Class A OMRR standard of 5 milligrams/kilogram, but were within the Class B OMRR standard of 15 milligrams/kilogram. Since that time, mercury concentrations have been substantially lower, but have occasionally exceeded 5 milligrams/kilogram (Class A standard exceeded in five of eighteen samples in total from August 1998 to December 2001, last exceedance May, 2001). The trace element aspect of biosolids quality is best addressed through source control (see Section 8.1).

Biosolids and compost containing biosolids that meet the trace element standards in the OMRR (Table 7-4) are further classified according to pathogen reduction and vector attraction reduction; these requirements are summarized in Table 7-5 and Table 7-6, respectively. The OMRR also lays out requirements for sampling, analysis and record keeping, as well as maximum cumulative limits for designated trace metals at biosolids application sites. Fecal coliforms in the digested biosolids produced at the Salmon Arm WPCC exceeded the Class A standard of 1000 MPN/g dry solids in 3 of 16 samples from September 1998 to November 2000; however fecal coliform counts in the digested biosolids have not exceeded the Class A standard since December 2000. The digester currently has adequate retention time and temperature to meet Class A standards for pathogen reduction according to the time-temperature requirements contained in the OMRR. Monitoring of vector attraction reduction in the digester should routinely be undertaken, to confirm that OMRR standards for this parameter are met.

TABLE 7-5
COMPARISON OF SALMON ARM WPCC BIOSOLIDS WITH OMRR AND USEPA TRACE METAL LIMITS

Parameter (milligrams/kilogram dry weight unless otherwise noted)	B.C. Organic Matter Recycling Regulation				USEPA[1] 503 Regulations		Salmon Arm WPCC Dewatered Biosolids (from Table 5-4)		
	Managed Organic Matter		Retail Grade Organic Matter						
	Class B Compost and Class B Biosolids	Class A[2] Biosolids	Biosolids Growing Medium (Topsoil)[3]	Class A Compost Containing Biosolids	High Quality mg/kg	Max. Allow mg/kg	Average	Maximum	Minimum
Arsenic	75	75	13	13	41	75	<4.4	12	<0.4
Cadmium	20	20	1.5	3	39	85	2.2	4.0	1.5
Chromium	1060	--	100	100	--	--	40	101	22
Cobalt	150	150	34	34	--	--	<3.5	6.0	2.0
Copper	2200	--	150	400	1500	4300	857	1540	594
Lead	500	500	150	150	300	840	<59	<100	<50
Mercury	15	5	0.8	2	17	57	5.6	14.1	3.0
Molybdenum	20	20	5	5	18	75	8.9	23	<4.0
Nickel	180	180	62	62	420	420	21	50	14
Selenium	14	14	2	2	26	100	<2.6	5.0	<2.0
Zinc	1850	1850	150	500	2800	7500	658	1150	499
% Total Solids by weight	--	--	--	--	--	--	33	37	27
Fecal Coliforms in Digested Biosolids(per gram dry solids)	$<2x10^6$	<1,000	--[3]	<1,000			<1221	11,500	<1

1 EPA 503 regulations are based on scientific risk analyses.

2 As specified in Trade Memorandum T-4-93 (September, 1993), Standards for Metals in Fertilizers and Supplements, as amended from time to time, as adopted by Agriculture and Agri-Food Canada under the Fertilizers Act (Canada) and regulations.

3 Biosolids growing medium must be derived from Class A biosolids or Class B biosolids that meet Class A fecal coliform and vector attraction reduction requirements.

TABLE 7-6
OMRR PATHOGEN REDUCTION REQUIREMENTS

TREATMENT REQUIREMENTS FOR PATHOGEN REDUCTION		
Class A Biosolids and Biosolids Used to Produce Biosolids Growing Medium	Class A Compost Containing Biosolids	Class B Biosolids and Class B Compost
• fecal coliforms <1000 per gram dry total solids and one of the following treatment processes is required 1. thermophilic aerobic digestion (at least 55°C, for at least 30 minutes, retention time according to Equation 2) 2. thermophilic anaerobic digestion (50°C for at least 10 consecutive days) 3. heat treatment (total solids at least 7%, at least 50 °C, retention time according to Equation 1)[1] 4. heat treatment (total solids <7%, at least 50 °C, retention time according to Equation 2)[1] 5. alkaline stabilization (pH >12 and 52°C for 72 hours, then air drying to >50% total solids) Equation 1: $D = 131{,}700{,}000/10^{0.1400\,t}$ Equation 2: $D = 50{,}070{,}000/10^{0.1400\,t}$ Where: D = time (days) t = temperature (°C)	• fecal coliforms <1000 per gram dry total solids and one of the following treatment processes is required 1. windrow composting (at least 55 °C for at least 15 days, minimum 5 turnings) 2. static aerated pile (at least 55 °C for at least 3 consecutive days) 3. enclosed vessel (at least 55 °C for at least 3 days)	• fecal coliforms <2,000,000 per gram dry total solids or one of the following treatment processes is required. 1. aerobic digestion (MCRT ranges from 40 days at 20 °C to 60 days at 15 °C) 2. air drying (minimum drying time 3 months, at least 2 months at >0 °C) 3. anaerobic digestion (MCRT ranges from 15 days at 35 °C to 60 days at 20 °C) 4. composting (at least 40 °C for 5 days, including minimum 4 hours at 55 °C) 5. lime stabilization (pH >12 after 2 hours contact

[1] minimum retention time applies depending on process used

TABLE 7-7
OMRR VECTOR ATTRACTION REDUCTION REQUIREMENTS

TREATMENT REQUIREMENTS FOR VECTOR ATTRACTION REDUCTION			
Class A Biosolids and Class B Biosolids Used to Produce Biosolids Growing Medium	Class A Compost	Class B Biosolids	Class B Compost
• at least 38% volatile solids destruction during digestion, or one of the following alternatives 1. anaerobic digestion: bench-scale anaerobic digestion of a portion of previously digested solids at 30 ^{o}C to 37 ^{o}C for 40 additional days, additional volatile suspended solids reduction must be <17% 2. aerobic digestion: bench-scale aerobic digestion of a portion of previously digested solids at 20 ^{o}C for 30 additional days, additional volatile suspended solids reduction must be <15% 3. specific oxygen uptake rate (SOUR): for aerobic digestion, SOUR not greater than 1.5 mg O_2/hour/gram total solids at 20 ^{o}C 4. alkali addition: pH at least 12 for 2 hours and pH 11.5 or higher for an additional 22 hours 5. percent solids: 〈90% total solids prior to mixing with other materials, 90% total solids must be maintained until biosolids are land applied or distributed.	• one of the following treatment processes is required. 1. minimum aerobic treatment time 14 days, minimum temperature 40 ^{o}C with average temperature greater than 45 ^{o}C, carbon:nitrogen ratio at completion at least 15:1 and no more than 35:1 2. minimum curing time 21 days, carbon:nitrogen ratio at completion as in Item 1, no re-heating upon standing to more than 20 ^{o}C above ambient temperature 3. alternative method approved by the Director	• must meet the vector attraction reduction requirements for Class A biosolids or one of the following: 1. soil injection within 8 hours of discharge from pathogen reduction process if fecal coliforms are $<2x10^{6}$ per gram dry solids. 2. incorporation by tillage within 8 hours after discharge from pathogen reduction process if fecal coliforms are $<2x10^{6}$ per gram dry solids and no significant amount of biosolids on surface 6 hours after application.	• must meet the vector attraction reduction requirements for Class A biosolids or one of the following: 1. incorporation by tillage: no significant amount of compost on soil surface 6 hours after application. 2. applied using other technologies: in accordance with best management practices described in most recent edition of OMRR guidelines approved by director

The OMRR specifies restrictions for reuse of the various biosolids products. These are summarized in Table 7-7. As shown, compost and biosolids growing medium derived from biosolids (retail grade organic matter) have unrestricted distribution. Class B biosolids may be used to produce topsoil (biosolids growing medium) for unrestricted distribution, provided that the Class B OMRR trace metals restrictions shown in Table 7-4 and Class A vector attraction reduction and pathogen reduction requirements are met. Class A biosolids have unrestricted distribution only in amounts less than 5 cubic metres per vehicle per day or in sealed bags for retail purposes, each not to exceed 5 cubic metres, with no restriction on the number of bags per vehicle per day. For amounts of Class A biosolids greater than 5 cubic metres, for Class B biosolids, and for Class B compost, a Land Application Plan signed by a qualified B.C. professional is required. As shown in Table 7-7, there are fewer restrictions on the reuse of Class A biosolids compared to Class B biosolids.

The OMRR specifies that a discharger must use the standard form (Schedule 13) attached to the OMRR to notify the MWLAP (and the local Medical Health Officer if the application site is located in a watershed used as a permitted water supply under the Safe Drinking Water Regulation, B.C., Reg. 230/92 or on agricultural land) at least 30 calendar days before the land application of managed organic matter. If the application site is within the agricultural land reserve or forest reserve land, the Land Reserve Commission must also be notified using the standard form at least 30 days before the application. The MWLAP may, within 30 days of receipt for the completed standard form, request additional information or impose site specific standards or management practices. The Medical Health Officer may, within 30 days of receipt of the completed standard form, provide written direction that the application must not proceed, or may only proceed subject to specified conditions. If no requests or directions are received after the 30 days have elapsed, the biosolids application can proceed according to the Land Application Plan.

TABLE 7-8 - OMRR BIOSOLIDS REUSE CRITERIA

Product Classification	Reuse Criteria	Product Reuse Restrictions
Class A Compost	• biosolids used as feedstock must meet trace element requirements for Class B biosolids as shown in Table 3-2. • Carbon: Nitrogen ratio > 15:1, carbon nitrogen ratio < 35:1 • foreign matter content < 1% dry weight. • does not contain sharp foreign matter that can cause injury • trace elements as shown in Table 7-4 • treatment requirements as shown in Tables 7-5 and 7-6	• sale or give away, no volume restriction
Biosolids Growing Medium	• biosolids growing medium must be derived from either Class A biosolids or Class B biosolids that meet pathogen and vector attraction reduction requirements for Class A biosolids. • total kjeldahl nitrogen < 0.6% by weight • Carbon: Nitrogen ratio > 15:1 • organic matter must not exceed 15% dry wt. • foreign matter content <1% dry wt. • does not contain sharp foreign matter that can cause injury • trace elements as shown in Table 7-4 • treatment requirements as shown in Tables 7-5 and 7-6	• sale or give away, no volume restriction
Class A Biosolids	• land application plan (if required) must be prepared by a qualified professional • foreign matter content <1% dry weight • does not contain sharp foreign matter that can cause injury • trace elements as shown in Table 7-4 • treatment requirements as shown in Tables 7-5 and 7-6	• distribution to composting facilities or biosolids growing medium facilities, no volume restrictions • sale or give away in volumes less than 5 cubic metres per vehicle per day • sale or give away in sealed bags, each not exceeding 5 cubic metres, no restriction on number of bags per vehicle per day • land applied in accordance with land application plan for Class A biosolids
Class B Biosolids and Class B Compost not meeting Class A fecal coliform limits or Class A vector attraction reduction requirements	• land application plan (if required) must be prepared by a qualified professional • application sites with restricted public access or use only • animal grazing and crop restrictions per Schedule 8 of OMRR • visible signage at reuse sites per Schedule 8 of OMRR • groundwater level more than 1 metre below surface at time of application • buffer zone restrictions per Schedule 8 of OMRR • foreign matter content <1% dry weight • does not contain sharp foreign matter that can cause injury • trace elements as shown in Table 7-4 • treatment requirements as shown in Table 7-5 and 7-6	• land applied in accordance with Land Application Plan for Class B biosolids • Class B Biosolids that meet specified requirements may be distributed to selected composting facilities, no volume restriction • Class B biosolids and Class B compost must not be land applied in a watershed used as a permitted water supply under the Safe Drinking Water Regulation, B.C. Reg. 230/92, as amended from time to time

7.5 Facilities Requiring Operational Certificates

In order to issue Operational Certificates to wastewater treatment facilities that treat municipal liquid waste in the Liquid Waste Management Plan (LWMP) area, all public and private facilities, (i.e. the permitted discharges given in Table 4-1 and future wastewater treatment plants within the study area), must be identified in the LWMP. Future facilities not identified in the plan will require discharge permits, or the LWMP will have to be amended/modified to include these facilities.

The only wastewater treatment facility currently within the LWMP area that will require an Operational Certificate is the Salmon Arm WPCC. In the event that the District were to assume the responsibility for the operation of additional facilities in future (e.g. small community facilities in areas remote from the WPCC collection system), these facilities would also require Operational Certificates.

8.0 SOURCE CONTROL AND WASTE VOLUME REDUCTION

8.1 Source Control

Regulation of waste discharges into sanitary sewers is essential for the protection of public health and the environment. Toxic and hazardous materials that enter the sanitary system pose a risk to sewerage system workers, to the general public, to the collection and treatment works, and to the receiving environment. Toxic and hazardous materials in wastewater can upset biological treatment processes, heavy metals can accumulate in sediments and wastewater treatment plant residuals (biosolids), and waterborne contaminants can be discharged to surface waters; the result is a negative impact on the environment from both liquid and solids discharges.

Source controls are used to discourage the discharge of wastes to the sanitary sewer (and storm drainage system) that may degrade the quality of receiving waters, or hinder the efficiency of treatment facilities. Source controls can be implemented through either a regulatory or an educational approach, or through a combination of the two. The regulatory approach is typically focused on non-domestic (i.e., commercial, industrial, and institutional) dischargers, often through sewer use bylaws. Source controls for both domestic (households) and non-domestic dischargers can also be undertaken through education to reduce the use and disposal of hazardous and toxic products, and through regulatory restrictions on the sale of such products. The objective of the regulatory and educational programs should be to provide a consistent and comprehensive approach to source control for discharges to sanitary sewers (and storm drainage) throughout the study area. A source control approach that includes a significant educational component is likely to be more effective than one of strict policing and enforcement. However, it must be emphasized that it is essential to prevent unauthorized discharges of industrial, toxic, and/or dangerous wastes to the Water Pollution Control Centre (WPCC). Responsibilities for inspection and enforcement of source control regulations should be clearly defined.

This section contains a discussion of source control approaches for minimizing the discharge of contaminants to the sanitary sewer system. Source control approaches for urban storm runoff and agriculture are discussed in Sections 10 and 11, respectively.

8.1.1 Source Control Regulations for Sanitary Sewers

The District of Salmon Arm enacted Sewer Connection Bylaw No. 1410 in 1981. The bylaw contains restrictions for discharges to both sanitary and storm sewers.

Source control of trace metals is particularly important where the biosolids generated at the wastewater treatment plants are to be reused as a soil amendment/fertilizer. The reuse of biosolids in B.C. is restricted by the Provincial Organic Matter Recycling Regulation (OMRR) according to trace metals content and other factors. The biosolids quality data from the Salmon Arm WPCC (Table 5-4) shows that the one metal that has exceeded the OMRR criteria for Class A biosolids at the Salmon Arm WPCC, namely mercury, is not contained in Bylaw No. 1410. In addition, molybdenum, selenium and cobalt are not contained in the bylaw, although they are contained in the OMRR standards.

Wastes which can damage the sewer system and which pose a threat to worker health and safety should be prohibited from being discharged to the sewer system. Prohibited wastes under Bylaw No. 1410 are compared to those defined in bylaws from other jurisdictions in Table 8-1. Restricted wastes include those which can be accepted safely at sewage treatment plants, but have specific limits on discharge concentrations. The concentrations for restricted wastes allowed under Bylaw No. 1410 are compared to those from other jurisdictions in Table 8-1. (In contrast with some other jurisdictions, the text of Bylaw No. 1410 does not contain any specific definitions for prohibited or restricted wastes).

Unlike many other communities, the District of Salmon Arm Bylaw No. 1410 does not require a Waste Discharge Permit for restricted wastes, high volume discharges, stormwater or cooling waste. A Permit typically will apply to non-domestic discharges from the industrial, commercial and institutional (ICI) sectors.

Waste Discharge Permits typically apply to the following:

- limits and restriction on the quantity, frequency and nature of the discharge; and
- requirements of the Permit holder (discharger) to:
  - construct the pre-treatment works if needed to meet the specified discharge limits,
  - monitor the discharge and provide reports to District, and
  - operate and maintain the pre-treatment and monitoring facilities.

TABLE 8-1
COMPARISON OF PROHIBITED AND RESTRICTED WASTE DISCHARGES FOR SANITARY SEWERS

Comparison of the Discharge Limits for Prohibited/Restricted Wastes											
Regulated Parameters	District of Salmon Arm	City of Kelowna 1991	District of Campbell River 1997	District of Mission 1989	City of Abbotsford (draft) 1996	Fraser Valley Regional District 1995	Greater Vancouver Regional Disrict 1991	Capital Regional District 1997	City of Prince George	Ontario Model Bylaw 1998	Seattle 1990
1. General Contaminants											
Air Contaminant Waste			P								
Colour	P	P	R	P	R			R		P	
Corrosive Wastes		P	P		P	P	P	P	P		P
Excessive Waste			P		R			P			
Flammable/Explosive Wastes	P	P	P	P	P	P	P	P	P	P	P
Food Waste	R	P	5 mm	6 mm	5 mm	5 mm	5 mm	5 mm	5 mm		P
Fuel		P								P	
Hauled Waste/Septic Tank Waste			P[1]		P[1]	P[1]	P[1]	P[1]		P	P
Hazardous Wastes	P	P	P	P		P	P		P	P	
High Strength Wastes			R						P		P
High Temperature Waste			P				P	P		P	
Leachate										P	
Odorous Waste	P			P	P		P		P	P	P
Obstructive/Interfering Wastes	P	P	P	P	P	P	P	P	P	P	P
Organic Compounds											P
Pathological/Biomedial Wastes			P		P	P	P	P		P	
PCBs								P		P	
Pesticides		P	P							P	
Radioactive Materials	P	P	R	P	R	R	R	R	P	P	P
Reactive Materials										P	
Seawater			45.5 m^3/d					R			
Severely Toxic Materials					R	P	P		P	P	
Settleable Solids, mL/L											7
Special Wastes		P	P			P	P	P	P		
Storm/Drainage/Uncontaminated Water/Groundwater/Cooling Water	P	P	P	P	P	P	P	P	P	P	
Toxic Vapours									P		P
2. Inorganic Contaminants											
Aluminium, mg/L		50	50		50	50	50		50	50	
Antimony, mg/L									5	5	
Arsenic, mg/L	1.0	1.0	0.2	1.0	1.0	1.0	1.0	0.2	1.0	1.0	

TABLE 8-1 (cont'd.)
COMPARISON OF PROHIBITED AND RESTRICTED WASTE DISCHARGES FOR SANITARY SEWERS

Comparison of the Discharge Limits for Prohibited/Restricted Wastes											
Regulated Parameters	District of Salmon Arm	City of Kelowna 1991	District of Campbell River 1997	District of Mission 1989	City of Abbotsford (draft) 1996	Fraser Valley Regional District 1995	Greater Vancouver Regional Disrict 1991	Capital Regional District 1997	City of Prince George	Ontario Model Bylaw 1998	Seattle 1990
Bismuth, mg/L											
Boron, mg/L		50	50		50	50	50		50		
Cadmium, mg/L	1.0	0.2	0.10	1.0	0.2	0.2	0.2	0.1	0.2	1.0	
Chlorides, mg/L				R				15.00		1500	
Chromium (total), mg/L	5.0	4.0	5.0	5.0	4.0	4.0	4.0	5.0	2.0	5.0	
Cobalt, mg/L		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	
Copper, mg/L	2.0	2.0	1.0	2.0	2.0	2.0	2.0	1.0	2.0	3.0	
Cyanide (total), mg/L	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	
Fluorides, mg/L										10	
Hydrogen Sulphide, mg/L											
Iron, mg/L	10	10	50	1.0	10	10	10	50	50	50	
Lead, mg/L	2.0	1.0	0.5	2.0	1.0	1.0	1.0	0.5	1.0	5.0	
Manganese, mg/L		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	
Mercury, mg/L		0.05	0.05		0.05	0.05	0.05	0.05	0.05	0.1	
Molybdenum, mg/L		1.0	5.0		1.0	1.0	1.0	5.0	1.0	5.0	
Nickel, mg/L	3.0	2.0	1.0	3.0	2.0	2.0	2.0	1.0	2.0	3.0	
Nitrogen (Kjeldahl), mg/L											
Phosphorus, mg/L		12.5								10	
Selenium, mg/L									0.1	5.0	
Silver, mg/L		1.0	2.0		1.0	1.0	1.0	2.0	1.0	5.0	
Sulphate, mg/L		1500	1500	R	1500	1500	1500	1500	1500	1500	
Sulphide, mg/L		1.0	1.0		1.0	1.0	1.0	1.0	1.0		
Tin, mg/L		5.0	5.0						3.0	5.0	
Titanium, mg/L										5.0	
Vanadium, mg/L										5.0	
Zinc, mg/L	4.0	3.0	3.0	4.0	3.0	3.0	3.0	3.0	5.0	3.0	
3. Conventional Contamination											
BOD_5, mg/L	500	500	500	300	300	300	500	500	500	300	
COD, mg/L		750	1000					1000			
Fats, Oils & Grease (total)[4], mg/L		150	150	100	150	150	150	100	R		
Suspended Solids, mg/L	600	600	350	300	300	300	600	350	500	350	
pH	5.5-9.5	5.5-10.5[3]	5.5-11.0	5.5-9.5	5.5-9.5	5.5-10.5[3]	5.5-10.5	5.5-11.0	5.0-9.5	5.5-9.5	
Temperature	65°C	65°C	65°C	54°C	54°C	65°C	65°C	65°C	65°C	65°C	

TABLE 8-1 (cont'd.)
COMPARISON OF PROHIBITED AND RESTRICTED WASTE DISCHARGES FOR SANITARY SEWERS

Comparison of the Discharge Limits for Prohibited/Restricted Wastes											
Regulated Parameters	District of Salmon Arm	City of Kelowna 1991	District of Campbell River 1997	District of Mission 1989	City of Abbotsford (draft) 1996	Fraser Valley Regional District 1995	Greater Vancouver Regional Disrict 1991	Capital Regional District 1997	City of Prince George	Ontario Model Bylaw 1998	Seattle 1990
4. Organic Contamination											
Benzene, mg/L			0.10					0.10			
Chlorophenols, mg/L			0.05		0.05[2]	0.05[2]	0.05[2]	0.05[2]	0.05		
Ethyl Benzene, Toluene, Xylene, mg/L			0.20					0.2			
Petroleum Hydrocarbon, mg/L			15.0	15	15	15	15	15			
Phenols, mg/L	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Polycyclic Aromatic Hydrocarbons (PAHs), mg/L			0.05					0.05			

P Prohibited Waste

R Restricted Waste, numerical limit not specified.

1 Discharge allowed at authorized receiving stations only.

2 Chlorinated phenols are the total of chlorophenols, dichlorophenols, trichlorophenols, tetrachlorophenols and pentachlorophenols

3 Two Hour Composite Sample (composed of 8 grab samples collected at consecutive 15 min. intervals)

4 Includes petroleum hydrocarbons.

8.0 SOURCE CONTROL AND WASTE VOLUME REDUCTION

8.1 Source Control

Regulation of waste discharges into sanitary sewers is essential for the protection of public health and the environment. Toxic and hazardous materials that enter the sanitary system pose a risk to sewerage system workers, to the general public, to the collection and treatment works, and to the receiving environment. Toxic and hazardous materials in wastewater can upset biological treatment processes, heavy metals can accumulate in sediments and wastewater treatment plant residuals (biosolids), and waterborne contaminants can be discharged to surface waters; the result is a negative impact on the environment from both liquid and solids discharges.

Source controls are used to discourage the discharge of wastes to the sanitary sewer (and storm drainage system) that may degrade the quality of receiving waters, or hinder the efficiency of treatment facilities. Source controls can be implemented through either a regulatory or an educational approach, or through a combination of the two. The regulatory approach is typically focused on non-domestic (i.e., commercial, industrial, and institutional) dischargers, often through sewer use bylaws. Source controls for both domestic (households) and non-domestic dischargers can also be undertaken through education to reduce the use and disposal of hazardous and toxic products, and through regulatory restrictions on the sale of such products. The objective of the regulatory and educational programs should be to provide a consistent and comprehensive approach to source control for discharges to sanitary sewers (and storm drainage) throughout the study

8.1.2 Inspection and Monitoring

Bylaw No. 1410 specifies that the Superintendent or other authorized person may at any reasonable time enter any property or premises to sample discharges to the sewer, although sampling protocols are not specified.

In general, where inspection and monitoring requirements contained in sanitary sewer use bylaws do not require composite samples to be taken, this will likely result in grab sampling in cases where the discharger is required to take the samples, due to the higher cost of composite sampling over a 24 hour period. Grab samples are not a reliable indicator of discharge quality, since contaminant concentrations may vary widely over time. In addition, grab sampling provides the opportunity for the discharger to sample selectively during periods of known low contaminant discharges.

8.1.3 Penalties and Fines

The maximum penalty for violation of Bylaw No. 1410 is $500 or up to six months imprisonment or both for each offense, where each day of violation constitutes a separate offense.

The maximum fine specified for violation of Bylaw No. 1410 ($500) is lower than for some other jurisdictions (eg. $10,000 for the Greater Vancouver Regional District, the Capital Regional District and the City of Prince George and $2,000 for the City of Kelowna). Low maximum fines may encourage repeated violations, in cases where the alternative is the installation of expensive pre-treatment works.

8.1.4 Surcharges

In some jurisdictions, surcharge fees are levied on discharges which significantly exceed the strength of typical domestic sewage (the strength of a wastewater is usually evaluated using the concentrations of BOD_5 and total suspended solids). The purpose of surcharge fees is to recover the additional treatment costs associated with high strength discharges, to promote the polluter-pay principle, and to encourage source control. As an example, in the Fraser Valley Regional District, for wastes having an average strength in excess of 300 mg/L suspended solids or BOD_5, there is an extra strength charge of $0.37 per kg ($0.17 per lb) per month for both suspended solids and BOD_5 up to a concentration of 600 mg/L, and $0.55 per kg ($0.25 per lb) for concentrations greater than 600 mg/L. The Langley bylaw contains a formula to be used in calculating surcharge rates for wastes containing BOD_5 and total suspended solids concentrations in excess of 300 mg/L. The District of Salmon Arm Sewer Connection Bylaw No. 1410 does not contain specific provisions for surcharges.

8.1.5 Codes of Practice

In jurisdictions where there is a large number of small volume dischargers in a particular industrial or commercial sector (eg. photo-finishers, auto repair shops, dry cleaners, restaurants, etc.), Codes of Practice may be used to simplify monitoring and enforcement. Codes of Practice are generally developed for specific industrial or commercial sectors. Businesses operating according to an approved Code of Practice may not require a Waste Discharge Permit under the applicable sewer use bylaw. A Code of Practice usually contains detailed requirements regarding pretreatment of discharges, waste segregation, waste collection and disposal, waste reduction techniques, inspection and servicing frequency, reporting, and record-keeping. There are currently no Codes of Practice developed for the study area.

8.1.6 Alternatives for Source Control Regulations

The District should undertake a review of Sanitary Sewer Connection Bylaw No. 1410 to address threats to biosolids quality, as well as to protect the biological processes at the WPCC and to enhance the quality of the WPCC discharge. The review should include evaluation of prohibited and restricted wastes as well as metals limits, and the outlining of a strategy to implement a monitoring and enforcement program that could include identification of industrial/commercial/ institutional discharges, the need for industry sector Codes of Practice, and education for business/industry and the public.

The following alternatives for review of Bylaw No. 1410 were developed for the District of Salmon Arm LWMP.

1. Review the standards for prohibited and restricted wastes. Add specific limits for mercury, molybdenum, selenium and cobalt to Bylaw No. 1410. These can be developed from those specified for other jurisdictions (see Table 8-1).

2. Clearly define responsibilities for inspection and enforcement of Bylaw No. 1410.

3. Consider increasing the maximum allowable fine for violation of Bylaw No. 1410.

4. Consider including a clause in Bylaw No. 1410 setting out requirements for Discharge Permits for industrial, commercial and institutional discharges to the sanitary sewer system. This should include specifying surcharges for discharge of high strength wastes to the sanitary sewer system serving the WPCC. Consider the merits of on-site pretreatment versus surcharges. Include a clause in the sewer use bylaw that allows the District to require pre-treatment for non-domestic dischargers.

5. Consider the development of Codes of Practice for specific categories of numerous small volume dischargers (e.g. dental offices for source control of mercury), to simplify regulation and enforcement of source control bylaws. Sample Codes of Practice are included in Appendix 3.

6. Consider revising Bylaw No. 1410 to include a clause authorizing the District to direct the discharger to undertake sampling and analysis at the expense of the discharger. Protocols requiring composite sampling should also be added to the Bylaw.

The estimated cost to the District for updating the bylaw is $10,000 for consultant assistance and $5,000 for legal advice. The estimated cost for developing a monitoring and enforcement program is $10,000.

7. Consider undertaking an inventory of commercial and industrial dischargers to the sanitary sewers (and storm drainage systems), to assist in identifying potential dischargers of problem contaminants and in focusing regulatory and educational source control approaches (e.g., consideration of Codes of Practice). The inventory should coordinate with management of storm runoff (see Section 10.5). Budget $10,000.

8. Develop a public and private sector education program, to encourage source control of contaminated discharges to the sanitary sewer (and storm drain) systems. Include source controls in a broader education program that includes water conservation and solid wastes (see Section 8.1.7 below). Budget $15,000 for consultant assistance and $15,000 for educational facilities and materials and $10,000 for publicizing the program over the first 5 years.

8.1.7 Source Control Education Programs

In order to eliminate or minimize waste generation, a comprehensive education program is required, to educate domestic and non-domestic dischargers about the causes and effects of pollution, the need for action, and practical alternatives to present practices.

A source control education program for sanitary sewers and storm drains should emphasize waste reduction through source reduction and in-process recycling, rather than treatment and disposal of waste products. Techniques which transfer pollutants from one medium to another (eg. from liquid to solid waste) do not qualify as source control methods. Bylaws and regulations will be much easier to implement and enforce if industrial and commercial dischargers are aware of the benefits of pollution prevention, and of alternatives to present practices which might reduce waste generation. An education program should be designed to encourage commercial/industrial dischargers to assess and implement waste reduction practices within their own operations. Incentives to implement waste reduction practices include potential economic benefits derived from reductions in treatment and monitoring requirements, less raw material use, lower operation and maintenance costs, reduced or eliminated regulatory compliance costs, and fewer hazards to employees through exposure to toxic substances. Further benefits include improved public image and employee morale. Householders should be encouraged to use less hazardous products, and to properly store and dispose of wastes.

Education programs designed to reduce contaminant inputs to sanitary sewers have many elements in common with education programs aimed at protection of the storm drainage system. To minimize costs, a single program should be designed to serve both objectives. Further, an education program for source control of pollutant inputs to the sanitary sewer and storm drain systems should be one component of a broader educational program which includes other waste management issues such as solid waste and water conservation. All of the above educational issues should be centrally coordinated, to ensure a consistent approach and to avoid duplication of effort. Sample educational materials are included in Appendix 3.

An effective education and public involvement strategy should be an integral part of the liquid waste management planning process. The need for liquid waste management planning should be emphasized in education programs by clearly outlining the potential negative impacts of contaminated discharges on the long-term sustainability of resources and receiving water uses in general. It is important to include clear goals and objectives which can visibly demonstrate progress and success.

Requirements for effective public involvement include the following developed by the Puget Sound Water Quality Authority (PSWQA, 1991):

$ timely, understandable, and complete notice of pending actions;
$ access early in any decision-making process;

$	ease of access to the decision-making process;

$	response to citizens on how comments or recommendations are used.

Existing educational resources which might be suitable for delivering messages and information on liquid waste issues should be identified. Possible resources and methods which are suited to public education and involvement in liquid waste management planning issues are described below (adapted from PSWQA, 1989).

1. Mailing lists can be used for communicating liquid waste management planning activities to interested parties. Mailing lists can be developed from lists created for other purposes, from sign-up attendance sheets at public meetings, and from blanket mailings with return cards.

2. Brochures, flyers, fact sheets and newsletters can be used for providing information on project updates, meetings, workshops and events, and liquid waste management issues in general. Publications should be planned in advance as a coordinated package with similar graphics and style, and should be designed to capture the readers' attention and explain the importance of the enclosed information.

3. Field trips can be used to provide first hand demonstrations of liquid waste management problems and solutions within a study area. Field trips should be carefully planned and routes driven beforehand, and should take into account the physical condition of the participants. Knowledgeable speakers and maps and handouts should be available to describe each stop, and time for questions and discussion should be allowed.

4. Displays at public functions and events, at conferences, and in schools can be used to describe liquid waste impacts and issues. Messages should be kept simple to encourage casual readers, and should be staffed if possible.

5. Surveys can be used to educate, gather information, and assess the level of understanding and support for liquid waste issues within the community. Some follow-up by letter or telephone will generally increase the response rate.

6. Meetings and workshops are valuable opportunities for two-way communication and public feedback. Issues can be debated or discussed in depth, and input from a variety of sources can be obtained. The location, timing and venue of public meetings should be chosen to maximize accessibility, convenience and comfort for the participants.

7. Involvement of the local news media can be important in educating the public on liquid waste issues and planning, gathering public support, and publicizing meetings and events. Personal contacts should be developed with members of the media for maximum effectiveness.

8. Education provided by appropriate experts to individuals can be effective in providing information about pollution problems and solutions, and in developing control strategies for a particular problem or pollution source.

9. Speaking engagements, including videos and slide shows, can be designed to inform large audiences about liquid waste problems and solutions.

10. Projects involving school children reach an important audience, and might include visiting classes, field trips, or specific projects dealing with problems within the study area.

Education programs should be designed to provide particular groups with appropriate messages and information, and should be uncomplicated, non-technical, and free of jargon. Specific audiences should be identified, and appropriate messages and information targeted for those audiences developed. A focus on local issues helps to promote a sense of place; however, a common direction for the entire study area should be apparent. Cooperation should be encouraged among all parties interested in or affected by the Liquid Waste Management Plan. Interesting and innovative activities which involve people and lead to action will encourage public support and participation. Local environmental groups should be encouraged to participate in the education program.

8.2 Wastewater Volume Reduction

A reduction of water usage can result in decreased sanitary sewer flows and a corresponding reduction in wastewater treatment costs through deferment of expansions to facilities and lower operation and maintenance costs. A study to review water demand and supply management within the District of Salmon Arm was recently undertaken (Dayton & Knight Ltd., 2001c). Water conservation measures recommended in the study that could impact wastewater volumes are summarized in this section.

The uses of water delivered to residential homes can be categorized as "inside home" and "outside home." Water use inside the home has a significant impact on wastewater volumes, since most in-home water is directed to the sanitary sewer after use. Water conservation measures aimed at reducing in-home water use can significantly reduce sewage flow volumes. Most of the water used outside the home is for irrigation, and does not impact wastewater flows, since it does not normally go to the sanitary sewer after use.

Commercial establishments and large public institutions are often large users of water for irrigation and indoor uses. Water use inside commercial and institutional buildings is mainly for sanitation, and many of the water conservation techniques for domestic users are applicable to commercial and institutional users as well.

Industry uses water for process water, cooling water, irrigation, and sanitation. Water conservation techniques for sanitation for industry are similar to the corresponding techniques for domestic users. Reduced use of industrial cooling and process water can have a significant impact on the load to wastewater treatment plants.

The District recently established a Citizen's Advisory Committee on Water Use Efficiency, supported by District staff, to provide advice on setting water reduction goals and implementing a water use efficiency program, including recommendation of water conservation strategies, public education, and monitoring of performance/success.

There are presently an estimated 4,500 service connections on the District water supply system. A breakdown of the number of service connections is provided in Table 8-2.

TABLE 8-2
SUMMARY OF SERVICE CONNECTIONS, DECEMBER 31, 2000
(from Dayton & Knight Ltd., 2001c)

Land Use	Number of Connections	Number of Metered Connections
Strata	42	41
Residential	3954	255*
Residential with suite	72	--
Farm	15	15
Commercial	367	218
Industrial	4	4
Mobile Home Park	8	7
Indian Band Land	17	17
Total	4479	557

* Four single family meters are read and billed by the District.

8.2.1 Affect on Wastewater Flows

Wastewater flows consist of a base flow that varies over the course of each day. The base sanitary flow contribution includes grey water from household appliances (dishwashers, washing machines, sinks, showers), sanitary toilet flows, and industrial/commercial/institutional flows. The base flows normally fluctuate daily with water usage, and peaks occur in the morning (6-10 a.m.) and evening (5-8 p.m.). Water use efficiency measures such as ultra low flow (6 L/flush) toilets, leak reduction, low flow faucets and shower heads, and metering will all contribute to the reduction of sanitary base flows.

As described in Section 5.2, inflow and infiltration (I&I) includes inflow to the sewer collection system due to rainfall plus groundwater infiltration. Water use efficiency measures will decrease the base sanitary flow, but will not affect the I&I component of sanitary flows.

In the water demand study, District water demands were compared to the wastewater flows measured at the WPCC. Estimated in-home water use in 1999 was about 4,300 m^3/d, similar to the recorded dry weather (base) flow at the WPCC. It was estimated that a 30% reduction in water consumption through water reduction efforts would result in a 30% reduction of base (dry weather) sewage flows, or a 28% reduction in average annual sewage flows (Dayton & Knight Ltd., 2001c).

8.2.2 Potential Wastewater Treatment Cost Savings

The potential cost savings from reduced water usage and corresponding reduced wastewater flows include a potential deferment of capital costs for expansion of some process components, as well as reduced operation and maintenance (O&M) costs at the WPCC. With a decrease in wastewater flows due to water efficiency efforts, the hydraulic load to the wastewater treatment plant would be reduced. However, reduced water use would not affect the mass loading of contaminants carried by the wastewater stream (e.g. solids, phosphorus, etc.).

The impending Stage IIIB upgrade/expansion of the WPCC is described in Section 4.2.2. This upgrade is required immediately to meet regulatory requirements, to provide emergency backup facilities, and to expand the solids handling facilities. None of these needs is driven by increases in the hydraulic load (however, the Stage IIIB upgrade will also increase the capacity of the WPCC to serve 15,000 people). In any case, a significant reduction in hydraulic load resulting from water conservation measures would take many years to significantly affect sewage flow rates. Therefore, water conservation would not defer the Stage IIIB upgrade. However, water conservation could defer some aspects of future expansion (i.e., Stage IV and beyond). The capital upgrades that could be deferred assuming a 28% reduction in hydraulic loading to the WPCC are summarized in Table 8-3. The resulting savings in financing costs would depend on the timing of the upgrades.

TABLE 8-3
CAPITAL COST SAVINGS DUE TO WATER CONSERVATION

Item	Approximate Capital Cost (2002 Dollars)	Without Water Conservation	With Water Conservation
1. Add 2nd Bar Screen	$150,000	Stage IV	Stage V
2. Add 3rd Primary Sedimentation Tank	$500,000	Stage IV	Stage V
3. Expand Effluent Filter	$750,000	Stage IV	Stage V

Assuming 1.5% population growth from 2001, the Stage IV upgrade (>15,000 service population) would be required around the year 2018 and the Stage V upgrade (>20,000 service population) would be required around 2032. A 28% reduction in hydraulic load due to water conservation would allow deferring of the items shown in Table 8-2 from Stage IV to Stage V, at a total capital cost deferment of about $1.4 Million (2002 dollars). Assuming a real interest rate of 5% annually, the present value of the $1.4 Million in improvements would be about $640,000 if undertaken in 2018 (Stage IV), compared to $320,000 if undertaken in 2032 (Stage V). The present value of the savings would then be about $320,000. Under the high growth (3%) scenario, the Stage IV upgrade would be needed around 2010, and the improvements listed in Table 8-3 could be delayed until about 2018 (Stage V); the present value of savings would then be about $310,000.

A reduction in wastewater flows from water conservation could also result in a significant reduction in operation and maintenance (O&M) costs at the WPCC. The O&M costs consist of fixed and variable components. Fixed costs include labour and administration. Variable costs directly related to the plant flow rate include power (pumping) and chemical addition for disinfection (chlorine) and dechlorination (sulphur dioxide). In the water demand study, an O&M cost analysis was done for the fixed and variable costs with an assumed 28% reduction in flows, based on the 2000 budget costs for the WPCC. The cost analysis is summarized in Table 8-4. As shown, a 28% reduction in wastewater flows due to reduced water use could result in an annual savings of about $24,000/yr in WPCC O&M costs at current flow rates (Dayton & Knight Ltd., 2001c). Annual savings in dollars would increase with increasing flow rates in future.

TABLE 8-4
ESTIMATED WPCC O&M COST SAVINGS FOR WATER EFFICIENCY PROGRAMS (from Dayton & Knight Ltd., 2001c)

Items	WPCC 2001 Annual Budget ($)	Cost Savings Resulting From 28% Flow Reduction ($)
Fixed Costs • Labour	165,000	None
Variable Costs • Power • Chemicals (Cl_2 and SO_2)	70,000 13,000	20,000 4,000
TOTAL SAVINGS		$24,000

* Chemical cost budgeted at $90,000, the bulk of which is for biosolds dewatering chemicals.

The water conservation requirements and costs identified in the study that are relevant to wastewater flow reductions are summarized in Table 8-5 (from Dayton & Knight Ltd., 2001c).

TABLE 8-5
SUMMARY OF WATER USE EFFICIENCY COSTS AND BENEFITS*, **

Measure	Estimated Annual Water Saving In ML (Mg)	Estimated Cost of Measure ($)		Estimated Saving per Year *, ** ($ per year)	Comments
		Annual	One Time		
Retrofit Kits	247 (54)	--	$112,500	$27,170 to $41,990	- Recommended
Ultra Low Flush Toilets	495 (109)	--	$1,350,000	$54,450 to $84,150	- Voluntary basis - Re-evaluate if enhanced water treatment is adopted.
New Plumbing Code	30% of indoor use on new buildings	Minimal cost to District			- Recommended
Commercial/ Institutional/ Industrial Audit	660 (145)	--	$210,500	$72,000 to $112,000	- Recommended for large water users.
Public Education Program	66 (14)	$14,000	--	$7,200 to $11,200	- Recommended
Pricing/Universal Metering	495 (109) to 990 (218)	$112,000	$1,688,000	$55,000 to $170,000, plus delayed water system capital costs, plus reduced operating and delayed capital costs at the WPCC.	- On all service connections installed after February 1996. - Review a voluntary retrofit program with a modified rate structure. - Plan in 5 year capital plan to retrofit all service connections installed prior to February 1996.

* Not including benefits to the District's Water Pollution Control Centre with reduced flow rate or decreased rate of flow rate increase.
** Not including benefits to delay in capital projects to accommodate increased water demand with population growth.

8.2.3 Alternatives for Wastewater Volume Reduction

The following alternatives apply to wastewater volume reductions through water conservation in the study area (from Dayton & Knight Ltd., 2001c). The District of Salmon Arm Water Use Efficiency Committee is currently considering these issues.

1) Adopt a water use efficiency policy including establishing annual and peak day reduction targets for the next five years. The District should track the daily demand by year, and analyze the pattern for trends in the consumption and impacts of water use efficiency efforts. As part of this program, the findings should be reported annually to the public as part of the education program. There would be minimal cost to District, principally in staff time.

2) Develop and adopt a bylaw requiring ultra low flush toilets for all new buildings. There would be minimal cost to District.

3) Undertake a voluntary program to retrofit existing showerheads and taps and install toilet dams on all buildings constructed prior to 1995 when the B.C. Plumbing Code was changed requiring low water use fixtures. This should be viewed as a step prior to retrofitting all homes constructed prior to 1995 with ultra flow flush toilets. The capital cost would be about $115,000.

4) Identify a program to retrofit all buildings constructed prior to 1995 with ultra low flush toilets if a program to construct a water treatment plant is adopted. The capital cost would be about $1,350,000.

5) Conduct an audit of the largest commercial/industrial/institutional water users to assist with identification of cost effective methods to reduce indoor and outdoor consumption. The cost would be about $210,000 for the 421 service connections.

6) Design a strategy for universal metering of all service connections as listed below.

    a) Identify the costs, timing and budget in the District's 5-year plan for implementation of universal metering. Review a voluntary retrofit program for homes constructed prior to February 19, 1996 with a modified rate structure. There would be minimal cost to District.

    b) Purchase and install meters on the existing domestic service connections for encoded registers and outdoor installations. The capital cost would be about $1,700,000. Assuming the meters have encoded registers for electronic reading and the meters are read four times per year, the annual cost would be about $110,000.

c) If and when (7b) is adopted, review the merits and details of establishing rates based on consumption, including an inclining block rate to reward water conservation efforts.

7) Undertake water conservation awareness programs and confirm a commitment to water use efficiency in the community and schools. This could include the items listed below. The annual cost would be about $14,000/yr.

- Bill stuffers on water conservation from such organizations as the American Water Works Association
- School programs
- Work with hotels and other commercial users exploring avenues for water conservation
- Prepare a handout advising the public on ways to reduce water consumption
- Attending local trade shows

Since the capital facilities are typically being planned at the same time as the conservation program, the process is an iterative one. That is, the planning of conservation and review of the water supply facilities and the sewage treatment facilities should be integrated and done together.

9.0 WASTEWATER TREATMENT AND REUSE ALTERNATIVES

Reuse and wastewater treatment provide the means of protecting public health, the environment and community resources to secure financial and organizational well being for a growing community.

In this section, wastewater treatment and reuse systems are explained and used to develop several alternatives for securing a safe community growth for the District of Salmon Arm in accordance with the current Official Community Plan.

The basic processes of wastewater treatment include the following components:

- preliminary treatment – screening, grit removal;
- primary treatment – removal of crude solids by gravity settling, removal of oil and grease and other floatable material by skimming;
- secondary treatment – removal of dissolved and fine particulate oxygen-demanding organic material by a community of microorganisms (mainly bacteria) that are cultured in a bioreactor, followed by gravity separation of the microorganisms from the treated wastewater;
- advanced treatment – may include removal of phosphorus by chemical addition, removal of phosphorus and/or nitrogen by a community of microorganisms (similar to secondary treatment), and filtering to remove fine solids escaping secondary treatment; and
- disinfection – destruction or inactivation of disease-causing organisms by chlorination, ozonation, or ultra violet light.

More detail regarding the above processes can be found in Appendix 2.

9.1 Wastewater Treatment Technologies for Larger Regional Plants

The District of Salmon Arm has a legal obligation to provide reliable and effective wastewater treatment for its citizens. An important consideration in meeting this obligation is the selection of treatment technologies that are reliable and cost effective, and that can consistently meet mandated effluent quality criteria. Larger plants typically utilize mechanical forms of treatment because natural systems and less mechanized forms occupy too much land, which frequently is not available. Both mechanical and natural treatment facilities rely mainly on bacteria for removal of contaminants.

Appropriate technologies for larger treatment facilities can be generalized into suspended growth and fixed growth systems. Suspended growth systems generally include variations of the activated sludge process (e.g., conventional activated sludge, contact stabilization, pure oxygen, oxidation ditch, sequencing batch reactor, extended aeration). Fixed growth systems include trickling filters and rotating biological contactors (RBC). Combined systems contain both fixed and suspended growth components. More detail on suspended and fixed growth biological treatment systems is provided in Appendix 3.

The only major wastewater treatment facility within the study area is the Salmon Arm Water Pollution Control Centre (WPCC). Many suspended growth and fixed growth systems (including the Salmon Arm WPCC) are capable of producing an excellent quality effluent (e.g., both total suspended solids and five-day biochemical oxygen demand less than 20 mg/L). The system in place at the WPCC has been developed using a combination fixed growth/suspended growth process for advanced treatment; this process was originally installed in 1986, and was expanded in 1996. The process includes biological (bacterial) removal of biochemical oxygen demand (BOD), phosphorus, and nitrogen (see Section 4.2.2 for process description). A comparison of the WPCC construction costs to other treatment facilities and technologies is shown on the plot included in Appendix 4.

Ample space is available at the WPCC to increase the capacity of the existing physical and biological treatment facilities to serve at least 30,000 population equivalents, and to add more advanced treatment (eg. effluent filtration) as necessary.

As described earlier in this report, the impending Stage IIIB Upgrade at the WPCC will produce a treated effluent that meets regulatory criteria for reclaimed water to be used in areas with restricted public access.

9.2 Wastewater Treatment Technologies for Smaller Community Plants

Suspended growth systems suitable for small plants include extended aeration, oxidation ditch and sequencing batch reactors. Rotating biological contactor (RBC) units are the most widely used fixed growth systems for small facilities, but trickling filters are also gaining favour. More detail is provided in Appendix 3.

In addition to small mechanical facilities incorporating suspended and fixed growth systems, natural systems may be appropriate to smaller treatment plants. Natural systems include various lagoon options including anaerobic, facultative, aerobic and aerated (fully and partially mixed). Technologies that use natural systems to treat wastewater include natural wetlands, constructed wetlands and aquatic plant systems. Wetlands are normally used for polishing effluent following secondary treatment, but they may also be used as a secondary treatment process if sufficient space is available. An additional function is to use effluent to supplement flows into natural wetlands that are water-short due to development pressures. An example of a natural wetland system in British Columbia is at Valemont where lagoon effluent is discharged to a wetland designed by Ducks Unlimited.

Aquatic plant systems utilize shallow ponds, floating and/or submerged plants and include artificial aeration to maintain aerobic conditions. An example is the water reclamation pilot plant in San Diego (1 mgd) that applies primary effluent (fine screens) to aquatic beds to accomplish secondary treatment. A variation of the aquatic system is Solar Aquatics, where the aquatic system is enclosed in greenhouses to maintain temperature for controlled biological activity. The greenhouse component of the Solar Aquatics system has been shown by independent study to be largely aesthetic in nature, with conventional processes providing the majority of treatment (USEPA, 1996).

In general, the suspended growth and fixed growth technologies have a proven record and capital and operating costs are well documented. The same is true for the lagoon systems. Data are limited for both wetland and aquatic systems.

9.3 Onsite Treatment and Disposal

Septic tank and conventional or mound type ground disposal systems are the most common form of individual onsite treatment facilities in use throughout North America. Under favourable conditions of good soils, adequate depth to water table, and proper design, construction, operation and maintenance, septic systems will perform adequately by protecting public health and the receiving environment.

Where unfavourable conditions exist, mound disposal systems and better treatment can be considered. Better treatment can be provided to upgrade septic tanks by the addition of screens and filter systems. Treatment may also be upgraded by using a "package" treatment plant in place of or to supplement the septic tank to produce a secondary or advanced quality effluent. Many patented package plants are available, most of which utilize an extended aeration form of the activated sludge (suspended growth) process. There are also small trickling filter and RBC units available. There are a number of package plants supplied and serviced in British Columbia that have a history of good performance. It is important, however, to understand that package plants require ongoing operation and maintenance by qualified personnel; otherwise, performance will not meet effluent quality expectations.

Proper management of onsite systems is essential to ensure the long-term effectiveness of these systems in locations where site conditions allow their use. Proper management of onsite systems may allow their use in locations that would otherwise be unsuitable. In B.C., the actual functioning and performance of onsite systems (that are regulated by the Ministry of Health (MOH)) once installed are only addressed if a formal complaint is lodged with the MOH.

The current MOH regulatory approach under the Sewage Disposal Regulation (SDR) addresses only site evaluation and minimum design requirements for onsite systems (a revised Regulation has been drafted, but the implementation schedule is not known at this time). In addition, the SDR is focused on protection of the public health, and not on environmental protection. As detailed below, there are several potential control points for onsite systems that address both public health and environmental protection. Many of these are not addressed by the current regulatory structure.

9.3.1 Principal Control Points for Onsite Systems

Site Evaluation

- site assessment for the use of absorption fields - percolation tests, soil type and depth, groundwater elevation, presence of impermeable layers and/or bedrock outcrops, lot size and slope, distance to breakout (currently conducted by MOH according to minimum standards specified under the Health Act)
- in difficult areas known for system failures, a professional engineer should be involved in site evaluation and system design

Systems Design

- determine level of treatment required upstream of absorption field (septic tank vs. package treatment plant), size of field, trench dimensions and depths, trench spacing, type of fill material (currently regulated by the MOH according to standards specified under the Health Act)
- additional design standards could include improved design of septic tanks, gravity vs.

pumped distribution to absorption fields, the need for alternating use of two fields, and training/certification of system designers

Systems Construction

- site inspection by MOH prior to backfilling of absorption field is currently required
- potential additional requirements include additional inspections during construction to ensure compliance with design specifications, avoid excessive compaction of native soils and fill material, and prepare record (as constructed) drawings to detail divergence from design drawings and specifications
- additional requirements could also include training and/or certification of system installers

Monitoring of Systems Performance

- the performance of onsite systems regulated by MOH is not monitored under the current regulations
- potential monitoring activities include the following:
  - field inspections of septic tanks and package treatment plants
  - dye testing of existing absorption fields
  - sampling and analysis of water entering and exiting absorption fields, or, alternatively, sampling and analysis of water in ditches and streams
  - periodic re-testing of soil percolation rate
- monitoring wells should be installed upslope and downslope of on-site systems in areas of known system failures or marginal soil conditions, to facilitate long term monitoring of the downgradient water quality and any water table rise effects that may result in septic break-out
- monitoring requires record keeping to track systems performance to identify failing systems

Operation and Maintenance (O&M)

- there is a potential for improved systems performance and reduced failures through regularly scheduled removal of sludge from septic tanks and package treatment plants, regular inspection and maintenance of pumps and other mechanical equipment, cleaning of clogged pipes, and "resting" periods for absorption fields etc.
- maintenance of onsite package plants is often included in the purchase price for the duration of the warranty period (typically 2 years), with a continuing contract available
- O&M activities may include education of householders, field inspections, review of maintenance records, penalties for non-compliance, and direct action if householder fails to act
- requires record keeping to track maintenance histories

Failed Systems

- requirements for rehabilitation, repair, or abandonment of failed or improperly functioning systems (currently administered by the MOH but only in cases where formal complaints are lodged)
- potential additional activities include legally binding violation notices requiring corrective action, direct corrective action if householder fails to act
- monitoring of systems performance could be used to identify poorly functioning and failed systems

Reduced Water Use and Public Education

- there is a potential for improved performance and/or reduced failures through reductions in hydraulic loading to onsite treatment and disposal systems
- potential activities include the use of water efficient fixtures in the home, repair of existing leaky fixtures, water metering with higher rates for larger volume users, elimination of connections to foundation drains, and education of householders on

water conservation and proper operation and care of onsite systems

9.4 Biosolids Treatment Technologies

Treatment of liquid wastewater produces solid byproducts (commonly referred to as sludge), regardless of the technology used. At larger facilities, both primary (crude) and secondary (biological) solids are produced. These solids normally require further processing before disposal or reuse. For maximum opportunity for reuse applications on land, waste solids should be both stabilized and pasteurized. Stabilization reduces the putrescible (volatile) fraction of the solids, with a consequent reduction in mass, odours and vector attraction. After stabilization, waste solids are commonly referred to as biosolids. Pasteurization coupled with stabilization reduces or eliminates pathogens in the biosolids.

For larger plants, anaerobic digestion with energy (methane gas) recovery is normally used for the stabilization process. Heat treatment in a thermophilic reactor in line with the anaerobic digesters and composting of the anaerobically digested biosolids are two methods for effecting pasteurization. Because of the large, gas-tight reactors needed for anaerobic digestion, this technology is cost-effective only for larger facilities, typically with an average daily flow of at least 7,500 m^3/d (i.e., about 1.5 times the capacity of the existing WPCC).

The existing biosolids treatment facility at Salmon Arm WPCC is based on autothermal thermophilic aerobic digestion (ATAD). Expansion of the existing digestion facilities in the near future will continue the capability for thermophilic operation to pasteurize biosolids during digestion. This technology stabilizes and pasteurizes the biosolids using much smaller reactors than anaerobic digestion making the ATAD technology cost effective. A disadvantage is that no methane gas is produced, although waste heat can be recovered.

For smaller plants, aerobic digestion and composting can be used to stabilize and then pasteurize the biosolids. Other methods of stabilization and pasteurization include chemical oxidation (typically using chlorine), pH adjustment (usually by adding lime), and a patented process using lime addition in conjunction with electrical resistance heaters.

In general, solids stabilization processes are one of the principal odour sources at wastewater treatment facilities, particularly those that involve high temperature (thermophilic) treatment.

9.5 Discharge of Treated Effluent to Surface Waters

Criteria for discharge of treated effluent to surface waters are set out in the Municipal Sewage Regulation (MSR) as described in Section 7.3. The recent Environmental Impact Study (EIS) showed that the existing WPCC outfall may not provide sufficient dilution to prevent chronic ammonia toxicity at the edge of the initial dilution zone (IDZ) during periods of extremely high lake water temperature and pH (see Section 6.1.2). During low lake levels, the existing outfall discharges to a pool on the exposed mudflats on the lake foreshore and flows via a short channel to the main body of the lake (the outfall is submerged at high lake levels). The EIS showed that extension of the outfall into deeper water near Sandy Point to meet MSR depth requirements and the addition of a multi-port diffuser would not significantly reduce the growth of algae and nuisance aquatic vegetation in Salmon Arm Bay, but would prevent chronic ammonia toxicity at the edge of the IDZ at all times of the year. Estimated costs for outfall improvements at the existing WPCC are as follows:

• extend or replace existing WPCC outfall 1800 m to deeper water (minimum depth at low water 20 m) and add multi-port diffuser	$2,000,000
• effluent pumping station	500,000
Total Construction Cost	$2,500,000
35% Allowance (Engineering, Contingencies)	880,000
TOTAL Capital Cost	$3,380,000

9.6 Collection and Treatment

For the purpose of comparing options, the low (1.5%) population growth scenario was assumed, since this best reflects current growth in the District (see Section 3.2.2). The options described below were developed for the estimated population at the LWMP planning horizon of 2020 (i.e., total District population about 20,000 and WPCC service population about 17,000). However, as described in Section 3.1.1, wastewater treatment plant sites should be secured for at least a 100 year planning horizon, major interceptor pipes and trunk sewers should be sized for at least a 40 year design period to avoid costly duplication of facilities in the long-term future, and forcemains should be sized for the 20 year horizon due to hydraulic restrictions. The options described below take into account the need to identify treatment plant sites that have the capacity to serve the ultimate build-out population of the District according to the land use and development densities specified in the OCP. For costing purposes major trunk sewers and interceptors were sized for the estimated build-out population within the District (i.e., 40,000 people).

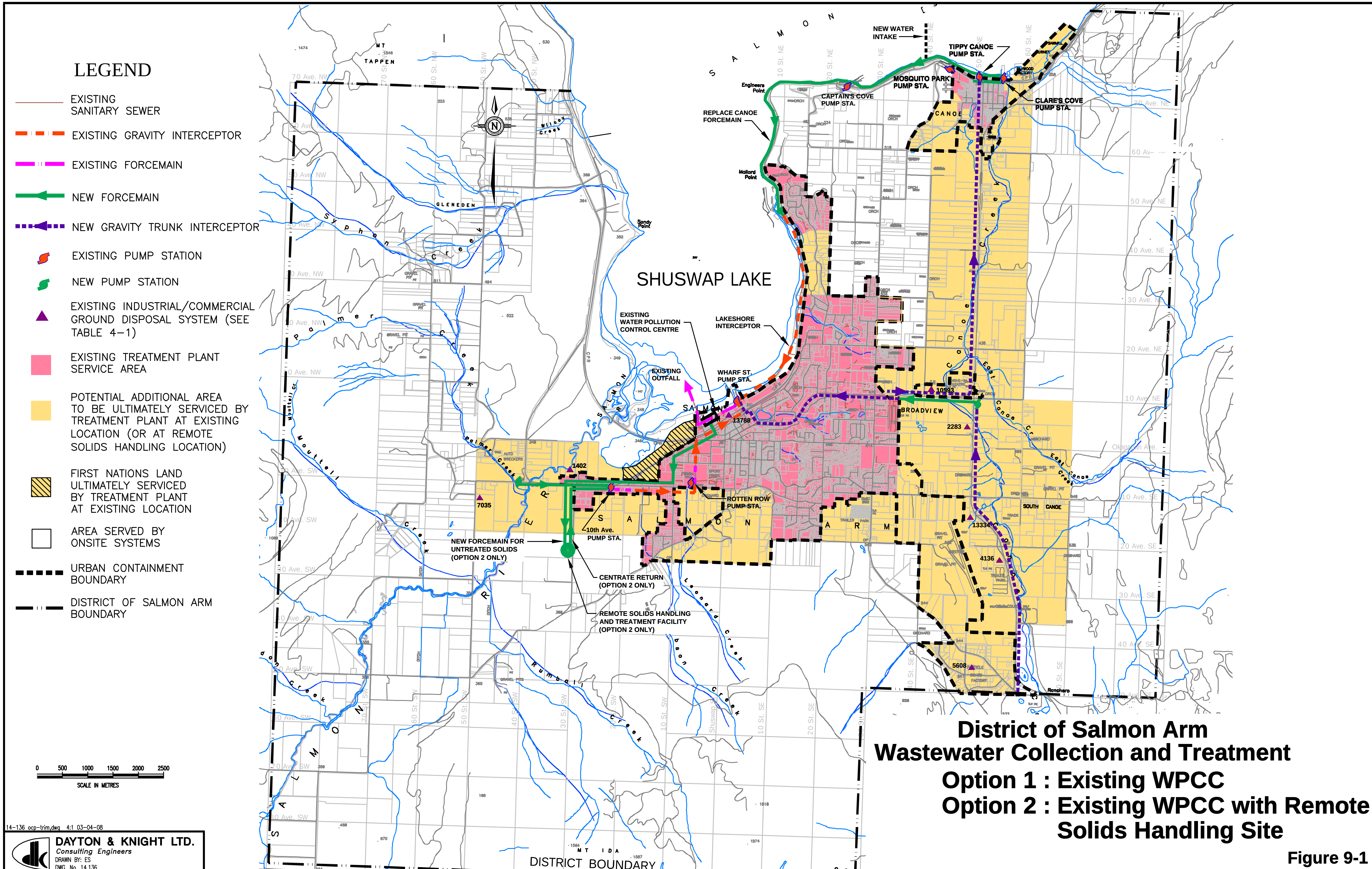
For options involving expansion of the existing WPCC, it was assumed that the capacity of the plant would be increased from the Stage IIIB capacity of 15,000 people to the planned Stage IV capacity of 20,000 people. For options that include servicing of the Industrial Park by the WPCC or an alternate facility, it was assumed that wastewater generation from the Industrial Park would represent a maximum of about 500 population equivalents (200 m^3/d wastewater) at build-out (see Section 5.4). Thus the Stage IV WPCC capacity could accept additional flows from the Industrial Park and other industrial flows, as well as additional residential flows if growth exceeds 1.5%.

It should be noted that the Stage IV Expansion at the WPCC involves the construction of significant new facilities including an outfall (twinning or replacement). Up to Stage IIIB, the suspended growth basins for biological treatment were mainly housed in existing tanks designated for future use as primary settling tanks. For Stage IV, new suspended growth basins are to be constructed, since some of the existing basins will have to be converted to primary tanks. In addition, the fixed growth component (i.e., the trickling filter) is to be expanded in Stage IV. The existing outfall is adequate for the Stage IV flows if it is not extended; if the existing outfall is extended to deeper water, effluent pumping will be needed for the Stage IV flows. A site plan of the Stage IV facilities that was developed in 1996 is shown on Figure 4-2 in Section 4. Depending on population growth and ongoing process optimization at the WPCC, it may be possible to reduce the new construction associated with the Stage IV Expansion. However, for costing purposes, the Stage IV facilities shown on Figure 4-2 were assumed (locations of some facilities will vary from the 1996 site plan shown on Figure 4-2).

Construction costs and operating costs for wastewater treatment facilities were based on experience and on the cost curves contained in Appendix 4, assuming that effluent quality would meet reclaimed water standards according to the MSR – see Sections 7.3.1 and 7.3.2). This level of treatment would allow the treated effluent to be used for wetlands and possibly for stream augmentation. An additional allowance of 20% was added to construction costs for odour control. Capital costs were then calculated by adding an allowance of 35% to construction cost for engineering, architecture, noise control, earthquake protection and contingencies. Capital repayment was calculated assuming a 20-year facility life and 6% real interest rate.

9.6.1 Option 1 – Existing WPCC

- this option is illustrated on Figure 9-1
- continue to expand existing collection system and WPCC to serve all areas within the Urban Containment Boundary as set out in the OCP, as well as additional areas where onsite ground disposal systems are problematic (e.g., due to poor soils, high water table, small lots, vulnerable underlying aquifers etc.) – maximum capacity of the existing WPCC site is about 30,000 service population
- identify and obtain a site to be used in the long-term future for a WPCC to serve the ultimate build-out population of the District beyond the current LWMP horizon (i.e., about 40,000 people) or pursue acquisition of additional property adjacent to existing WPCC for future use



District of Salmon Arm
Wastewater Collection and Treatment
Option 1 : Existing WPCC
Option 2 : Existing WPCC with Remote Solids Handling Site

Figure 9-1

- industrial sites currently using onsite systems in problem areas may be connected to the WPCC collection system under this option - acceptance of high-strength wastewater generated by industry (e.g., abattoirs, dairies, etc.) at the WPCC may significantly impact design requirements and/or treatment process performance – pre-treatment for some industries may be required if they are to discharge into the central collection and treatment system (see Section 4.1, Source Control Bylaw)
- impending Stage IIIB upgrade will produce effluent that meets MSR standards for reclaimed water to be used in applications with restricted public access – see Section 9.3 for options
- areas to be served by the WPCC may include:
  - Industrial Park (this area is underlain by a vulnerable unconfined aquifer – see Figure 6-2)
  - remote area within the Urban Containment Boundary at intersection of Hwy. 1 and Hwy. 97B
  - onsite systems regulated by MWLAP and MOH where ground disposal problems are identified (both residential and industrial/commercial systems are located within the problem areas identified by the Health Unit – see Section 6.2.1)
- the following assumptions were made for evaluation of Option 1:
  - Stage IV expansion of existing WPCC to serve 20,000 population
  - extension and upgrading of existing WPCC outfall to deeper water to meet MSR requirements to be included in Stage IV WPCC expansion (regulatory agency comments regarding the outfall extension are contained in Appendix 9 – the existing information is not sufficient to determine the relative environmental impacts of continuing with the status quo versus extension of the outfall to deeper water).
  - replace Canoe Forcemain (existing pipe is asbestos-concrete and is 27 years old)
  - relocate Wharf Street pump station to WPCC and extend storage/interceptor trunk to WPCC.
  - service Industrial Park and properties in Canoe Creek valley south of 10 Avenue NE with new gravity interceptor connecting to pump station located near

intersection of Highway 97B and 10 Avenue NE – construct forcemain west along Highway 1 to Wharf Street Pump Station

- service properties in Canoe Creek Valley north of 10 Avenue NE with new gravity interceptor connecting to Canoe Pump Station
- service properties in Salmon River Valley along Highway 1 west of 30 Street S.W. to 1st Avenue S.W. with new pump station and forcemain connecting to 10 Avenue Pump Station.

Estimated costs for Option 1 are shown in Table 9-1.

TABLE 9-1
COSTS FOR OPTION 1
TREATMENT AT EXISTING WPCC LOCATION

Item	Construction Cost	Allowance (35%)	Total Capital Cost	Annual O&M Cost
expand WPCC to 20,000 service pop.	$7,000,000	$2,450,000	$9,450,000	$600,000
outfall improvements and pump station	$2,500,000	$875,000	$3,375,000	$8,000
relocate Wharf St pump station & extend trunk	$2,000,000	$700,000	$2,700,000	$15,000
standby power for Wharf Street pump station	$100,000	$35,000	$135,000	
gravity interceptor, Ind. Park to 10 Ave NE	$2,630,000	$920,500	$3,550,500	
pump station at Hwy 97B & 10 Ave NE	$280,000	$98,000	$378,000	$12,000
forcemain, Hwy 97B to 30 St NE	$300,000	$105,000	$405,000	
gravity trunk, 30 St NE to Wharf St	$2,150,000	$752,500	$2,902,500	
gravity interceptor, Wharf St to Canoe PS	$2,460,000	$861,000	$3,321,000	
upgrade Canoe PS	$440,000	$154,000	$594,000	$12,000
replace forcemain, Canoe to Wharf St	$1,200,000	$420,000	$1,620,000	
pump station at Hwy 1 & 40 St SW	$80,000	$28,000	$108,000	$10,000
forcemain, 40 St SW to 10 Ave SW PS	$310,000	$108,500	$418,500	
upgrade pump station at 10 Ave SW	$100,000	$35,000	$135,000	$10,000
Total	**$21,550,000**	**$7,540,000**	**$29,090,000**	**$670,000**

[1] Allowance 35% of construction cost – includes engineering, noise control, earthquake protection, architecture, contingencies –does not include cost of land or financing and administration.
[2] Does not include replacement of depreciated existing systems at WPCC or expansion of administration.

9.6.2 Option 2 – Existing WPCC with Remote Solids Handling Site

- this option is illustrated on Figure 9-1 along with Option 1
- same as Option 1 for wastewater collection and treatment
- solids treatment and handling (which is the primary odour source at the WPCC) would be moved to a site further from the urban core and closer to potential biosolids

reuse sites, while maximizing the use of the existing collection system and liquid treatment facilities

- the solids handling site could also include liquid treatment facilities in the long-term future when the existing WPCC site reaches capacity (i.e., 30,000 service population)
- the following assumptions were made for evaluation of Option 2:
  - includes all components listed for Option 1
  - construct new solids digestion and dewatering facilities (for costing purposes, the remote site was assumed to be at Minion Field) - this facility could potentially also accept septage and/or solids residuals from other treatment plants in the area
  - retain liquid treatment and thickening facilities for waste biological solids at WPCC existing location
  - construct pump station and forcemain to transport combined waste primary and biological solids from WPCC to new solids handling facilities
  - construct pump station and forcemain to transport centrate from biosolids dewatering site to existing WPCC via 10th Avenue pump station (requires pre-treatment of centrate at solids handling facility to control odour)

Estimated costs for Option 2 are shown in Table 9-2.

TABLE 9-2
COSTS FOR OPTION 2
LIQUID TREATMENT AT EXISTING WPCC LOCATION WITH REMOTE SOLIDS HANDLING SITE

Item	Construction Cost	Allowance (35%)	Total Capital Cost	Annual O&M Cost
expand WPCC to 20,000 service pop. (liquid only)	$6,000,000	$2,100,000	$8,100,000	$500,000
outfall improvements and pump station	$2,500,000	$875,000	$3,375,000	$8,000
relocate Wharf St pump station & extend trunk	$2,000,000	$700,000	$2,700,000	$15,000
standby power for Wharf St. pump station	$100,000	$35,000	$135,000	
pump station at WPCC for waste solids	$500,000	$175,000	$675,000	$10,000
forcemain for waste solids, WPCC to remote site	$280,000	$98,000	$378,000	
remote solids handling & treatment facilities	$4,000,000	$1,400,000	$5,400,000	$200,000
pump station at remote site for centrate	$15,000	$5,250	$20,250	$10,000
centrate forcemain, remote site to 10 Ave SW PS	$250,000	$87,500	$337,500	
gravity interceptor, Ind. Park to 10 Ave NE	$2,630,000	$920,500	$3,550,500	
pump station at Hwy 97B & 10 Ave NE	$280,000	$98,000	$378,000	$12,000
forcemain, Hwy 97B to 30 St NE	$300,000	$105,000	$405,000	
gravity trunk, 30 St NE to Wharf St	$2,150,000	$752,500	$2,902,500	
gravity interceptor, Wharf St to Canoe PS	$2,460,000	$861,000	$3,321,000	
upgrade Canoe PS	$440,000	$154,000	$594,000	$12,000
replace forcemain, Canoe to Wharf St	$1,200,000	$420,000	$1,620,000	
pump station at Hwy 1 & 40 St SW	$80,000	$28,000	$108,000	$10,000
forcemain, 40 St SW to 10 Ave SW PS	$310,000	$108,500	$418,500	
upgrade pump station at 10 Ave SW	$100,000	$35,000	$135,000	$10,000
Total	**$25,600,000**	**$8,960,000**	**$34,550,000**	**$790,000**

[1] Allowance 35% of construction cost - includes engineering, noise control, earthquake protection, architecture, contingencies – does not include cost of land or financing and administration.
[2] Does not include replacement of depreciated existing systems at WPCC or expansion of administration.

9.6.3 Option 3 – Single Treatment Plant at New Location

- this option is illustrated on Figure 9-2
- same as Option 1 for wastewater collection
- a new site for the WPCC more distant from the urban area would be identified
- no expansion of the existing WPCC beyond Stage IIIB (15,000 service pop.)
- existing WPCC would be decommissioned and the outfall abandoned
- sites to be considered for a new WPCC to be determined (potential sites could include the industrial area NE of Canoe and the Airport/Industrial Park area, as well as sites previously considered in the Salmon River Valley)
- the main objectives would be to remove the WPCC outfall discharge from Salmon Arm Bay and to locate the new facility where the risk of nuisance odours in urban areas would be reduced.

LEGEND

EXISTING SANITARY SEWER

EXISTING GRAVITY INTERCEPTOR

EXISTING FORCEMAIN

NEW FORCEMAIN

NEW GRAVITY INTERCEPTOR

EXISTING PUMP STATION

NEW PUMP STATION

EXISTING INDUSTRIAL/COMMERCIAL GROUND DISPOSAL SYSTEM (SEE TABLE 4–1)

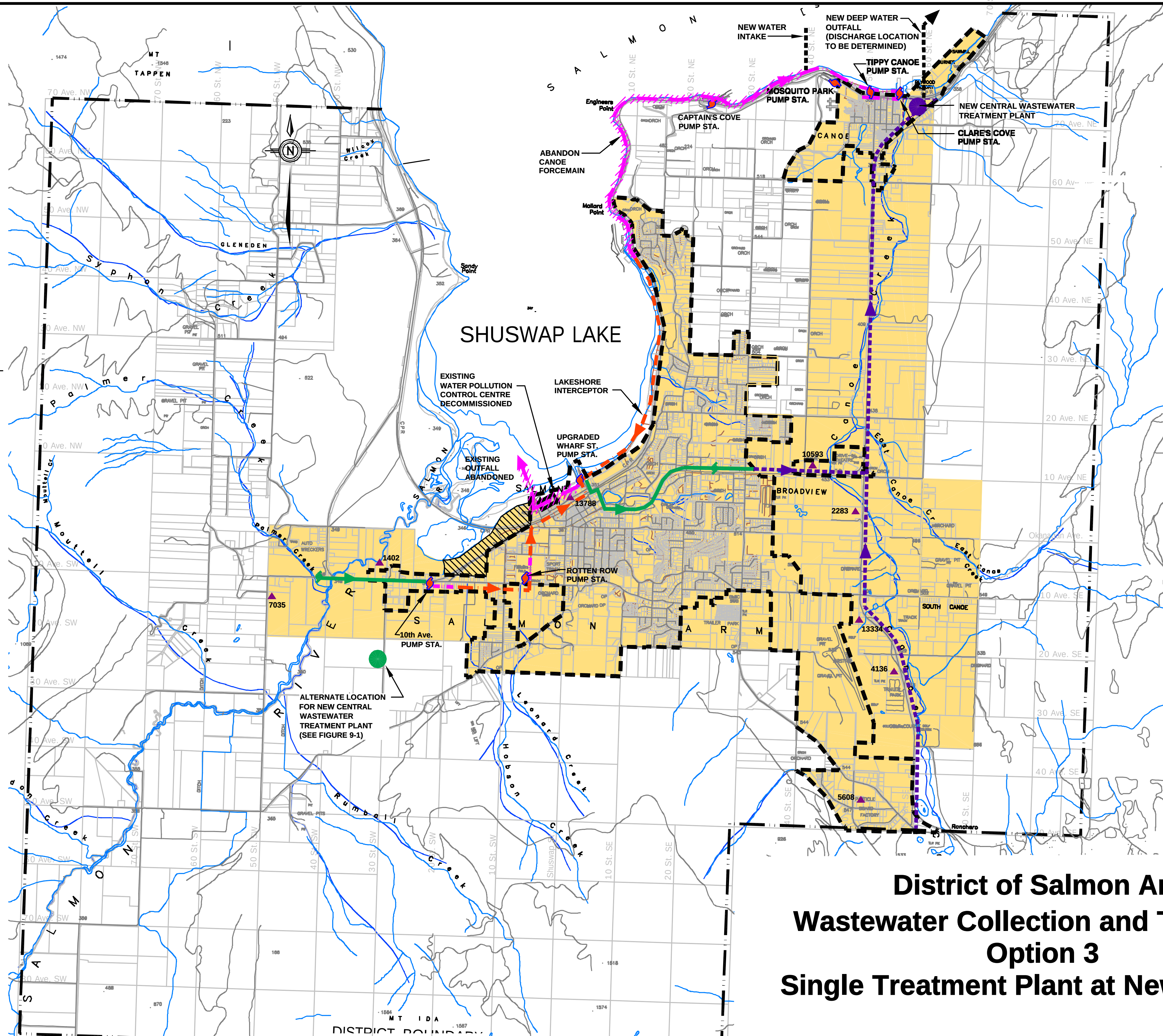
POTENTIAL ADDITIONAL AREA TO BE ULTIMATELY SERVICED BY TREATMENT PLANT AT NEW LOCATION

FIRST NATIONS LAND ULTIMATELY SERVICED BY TREATMENT PLANT AT NEW LOCATION

AREA SERVED BY ONSITE SYSTEMS

URBAN CONTAINMENT BOUNDARY

DISTRICT OF SALMON ARM BOUNDARY



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District of Salmon Arm
Wastewater Collection and Treatment
Option 3
Single Treatment Plant at New Location

Figure 9-2

- reuse or disposal of reclaimed-quality water (see Section 9.3 for options)
- the following assumptions were made for evaluation of Option 3
  - construct new advanced treatment plant for liquid and solids for 20,000 service population at location remote from main downtown area (for costing purposes, the site was assumed to be near the Federated Coop Mill at Canoe)
  - construct new deep water outfall to lake at new treatment plant
  - decommission existing WPCC and abandon existing outfall
  - upgrade Wharf St. pump station to convey wastewater to new treatment location
  - construct new gravity trunk along Hwy. 1 from 20 St. NE to new treatment plant at Canoe
  - construct new forcemain along Hwy. 1 from Wharf St. to 30 St. NE, abandon Canoe forcemain
  - service Industrial Park and properties in Canoe Creek valley with new gravity interceptors along Hwy. 97B and Hwy. 1 to new treatment facility at Canoe
  - service properties in Salmon River Valley along Highway 1 west of 30 St. SW to 1st Ave. S.W. with new pump station and forcemain connecting to 10 Ave. pump station

Estimated costs for Option 3 are shown in Table 9-3.

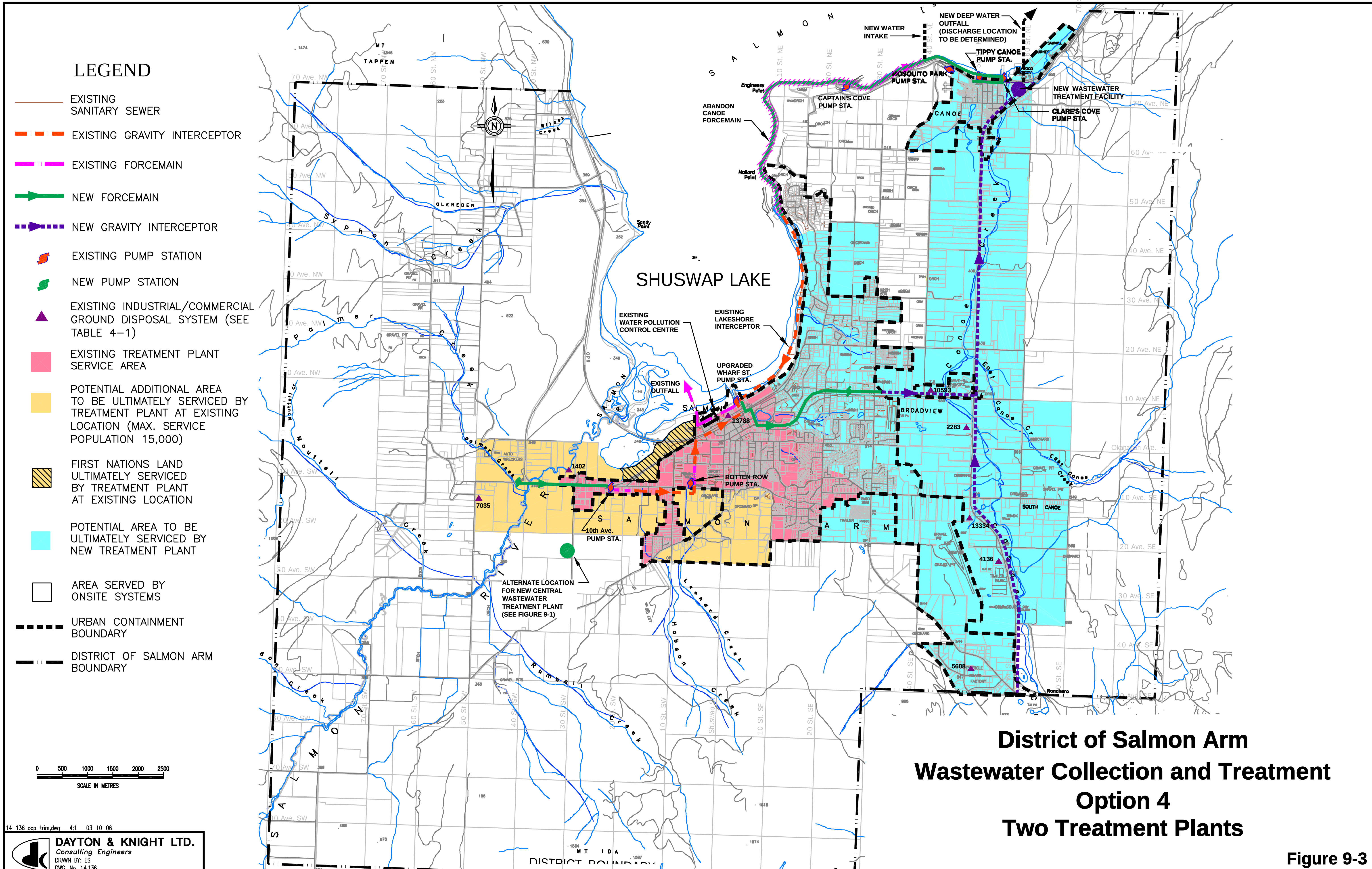
TABLE 9-3
COSTS FOR OPTION 3
TREATMENT AT NEW WPCC LOCATION

Item	Construction Cost	Allowance (35%)	Total Capital Cost	Annual O&M Cost
new advanced WPCC for 20,000 service pop.	$24,000,000	$8,400,000	$32,400,000	$600,000
deep water outfall and PS (allowance)	$3,000,000	$1,050,000	$4,050,000	$30,000
decommission existing WPCC (allowance)	$500,000	$175,000	$675,000	
upgrade Wharf St pump station + standby power	$3,000,000	$1,050,000	$4,050,000	$85,000
forcemain, Wharf St to PS at Hwy 1 & 25 St NE	$1,500,000	$525,000	$2,025,000	
pump station at Hwy 1 and 25 St NE	$900,000	$315,000	$1,215,000	$16,000
forcemain, 25 St NE to 30 ST NE	$300,000	$105,000	$405,000	
gravity interceptor, 30 St NE to Hwy 97B	$1,690,000	$591,500	$2,281,500	
gravity interceptor, Ind. Park to 10 Ave NE	$2,630,000	$920,500	$3,550,500	
gravity interceptor, 10 Ave NE to new WPCC Site	$7,950,000	$2,782,500	$10,732,500	
pump station at Hwy 1 & 40 St SW	$80,000	$28,000	$108,000	$10,000
forcemain, 40 St SW to 10 Ave PS	$310,000	$108,500	$418,500	
upgrade pump station at 10 Ave SW	$100,000	$35,000	$135,000	$10,000
Total	**$45,960,000**	**$16,090,000**	**$62,050,000**	**$750,000**

[1] Allowance 35% of construction cost - includes engineering, noise control, earthquake protection, architecture, contingencies – does not include cost of land or financing and administration.
[2] Does not include replacement of depreciated existing systems at WPCC or expansion of administration.

9.6.4 Option 4 – Two Treatment Plants

- this option is illustrated on Figure 9-3 and is similar to Option 3 except that the existing WPCC would not be decommissioned
- there would be no further expansion of the existing WPCC beyond Stage IIIB (15,000 pop.), with the existing WPCC maintained at this capacity to at least 2020
- identify a site for a second WPCC, with service population exceeding 15,000 to be serviced by the new WPCC
- reuse or disposal of reclaimed-quality water – see Section 9.3 for options
- the following assumptions were made for evaluation of Option 4:
    - construct new treatment plant for liquid and solids at location remote from main downtown area, expand as needed to handle flows beyond the capacity of the existing (Stage IIIB) WPCC (for costing purposes, the site was assumed to be near the Federated Coop Mill at Canoe)
    - no improvements to existing WPCC outfall



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District of Salmon Arm
Wastewater Collection and Treatment
Option 4
Two Treatment Plants

Figure 9-3

- service Industrial Park, Canoe, and properties east of 30 St. E. not within current WPCC service area with new gravity interceptors along Hwy. 97B and Hwy. 1 east of 30 St. N.E. to new treatment facilities located at Canoe
- reconstruct Wharf Street pump station to pump 15,000 pop. flows to existing WPCC, and pump any additional flow to new facility (e.g., at Canoe)
- twin forcemain from Wharf Street pump station to WPCC
- new pump station on Hwy. 1 between Wharf Street and 30 St. NE
- new forcemain from Wharf Street along Hwy. 1 to 30 St. NE
- abandon Canoe forcemain
- service properties in Salmon River Valley along Hwy 1 west of 30 St. S.W. to 1st Ave. S.W. with new pump station and forcemain connecting to 10 Ave. pump station

Estimated costs for Option 4 are shown in Table 9-4.

TABLE 9-4
COSTS FOR OPTION 4
TREATMENT AT TWO WPCC LOCATIONS

Item	Construction Cost	Allowance (35%)	Total Capital Cost	Annual O&M Cost
new advanced WPCC for 5,000 service pop.	$8,000,000	$2,800,000	$10,800,000	$250,000
deep water outfall and PS for 5,000 pop. (allowance)	$2,000,000	$700,000	$2,700,000	$10,000
maintain existing WPCC at 15,000 service pop	-	-	-	$500,000
maintain existing Wharf St pump station, twin forcemain	$500,000	$175,000	$675,000	$15,000
additional pump station at Wharf St	$700,000	$245,000	$945,000	$15,000
standby power for both Wharf St pump stations	$150,000	$52,500	$202,500	
forcemain, new Wharf St PS to PS at Hwy 1 & 25 St NE	$630,000	$220,500	$850,500	
pump station at Hwy 1 and 25 St NE	$200,000	$70,000	$270,000	$10,000
forcemain, 25 St NE to 30 ST NE	$125,000	$43,750	$168,750	
gravity interceptor, 30 St NE to Hwy 97B	$1,460,000	$511,000	$1,971,000	
gravity interceptor, Ind. Park to 10 Ave NE	$2,630,000	$920,500	$3,550,500	
gravity interceptor, 10 Ave NE to new WPCC Site	$7,230,000	$2,530,500	$9,760,500	
pump station at Hwy 1 & 40 St SW	$80,000	$28,000	$108,000	$10,000
forcemain, 40 st SW to 10 Ave PS	$310,000	$108,500	$418,500	
upgrade pump station at 10 Ave SW	$100,000	$35,000	$135,000	$10,000
duplicate forcemain, 10 Ave SW PS to Wharf St	$300,000	$105,000	$405,000	
Total	**$23,820,000**	**$8,340,000**	**$32,150,000**	**$820,000**

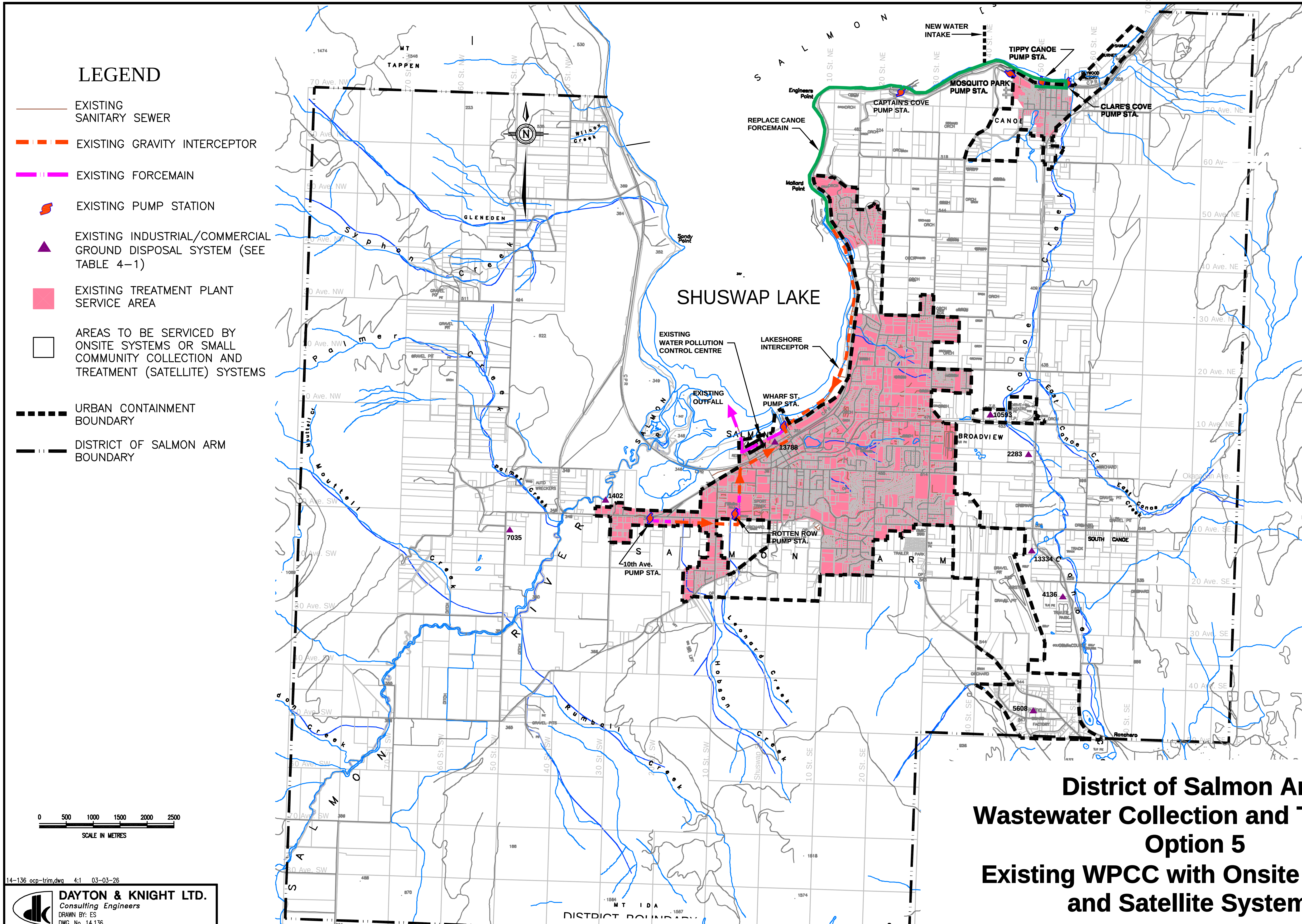
[1] Allowance 35% of construction cost - includes engineering, noise control, earthquake protection, architecture, contingencies – does not include cost of land or financing and administration.

[2] Does not include replacement of depreciated existing systems at WPCC or expansion of administration.

9.6.5

Option 5 – Existing WPCC with Onsite Systems and Satellite Systems

- this option is illustrated on Figure 9-4
- continue to expand the existing WPCC and collection system to serve areas within the urban core of Salmon Arm (i.e., expand existing WPCC as needed to serve infill development in existing service area, but no significant expansion of existing WPCC service area)
- rely on individual onsite systems to serve areas outside the existing WPCC service area for the foreseeable future
- establish procedures to ensure adequate maintenance and monitoring of onsite systems, as well as upgrade/replacement of failing systems and installation of individual onsite treatment (package) plants where necessary
- consider small community collection and treatment (i.e., satellite) systems in areas where there are numerous failed or failing onsite disposal systems - e.g., this could include selected locations in the Canoe Creek corridor along Highway 1 and Highway 97B, the Industrial Park, and the area between 10th Avenue SW and 1st Avenue SW (note that consideration should be given to locating suitable soils and evaluating the site hydrogeology during the feasibility phase of satellite plant design – it may take up to two years to locate, prove and monitor soils suitable for ground disposal of renovated effluent).
- solid residuals generated at satellite treatment facilities could be treated onsite or transported to the WPCC for treatment and eventual reuse
- the following assumptions were made for evaluation of Option 5:
  - Stage IV expansion of WPCC to serve 20,000 population
  - extension of existing WPCC outfall to deeper water to meet MSR requirements to be included in Stage IV expansion
  - replace Canoe forcemain
  - relocate Wharf Street pump station to WPCC and extend storage/interceptor trunk to WPCC
  - no extension of existing WPCC service area
  - onsite systems used where feasible



District of Salmon Arm
Wastewater Collection and Treatment
Option 5
Existing WPCC with Onsite Systems
and Satellite Systems

Figure 9-4

- satellite treatment facilities used in areas that are outside existing WPCC service area and are also unsuitable for onsite ground disposal systems

Option 5 relies extensively on individual onsite wastewater ground disposal systems (or possibly on a small number of satellite treatment facilities). Criteria for ground disposal of treated and partially treated effluent are set out in the MSR for larger systems and in the Sewage Disposal Regulation (SDR) for smaller systems (see Section 7.3.2). Ground disposal is reported to be problematic in several areas within the District, due to high water table, small lots, and/or poor soils (see Section 6.2.1). Ground disposal may still be feasible in these areas, provided that measures are taken to ensure protection of the environment. Qualified professionals should be employed to ensure that appropriate technologies are used in areas with marginal soil conditions.

Comprehensive monitoring and management of onsite systems is a significant undertaking. This approach has developed in areas of the U.S. where residents wish to continue with onsite systems rather than installing collector sewers. In these cases, monitoring and management of onsite systems can sometimes be used to ensure that the public health and the environment are protected (depends on local conditions). This can be implemented through the creation of a Local Service Area (LSA) or similar entity. The LSA is an umbrella organization that assumes public responsibility for assuring technically sound management of privately owned onsite systems. The LSA is normally funded by property owners within the service area. Functions of the LSA may include planning, operations (monitoring, inspections, onsite testing), education, and training.

Descriptions and costs for LSAs are provided in Appendix 8. The estimated operating cost for an LSA encompassing the 1,400 on site systems within the District of Salmon Arm is about $150/year per lot. This cost is based on a comprehensive data acquisition and monitoring program, and it includes site inspections, field sampling and laboratory analysis, certification programs for system designers and installers, issuance of permits and violation notices, billing and staff training (see Appendix 8 for details). Detailed guidance in developing such a program is available (e.g., USEPA, 2002).

Some areas of B.C. have initiated onsite systems management in their Liquid Waste Management Plans. The Capital Regional District LWMP contains a commitment to develop and implement a management program for onsite systems within 5 years. Education is identified as a key component of the strategy. It is recommended in the Plan that a single agency assumes responsibility for the program, although that agency is not identified. Cost estimates for the program are not provided. Septage treatment is to be provided by the private sector (CRD, 2000).

The Columbia Shuswap Regional District has also addressed onsite systems management in its LWMP for the South Shuswap. An annual Environmental Enhancement Levy not to exceed $25 per lot will be used by the Regional District to undertake an inventory of onsite systems, to begin monitoring of groundwater and lake water quality, and for public education. This will be undertaken by CSRD staff. The CSRD program is regarded as an interim measure, and problem areas may have to be sewered in future.

It is difficult to compare the real costs of onsite systems with that of central collection and treatment, since the age of many systems onsite is unknown, and the useful life of onsite systems in general can vary from a few years on difficult sites to more than 30 years on ideal sites. For the purpose of comparing costs, an average 20-year life was assumed for onsite systems. The ammortized capital and annual operating costs for various types of onsite systems ranging from a simple septic tank and conventional drainfield to a complex system for difficult sites that includes septic tank, package treatment plant, and mounded drainfield are described in Appendix 8.

Capital and O&M costs for Option 5 are summarized in Table 9-5 (existing WPCC system), Table 9-6 (satellite treatment systems), and Table 9-7 (onsite systems – see Appendix 8 for more detail on the costs of onsite systems).

TABLE 9-5
CAPITAL AND O&M COSTS FOR OPTION 5
CENTRALIZED COLLECTION AND TREATMENT FOR EXISTING WPCC

Item	Construction Cost	Allowance (35%)	Total Capital Cost	Annual O&M Cost
expand WPCC to 20,000 service pop.	$7,000,000	$2,450,000	$9,450,000	$600,000
relocate Wharf St pump station & extend trunk	$2,000,000	$700,000	$2,700,000	$12,000
standby power for Wharf St. pump staton	$100,000	$35,000	$135,000	
outfall improvements and pumping	$2,500,000	$875,000	$3,375,000	$8,000
replace forcemain, Canoe to Wharf St	$1,200,000	$420,000	$1,620,000	$10,000
Total	**$12,800,000**	**$4,480,000**	**$17,280,000**	**$630,000**

1 Allowance 35% of construction cost – includes engineering, noise control, earthquake protection, architecture, contingencies –does not include cost of land or financing and administration.

2 Does not include replacement of depreciated existing systems at WPCC or expansion of administration.

TABLE 9-6
COSTS FOR SATELLITE WASTEWATER TREATMENT

Item	Construction Cost[6]	Allowance[1] (35%)	Total Capital Cost	Annual O&M Cost[2]
satellite treatment plant for Industrial Park[3]	$600,000	$210,000	$810,000	$70,000
satellite treatment plant for 50 service pop.[4]	$200,000	$70,000	$270,000	$22,000
satellite treatment plant for 125 service pop.[5]	$300,000	$105,000	$410,000	$35,000
satellite treatment plant for 500 service pop.[3]	$600,000	$210,000	$810,000	$70,000

1 allowance 35% of construction cost - includes engineering, noise control, earthquake protection, architecture, contingencies – does not include cost of land, financing and administration.

2 assumes solids disposal by pumper truck to septage treatment lagoon near Tappen at $200 per 13,600 L load

3 design average flow 200 m^3/d

4 design average flow 20 m^3/d

5 design average flow 50 m^3/d

6 does not include cost of sewer collection system serving individual lots

TABLE 9-7
COSTS FOR ONSITE SYSTEMS

Type of System	Capital Cost	Amortized Capital Repayment[1]	Annual[6,7] O&M	Annual Cost of Management Program		Total Annual Cost per Household	
				Basic[2]	Comprehensive[3]	Basic[2]	Comprehensive[3]
septic tank and conventional drainfield already in place, assumed to require replacement in 20 years[4]	$3,400	$110	$50	$25	$150	$185	$310
immediate replacement or installation of septic tank and conventional drainfield, assumed to require replacement in 20 years[5]	$3,400	$300	$50	$25	$150	$375	$500
immediate installation of septic tank, package plant, and conventional drainfield, assumed to require replacement in 20 years[5]	$16,000	$1,400	$380	$25	$150	$1,805	$1,930
immediate installation of septic tank, package plant, and mounded drainfield, assumed to require replacement in 20 years[5]	$23,000	$2,010	$380	$25	$150	$2,415	$2,540

1 assumes 20 year amortization
2 based on CSRD program
3 based on comprehensive program under Local Service Area – see Appendix 8 for details
4 capital repayment is annual amount to be invested starting now to have $3,400 in 20 years, assuming 4% return on investment (sinking fund factor = 0.0336)
5 capital repayment is annual payment on principal borrowed now assuming 6% real interest rate (capital recovery factory = 0.0872)
6 assumes pumpout every 3 years, does not include the costs of onsite systems management program.
7 assumes $300/year O&M contract with private contractor for package plant, and $30/year for disposal of solids from package plant.

9.7 Summary of Wastewater Collection and Treatment Options

9.7.1 Costs

A summary of costs for Options 1 through 5 is shown in Table 9-8. Current (2003) municipal taxes for sewage collection and treatment are $137.10. This will increase to $225.40 in 2004. Comparison of the cost per household among the options depends on the potential for funding grants and apportioning of costs to system users (e.g., Development Cost Charges, sewer rates for developed and undeveloped properties etc). The costs per household shown in Table 9-8 for Options 1 to 4 assume that all of the homes serviced by the treatment plant(s) would share equally in the cost of the improvements. The costs shown for Options 1 to 4 include sewer mains and pumping stations, but do not include collector sewers serving individual lots. Typical costs for collector sewers are in the range $5,000 to $10,000 per lot for 20 m to 30 m lot width, depending on ground conditions. These costs can be expected to rise in direct proportion to lot width (e.g., 60 m lot width $10,000 to $20,000).

For Options 1 to 4, a significant portion of the capital costs are for servicing of rural areas, which have poor conditions for onsite systems (e.g., over $12 million associated with servicing of the Canoe Creek Valley - see Table 9-1). If these costs were apportioned only to the lots serviced by the new sewer system, the per lot cost would be much higher than that shown in Table 9-8. For example, apportioning of the capital costs for sewering the Canoe Creek Valley among the actual local population of about 2,000 people would result in a capital cost of $6,000 per capita (not including collector sewers). To justify distributing the cost burden throughout the whole community assumes that the whole community would benefit through the protection of health and the environment to enhance general well being and prosperity. Otherwise, the improvements would need to be undertaken by specified area, DCC, etc.

Among the options involving expansion of the WPCC service area (s) beyond the Urban Containment Boundary (i.e., Options 1 to 4), Option 1 (use of existing WPCC to the LWMP horizon of 20,000 population around 2021) has the lowest capital cost at about $29.1 million ($400 per lot). Option 2, which involves relocation of the solids handling facilities to reduce odour impacts, is about $34.6 million ($480 per lot). Maintaining the existing WPCC at the Stage IIIB capacity and accommodating additional growth at a second treatment plant (Option 4) would cost about $32.2 million ($450 per lot). The most expensive option by far is relocation of the WPCC (Option 3) at about $62.1 million or $770 per lot (Table 9-8).

The costs associated with extension of the existing WPCC outfall and addition of the required pump station under Options 1, 2 and 5 are substantial (i.e., about $3.4 million total capital cost – see Tables 9-1, 9-2 and 9-5). Based on the comments from regulatory agencies contained in Appendix 9, the environmental benefits that might be obtained by extension of the outfall must be weighed against the environmental impacts of outfall construction and the potential detrimental impacts on fish caused by locating the discharge in deeper water. Additional investigation into the relative merits of extending the outfall versus the status quo will be needed if Options 1, 2 or 5 are selected.

TABLE 9-8
SUMMARY OF ANNUAL COSTS FOR OPTIONS 1 TO 5

Option	Description	Total Capital Cost[1]	Capital Repayment[2]		Annual O&M		Total Annual Cost (Capital + O&M)	
			Total	Per Lot[3]	Total	Per Lot[3]	Total	Per Lot[3]
1	Centralized Collection and Treatment for 20,000 Service Pop. at Existing WPCC Location	$29,090,000	$2,540,000	$320	$670,000	$80	$3,210,000	$400
2	Centralized Collection and Treatment for 20,000 Service Pop.at Existing WPCC Location for Liquid Treatment with Remote Site for Solids Handling and Treatment	$34,550,000	$3,010,000	$380	$790,000	$100	$3,800,000	$480
3	Centralized Collection and Treatment for 20,000 Service Pop. at New Location, Decommission Existing WPCC	$62,050,000	$5,410,000	$680	$750,000	$90	$6,160,000	$770
4	Centralized Collection and Treatment for 15,000 Service Pop. at Existing WPCC and for 5,000 Service Pop. at New Location	$31,150,000	$2,800,000	$350	$820,000	$100	$3,620,000	$450
5	Centralized Collection and Treatment within Urban Containment Boundary at Existing WPCC, Remaining Pop. Served by Onsite Systems and/or Satellite Systems							
	WPCC and Collection, Existing Service Area Only	$17,280,000	$1,510,000	$190	$630,000	$80	$21,140,000	$270
	Satellite Treatment (not incl. sewers & service connections)							
	-Industrial Park (AAF=200 m^3/d)	$810,000	$70,000	$270	$70,000	$270	$140,000	$540
	-20 homes, 50 service pop. (AAF=20 m^3/d)	$270,000	$20,000	$1,000	$22,000	$1,100	$42,000	$2,100
	-50 homes, 125 service pop. (AAF=50 m^3/d)	$410,000	$40,000	$800	$35,000	$700	$75,000	$1,500
	-200 homes, 500 service pop. (AAF=200 m^3/d)	$810,000	$70,000	$350	$70,000	$350	$140,000	$700
	Onsite Systems, Basic Management Strategy							
	-basic system already in place	$3,400	-	$110	-	$75	-	$185
	-new installation, basic system	$3,400	-	$300	-	$75	-	$375
	-new installation, incl. package plant, mounded field	$23,000	-	$2,010	-	$405	-	$2,415
	Onsite Systems, Comprehensive Management Strategy							
	-basic system already in place	$3,400	-	$110	-	$200	-	$310
	-new installation, basic system	$3,400	-	$300	-	$200	-	$500
	-new installation, incl. package plant, mounded field	$23,000	-	$2,010	-	$530	-	$2,540

1 capital costs do not include collector sewers serving individual lots – capital costs for collector sewers are typically $5,000 to $10,000 per lot for 20 m to 30 m lot width, and rise in direct proportion to increasing lot width (e.g., 60 m lot width $10,000 to $20,000 per lot).
2 assumes 20 year amortization at 6% real interest rate
3 assumes 20,000 WPCC service population at 2.5 people per household for Options 1 to 5

Under Option 5, the WPCC service area would be restricted to within the Urban Containment Boundary, and capital improvements associated with the WPCC to accommodate growth to the LWMP horizon would be about $17.3 million (Table 9-8). As described earlier for Options 1 to 4, these costs do not include collector sewers serving individual lots. Apportioning these costs equally among all households serviced by the system (including capital repayment and O&M) results in an annual cost of about $270 per lot (not accounting for DCC's or potential grants). By comparison, the amortized annual cost (capital plus O&M) of an existing residential onsite septic tank system with a basic ($25/year) management strategy is about $185/year. Under a comprehensive management structure (Local Service Area at $150/year), an existing septic tank system would cost a total of about $310/year, which is about $40/year more than the annual costs for a home serviced by the WPCC (provided that the serviced home is within the urban containment boundary). The amortized total capital and O&M costs of newly installed septic tank systems under the basic management structure ($375/year) are higher than the WPCC per household costs of $270/year. For onsite systems in difficult areas requiring package plants and mounded fields, the annual cost for new systems could be as high as $2,500/year. The amortized capital and O&M cost per household for small community treatment facilities based on the costs in Table 9-6 ranges from $700 to $2,100 per household (not including collector sewers and service connections). Servicing of the Industrial Park with a satellite treatment plant would cost about $800,000 or $540 per lot (again not including collector sewers and service connections). As described earlier for Options 1 to 4, costs for collector sewers depend on ground conditions and lot size.

It is apparent from Table 9-8 that improvements to outlying rural areas where ground conditions for conventional septic tank systems are difficult will be costly, regardless of whether this is accomplished by the installation of more sophisticated onsite systems, or by collection and treatment at satellite or larger central facilities. Before large sums are expended on capital works, more detailed information on the condition and performance of onsite systems in the District is needed, to determine the current and future environmental impacts of these systems on sensitive water bodies such as Canoe Creek, the Salmon River and Salmon Arm Bay. This should be undertaken initially through an inventory of onsite systems (location, age, condition, soils, water table, lot size, etc), to be followed by the development of a water quality-monitoring program to evaluate water quality impacts of ground disposal systems in specific areas. The appropriate corrective measures for areas where detrimental impacts are identified will depend to some extent on the results of the monitoring program (i.e. wide spread problems versus small, localized problem areas). Costs for the inventory of onsite systems within the District using a private consultant are estimated at $20,000. A recommended scope and budget for a monitoring program are given below.

Instrument and monitor up to 10 existing in-ground disposal field "clusters" based upon surficial geology.

- Sample site selection based upon the following soil groups (from Figure 6-1):
  Group 1: Bog Deposits (B) and Modern Alluvium (A)
  Group 2: Fan Deposits (F), Slope Deposits, Landslide Deposits (S)
  Group 3: Fluvial Soils (T, TK, H)
  Group 4: Lacustrine Soils (L, Lt, Lx, Lc)
  Group 5: Glacial Deposits (M)
  Group 6: Bedrock (B)
- Brief initial assessment of the in-ground disposal "cluster" to be conducted (local physiology, review of system as-builts, review of Interior Health data, etc…)
- Total of four shallow monitoring wells to be installed at each disposal field "cluster" (using a truck mounted auger rig) to assess soil conditions, position of the water table and evaluate special/temporal changes in water quality due to climate and operation of local on-site disposal systems – it is proposed to install the monitoring wells in the following locations
  - one upslope of the disposal field "cluster" (background)
  - one within the disposal field cluster
  - two downslope of the disposal field cluster
- Water levels to be monitored on a monthly basis for a period of one year

- Water samples to be obtained on a quarterly basis to coincide with yearly high and low groundwater levels
- Water samples to be analyzed for a limited set of constituents focusing upon the nitrogen and bacteriological analysis

The order-of-magnitude cost of the proposed regional study is anticipated to be as follows:

Description	Maximum
• Engineering Fees	$40,000
• Contractor Costs	$40,000
• Laboratory Costs	$20,000
Total	$100,000

The inventory and monitoring program should be at least partially funded by the owners of onsite systems, through the creation of a Local Service Area or similar body. The water quality monitoring program should be coordinated with other similar programs currently ongoing in the area (e.g., the CSRD landfill site and the South Shuswap LWMP). Additional program elements as described in Section 9.3 and Appendix 8 (e.g. designer/installer certification, maintenance schedules, requirements for repair of failing systems etc.) can be added in future if the continued use of onsite systems is deemed appropriate. Option 5 would require cooperation between the District and the Salmon Arm Health Unit (SAHU). Comments from the SAHU regarding Option 5 are contained in Appendix 8. The comments are generally supportive, and this approach appears to be potentially workable from a regulatory standpoint (see Appendix 8 for more detail).

9.7.2 Environmental Evaluation of Options

The specific environmental impacts and regulatory requirements associated with the individual components of each of the five wastewater collection and treatment options described in Section 9.6 are set out in the table contained in Appendix 10. This information is summarized briefly below.

Option 1:

- extension of WPCC outfall, installation of new trunk sewers, and replacement of Canoe forcemain would impact fish and wildlife habitat and would probably trigger requirements for extensive environmental review and impact assessments at both the Federal and Provincial levels

Option 2

- see Option 1
- assumed location for remote solids handling facility (Minion Field) and associated forcemain for solids transfer would not impact streams or wetlands and would probably not require in-depth environmental impact assessments

Option 3

- discussions with Federal and Provincial fisheries agencies would be needed regarding the abandonment in place of the existing WPCC outfall and the Canoe forcemain
- assumed location for new central WPCC and outfall (at Canoe) and installation of associated new trunk sewers and forcemains would impact fish and wildlife habitat and would probably trigger requirements for extensive environmental review and impact assessments at both the Federal and Provincial levels

Option 4

- discussions with Federal and Provincial fisheries agencies would be needed regarding the abandonment in place of the Canoe forcemain
- assumed location for new WPCC and outfall (at Canoe) and installation of associated new trunk sewers and forcemains would impact fish and wildlife habitat and would

probably trigger requirements for extensive environmental review and impact assessments at both the Federal and Provincial levels

Option 5

- extension of WPCC outfall, installation of new trunk sewers, and replacement of Canoe forcemain would impact fish and wildlife habitat and would probably trigger requirements for extensive environmental review and impact assessments at both the Federal and Provincial levels
- comprehensive monitoring of the impacts of onsite systems would be needed to ensure adequate protection of environmental resources

9.8 Septage Handling and Treatment

Septage within the District is currently collected and treated by a private contractor, using pumper trucks discharging to a lagoon treatment facility located outside of the District in the Tappen area (current lagoon area about 0.45 ha). The cost is typically $150 for septage removal from a single residential system. Assuming pump out on a 3-year cycle, the cost of septage removal and treatment under the existing structure is about $50 per year per lot.

Two other options for septage treatment are delivery to the WPCC and treatment at a dedicated septage facility. If treatment were done at the WPCC, a septage receiving station and equalization facility with comprehensive odour control would be required. Based on the septage volumes discussed in Section 5.4, the total annual septage volume generated within the District (residential plus industrial) would be about 970 m^3/yr in 2001, increasing to about 1,040 m^3/d by 2021. Based on typical septage strength (Table 5-7), this would represent an equivalent population of about 300 people based on organic loading at the WPCC (assuming a peaking factor of 1.5 times average annual load). This represents an increase of about 2% in plant organic loading. Apportioning capital improvement and O&M costs at the existing WPCC on this basis using the costs shown for Option 5 in Table 9-8 in the previous section would result in an annual cost of about $60,000/yr for septage treatment, or about $40 per onsite system (assuming 1,400 residential systems and 140 industrial systems). The capital costs of the septage receiving station would be about $200,000 or $10 per year per system, based on a 6% real interest rate and 20 year system life. Septage pumping and hauling costs are estimated at about $15/1,000 L or $25 per system per year for residential systems. Total costs for this option would then be about $75/year for residential systems. Costs would be higher for industrial systems generating larger septage volumes. Disadvantages associated with this option in addition to higher costs include the need to haul septage through the urban area, as well as the potential for process upsets and increased odours at the WPCC.

The third option is for the District to identify a site for a dedicated septage treatment facility. This could be similar in nature to the existing private facility near Tappen (i.e., a large facultative lagoon relying on evaporation with no discharge). Alternatively, a mechanical treatment plant could be constructed, or septage could be mixed with drier materials (e.g. wood chips, garden waste, dewatered biosolids) and composted. Such a facility would have to be located at a remote site or comprehensive odour control would be needed, due to the potential for odour problems. Composting with comprehensive odour control is a costly option, as described in Section 9.10. The lowest capital cost under this option would be a simple lagoon disposal facility similar to the private facility at Tappen. Assuming a 0.2 ha lagoon area and a 50 m buffer zone, about 2 ha of land would be required. Capital costs for such a lagoon facility are estimated at about $75,000, assuming suitable ground conditions and not including the cost of land. Costs would be significantly higher for a site with difficult ground conditions (e.g. synthetic liner required). Operating costs would depend on location (trucking distance), but can be assumed similar to the existing private operation.

The operator of the existing private septage facility holds a lease on the lagoon property until 2010, at which time the lease is expected to be renewed. There is reported to be sufficient space at the site to expand the facility well beyond the LWMP horizon of 2021. The current system appears to be reasonable in cost, and there is no apparent compelling need for the District to develop a publicly-owned septage treatment facility. However, to serve the long-term needs of the District, it is recommended that a potential site for a septage treatment/composting facility be identified, with a view to acquiring the property for future use if the need becomes apparent. Criteria for selecting a suitable site should include proximity to existing and future development, prevailing wind conditions, soil conditions and drainage, and average distance from areas served by onsite systems. If LWMP Option 2 is selected for wastewater management, consideration should be given to accepting septage at the remote solids treatment facility.

9.9 Reuse of Reclaimed Water

Criteria for effluent reuse in British Columbia are set out in the MSR (see Section 7.3.3). Reuse programs must be designed to make beneficial use of effluent (to provide water and nutrients to crops or other beneficial use), and also to protect human health and the environment. Water reuse in British Columbia is currently practiced at Vernon, Cranbrook, 100 Mile House (all range, pasture or crop spray irrigation projects) and at Osoyoos and French Creek (golf course irrigation). Onsite use of reclaimed water is currently undertaken at several wastewater treatment facilities in British Columbia for site irrigation, washdown water, and process water; this has resulted in a significant reduction in the consumption of potable water (e.g. from $32,000/yr to $6,000/yr at the J.A.M.E.S. facility at Abbotsford). The Greater Vancouver Regional District (GVRD) recently undertook a study to evaluate options for the reuse of treated effluent; onsite reuse at wastewater treatment facilities was found to be the most cost effective reuse option (Dayton & Knight Ltd., 2001d).

Leaders in the wastewater reuse field include utilities in California, Florida, Israel and Arizona. In more temperate climates, utilities in Japan and Colorado may also be noted. Recent programs are motivated by economics, pollution reduction, and alleviating water shortages. Past international trends in dual distribution have been to provide such systems only for new growth and development areas. More recently, No. 1 quality (drinking) water supply is becoming increasingly scarce, and No. 2 quality irrigation systems are being extended into already established neighbourhoods for irrigation purposes (Dayton & Knight Ltd., 2001c).

Alternatives for reuse of treated effluent which can be considered for application within the study area are summarized below.

9.9.1 Option 1 – Agricultural Irrigation

Regulatory Requirements

Because effluent irrigation is regulated by the MSR, no permit is required from the B.C. Ministry of Water, Land and Air Protection (MWLAP). Instead, the discharger must register the intention to use the reclaimed water with the appropriate Regional Manager of MWLAP, and undertake the required environmental studies and effluent analyses. There are no quality standards for nutrient content of effluent to be used for irrigation; if a reuse program is contemplated it may not be desirable to practice enhanced phosphorus removal, since phosphorus in the effluent increases the quality of the effluent as a source of nutrients.

Municipalities intending to begin effluent irrigation must begin the process well in advance by registering their intent with the MWLAP. Given the length of time required to undertake public and stakeholder consultation and the environmental impact study, it is recommended that registration be made at least one year and preferably up to two years in advance of when it is intended to begin irrigation of effluent.

Requirements of the Environmental Impact Study (EIS)

Prior to starting construction of an effluent irrigation system, an EIS of the proposed application sites is required. A qualified professional must be retained to undertake the study. The study must be completed at least 90 days before the start of operations and provided to the appropriate Regional Manager of the MWLAP. The study must assess the potential impact of the effluent on the environment and human health. The MSR outlines in general the requirements for the EIS but it is expected that the qualified professional will have the expertise to identify the issues that should be addressed in the EIS.

The EIS must document the background conditions on the sites proposed to receive effluent. This would include such things as soil depth, soil texture, soil chemical and physical characteristics, location and vulnerability of surface and groundwater sources, vegetation on site, site topography, terrain stability issues, and location of neighbours and sensitive environmental areas. The EIS must also outline the irrigation requirements of the crop or vegetation to receive the reclaimed water, and its nutrient requirements. It must demonstrate that the irrigation will not oversupply the soil and crop with metals or nutrients.

The study should contain a receiving environment monitoring plan, which outlines sampling locations and a sampling strategy for monitoring the irrigation sites for impacts of the reclaimed water. The irrigation sites must be monitored on an ongoing basis and monitoring results submitted to MWLAP as required. Monitoring should include annual soil sampling to ensure the soil is not impacted by the effluent. Application rates of effluent should also be monitored on a site by site basis to ensure that over application is not occurring. Depending on the receiving vegetation, foliage monitoring may also be recommended. A visual inspection of irrigated areas should also be conducted at least annually to ensure that irrigation is not causing physical damage to the soil such as erosion or runoff, or downslope resurfacing.

The capacity of agricultural areas to accept ground disposal of reclaimed wastewater may not correlate well to local soil conditions presented in Figure 6-1 due to the points described below.

- Current soil types and structures present in agricultural areas have evolved significantly from the original soils developed during the last ice-age (as presented on the map) due to mechanical cultivation. These changes in shallow soil structure (i.e. thickness, porosity, depth of impermeable sediments, etc…) may have a significant impact on the ability to agricultural soils to sustainably infiltrate reclaimed water.

- The rate of wastewater irrigation in agricultural areas during the three to four month growing period will be controlled mainly by the rate of surface evaporation and the rate of transpiration from planted crops. These rates are primarily controlled by the intensity of solar radiation, relative humidity, wind speed and surface temperature. The soil type has only a small effect on these variables.

It is anticipated that any of the recycled water that does infiltrate into the ground will benefit groundwater recharge. As long as the recycled water quality meets MSR standards, there is minimal concern about contaminating highly vulnerable unconfined aquifers beneath existing agricultural lands. However, if groundwater is used as a source of drinking water in the immediate vicinity of irrigation, travel times and setback requirements should be respected.

The above comments for agricultural irrigation apply to forested lands and golf course irrigation also. However, forested areas suitable for irrigation do not cover as much surface area above known aquifers, compared to agricultural land. Thus, it is expected that the benefits of groundwater recharge may not be as significant to the known aquifers as agricultural irrigation.

The complexity of the EIS will depend on the type of site chosen to receive effluent. It is expected that forested sites in sloping terrain may require a more complex EIS than agricultural sites in the Salmon River delta.

Once effluent application sites are chosen, completion of the EIS should require from two to six months depending on the type of site chosen and the types of environmental issues the EIS must address.

It is estimated that the EIS will cost between $5,000 and $20,000, depending on the number of individual sites that require assessment and the complexity of the issues on the site. This estimate includes analytical costs.

Public/Stakeholder Consultation

While the MSR does not specifically require stakeholder consultation for new effluent reuse projects, it is recommended that consultation be undertaken to alleviate any concerns by community and stakeholder groups. It is suggested that this occur at least one year in advance of the planned start of irrigation. If the District opts for agricultural use of the effluent, a publicity campaign in the planned service area should be undertaken to interest farmers in the effluent. Some area farmers may wish to switch from irrigating with river water, while others may opt to change farming practices and produce irrigated crops. Local farmers would have to clearly understand the benefits of using effluent and the potential risks. They would have to feel confident that the effluent will be a reliable and safe supply of irrigation water before they would agree to participate.

Case Study: City of Armstrong

Within the North Okanagan, both the City of Vernon and the City of Armstrong are currently successfully reusing all treated effluent as irrigation water. In both Vernon and Armstrong the effluent is irrigated onto area farmland. Both municipalities have chosen to cover all costs of the infrastructure required to store the effluent, to move it to farmland and to irrigate it. They own all pipe, pumps, meters and irrigation equipment. The farmer is responsible for operating the equipment on his/her own land and for determining crop irrigation requirements. The municipalities determine when the system will be started in spring and shut down in the fall, and maintain all system infrastructure. Of these two municipalities, the City of Armstrong's program appears to be most similar to what might evolve in Salmon Arm.

All effluent from the City of Armstrong is irrigated onto crop land (used for the production of livestock feed) south of Armstrong within the Municipality of Spallumcheen. The City currently produces about 2,000 cubic meters of effluent per day, which is stored year-round in a reservoir located approximately 7.5 km south of the City. The effluent is pumped from the City's wastewater treatment plant through a 400 mm diameter pipe to the reservoir. The reclaimed water moves by gravity out of the reservoir, into the chlorinator and into the piping for distribution to area farms. A series of pumps located along the distribution lines provide pressure for the system. Farmers are allocated a certain volume of water over the irrigation season based on the predicted water requirements of their crops. The City estimates that operation of the system utilizes one quarter of a full-time position: in their case the treatment plant operator has been able to absorb the additional workload of the irrigation system.

When the system was originally installed there was opposition from some area farmers and a general lack of understanding of the use of effluent for irrigation. In order to encourage farmers to utilize the effluent, the City purchased all irrigation equipment and made it available free of charge to farmers who utilized the effluent. The effluent irrigation program is now oversubscribed, and the City has a waiting list of farmers who would like to use it. Because of this, and because the original irrigation equipment is aging, the City has decided to sell the irrigation equipment to effluent users and in future require farmers to supply their own equipment. The City will continue to maintain the infrastructure up to the farm boundary.

It is recommended that District of Salmon Arm meet with staff from the City of Armstrong and City of Vernon programs if there is serious interest in pursuing an effluent irrigation program.

<u>Land Base Required to Utilize Effluent</u>

Within the District of Salmon Arm, 6,370 hectares are in the Agricultural Land Reserve. Approximately 1,780 hectares of this area are planted to field crops (forages, silage corn and cereals) and 1,022 hectares are in pasture land for livestock grazing (1996 census data) for a total of 2,802 hectares of farmland. Approximately 500 hectares of this agricultural land are currently irrigated. A large area of land in field crops and pasture is located in the Salmon River Valley, which is located as close as 2 km from the WPCC. There is also a substantial amount of land in the Gleneden area, located on a bench above and to the west of the Salmon River Valley.

The land base required to utilize the effluent would depend on whether effluent was stored year-round with the entire volume irrigated during the growing season, or whether irrigation occurred only during the growing season and the remainder was disposed of through lake discharge or rapid infiltration. Effluent reuse for agricultural irrigation was based on the assumptions described below.

- Stage IIIB Upgrade will meet MSR standards for this application (see Table 7-2 and Table 7-4)
- assume total irrigation requirement is 300 mm over 3 month season
- extensive public/stakeholder consultation and binding long-term agreements with private landowners or purchase of adequate farmland by the District would be necessary
- Sub-Option 1A
  - store treated effluent during off season (size reservoir to hold twice the average annual discharge volume to allow for wet years when irrigation is not possible and to ensure no discharge to lake).
  - irrigate entire annual volume during 3 month season

Year	WPCC Service Population[1]	Storage (ha-m)[2]	Land (ha)[3]
2005	13,000	360	600
2020	17,000	480	780
Long-term	40,000	1,100	1,850

[1] assumes 1.5% annual growth
[2] sized to hold twice the average annual WWTP discharge volume
[3] Based on average irrigation rate of 300 mm/yr.

- Sub-Option 1B
  - discharge treated effluent to Shuswap Lake (or other receiving bodies) during off season or during unseasonably wet irrigation season
  - irrigate only the volume produced during the 3-month irrigation season
  - storage volume for 20 days at average daily discharge volume

Year	WPCC Service Population[1]	Storage (ha-m)[2]	Land (ha)[3]
2005	13,000	10	150
2020	17,000	13	200
Long-term	40,000	30	460

1 assumes 1.5% annual growth
2 sized to hold twice the average annual WWTP discharge volume
3 Based on average irrigation rate of 300 mm/yr.

<u>Cost Estimates for Agricultural Effluent Irrigation Program</u>

Based on City of Armstrong capital cost estimates which have been projected upwards for the higher effluent production of the District of Salmon Arm (currently approximately twice the volume produced by Armstrong) and updated using the ENR Index it is estimated that installation of the irrigation infrastructure (piping, pumps, chlorinator, irrigation equipment) would cost $4.5 million for an agricultural year-round effluent use program at 2003 WWTP flow rates. An additional $15 million would be required to build a storage lagoon sized to hold twice the average annual (2003) WWTP discharge volume. A significant portion of the cost of infrastructure might be covered by grants. If the District opted for seasonal storage and irrigation, costs for system infrastructure would decline significantly to about $1.5 million for irrigation infrastructure and $0.5 million for the storage reservoir. Based on the above, total capital costs would be in the range of $20 million for a system designed for no lake discharge, to $2 million for a much smaller system designed only to minimize lake discharge during the summer (at 2003 flow rates). Injection of sodium hypochlorite to the reclaimed water distribution system to maintain chlorine residual for preventing regrowth of pathogens is included in the cost estimate. Costs would vary depending on how far the effluent has to be pumped, whether a forested or agricultural land base is targeted, and on other factors.

Based on the experience of other jurisdictions, it is recommended that if the District opts for agricultural use of the effluent, the District should purchase all required irrigation equipment and lend it to farmers to encourage participation in the program. Once the program is well established, the District could contemplate requiring farmers to use their own equipment. It is also recommended that the District, as part of ongoing monitoring, engage an Agrologist to provide a 'nutrient management' service to participants to ensure that they make the best use of the fertilizer value of the effluent and to answer any management questions that may arise. The effluent irrigation program could be expected to take at least 7-8 years to become fully established with the local farming community (as was the case at Armstrong). The District should also consider purchasing farmland to initiate the program if enough committed farmers cannot be identified initially.

Ongoing costs of the program would include operation, maintenance and repair of the system, labour, analytical costs and monitoring. Based on the labour requirements of the City of Armstrong's program, it is estimated that approximately one half-time position would be required to run the program. Estimated annual operation and maintenance costs for the Salmon Arm system designed for zero lake discharge at 2003 flows would be about $200,000 per year, not including capital equipment replacement.

The MSR requires ongoing monitoring of receiving sites. This would require the services of a qualified professional to undertake annual (or more frequent) monitoring of each area receiving effluent. There would be laboratory analytical costs associated with the monitoring program for effluent, soil and possibly vegetation analyses. It is estimated that this would cost approximately $5,000 to $10,000 per year.

9.9.2 Option 2 – Forest Irrigation using WPCC Effluent

There is an extensive amount of forested land surrounding the District of Salmon Arm. This land is in general located further from the WPCC than is the bulk of the agricultural land. Two options for forest irrigation are described below. Costs would be higher than those described earlier for agricultural irrigation; due to more difficult terrain and higher pumping head.

- Stage IIIB Upgrade will meet MSR standards for this application (see Table 7-2 and Table 7-3)
- assume total irrigation requirement is 200 mm over 3 month season
- extensive public/stakeholder consultation and binding long-term agreements with private woodlot owners, forest companies or for Crown land would be necessary
- Sub-Option 2A
  - same as 1A except lower irrigation rate for forested land compared to agricultural land

Year	WPCC Service Population[1]	Storage (ha-m)[2]	Land (ha)[3]
2005	13,000	360	900
2020	17,000	480	1,170
Long-term	40,000	1,100	2,780

1 assumes 1.5% annual growth
2 sized to hold twice the average annual WWTP discharge volume
3 Based on average irrigation rate of 300 mm/yr.

- Sub-Option 2B
  - same as 1B except lower irrigation rate for forested land compared to agricultural land

Year	WPCC Service Population[1]	Storage (ha-m)[2]	Land (ha)[3]
2005	13,000	10	225
2020	17,000	13	300
Long-term	40,000	30	690

1 assumes 1.5% annual growth
2 sized to hold twice the average annual WWTP discharge volume
3 Based on average irrigation rate of 300 mm/yr.

9.9.3 Option 3 – Reuse at the WPCC

- Stage IIIB upgrade will meet MSR standards for this application except that additional disinfection facilities would have to be added to reduce fecal coliform counts and to maintain a chlorine residual in distribution piping for the reuse water (see Table 7-2 and Table 7-4)

- potential applications include washdown water, process water (polymer mixing etc.), bioscrubber irrigation, landscape irrigation on WPCC grounds
- experience at J.A.M.E.S. and French Creek facilities shows that at least 80% of potable water consumption at some WWTPs can be replaced with reclaimed water (excluding biofilter irrigation, which is not normally undertaken using potable water)
- a meter was recently installed to monitor potable water consumption at the Salmon Arm WPCC
- would require cost-benefit study to determine potential reuse water volume at the WPCC and costs of the required disinfection facilities versus use of potable water

9.9.4 Option 4 – Landscape and Golf Course Irrigation

- Stage IIIB upgrade would not meet the requirements for irrigation of publically-accessible areas (chemical addition and higher level of disinfection required – see Table 7-2 and Table 7-4)
- golf course irrigation possible using Stage IIIB effluent provided health and environmental concerns of MWLAP are met (e.g., irrigation at night only)
- approximately the same land requirements as Option 1
- potentially suitable for satellite systems located near golf courses
- potentially suitable for irrigation along public walking trail between WPCC and lake and other public parks in the area, but would not accept a significant portion of the WPCC discharge volume

9.9.5 Option 5 – Industrial Process Water

- Stage IIIB Upgrade will meet MSR requirements for industrial applications (see Table 7-2 and Table 7-4)
- uses are industry-specific (e.g. cooling water, concrete ready-mix)
- may be potential for use at the Industrial Park and/or other locations

- inventory of local industry would be needed to assess potential reuse locations, volumes and costs

9.9.6 Option 6 – Landscape Impoundments and Wetlands

- Stage IIIB Upgrade will meet MSR requirements for this application (see Table 7-2 and Table 7-4)
- potential for discharge of reclaimed-quality water to engineered wetland areas in Salmon Arm Bay and/or near Industrial Park – these wetland areas could be designed as public amenities with walking trails and rest areas that include educational displays
- would require site-specific Environmental Impact Studies
- landscape impoundments could be incorporated into golf courses and parks

The LWMP Advisory Committee recommended consideration of a concept design for an engineered wetland/nature park utilizing the WPCC treated effluent as a water reuse option. The wetland was envisioned as an alternative to the existing WPCC outfall, which would then be used for emergency purposes only. The engineered wetland was estimated to require about 15 ha of area, and was assumed to be located on the lake foreshore near the WPCC. Comments were requested from regulatory agencies regarding this water reuse option (see Appendix 9). The general tone of the comments was that MWLAP and FOC do not support the construction of an artificial wetland in this location, due to the value of the existing fish and wildlife habitat (see Appendix 9). This options was not considered further for the WPCC discharge in light of the response from regulatory agencies.

9.9.7 Option 7 – Snow Making

- Stage IIIB Upgrade will meet MSR requirements for snowmaking applications not for skiing or snowboarding (see Table 7-2 and Table 7-4)
- for skiing or snowboarding, chemical addition and higher level disinfection would be required (see Table 7-4)
- no potential application sites identified in the Salmon Arm area

9.9.8 Option 8 – Deep Well Injection or Exfiltration Basins for Groundwater Recharge

- this application is extensively practiced in the drier areas of the U.S.A. where potable water is in short supply and aquifers are a major source of potable water (i.e., indirect potable reuse)
- the MSR does not identify this reuse category (see Table 7-4)
- this method could potentially eliminate direct discharge to Salmon Arm Bay
- hydrogeological and environmental impact studies would be required to identify suitable locations for injection wells and to evaluate potential impacts on groundwater
- the feasibility of well injection and/or infiltration basins is highly dependant upon local aquifer hydraulics and on the distance to water supply wells (i.e. vertical and lateral permeability, distance to hydraulic boundary conditions)
- although this option may be technically feasible, public perception and inexperience with deep disposal systems by local regulators may make this option difficult to implement.
- sustained “year-round’ deep well injection is possible, but the capital and maintenance costs associates with this option are likely much greater than irrigation - this is due to the requirements for injection well maintenance, fluid de-aeration, and well field/aquifer monitoring
- in general groundwater exfiltration is less expensive and potentially more reliable than deep well injection

There is currently not enough information available to determine the requirements of site-specific feasibility studies required for ground disposal options. A literature review and desktop study should initially be conducted to evaluate the following:

- assess the feasibility of using ground disposal (Options 1, 2, 4 and 8 identified above) within the Regional District;
- identify potentially suitable and unsuitable areas for each of the disposal options;

- identify any technical studies required prior to proceeding with site-specific feasibility studies (including scope, budget and time fame); and
- identify scope, budget and time requirements required for site-specific feasibility studies (depending upon the outcome of the proposed literature review/desk study).

The estimated cost of the above desktop study is $20,000.

9.9.9 Option 9 – Dual Distribution

- would require higher level of treatment than that proposed for WPCC Stage IIIB (see Table 7-2 and Table 7-4)
- this is practiced in some of the drier areas of the U.S.
- dual piping system required, one for potable water and one for reclaimed water
- reclaimed water used for fire protection, landscape irrigation (including individual homes using sub-surface systems) and toilet flushing
- can significantly reduce potable water demand
- normally cost-effective only for arid areas where potable water is in short supply

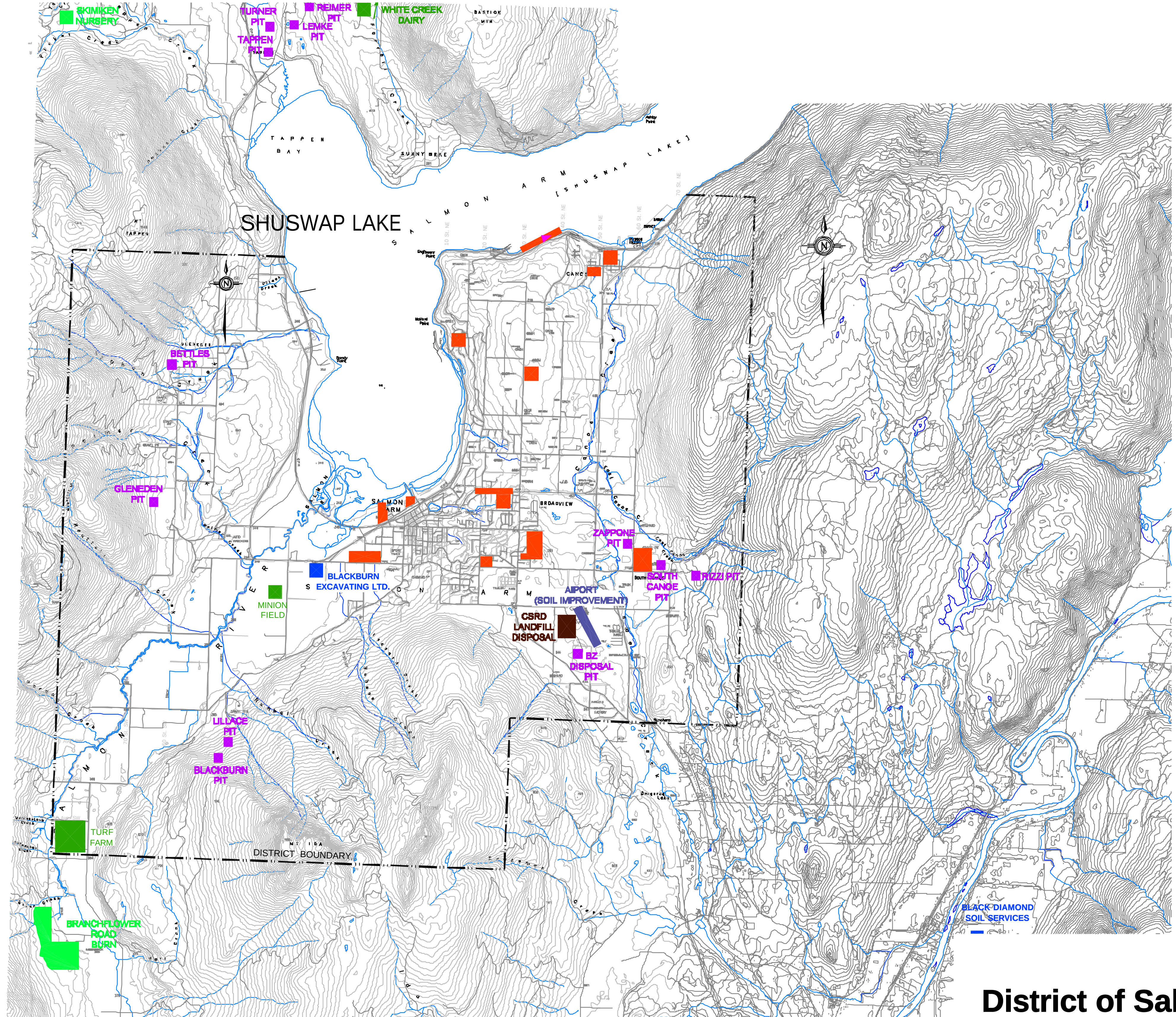
9.10 Biosolids Reuse

The District should incorporate the biosolids reuse strategies recently developed in other projects into the LWMP. The following recommendations are based on the analysis presented in earlier studies (e.g., Dayton & Knight Ltd., 2002d). Budget amounts and other key issues are summarized in Table 9-9. Potential biosolids reuse locations listed in Table 9-9 is illustrated on Figure 9-5.

1. The District should initiate a long-term biosolids management strategy that includes more than one end user. This is essential in the event that one or more options become unavailable over time, due to changing circumstances.

LEGEND

- AGRICULTURE
- TOPSOIL PRODUCER
- DISTRICT OF SALMON ARM RECREATIONAL PROPERTY (PARKS, SPORTS FIELDS)
- GRAVEL PIT
- FORESTRY/SILVICULTURE
- AIPORT
- LANDFILL
- DISTRICT OF SALMON ARM BOUNDARY



0 500 1000 1500 2000
SCALE IN METRES

NOTE:

1. WIDTH OF ENVIROMENTALLY SENSITIVE WATERCOURSES IS NOT TO SCALE REFER TO POLICY 3.5.1
2. ALL DESIGNATIONS ARE CONCEPTUAL ONLY. SUBJECT TO SITE SURVEY.
3. INVENTORY OF STEEP SLOPE HAZARDOUS AREAS IS NOT COMPLETE. ADDITIONAL DETAILED MAPPING IS REQUIRED.

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District of Salmon Arm Potential Biosolids Reuse Sites

(adapted from Dayton & Knight Ltd., 2002d)

Figure 9-5

2. The District should pursue topsoil production using biosolids as a potential strategy for the long-term future. Both privately operated and publicly operated facilities are possible. Discussions with local topsoil suppliers and with the Columbia-Shuswap Regional District should be initiated, with a view to identifying a suitable site for a facility and establishing long-term binding agreements. A pilot-scale operation should be initiated by the District to develop accurate costs and assess the feasibility of a full-scale District-owned facility.

3. The District should pursue agricultural applications for biosolids reuse. Application sites where no acceptance fee would be applicable should be given priority (e.g., Minion Field). The cost effectiveness of applications to privately owned agricultural land would depend on the acceptance fee charged by the land owner/farm operator.

4. Forest fertilization should be identified as a potential biosolids reuse strategy for the immediate and long-term future. There is a large reforestation site available near the WPCC, and the Ministry of Forests has expressed interest in supporting such a project. The District should approach the Ministry of Forests, Salmon Arm office, to initiate discussion/negotiation for biosolids application to this site. The potential for cost sharing between the District and the Ministry should be explored. The initial applications should be designed as public demonstration/education projects if possible.

5. The District should approach the B.C. Ministry of Transportation and Highways and local private gravel pit operators to initiate discussions regarding a pilot-scale land reclamation demonstration project at a borrow pit or disturbed highways site in the Salmon Arm area. The number and area of potential application sites should be identified early in the discussions, to evaluate the long-term sustainability of this option.

6. The public education and outreach program regarding biosolids reuse should be continued and extended to include other initiatives as well as agriculture.

7. The District should pursue funding sources to support the long-term biosolids management strategy.

8. The District should undertake a source control program to ensure the quality of the WPCC effluent and biosolids, and to protect the biological treatment process at the WPCC. This should include education, enforcement, and review of the sewer connection bylaw (see Section 4.1).

TABLE 9-9 - SUMMARY OF BIOSOLIDS REUSE OPTIONS (from Dayton & Knight Ltd., 2002d)

Option	Regulatory Requirements	Cost – Annual – 2002	Cost – Annual – 2022	Cost – 20 Year Present Worth – Total	Cost – 20 Year Present Worth – Unit	Beneficial Reuse Potential/Sustainability	Potential for Stakeholder Acceptance
• Forest Fertilization (dewatered, 10 km one-way haul).	- requires Land Application Plan under OMRR - Class A or Class B biosolids	\$30,700	\$59,400	\$495,000	\$11/m^3	- high sustainability due to extensive lands available. - financial assistance may be available from Ministry of Forests	- high public acceptance - benefits local economy (forestry) over the long term.
• Gravel Pit Reclamation (dewatered, 10 km one-way haul)	- requires Land Application Plan under OMRR - Class A or Class B biosolids	\$33,300	\$64,300	\$517,000	\$12/m^3	- potential application land area unknown - numerous potential locations near Salmon Arm	- requires pilot-scale demonstrations - high public acceptance
• Reclamation of Disturbed Highways Sites in Kamloops area (65 km one-way haul)	- requires Approval under OMRR - Class A biosolids for publicly accessible areas	\$44,000	\$88,000	\$700,000	\$16/m^3	- potential application land area unknown	- requires pilot scale demonstration - high public acceptance for product
• Composting Facility (not including land, transportation, regulatory approvals, marketing, or cost recovery through sale of compost).	- facility must meet requirements listed in OMRR, including environmental impact assessment and leachate management - Class A or Class B biosolids	\$535,000	\$685,000	\$6,800,000	\$157/m^3	- produces a very marketable Class A product. - some potential for revenue	- high public acceptance for product. - may be resistance from private compost suppliers
• Topsoil Production (not including odour control, marketing of product, supply of materials other than biosolids, or cost recovery through sale of product.	- must meet Class A pathogen and vector attraction reduction criteria	\$7,700 to \$17,600[2]	\$17,500 to \$40,000[2]	\$130,000 to \$301,000	\$3/m^3 to \$7/m^3	- sustainability depends on local market for topsoil - some potential for revenue or use of product by District	- public consultation required - joint venture with CSRD and/or private sector possible
• Shuswap Regional Airport (liquid or dewatered, 5.5 km one-way haul, 60 DT/yr only)	- District already holds Permit - Class A or Class B biosolids	Liquid \$21,400 Dewatered \$5,200	Liquid \$21,400 Dewatered \$5,200	Liquid \$245,000 Dewatered \$63,000	Liquid N/A Dewatered \$1/m^3	- limited land area available - reliable emergency standby reuse option for partial biosolids reuse	- has been practiced in the past with no public resistance
• CSRD Landfill (dewatered, 7 km one-way haul, tipping fee \$30/m^3)	- none - Class A or Class B biosolids	\$47,300	\$107,500	\$800,000	\$19/m^3	- disposal only, no beneficial reuse - no environmental benefits gained from recycling	- limited
• Agricultural application at Minion Field[3]	- District already has authorization	\$16,200	\$28,500	\$225,000	\$5/m^3	- extensive agricultural land available in the area	- high
• Agricultural application at White Creek Dairy[3]	- District already has authorization - land application in place.	\$44,900	\$83,400	\$770,000	\$18/m^3	- demonstration trial	- high

1 assumes real interest rate of 6% annually, 20 year amortization of capital costs.
2 for facility located at Salmon Arm – low cost assumes no acceptance fee, high cost assumes acceptance fee of \$7.50/m^3
3 information provided by District of Salmon Arm

10.0 STORMWATER MANAGEMENT

Development generally increases the volume and rate of storm surface runoff, due to an increase in the amount of impervious area caused by the construction of roofs and paved surfaces. The increased runoff caused by development can cause flooding in downstream areas, increase erosion in watercourses, and reduce dry season stream flows due to lower groundwater reserves. Development is also known to increase the pollutant load carried to receiving waters by surface runoff; much of the contaminant load in the surface runoff from urban areas is associated with the operation of motor vehicles.

In the past, many storm drainage facilities were designed for flood control only, based on relatively large storms. Storm surface drainage is now recognized as a significant source of contamination of surface waters. It has also been recognized that frequently occurring smaller storms can cause more erosion damage to streams than occasional large events. The implementation of Best Management Practices (BMPs) to reduce contamination of receiving waters by storm surface runoff and to preserve the natural hydrologic cycle is encouraged by the Province, but Provincial regulations regarding the quality of surface runoff discharges have not yet been developed. The Province has published guidelines to assist municipalities in developing programs to improve the quality of urban surface runoff (e.g., B.C. Environment, 1992b and CH_2M Hill and Lanarc, 2002). Some restrictions on surface runoff discharges are provided under the Federal Fisheries Act, mainly relating to negative impacts on fish habitat. Stormwater management for flood control, erosion control, and water quality enhancement is also addressed in land development guidelines for the protection of aquatic habitat developed by Federal Fisheries and the Province (DFO/MELP, 1992).

Stormwater issues are best addressed on a watershed basis, by considering drainage area boundaries rather than political boundaries. For effective stormwater management, the issues of flood control, erosion control, and pollution control should all be coordinated on a watershed-encompassing scale. If watershed issues are not considered, flood control works which may improve the situation for a specific area can actually increase flooding and erosion in downstream areas. In addition, regulatory and educational approaches for source control of pollutants entering the storm drainage system are similar in nature to those for sanitary sewer systems. A watershed approach can avoid costly duplication of effort, and result in regulatory and educational programs which are consistent with water quality objectives developed for the entire watershed (B.C. Environment 1992b).

10.1 Runoff Quantity

The amount and rate of runoff from a particular storm event are affected by the ground moisture conditions, soil and cover type, and the amount of pervious and impervious ground cover. Development causes a change of ground surface from pervious to impervious through the construction of roofs, streets, sidewalks and parking lots, and consequently speeds the runoff rate and increases the runoff volume, due to a reduction in rainfall losses from surface wetting, depression storage, and soil infiltration. Catchment areas not covered by impervious surfaces are often landscaped. Landscaped areas are normally covered with vegetation and are often treated with chemicals; this may contribute to increased pollutant levels.

Once the overland runoff collects into channels or drainage pipes, it increases to a peak or to several peaks during and after a storm. The water is stored and released from numerous natural or man-made channels and basins, which affect the time-distribution of the runoff hydrograph (the hydrograph is a plot describing the pattern of the runoff flow rate). Improved or increased hydraulic capacity in the urban drainage system to prevent flooding of low-lying areas can significantly alter the runoff process. When natural channels are deepened, lined, and straightened or when storm sewers are installed, watershed storage time is reduced, and the peak rate of runoff is increased. Man-made structures can be provided to replace natural detention in stream channels, floodplains, and ponds.

According to Rantz (1971) the change from rural to urban, with the construction of storm sewers and without storage detention, have increased drainage peaks from 1 to 4 times for 2-year recurrence rainfalls, up to 3 times for 10-year recurrence intervals, up to 2.75 times for 25-year recurrence intervals, and up to 2.50 times for 100 year recurrence intervals. Cook (1986) found similar effects for a small controlled drainage basin in Ontario. The recurrence interval is a statistical parameter that describes the probable time interval between rainstorms of a given size (e.g., the 2 year recurrence rainfall is the relatively small rainstorm that will occur on average once very two years, and the 100 year recurrence rainfall is the much larger rainstorm that will occur on average only once every 100 years). Because of the increased flows brought about by urban development, criteria for handling or reducing these increased flows must be developed. Drainage design criteria have to some extent been addressed by the District within the study area in the Official Community Plan, as described in Section 9.4.

Drainage design should incorporate a minor and major system. The minor system is usually designed to handle storm flows from 2 to 25 year rainfall recurrence intervals, and the major system is designed to handle excess flows up to 100-year recurrence intervals. The minor system normally consists of catchbasins, manholes and pipes or ditches, handles local drainage from developed areas, and remains separate from the major system. The major system provides higher flood protection by routing large flows that overwhelm the minor system along streets, in major channels, in special floodways, and through large storm sewers. In some cases, an overland route is not feasible for the major system, and it must be combined with the minor system in a pipeline, particularly in areas of existing development which were not laid out with the two-system concept in mind. Erosion protection, provisions for sediment transport or reduction, and stream pollution also become important when the design method is selected.

The minor-major system, erosion-sediment control, and pollution control are management responsibilities, as well as design responsibilities. Management objectives and criteria must be set out for protecting major flood routes for erosion-sediment reduction and for minimizing the pollution of watercourses.

If flood control by construction of drainage works is the desired solution, management options generally include the following:

- improved channel hydraulics;
- diversion of portions or all of the flow;
- delay of peaks through detention facilities;
- policy changes to reduce runoff, such as land development policy changes;
- purchase of floodplain and use restrictions; and
- combinations of the above.

Runoff rates can be reduced by storage in creeks or floodplains, and also in man-made detention facilities. Hydrologic and hydraulic computer models can be used to determine the rates, volumes and effects of runoff for pre-development and post-development conditions, to identify potential problem areas, and to evaluate the effects of alternative drainage solutions. Modelling of surface runoff flows and the evaluation of alternative solutions have been carried out to some extent for most of the catchments within the study area, as described in Section 10.3.

10.2 Runoff Quality

Monitoring of urban runoff quality is a complex and costly undertaking, due to the transient nature of the flows and the number of water analyses required. In general, runoff quality has been observed to vary widely at individual sampling sites during the course of a single storm, among different storms at individual sites, and among different sampling sites during the same storm. This makes it difficult to develop “typical” contaminant levels in storm runoff.

Comprehensive long-term studies regarding the quality of urban surface runoff have been carried out in the U.S. and elsewhere. The results are summarized and compared to B.C. Environment criteria for the protection of aquatic life in Table 1.1 in Appendix 5 (from B.C. Env., 1992b). As shown, constituents found in general urban runoff which frequently exceed the B.C. Environment water quality criteria include suspended solids, lead, copper, zinc, cadmium, chromium, nickel, arsenic, and phosphorus. Runoff from heavily-travelled highways and roads may exceed B.C. Environment criteria for polynuclear aromatic hydrocarbons, in addition to the constituents listed above.

No studies describing the quality of storm surface runoff within the District of Salmon Arm were found. Based on data from other jurisdictions, potential sources of contamination within the District are as follows:

- pesticide use – harmful organic compounds;
- fertilizer use – nutrients, primarily nitrogen and phosphorus;
- construction activities – sediment, petroleum products, garbage, chemicals, concrete washwater;
- household activities – illicit dumping of hazardous chemicals, vehicle washing, pet washes, decaying yard wastes;
- motor vehicles – metals and hydrocarbons from fluid leaks, particles from clutch and brake linings, corrosion of parts;
- industrial and commercial activities – metals and organic contaminants;
- cross-connections with the sanitary sewer system; and
- roadway de-icers – salt, toxic metals, cyanide (used as an anti-caking ingredient).

Areas within the District that have the potential to generate significant contamination of surface runoff include highways, vehicle storage and repair yards (including large parking lots), industrial areas, and pesticide and fertilizer use by householders, private businesses, and municipal operations.

Regulation of storm surface runoff quality is difficult, due to the transient nature of storm events and the wide variations in contaminant concentrations typically observed. In general, source controls are preferred over treatment, due to the cost and the unproven nature of many stormwater treatment processes (Gibb et.al., 1991). Key elements in a source control program for stormwater quality management include maintenance and protection of the existing storm drain system (regular cleaning of catchbasins, elimination of illicit connections), modification of domestic and non-domestic practices to reduce or eliminate the production of pollutants or to prevent contact between pollutants and stormwater runoff, and on-site structural Best Management Practices (BMPs) to remove or reduce the pollutant load in surface runoff, before it enters the drainage system.

Management solutions for the enhancement of urban runoff quality include both structural and non-structural approaches. Non-structural management solutions include source controls (regulatory and educational) and land use regulations. Structural approaches include the construction of stormwater treatment facilities which are often referred to as Best Management Practices (BMPs); these include the following measures:

- oil-water separators;
- swirl concentrators for sediment removal;
- dry detention ponds for sedimentation;
- physical-chemical treatment;
- wet detention ponds;
- wetlands;
- grassed swales;
- vegetated filter strips;
- infiltration basin and trenches; and
- porous pavement.

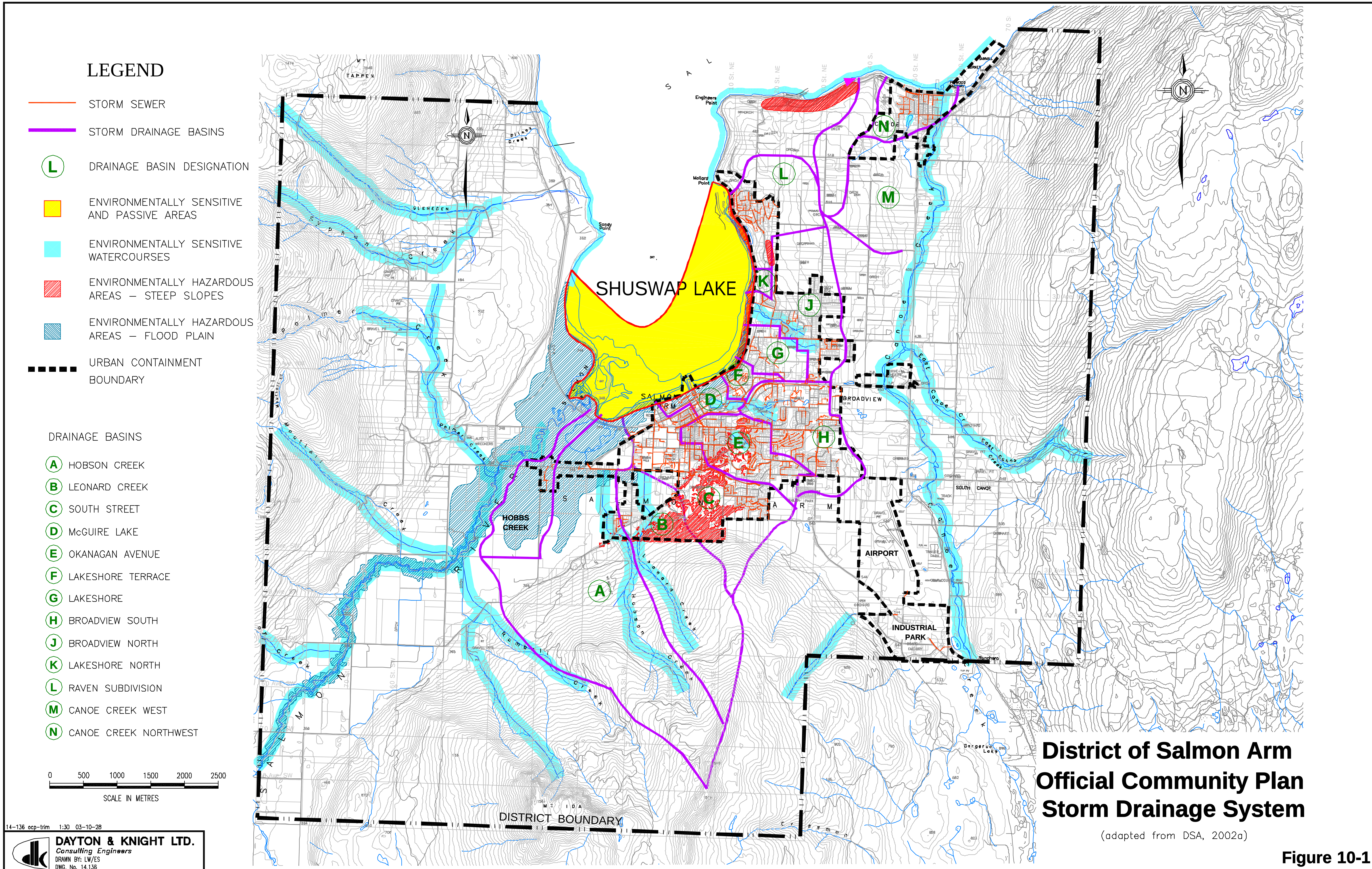
The documented effectiveness of the above treatment technologies is summarized in Table 2.1 in Appendix 5.

Non-structural approaches to eliminate the production of runoff pollutants or to prevent contact between pollutants and runoff are a practical first step; since these methods can have positive impacts and have a relatively low cost. In situations where non-structural approaches are insufficient (e.g., heavily-travelled roads, some industrial activities, vehicle storage and repair yards), structural BMPs may be required to achieve the desired runoff water quality. The use of stormwater treatment BMPs is highly site-specific; procedures for applying BMPs to specific situations are available (e.g., B.C. Environment, 1992b and Dayton & Knight Ltd. et.al., 1999). Both structural and non-structural approaches are usually evaluated when comprehensive drainage studies are carried out for individual catchments.

10.3 Existing Drainage Facilities, Policies and Regulations

Two comprehensive drainage studies have been carried out within the study area (Dayton & Knight Ltd., 1976 and Dayton & Knight Ltd., 1991), supplemented by a number of smaller projects aimed at solving localized drainage problems. The two comprehensive studies contain descriptions of basin character, land use and fisheries resource, assessments of existing drainage systems, evaluation and costing of alternative improvements, and recommendations for the most cost effective stormwater management plan. The studies include discussion of the environmental aspects of urban surface runoff, in addition to flood and erosion control. In general, the studies recommended preservation of the existing natural creeks and ponds, which is consistent with the currently accepted approach of preserving natural hydrologic processes whenever possible, rather than attempting to replace these processes with man-made structures. This approach is also enshrined in the District's Official Community Plan (OCP).

Existing storm drainage facilities include storm drain piping and open channels in urban areas, open drainage ditches and natural watercourses in rural areas and natural detention storage in ponds and lakes. The existing storm drainage system for the District of Salmon Arm is illustrated on Figure 10-1. According to the OCP, planning and design for the storm system has been based on the 25 year return period storm event. The District has gradually



District of Salmon Arm
Official Community Plan
Storm Drainage System

(adapted from DSA, 2002a)

Figure 10-1

been upgrading its storm sewer system to urban standards as development has proceeded within the Urban Containment Boundary. Urban standards as defined in the OCP include storm sewers and paved streets with curb and gutter (and sidewalks in some cases), while rural standards are based on open ditching and paved streets with gravel shoulders (DSA, 2002a). New development is required to ensure that post-development flows do not exceed pre-development flows. The OCP states that the District will continue to use the existing natural drainage pattern as the primary storm drainage system, and that detention/retention will continue to be the principal means of controlling post-development flows. Stormwater facilities are to be designed and constructed in an environmentally sensitive manner in recognition that final discharges flow into Shuswap Lake. Funding for major storm drainage components is to continue to be provided from General Revenue and Development Cost Charge Reserve Funds, with minor (local) improvements financed by local improvement/specified area charges. In the OCP, the District commits to working with various levels of government to control the quality of surface runoff from new development areas. Specific measures required by the District for development may include on-site siltation control. The District also commits to undertaking a comprehensive review of the storm drainage system during the term of the OCP.

The District of Salmon Arm Sewer Connection Bylaw No. 1410 contains the following restrictions for storm water discharges. Bylaw No. 1410 states that the District Council or the Local Board of Health may require any property owner to connect to the public sewer (includes storm drains).

a) No person shall discharge into any ditch, drain, creek, stream, watercourse, waterway, lake or bay, without first obtaining permission to do so from the Superintendent, any sanitary sewage, other waters, industrial wastes, petroleum products, coal tar, or any refuse of any kind whatsoever.

b) Where no sewer is available the Superintendent may, upon application therefor, grant permission for the discharge to or into any ditch, drain creek, stream, watercourse, waterway, lake or bay, subject to such standards of quality, quantity and rate of discharge as the Superintendent may prescribe upon granting his permission aforesaid, of storm water, sanitary sewage, industrial wastes or other wastes, and subject to the approval of the Ministry of Environment.

c) Where no appropriate sewer is available or where it is considered that the proposed discharge would be injurious to or in any way overload the sewer or sewage system, an industry shall discharge its wastes into such natural outlet or watercourse as may be prescribed, subject to such standards of quality, quantity and rate of discharge as may be prescribed by the Ministry of Environment.

d) In any event the District may require any industry to discharge unpolluted cooling water or other unpolluted waters into a natural outlet or watercourse rather than into a public sewer.

In addition, Bylaw No. 1410 prohibits the discharge of substances that may obstruct the sewer. The substance limits listed in Section 7.1.1 for sanitary sewer source control also apply to storm sewers within the District. Other prohibited discharges include the following:

- flammable and explosive wastes;
- toxic or poisonous substances;
- radioactive wastes; and
- undesirable colour or obnoxious gases.

Dayton & Knight Ltd. (1991) provided descriptions of the individual drainage basins within the District, together with known drainage problems, and recommended solutions. The basins are identified on Figure 10-1, and are described briefly below, together with two basins not included in the 1991 study, namely Hobbs Creek and the Airport/Industrial Park area. The environmentally sensitive areas identified earlier on Figure 6-3 are included on Figure 10-1 for convenience. Most of the drainage basins discharge to Salmon Arm Bay.

10.3.1 Hobbs Creek

This basin borders the eastern edge of the Salmon River near the mouth (see Figure 10-1). The total Hobbs Creek drainage area is approximately 141.5 hectares. Approximately 85% of the basin is flat agricultural fields and the remainder (NE corner) is developed as a light industrial subdivision. The existing drainage system is combined overland drainage flowing through a series of open ditches, culverts and storm sewers. At the lowest end of the drainage study area, stormwater is confined to a 600 millimetre diameter culvert crossing the Trans-Canada Highway, which appears to be causing flooding during storm events. Recommended improvements are to upgrade undersized storm sewers and ditches within the basin, and to replace the culvert crossing the Trans-Canada Highway with a larger diameter culvert (Dayton & Knight Ltd. 1998). The Hobbs Creek Basin lies entirely within the floodplain of the Salmon River. As shown on Figure 10-1, no environmentally sensitive surface water bodies were identified in the OCP within the Hobbs Creek Basin (True Consulting, 2002).

10.3.2 Basin A (Hobson Creek)

This 820 hectare watershed originates high on Mt. Ida south of Downtown Salmon Arm. The Creek flows down the mountain side to Foothill Road, and then northerly in an open ditch through farmlands directly to Shuswap Lake. Little additional urban development is envisioned to take place in the Hobson basin. Logging in the watershed will increase runoff to some extent. There are relatively limited opportunities for storage to manage peak runoff flows (about 160,000 cubic metres of storage capacity would be required). The recommended approach was to divert the peak storm discharges from Hobson Creek into the 10th Street (Piccadilly) ditch to 10th Avenue S.W. (Rotten Row), which then enters the 1700 millimetre diameter culvert along 10th Avenue. This culvert takes the water west along 10th Avenue across the Trans Canada Highway, and finally into a back eddy of Shuswap Lake in the Band Lands. Alternatively, a watercourse to the Salmon River could be considered (or upgrading of the existing ditches now serving the watershed), but this may not be readily implementable because of land requirements (Dayton & Knight Ltd., 1991). As shown on Figure 10-1, Hobson Creek was identified as an environmentally sensitive watercourse in the OCP. Small pockets of environmentally hazardous terrain (steep slopes) were identified along the foot of Mount Ida near Hobson Creek. The lower portion of this basin lies within the floodplain of the Salmon River (True Consulting, 2002).

10.3.3 Basin B (Leonard Creek)

This 506 hectare watershed originates high on Mt. Ida south of Downtown Salmon Arm. Similar to Hobson Creek, the water flows across Foothill Road and then through farmlands in an open ditch to 10th Avenue S.W., where it enters the 1700 millimetre diameter pipe. Little urban development is expected take place in this basin. The recommended management of Leonard Creek flows was similar to that for Hobson Creek. It was found that detention storage would not be cost effective, and that open channel diversion to Salmon River would be problematic because of land requirements. The 1700 millimetre diameter storm sewer on 10th Avenue S.W. was found to have the needed capacity to carry the flows from Basin B along with those from Basin A (Dayton & Knight Ltd., 1991). As shown on Figure 10-1, Leonard Creek was identified in the OCP as an environmentally sensitive watercourse. Large tracts of environmentally hazardous terrain (steep slopes) were identified along the foot of Mount Ida east of Leonard Creek (True Consulting, 2002). District staff report significant erosion in the upper reaches of Leonard Creek.

10.3.4 Basin C (South Street Basin)

This 308 hectare watershed starts relatively low on Mt. Ida and the water concentrates along 10th Avenue, finally reaching the low ground near Shuswap Street. From the low ground the water is directed into a 600 millimetre diameter culvert through the residential retirement development to the west, and then northwards in a 900 millimetre diameter pipe to discharge to Shuswap Lake at the east boundary of the Band Lands near the Water Pollution Control Centre. This basin will see considerable additional urbanization, including some redevelopment in its lower levels. A portion of this basin discharges through the 900 millimetre diameter drain, but the capacity of this drain was found to be limited to 1.1 cubic metres/second. The land which used to flood and mitigate the peak flows has now been largely filled in and developed (Shuswap and Rotten Row), and there are very limited opportunities for storage available. A review was made to provide dry storage in the low lands at Rotten Row and Shuswap, but the downstream pipe diameter would only be decreased from 1500 millimetres to 1450 millimetres by the very maximum of storage now feasible in this area. Flows in excess of the capacity of the 900 mm diameter pipe could be diverted to the 1700 millimetre diameter storm drain along 10th Avenue (Dayton & Knight Ltd., 1991). As shown on Figure 10-1, no environmentally sensitive surface water bodies were identified in the OCP in Basin C. Large areas of environmentally hazardous terrain (steep slopes) were identified in the upper portion of Basin C east of Shuswap Street (True Consulting, 2002).

10.3.5 Basin D (McGuire Lake Basin)

This is a small (44 hectare) basin in part feeding McGuire Lake, which is drained by a 200 millimetre diameter system to Shuswap Lake near Marine Park Drive. The basin is also partly fed from Basin H (above the Trans-Canada Highway) by a 450 millimetre storm drain discharge to McGuire Lake. A 600 millimetre system drains Basin D discharging to Shuswap Lake near Marine Park Drive. A new 1525 millimetre diameter system (1200 millimetre diameter across the railway track and in the upper reaches near the Municipal Hall) has been installed through the western portion of Basin D, discharging to Shuswap Lake near 10th Avenue N.E. Basin D is largely developed, but some redevelopment may take place. The concerns with drainage in Basin D centre on the pollutant loading to McGuire Lake (particularly on the untreated Trans-Canada Highway discharges), and secondly on increasing peak flows in areas D, E and H as well as from the Highway. The highway flows have now been bypassed around McGuire Lake. Additional alternatives for upgrading include the mitigation of upstream basin H discharges by retention/detention, and a major interceptor (mainly through Basin F) directly to Shuswap Lake (Dayton & Knight Ltd., 1991). As shown on Figure 10-1, McGuire Lake and its tributary stream were identified in the OCP as environmentally sensitive water bodies (True Consulting, 2002).

10.3.6 Basin E (Okanagan Avenue)

This 178 hectare basin starts below 10th Avenue S.E. just above Auto Road, and discharges through several hillside streams down to 6th Street, and along 6th Street down to Okanagan Avenue. Part of the basin is also drained directly by Okanagan Avenue storm drains to 6th Street, and a small portion of Basin E reaches the Trans-Canada Highway. Eventually, almost all Basin E runoff flows via Okanagan Avenue to the older 600 millimetre diameter drain and the newer 1200 millimetre diameter drain near the Municipal Hall, and then through the 1500 millimetre diameter system through Downtown to Shuswap Lake near Ross Street. The small portion reaching the Trans-Canada Highway ditch goes to McGuire Lake. Basin E will see considerable future urbanization. The alternatives for upgrading include the extension of the 1500 to 1200 millimetre diameter system from the Municipal Hall uphill into the basin, some retention/detention in the upstream watersheds, and a partial diversion of the watershed to the 1700 millimetre diameter 10th Avenue drain through Basin C (South Street). The latter was concluded to be particularly cost effective (Dayton & Knight Ltd., 1991). As shown on Figure 10-1, a short reach of open stream located near the centre of Basin E was identified in the OCP as an environmentally sensitive watercourse. Environmentally hazardous areas (steep slopes) were identified on both sides of this watercourse (True Consulting, 2002).

10.3.7 Basin F (Lakeshore Terrace Basin)

This is a small (24 hectare) developing basin, the drainage from which could be directed south-westerly along Lakeshore Road into the 1500 millimetre diameter railway culvert. Almost all Trans-Canada Highway drainage and drainage from upstream basin H has to be brought through this basin. Some of Basin F now flows into McGuire Lake. The management of the Basin F flows was recommended to include an interceptor along Lakeshore Road to the existing 1500 millimetre diameter culvert under the railway tracks. The Trans-Canada Highway/Basin H relief drain also runs though Basin F, reducing the flows from these areas into Basin D and McGuire Lake (Dayton & Knight Ltd., 1991). As shown on Figure 10-1, no environmentally sensitive surface water bodies were identified in the OCP in Basin F (True Consulting, 2002).

10.3.8 Basin G (Lakeshore)

This 68 hectare basin is all below the Trans-Canada Highway and is served by a small creek and a 1050 millimetre diameter drainage system, discharging near 17th Avenue N.E. Basin G will see considerable urbanization. Retention/detention was found to be feasible for Basin G. A major threat to the drainage in this area is the new Trans-Canada Highway north frontage road drainage, which naturally flows into this watershed. Most of the Highway north frontage drainage has now been routed back onto the Highway and down to Basin F, where upgrading costs are much lower than in Basin G (Dayton & Knight Ltd., 1991). As shown on Figure 10-1, no environmentally sensitive surface water bodies was identified in the OCP in Basin G. The area along the shore of Shuswap Lake was identified as environmentally hazardous because of steep slopes (True Consulting, 2002).

10.3.9 Basin H (Broadview South Basin)

This 233 hectare basin covers the large undulating area around Upper Broadview (Broadview South) in the urban development area. Basin H contains several periodically non overflowing small ponds. A considerable amount of runoff is now conveyed via groundwater flow from the upper areas to the lower levels, reappearing at or near Okanagan Avenue. The concentration point for most of Basin H is the 14th Street area, where a 450 millimetre diameter stormdrain now takes the water to McGuire Lake. Some of the drainage from Basin H flows to the 600 millimetre diameter drain in the Lakeview Drive area in Area F. The lower reaches of the basin receive groundwater release from the upper reaches. This is a very important urbanization basin in Salmon Arm. The opportunities for stormwater management in this area are diverse. It may be feasible to reduce the runoff discharges because of the multitude of underground flow and storage possibilities in this watershed (Dayton & Knight Ltd., 1991). As shown on Figure 10-1, several small environmentally sensitive watercourses were identified in the OCP in the lower reaches of Basin H (True Consulting, 2002).

10.3.10 Basin J (Broadview North)

This 330 hectare basin is quite similar to Basin H, and contains several small non overflowing lakes. The water generally surfaces in a small creek, which flows westerly to Shuswap Lake. A portion of this basin is outside the development area on the ridge separating Shuswap Lake and Canoe Creek; this portion is mainly bare farmland. Considerable additional development is expected to take place in the urban portion of Basin J. This basin has the potential for storage of runoff combined with open watercourse conveyance. Interception and safe downhill conveyance of snowmelt runoff from the agricultural and non urban lands is needed. The piped system through this area has been extended to minimize erosion channels associated with prolonged winter discharges, but interception is also required (Dayton & Knight Ltd., 1991). As shown on Figure 10-1, the surface streams in Basin J were identified in the OCP as environmentally sensitive watercourses. The area along the shore of Shuswap Lake was identified as environmentally hazardous because of steep slopes (True Consulting, 2002).

10.3.11 Basin K (Lakeshore)

This is a very small (21 hectare) basin on the shore of Shuswap Lake near the railway. Basin K is undeveloped at this time because it is quite steep. This is a very small area, and drainage development has not many options. A new 600 millimetre diameter pipe across the railway was recommended (Dayton & Knight Ltd., 1991). As shown on Figure 10-1, no environmentally sensitive surface water bodies were identified in the OCP in Basin K. The area along the shore of Shuswap Lake was identified as environmentally hazardous because of steep slopes (True Consulting, 2002).

10.3.12

Basin L (Raven Subdivision)

This 204 hectare basin is the northernmost in the major urban development area. Basin L houses the Raven Subdivision, which has a drainage system discharging to Shuswap Lake. A considerable portion of Basin L is in the non-urban area on the ridge separating Shuswap Lake and Canoe Creek, which at times (particularly in the winter) contributes runoff to the storm sewer system. Some additional urbanization is foreseen for the southern portions of Basin L. A storm sewer system to serve the northern portion of the Basin has been started for the Raven Subdivision. The system is mainly adequate, with the exception being management of the uphill runoff during snowmelt (Dayton & Knight Ltd., 1991). As shown on Figure 10-1, no environmentally sensitive surface water bodies were identified in Basin L in the OCP. Environmentally hazardous areas (steep slopes) were identified in the southern portion of the basin along the shore of Shuswap Lake and in a small area upslope (True Consulting, 2002).

10.3.13 Basin M (Canoe West Basin)

This is a large (263 hectare) basin draining to Shuswap Lake at Canoe. Most of Basin M will remain undeveloped. The only significant problem is the existing development in Canoe, which is serviced by inadequate storm sewers (Dayton & Knight Ltd., 1991). As shown on Figure 10-1, the reach of Canoe Creek that lies within Basin M was identified in the OCP as an environmentally sensitive watercourse (True Consulting, 2002).

10.3.14 Basin N (Canoe NW Basin)

This 63 hectare basin is west and slightly north of Canoe. Some growth is envisioned in Basin N, which will overload the natural channel to Shuswap Lake off 20th Avenue N.E., and particularly the railway culvert. A diversion storm drain would improve the chronic high groundwater table in the area planned for development (Dayton & Knight Ltd., 1991). As shown on Figure 10-1, a small lake and the reach of Canoe Creek that lie within Basin

N as well as the shore of Shuswap Lake were identified in the OCP as environmentally sensitive water bodies (True Consulting, 2002).

10.3.15 Industrial Park

Storm drainage in the Industrial Park area was described by Urban Systems (1995). There were reported to be no internal natural drainage courses in this area; with surface runoff draining to a number of low-lying areas, where it eventually seeps into the ground or evaporates. Flooding of roadways and other areas occurs in association with larger storm events.

An intermittent stream called White Creek originating on the eastern slopes of Mount Ida carries spring melt water into the Industrial Park area via a 600 millimetre diameter drain; this water pools in low areas opposite 40th Avenue and 50th Street S.E.

Groundwater levels have not been confirmed, but are believed to be well below the surface. The upper reaches of Canoe Creek lie to the east of the Industrial Park across Highway 97B. Urban Systems (1995) recommended a combination open ditch and large diameter storm drain system to divert flows from White Creek around the Industrial Park area to Canoe Creek. A conventional ditch and pipe conveyance system draining problem areas within the existing and future Industrial Park to Canoe Creek was recommended and was subsequently constructed (infiltration may also be possible depending on soil conditions). It was noted that Canoe Creek is an environmentally sensitive stream (Figure 10-1), and that water quality is important to protect fisheries. Routing of collected stormwater to detention/treatment ponds prior to discharge to Canoe Creek was recommended. A natural marsh approximately one square kilometre in size was identified as a potential detention facility to control peak flows to Canoe Creek (Urban Systems, 1995).

10.4 Drainage Improvements

The estimated costs for drainage works needed for the growth to a 25,000 population in the urban development area (Basins A through N) were identified by Dayton & Knight Ltd. (1997b). Some of the works have been constructed, and some remain to be implemented. The costs (1997 dollars) are summarized in Table 10-1.

TABLE 10-1
COST OF DRAINAGE WORKS AND ACTIONS FOR 15 TO 20 YEAR HORIZON

		1997 $ Capital Cost
1. Recent construction requiring borrowing (insufficient DCC fund or insufficient grants) which benefits future growth and development (Okanagan Avenue Storm Sewer, 10th Avenue downtown storm sewers and miscellaneous work)		1,200,000
2. Updating of watercourse protection and preservation bylaws.		30,000
3. Basin A:	Ditch Upgrading	110,000
4. Basin B&C:	800 m of 600 mm	125,000
5. Basin D:	120 m of 600 mm	70,000
6. Basin F:	460 m of 750 mm 370 m of 600 mm	330,000 135,000
7. Basin G:	310 m of 600 mm 310 m of 900 mm 310 m of 600 mm and lesser diameters 1000 m^3 of storage and water course upgrading	165,000 245,000 135,000 220,000
8. Basin H:	50,000 m^3 of storage and water course upgrading	550,000
9. Basin J:	Uphill runoff upgrades (mainly ditching) 460 m of 900 mm 2600 m of 600 mm and lesser diameter 20,000 m^3 of storage and water course upgrading	305,000 40,000 1,125,000 330,000
10. Basin K:	150 m of 600 mm including railway crossing	165,000
11. Basin L:	510 m of 600 mm and lesser diameter uphill runoff controls	320,000 390,000
12. Basin M&N:	400 m of 600 mm including railway crossing	500,000
13. Stormwater Quality Controls (Sed. Basins)		760,000
14. Industrial area drainage works		800,000
	TOTAL	**$8,050,000**

10.5 Recommended Approach for Stormwater Management

It is recommended that the following stormwater management initiatives be considered for inclusion in the LWMP. Suggested budgets are for consultant assistance and do not include District staff time.

1. The existing drainage studies and plans developed by the District should be updated and consolidated, with the ultimate objective of developing a comprehensive Master Drainage Plan for the entire District. The update should include consideration of land use according to the 2002 Official Community Plan and drainage improvements undertaken since the 1990 Update of Comprehensive Drainage Planning. The update should also set priorities for additional studies for individual watersheds, with the highest priority set on areas that are expected to undergo significant development or redevelopment and where sensitive environmental resources have been identified (see Item 2). Priorities for drainage planning should ensure that detailed watershed studies are conducted in advance of development. Drainage planning should include consideration of the effects of frequent small storms as well as larger, infrequent storms. Budget $75,000 for updating and consolidating existing drainage studies. New studies for designated (priority) areas and catchments can vary in cost from $5,000 to $50,000 or more, depending on the scope of work and level of detail required.

2. The environmental resources identified in Sections 6.3 and 6.4 of the LWMP (unconfined aquifers, sensitive streams and habitat) should form an integral part of drainage planning and development planning within the District. Natural drainage features such as wetlands, groundwater recharge/discharge areas, and stream corridors should continue to be preserved whenever possible. This approach, which is enshrined in the Official Community Plan will minimize the need for manmade drainage structures, thereby reducing costs, and helping to preserve the natural environment. Drainage planning and development planning should be undertaken together, so that drainage issues and protection of natural drainage features such as wetlands and groundwater recharge areas can be considered while the development site plan is being

developed. The District should undertake a review of existing development application approval procedures to ensure that planning, engineering, and operations issues are all considered at an early stage in the development application process. Budget $20,000.

3. The District's drainage design criteria for subdivision servicing should also be reviewed, to ensure that they are in accordance with current drainage practice and regulatory requirements. Detailed criteria should be developed for both major and minor drainage systems. Budget $30,000.

4. A storm drainage bylaw and accompanying enforcement policy should be developed, to ensure that the District has the authority to regulate all aspects of stormwater management, including flood control, erosion control, and water quality. The bylaw should consolidate drainage design criteria (see Item 2) as well as other aspects of drainage (e.g. Bylaw No. 1410), and should also ensure that sensitive environmental resources such as fisheries streams and groundwater can be protected from spills and contaminated runoff (e.g., from commercial/industrial sites). This is particularly important for the Industrial Park area, which drains to Canoe Creek, a sensitive fisheries stream. Budget $20,000.

5. Onsite infiltration of precipitation rather than collection and offsite conveyance of runoff should be encouraged in areas where ground conditions are shown to be suitable. Before onsite infiltration is undertaken, hydrogeological studies to evaluate both site-specific conditions and regional effects on the groundwater regime and drainage should be completed. In addition, Bylaw No. 1410, which currently requires connection to the storm sewer when one is available, would have to be amended to allow onsite infiltration, subject to completion of the necessary studies.

6. Land use as described in the Official Community Plan should be reviewed in light of the environmental resources identified in Section 6 of the LWMP, to ensure that sensitive areas and species are not endangered by development. Budget $20,000 (plus $10,000 for public consultation if substantial changes are recommended).

7. The source control education program described in Section 8.1.7 should include stormwater issues.

8. The inventory of non-domestic dischargers to the sanitary sewer system (see Section 8.1.6) should include potential contaminant sources of storm runoff (e.g. vehicle repair yards, outdoor lumber storage, etc).

11.0 AGRICULTURAL WASTE MANAGEMENT ISSUES

A wide variety of types of agriculture is found within the District of Salmon Arm, from commercial dairy, poultry and beef production to tree fruits, berries and vegetables. As well, there are a large number of small-scale 'hobby' farms with beef cattle, sheep, goats, horses and exotic livestock such as llamas and emus. Agricultural operations are located throughout the District of Salmon Arm. The best farmland is located in the lower Salmon River Valley, and in this area most of the commercial livestock and poultry production is found. There is also a significant amount of agriculture in the Broadview and Canoe areas. Agricultural operations along the Canoe Creek watershed are predominantly small scale hobby farms, while on the higher ground between Canoe Creek and the lake there are many orchards and some small fruit and vegetable operations.

Agriculture is important to the economy of the District. Total gross farm receipts in 1996 were $8,627,492 while in the same year, total cash wages paid were $1,536,213. (Statistics Canada, 1997).

This survey of agriculture and discussion of water quality issues associated with agriculture dealt only with livestock, including horses and poultry operations. The aim of this survey was to quantify the number and location of livestock operations in the area, since animal agriculture has been pinpointed as one of the sources of nutrient loading to the Salmon River (see Section 6).

11.1 Survey of Agricultural Operations

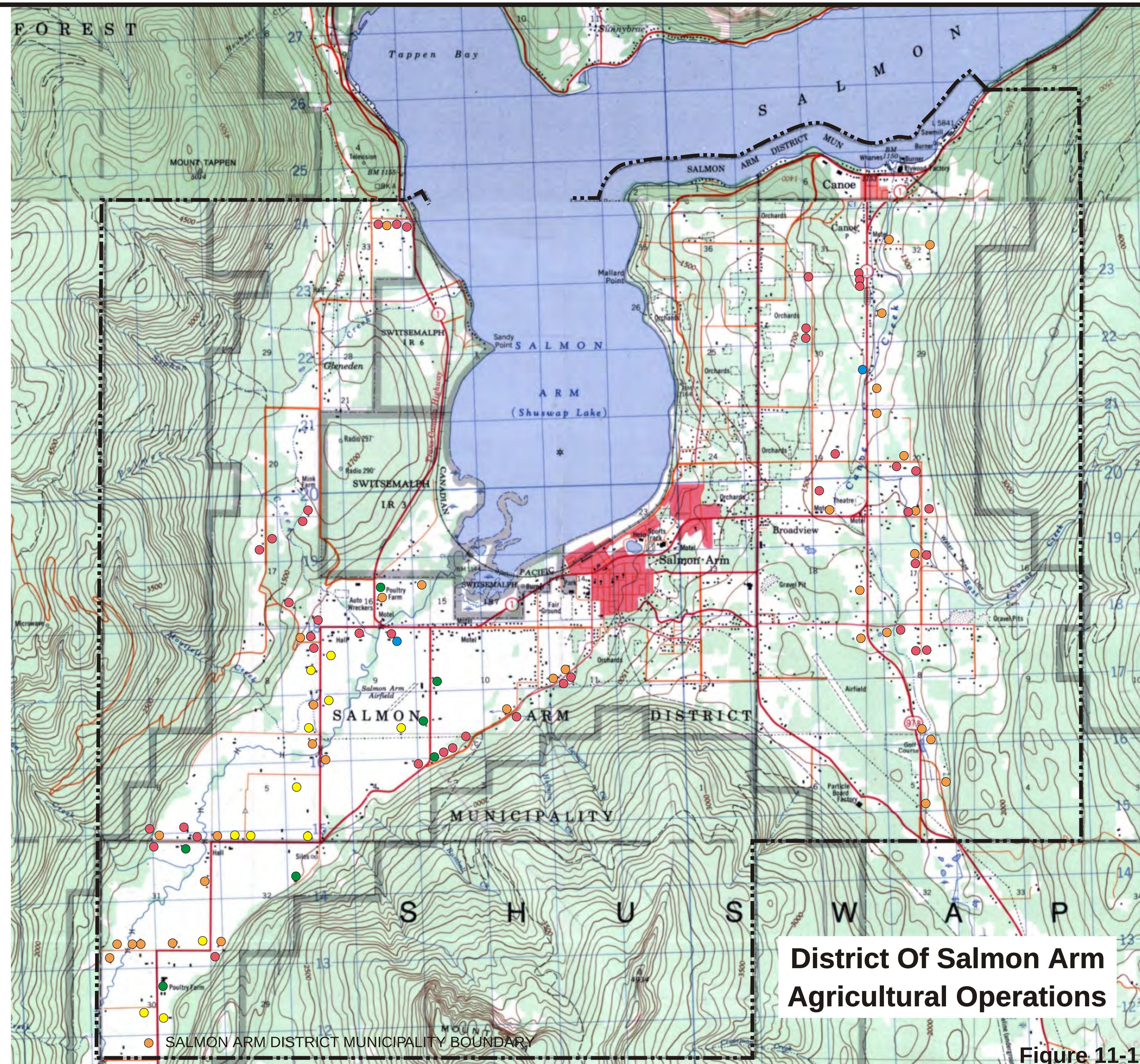
The data for this report were collected from a drive-by survey of agricultural operations in the District conducted between April 4 and April 12, 2002. The survey concentrated on three areas, the Salmon River corridor from Shuswap Lake south to the district boundary, the Salmon River corridor upriver from the district boundary to Glenemma (junction of Salmon River Road and Heywood-Armstrong Road approximately 10 km south of the southern District boundary), and the portion of the Canoe Creek watershed that lies within the District of Salmon Arm. The Salmon River floodplain and the land lying along Canoe Creek were chosen for this survey because the focus of the survey was to identify areas within the District where agriculture might be contributing to deterioration of water quality in Shuswap Lake. These two areas are where most of the livestock production is found and where watercourses draining agricultural areas enter Shuswap Lake. Most of the Salmon River corridor is outside of the District, but is important because of the many livestock operations located along the Salmon River that could potentially contribute pollutants to the river.

The following sections contain summaries of the types and numbers of animal agriculture operations that are found within the three areas surveyed. It was not possible to determine the number of livestock at each individual operation; however, it was assumed that dairy and poultry operations were of commercial size, that cow/calf operations varied from small to large in size, and that hobby farms were small-scale. The survey did not consider tree fruit, small fruit, vegetable, Christmas tree or other non-livestock operations, as these types of operations are less likely to contribute to nutrient loading of soil and water from manure and fertilizer. The livestock operations within the Salmon River corridor south to the District boundary and within the Canoe Creek watershed are identified on Figure 11-1, and are summarized in Table 11-1. The livestock operations found upriver from the District boundary are not shown on Figure 11-1, but they are included in Table 11-1.

LEGEND

- DAIRY
- POULTRY
- COW/CALF
- FEEDLOT
- HOBBY FARM*
- RIVER OR CREEK

* Hobby Farm includes farms with 5 or fewer horses, sheep, goats, llamas, alpacas and other exotics



District Of Salmon Arm Agricultural Operations

Figure 11-1

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CONSULTING ENGINEERS
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TABLE 11-1
SURVEY OF AGRICULTURAL OPERATIONS

Area	Type of Farm	Number of Farms
Salmon River Floodplain	Cow/Calf	24
	Beef feedlot	2
	Dairy	13
	Poultry	7
	Hobby Farm (all types)	20
TOTAL		**66**
Canoe Creek Watershed	Cow/Calf	16
	Beef Feedlot	2
	Horse Ranch (more than 5 horses)	1
	Hobby Farm (all types) (5 or less horses)	30
TOTAL		**49**
Salmon River Corridor from District Boundary to Glenemma	Cow/Calf	15
	Dairy	2
	Poultry	2
	Horse Ranch (more than 5 horses)	6
	Hobby Farm (all types) (5 or less horses)	22
TOTAL		**47**

11.1.1 Salmon River Area

Table 11-1 contains a summary of the livestock operations surveyed in the Salmon River area. The Salmon River floodplain contains the best soils for agriculture within the District of Salmon Arm. These soils are mapped in the Mara series as Mara clay, a soil type that extends throughout the floodplain of the Salmon River Valley from the river mouth to about 10 km upstream (Kelley, 1948). All arable land in this area is fully developed for agriculture. This area contains predominately large commercial livestock operations on a large land base, where the land base is used to produce forage as winter feed for dairy and beef cattle.

Commercial scale dairy and poultry operations represent the greatest number of animal units in this area. Although there are more cow/calf operations than dairy and poultry farms, beef operations are in general small to medium size operations. There is also a significant number of hobby farms in this area. Most ‘horse’ hobby farms had fewer than five horses - the majority had only one or two. Two facilities with more than 20 horses were observed in this area.

Each of the large poultry and dairy operations in this area is surrounded by a large land base. From the visual survey, it appears that forage grass and corn are the predominant crops grown on the land base. There is also some Christmas tree production, a turfgrass farm, and two small greenhouse operations.

11.1.2 Canoe Creek Watershed

This survey area runs from the neighbourhood of North Canoe where Canoe Creek empties into Shuswap Lake, south to the municipal boundary (just south of the golf course on Highway 97B). It also covers the agricultural land bordering East Canoe Creek. In this area, the valley is not as open and broad as the northern reaches of the Salmon River, and farms are smaller. The soils in this area consist almost entirely of Broadview clay loam interspersed with patches of Shuswap sandy loam (Kelley, 1948). These are very productive soils, provided that they are irrigated during the growing season.

The livestock and poultry operations observed from the drive-by survey in the Canoe Creek Watershed within the District boundary are included in Table 11-1. This area contains almost exclusively small to medium sized cow/calf operations and hobby farms of all types. There are no large dairies or poultry operations visible from the road. As well as the livestock operations observed along Canoe Creek, there are also several smaller beef operations and hobby farms along the Highway 97B portion of the survey route.

Most agricultural parcels along the stretch of Highway 97B to Canoe appear small (4 to 8 hectares) with most used for hay production or pasture. There is a small number of horticultural crop producers (vegetables) and two Christmas tree farms. There are also some well established orchards at higher elevation between Canoe Creek and Shuswap Lake.

11.1.3 Salmon River Corridor South from Municipal Boundary

This agricultural area borders the Salmon River between the District of Salmon Arm municipal boundary and Glenemma. The valley narrows south of the municipal boundary, and agriculture is found in a narrow strip running on either side of the Salmon River to Westwold, where the river emerges from underground (the river runs underground year round through the Westwold valley). The survey area extends only as far along the river corridor as Glenemma. The type and number of livestock and poultry operations observed during the drive-by survey within this area are included in Table 11-1. In this area, small and medium sized cow/calf operations and hobby farms predominate. Most of the farms border on the river, due to the narrowness of the valley. There are also a few commercial poultry and dairy operations. The farms in this area are not shown on Figure 11-1. Between Glenemma and Westwold, the pattern of animal agriculture is much the same, with small and medium sized beef cattle operations located on all of the agricultural land bordering the river. As well, there is at least one dairy farm between Glenemma and Westwold. River bottomlands are used for forage production in the summer months and as fall grazing and winter feeding areas.

The Westwold area has many large cattle operations, and much of the valley bottomland which is used for hay production in the summer is also used as feeding areas through the winter. The east end of the valley floods with runoff each spring, providing the opportunity for manure to be carried into the Salmon River from cattle overwintering areas.

The headwaters of the Salmon River are located in the plateau country south of Westwold, which is part of the Douglas Lake Ranch. In the past there have been livestock overwintering areas near the river, but it is not known if this is still occurring (Grace, 2002).

11.2 Statistics Canada Agricultural Data

There were no data available from either the B.C. Ministry of Agriculture, Food and Fisheries (BCMAFF) or Statistics Canada on agricultural activities within the District of Salmon Arm. The BCMAFF does not keep such statistics, and Statistics Canada's smallest subdivision of land in the area is by Regional District. The agricultural statistics for the Columbia-Shuswap Regional District are not specific enough for the purposes of this report, and they have not been included here. The Regional District also encompasses the agricultural areas around Mara, Tappen, Sorrento, part of Deep Creek, and along the Trans-Canada highway to Sicamous and beyond.

11.3 Water Quality Issues Related to Agriculture

Animal agriculture can contribute many different pollutants to surface water sources, including nutrients, sediment, pathogens and residues from pesticides. In the District of Salmon Arm, the main pollutant of concern related to agricultural practices is phosphorus, because of the impact of this nutrient on the shallow waters of Salmon Arm Bay (see Section 6.1.2). Of the three areas surveyed for this report, the Salmon River floodplain and the agricultural area upriver of the municipal boundary along the Salmon River are of most concern, since the Salmon River drains directly into Salmon Arm Bay. The Canoe Creek agricultural area is not expected to be as significant a contributor of nutrients to Shuswap Lake, since there are fewer livestock in this area.

The items listed below summarize the various ways phosphorus and other nutrients can enter surface waters from agricultural operations. In the agricultural areas of the District and upriver along the Salmon River, all of these pathways are likely to contribute some pollutants to the river.

- **Livestock feeding areas too close to the river:** Many of the beef cattle operations along the length of the Salmon River have cattle winter feeding areas that are located next to the river on bottomland. During spring snowmelt and runoff, manure can directly enter the river from these areas of concentrated manure.

- **Livestock access to the river for watering:** Beef cattle operators and hobby farmers may allow their livestock access to the river for watering. Manure can be deposited directly in the river from this practice. As well, cattle will destroy riparian vegetation along the river, which promotes erosion of soil into the river. Nutrients and sediments enter the river when soil erosion occurs.
- **Manure application too close to the river:** When manure is spread too close to the river, particularly if it is applied to snow or frozen ground, it can enter the river with spring runoff or soil erosion.
- **Over-application of nutrients to the land base:** When manure and fertilizer are applied in excess of crop nutrient requirements, there can be several undesirable consequences. Over time, phosphorus will build up to very high levels in the surface layers of the soil. Erosion of high phosphorus soil into the river can add a substantial amount of phosphorus to the system. The nitrate form of nitrogen will leach through the soil and can be carried to surface water via groundwater and ditches during seasonal high water in the Salmon River floodplain.
- **Subsurface drainage:** Fields with subsurface drainage can contribute substantial amounts of phosphorus to fresh water. Phosphorus moves from the surface soil layers through soil pores or with drainage water into tile drains, and then into ditches which empty ultimately into the river. It is not known how many tile drained fields there are in the Salmon River area.
- **Manure stockpiles too close to the river:** Manure stockpiled near the river can be carried into the river with spring runoff or during heavy rain events. In areas with a seasonal high water table, nutrients leached from stockpiled manure can be moved into groundwater and thus into the river.

Over the past decade, a community based organization, the Salmon River Watershed Roundtable, has been actively working along the river to reduce the impacts of agriculture on the water quality in the river. This group has concentrated on stream bank fencing to keep cattle out of the river and on restoring riparian vegetation. They have also maintained an ongoing educational program to increase the awareness of people living along the river regarding water quality issues.

At the same time the Roundtable has been working on the river, there have been several province-wide initiatives through the B.C. Ministries of Agriculture and Water, Land and Air Protection aimed at educating farmers regarding sustainable use of manures and fertilizers, and on surface and groundwater quality issues and waste management. Most of these programs have been aimed at large-scale commercial livestock and poultry producers, and there is some evidence that practices have improved in this area of agriculture. There have been virtually no programs aimed at hobby farmers; there is little information available about how manure and fertilizer are handled on small-scale operations. As described earlier, there are a large number of small-scale farms as well as larger size operations in the study area.

11.4 Jurisdictional Issues

In B.C. there are two pieces of legislation that are important to the regulation of agricultural waste management practices; the provincial Waste Management Act (and the related Agricultural Waste Control Regulation and Code of Agricultural Practice for Waste Management), and the federal Fisheries Act. Of lesser importance are the provincial ‘Farm Practices Protection Act’ (the ‘Right to Farm’ Act), the Soil Conservation Act, and the various municipal bylaws which can permit land use within municipal jurisdiction.

11.4.1 Waste Management Act

The Waste Management Act regulates the generation, storage and disposal of waste in the province. It is the most important piece of legislation in B.C. for regulating agricultural waste. It provides for the entry of waste into the environment through a permit or approval from the Ministry of Water, Land and Air Protection. It contains a number of exemptions, of which the most important for agriculture is the Agricultural Waste

Control Regulation. This regulation allows agricultural operations which produce and dispose of agricultural waste to be exempt from requiring a permit under the Waste Management Act, provided that they manage that waste according to the ‘Code of Agricultural Practice for Waste Management’ (enacted in 1992). If producers are found to be in contravention of the Code, they can be charged under the Waste Management Act, and served with a ‘pollution abatement order’ which requires the polluter to clean up the pollution at his own expense, or a ‘pollution prevention order’ which requires a producer to stop doing an activity that is likely to cause pollution.

The ‘Code’ describes practices for managing agricultural wastes (manure, used mushroom media and agricultural vegetation waste) in an environmentally sound manner. If a producer is managing manure according to the Code, he/she cannot be prosecuted under the Waste Management Act. If a producer is found to be managing manure in an unsafe manner and is in contravention of the Code, he/she is required to make changes to the operation to become compliant with the Code or face prosecution under the Waste Management Act. If a complaint is made about a farm’s agricultural waste management in B.C., it is referred to the Ministry of Water, Land and Air Protection. Up until recently, it would then be referred to the appropriate commodity group peer advisory service, who would make an initial inspection and attempt to address the problem. If that proved unsuccessful, it would be referred back to the Ministry. The peer advisory program has been disbanded, so the primary means of resolving agricultural waste problems in B.C. currently is through the Ministry of Water, Land and Air Protection.

In terms of land application of manure, the Code states that manure must be applied to land as a fertilizer or a soil conditioner, and must not be applied to land if runoff or the escape of agricultural waste causes pollution of a watercourse or groundwater. It outlines conditions where manure should not be land applied, but does not prohibit any applications provided that pollution of water does not occur as a result of the application. The Ministry of Agriculture, Food and Fisheries (MAFF) has developed Environmental Guidelines for each livestock commodity group that outline acceptable manure application practices. The MAFF has also developed the Best Agricultural Waste

Management Plan program to provide individual farms with information about on-farm manure management, and is currently developing on-farm environmental and nutrient management planning materials. All of these programs have been attempts at bringing the farming community into voluntary compliance with the Code. The Ministry of Water, Land and Air Protection in consultation with producer groups and the Ministry of Agriculture, Food and Fisheries has developed manure management guidelines for the Okanagan/Shuswap, to outline more clearly what are appropriate manure management practices to prevent contaminated runoff from entering surface and groundwater in these areas.

11.4.2 Fisheries Act (Federal)

This act is designed to protect fish and fish habitat within Canada. Of relevance to agriculture are the sections that deal with the damage or pollution of fish habitat. Under the Act, no works are allowed in or around fish bearing streams that result in '(harmful) alteration, disruption or destruction of fish habitat'. No deposition of deleterious substances of any type is allowed in water frequented by fish (ammonia has been determined to be deleterious). Fines for infringements of this Act are up to $1,000,000; however, in reality, it is very rarely used as a regulatory tool when dealing with agricultural waste infringements in fresh water streams and rivers in B.C. Because the Ministry of Water, Land and Air Protection staff respond to agricultural waste complaints, the Waste Management Act is the normal tool for dealing with manure related violations.

11.4.3 Farm Practices Protection Act (Right to Farm)

This provincial Act provides protection for farmers in the ALR from nuisance complaints about farm odours, noise or dust, provided that they are performing a standard farming practice and that they follow acceptable, environmentally sound farm practices as defined in the Code. The Ministry of Agriculture, Food and Fisheries has prepared a guide to normal farm practices to aid in resolving 'nuisance' complaints; these complaints are referred to Ministry staff or to a Farm Practices Board. This Act also protects the farming community from local government nuisance bylaws when normal farming practices are being used. At the same time as this Act was proclaimed, changes were made to the Municipal Act (now the Local Government Act) which allow local governments to enact special farm bylaws that may prohibit specific farm operations in certain locations, and may restrict certain farm activities to specified times (for example, manure application).

11.4.4 Soil Conservation Act

The Soil Conservation Act is of minor importance in the regulation of agricultural waste. This act is administered by the B.C. Land Reserve Commission, is designed to protect the quality and productivity of farmland, and mostly regulates the deposition of ‘fill’ on land within the agricultural land reserve. Fill is defined as any material brought onto land within an agricultural land reserve, and includes non-agricultural wastes (such as municipal biosolids). Materials brought onto farm land must be applied according to good agricultural practice; applications that are higher than appropriate are considered to be fill and require a permit which is issued through local government (regional district or municipality). If agricultural waste is being moved from its place of origin to be land applied at another location and is not being land applied according to good agricultural practice, the perpetrator can be charged under this Act.

11.4.5 Local Government Bylaws

As far as agricultural waste management is concerned, local government can have only a minor impact. Because of their authority in land use planning, municipal governments through bylaws can prohibit specific agricultural operations in certain locations, restrict the timing of certain agricultural activities, and define building setbacks (see Section 11.4.3). Bylaws restricting agriculture are common throughout the Fraser Valley and Surrey. Local governments are often the initial contact when there is a complaint about agricultural waste management within their boundaries, but they have no authority to pursue the complaint.

11.5 Provincial Government Strategy For Resolving Agricultural Waste Management Issues

Despite years of government educational programs, convincing livestock producers to change practices that lead to degradation of water quality has proven difficult. Producers can be prosecuted under the Waste Management Act for allowing the entry of manure into surface water; however, this rarely occurs due to lack of staff to monitor infringements. With the recent cutbacks in the provincial government, the agricultural enforcement staff for the entire Thompson, Nicola and North Okanagan areas went from one full-time person to one half-time position. In fact, enforcement has always been a very small part of monitoring agricultural waste problems in the interior; educating producers about better ways to operate has been more important. In the Fraser Valley, a more aggressive stance has been taken, with regular helicopter flyovers and drive-by inspections to ensure that producers are managing manure appropriately. This has led to a very adversarial relationship between the enforcers (Ministry of Water, Land and Air Protection) and the producers. In some instances, this has improved manure management; however, in other cases, livestock producers have simply become more devious about how they break the law. The situation in the interior has been far less adversarial.

The current provincial strategy for reducing surface and groundwater contamination from agricultural waste is a continuation of the educational programs that were begun when the Code was introduced. Prosecuting producers for pollution is now a relatively low priority. The next generation of farmer education tools includes environmental farm plans and on-farm nutrient management plans, currently being developed by the Ministry of Agriculture, Food and Fisheries in consultation with producer groups. These build on the 'Best Agricultural Waste Management Plans' that were developed in the early 1990's. Environmental and nutrient management plans are self-assessment tools for farmers. The plans will be voluntary unless a producer is ordered to have one as part of a pollution abatement or pollution prevention order through the Ministry of Water, Land and Air Protection. The Plans can be completed by a qualified professional or by the producer, and they cover all aspects of a farm's waste management system including production, handling, storage and land application. The cropping system and fertilization regime is examined, and areas where improvements can be made are identified. Many other jurisdictions within Canada and elsewhere in the world have adopted similar systems, and in many areas (the most recent is Ontario), farm plans are required for larger producers.

11.6 Agricultural Waste Management Problems That Contribute To Contaminant Loading Of The Salmon River And Mitigating Management Practices

Agricultural waste management problems can be roughly divided into two groups. The first group includes problems arising because the farm operation has insufficient land base to sustainably utilize the waste produced by the livestock on the farm, and so manure is over-applied on the land base, leading to nutrient buildup in the soil and nutrient movement into water sources from leaching, runoff and soil erosion. The second group of problems has more to do with placement of agricultural wastes, and is generally caused from depositing or allowing manure to be deposited too close to surface water, from where it can enter with runoff or flood water. The second group of waste management problems appears to be more important in contributing pollutants to the Salmon River, particularly upstream from the municipal boundary. The four most important pathways by which phosphorus and other pollutants can enter the Salmon River system are discussed below, together with solutions that have been tried throughout the interior of British Columbia.

11.6.1 Agricultural Waste Entering Water Courses With Runoff Or Flood Waters

In the Salmon River watershed, this pathway of contaminant loading of the river is the most important. Several common agricultural practices can contribute pollutants to surface water in this way, as follows:

- winter feeding of livestock on low lying fields next to tributary creeks or the river;
- early spring calving grounds situated on low lying fields next to surface water;
- fall and winter surface application of manure on low lying fields next to surface water; and
- stockpiling of manure on low lying fields next to surface water.

The movement of contaminants into surface water via this pathway occurs predominantly during spring. Normally, during the rest of the year in the Interior of the province, neither rainfall nor water levels are high enough to create runoff or flooding problems. Manure can move into surface water following any number of typical spring weather occurrences. These include the following:

- rapid snow melt which occurs too fast for melt water to infiltrate the soil or which takes place when the ground is frozen;
- rainfall on frozen ground or snow;
- flooding of low lying areas, particularly in years when flood levels are higher than normal (May 2002 was an example of this); and
- heavy rainfall in spring before vegetation starts growing which exceeds the soil's capacity to absorb it.

Management Practices To Reduce Contaminant Loading From Runoff And Flooding

The Code stipulates that livestock feeding (and calving) areas must be maintained so as to prevent pollution entering surface or ground water, through the use of berms if necessary, and by keeping moveable feed bunks at least 30 metres from a watercourse. The Code also states that agricultural waste must not be applied to land if runoff or the escape of the waste causes pollution of a watercourse. Producers who are causing pollution can be charged under the Waste Management Act.

Since the introduction of the Code, there have been ongoing programs designed to educate livestock producers about unacceptable practices, and to encourage producers to change practices that lead to contaminants entering surface water from runoff and flooding. When this strategy, combined with some enforcement, did not result in widespread adoption of the requirements of the Code, additional guidelines were developed. Fall and winter manure management guidelines were developed for the Okanagan/Shuswap, which outline acceptable and unacceptable manure application timing and practices (included as Appendix 6). The guidelines provide additional guidance about fall and winter applications of manure on land near surface water. As well, 'Environmental Guidelines' were developed for each livestock commodity group which outlined acceptable manure management practices specific to the type of livestock.

The solutions to this source of contaminant loading are fairly simple, but they involve producers being proactive in making changes to their operations as summarized below.

- Winter feeding grounds and spring calving grounds should be moved to higher ground and away from surface water where there is any risk that runoff could occur from the site.
- Fall and winter manure application on low lying ground should only occur when there is no possibility of flooding or runoff from the field, even in unusually high runoff years. In the Interior, fall application of manure on crop land is acceptable as minimal leaching occurs over winter; however, fall surface applications of manure should be at a low application rate. Manure application on snow is particularly susceptible to runoff.
- Manure stockpiles should never be situated in areas where there is risk of manure running off into surface water. Often, solid manure is stockpiled throughout a field in preparation for spreading in the spring; this should only be done if the field is not susceptible to flooding, and where snowmelt or rain runoff cannot carry manure into surface water.

11.6.2

Direct Access By Livestock To Streams And River

In some instances, livestock (dairy and beef cattle, horses, sheep and exotic species) have direct access to tributary streams or the river for watering; in other instances, livestock are turned into a field which does not have streamside fencing. Access to a water course for watering allows direct deposition of manure into the water. Livestock also graze riparian vegetation when they have access to a water course, and this activity may lead to the loss of vegetation with resulting streambank erosion. This also occurs around lakes where livestock have unlimited access. The combination of water action and livestock hooves breaking down the streambank leads to erosion of soil material (which contains contaminants such as nitrogen and phosphorus) and manure into the water course, particularly during spring high water. Loss of the riparian vegetation also means that there is no vegetated buffer to slow down runoff from fields when it occurs, exacerbating spring runoff events.

Management Practices To Reduce Contaminant Loading From Direct Access To Surface Water By Livestock

The Code allows for livestock access to a watercourse for watering, provided that the agricultural waste produced by the livestock does not cause pollution. In seasonal feeding areas, which are much smaller than grazing areas and where livestock are typically confined for several months over winter, the access must be located and maintained as necessary to prevent pollution.

There has been extensive work in the interior during the last ten years to address this source of contaminant loading. A number of conservation groups, funded by both the provincial and federal governments and privately, have undertaken many demonstration projects and restoration programs to address the problem. Solutions have included streambank fencing to keep livestock away from water courses, limited access points for livestock to drink from surface water without destroying stream banks, inexpensive off-stream livestock watering systems so livestock do not need access to surface water sources, and stabilization and revegetation of banks and riparian areas. The various provincial cattlemen's associations have been very involved in these programs, recognizing that they must work on finding solutions before changes are required by law. Many groups are still working on this problem, including the Salmon River Watershed Roundtable, which continues to carry out streambank and riparian restoration along the lower reaches of the Salmon River. There have been improvements made, but there remain too many livestock operations where access to surface water may lead to contaminant loading and/or streambank erosion.

11.6.3 Over-Application Of Agricultural Waste To The Land Base

Within the District, this is likely an important source of contaminant loading in the Salmon River. Upstream from the municipal boundary, this is a less important source of contamination. Overall, within the District of Salmon Arm, there is adequate land to utilize sustainably all of the manure produced (based on a nutrient balance for nitrogen and phosphorus in manure produced by all livestock within the District, and uptake by all crop land in the District). However, there are individual operations where over-application of manure on the land base occurs, which leads to a buildup of nutrients in the soil (phosphorus and potassium), leaching of soluble nutrients (nitrogen) to groundwater (that may eventually discharge into surface water), and movement of nutrients (phosphorus and nitrogen) into surface water when soil erosion occurs. Long term over-application of manure leads to a severe buildup of phosphorus in the surface soil. The soil phosphorus level will increase gradually over time, even when manures are applied at moderate rates, because crops use far more nitrogen than phosphorus relative to the amounts found in manures. Operations situated next to the river are at greatest risk of contributing phosphorus to surface water. When high phosphorus soil erodes into surface water, the amount of phosphorus put into the system can be significant.

Management Practices To Reduce Contaminant Loading From Over-Application Of Manure

The Code requires that agricultural waste be applied to land only as a fertilizer or soil conditioner. It further states that agricultural waste must not be applied at rates of application that exceed the amount required for crop growth if runoff or escape of waste will not cause pollution. It does not prohibit over-application, provided that pollution does not occur.

The solution to over-application of manure on a land base in the southern interior appears to be relatively simple, as there is ample land available for manure application (compared with the situation in the Fraser Valley, where there is more manure produced in the valley than can be sustainably used on the land base available). However, often the over-application of manure is due to the use of chemical fertilizer in addition to manure. The combination of both provides far more nutrients than the crop requires. The simple solution is to cut back on the use of chemical fertilizer when manure is used. In practice, this is often difficult for producers to do. Manure is a highly variable substance, and it is difficult for producers to confidently use it in place of chemical fertilizer.

The provincial government, with funding from the federal government, has been conducting research and demonstration trials throughout the province for the past decade, to try to educate farmers about appropriate on-farm utilization of manures and other wastes. This has included extensive educational programs on using manures as a chemical fertilizer replacement for forage crops, with information provided on the correct application rate, timing and application methods to get the maximum benefit from the use of manure, with the ultimate goal that producers who have access to manure will reduce their use of chemical fertilizers. In the interior, several projects targeted dairy and beef producers. The funding for these programs ran out several years ago.

As with other agricultural waste problems, there have been improvements since the awareness program began. Unfortunately, however, over-application of manure on a land base does not constitute pollution, provided that the ‘pollutants’ do not leave the farm. Manure over-application can result in non-point source pollution of surface and groundwater, which is generally not detectable and therefore not subject to prosecution. Therefore, the only effective method of effecting change to current management practices is to provide on-going education for producers.

The provincial government’s current strategy is to promote self-education of producers through on-farm environmental and nutrient management planning. Tools for this process are currently being developed by the Ministry of Agriculture, Food and Fisheries in consultation with producer groups. Once the program is developed and approved by producer groups, producers will voluntarily produce their own farm plans that evaluate their operation’s environmental and nutrient management. Other jurisdictions have similar programs, but require all large livestock and poultry producers to have one completed and to abide by it; B.C. has so far opted for voluntary participation.

11.6.4 Improper Management Of Manure Applications On Tile Drained Fields

It is believed that this pathway is not a significant contributor of phosphorus to the Salmon River, because there are relatively few tile drained fields in the floodplain, and fewer above the municipal boundary. However, if improperly managed, tile drained fields can contribute a substantial amount of phosphorus to the water course into which they drain. Phosphorus is normally held very tightly in the soil, and does not leach unless the soil is saturated with phosphorus (normally from over application of manure); in this case, phosphorus will leach with soil water into drain tiles. Phosphorus can also move into drain tiles through soil macropores created by earthworms, and through cracks in dry soil; liquid manure and soil particles containing phosphorus can move very rapidly through the soil via these pathways and into drain tiles.

Management Practices To Reduce Contaminant Loading From Tile Drains

Awareness of this pathway of contaminant movement is just beginning. The farming community is not as aware of this problem as they are of some of the others discussed, partly because the research and education emphasis has been on nitrogen management as this is of greater concern in the Fraser Valley. Phosphorus is the next ‘issue’ in agriculture, and government programs are beginning to reflect this. Simple management methods can largely prevent loss of phosphorus through drain tiles. Bare fields should be tilled to break up the surface macropores before liquid manure is applied to them in spring. The application rate of liquid manure should be low enough to prevent movement to drain tiles; tiles should be monitored during and after application. Buildup of phosphorus in the soil should be avoided by monitoring soil phosphorus level, and by limiting manure application rate to the amount that provides crop phosphorus requirement.

11.7 Initiatives To Reduce Environmental Contamination From Agriculture

As will be evident from the preceding discussion, reducing the contaminant loading to the Salmon River from agriculture is not a simple task. Over the past decade, many initiatives throughout the province have addressed agricultural waste management issues with varying success. The most successful initiatives have been those that farmers did not have to pay for themselves. When funding disappears, farmer adoption of new technology and practices drops off drastically. There remains a significant proportion of livestock producers who either are not aware of the problems they are causing, or who refuse to change their management practices to improve water quality. Because enforcement has largely been abandoned by the provincial government, the only tools left for those who wish to effect changes to management practices are moral persuasion and education, or undertaking the works themselves. Suggested initiatives for the Salmon Arm Liquid Waste Management Plan are listed below.

1. Promote the establishment of a water quality monitoring program to determine what proportion of the phosphorus and other contaminants comes from beyond the municipal boundary and what proportion is contributed within the Salmon River floodplain. Appropriate initiatives to impact contaminant flow will depend on the pathway by which the contaminants enter surface water; runoff of manure and direct livestock access to surface water are the main issues above the floodplain, while these concerns plus over-application of manure and poor management of tile drained fields are of concern within the floodplain.

2. Cooperate with and provide funding for the Salmon River Watershed Roundtable to extend their work in streambank and riparian restoration to areas within the District boundary. Although this does not directly address the largest source of contamination from agriculture (i.e., spring runoff and flooding), the works undertaken by this group indirectly reduce the contaminant flow by providing a vegetated buffer between manure and the river, and by moving manure sources further back from the river. This group already has a presence on the river. Although the agricultural community may not be wholeheartedly behind them, they continue to be successful at running on-farm projects because there is no cost to the farmer.

3. Partial funding for stewardship projects is available through the ‘Agriculture and the Environment Fund’ (administered by the B.C. Agriculture Council in Kelowna). These funds can be used to address on-farm manure management issues. The District of Salmon Arm could develop a program with the beef and dairy livestock associations in the area to look at reducing phosphorus loading in the river, particularly from spring runoff and flooding (see item 5). Funds could partially pay the cost of item 5

4. Liaise with the local beef producers association (North Okanagan Livestock Association) and the provincial association to develop an educational program for small beef operators. The B.C. Cattlemen’s Association has a provincial stewardship coordinator whose job it is to address stewardship issues. Educational programs

aimed at cattle producers in the past may not have targeted small producers who may be contributing a proportionately large amount of the contamination due to lack of awareness.

5. Provide partial funding for producers in the floodplain and upriver to develop their own environmental farm plans. The process of developing the plan with a professional agrologist will make the producer much more aware of pollution issues.

6. Pressure the provincial government to require environmental farm plans and nutrient management plans for all livestock operations located on sensitive waterways (such as the Salmon River).

7. Pressure the provincial government to increase the budget for enforcement of Code violations.

12.0 LWMP IMPLEMENTATION PLAN

The District of Salmon Arm budget and schedule for the LWMP are summarized in Table 12-1. Line items are included for specific LWMP components over the next five to ten years, beginning in 2003. As shown, a line item has been included for review of LWMP progress at the year 2009; the results of this progress review should be used to further develop detailed line items for financial commitments and scheduling to the LWMP planning horizon of 2020.

The recommended approach for the District of Salmon Arm Liquid Waste Management Plan follows the Official Community plan in that there are no immediate plans for servicing of areas outside the Urban Containment Boundary (UCB) with sanitary sewers. This option is recommended because of the high costs (greater than $10 million) associated with servicing areas outside the UCB. The recommended approach includes continuing to expand the existing central wastewater treatment facilities located at Narcisse Street, since this will conserve the District's investment in the existing sewer collection systems. The draft Operational Certificate for the WPCC is attached as Appendix 11. However, to secure the District's long-term needs (20 to 50 year time frame and beyond), it is recommended that an alternative site more distant from the urban core be identified. The primary issue associated with relocation of the central treatment facilities in the long term is reducing the risk of problem odours near the downtown area and the growing residential and hotel development along the shore near the existing plant. For the purposes of developing costs, it was assumed that the alternative site would be the District owned property at Minion Field. Since Minion Field is located in the Agricultural Land Reserve (ALR), the District will have to apply to the Agricultural Land Commission to have the property excluded from the ALR or approved for non-agricultural use if this site is selected for relocation of the wastewater treatment facilities.

To address the above issues in an iterative approach over the short and long term future, it is recommended that the District begin developing the alternative site during the next (Stage IV) upgrade to the facilities at Narcisse Street. That is, the solids handling and treatment facilities will be relocated to the new site during the Stage IV expansion. This will remove the primary odour sources from the location at Narcisse Street, while continuing to utilize the existing facilities for wastewater collection and liquid treatment. The initial step in locating a site for the solids facilities would be to undertake a site selection study that includes stakeholder and public input.

The new site could ultimately serve as the location for both liquid and solids treatment for the long-term future; this would be similar to Option 4, except that the time frame for decommissioning the existing WPCC at Narcisse Street would be delayed well into the future (i.e., 20 to 50 year time frame). The District-owned property at Minion Field is 32 hectares in area, and it could ultimately contain treatment facilities (both liquid and solids) to serve more than 500,000 people using current technologies (allowing a 50 m buffer around the perimeter of the property).

The effects of extending the outfall pipe from the wastewater treatment plant to deeper water in Salmon Arm Bay were reviewed in the LWMP. An environmental impact assessment of the outfall discharge was conducted as a condition of the discharge permit in 2002. The primary issue from an environmental standpoint is algae growth in Salmon Arm Bay, which is driven mainly by phosphorus inputs. The environmental impact assessment, which included limited modeling of phosphorus impacts in the Bay, indicated that removal of the effluent discharge from Salmon Arm Bay would probably not reduce algae growth, due to the high phosphorus loading from the Salmon River. In light of the costs of extending the outfall to deeper water ($3.4 million) and the results of the environmental impact assessment, as well as comments from Fisheries and Oceans Canada regarding habitat impacts associated with construction of the outfall extension, and comments from Interior Health regarding the proximity of drinking water intakes to an extended outfall, extension of the outfall is not recommended at this time. Additional comprehensive environmental studies would be required to further evaluate the possible benefits of outfall improvements. It is important to note that completion of the Stage IIIB upgrade currently underway at the wastewater treatment plant will further reduce the concentration of phosphorus in the outfall discharge.

Reclamation and reuse of treated wastewater in the short term will be evaluated by completing a pre-design study for onsite use at the wastewater treatment facilities. For the long term, use of reclaimed effluent for agricultural irrigation in the Salmon River Valley should be considered. This will require extensive public and stakeholder consultation. Use of reclaimed water from the wastewater treatment plant for agricultural irrigation would reduce or eliminate the outfall discharge from Salmon Arm Bay.

The recommended approach relies on servicing only areas within the UCB with sanitary sewers. Areas lying outside the UCB will continue to rely on onsite systems (mainly septic tanks), provided that environmental monitoring conducted as a component of the LWMP does not identify environmental contamination or public health risks associated with the onsite systems. Estimated costs for developing and conducting the monitoring program are included in the LWMP. It is recommended that the initial monitoring be focused on known and suspected problem areas, and that monitoring and data management costs be initially funded from by general revenues. If contamination issues associated with onsite systems are identified as a result of the monitoring program, detailed site-specific studies will be required, to determine whether the development of a comprehensive management structure for onsite systems (e.g. Local Service Area) can be used to protect the environment; or satellite (community) sewer collection and treatment systems will solve the problem; or extension of the main sanitary sewer system is necessary.

Additional elements of onsite systems management (e.g., certification of system designers and installers, development and enforcement of inspection and performance standards, etc.) would be added to the onsite systems monitoring program if site-specific studies determined that this approach would adequately protect public health and the environment. In areas where a formal management structure was determined to be the best option, the process of developing the management structure should begin with a review of approaches elsewhere (e.g., U.S.A., Capital Regional District, Columbia Shuswap Regional District), identification of roles (District of Salmon Arm, Local Health Unit, Ministry of Water, Land and Air Protection, Columbia Shuswap Regional District), and identification of options for the scope and implementation of the program.

Environmental initiatives such as water conservation and reuse to reduce wastewater volumes, beneficial use of the solid byproducts of wastewater treatment (biosolids), and stormwater management are also included in the LWMP. Recommended water conservation measures include the adoption of a water use efficiency policy, an education and awareness education program, a bylaw to require low-flush toilets for new construction, audits of large commercial/industrial/institutional water users, a program to retrofit low use water fixtures to existing buildings, and universal water metering.

Beneficial use of biosolids produced at the wastewater treatment facilities was extensively explored by the District prior to beginning the LWMP. As a result, the District has developed a long-term strategy that includes both short term and long term applications. Current applications include topsoil production, soil remediation at the Shuswap Regional Airport, and agricultural applications in the Salmon River Valley. Potential future applications include reclamation of a local forest fire burn, additional agricultural use, and gravel pit reclamation. Public/stakeholder education and source control of contaminants are essential support programs for biosolids reuse.

Source control initiatives are used top prevent the discharge of harmful contaminants to the sanitary sewer and storm drainage systems. Initiatives for the Salmon Arm LWMP include updating and revising the District's sanitary sewer protection bylaw, conducting an inventory of industrial/commercial/institutional dischargers, a public education program, and a monitoring and enforcement program for the sanitary sewer protection bylaw.

Stormwater management initiatives included in the LWMP are ongoing maintenance and repair of the storm drainage system, the development of a Master Drainage Plan, upgrading and expansion of the storm drainage system, the development of a storm drainage bylaw, review of the District's development application procedures to ensure that drainage issues are considered at the outset of the land use planning process, and a review of the Official Community Plan to ensure that important natural components of the local hydrology and drainage are protected.

It is recommended that the elements of the LWMP be integrated with other environmental initiatives and approaches currently developing in the District of Salmon Arm and elsewhere (e.g. Salmon Arm Round Table, Columbia Shuswap Regional District LWMP).

TABLE 12-1
LWMP FINANCIAL COMMITMENTS AND SCHEDULE

LWMP Component	Budget Amount (2003 $)	Funding Source	Schedule
1. Update LWMP			
Review LWMP Progress, Update and Revise as Required	$50,000	General Revenues	2009
2. Upgrade WWTP			
a. WWTP Stage IIIB Upgrade	$7,360,000	Infrastructure Grants, DCC, Sewer Utility	2003 to 2004
b. Site selection study for relocation of WWTP	$75,000	Infrastructure Grants, Sewer Utility	2008 to 2009
c. WWTP Upgrade Pre-Design Studies and Audits for Stage IV	$100,000	DCC & Sewer Utility	2011 to 2012
d. WWTP Stage IV Upgrade, incl. relocate Wharf Street PS and replace Canoe forcemain.	$13,900,000 (annual O&M $800,000/yr)	DCC & Sewer Utility	2013 to 2014
e. Item c plus cost to construct solids handling at remote site during Stage IV Upgrade (from Option 2)	$5,500,000 (annual O&M per Item c plus $120,000/yr)	DCC & Sewer Utility, Infrastructure Grants	2013 to 2014
3. Environmental Monitoring and Onsite Systems Management (from Option 5).			
a. Consultant assistance to design environmental monitoring program	$20,000	General revenues, apply for provincial support funding	2006
b. Monitoring Program • Sample collection and analysis, data management, review and reporting	$25,000/yr	General revenues, apply for provincial support funding to expand program	2007 to 2008
4. Sewer Collection System			
a. Sewer Inspection, Maintenance and Repair	$220,000/yr	Sewer Utility	2004 to 2009
b. Infiltration and Inflow Reduction	$10,000/yr	Sewer Utility	2004 to 2009
c. Upgrade deficiencies in existing sewer system.	$50,000-$100,000/yr	Sewer Utility	2004 to 2009

TABLE 12-1 (cont'd.)
LWMP FINANCIAL COMMITMENTS AND SCHEDULE

LWMP Component	Budget Amount (2003 $)	Funding Source	Schedule
d. Expansions to existing system	Varies subject to development	DCC & Sewer Utility	2004 to 2009
5. Wastewater Flow Reduction (see Water Use Efficiency Report)			
a. Adopt water use efficiency policy.	Minimal	Water Utility	2005
b. Education program	$25,000/yr	Water Utility	2003 to 2009
c. Adopt bylaw requiring ultra low flush toilets for all new buildings.	Minimal	Water Utility	2005
d. Audit large Industrial, Commercial and Institutional water users.	$210,000	Future	Future
e. Program to retrofit low water use fixtures.	$115,000	Future	Future
f. Program to retrofit low flush toilets.	$1,350,000	Future	Future
g. Universal water metering program.	$1,700,000 plus $110,000/yr	Future	Future
6. Reclaimed Water Use			
a. Pre-design study for onsite use at WPCC.	$15,000	Provincial Study Grant $10,000 and Sewer Utility $5,000	2005
b. Agriculture Irrigation (begin public/stakeholder consultation)	Future	Future	Future
7. Biosolids Management			
a. Topsoil production by private contractors.	$14,000/yr $21,000/yr	Sewer Utility (WWTP O&M Budget)	2003 2014
b. Public education and outreach.	$5,000/yr	Sewer Utility or General Revenues	2004 to 2009
c. Soil remediation at Airport (contingency)	$28,500/yr	Sewer Utility (WWTP O&M Budget)	2014
d. Agricultural applications (contingency).	$24,000/yr	Sewer Utility (WWTP O&M Budget)	2014

TABLE 12-1 (cont'd.)
LWMP FINANCIAL COMMITMENTS AND SCHEDULE

LWMP Component	Budget Amount (2003 $)	Funding Source	Schedule
e. Forest fire burn site.	Future	Future	Future
f. Gravel pit reclamation (discussions with Highways to develop pilot project)	Minimal	--	Future
8. Source Control			
a. Review and revise Bylaw No. 1410.	Minimal	--	2006
b. Inventory of Industrial, Commercial and Institutional Sector (see Section 5)	$10,000	Sewer Utility or General Revenues	2005
c. Education program		Sewer Utility or General Revenues	
i. develop program	$15,000		2006
ii. facilities & materials	$3,000/yr		2006 to 2009
iii. public program	$2,000/yr		2006 to 2009
d. Source control monitoring and enforcement program.		Sewer Utility or General Revenues	
i. develop program	$15,000		2006
ii. ongoing monitoring and enforcement	$10,000/yr		2006 to 2009
9. Stormwater Management			
a. System inspection, maintenance and repair	$180,000/yr	General Revenues (consider Drainage Utility)	2004-2009
b. Master drainage plan.	$75,000	General Revenues	2005
c. System upgrades and expansion	$75,000-$125,000/yr	General Revenues	2005-2009
d. Develop storm drainage bylaw.	$20,000	General Revenues	2005
e. Review and revise development application approval procedures.	$20,000	General Revenues	2008
f. Review OCP land use.	$20,000 (plus $10,000 for public consultation if substantial changes needed)	General Revenues	2008
g. Public education.	See Item 8b	See Item 8b	2006 to 2009
h. Inventory ICI sector.	See Item 8d	See Item 8b	2004

TABLE 12-1 (cont'd.)
LWMP FINANCIAL COMMITMENTS AND SCHEDULE

LWMP Component	Budget Amount (2003 $)	Funding Source	Schedule
10. Sewer and Drainage Management			
a. Complete/continue GIS program	$20,000/yr	Utility	2003 to 2015
b. Develop computer maintenance management systems	$50,000 $50,000	Utility	2007 2008
c. Develop sinking fund for facility replacement and upgrades (asset management)	$150,000	Utility	2007
11. Agricultural Waste Management			
a. Pressure provincial government and agricultural area plan committee to undertake the following agricultural area plan: • Promote water quality monitoring in Salmon River. • Develop program with beef and dairy livestock associations to reduce P load to Salmon River. • Develop education program for small beef producers. • Require development of environmental farm plans and nutrient management plans. • Increase budget for enforcement of violations. • Liaise with MWLAP to develop sustainable regulations (OMRR) to promote land application.	Minimal	-	2005 to 2009

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DISTRICT OF SALMON ARM
LIQUID WASTE MANAGEMENT PLAN

APPENDIX 1

TECHNICAL AND PUBLIC LIQUID WASTE ADVISORY COMMITTEE MEMBERS

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DISTRICT OF SALMON ARM
LIQUID WASTE MANAGEMENT PLAN

APPENDIX 2

WASTEWATER TREATMENT PROCESSES AND TECHNOLOGIES

DISTRICT OF SAMON ARM
LIQUID WASTE MANAGEMENT PLAN
LOCAL ADVISORY COMMITTEE MEETING #1

1.0 OVERVIEW OF MUNICIPAL WASTEWATER COLLECTION AND TREATMENT

1.1 Definition of Municipal Wastewater

- a combination of liquid and water carried wastes collected from residential, commercial, industrial and institutional activities mixed with water that enters the collection system from other sources (e.g., groundwater, rainfall)

1.2 Collection and Treatment of Wastewater

- there are two basic approaches to managing wastewater, central systems and onsite systems
- central systems: one approach is to put in a sewer collection system to serve the whole community, and pipe the collected wastewater to a central treatment and disposal facility - the treated water from central facilities is usually discharged to a surface water body via an outfall
- on-site systems: the other approach is not to put in a sewer collection system - wastewater generated by individual homes is treated and disposed of on each lot - these systems normally include a septic tank and a ground disposal field at each home
- in some cases, small (package) treatment facilities may be used to serve small groups of homes, with discharge to community sub-surface absorption fields or an outfall to surface waters – these are sometimes called satellite systems, since they are often located in areas not serviced by the main central system
- whatever the approach or technology used, if a reasonably high level of treatment is required, virtually all systems for treatment of municipal wastewater rely on bacteria to do most of the work

1.3 Contaminants To Be Removed From Municipal Wastewater

- pathogenic (disease-causing) organisms: it is impractical to try to isolate and identify all of the pathogens that might be present in wastewater samples, so we use indicator organisms that are known to be present in human waste - if the indicator organisms are present, we assume that pathogens may also be present - the most commonly used indicator organisms are total coliforms (TC) and fecal coliforms (FC)
- suspended solids: may cause sludge deposits in receiving environment, oxygen starvation in sediments
- biodegradable organic material: decomposition by bacteria causes oxygen depletion in receiving environment - the most commonly used measure of degradable organic matter in wastewater is the five-day biochemical oxygen demand (BOD5)
- toxicity: e.g., metals, ammonia nitrogen can be toxic to fish
- nutrients: mainly nitrogen and phosphorus, which can stimulate the growth of nuisance algae and aquatic plants in the aquatic receiving environment
- odours: gaseous products of decomposition, aesthetic concerns

2.0 CENTRAL AND SATELLITE TREATMENT FACILITIES

- most central and satellite wastewater treatment facilities include at least preliminary, primary, and secondary treatment
- these types of facilities are regulated in British Columbia by the Ministry of Water, Land and Air Protection
- secondary treatment has been mandated by the province as the minumum acceptable for municipal wastewater discharges to surface waters
- some central and satellite facilities may include disinfection and/or additional (tertiary) treatment steps, depending on the sensitivity of the receiving environment

2.1 Preliminary Treatment

- may include *screening* to remove trash (rocks, plastics, other debris) - prevents clogging and damage to equipment
- may also include grit removal - prevents accumulation of settled grit in treatment basins and channels and protects downstream equipment and from abrasion
- collected screenings and grit are usually buried in landfills (screenings are sometimes incinerated)
- preliminary treatment does not remove a significant amount of contaminants other than trash and coarse solids – screened and de-gritted sewage typically contains about 200 mg/L BOD_5 and total suspended solids (TSS)

2.2 Primary Treatment

- primary treatment is the removal of crude solids and floatables from wastewater by gravitational forces in quiescent basins
- crude solids are allowed to settle to the bottom of the basin, and floatables (e.g., oil and grease) are allowed to rise to the surface
- settled solids are collected in a hopper at the bottom of the tank and pumped to solids treatment
- floating material is skimmed from the surface and pumped to solids treatment or sent to landfill
- the settled (primary treated) sewage flows to an outfall or to the next treatment step
- primary treatment normally removes about 30% of the BOD5 and 50% of the total suspended solids (TSS) from raw sewage

2.3 Secondary Treatment

- primary treatment removes only particulate matter that will settle out by gravity and floatable material such as oil and grease - it cannot remove dissolved organic compounds - this requires biological treatment

- removal of dissolved oxygen-demanding organic compounds (measured as BOD5) biologically is called secondary treatment
- in biological (secondary) treatment, a culture of bacteria are cultured in a bioreactor
- the wastewater is fed into the bioreactor where the bacteria feed on suspended and dissolved organic material (measured as BOD5)
- the bioreactor is followed by a gravity settling tank (usually called a secondary clarifier or final clarifier) where the bacterial solids sink to the bottom and the clarified liquid flows out the top over a weir to the next treatment step or to the receiving environment
- in suspended growth (activated sludge) systems, the process bacteria develop in small clumps (flocs) that are suspended in the process liquid in the bioreactor
- in attached growth systems (e.g., trickling filters), the bacteria develop in a slime layer attached to the surface of some solid medium - contaninants are removed from the wastewater by the process bacteria as the water flows over the slime layer
- in recent years, combined fixed and suspended growth systems have been developed to take advantages of the unique attributes of each type of system - these normally combine trickling filters with activated sludge systems
- combined processes combine many of the advantages of fixed growth (process stability, resistance to hydraulic and toxic shocks, low energy for aeration, no sludge bulking or filamentous growth) with the excellent effluent quality that can be achieved by activated sludge (suspended systems)
- all biological treatment processes generate excess cell mass as a result of bacterial growth - the excess cell mass is called waste biological sludge, and is normally routed to solids treatment along with the collected primary sludge
- secondary treatment can achieve better than 90% removal of BOD5 and TSS from raw sewage

2.4 Advanced (Tertiary) Treatment

- advanced (tertiary) treatment is sometimes required to remove suspended and/or dissolved substances remaining after secondary treatment
- ammonia nitrogen can be bacterially oxidized to nitrate nitrogen, usually to reduce the ammonia toxicity of the effluent to fish
- nitrate nitrogen can be removed biologically to help limit the growth of algae and nuisance aquatic weeds in receiving waters
- phosphorus can be removed biologically or by adding chemicals usually to help limit the growth of algae and nuisance aquatic weeds in receiving waters
- tertiary filtration: the liquid from secondary treatment still has a BOD5 and TSS of about 10-15 mg/L - tertiary filtration can remove BOD5 and TSS to less than 5 mg/L

2.5 Disinfection

- disinfection is the destruction or inactivation of pathogens (disease causing organisms)
- in wastewater treatment the most common disinfectants are chlorine and ultraviolet (UV) light - ozone can also be used
- chlorine is a potent oxidizing chemical that disinfects by disrupting the chemical cell structure of bacteria - it is normally added directly to treated wastewater as a gas or liquid - chlorine is very toxic to fish, so if the chlorinated effluent is to be discharged to fish-bearing waters, it must first be dechlorinated, usually using sulfur dioxide gas - chlorine may also combine with organic molecules to form toxic or carcinogenic compounds
- UV light is absorbed by cell reproductive molecules and deforms them to either kill the cell or prevent it from reproducing - treated wastewater flows through banks of UV lamps submerged in a channel - an advantage over chlorine is that UV light does not cause fish toxicity does not result in the formation of toxic or carcinogenic compounds

- ozone gas is a powerful oxidant – it is very unstable and must be generated onsite, normally be electrical discharge through air or pure oxygen - ozone destroys bacteria and viruses by disintegrating their structure – it has few if any adverse environmental impacts, although there are health concerns for operations personnel

2.6 Solids (Sludge) Handling and Treatment

- screenings and grit removed during preliminary treatment are usually sent to landfills (alternatively, screenings may be incinerated)
- primary waste solids - crude solids settled out in the primary sedimentation tanks
- biological waste solids - biomass (bacterial cells) generated by bacterial oxidation of organic material in secondary treatment and settled out in the final (secondary) clarifier
- primary and secondary waste solids (commonly referred to as sludge) will quickly generate odours and become a disease hazard if not treated to reduce the biodegradable component
- some wastewater treatment plants also accept septage (partially digested organic material pumped from the bottom of septic tanks)
- stabilization of the biodegradable organic matter in wastewater solids is usually called digestion – the waste solids are fed to some type of bioreactor, normally called a digester, where the bacteria feed on the organic material
- there are many different types of digestion - some generate heat or methane gas as a byproduct
- other methods of solids treatment include incineration and lime addition
- wastewater solids that have been treated (digested or limed) to the point where they can be beneficially reused as a soil amendment are called *biosolids*
- biosolids added to soils increases the organic content of soil - this improves the water holding capacity for droughty soils and acts as a slow release organic fertilizer, reducing or eliminating the need for chemical fertilizers

- in B.C. reuse of biosolids is regulated under the recently passed Organic Matter Recycling Regulation (OMRR)

2.7 Odour Control at Wastewater Treatment Plants

- odour control is becoming increasingly important at wastewater treatment plants
- many plants that were built in remote or undeveloped locations are now surrounded by residential development - may require odour control for most or all aspects of liquid and solids treatment
- in general, treatment processes must be enclosed within a building, with foul air collected and sent to one or more treatment processes
- there are many processes for treatment of odours, which may be used alone or in combination with others, depending on the application
- strong oxidants such as chlorine, hydrogen peroxide and ozone can be used to oxidize hydrogen sulfide or other odorous gases
- combustion or high-temperature oxidation can be used to destroy odorous compounds
- in biofilter systems, foul air is passed through a porous filter bed, and odorous compounds are oxidized by bacteria growing in the filter bed (foul air may also be treated biologically by using the foul air as feed air for an activated sludge system, or by passing the foul air through a trickling filter tower)

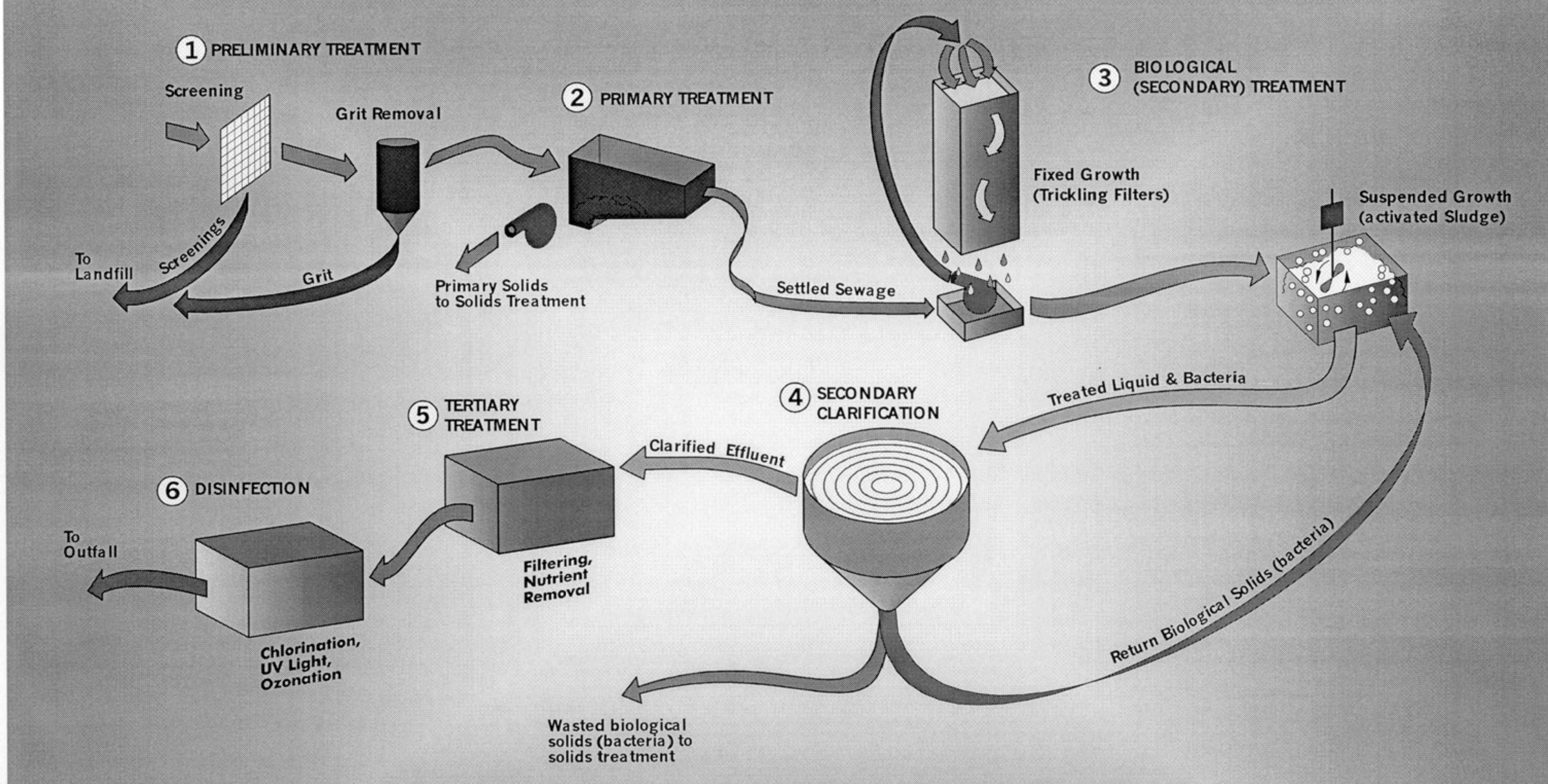
3.0 ON-SITE TREATMENT

- sometimes there are developments that are located outside the area serviced by central collection and treatment – also in rural and semi-rural areas where building lots are large and buildings are far apart, it may be too expensive to install collector sewers – these areas can sometimes be serviced by onsite systems
- onsite systems in British Columbia are regulated by the Ministry of Health
- most on-site treatment systems consist of a septic tank connected to a subsurface absorption field

- septic tanks are buried, watertight receptacles that provide gravity settling of heavy solids and skimming of floatable material such as grease, scum, and buoyant trash - the settled solids are partially digested by bacteria under anaerobic conditions (no oxygen available) at the bottom of the septic tank - the solids (septage) must be periodically removed from the tank for further treatment and disposal or recycling
- further treatment of the liquid leaving the septic tank is required, normally using subsurface absorption fields (also referred to as drain fields, tile fields, and disposal fields) – these consist of a buried network of perforated pipes - partially treated wastewater (normally the effluent from a septic tank) flows by gravity or is pumped into the disposal field - as the wastewater percolates out through the surrounding soil, solid particles are filtered out, and biological treatment is accomplished by a community of bacteria that develops in the soil
- common problems with on-site systems include surfacing of inadequately treated effluent (sometimes on neighboring lots), faulty design and/or construction, overloading, contamination of ground and surface waters, raising of the groundwater table, and clogging of absorption fields by solids, biological growth, or grease
- on-site absorption fields may not be permitted in some cases due to site constraints that prevent adequate treatment from occurring before the effluent surfaces or leaves the site - typical site constraints include small lot size, unsuitable soil types, fractured rock and rock outcrops, steep slopes, and high groundwater table
- on-site package treatment plants are small, self-contained mechanical systems that rely on communities of bacteria to provided biological conversion and removal of contaminants from wastewater - they are essentially miniature secondary treatment plants that may be used to further treat the liquid effluent from septic tanks before it is routed to on-site subsurface disposal fields on problem lots

14.136

Liquid Wastewater Treatment



① PRELIMINARY TREATMENT

Removes coarse solids (rock, rags, plastics, etc.) and grit (sand and gravel) which are normally sent to landfill.

② PRIMARY TREATMENT

Removes crude (fecal) solids by gravity settling, which are sent to the solids treatment processes; also removes oil and grease by skimming, which are normally sent to landfill.

③ BIOLOGICAL (SECONDARY) TREATMENT

Removes dissolved oxygen-demanding organic substances by using bacteria to convert degradable organic matter into bacterial cells, which may grow in suspension in a mixed basin (suspended growth) or in a slime layer attached to a solid surface (fixed growth).

④ SECONDARY CLARIFICATION

Separates the treated liquid from the bacterial cells grown in Step 3 by gravity settling, some bacteria may be returned to Step 3, and the rest are sent to solids treatment with the primary sludge.

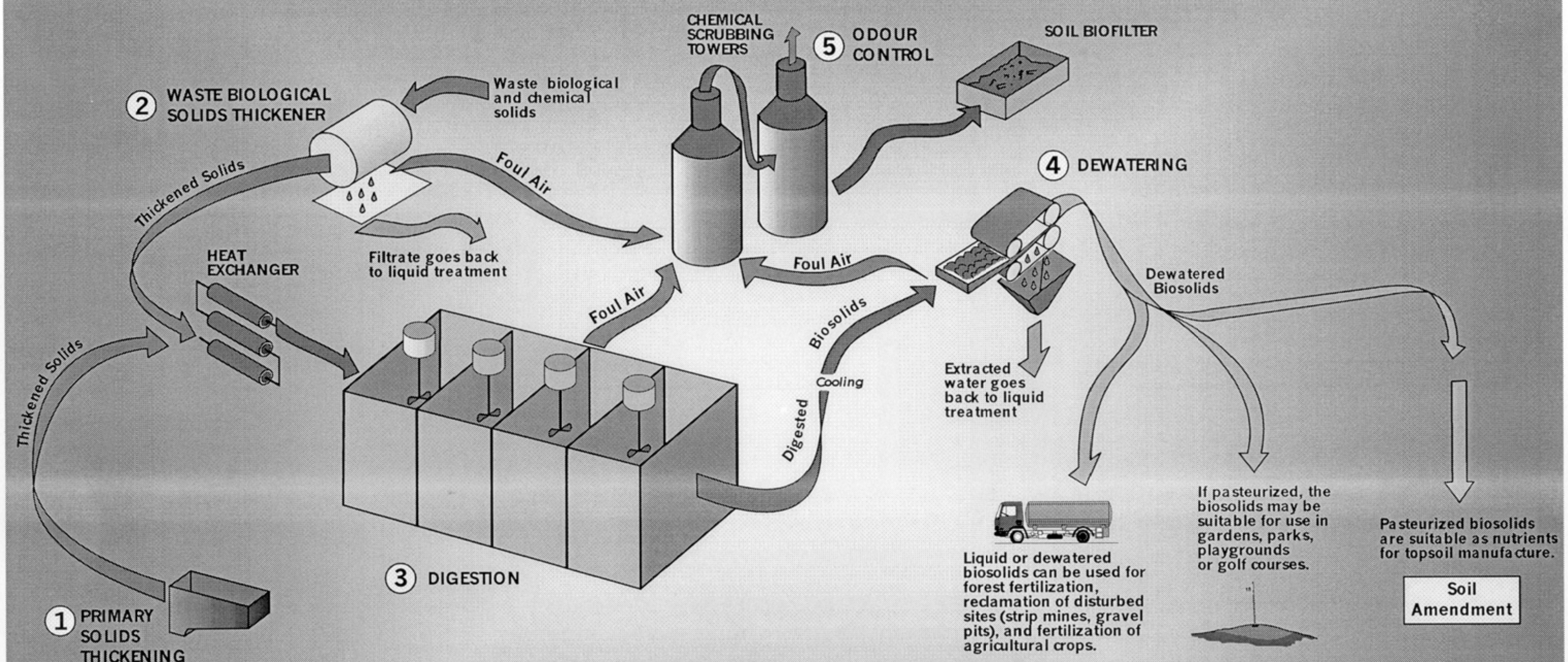
⑤ TERTIARY TREATMENT

Polishes effluent from secondary treatment by removing one or more of nitrogen, phosphorus, and fine suspended solids.

⑥ DISINFECTION

Kills or disables disease causing organisms and viruses in the treated wastewater.

How does digestion turn wastewater solids into usable soil conditioners (biosolids)?



① PRIMARY SOLIDS THICKENING

Primary solids from liquid treatment are collected and thickened in the primary sedimentation tanks.

② WASTE BIOLOGICAL SOLIDS THICKENER

Biological solids from liquid secondary are mechanically thickened.

③ DIGESTION

In this stage, solids are stabilized producing biosolids that are safe for reuse. Up to 50% of the solids are broken down to carbon dioxide and water. If high temperature (thermophilic) digestion is used, the biosolids are also pasteurized.

④ DEWATERING

Water is removed from the treated biosolids to reduce the costs of trucking to reuse sites.

⑤ ODOUR CONTROL

Foul air can be collected and odours can be removed using chemical and biological treatment.

DISTRICT OF SALMON ARM
LIQUID WASTE MANAGEMENT PLAN

APPENDIX 3

SAMPLE CODES OF PRACTICE AND SOURCE CONTROL EDUCATIONAL MATERIALS

Other Waste Management Tips

- Foil backing from X-ray film packets contain lead. Do not throw these materials in the garbage; give or sell them to a metal recycler. Contact the CRD Hotline for further information.
- If you are not sure what kind of waste you have, don't dump it down the drain or toss it in the garbage. Contact CRD Engineering for assistance.
- Dental practices that are connected to septic systems risk contamination of their tanks and drainfields. In addition, residual solids may become contaminated leading to additional disposal costs. Wastewater from your business should be contained and managed as appropriate. Contact CRD Engineering for assistance.
- Never discharge dental waste, whether "treated" or not, to a storm drain.

Your Office Can Save Money

Consider the following practices when looking for ways to help save money:

- Safe and careful handling of chemicals will avoid excess use and spills.
- Efficient silver recovery systems can provide additional sources of income.
- Sharing together with other dentists when purchasing waste treatment equipment will help reduce costs.
- If you have special waste that is being disposed of by a hazardous waste disposal vendor, inquire about "milk-run" services which can save your office, and others, money for pick-up.
- Keep all special waste separate in labelled containers. Never combine two or more different types of wastes as this may lead to higher costs due to decreased disposal or recycling options.

Additional Information

We Want To Help You!

CRD Contacts:

General Inquiries	360-3030
CRD Engineering (Permit and Discharge Information)	360-3045
CRD Recycling Hotline	360-3030

Special Waste Contacts

BC Recycling Hotline	1-800-667-4321
BC Environment	727-2141

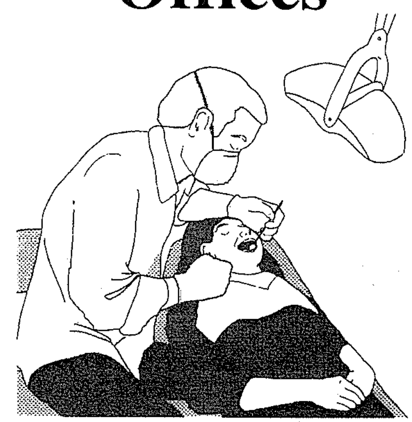
Business Contacts

Victoria and District Dental Society	642-3535 or: 595-4478
BC College of Dental Surgeons	1-800-663-9169

Literature Cited:

1. "Dental Office Waste Stream Characterization Study," Municipality of Metropolitan Seattle, September 1991.
2. "Control of Mercury in the Wastewater Treatment Facility of Pima County," Pima County Wastewater Management Department, December 1991.
3. "Problem Constituents discharged from Dental Businesses in the City and County of San Francisco," CCFS Department of Public Works, May 1992.
4. Arenholt -Bindslev, D. "Dental Amalgam -Environmental Aspects" Advances in Dental Research, September 1992, 6:125-30.

Liquid Waste Management Guidelines for Dental Offices



A Guide To Controlling The Disposal of Waste To The Sewer System

CRD Source Control Program

YES WE CAN CRD

Victoria & District Dental Society

DENTAL WASTE SOURCE CONTROL

INTRODUCTION

The Capital Regional District, in cooperation with local businesses and institutions, has initiated a strategy aimed at reducing, **at source,** the amount of chemical pollutants discharged to the environment through the sanitary and storm sewer systems. This strategy is called the **Source Control Program.**

Source Control is important for several reasons. Firstly, it can help decrease the amount of chemical contaminants that end up in the receiving environment - helping to ensure a healthy habitat for marine life. It can also help protect and increase the life span of our sewer and storm drain systems--helping avoid costly repairs and replacements. Finally, Source Control can help reduce contamination of sewage solids (biosolids) that might otherwise be reclaimed as a resource for such things as composting or fertilizer.

A Sewer Use Bylaw that applies throughout the CRD was adopted in August 1994. This bylaw defines specific prohibited and restricted waste categories, provides for a permit system and includes sections on inspection and enforcement.

In your dental practice, you work with materials containing, mercury, silver, and other potentially hazardous substances. If these materials are discharged to the sewer system, they may be in violation of regulated discharge limits.

Utilizing the options discussed in this brochure will help you ensure that liquid waste management requirements are met, reducing your legal and environmental liability. More information can also be obtained through contacts listed on the back of this brochure.

BACKGROUND

Recent analysis of marine sediments in the vicinity of the District's two largest sewage outfalls has shown elevated levels of certain chemicals, including mercury. Both mercury and silver have also been found at high levels in biosolids produced at one of the District's sewage treatment plants.

Mercury is an extremely toxic substance, particularly when converted into its organic forms in the receiving environment. Mercury has been shown to accumulate in the tissues of fish, plants and mammals and tends to "bioconcentrate" within the food chain. Both mercury and silver can be harmful to aquatic organisms even at very low concentrations.

These, and other, heavy metals, cannot be broken down or deactivated by sewage treatment processes and they tend to pass through such processes and concentrate in the receiving environment or accumulate in treatment plant biosolids. In order for these biosolids to be applied to land, the metal levels must meet stringent provincial government criteria.

Studies undertaken in other jurisdictions in North America and Europe have shown that dental offices can discharge significant amounts of mercury and silver to the sanitary sewer. (*See* - Literature Cited.)

There are approximately 200 dental offices operating throughout the District. Although the individual discharges of hazardous materials from each office are small and may not seem to present a problem, the collective daily discharges from all these sources have the potential to significantly impact the quality of biosolids and the marine environment.

HAZARDOUS WASTE MANAGEMENT

Check your product Material Safety Data Sheets (MSDS) for hazardous chemicals. These sheets should be kept in your work area and can be obtained from your product supplier. If you are disposing of waste which contains these chemicals you may have "Special Waste" which must be disposed of according to BC Environment's Special Waste Regulations. Call CRD Engineering or BC Environment to make sure. It is important to identify which wastes fall into this category.

Storage of these wastes must also be carried out in accordance with BC Environment Regulations. Do not stockpile wastes in unprotected areas. Label all containers and keep them in a secured area. Do not mix wastes - disposal fees will increase.

Special wastes cannot be disposed of in sewers or the regular garbage. Hazardous waste disposal vendors are available to take them away for treatment and safe disposal. Vendors who provide services to Vancouver Island are listed in the CRD Recycling Directory and the Yellow Pages.

DENTAL WASTE HANDLING AND DISPOSAL

Use the following information as a guide for the proper handling and disposal of common dental office wastes.

X-RAY PROCESSING

Silver concentrations in X-ray fixer solutions can be as high as 3000 parts per million (ppm). The CRD's Sewer Use Bylaw currently defines solutions containing more than 2 ppm silver as Restricted Waste. Restricted Waste may **not** be discharged to the sanitary sewer unless authorized under a waste discharge permit or an approved code of practise.

OPTIONS FOR THE DISPOSAL OF FIXER SOLUTION INCLUDE:

- Have your X-ray process solutions picked up by your supplier or a hazardous waste disposal vendor. It is important to label the container with "Spent X-ray Fixer Only" and **not** to mix fixer with other materials including developer. When fixer and developer are kept separate, silver reclamation is easier.
- Seek an agreement with a local photo lab to put your fixer through their silver recovery equipment. Be sure that any company that receives your fixer is actually recovering the silver and is familiar with the Special Waste Regulations and sewer discharge limits.
- Install a silver recovery unit in your office. These units extract silver from spent fixer and can help you meet the 2 ppm discharge limit if operated according to manufacturer's instructions. Contact your photo processing solution supplier for information on the types of recovery units available. To reduce costs, a group of dentists could purchase and share a recovery unit.

OTHER X-RAY PROCESS POINTS

Used developer, **if <u>not</u> a Special Waste or a restricted waste and if uncontaminated with any other solutions (including fixer)**, may be discharged to the sanitary sewer.

Contact your chemical supply company about new products and processes available to help you reduce, regenerate or eliminate the production of X-ray chemical residuals.

CHEMICLAVE SOLUTIONS

Chemiclave units that are operated in accordance with manufacturer's specifications will normally generate wastes that are acceptable for discharge to the sanitary sewer. Check that your chemiclave solutions are within the acceptable pH range of 5.5 to 11.0 and are not classified as Special Wastes.

Unused solutions can be given to another dental office for use.

DISINFECTANTS

Many disinfectants contain flammable substances including alcohol, ether, acetone, xylene, chloroform and other solvents. Never pour any of these substances down the drain as they could present a fire or explosion hazard, seriously injure sewer workers or damage your plumbing. Contact your local fire marshal for information on safe bulk storage of these materials.

Hazardous waste disposal vendors can provide a pick-up service for these stored wastes.

Small amounts of diluted alcohol or peroxide rinses used in patients mouths (30-50 ml) do not pose a problem.

AMALGAM WASTES

Amalgam dust and particles which accumulate in suction traps or are carried in rinse waters can contribute high levels of mercury and silver. Solutions containing more than 0.05 ppm mercury or 2 ppm silver are defined as restricted wastes under the CRD's Sewer Use Bylaw.

Suction trap residues require special handling and are best managed through regular trap clean out, storage and pick-up by a hazardous waste disposal vendor.

Treatment equipment that significantly reduces metal levels in rinse waters is available and is currently being tested by other agencies. More information will become available as requirements and best management practices are developed.

ELEMENTAL MERCURY

Elemental Mercury is an extremely hazardous waste and is considered a "Special Waste" by BC Environment. Always dispose of elemental mercury through a metal recycling company or a hazardous waste disposal vendor. Contact the CRD Hotline for more information.

Remember:

- Hotel and motel wastewater should be discharged to sanitary sewer or septic field systems only (not to storm drains)
- Use a combination of Fats, Oils and Grease (FOG) management strategies to minimize your FOG discharges and comply with local regulations.
- Never pour unwanted concentrated cleaning fluids, solvents or spot removers into sanitary sewers or storm drains.
- Always follow product instructions carefully and dispose of excess or waste hazardous products using a hazardous waste disposal vendor or a recycling broker.
- Look for alternatives to products containing chlorine or chlorinated solvents.
- Avoid the use of urinal blocks and toilet bowl cleaners that contain paradichlorobenzene (or 1,4 - dichlorobenzene). This compound has been targeted as a chemical of concern in the CRD's wastewater. Check the MSDS sheets available from your supplier and enquire about alternative products.
- Do not discharge acid (less than pH 5.5) or alkaline (greater than pH 11.0) products to sanitary sewers or storm drain systems.
- Never discharge excessively hot water (greater than 65 degrees C) to sanitary sewers or storm drains.

Your Company Can Save Money

Consider the following practices when looking for ways to help save money:

- Safe and careful handling of chemicals will avoid excess use and spills.
- Check with your chemical supplier for less hazardous alternatives. As demand increases for more environmentally responsible products they will become more readily available at a lower cost.
- If you have special waste that is being disposed of by a hazardous waste disposal vendor, enquire about "milk-run" services which can save your company, and others, money for pick-up.
- Keep all hazardous wastes separate in labelled containers - never combine two or more different types of wastes. This will help reduce the cost of special waste disposal.

Additional Information

We Want To Help You!

Call the CRD Hotline or CRD Engineering for information on:

- **CRD Sewer Use Bylaw** and other discharge regulations
- equipment and services to help reduce FOG emissions
- alternatives to toxic or hazardous cleaners

General Inquiries	360-3030
CRD Engineering (Permit and Discharge Information)	360-3045
CRD Recycling Hotline	360-3030

Special Waste Contacts

BC Recycling Hotline	1-800-667-4321
BC Environment	727-2141

Industry Contacts

BC & Yukon Hotel Association	1-800-663-3153

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CRD 10/94 300?HP

Liquid Waste Management Guidelines for Hotels & Motels

A Guide To Controlling The Disposal of Waste To The Sewer System

CRD Source Control Program

British Columbia & Yukon Hotels' Association Greater Victoria Zone

"Source Control"

What It Means To The Hospitality Industry

The Capital Regional District, in cooperation with local businesses and institutions, has initiated a strategy aimed at reducing, **at source**, the amount of potentially hazardous chemicals, fats, oils and grease discharged to the ocean and beaches through the District's sanitary sewer and storm drain systems. This strategy is called the **Source Control Program**.

Why Source Control?

Decreasing the amount of chemicals, fats, oils and grease in the sewer and storm drain systems means:

- decreasing the potential of costly blockages occurring in **your sewer line**.
- less chemicals ending up in local waters and marine sediments.
- increasing the lifespan of pipes and other equipment, avoiding costly repairs and replacements.
- reducing contamination of sewage solids that might otherwise be reused for such purposes as composting or soil conditioning.

This brochure, prepared with your specific industry in mind, provides some initial steps your business can take to help protect the environment, the sewer system, and your own operation. More information can also be obtained through the contacts listed on the back of this brochure, and from the Source Control Program Booklet available from the CRD.

Large or Small - The Size of Your Company Doesn't Matter

Small, individual businesses may not think their liquid waste contribution is significant or poses a problem. However, this is not the case. Some chemicals discharged to sewers, such as heavy metals or chlorinated organics, can present a serious threat to the environment -- even in very small quantities. In addition, many small businesses contributing small quantities of wastes can collectively present a problem. Every business or institution should consider its waste disposal practices seriously.

Fat, Oil and Grease (FOG) Management

FOG is found in many foods such as meats, sauces, salad dressings, deep fried foods, pastries, cheese and butter. Improper disposal of FOG from food service facilities can cause blockages in internal drains and in municipal sewage collection systems. These blockages often lead to expensive repairs, cleanups or regular maintenance schedules.

The current CRD regulations require wastewater to contain an equivalent of less than one teaspoon of FOG per 45 litres (10 gallons) of water.

The main components of FOG management include:

Source separation

Ensure that FOG contained in food waste or resulting from food preparation is separated into recyclable, compostable (where opportunities exist) and solid waste "streams". Avoid the use of garborators to dispose of FOG-containing materials as this increases the "strength" of your waste and much of the resulting material must be screened from wastewater prior to treatment. This screened material ends up being trucked to Hartland Landfill.

Recycling

Frying grease and oils that are not mixed with water can be recycled by rendering companies.Contact the CRD Hotline for more information.

Garbage Pickup

Use your regular garbage container for disposal of all non-recyclable, non-compostable solid and semi-solid waste rather than your pre-rinse sink. Solid waste can accommodate 20% liquid, so even gravies and other oily sauces can be sent to the landfill.

Grease Traps/Interceptors

Both of these are tanks that act to slow the disposal of kitchen wastewater so that the FOG can rise to the surface, allowing cleaner water to leave from the bottom of the tank. When the tank fills with FOG it can be pumped out by a liquid waste hauler. Traps are generally smaller, are located inside a building and require frequent maintenance. Interceptors are located in the ground outside the building, are generally larger and are more efficient at removing FOG. It is important to have tanks sized to match your water usage and to have them cleaned out on a regular basis.

Employee Education

Train kitchen personnel to handle and dispose of FOG properly. Posting "NO GREASE" signs will remind your staff not to pour used frying grease, hood vent grease or any other used fats or oils down the sink drain and to use alternative methods of disposal. Adding detergent or hot water to FOG may mean that it will pass through any downstream trap or interceptor, and solidify further down the pipe.

Bio-treatment

Biological treatment, using products containing microorganisms which decompose grease naturally, has been effective in reducing maintenance costs where grease traps or interceptors are used. Contact the CRD Environmental Chemist for more information.

Pipe cleaning companies report that 95% of the problems they fix are due to grease. Save yourself money with a grease management plan!

Cleansers and Other Chemical Products

Check your Material Safety Data Sheets (MSDS) for hazardous chemicals. These sheets can be obtained from your product supplier and should be kept in your work area. If you are disposing of wastes which contain these chemicals you may have "Special Waste" which must be disposed of according to the BC Environment's **Special Waste Regulations**. Call CRD engineering or BC Environment to make sure. It is important to identify which wastes fall into this category to avoid costly fines.

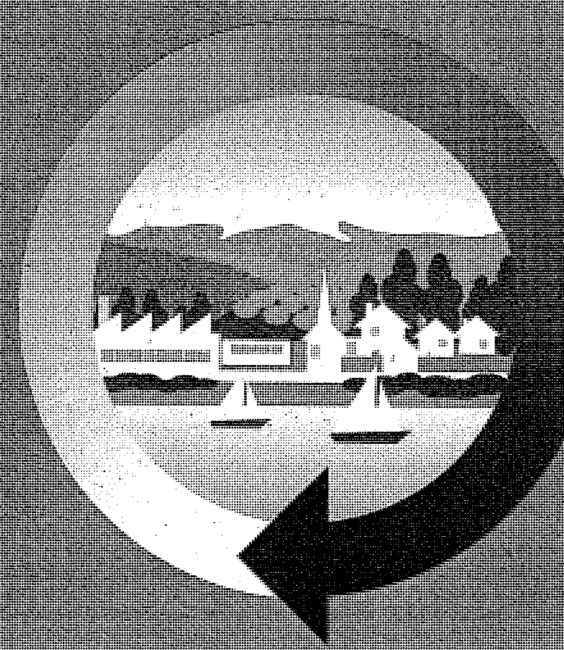
Storage of these wastes must also be carried out in accordance with the Special Waste Regulations. Do not stockpile wastes in unprotected areas. Label all containers and keep them in a secured area. Do not mix wastes -- your disposal fees will go up.

Special Wastes cannot be disposed of in sewers or the regular garbage. Hazardous waste disposal vendors are available to take your chemical wastes away for safe disposal. Check the CRD Recycling Directory or the Yellow Pages for the names and numbers of such companies.

For more information or a copy of the bylaw contact:

Sewage Control Manager	862-5500
Environmental Technologist	862-3341

THE CITY OF KELOWNA'S SANITARY SEWER/ STORM DRAINAGE BYLAW AND YOU...

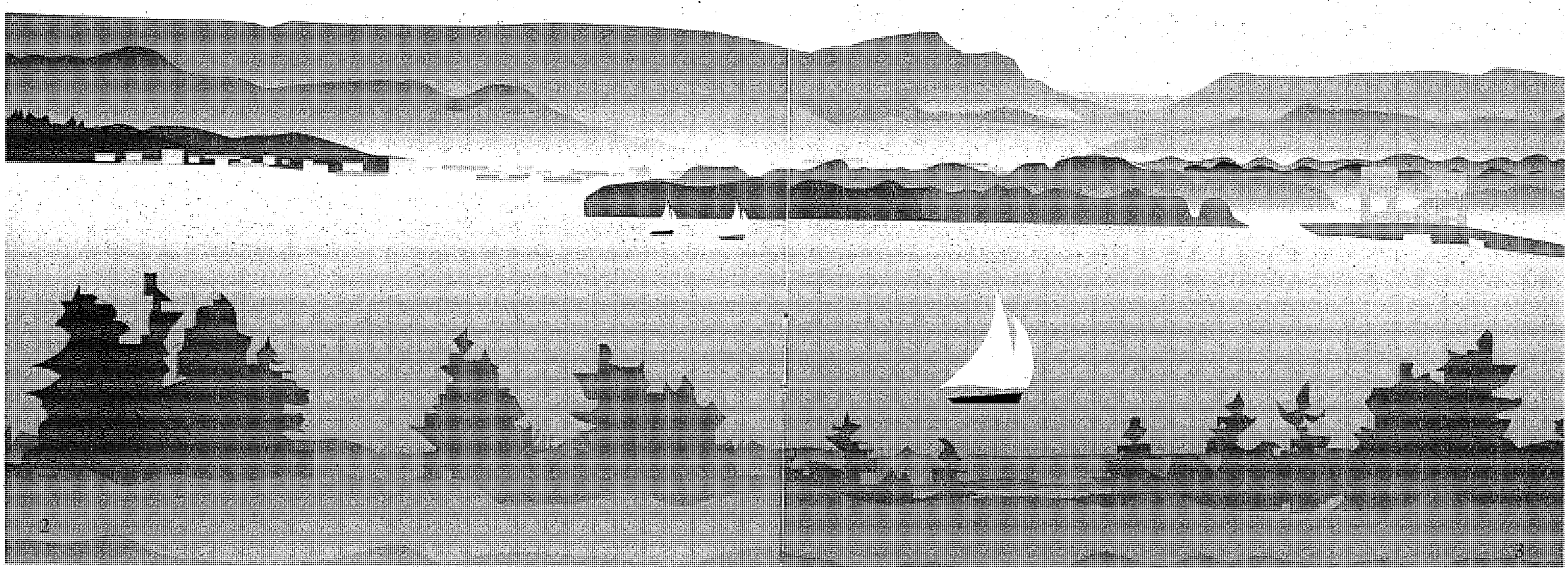


Okanagan Lake is our greatest natural resource.

It is also the most fragile — requiring ongoing city-wide co-operation to maintain high water quality standards. ◆ With the construction of its biological sewage treatment plant in the early '80s, the City of Kelowna took a giant first step toward ensuring superior water quality for future generations. To help maintain this high standard of water quality, the City recently adopted the Sanitary Sewer/Storm Drainage Bylaw, which regulates any discharge to a sanitary sewer or storm drain within the City. ◆ The Bylaw, adopted in January of 1991, is designed to ensure the health and safety of Kelowna residents; to safeguard against environmental degradation; and to protect the integrity of the City's collection and treatment systems.

To foster better understanding and co-operation,

the City has adopted an education and enforcement approach to the legislation. ◆ The Bylaw is being implemented slowly to give existing businesses adequate time to acquaint themselves with the provisions, and to make any necessary changes. New businesses must comply before licensing is approved. ◆ Monitoring of wastewater quality and routine inspection is expected to begin in the fall of 1992.



Understanding the System:

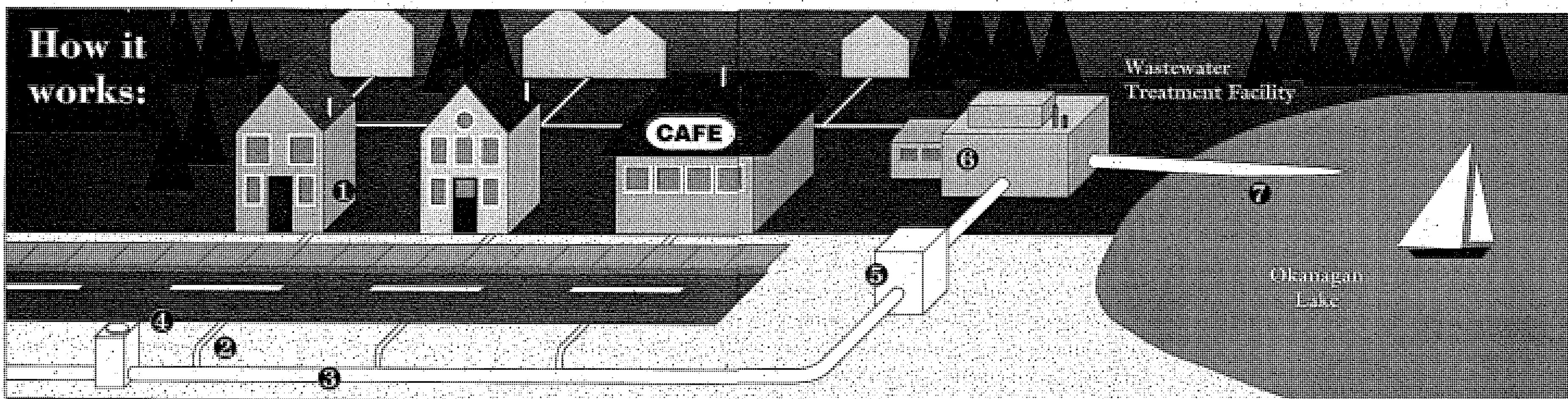
Kelowna's sewer is divided into two separate and distinctly different systems — The Sanitary Sewer to manage domestic wastewater, and the Storm Drain to handle rainfall and run-off. Linking the two is Okanagan Lake — where outfall from both systems is discharged.

Kelowna's Sanitary Sewer System collects, conveys, treats and disposes of domestic wastewater (that derived from the home) and industrial wastewater (that resulting from business use, manufacturing and processing.) This system currently services close to 60% of Kelowna's population, and is being expanded to reach presently-unserviced areas, as well as to accommodate rapid growth.

Although our treatment methods for sanitary sewage are among the best in North America, the continued effectiveness of our treatment plant depends on the quality and quantity of wastewater received.

Kelowna's sanitary sewage is collected and conveyed through 200 kilometers of underground pipe ranging in diameter from 4" to 48". Higher than acceptable levels of certain chemicals damage these pipes and the pumps which regulate wastewater flow. Other discarded substances such as oil, grease and paint residues clog them.

The biological sewage treatment plant, which depends on 'living' bacterial organisms to reduce levels of nitrogen and phosphorous, could be less effective if toxic materials exceed certain limits. To protect Okanagan Lake — our main source of water for everything from drinking to bathing — everyone living and working in Kelowna must share responsibility for the sanitary sewage system and the treatment plant.



1 Domestic and industrial wastewater is produced. 2 Wastewater exits through sewer pipes hooked into each building. These small pipes connect to 3 larger main lines which run parallel to roadways. The pipes are maintained, in part, by access through nearly 1800 manholes 4 located strategically along the line. Gravity, along with 19 pumping stations 5 located throughout the City, propel the sewage through major trunk lines to the biological sewage treatment plant 6. Using the Bardenpho method to remove nitrogen, phosphorous, and other contaminants, the plant treats nearly 20 million litres of wastewater daily. 7 The purified effluent (drinking water quality) is then pumped into Okanagan Lake through a single outfall pipe.

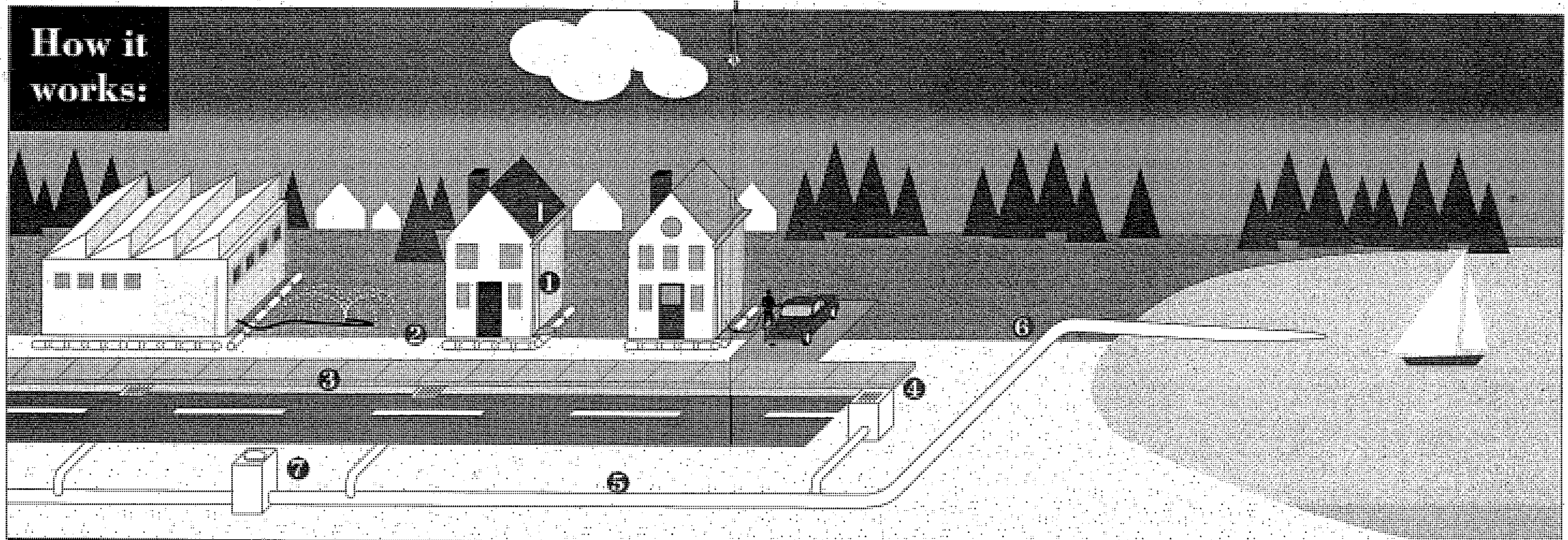
YOU CAN HELP... protect the sanitary sewer and, ultimately, Okanagan Lake by voluntarily adopting these practices at home and at work. Your co-operation will decrease the quantity and improve the quality of wastewater entering the sanitary sewer system.

- Conserve water wherever possible.
- Use phosphate-free detergents and cleaners, and use less than manufacturers recommend.
- Replace toxic household cleaners with compounds like borax, baking soda and vinegar.
- Don't put anything down the drain that pictures a skull and crossbones on the label.
- Don't use garburetors.
- Install water-saving devices on shower heads, taps and toilets.
- Don't flush or pour medications down the toilet or drain.
- Don't drain swimming pools into the sanitary sewer.
- Connect to the sanitary sewer if possible.

Understanding the System:

The Storm Drainage System... collects, conveys and disposes of stormwater (rain and snow melt). To prevent flooding, some of Kelowna's developed areas and roadways are serviced by ditches or catch basins connected to storm drainage pipes, or a system to soak the water into the ground. Although the storm drain is simpler than the sanitary sewer system, its outfall is potentially more damaging because it is discharged directly into the lake without treatment.

How it works:



Stormwater and groundwater are funnelled into the storm drain via 1 roof drains, 2 foundation drains, 3 curb and gutter ditches and ultimately 4 catch basins. 5 By means of gravity, water is collected and diverted through 125 kilometers of pipe. 6 Water is directed to Okanagan Lake via 78 outfall pipes — 70 draining into nearby creeks, eight directly into the lake. 7 1254 storm drain manholes allow access for cleaning and inspection.

YOU CAN HELP... protect our water source by remembering that everything discharged into the storm drain goes directly into Okanagan Lake. By voluntarily practicing these few things, you'll help protect it.

- Conserve water wherever possible.
- Avoid overwatering lawns and gardens.
- Don't put anything toxic down a storm drain grate.
- Limit use of pesticides and herbicides by exploring alternative methods of weed and pest control in lawns and gardens.
- Use a broom, not a hose, to clean your driveway.
- Use environmentally-friendly detergents for car washing.
- Don't allow oils or chemicals to drain on areas which will be washed to a catch basin.

The Sanitary Sewer/Storm Drain Regulation Bylaw...

was designed and implemented to protect our water resource. By controlling levels of pollutants being discharged into sanitary sewers and storm drains, the City can protect its collection and treatment facilities, its people and the environment.

Voluntary compliance with the regulations contained in the bylaw is encouraged at this time.

In short, the bylaw states that:

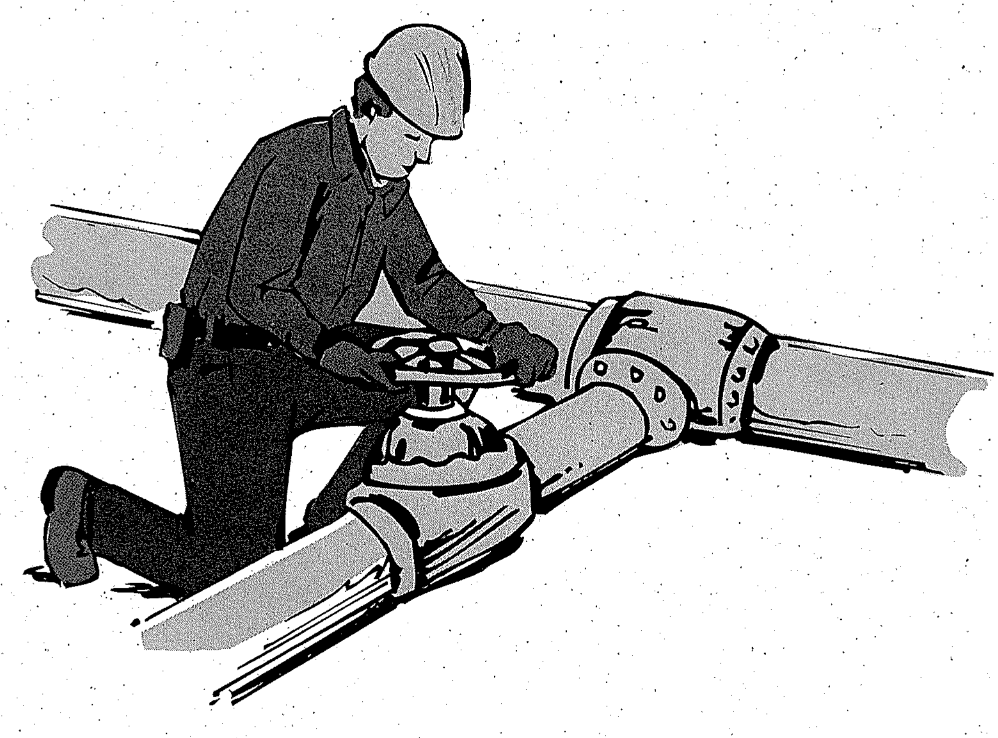
- Specific water-borne wastes are either totally prohibited, or are restricted to allowable limits (see pages 10 and 11).
- Buildings with plumbing fixtures situated on properties within a Sanitary Sewer Specified Area MUST be connected to the City's sanitary sewer. Proper application and connection procedures must be followed.
- Septic tanks cannot be connected to the storm drain.
- The discharge of any substance that impedes or halts flow in the drainage system is prohibited.
- The discharge of substances which may impair the quality of water in any well, lake, river or reservoir downstream is prohibited.

Residential:

- The installation of garburetors which discharge waste into the sanitary sewer is prohibited.
- Use of sump pumps connected to the sanitary sewer is prohibited.

Commercial and Industrial:

- Commercial and industrial applicants must submit waste reports, indicating the expected quality and quantity of their wastewater. Any additional testing required may be at the owners expense.
- A change in the type of business being operated at a specific location must be reported to the City.
- All food preparation facilities must install grease and oil interceptors as close to the source of these as possible. Such interceptors must be easily-accessible for cleaning and inspection by the owner.
- Service stations, and vehicle repair and maintenance establishments must install grease, oil and sand interceptors as close to the source as possible and upstream from service connections.
- Any industry likely to discharge wastewater into the sanitary sewer which exceeds the standards for restricted wastes, is required to install and operate a pre-treatment facility to be approved by the City.
- The equipment needed to comply with these bylaws must be installed and maintained at the property owner's expense.

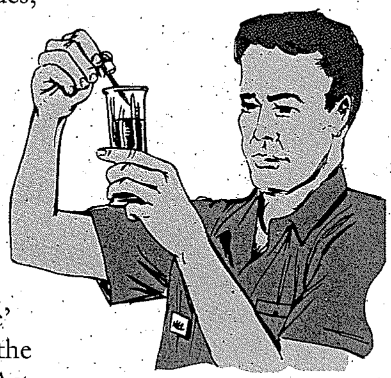


Prohibited Waste:

Certain wastes, when discharged into the sanitary sewer or storm drain, endanger City workers, sewer system components, local residents and the environment. ***These wastes are prohibited and must never be discharged into either collection system.***

They include:

- flammable or explosive wastes, including all petroleum products and alcohols,
- pesticides, herbicides or fungicides,
- corrosive materials,
- radioactive materials,
- wastes which obstruct or interfere with flow through sewer facilities (e.g. oil, grease, paint residues, groundwater or seepage water)
- wastes from cesspools, or septic tanks
- waste classified as 'Special Waste' pursuant to provisions made in the province's Waste Management Act.



It is also illegal to discharge stormwater or uncontaminated wastewater into the sanitary sewer. Conversely, no domestic or industrial wastewater can be disposed of into the storm drain.

Any person aware of, or responsible for the accidental discharge of a prohibited substance into either the sewer or storm drainage system must report the discharge immediately to the Sewage Control Manager so steps can be taken to minimize any damaging effects.

Restricted Wastes:

In large amounts or high concentrations, some types of water-borne waste are environmentally hazardous and/or may interfere with sewer facility operations. Examples of these are wastes discharged by drycleaners, photo labs, hair salons, pharmacies, carpet cleaners, restaurants, vehicle repair and maintenance shops, and dental and medical clinics.

Small amounts of these contaminants, however, can be treated safely at the City's sewage treatment plant. Wastes listed on the enclosed insert sheet are restricted to the allowable concentrations shown. A business whose waste exceeds the allowable limits must pre-treat

that waste before discharging it into the system, or pay a surcharge imposed by the City.

DILUTION OF WASTE FOR THE PURPOSE OF MEETING CONCENTRATION LIMITS IS STRICTLY PROHIBITED.

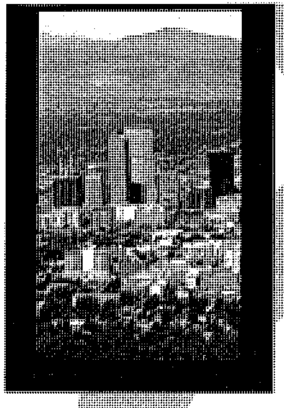
PLEASE READ THE ENCLOSED INSERT SHEET FOR FURTHER DETAILS REGARDING PROHIBITED AND RESTRICTED WASTES.

The Sampling Program:

From June 1992 onward, wastewater samples will be gathered routinely from random locations along the sanitary sewer and drainage systems. These will be tested for priority pollutants in conjunction with the City's newly-adopted sewer bylaw. By working back through the sewer system, City employees are able to pinpoint 'hotspots,' or areas where unacceptable wastewater is being discharged. Polluters will be identified and dealt with according to provisions laid down in the Sanitary Sewer/Storm Drainage Regulation Bylaw.

Penalties and Fines:

- The Sewage Control Manager and/or anyone authorized by him can enter property or premises at any reasonable time to determine bylaw compliance or violation.
- The Sewage Control Manager, or designate, may disconnect water service or seal off the sewer line to any business discharging wastewater which creates immediate personal danger or endangers or interferes with the operation of the sewer or drainage systems. The owner or occupant will be responsible for any costs incurred.
- Any person who violates the bylaw, or is aware of a violation and does not report it, is subject to the penalties imposed by the bylaw.
- Persons guilty of a bylaw violation will face penalties up to $2,000.00 for each offense. Every day that an infraction is permitted to exist will constitute a separate offense.



Remember...

Water runs downhill.

Water picks up everything.

Water flows to our rivers, streams, and creeks.

Do your part
to keep our water clean!

Dumping liquid or solid waste into a storm drain or creek is a crime! If you see illegal dumping, report it!

Denver
303-446-3700

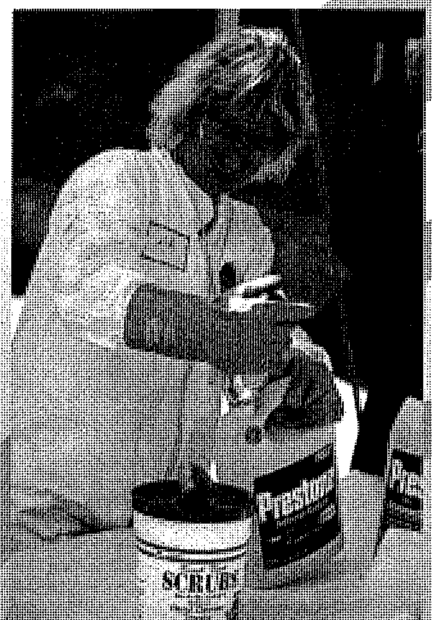
Aurora
303-739-6700

Lakewood
303-987-7111

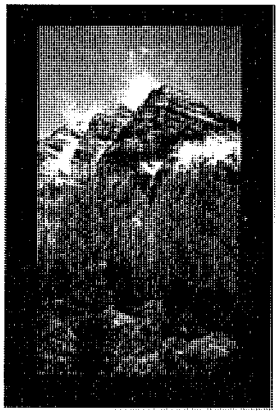
Arapahoe County
303-795-4640

Urban Drainage
303-455-6277

CLEAR CHOICES
FOR CLEAN WATER



Managing Your Household Wastes



Conserve and recycle

Buy only what you need

Avoid creating waste. Buy only the amounts that you will use right away.

Recycle

Take old or unwanted household chemicals to your local recycling centers (where available). Take advantage of local household chemical round-ups. If you change your own oil, collect all of the used oil and take it to your local oil recycling center.

Buy recycled products

Look for recycled paint, motor oil, and antifreeze.

Use and dispose of chemicals properly

Never mix chemicals

Don't mix different household chemicals together. The mixture might be harmful or toxic.

Store products safely

Store products in their original, labeled containers in a covered and secure area, away from children and pets.

Dispose of chemicals properly

Take responsibility for chemicals that you throw away. Rinse paint brushes in the sink rather than outdoors with a hose. Never pour household, automotive, or lawn and garden chemicals into the storm drains — it's illegal and it pollutes the water. For additional information on proper disposal, call the number on this brochure.

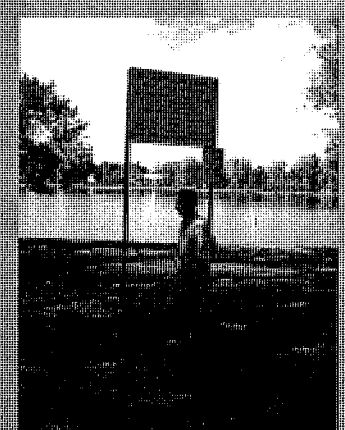
Contain yard, household, and pet waste

Keep garbage in its place

Keep garbage cans tightly covered. To avoid litter, take garbage and recyclables out to your curb only on the day your trash is picked up.

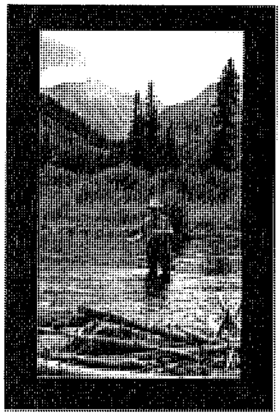
Manage yard wastes

Keep leaves, grass clippings, and other yard wastes cleared off driveways, sidewalks, and streets, so that they won't wash into storm drains.



Bag pet wastes

Pet wastes carry disease-causing organisms! Pick up after your pet. Bag pet wastes and dispose of properly in the garbage.



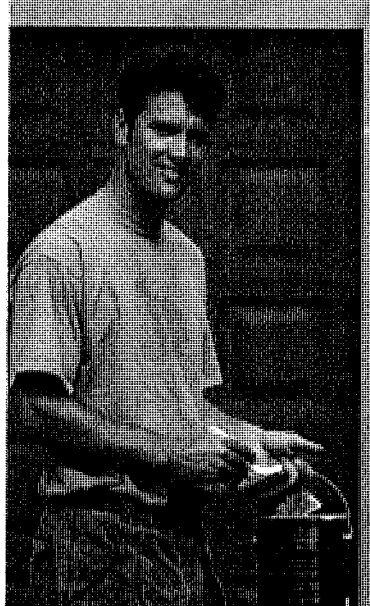
Clean water – we need it to survive

Rivers, streams, creeks, ponds, lakes, reservoirs — the metro area's waterways are some of our most precious resources. They provide drinking water, recreation, and wildlife habitat. But only if the water remains clean and unpolluted.

This brochure offers ways to handle household chemicals and waste that will help prevent water pollution and keep our streams, rivers, and lakes clear and clean.

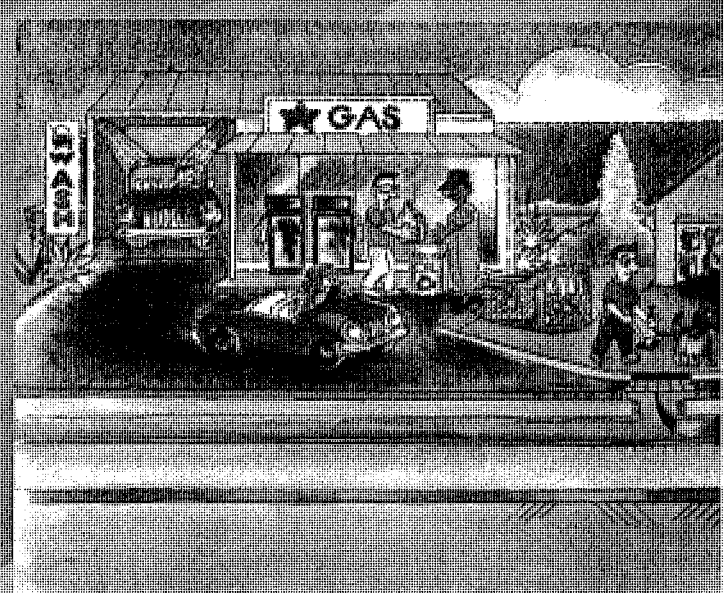
The gutter in the street outside your home carries water into a network of storm drains that lead straight to local creeks and rivers. Storm drains are separate from the sanitary sewer system (which handles wastewater from your sinks, tubs, and toilets). Unlike wastewater, stormwater is not treated at a sewage treatment plant. Stormwater goes directly from the storm drainage system into local creeks and rivers.

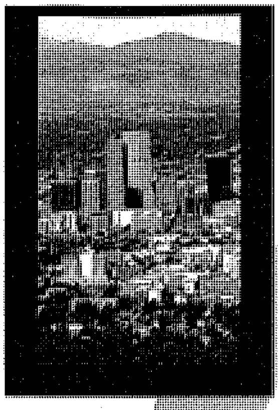
Anything on the sidewalks and streets, such as trash, antifreeze, motor oil, pet waste, paint, or excess fertilizer, is carried away by runoff and ends up in storm drains, where it flows into rivers, lakes, and streams.



Not all pollution is intentional

We all need to do our part to protect local waterways from pollution. What you may not realize is how much water pollution is unintentional, caused by the things that we do everyday — at work, at home, at play.

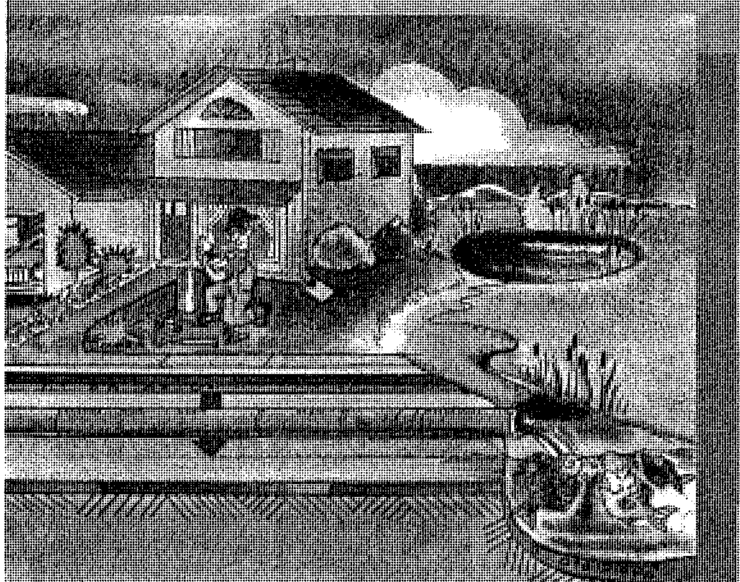




What you do makes a difference!

You might not think that you can help solve the problem, but you can! The average home can accumulate as much as 100 pounds of chemical wastes each year — from common household and lawn and garden products such as:

- Paint
- Paint thinners
- Cleaning solutions
- Degreasers
- Pesticides
- Weed killers
- Fertilizers
- Antifreeze
- Motor oil
- Gasoline



Improper use or disposal of these common household products leads to water pollution. Yard waste, such as leaves and grass clippings, and pet waste can also contribute to water pollution.

You can keep your home clean and safe and help prevent water pollution! Here's how.

Look for alternatives

Use non-toxic products

Ask retail experts about non-toxic or less toxic alternatives to your current cleaning, automotive, and lawn care products. Consider using basic products like vinegar, ammonia, and baking soda for your cleaning needs.

Read product labels

Avoid products labeled "Danger" or "Poison." Products labeled "Warning" or "Caution" are less hazardous.

Use commercial car washes

Instead of washing your car in the driveway, use your local car wash. Commercial car washes collect and filter out dirt, soap, and oil. The wash water is then cleaned and recycled.

Maintenance Record

DATE	WORK DONE	CONTRACTOR

Map your Home

Plot the position of your septic system in relation to your site & home for quick reference

N

For more information and a copy of our video contact your local Public Health Agency

Environment Canada
FRASER RIVER ACTION PLAN

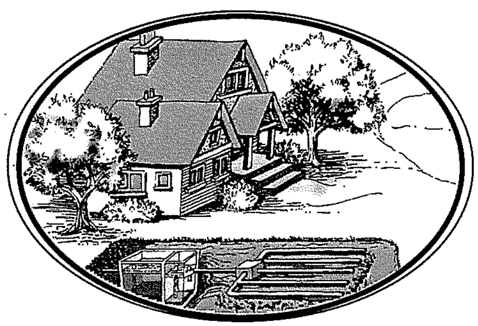
Environnement Canada
PLAN D'ACTION DU FRASER

CENTRAL FRASER VALLEY UNION BOARD OF HEALTH

Q.P. # 16985

SEPTIC SYSTEM MAINTENANCE

Pure & Simple



A GUIDE FOR HOMEOWNERS

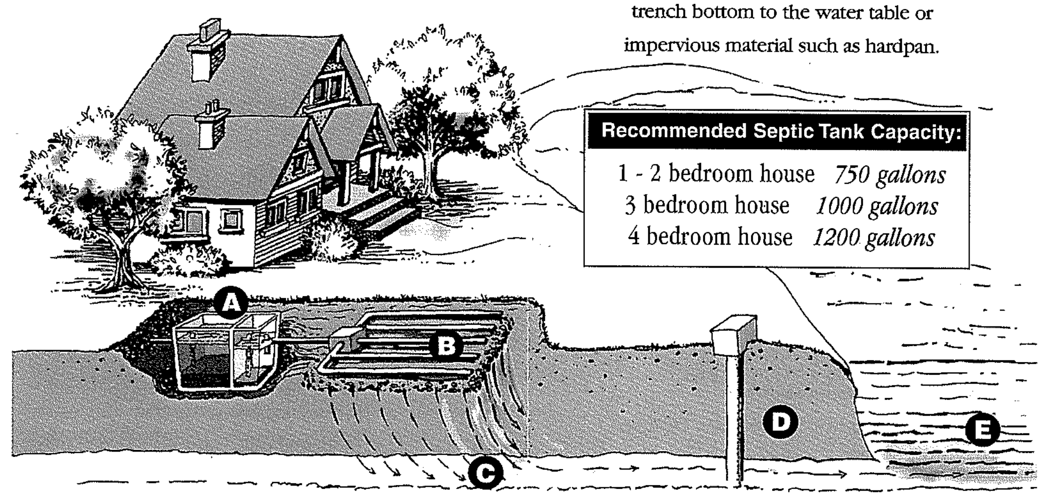
Your simple step-by step guide to septic systems maintenance and trouble-shooting.

How Septic Systems Work

A Conventional Gravity Flow Sewage Disposal System

SIZE AND DIMENSIONS:

The average septic tank requires a space about 10 ft. x 10 ft. The disposal (or drain) field should be 30 ft. x 50 ft. or larger, with an additional area of similar size held in reserve in case of drainfield failure. The drainfield must have 4 ft. of good native soil from the surface to the water table or hardpan and a minimum of 2 ft. vertical separation from trench bottom to the water table or impervious material such as hardpan.



Recommended Septic Tank Capacity:	
1 - 2 bedroom house	*750 gallons*
3 bedroom house	*1000 gallons*
4 bedroom house	*1200 gallons*

There are many types of septic systems used around the province. Depending on location and soil condition, homeowners may use treatment plants, sand filters, pumps or siphons. The treatment principals are generally the same in all systems.

In conventional systems, waste water from sinks, tubs and toilets flush out of the house into a tank (A) that separates and stores the solids. Bacteria help to break down some of the heavier sludge and floating scum, but the rest accumulates in the tank until it is pumped out.

The partially treated waste water (or effluent) flows from the tank into a distribution box that evenly divides the discharge into a network of pipes (B) that are buried in gravel-filled trenches in the drainfield. Small holes in each pipe allow waste water to seep through the gravel, then into the soil. As effluent trickles through the soil, any remaining particles are removed by natural filtration and bacterial action. When waste water finally reaches the water table (C), it has been treated and cleansed.

If waste water doesn't get the full treatment contaminants can leach into the ground water (C) that supplies our wells (D), or drain directly into (E) lakes, streams or our own backyard.

- **HAVE YOUR TANK PUMPED EVERY 3 TO 5 YEARS.** Septic system professionals should inspect the entire system - field, distribution box and pump chambers.
- Know where your system is. Keep a photo or map and maintenance records.
- Be safety conscious when checking your system. Watch for heavy tank covers, sewer gases and raw sewage.
- Practice water conservation by using **low flush toilets, water saving faucets and shower heads, dishwashers only when full** – your system will last longer.

Do's

- Take hazardous wastes to approved disposal centres.
- Plant grass on your drainfield rather than trees or shrubs. **Water sparingly.**
- Divert roof, patio and driveway runoff away from the drainfield. Keep sump pumps, hillside runoff and foundation drains away from the system as well.
- Protect the reserve drainfield area.
- Ensure that your system is large enough for your needs. Garburetors put extra pressure on the system. So do additional bedrooms or suites.
- Contact your local public health agency for permits for repairs, improvements, installations and further information.

ONGOING Care & Maintenance

Pure water is important to the quality of life we enjoy in British Columbia. How we dispose of waste water once we've used it is crucial to the health of our families and our communities.

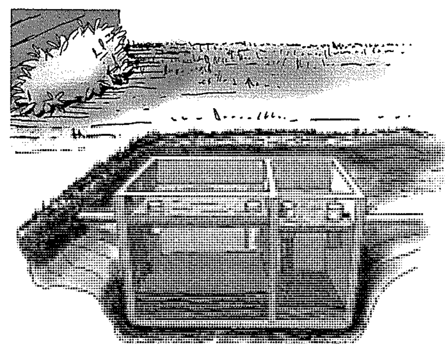
In rural areas, individual sewage disposal (or septic) systems use natural treatment and filtration to clean waste water before it is dispersed underground.

When septic systems work properly, they are efficient, inexpensive to maintain and environmentally friendly; when they fail, they cause odours, water pollution and major expense.

By properly maintaining sewage disposal systems, homeowners play a significant role in protecting our health and natural resources.

WARNING SIGNS

- **slow or backed up drains**
- **patches of lush growth over the drainfield**
- **unpleasant odours around the yard**
- **sewage surfacing on lawns or in ditches**



TYPICAL SEPTIC TANK INSTALLATION

The key to a healthy septic system is to ***protect the tank and drainfield from becoming clogged*** with solids. This means having the tank pumped regularly, conserving water and keeping harmful material out of the system.

A plugged tank or disposal field can cause sewage to back up into the house or seep into the environment. This can present a health hazard and be very expensive to repair or replace. It is important to watch for signs that your system may be failing.

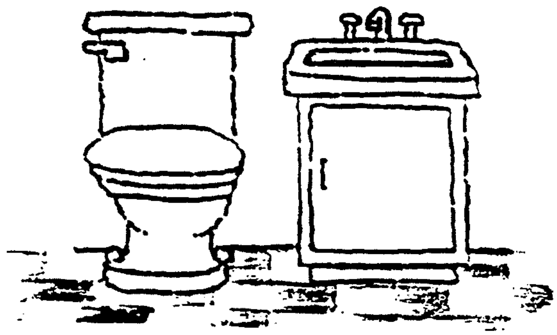
- Don't put non-degradables down sinks or toilets. No cigarettes, diapers, hair, grease, cat litter, coffee grounds, etc.
- Don't use commercial septic tank additives; they are unnecessary, expensive and may cause pollution.
- Don't use excessive amounts of bleach or kitchen solvents.

Don'ts

- Don't pour harmful chemicals down your drains: no paint, kerosene, solvents, antifreeze, gas, oil, herbicides or pesticides. These can leach into groundwater and poison the environment.
- Don't stress the system with multiple laundry loads on one day.
- Don't discharge water softening devices into the system.
- Don't park or drive on your drainfield. Outbuildings, patios or pools can compact the soil, crush pipes and reduce aerobic action in the drainfield.
- Don't saturate your drainfield with automatic sprinkling.

CONSERVE

9 THINGS YOU CAN DO TO SAVE WATER IN THE BATHROOM



1 **Check your toilets for leaks.** Put a little food coloring in your toilet tank. If, without flushing, the color begins to appear in the bowl, you have a leak that should be repaired immediately.

2 **Stop using the the toilet as an ashtray or wastebasket.** Every time you flush a cigarette butt, facial tissue, or other small bit of trash, you waste five to seven gallons of water.

3 **Put plastic bottles in your toilet tank.** To cut down on water waste, put an inch or two of sand or pebbles inside each of two plastic bottles to weigh them down. Fill them with water and put them in your toilet tank, safely away from operating mechanisms. In an average home, the bottles may displace and save ten or more gallons of water a day.

4 **Take shorter showers.** Long, hot showers can waste five to ten gallons every unneeded minute. Limit your showers to the time it takes to soap up, wash down, and rinse off.

5 **Install water-saving shower heads or flow restrictors.** Your local hardware or plumbing supply store stocks inexpensive water-saving shower heads or restrictors that are easy to install.

6 **Take baths.** A bath in a partially filled tub uses less water than all but the shortest showers.

7 **Turn off the water after you wet your toothbrush.** There is no need to keep water pouring down the drain. Just wet your brush and fill a glass for mouth rinsing.

8 **Rinse your razor in the sink.** Fill the bottom of the sink with a few inches of warm water. This will rinse your blade just as well as running water. And far less wastefully.

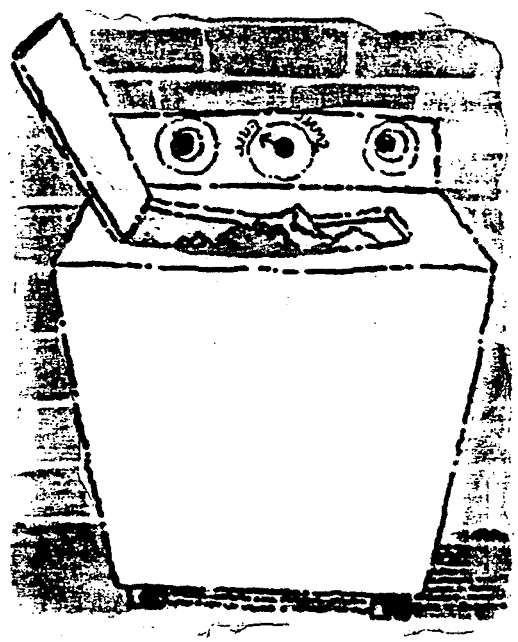
9 **Check faucets and pipes for leaks.** Even the smallest drip from a worn washer can waste 20 or more gallons a day. Larger leaks can waste hundreds.

UPPER EAGLE VALLEY CONSOLIDATED
SANITATION DISTRICT

846 FOREST ROAD • VAIL, COLORADO 81657
(303) 476-7480 • FAX (303) 476-4089

CONSERVE

6 THINGS YOU CAN DO TO SAVE WATER IN THE KITCHEN AND LAUNDRY



1 **Use your automatic dishwasher only for full loads.**

2 **Use your automatic washing machine only for full loads.**

3 **If you wash dishes by hand, don't leave the water running for rinsing.** If you have two sinks, fill one with soapy water and one with rinse water. If you have only one sink, gather washed dishes in a dish rack and rinse them with a spray device or a panful of hot water.

4 **Don't let the faucet run while you clean vegetables.** Just rinse them in a stoppered sink or a pan of clean water.

5 **Keep a bottle of drinking water in the refrigerator.** Running tap water to cool it off for drinking water is wasteful.

6 **Check faucets and pipes for leaks.** Leaks waste water 24 hours a day, seven days a week and often can be repaired with only an inexpensive washer.

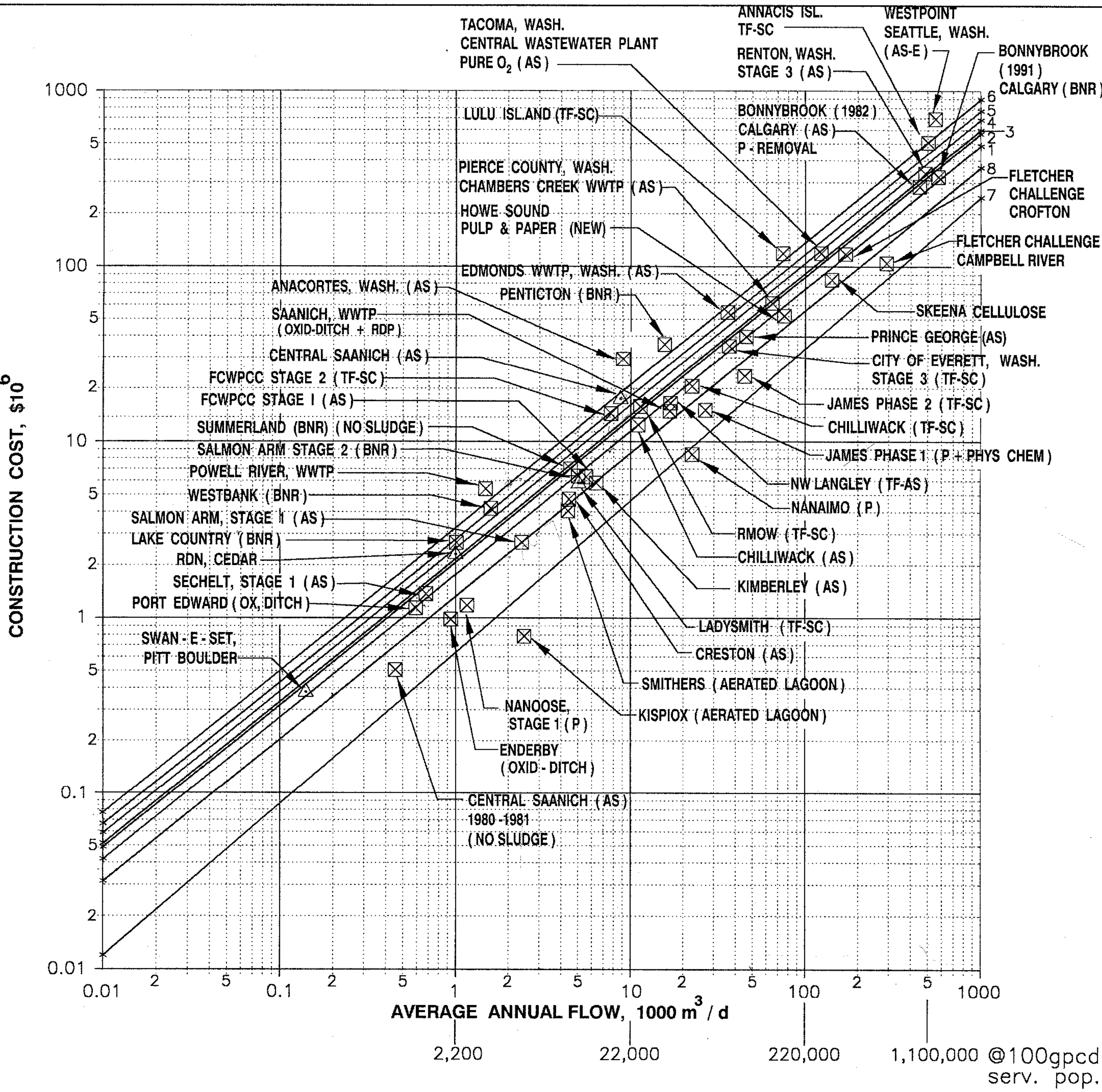
UPPER EAGLE VALLEY CONSOLIDATED SANITATION DISTRICT

846 FOREST ROAD • VAIL, COLORADO 81657
(303) 476-7480 • FAX (303) 476-4089

DISTRICT OF SALMON ARM
LIQUID WASTE MANAGEMENT PLAN

APPENDIX 4

CONSTRUCTION COSTS FOR TREATMENT PLANTS



CURVE		MONTHLY MEAN EFFLUENT LIMITS, EPA (1976) BOD/SS	P	NH_3	NO_3
1	─✱─✱─	20–30	–	–	–
2	─✱─✱─	5–19	–	–	–
3	─✱─✱─	5–19	R	–	– TERTIARY P REMOVED
4	─✱─✱─	5–19	R	R	– + TERTIARY $NH_3 \rightarrow NO_X$
5	─✱─✱─	5–19	R	R	R + TERTIARY $NO_X \rightarrow N_2$
6	─✱─✱─	<5	R	R	R + AWT FILTRATION
7	─✱─✱─	DEDUCTION FOR EXISTING PRIMARY TREATMENT			
8	─✱─✱─	DEDUCTION FOR EXISTING SECONDARY TREATMENT			

P -----	PRIMARY
AS ---	ACTIVATED SLUDGE
TF–SC ---	TRICKLING FILTER SOLIDS CONTACT
BNR ----	BIOLOGICAL NUTRIENT REMOVAL
R -----	REDUCTION
P -----	PHOSPHORUS
NH_3 ----	AMMONIA
NO_3 – NO_X –	NITRATES
N_2 ----	NITROGEN(g)
E ----	EXTRAORDINARY

LEGEND

△	STUDY ESTIMATES
⊠	ACTUAL COSTS USING CREDIT APPROACH

NOTE:
CURVES REPRESENT CONSTRUCTION COST ONLY; ADD ALLOWANCE FOR NOISE CONTROL, EARTHQUAKE PROTECTION, ODOUR, LAND, CONVEYANCE, SPECIAL ARCHITECTURE, OUTFALL, CONTINGENCIES, ENGINEERING, FINANCING, CAPACITY>2.5 DWF AND ADMINISTRATION.

TREATMENT PLANT CONSTRUCTION COST CURVES
ENR 6223 (Sept. 2000)

DAYTON & KNIGHT LTD.
Consulting Engineers

ENR 6223.DWG

SUPERSEDES CURVES, PRIOR TO SEPT, 2000

TREATMENT PLANT OPERATION COST CURVES
ENR 6500 (2001)

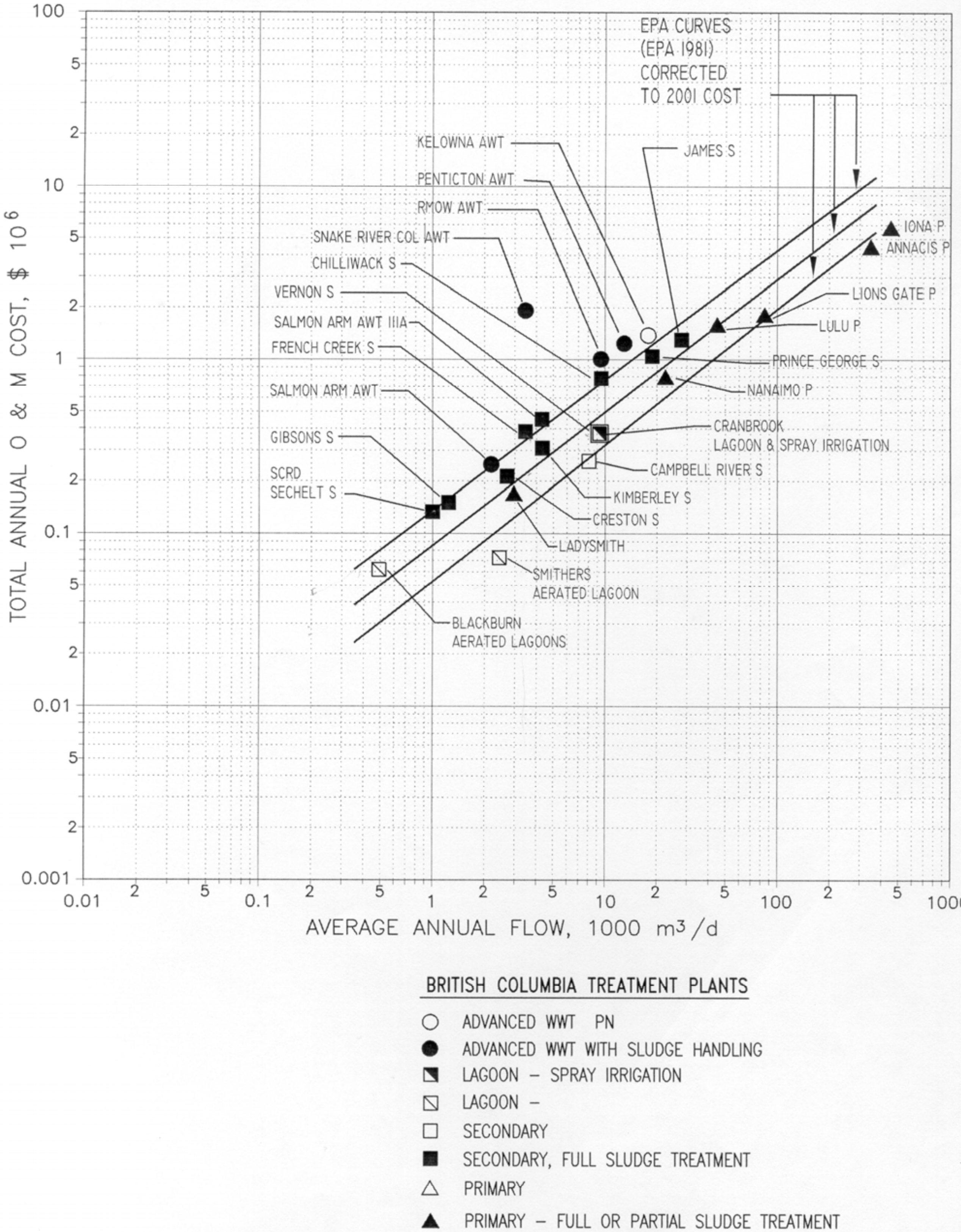


FIGURE 2

DAYTON & KNIGHT LTD.
Consulting Engineers

ACAD DWG. OP COST CURVE– ENR 6500

SUPERSEDES CURVES PRIOR TO MAY28, 2001

DISTRICT OF SALMON ARM
LIQUID WASTE MANAGEMENT PLAN

APPENDIX 5

URBAN RUNOFF CHARACTERISTICS AND TREATMENT

TABLE 1.1
CONSTITUENTS OF GENERAL URBAN AND HIGHWAY RUNOFF

CONSTITUENTS	GENERAL URBAN RUNOFF		HIGHWAYS RUNOFF		LIMITS FOR PROTECTION OF AQUATIC LIFE**
	MEAN	RANGE*	MEAN	RANGE*	
Suspended Solids (mg/L)	150[2]	2-2890	220[3]	14-522	10 if background ≤100 mg/L 10% of background if background >100 mg/L
BOD (mg/L)	9[1]	0.41-159	•	•	•
COD (mg/L)	65[1]	<10-1031	124[3]	34-1291	•
Lead (μg/L)	140[1]	3-28000	550[3]	10-3775	34
Copper (μg/L)	34[1]	4-560	43[7]	13-288	6.7
Zinc (μg/L)	160[1]	10-5750	380[3]	40-25500	30
Cadmium (μg/L)	0.7[8]	0.7-30	•	•	0.2
Chromium (μg/L)	7[8]	<10-110	•	•	2
Nickel (μg/L)	12[8]	<2-126	•	•	25
Arsenic (μg/L)	13[8]	10-130	•	•	50
Organic Pesticides (μg/L)	•	0.002-0.35[8]	•	•	•
Phthalate Esters (μg/L)	•	0.06-160[8]	•	•	4-DBP, 0.6-DEHP 0.2-all other PAE's
Phenols (μg/L)	•	8-115[8]	•	•	•
Oil & Grease (mg/L)	7.8[4]	up to 35.7	30[6]	•	•
Total Hydrocarbons (mg/L)	3.7[5]	1.8-43	•	•	•
Polynuclear Aromatic Hydrocarbons (μg/L)	•	<0.01-12	3.7[6]	•	0.01 BaP
Total Nitrogen (mg/L-N)	1.5[1]	0.34-20	2.72[3]	up to 3.4	•
Total Phosphorus (mg/L)	0.33[1]	0.01-4.3	0.59[3]	up to 0.7	0.005-0.015***
Alkalinity (mg/L)	38.2[4]	5.5-87	•	•	recommend >20
pH	•	6.2-8.7[4]	•	6.6-8.0[6]	6.5-9.0

Notes:
- • No data reported
- * Range of actual values reported in the literature from various studies unless otherwise indicated.
- ** Maximum concentrations for the protection of freshwater aquatic life as reported in "Approved and Working Criteria for Water Quality", B.C. Ministry of Environment (1989), when the receiving water hardness is 50 mg/L $CaCO_3$ (average for Fraser River in Lower Mainland)
- *** For lakes with salmonids as the predominant fish species.
- 1 U.S. Nationwide Urban Runoff data base
- 2 U.S. EPA data base
- 3 Median of U.S. Federal Highways Administration data base
- 4 Light Industrial Catchment in British Columbia
- 5 General Urban Catchment in Philadelphia
- 6 Highway runoff in England
- 7 Highway runoff in Washington State
- 8 Data from Metro Seattle

TABLE 2.1

POLLUTANT REMOVAL EFFICIENCIES OF TREATMENT BMPs

BMP	SOURCE OF DATA	RANGE OF REPORTED CONTAMINANT REMOVAL (Percent)					
		SUSPENDED SOLIDS	CHEMICAL OXYGEN DEMAND	TOTAL LEAD	TOTAL ZINC	TOTAL PHOSPHORUS	TOTAL NITROGEN
Extended Detention Dry Basins	Design Manuals	50-100	0-60	75-90	30-60	0-60	0-40
	Field Studies	3-74	16-41	24-84	40-65	10-56	24-60
Wet Ponds	Design Manuals	60-100	20-60	20-80[1]	20-80[1]	40-80	20-80
	Field Studies	5-91	2-69	9-95	0-79	3-79	0-60
Wetlands	Design Manuals	80-100	60-80	60-80[1]	60-80[1]	40-60	40-60
	Field Studies	64-99	54-89[2]	88-97	33-96	0-97	0-95
Grassed Swales	Design Manuals	0-40	0-40	0-20[1]	0-20[1]	0-40	0-40
	Field Studies	80	25	50-80	50-60	0	0
Vegetated Filter Strips	Design Manuals	20-100	0-80	20-100[1]	20-100[1]	0-60	0-60
	Field Studies	•	•	•	•	•	•
Infiltration Basins and Trenches	Design Manuals	75-99	70-90[2]	75-99[1]	75-99[1]	50-75	45-75
	Field Studies	•	•	•	•	•	•
Porous Pavement	Design Manuals	•	•	•	•	•	•
	Field Studies	82-95	82	98	99	65	80-85

[1] Total Metals
[2] Biochemical Oxygen Demand
• No Data

DISTRICT OF SALMON ARM
LIQUID WASTE MANAGEMENT PLAN

APPENDIX 6

FALL AND WINTER MANURE MANAGEMENT INFORMATION

1996/97 FALL & WINTER MANURE MANAGEMENT INFORMATION
(for the Okanagan/Shuswap)

Goal: To prevent contaminated runoff from entering surface or groundwaters.

Issue: Excess nutrients entering into surface waters in the Shuswap/Okanagan have resulted in reduced water quality. Runoff from manured fields is believed to be a significant source of these nutrients. Manure may also carry pathogens which, together with excess nutrients, may reduce downstream water quality for drinking or recreation.

Producer Responsibility: Manure must be applied to land only as a fertilizer or a soil conditioner. Producers are responsible for ensuring that contaminated runoff from their fields does not enter watercourses (i.e. ditches, streams, marshes, rivers or lakes).

What is Contaminated Runoff? Water is contaminated if it exceeds the water quality objectives for the water course it enters.

☞ ***Rule of Thumb:*** *If the water running off of a manured field is brown in color, it is clearly contaminated.*

What can producers do?

In order to prevent or reduce the risk of contaminated runoff from entering a watercourse, producers should not spread manure:

- within 5 m of a bank or slope leading to a watercourse;
- within 30 m of any well, stream or spring used for domestic purposes. These distances should be increased where the ground slopes toward the stream, watercourse or well;
- on steep or very long shallow slopes where erosion and/or surface runoff is likely to occur;
- on saturated soils or in areas of standing water where manure will not infiltrate into the soil; and
- within the high water mark of field depressions during times of the year when there is a risk of direct surface runoff to a water course.

<u>Fall and winter application</u> rates of should not exceed the total annual nutrient requirements of the crop. Fields receiving manure should have a good level of vegetative cover or crop residue present. Avoid tilling under crop residue as this may increase the risk of soil and manure loss in runoff. A crop specialist can advise the producer on a suitable application rate.

Uncontaminated runoff (clean water) should be diverted around pens, exercise yards, manured fields, or other areas where contamination is likely to occur. If contamination of some runoff is likely, facilities should be constructed (storages, berms, swales etc.) to contain that runoff until it can be spread as a fertilizer.

☞ ***Rule of Thumb:*** *If runoff water is clean - keep it clean!*

Application Conditions:

1. Manure application to unfrozen ground in fall.
This is a good time to apply manure to many corn or grassland sites as most of the manure nutrients will be available for the crop next spring. Avoid wet areas, areas close to a watercourse and fine textured soils with long or steep slopes.

☞ ***Rule of Thumb:*** *If there has been runoff or flooding in previous years - don't apply manure to that field.*

2. Manure application to frozen ground in fall or winter
<u>This practice is not recommended on most fields.</u> The risk of contaminated runoff from this practice is high. If you must apply manure to frozen ground then apply to grassland or standing grain stubble where soils are coarser textured, and where slopes are shallow. Stay well away from water courses.

☞ ***Rule of Thumb:*** *Fields which have had runoff, even if only in some years, should be avoided as the risk of runoff is high.*

3. Manure application to snow covered ground.
<u>This practice is not recommended - and may be further restricted in future if spring runoff continues to occur.</u>
Manure applied to snow is most at risk to create contaminated runoff. This is due to an increased rate of melt and limited potential for the manure to bind to the soil or crop residue. If you must apply manure to snow covered ground use fields that are level or have a shallow slope, are well away from a watercourse, have coarse textured soils, have a northern exposure (aspect) and have significant vegetative cover.

☞ ***Rule of Thumb:*** *Fields which have had runoff at snowmelt, even if only in some years, should be avoided as the risk of runoff is high.*

BC Environment: role and intentions

Enforcement of the Agricultural Waste Control Regulation is the mandate of BC Environment. Resolution of the "manure contaminated runoff" issue is essential to the success of a self regulated, environmentally sustainable agricultural industry. The Ministry is working actively with producer groups to substantively eliminate manure contaminated runoff within a tight time frame to meet BC Environment regulations and public expectations.

Responsibility for compliance with the Regulation rests with the producer. The Ministry is prepared to work with producers to find solutions where unusual circumstances exist. Producers who continue to experience contaminated runoff are in violation of the Regulation and are subject to enforcement under the Waste Management Act.

Contacts for more information

BC Environment

- Barb John, Agricultural Impact Officer, Kamloops, **(604)** 371-6299
- Ron Townson, Environmental Protection Officer, Penticton, **(604)** 490-8276

BC Ministry of Agriculture, Fisheries and Food

- Brian Harper, District Agriculturist, Salmon Arm, **(604)** 832-1629
- Ted Moore, District Agrologist, Kamloops, **(604)**371-6052
- Kevin Murphy, District Agriculturist, Vernon, **(604)** 260-3000
- Geoff Hughes-Games, Soil Specialist, Abbotsford, (604) 556-3102

Agriculture and Agri-Food Canada

- Dr. Bernie Zebarth, Soil Scientist, Summerland, **(604)** 494-6391

AEPC or Commodity Group Peer Inspectors

Note Phone numbers with **(604)** (*bolded*) will change to (250) in October 1996

DISTRICT OF SALMON ARM
LIQUID WASTE MANAGEMENT PLAN

APPENDIX 7

WPCC PERMITS

PE 1251
PE 11402

BRITISH COLUMBIA

PROVINCE OF BRITISH COLUMBIA

MINISTRY OF ENVIRONMENT, LANDS AND PARKS

Environment and Lands
Pollution Prevention
1259 Dalhousie Drive
Kamloops, British Columbia
V2C 5Z5
Telephone: (250) 371-6200
Fax: (250) 828-4000

July 15, 1999

File: PE-1251

REGISTERED MAIL

District of Salmon Arm
450 - 2nd Avenue NE
PO Box 40
Salmon Arm, BC V1E 4N2

Dear Permittee:

Enclosed is amended Permit PE-1251 issued under the provisions of the *Waste Management Act*. Your attention is respectfully directed to the terms and conditions outlined in the Permit. An annual permit fee will be determined according to the Waste Management Permit Fees Regulation.

This Permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority shall rest with the Permittee. This Permit is issued pursuant to the provisions of the *Waste Management Act* to ensure compliance with Section 54(3) of that statute, which makes it an offence to discharge waste without proper authorization. It is also the responsibility of the Permittee to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties, and comply with other applicable legislation that may be in force.

This Permit may be appealed by persons who consider themselves aggrieved by this decision in accordance with Part 7 of the *Waste Management Act*. Written notice of intent to appeal must be received by the Environmental Appeal Board within thirty (30) days of the date of the Permit.

Administration of this Permit will be carried out by staff from the Regional Office located at 1259 Dalhousie Drive, Kamloops, British Columbia V2C 5Z5. Plans, data and reports pertinent to the Permit are to be submitted to the Regional Waste Manager at this address.

Yours truly,

T.R. Forty, P. Eng.
Assistant Regional Waste Manager
Southern Interior Region

enclosure

PROVINCE OF
BRITISH COLUMBIA

BRITISH COLUMBIA

Environment and Lands
Pollution Prevention
1259 Dalhousie Drive
Kamloops
British Columbia V2C 5Z5
Telephone: (250) 371-6200
Fax: (250) 828-4000

MINISTRY OF ENVIRONMENT,
LANDS AND PARKS

PERMIT
PE-1251

Under the Provisions of the Waste Management Act

District of Salmon Arm

is authorized to discharge effluent to Tappen Bay of Shuswap Lake from a municipal sewerage system located in Salmon Arm, British Columbia, subject to the conditions listed below. Contravention of any of these conditions is a violation of the Waste Management Act and may result in prosecution.

This Permit supersedes and amends all previous versions of Permit **PE-1251**, issued under the Waste Management Act.

This Permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority shall rest with the Permittee.

T.R. Forty, P. Eng.
Assistant Regional Waste Manager

Date Issued: July 4, 1972
Dates Amended: June 17, 1976
March 18, 1988
February 7, 1990
July 15, 1999

1. AUTHORIZED DISCHARGES

1.1 This subsection applies to the discharge of effluent from a **MUNICIPAL SEWAGE TREATMENT PLANT**. The site reference number for this discharge is **E212492**.

1.1.1 The maximum authorized rate of discharge is **8200 m^3/day**.

1.1.2 The characteristics of the discharge shall not exceed:

5 - day Biochemical Oxygen Demand (BOD)	**30 mg/L**
Non-filterable residue (TSS)	**40 mg/L**
Chlorine	**0.01 mg/L**
Total Phosphorus	**1.0 mg/L**

1.1.3 The authorized works are **a fixed growth - suspended growth secondary treatment plant with biological and/or chemical phosphorus removal, chlorination - dechlorination facilities, auto thermophilic aerobic digester, sludge handling facilities, outfall**, and related appurtenances approximately located as shown on attached Site Plan A.

1.1.4 The location of the facilities from which the discharge originates is **Lot 1 of the NW 1/4 of Section 14, Township 20, Range 10, West of the Sixth Meridian, Kamloops Division Yale District, Plan 26245.**

1.1.5 The location of the point of discharge is **unsurveyed Crown Land (all in the bed of Shuswap Lake).**

2. GENERAL REQUIREMENTS

2.1 Maintenance of Works and Emergency Procedures

The Permittee shall inspect the pollution control works regularly and maintain them in good working order. In the event of an emergency or condition beyond the control of the Permittee which prevents continuing operation of the approved method of pollution control, the Permittee shall immediately notify the Regional Waste Manager and take appropriate remedial action.

2.2 Bypasses

The discharge of effluent which has bypassed the designated treatment works is prohibited unless the approval of the Regional Waste Manager is obtained and confirmed in writing.

T.R. Forty, P. Eng.
Assistant Regional Waste Manager

Date Issued: July 4, 1972
Date Amended: June 17, 1976
March 18, 1988
February 7, 1990
July 15, 1999

2.3 Process Modifications

The Permittee shall notify the Regional Waste Manager prior to implementing changes to any process that may affect the quality and/or quantity of the discharge.

2.4 Plans - New Works

Plans and specifications of any proposed works shall be submitted to the Regional Waste Manager and the Manager's approval obtained before construction commences. The works shall be constructed in accordance with such plans.

2.5 Posting of Outfall

The Permittee shall erect a sign along the alignment of the outfall above high water mark. The sign shall identify the nature of the works. The wording and size of the sign requires the approval of the Regional Waste Manager.

2.6 Outfall Inspection

The Permittee may be required to conduct a dye test on the outfall line (or inspect by another method approved by the Regional Waste Manager). The test shall be conducted when directed by the Regional Waste Manager.

2.7 Chlorination

The Permittee shall maintain a chlorine residual prior to dechlorination between 0.5 and 1.0 mg/L at all times and provide not less than one hour contact time at average flow rates.

2.8 Dechlorination

The effluent shall be dechlorinated prior to discharge to reduce the chlorine residual to 0.01 mg/L or less.

2.9 Sludge Wasting and Disposal

Sludge wasted from the treatment plant shall be disposed of to a site and in a manner approved by the Regional Waste Manager.

2.10 Operator Certification

The sewage treatment facility shall be classified by the Environmental Operators Certification Program. The Permittee shall ensure that all operators of the facility be certified by the Program to the appropriate level for the facility, and to the satisfaction of the Regional Waste Manager.

T.R. Forty, P. Eng.
Assistant Regional Waste Manager

Date Issued: July 4, 1972
Date Amended: June 17, 1976
March 18, 1988
February 7, 1990
July 15, 1999

2.11 Phosphorus Study

The Permittee shall retain a suitably qualified professional to study the environmental impact of the phosphorus loading at the maximum discharge rate of 8200 m3/day. The study shall consider the morphology of the lake in the discharge area, other sources of contaminants (i.e. Salmon River, White Creek, stormwater runoff etc.) and the location of the outfall. As well as the phosphorus issue, this study shall address the toxicity of the effluent and the potential impacts on aquatic life, especially during low water conditions. This study shall be complete and submitted for approval by the Regional Waste Manager by December 31, 2000.

3. MONITORING AND REPORTING REQUIREMENTS

3.1 Discharge Monitoring

3.1.1 Composite Sampling

The Permittee shall obtain composite samples of the effluent. The composite samples shall comprise samples taken over a 24 hour period.

The following samples and analyses shall be obtained:

PARAMETERS	FREQUENCY
5-day Biochemical Oxygen Demand	weekly
Non-filterable Residue (total suspended solids)	weekly
Total Phosphorus	weekly
Ammonia	monthly
Nitrates	monthly
Fecal Coliforms	monthly
pH	monthly
Toxicity	annually
Chlorine	continuous

Proper care should be taken in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage, etc.

T.R. Forty, P. Eng.
Assistant Regional Waste Manager

Date Issued: July 4, 1972
Date Amended: June 17, 1976
March 18, 1988
February 7, 1990
July 15, 1999

3.2 Monitoring Procedures

3.2.1 Analyses

Analyses are to be carried out in accordance with procedures described in the latest version of "British Columbia Environmental Laboratory Manual for the Analysis of Water, Wastewater, Sediment and Biological Materials, (March 1994 Permittee Edition)", or by suitable alternative procedures as authorized by the Regional Waste Manager.

Copies of the above manual may be purchased from Queen's Printer, P.O. Box 9452, Stn Prov Govt, Victoria, British Columbia V8W 9V7 (1-800-663-6105).

Analyses for determining the toxicity of liquid effluent to fish shall be carried out in accordance with the procedures described in the "Laboratory Procedures for Measuring Acute Lethal Toxicity of Liquid Effluent to Fish", dated November, 1982.

Copies of the above manual may be purchased from the Ministry of Environment, Lands and Parks, P.O. Box 9342, Stn Prov Govt, Victoria, British Columbia, V8W 9M1.

3.2.2 Sampling Location and Techniques

All sampling locations, techniques and equipment require the consent of the Regional Waste Manager prior to use.

Sampling and flow measurement shall be carried out in accordance with the procedures described in "British Columbia Field Sampling Manual for Continuous Monitoring plus the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment and Biological Samples", as published by the Ministry of Environment, Lands and Parks, or by suitable alternative procedures as authorized by the Regional Waste Manager.

Copies of the above manual are available from the Ministry of Environment, Lands and Parks, P.O. Box 9342, Stn Prov Govt, Victoria, British Columbia V8W 9M1.

3.3 Flow Measurement

The Permittee shall provide and maintain a suitable flow measuring device and record once per day the effluent volume discharged over a 24-hour period.

3.4 Reporting

The Permittee shall maintain data of analyses and flow measurements for inspection and submit the data, suitably tabulated, to the Regional Waste Manager for the previous month.

T.R. Forty, P. Eng.
Assistant Regional Waste Manager

Date Issued: July 4, 1972
Date Amended: June 17, 1976
March 18, 1988
February 7, 1990
July 15, 1999

3.5 Annual Report

The Permittee shall submit an annual report on or before March 31 of each year.

The annual report shall review and interpret monitoring data for the preceding calendar year and provide graphical analysis with suitable interpretations of any trends in the monitoring results.

The annual report shall review the performance of the sewage treatment system and identify any necessary changes to the treatment process and for works.

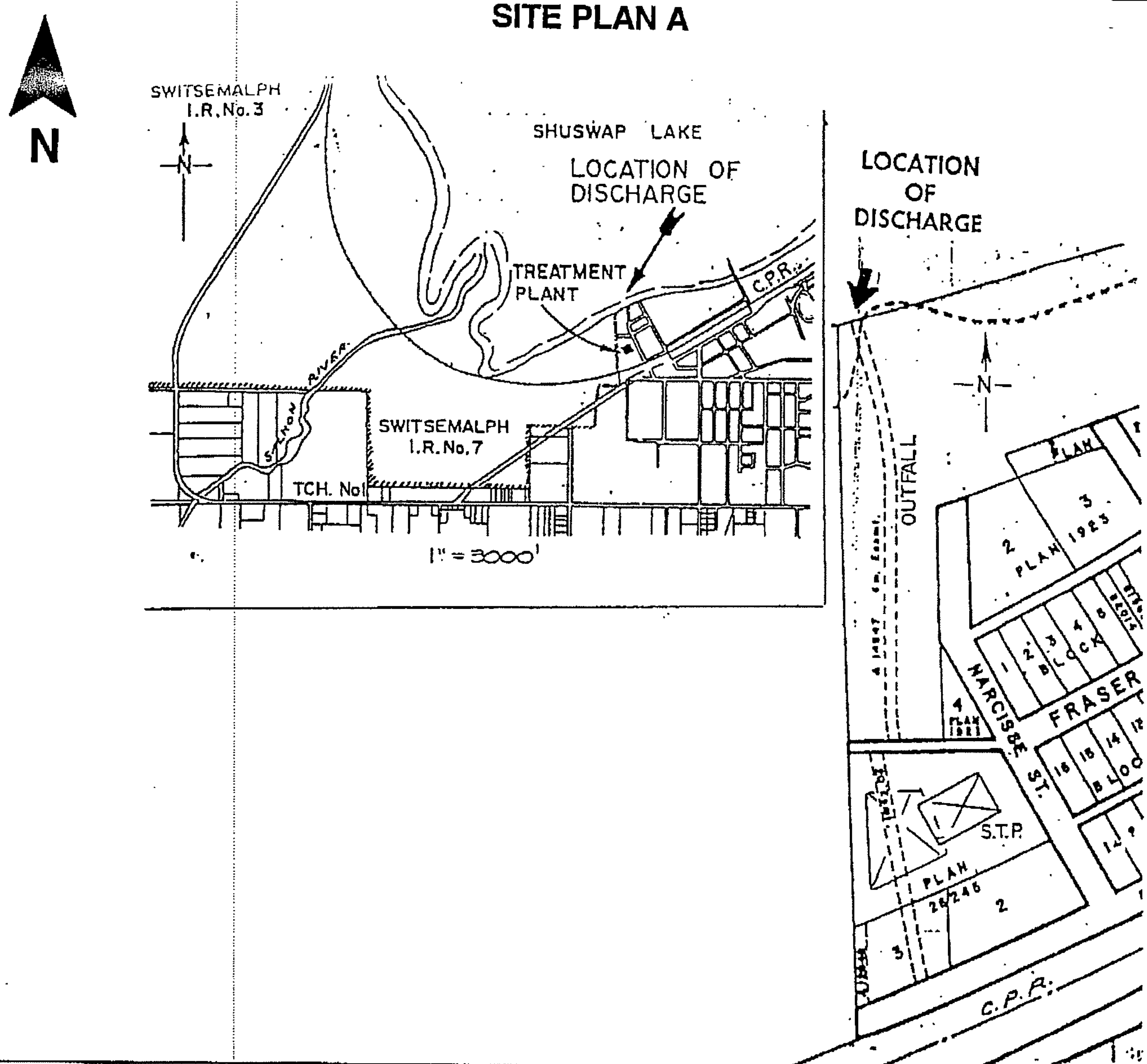
T.R. Forty, P. Eng.
Assistant Regional Waste Manager

Date Issued: July 4, 1972
Date Amended: June 17, 1976
March 18, 1988
February 7, 1990
July 15, 1999

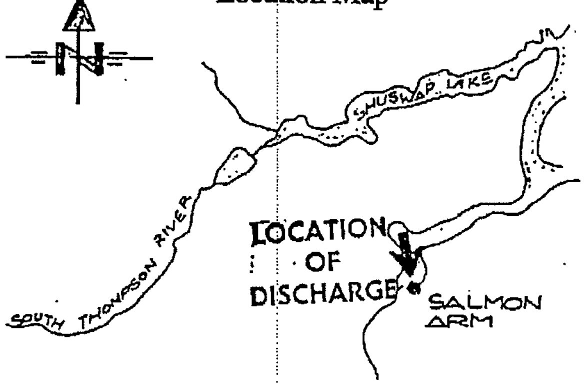
PROVINCE OF
BRITISH COLUMBIA

Pollution Prevention

SITE PLAN A



Location Map



Permit: PE-1251

Date: July 15, 1999

T.R. Forty, P. Eng.
Assistant Regional Waste Manager

Province of British Columbia
Ministry of Environment, Lands and Parks

BC Environment

Southern Interior Region
1259 Dalhousie Drive
Kamloops
British Columbia
V2C 5Z5
Telephone: (604) 371-6200

October 21, 1996

File: PE 11402

REGISTERED MAIL

District of Salmon Arm
P.O.Box 40
450-2nd Ave NE
Salmon Arm , BC V1E 4N2

Dear Permittee:

Enclosed is Permit PE-11402 issued under the provisions of the Waste Management Act. Your attention is respectfully directed to the terms and conditions outlined in the permit. An annual permit fee will be determined according to the Waste Management Permit Fees Regulation.

This permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorised by the owner of such lands or works. The responsibility for obtaining such authority shall rest with the permittee. This permit is issued pursuant to the provisions of the Waste Management Act to ensure compliance with Section 34(3) of that statute, which makes it an offence to discharge waste without proper authorisation. It is also the responsibility of the permittee to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties, and comply with other applicable legislation that may be in force.

This permit may be appealed by persons who consider themselves aggrieved by this decision in accordance with Part 5 of the Waste Management Act. Written notice of intent to appeal must be received by the Regional Waste Manager within twenty-one (21) days.

Administration of this permit will be carried out by staff from the Regional Office located at 1259 Dalhousie Drive, Kamloops, BC ., V2C 5Z5 . Plans, data and reports pertinent to the permit are to be submitted to the Regional Waste Manager at this address.

Yours truly,

Donald K. May

Donald K. May, P.Eng.
Assistant Regional Waste Manager

enclosure

PROVINCE OF
BRITISH COLUMBIA

Environmental Protection
1259 Dalhousie Drive
Kamloops
British Columbia V2C 5Z5
Telephone: (604) 371-6200

MINISTRY OF ENVIRONMENT,
LANDS AND PARKS

PERMIT
PE 11402

Under the Provisions of the Waste Management Act

The District of Salmon Arm

is authorized to discharge thermophilically digested biosolids from a Sewage Treatment Plant located in Salmon Arm, British Columbia to land located in and around the District of Salmon Arm, British Columbia, subject to the conditions listed below. Contravention of any of these conditions is a violation of the Waste Management Act and may result in prosecution.

This Permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority rest with the Permittee.

Donald K. May, P.Eng.
Assistant Regional Waste Manager

Date Issued: October 21, 1996
Amendment Date:
(most recent)

1. AUTHORIZED DISCHARGES

1.1 This subsection applies to the discharge of thermophilically digested biosolids from the District of Salmon Arm Water Pollution Control Centre located at 121 Narcisse Street SW in Salmon Arm.

1.1.1 The maximum authorized rate of discharge is 1500 cubic metres of thermophilically digested biosolids per year.

1.1.2 The characteristics of the biosolids shall be equivalent to or better than typical pasteurized sludge from the autothermophilic digestion of sewage sludge.

1.1.3 The authorized works are biosolids storage facilities, biosolids spreaders and related appurtenances.

2. Location of the Facilities

The lands to which the biosolids are to be applied are legally described as:

a) Lot 2, Plan KAP 47072, Section 7, Township 20, Range 9, Kamloops Division Yale District, West of the Sixth Meridian.

b) Various other locations in and around the District of Salmon Arm area, subject to written authorization by the Regional Waste Manager on a site specific basis.

c). Technical information regarding sites referred to in Section 2. (b) must be submitted to the Regional Waste Manager for reveiw, at least 60 days prior to the intended commencement of biosolids application. The Regional Waste Manager, at his discretion, may require public notification of the intent to discharge biosolids. If it is determined that such notification is required, the Permittee will be informed in writing by the Regional Waste Manager. The Permittee shall bear the costs of such notification.

3. GENERAL REQUIREMENTS Applicable to the Authorized Discharges

3.1 Biosolids shall have been stabilized by an acceptable process of digestion or composting. More stabilization may be required by the Regional Waste Manager if odour or vector problems develop.

Donald K. May, P.Eng.,
Assistant Regional Waste Manager

3.2 Biosolids shall be applied to land in accordance with the *draft Guidelines for Disposal of Domestic Sludge under the Waste Management Act (attached)*

3.3 Movement of biosolids and/or constituents off-site, subsequent to application, the result of rain, wind, water, or freeze-thaw conditions is prohibited.

3.4 Biosolids shall not be applied to frozen or snow covered land or to land with a slope of 10% or more.

3.5 Biosolids shall not be applied within 30 metres of a surface waterbody.

3.6 Biosolids shall be applied in a manner consistent with acceptable agricultural practise, as outlined in the *Agricultural Waste Control Regulation, B.C. Reg. 131/92.*

3.7 Biosolids shall not be applied to land where the groundwater table at the time of application is within one metre of the surface.

3.8 Public access to biosolids treated sites shall be controlled by means satisfactory to the Regional Waste Manager.

3.9 The Regional Waste Manager may prohibit application of biosolids to a site if, in his opinion, any substance in the soil is approaching levels detrimental to health and/or the environment.

4. Process Modifications

The Permittee shall notify the Regional Waste Manager prior to implementing changes to any process that may affect the quality and/or quantity of the discharge.

5. Bypasses

The discharge of biosolids which has bypassed the designated treatment works is prohibited unless the consent of the Regional Waste Manager is obtained and confirmed in writing.

6. Monitoring

The soils to which the biosolids are to be applied shall be analyzed prior to each application and once after each application of biosolids as directed by the Regional Waste Manager. The soils shall be analyzed for the following parameters:

Donald K. May, P.Eng.
Assistant Regional Waste Manager

Arsenic	Chromium	Mercury	Selenium
Cadmium	Copper	Molybdenum	Zinc
Cobalt	Lead	Nickel	Total Kjeldahl Nitrogen

The biosolids to be applied to the ground shall be analyzed once annually or as otherwise specified by the Regional Waste Manager. Analysis shall be in accordance with Schedule C of the *draft Guidelines for Disposal of Domestic Sludge under the Waste Management Act.*

Soils and biosolids sampling shall be conducted in accordance with the soils and biosolids sampling methodology defined in the *draft Guidelines for Disposal of Domestic Sludge under the Waste Management Act.*

The Regional Waste Manager may require the monitoring of vegetation grown on the land treated with biosolids.

7. **Reporting**

The Permittee shall keep records of the quantity of biosolids discharged, the application rate (kg/ha), the areas and locations of land treated with biosolids, and analysis for inspection by Environmental Protection staff and submit the data suitably tabulated to the Regional Waste Manager for the previous year by January 31st of the next year.

Donald K. May, P.Eng.,
Assistant Regional Waste Manager

DISTRICT OF SALMON ARM
LIQUID WASTE MANAGEMENT PLAN

APPENDIX 8

LOCAL SERVICE AREA FOR COMPREHENSIVE MANAGEMENT OF ONSITE SYSTEMS AND REGULATORY COMMENTS

Interior Health

RECEIVED
JUL 14 2003
DAYTON & KNIGHT LTD.

July 9, 2003

Al Gibb
Dayton & Knight Ltd.
612 Clyde Ave.
West Vancouver, BC
V7T 1C9

Re: District of Salmon Arm Liquid Waste Management Plan (LWMP)

Thank you for the opportunity to review and comment on Option 5 of the LWMP. We are prepared to proceed with this option, however it may have some limitations as noted below. We have also taken this opportunity to provide additional comments and suggestions regarding the LWMP.

1. We agree that the Urban Containment Boundary (UCB) near the Junction of Highway 1 and 97B requires sanitary sewer. We would like to see this include the buildings on the North side of the highway (included in the UCB, I believe) and that sanitary sewer be extended North along Highway 1 up to 20th Ave including the Birch Lane Trailer Park.

2. We agree that the UCB at Canoe requires sanitary sewer. We would like to see the lakeshore properties to the West, up to and including Captain's Cove Marina, be included in the UCB. This would capture one of the main problem areas identified by the Public Health Inspectors in Salmon Arm. We would also like to see the municipal water supply extended to these same lakeshore properties.

3. A problem road that does not appear to be included in the UCB is the North side of Foothill Road between 10th Street and Shuswap Street. The entire area does not need to be included just the buildings on the North side of Foothill Road.

4. We understand that the sanitary sewer ends at the Canadian Tire when heading West towards Sorrento. We would like to see this main extended as far as possible to the West but as a minimum should extend to the Salmon River Bridge and, preferably, to 1st Avenue, NW.

5. To compliment the LWMP, the District of Salmon Arm should consider zoning restrictions in the problem area along Canoe Creek, restricting the minimum parcel size to 2 hectares. What this does is protect these sensitive areas by controlling density.

.../2

Bus: (250) 851-7350 **Fax:** (250) 851-7341
Email: dan.ferguson@interiorhealth.ca
Web: interiorhealth.ca

ENVIRONMENTAL HEALTH SERVICES
"Healthy People, Healthy Places".
519 Columbia Street, Kamloops, BC, V2C 2T8

6. Should the District of Salmon Arm allow subdivisions in the sensitive area adjacent to Canoe Creek then dry sewer mains should be installed as part of the subdivision approval process. If dry sewer mains are installed, these parcels should be limited to a minimum size of perhaps 1 acre (0.4 hectare) provided that the subdivision is serviced with District water. If the subdivision is not serviced by District water, we recommend that the minimum parcel size be one hectare. This has worked successfully in other communities so that when density reaches a certain point then the costs of connection (dry mains to a treatment centre) are greatly reduced. This concept could be extended to include all the properties included in the outlying areas of the Option 1 service area.

7. With regards to the Local Service Area concept, the future of Interior Health in land use issues is unknown. The Ministry of Health Planning is drafting new sewage disposal regulations, which will likely mirror the registration process in the Municipal Sewage Regulation. Interior Health does not support this concept and our intent is not to offer a land use program in 2004 should this legislation be passed.

8. One significant problem with the Local Service Area concept is that it appears to be based on the assumption that all of the existing properties in the problem areas have suitable areas for field replacement and in many cases this simply is not true. Another alternative which is more environmentally friendly but more costly is the use of holding tanks. The process must be underwritten by a local government by-law that holds the local government responsible for pumping of the tanks. The pumping fees are generally added to municipal taxes. This option has, however, had problems in other jurisdictions as homeowners, in an effort to avoid the costs of pumping, use sump pumps and discharge the holding tank contents to roadside ditches or to the lake itself. This option may be the only solution for some properties.

Thank you once again for the opportunity to comment on Option 5 of the District of Salmon Arm Liquid Waste Management Plan. If possible I would like to be copied on all minutes and correspondence related to the plan.

Yours truly,

DFerguson

Dan Ferguson
Manager, Health Protection
Thompson - Cariboo – Shuswap

Cc: Dale McTaggart, District of Salmon Arm

DF/jh

Local Service Areas for Onsite Systems Management

- comprehensive onsite systems management can be implemented through the creation of a Local Service Area (LSA) or similar entity – this could involve the District of Salmon Arm and the Salmon Arm Health Unit
- the LSA is an umbrella organization set up to ensure proper long-term functioning of onsite systems within a defined service area
- the LSA assumes public responsibility for ensuring technically sound management of privately owned onsite systems
- the LSA would be funded by property owners within the service area
- the functions of LSAs can include planning/administration, operations, and education/training. Some of theses activities are presently undertaken by the Salmon Arm Health Unit; others could potentially be undertaken by public employees (District or SAHU) or contracted to the private sector as summarized below

Planning/Administration

- these functions would be carried out by the LSA unless otherwise noted
- long-term budgeting and planning, permit issuance, billing
- review and management of data and maintenance records (water quality, frequency of sludge removal, maintenance history of package treatment plants, alternating use of absorption fields, etc.)
- set additional standards for site evaluations and onsite systems design, performance and maintenance standards
- review/approve systems designs and construction record drawings (LSA or certification by qualified professional)
- issue notice of impending maintenance deadlines, levy penalties for non-compliance
- certification of systems designers, installers, and O&M personnel

Operations

- these functions can all be carried out either by the LSA or by suitably qualified private contractors
- site inspections at key points during the construction of new systems and during the repair of failed systems
- ongoing systems inspections (solids accumulation, water sampling and analysis, dye testing of fields, re-testing of soil percolation rates, etc.)
- remove sludge from septic tanks and package plants
- inspect and maintain mechanical equipment

Education/Training

- these functions can all be carried out either by the LSA or by suitably qualified private contractors
- training of systems designers, installers, and O&M personnel
- training of inspectors – construction and operations monitoring
- education of householders - systems maintenance and water conservation for flow reduction (this function would be carried out by the District for all residents of the study area – see Section 8.2)

Potential Problems with Setting up Local Service Areas

- Who would assume administrative responsibility for management of the program?
- Does the entity have the right to establish bylaws to legally administer and finance the program?
- Is the legal right to enter private property to routinely inspect onsite systems available to the administrative body?
- Is the legal right available to order and enforce systems identified as having failed to be repaired to the standards established?
- Will the Ministry of Water, Land and Air Protection approve a LWMP based on this

concept?

- Will the Ministry of Health approve of this approach and what will their involvement be?
- The District of Salmon Arm has responsibility for issuing building permits and subdivision approval. What will the relation of the District be to the administrative body?
- Will certification of designers, contractors, pumpers and haulers, site inspectors and so on be a part of the program and who will assume responsibility for the certification process?
- There are no existing LSAs for onsite systems management in B.C., although a similar approach is being investigated in the Capital Regional District LWMP.
- This concept requires right of access to private property for inspection and testing of systems.
- This concept requires development and implementation of new bylaws.
- There are potential overlaps/conflicts with existing MOH regulations.
- This concept requires stable long-term funding from annual fees and/or other sources.

Estimated capital and O&M costs for a Local Service Area for management of onsite systems are detailed below, and are summarized in Table A8-1 at the end of this appendix. The costs were based on discussions with contractors and equipment suppliers and on the experience of the consulting team. It was assumed that the planning and administrative functions of the LSA would be supported by all of the member property owners in the form of an annual fee, which might take the form of an annually renewed permit. A one-time fee would also be required to offset the costs of setting up the LSA. Additional requirements based on site-specific problems would be born by individual property owners.

Under the LSA, owners of onsite systems that were found to provide an inadequate level of treatment would be required to repair or replace those systems immediately. The annual recovery costs for privately owned onsite systems that must be replaced immediately was calculated assuming a 20 year system life with an annual real interest rate of 6% (cost recovery factor = 0.0872). That is, the annual payment would be based on amortization of the capital cost over 20 years. This scenario represents the maximum potential annual cost for capital replacement of onsite systems.

It was assumed that owners of properly functioning onsite systems would not have to make any immediate capital improvements (i.e., unless the LSA monitoring program identified impending system failure). The annual costs for system replacement for these owners were calculated by assuming that the system would not have to be replaced for another 20 years, and that an annual amount would be invested beginning now to accumulate a total equal to the capital cost of replacing the system 20 years from now. The calculated annual payment was based on an annual real interest rate of 4% (actual less inflation, cost recovery factor = 0.0336). This scenario represents the minimum cost for capital replacement of onsite systems.

An estimated 3,500 people in the District would be using onsite systems from the present to the LWMP planning horizon of 2020 under the low (1.5%) growth scenario (see Section 4.4). Assuming 2.5 persons per household, there would be about 1,400 onsite systems in the study area.

<u>Set Up Cost for Onsite LSA</u>

- develop and pass bylaws to establish LSA
- develop additional design and performance standards for onsite systems
- develop certification program for designers and contractors
- office supplies and equipment (computer, etc.)
- includes consultant assistance

Total set up cost for LSA	$100,000

Total one-time set up cost for LSA = $70 per lot (assuming 1,400 lots)

<u>Ongoing Onsite LSA Administration and Operations Costs</u>

administration (1 person-day/wk)	$15,000/yr

- program planning, organization and progress review
- oversee certification programs (review and approve qualifications, etc.)
- supervise staff

clerical (5 person-day/week) $40,000/yr

- record keeping, computer entry of data collected by operations staff
- billing and receipts
- issue permits and violation notices
- issue certification for designers, contractors, inspectors
- assume average effort of 1.2 hr per onsite system per year

operations (5 person-day/week) $50,000/yr

- site inspections (once every 2 years)
- sample collection and shipping
- data collection and review
- identification of non-compliance with maintenance schedules
- identification of failing systems
- reporting
- assume average effort of 1.2 hr per onsite system per year

general expenses $35,000/yr

- office supplies, photocopying, postage, etc.
- vehicle insurance, fuel, depreciation etc.
- equipment rental, maintenance and repair
- legal and other professional services
- training for site inspectors

sample shipping and analysis $75,000/yr

- assuming 20 sampling sites, 50 samples per site per year
- assume average cost of $75 per sample for shipping and analysis

Total annual base operating cost for LSA = $215,000/yr = $150 per lot per year (1,400 lots). Some of these costs may presently be within the SAHU budget.

Site-Specific Costs for Individual Owners of Onsite Systems

These costs are based on budget quotes from contractors experienced in the construction of onsite systems.

septic tank with conventional field

- replace septic tank and field now (capital cost $3,400 incl. GST)	$300/yr
- replace septic tank and field in 20 years	$110/yr
- pump out septage every 3 years	$50/yr
- dye test absorption field (once/20 year)	$20/yr
- re-test soil percolation rate to detect impending failures (once/5 yr)	$20/yr
Total if system replaced now	$420/yr
Total if system replaced in 20 years	$230/yr

septic tank with mounded field

- replace septic tank and field now (capital cost $9,600 incl. GST)	$840/yr
- replace septic tank and field in 20 years	$320/yr
- pump out septage every 3 years	$50/yr
- dye test absorption field (once/20 year)	$20/yr
- re-test soil percolation rate to detect impending failures (once/5 yr)	$20/yr
Total if system replaced now	$960/yr
Total if system replaced in 20 years	$440/yr

septic tank with package plant and conventional field

- replace existing system now (capital cost $16,000 incl. GST)	$1,400/yr
- replace existing system in 20 years	$540/yr
- operations contract for package plant, incl. solids removal	$300/yr
- pump out septage every 3 years	$50/yr
- disposal of plant solids (assumed)	$30/yr

-	dye test absorption field (once/20 year)	$20/yr
-	re-test soil percolation rate to detect impending failures (once/5 yr)	<u>$20/yr</u>

Total if system replaced now	$1,820/yr
Total if system replaced in 20 years	$960/yr

septic tank with package plant and mounded field

-	replace existing system now (capital cost $23,000 incl. GST)	$2,000/yr
-	replace existing system in 20 years	$770/yr
-	operations contract for package plant, incl. solids removal	$300/yr
-	pump out septage every 3 years	$50/yr
-	disposal of plant solids(assumed)	$30/yr
-	dye test absorption field (once/20 year)	$20/yr
-	re-test soil percolation rate to detect impending failures (once/5 yr)	<u>$20/yr</u>

Total if system replaced now	$2,420/yr
Total if system replaced in 20 years	$1,190/yr

<u>Summary of Total Costs for Owners of Onsite Systems Serviced by the LSA</u>

minimum cost (properly functioning septic tank with conventional field that does not require replacement for 20 years)

-	one time set up fee for LSA (all members)	$70
-	annual cost	
	base operating cost for LSA (all members)	$150/yr
	capital replacement	$110/yr
	system operating costs	<u>$ 90/yr</u>
	Total minimum annual cost	$350/yr

maximum cost (replace existing system immediately with new septic tank, package plant, and mounded field)

-	one time set up fee for LSA (all members)	$70
-	annual cost	
	base operating cost for LSA (all members)	$150/yr
	capital replacement	$2,000/yr
	system operating costs	$420/yr
	Total maximum annual cost	$2,420/yr

TABLE A8-1: SUMMARY OF ONSITE CONTROL OPTIONS AND COSTS

Control Point	Item	Description	Status	Legal Authority	Financial Responsibility	Capital Cost	Operating and Maintenance Cost
Site Evaluation	Permit Application	mandatory for new construction	existing	MOH	Owner	N/A	N/A
	Individual lot	onsite soil percolation test, evaluate site features, standards specified by MOH	existing	MOH	Owner	N/A	N/A
	Proposed Subdivisions	soil percolation test for all proposed lots, standards specified by MOH	existing	MOH	Owner	N/A	N/A
	Issue Permit	includes site-specific technical requirements	existing	MOH	Owner	$410	N/A
Systems Design	Allowable Systems and Technologies	establish list of acceptable systems, including conventional and alternate absorption fields, septic tanks, package plants	existing	MOH	none	N/A	requires ongoing review of new technologies
	Minimum Design Standards	field size, trench spacing, need for alternative field or package plant	existing	MOH	none	N/A	N/A
	Additional Design and Performance Standards	develop additional specifications for septic tanks, gravity vs. pumped fields, two alternating fields, performance standards for package treatment plants	proposed	District bylaw	Local Service Area	$10,000 (consultant)	N/A
	Systems Design Review	review design drawings and specifications and compare to systems design and performance standards	proposed	District bylaw	Owner	N/A	N/A
	Issue Approval/Permit	includes O&M and sampling requirements	proposed	District bylaw	Owner		N/A
Systems Construction and Installation	Construction Inspection	site visit prior to backfilling of field	existing	MOH	N/A	N/A	N/A
	Construction Supervision and Inspection	site visits at key points to enforce systems design and construction standards and specifications during construction, prevent compaction of native soils	proposed	District bylaw	Local Service Area	N/A	assume average of 3 visits per site
	Record Drawings	provide professionally certified record drawings of system as constructed	proposed	District bylaw	Owner	N/A	
	Septic Tank with Conventional Field	minimum requirement for suitable sites	existing	MOH	Owner	$2,500	- pump out septage every two to three years, average $50/yr plus disposal cost
	Septic Tank with Mounded Field	use for site with shallow soils and/or high water table	existing	MOH	Owner	$5,000	- pump out septage every two to three years, average $50/yr plus disposal cost
	Pumped Distribution System	use to ensure even distribution throughout field	proposed	District bylaw	Owner	$1,000	- maintenance contract (incl. minor repairs), average $100/yr (2 visits)

TABLE 8-1: SUMMARY OF ONSITE CONTROL OPTIONS AND COSTS (cont'd.)

Control Point	Item	Description	Status	Legal Authority	Financial Responsibility	Capital Cost	Operating and Maintenance Cost
	Septic Tank with Sand Filter	use for sites with shallow soils and/or high water table	existing	MOH	Owner	$13,000	- pump out septage every 2-3 yr, average $50/yr plus disposal cost - maintenance contract (incl. minor repairs) avg. $100/yr (2 visits)
	Septic Tank, Onsite Package Plant & Conventional Field	use to reduce required drainfield size and improve effluent quality on steep lots, small lots, lots with two dwellings, and areas of rapid drainage and effluent breakout	existing	MOH	Owner	$15,000	- pump out septage once/3 yr, average $50/hr plus disposal cost - package plant maintenance contract (incl. minor repairs & solids removal), average $300/yr (2 visits)
	Septic Tank, Onsite Package Plant and Mounded Field	may be required for lots with compound problems – e.g., shallow soils and small lot size	existing	MOH	Onwer	$17,500	- pump out septage once/3 yr. average $50/yr plus disposal cost - package plant maintenance contract (incl. minor repairs and solids removal), average $300/yr (2 visits)
Monitoring of System Performance	Field Inspections	inspect septic tanks and package treatment plants for accumulation of solids, water sampling to assess field effectiveness	proposed	District bylaw	Local Service Area	install sampling well $50	once/2 yr inspection by qualified professional, including sampling and analysis[1], average $150/yr
	Dye Testing of Fields	conduct dye tests to determine effluent retention time in absorption fields, distance to breakout, etc.	proposed	District bylaw	Owner	N/A	once/20 yr test by qualified professionals, average $20/yr
	Re-test Soil Percolation Rate	determine degree of clogging since last test	proposed	District bylaw	Owner	N/A	once/5 yr test by qualified professional, average $20/yr
Failed Systems	Replace Septic Tank	replace due to leaking, inadequate size, poor design, etc.	proposed	District bylaw	Owner	$1,400	N/A
	Replace Conventional Field	replace due to failure identified by monitoring	proposed	District bylaw	Owner	$1,800	N/A
	Replace Mounded Field	replace due to failure identified by monitoring	proposed	District bylaw	Owner	$5,000 to $10,000	N/A
Reduced Water Use	Install Water Meters and Inclining Rates	potential universal use	proposed	District	Owner	installation $400 per connection	read water meters, included water billing
	Install Water Efficient Fixtures in Existing Homes	potential universal use	proposed	District	Owner	$250 to $1,000 per household	negligible
	Public Education	including water conservation, septic tank maintenance, source control, bylaws and penalties	proposed	not required	District	$10,000 (consultant)	ongoing program costs $1 to $2 per person per year

DISTRICT OF SALMON ARM
LIQUID WASTE MANAGEMENT PLAN

APPENDIX 9

FUTURE WPCC EXPANSION

Fisheries and Oceans
Pêches et Océans

BC Interior South
985 McGill Place
Kamloops, BC, V2C 6X6

Our File: 8900-S31-3
HRTS: 02-086

September 5, 2003

Mr. Al Gibb, P. Eng.
Dayton and Knight Ltd.
612 Clyde Avenue
West Vancouver, BC
V7T 1C9

Subject: ***DFO Comments Regarding the District of Salmon Arm Liquid Waste Management Plan (LWMP) Stage 1 and 2 Report, Outfall Impact Study and Potential Artificial Wetland Construction***

Dear Al;

Fisheries and Oceans Canada (DFO) has had the opportunity to review the District of Salmon Arm's Liquid Waste Management Plan (LWMP) Stage 1 and 2 Report and associated documents. As you are aware, the Shuswap Lake system supports a number of anadromous salmonid species (coho, chinook, sockeye and pink salmon) and resident salmonid species (rainbow trout, kokanee, lake char, bull trout and whitefish), burbot and a variety of non-game fish species. Species of particular concern include endangered Interior Fraser coho salmon stocks. As such, this department is concerned about any development which has the potential to impact fish habitat and/or fish populations.

The following comments primarily address Section 6 (Capacities of Land and Water to Accept Waste), Section 9 (Wastewater Treatment and Re-use Options) and Section 10 (Stormwater Management) of the LWMP Stage 1 and 2 Report, the Outfall Impact Study for the Water Pollution Control Centre, and the option of constructing an artificial wetland on and/or adjacent to the foreshore of Shuswap Lake.

<u>Section 5.1 – Wastewater Quantity and Quality</u>

- I note that a typical value for ammonia-nitrogen concentration (28 mg/litre) is provided for the Salmon Arm Water Pollution Control Centre (WPCC) influent. However, no values are provided for ammonia concentration in the treated effluent. Are these data available for the Salmon Arm WPCC?

<u>Section 6.0 – Capacities of Land and Water to Accept Waste</u>

- In regard to stormwater systems, the Stage 1 and 2 report (p. 6-2) states that "some restrictions of the *Fisheries Act* apply to stormwater discharges where fish or fish habitat are endangered". It should be noted that Section 36 (3) of the *Fisheries Act* prohibits the deposit of any deleterious substance (potentially including sediment) into waters frequented by fish. I am pleased to note that stormwater management is addressed within the LWMP Stage 1 and 2 report.

- The conclusions (Section 6.1.2) from the WPCC Outfall Impact study will be addressed later in this correspondence.
- It is encouraging to note that existing problem areas for sewage disposal have been identified by the Salmon Arm Health Unit. It is anticipated that these problem areas (Canoe Creek, Salmon River floodplain, etc) will be addressed as solutions are identified and funding is secured.
- The District of Salmon Arm is commended for compiling the fish and stream inventory information. I am pleased to note that historical fish distribution was considered in the inventory process and that it is recognized that impacts (e.g. sediment generation and transport) occurring in non-fish bearing stream reaches may still be transmitted downstream into fish bearing waters.
- As identified in the LWMP, the *Fish-stream Crossing Guidebook* developed for the forestry sector provides direction on how to proceed with the planning and installation of crossing structures over fish streams. Site-specific advice can also be provided by DFO staff, if requested.

<u>Section 9 – Wastewater Treatment and Reuse Alternatives</u>

- The LWMP indicates that approximately 5200 people are currently serviced by on-site disposal systems and that more detailed information is required about the condition and performance of these systems. In particular, developed areas adjacent to Canoe Creek, the Salmon River and Shuswap Lake are a potential concern to DFO. This department is encouraged to see that an inventory and monitoring program for on-site treatment systems is being proposed for these areas.
- Concerning a potential outfall being located at Canoe Beach, DFO will provide comments regarding any required physical works, if this option is pursued in the future. Potential concerns with this option include impacts to migrating and rearing salmon stocks. If this option is pursued, DFO will request that impact assessments be completed which address the effects of the outfall structure and the effluent on relevant fish species. It is anticipated that these studies will include site-specific investigations related to impacts as opposed to generic literature reviews. I also note that the costs for environmental assessments are not specifically accounted for, in the tabulations of costs for the various options.
- The outfall impact study indicates that the existing WPCC outfall may not be providing sufficient dilution to prevent chronic ammonia toxicity at the edge of the initial dilution zone during periods of extremely high lake water temperatures and pH. Further studies have been suggested by Environment Canada to determine the nature and extent of improvements to be made, if any (see Attachment #1).
- It is identified that Stage IV upgrades could service the industrial park and other industrial flows. The quality of wastewater from industrial sources should be assessed to ensure that the Salmon Arm wastewater plant remains in compliance with all relevant governing legislation. On-site controls should be pursued where necessary to protect water quality.
- The development of wetlands and/or stream flow augmentation is identified as a potential Stage IV option. Both of these options could potentially provide benefits to the local fisheries resource.

<u>Section 10 – Stormwater Management</u>

- I am pleased to see that the District of Salmon Arm is committed to managing stormwater flows on a watershed basis and that stream reaches were delineated based upon historical fish distribution. The current LWMP process should be utilized to prioritize catchment areas in regard to risk (environmental or drainage) and develop and implement plans to address any identified problems. The two previously completed comprehensive drainage studies could be partially utilized for this task. Demonstration projects could be completed within priority watersheds to implement and /or assess stormwater management policies and techniques (in keeping with the document *Stormwater Planning: A Guidebook for British Columbia*). This guidebook advocates the creation of a linkage between the Official Community Plan (OCP) and the LWMP and also advocates the establishment of goals and objectives for stormwater management in both the OCP and LWMP.

- While some fish inventories have been completed within the District of Salmon Arm, it appears that habitat information may still be lacking. This potential data gap should be addressed within the current LWMP, to aid in determination of environmental risk posed by the current stormwater system and to help guide prioritization of upgrades to the system.
- As noted earlier, Section 36(3) of the *Fisheries Act* prohibits the deposition of deleterious substances (potentially including stormwater runoff components) into waters frequented by fish. Solutions to stormwater management issues must also consider water quality criteria.
- The runoff quantity section provides only limited information regarding methods or strategies for retaining stormwater in developed areas. This section could be expanded to include more info on retention options rather than on standard flood control options (e.g. improved channel hydraulics, diversion of flows, etc.). The use of minor systems (2 to 25 year rainfall events) and major systems (25-100 year rainfall events) does not appear to address the issue of stormwater management for lower intensity, more frequent rainfall events (< 2year return interval). Potential options for stormwater retention should be identified for further consideration.
- The section on runoff quality indicates that modeling of surface runoff flows and evaluation of alternative solutions have been carried out for most of the catchments within the study area. It is also indicated that no studies describing the quality of local stormwater runoff were found. It appears that there is an opportunity to incorporate some stormwater water quality sampling within the District of Salmon Arm via the LWMP process.
- I am pleased to see that the approach of preserving natural hydrologic processes is enshrined in the District's OCP and that it is recognized that the stormwater system ultimately discharges to Shuswap Lake. Riparian vegetation also plays a valuable role in maintaining natural hydrologic processes and fish habitat. Any environmental risk evaluation resulting from this LWMP should also include a riparian vegetation component.
- A number of general comments pertain to stream crossings and ditch systems within the District of Salmon Arm. All new fish stream crossings or stream crossing replacements should be completed in keeping with the planning and installation criteria outlined in the federal/provincial *Fish-stream Crossing Guidebook* developed for the forestry sector. Non-embedded culverts (new installations or replacements) placed within a fish stream will be considered a harmful alteration, disruption or destruction (HADD) of fish habitat. Any open ditches that support fish populations are viewed as fish habitat. Additionally, non-fish bearing tributaries (or upstream reaches) to fish streams may also be viewed as fish habitat. Any newly constructed open ditches or upgrades to the storm sewer system should incorporate appropriate screens to limit fish access into these non-natural channels. If fish access to a newly constructed or revised system is considered a desirable option, referral to DFO should be made early in the planning process for input. Any in-stream works (whether ditching or sewer works) that are required must be completed utilizing appropriate sediment control methods and should be conducted in such a manner as to not result in the harmful alteration, disruption or destruction of fish habitat. Planning initiatives directed toward open ditch systems within agricultural areas should be cognizant of the effects of nutrients, pesticides, herbicides, etc on aquatic ecosystems.

- Information on fish distribution in the **Hobbs Creek** basin should be gathered if it is not currently available. Fish passage issues, if any, need to be considered prior to an upgrade of the Trans Canada Highway culvert. Constraints on timing of works and/or construction methods may arise if this system is found to support fish at or upstream of the highway. These constraints could also apply to any potential ditching works which may be proposed within the basin.
- It is not indicated whether problems with peak flow attenuation have been documented in the **Hobson Creek** catchment area (Basin A). As this basin is identified as fish-bearing,

changes to the stormwater system must not result in negative impacts to fish habitat (including non-peak stream flows).

- In the **Leonard Creek** section, it appears that two references to Hobbs Creek should name Hobson Creek. As a direct tributary to a fish-bearing stream, stormwater management planning for this sub-basin (Basin B) should be cognizant of potential impacts to fish habitat when developing options for addressing stormwater issues.
- As **Basin C** is anticipated to see considerable development or redevelopment, planning for this catchment area should include strategies for retention on-site.
- The LWMP indicates that pollutant loading from the Trans Canada Highway is a concern in the **McGuire Lake** Basin (Basin D). As such, DFO is not supportive of initiatives to direct this untreated water directly into Shuswap Lake. Implementation of retention and detention strategies for the contributing portion of Basin H should be explored further first. This basin should also be considered for further study in relation to water quality sampling.
- Solutions incorporating retention and detention strategies should be explored first for the **Basin E** (Okanagan Ave.), particularly as this basin is expected to see considerable growth. Solutions involving alteration of natural drainage patterns should be assessed for environmental risks.
- See above comments regarding diversion of TCH stormflows through **Basin F** directly to Shuswap Lake.
- Solutions incorporating retention and detention strategies should be explored first for the **Basin G** (Lakeshore), as this basin is also expected to see considerable growth. Solutions involving alteration of natural drainage patterns should be assessed for environmental risks. The LWMP does not indicate if the lower reach of the small stream is fish bearing or not.
- It appears that **Basin H** (Broadview South) may provide good opportunities for implementation of solutions incorporating retention and detention strategies.
- In regard to **Basin J**, it is not indicated whether the several non overflowing lakes are located on public or private land. Are these areas available for potential development in management planning? As **Basin J** is anticipated to see considerable development, planning for this catchment area should include strategies for retention on-site. The stream located in Basin J is directly tributary to Shuswap Lake and erosional issues have been previously identified; development activities should be preceded by the development of appropriate sediment and erosion control plans, in addition to stormwater planning.
- Maintenance of terrain stability, minimization of sediment generation and protection of downstream water quality should be a primary objective for **Basin K** (Lakeshore).
- In regard to **Basin L**, it is not indicated whether there is any District owned land that is available for use in control of snowmelt generated flows from the non-urban hillslopes. See above comments regarding the use of on-site retention strategies in new development areas.
- While inadequate storm sewers are identified as a problem in **Basin M** (Canoe West Basin) no potential options for remediation are presented in the LWMP. Were any options identified in the previous study for this basin? Fish habitat values and sensitivity are high in this area of Shuswap Lake and protection of water quality should be a primary objective for this basin.
- Has an outfall location been previously identified for the potential diversion storm drain in **Basin N** (Canoe NW Basin)? If a lake discharge is proposed, referral to DFO should be completed early in the planning phase. See above comments regarding fish habitat values and sensitivity in this area of Shuswap Lake. Fish habitat values in the natural channel to Shuswap Lake should be protected when planning for drainage in this basin.
- Pursuit of development of a detention feature incorporating the natural wetland area appears to have merit, in the **Industrial Park** basin. As identified in the LWMP, protection of water quality in Canoe Creek is necessary for protection of fisheries values in Canoe Creek. It is anticipated that the use of on-site controls such as oil/waters separators will be advocated for use (as guided by industry type) within the stormwater system in the industrial area. See above comments regarding the use of retention strategies where soil conditions permit.
- The LWMP does not indicate whether the proposed drainage improvements are considered to be essential to the current system or will be required only for future development.

- The recommended approaches for stormwater management identified in the LWMP are comprehensive and are generally in keeping with the guidance provided by the *Stormwater Planning Guidebook.*
- Expansion of detail on methods and strategies to integrate environmental resources into the planning process should be completed. Environment Canada recommends setting quantitative targets for this purpose. A monitoring program should be incorporated in the LWMP and the use of demonstration projects should be advocated to try out new or alternative methods.
- The implementation of a storm drainage bylaw and enforcement policy is a proactive way to deal with pollutant problems at the source.
- Preservation of natural drainage patterns and runoff volumes are critical strategies for the long-term protection of aquatic resources including fish and fish habitat. The LWMP should include further information on strategies and methods to preserve natural patterns and to retain runoff on-site.

Comments from Environment Canada regarding the Stormwater Management section are included as Attachment #2.

<u>Outfall Impact Study</u>

General concerns that I have identified in relation to this potential extension of the effluent outfall include impacts associated with physical works, potential impacts to migrating salmon stocks and physical and/or chemical impacts to water quality. Potential concerns related to water quality include the limited amount of data used in modeling impacts, toxicity at the end of the outfall pipe, changes in water temperatures associated with the effluent and the depth of the outfall pipe in relation to the thermocline.

The physical works that would be required to extend the outfall by 1800 metres would likely result in a harmful alteration, disruption or destruction (HADD) of fish habitat and would therefore have to be authorized under the *Fisheries Act*, if a HADD occurred. Additionally, anecdotal information suggests that the deeper water site identified for a potential outfall location is utilized as a holding area by migrating adult salmon from a number of Shuswap lake systems. If a *Fisheries Act* authorization is required, then an assessment of environmental impacts will be required under the Canadian Environmental Assessment Act (CEAA).

Another concern is the limited amount of data used in the modeling exercise. Questions that arise include whether the effluent data set used in the modeling is representative of the typical effluent quality for the plant, the accuracy of the assumed depth of the thermocline in Salmon Arm Bay at different times of the year and the lack of data regarding water currents and residence time within the bay. As identified in the report, further studies will be required to more accurately model potential chronic ammonia toxicity. It is assumed by this department that the issue of chronic ammonia toxicity will be addressed during this planning process.

Information provided in the report indicates that the epilimnion was situated at 15-20 m depth below the mean annual high water mark (MAHWM) in October of 1978-1979. It is a concern that the proposed outfall depth of 20-23 metres below the MAHWM is very close to the predicted depth of the thermocline in Salmon Arm Bay during the fall.
The summary of this document indicates that modifications to the outfall are not recommended at this time. The rationale for this decision is that there is little evidence that a significant reduction in nuisance aquatic plant growth in Salmon Arm Bay would result, if the modifications were made. It is identified that chronic ammonia toxicity in the Water Pollution Control Centre (WPCC) effluent could be addressed through incorporation of enhanced ammonia removal in the treatment process.

Comments from Environment Canada regarding the Outfall Impact Study are included as Attachnment #1.

Artificial Wetland Construction

Comments from Fisheries & Oceans Canada were requested regarding the potential for an artificial wetland to be constructed on the foreshore of Shuswap Lake, as a component of the District of Salmon Arm's waste management infrastructure. The constructed wetland is intended to function in the reclamation process for treated effluent and to also provide recreation values and enhanced fish habitat.

As you may be aware, the foreshore of Shuswap Lake within Salmon Arm Bay is utilized extensively by salmonids as rearing and/or migration habitats. The foreshore of Salmon Arm Bay is highly productive due to its biophysical characteristics and these foreshore and adjacent riparian habitats are considered critical habitats by Fisheries and Oceans Canada staff. Construction of the 15-20 hectare artificial wetland would require extensive modification of the foreshore of Shuswap Lake and potential negative impacts to the fisheries resource include permanent alienation of fish habitat, changes in hydrology of the area, alteration of erosional and/or depositional processes, reduction of productivity, obstruction of juvenile and/or adult fish migration, changes in water quality parameters, and increased predation of migrating juvenile fish. Understandably, the Department prefers that existing natural habitats of a high quality be maintained rather than replaced by artificially created habitats. As such, Fisheries and Oceans Canada does not support the development of the artificial wetland at this location on the foreshore of Shuswap Lake.

If you have any further questions or concerns regarding this matter, please contact the undersigned at (250) 851-4944. I look forward to continued participation in this planning process.

Sincerely,

Jeff Guerin, Habitat Biologist
Habitat and Enhancement Branch

cc Dale McTaggart, District of Salmon Arm
Phil Wong, Environment Canada – Vancouver
Laura Maclean, Environment Canada – Vancouver
Carol Danyluk, MoWLAP – Kamloops
Rick Howie, MoWLAP – Kamloops
Bruce Runciman, DFO – Salmon Arm

Attachment #1

Environment Canada Comments Regarding the Outfall Impact Study

The Water Pollution Control Centre Outfall Impact Study prepared by Dayton & Knight Ltd. and dated August 2002, was completed to fulfill the Environmental Impact Study (EIS) requirements specified in provincial Waste Management Permit No PE-01251 for the District of Salmon Arm. The environmental impact of phosphorus loading (nuisance algal growth) at both the current discharge of about 4,500 m3/d and the maximum permitted discharge of 8,200 m3/d was studied, including consideration of the morphology of Shuswap Lake in the discharge area and other sources of contaminants. As well, toxicity (ammonia nitrogen) of the effluent on aquatic life was also addressed.

Modeling was carried out using USEPA CORMIX 3.2 program to simulate three seasonal periods: freshet (May and June), winter low flow (December to February) and summer low flow (August). Modeling was carried out with the aforementioned scenarios incorporating subset of conditions such as current discharge, maximum permitted discharge, existing outfall location, and hypothetical extended outfall location. For the purpose of modeling of an extended outfall into deeper water, it was assumed that the outfall would be extended about 1800 metres from its present location to a depth of 23 m below mean high water (to meet provincial Municipal Sewage Regulation requirements for outfall depth while minimizing costs), and be equipped with a multiport diffuser.

Key conclusions and recommendations of the report included:

1. Salmon Arm Bay exhibits some characteristics of eutrophication. However, there is evidence that water quality has been improving over the past few years. The cause of this apparent improvement is unknown. Further monitoring is necessary to determine if this is a long term trend or an anomaly.

2. Modeling based on limited data shows that efforts directed at lowering phosphorus concentrations in the WPCC effluent and/or extending the outfall into deeper would not significantly impact the trophic state of Salmon Arm Bay (i.e., algae growth would not be significantly reduced). Unless there is a substantial effort to lower phosphorus transportation from Salmon River (which supplies the bulk of phosphorus loading), little change can be expected.

3. Computer dilution modeling showed that the existing outfall location may not prevent 30-day chronic ammonia toxicity at the edge of the 100 m initial dilution zone (IDZ) during periods of extremely high water temperature (25 degrees C) and pH (8.0) for either the existing discharge or the maximum permitted discharge. The modeling also showed that an extended outfall with a multiport diffuser would prevent 30-day chronic ammonia toxicity.

4. Extension of the outfall to deeper water would result in effluent being discharged into an area of the lake where adult salmon are reported to hold before entering Salmon River to spawn. Extension of the outfall would also move the discharge point closer to the District’s water supply at Canoe, as well as other water intakes in the area.

5. Modifications to the outfall are not recommended at this time since there is little evidence that significant water quality improvements in Salmon Arm Bay would result. The advisability of modifications to the WPCC outfall and approaches for reducing the phosphorus load from Salmon River should be considered in a multi-stakeholder approach when the District undertakes a Liquid Waste Management Plan. Additional studies to determine water residence time and circulation patterns in Salmon Arm Bay and the biologically availability of the total phosphorus in the WPCC effluent can also be considered at that time.

6. The District should continue to strive to minimize the phosphorus concentration in the WPCC effluent. The addition of effluent filtration in the Stage IIIB upgrade will reduce phosphorus levels to less than half of the current concentrations.

II am in general agreement with the findings and recommendations of the study. Specific detailed comments are as follows:

1. Page S-2 and S-3 – Summary, states that “The potential for 30-day chronic ammonia toxicity in the WPCC effluent can be addressed through consideration of outfall improvements or incorporation of enhanced ammonia removal in the WPCC treatment processes.” While Section 8.0 – Conclusions does indicate that extension of the outfall and a multiport diffuser should result in sufficient dilution to prevent 30-chronic ammonia toxicity at the edge of the IDZ, Section 9.0 – Recommendations also indicates that modifications to the outfall are not recommended at this time. The Conclusions and Recommendations sections are silent with respect to considering enhanced ammonia removal via treatment.

In my view, this ammonia chronic toxicity issue needs to be addressed more fully. For example, are outfall improvements a practical option? For an extension of the outfall, the report notes concerns related to the point of discharge area being used by adult salmon as a holding area and with the closer proximity to water intakes. Given that, as noted in section 6.1.1, at low water, the outfall discharges into a pool on the exposed mudflats and the discharge from the pool flows through a channel across the mudflats to the main body of the lake, is a diffuser at the existing outfall terminus of any value? Are there any plans to consider adding nitrification to enhance ammonia removal?

In light of possible difficulties in outfall improvements and enhancing treatment, perhaps the potential for chronic toxicity should be reviewed in closer detail. Based on a comparison of the modeled ammonia concentrations at the edge of the IDZ as shown in Table 9 on page 23 versus the water quality limits for the protection of aquatic life as shown on page 10, the allowable 30-day average ammonia concentration of 0.354 mg/L (based on recent WLAP data of pH of 8.0 and water temperature of 25 degrees C) is only marginally exceeded for the existing outfall for summer low flow under current and maximum permitted discharge conditions. Issues that may warrant further review include: quality of recent WLAP data versus data reported by Ross in 1984 (i.e., number and timing of samples, etc.); does data reflect maximum averages over 30 days or shorter term peaks; does high temperature of 25 degrees C occur coincidently with high pH of 8.0; and what are background ammonia levels in Salmon Arm Bay.

2. It is noted that typical seasonal maximum WPCC effluent ammonia nitrogen concentrations indicated on pages 19 and 20 range from 10 to 15 mg/L, with winter concentrations being the highest. The values in this range is below the proposed threshold limit of 16 mg/L specified in the Proposed Notice Requiring the Preparation and Implementation of Pollution Prevention Plans for Ammonia Dissolved in Water, Inorganic Chloramines and Chlorinated wastewater Effluents dated June 7, 2003 (under CEPA 1999 for managing wastewater effluents).

3. On page 3, section 2.0 – Study Objectives and Scope states that “It should be recognized that the study was limited in scope and was based on limited data. … Additional water quality monitoring would be necessary to obtain the data necessary for more comprehensive modeling (e.g. to identify bioavailable forms of phosphorus in discharges to lakes, water directional currents in Salmon Arm Bay, etc.).” Given the report findings related to the relatively minor input of phosphorus from the WPCC, it is my view that this limited approach is adequate with regard to addressing phosphorus loadings from the WPCC. However, as indicated above, ammonia toxicity concerns should be further addressed.

4. Section 6.2 – Modeling Criteria on page 19 states “It was agreed at a meeting held at the WPCC with the Ministry of Environment, Lands and Parks that total phosphorus would be used for the impact study, since bioavailable phosphorus has not been quantified." Clarification of the foregoing statement would be helpful. From the literature I have seen, and in conferring with EC biologists involved in Environmental Effects Monitoring, orthophosphate is a better indication of the phosphorus bioavailable to plants and microorganisms than total phosphorus. Based on data presented in Tables 4, 5 and 6, the WPCC effluent proportion of total orthophosphate loadings is significantly lower than the WPCC effluent proportion of the total mass loadings of total phosphorus.

5. Under section 6.3 - Modeled Results on page 20, the modeled bulk dilution at the edge of the IDZ are tabulated for 3 flow periods (freshet, summer low flow and winter low flow). These dilutions were based on assumed thermocline conditions (based on data reported by Ross), typical values for the WPCC effluent temperature, and flow rates as tabulated in Table 3. It is suggested

that the bulk dilution figures be confirmed as there some results which are intuitively surprising. For example, for most scenarios, dilution is greater for summer low flow than during freshet (when the Salmon River flow rate is about an order of magnitude higher than during low stream flow). As well, for the existing outfall, dilution is 19:1 for an effluent discharge of 4,500 m3/d and for 8,200 m3/d.

6. Page 30 under section 7.0 – Impacts of Phosphorus Inputs on Algal Biomass states "Calculations in Table 12 imply that unless substantial effort is placed on lowering total phosphorus transport from the Salmon River, little change in trophic status can be expected in Salmon Arm." The report does not indicate the sources of phosphorus to Salmon River or the level of difficulty in reducing loadings from these sources. Unless there is some certainty that reduction would be difficult, suggest that the foregoing statement be reworded to "Calculations in Table 12 imply that unless effort is placed on significantly lowering total phosphorus transport from the Salmon River, little change in trophic status can be expected in Salmon Arm." (i.e. place emphasis on degree of reduction rather than degree of effort).

Phil Wong
Pollution Protection Officer
Environment Canada (Vancouver)

***Date*:**

August 26th, 2003

***Comments by*:**

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General:

The introduction is comprehensive and addresses several key points:

- the root cause of flooding and environmental concerns (erosion, pollution, reduced base flows) is the same: land development which increases runoff volumes and flow rates
- need to do stormwater planning at a watershed scale

Should also emphasize the following:

- stormwater is a resource not a waste
- to be effective, stormwater planning requires the integration of land use planning and engineering solutions

Regulatory Issues:

Dayton and Knight indicate that "some restrictions on surface runoff discharges are provided under the federal *Fisheries Act*, mainly related to negative impacts on fish habitat." Section 36(3) of the *Fisheries Act* also prohibits the introduction of deleterious substances into fish-bearing waters; this includes stormwater runoff.

Provincial Stormwater Planning Guidebook:
http://wlapwww.gov.bc.ca/epd/epdpa/mpp/stormwater/stormwater.html

This document was written to assist local governments with developing the stormwater component of LWMPs and should be looked to for detailed guidance in this regard. Although it is not a regulatory requirement, the document lays out expectations for minimum level of effort in developing a stormwater management program. In particular, refer to Part B which identifies tools and methodologies for setting and achieving quantitative performance targets for stormwater management. A key theme of the Guidebook is that managing peak flows is no longer sufficient to protect or restore watershed health; it is cumulative increases in runoff *volume* that determines both environmental and flooding impacts.

The Guidebook defines a three-tier approach to managing precipitation volume based on the annual precipitation spectrum:

RETAIN all storms up to 50% of the MAR* (small storms)
DETAIN all storms from 50% MAR to MAR (large storms)
CONVEY all storms greater than MAR (extreme storms)
**MAR = mean annual rainfall, approximately equal to the 2 yr. storm event*

Since watershed impacts become discernible by the time less than 10% of a particular catchment is made impervious, the target condition for a healthy watershed becomes to preserve the characteristics of a watershed that has less than 10% total impervious area as development proceeds. This translates to the need to manage 90% of annual precipitation volume on site by returning it to natural hydrologic pathways (this is the "retain" part of the tiered approach). Since 90% of annual precipitation arrives in small storms, this is an achievable target.

Note that natural hydrologic pathways include the entire water balance: infiltration and interflow, infiltration to deep groundwater, evapotranspiration and surface runoff. Matching the pre-development hydrologic condition means maintaining all four of these pathways at their pre-development level. Environment Canada and the Province are currently developing an on-line scenario modeling tool called the Water Balance Model for BC to demonstrate how to maintain a site's natural water balance as development proceeds. See http://www.waterbalance.ca after September 15th or call me for more background.

Dayton and Knight call for drainage designs that incorporate a minor system (2 to 25 year storms) and a major system (up to the 100 year event); this strategy misses the chance to address a significant portion of annual precipitation volume on-site by providing source control/volume capture strategies for the small, frequently occurring precipitation events.

Individual Basins:

Sections 10.3.1 through 10.3.15 outline both the flooding challenges and expected growth and development patterns for each of the catchments listed, but do not include an evaluation of their relative environmental sensitivities (maybe this information is included elsewhere in the document?). Environmental information (fish habitat value, existing level of imperviousness in the catchment, integrity of the riparian corridor etc.) is important in assigning priorities to these catchments for stormwater management purposes. Which of these are at risk in the short term and may require immediate intervention? Which watersheds/catchments may require additional study (environmental or drainage)?

The Provincial Guidebook also lays out a methodology for developing Integrated Stormwater Management Plans (ISMPs) for individual catchments (see Chapter 9). For those catchments which are most at risk, an ISMP can map out a path to meeting performance targets as development takes place over time. The Greater Vancouver Regional District has developed a similar approach to which its municipalities have committed to adhere under that region's LWMP: see http://www.gvrd.bc.ca/sewerage/pdf/ismp_template.pdf

I would also recommend that if Salmon Arm is not already conducting monitoring on some of these systems, that this be called for within the LWMP. Specifically, they should be looking a measuring rainfall and pre-development runoff volumes and discharge rates in key watersheds, as well as benthic invertebrate indicators (various methods exist – B-IBI is popular within the Georgia Basin/Puget Sound region – see: http://www.salmonweb.org; Environment Canada has developed a method called the Reference Condition Approach – contact me for more info). The advantage of using benthic invertebrates as an indicator of stream health is that they integrate hydrologic and water quality impacts, and they generally react in predictable, quantifiable ways to disturbances. Benthic assessment methods provide an understanding of the effectiveness of any stormwater management program and can be used for adaptive management purposes.

Recommended Approaches (Section 10.4):

1. District-wide Master Drainage Plan - this could be supplemented (or replaced) by watershed-based Integrated Stormwater Management Plans.
2. Part A – "Environmental resources … should form an integral part of drainage and development planning within the District…" – agree, but need to spell out exactly how they will be integrated. Suggest setting quantitative targets as per Provincial Guidebook methodology and implementing ongoing monitoring and adaptive management, as per my comments above.

   Part B – Drainage design criteria – suggest looking at Chilliwack's recently-completed manual as an example of design criteria that adhere to the Guidebook approach: http://www.chilliwack.com/main/attachments/files/658/Surface_Water_Management.pdf

1. Storm drainage bylaw and accompanying enforcement policy – this should be a key part of the overall stormwater component of the LWMP. The Capital Regional District has recently completed a Model Bylaw (for adoption by all CRD municipalities) to regulate the discharge of waste into storm sewers and watercourses which takes advantage of new powers expected to be extended to local governments under the Community Charter. The bylaw includes regulatory codes of practice aimed at reducing stormwater pollution from particular commercial and industrial sectors. Contact me if you would like to see a copy.
2. Preserving natural drainage features – need to find specific ways to make this happen – can include municipality taking ownership of streams as part of municipal drainage infrastructure, conservation covenants, land acquisition etc. The LWMP should be as specific as possible in spelling out the available strategies. No cost estimate was provided for this item (hard to estimate).
3. On-site infiltration – this item should be expanded to include the full suite of on-site strategies available to maintain the natural water balance, from infiltration to bioretention and evapotranspiration to green roofs and rainwater harvesting and re-use. Some of them may sound a touch far-fetched right now, but putting them on the table now ensures they are not lost from future consideration. The Water Balance Model for BC (mentioned above) can be used to help identify which strategies will be most feasible for which sites. Ideally, the use of on-site strategies will be tied to quantifiable performance targets for managing stormwater volumes. No cost estimate was provided for this item.
4. Land use and environmental resources – this item is similar to #4. It is important, but probably belongs under the budget for the District OCP.

DISTRICT OF SALMON ARM
LIQUID WASTE MANAGEMENT PLAN

APPENDIX 10

FUTURE WPCC EXPANSION

Options	Features	Assumption	Environmental Issue	Regulation		Assumptions
				Federal	Provincial	
1	i) Expansion of existing WPCC and extension of Outfall to deep water site off Sandy Point	Extension will involve the addition of 1800m of pipe laid on the surface of the substrate.	**Footprint**: Potential for alteration of the substrate characteristics due to the footprint of the pipe. **Construction** Potential for sediment generation and/or alteration of substrate. **Operation**: Water quality at outfall off Sandy Point to deepwater location may conflict with anecdotal use of area as holding habitat for salmonids.	Fisheries ACT: Regional FOC policy does not support activities below EL 348.3m and 30m upslope of the elevation. Potential for activity to be designated a HADD where a section 35(2) authorization will be required triggering CEAA review and the requirement for compensation..	Provincial Fisheries Act:Streamside Protection Regulation. Waste Management Act:Waste Management Act Municipal Sewage Regulation will likely trigger the need for an Environmental Impact Study (EIS).	**Trenched or laid on top? To sandy point fish hole. Therefore ammonia may be to high for fish at hole.**
	ii) Replace Canoe Forceman along lakeshore	Replacement of forcemain to occur below EL 348.3m	**Footprint**: Potential for alteration of the substrate characteristics and or riparian area due to the footprint of the pipe. **Construction**: Potential for sediment generation and/or alteration of substrate/riparian area during construction. **Operation**: Security of forcemain with respect to potential spill.	Fisheries ACT: Regional FOC policy does not support activities below EL 348.3m and 30m upslope of the elevation. Potential for activity to be designated a HADD where a section 35(2) authorization will be required triggering CEAA review and the requirement for compensation..	Provincial Fisheries Act:Streamside Protection Regulation. Waste management Act:Waste Management Act Municipal Sewage Regulation will likely trigger the need for an Environmental Impact Study (EIS).	**below EL 348.3**
	iii) New Gravity Interceptors in Canoe Creek Valley, as well as, forcemain and gravity interceptor to Wharf Street Pump Sta.	Structures to be buried.	**Footprint**: Potential for alteration of the substrate characteristics and riparian area at stream crossings of Canoe Creek and its tributaries. **Construction**: Potential for sediment generation and/or alteration of substrate/riparian area during construction. **Operation**: Security of forcemain with respect to potential spill.	Fisheries ACT: Regional FOC policy does not support activities within 30m of the top of bank of these fish bearing watercourses. Potential for activity to be designated a HADD where a section 35(2) authorization will be required triggering CEAA review and the requirement for compensation..	Provincial Fisheries Act:Streamside Protection Regulation. Waste management Act:Waste Management Act Municipal Sewage Regulation will likely trigger the need for an Environmental Impact Study (EIS).	Pipe buried in ground

	iv) New Forcemain extending across Salmon River and near or across Palmer Creek (10th Ave.)	Structures to be buried.	**Footprint**: Potential for alteration of the substrate characteristics and riparian area at stream crossings of Salmon River and Palmer Creek. **Construction:** Potential for sediment generation and/or alteration of substrate/riparian area during construction. **Operation:** Security of forcemain with respect to potential spill.	Fisheries ACT: Regional FOC policy does not support activities within 30m of the top of bank of these fish bearing watercourses. Potential for activity to be designated a HADD where a section 35(2) authorization will be required triggering CEAA review and the requirement for compensation..	Provincial Fisheries Act:Streamside Protection Regulation. Waste management Act:Waste Management Act Municipal Sewage Regulation will likely trigger the need for an Environmental Impact Study (EIS).	Pipe buried in ground

	Features	**Assumption**	**Environmental Issue**	**Regulation**		
				Federal	**Provincial**	
2	i) Option 1 Features	See Table 1				see above - same issues would apply
	ii) New Forcemain for untreated solids	No streams nor wetlands impacted and structures are within previously developed areas.	na	na		assuming no streams and that sites are within existing areas of development
	iii) Remote Solids Handling and Treatment Facility	No streams nor wetlands impacted and structures are within previously developed areas.	na	na		assuming no streams and that sites are within existing areas of development
	iv) Extension of forcemain from 10th Ave. to service i and ii	No streams nor wetlands impacted and structures are within previously developed areas.	na	na		assuming no streams and that sites are within existing areas of development

	Features	**Assumption**	**Environmental Issue**	**Regulation**		
				Federal	**Provincial**	
3	i) Decommission existing outfall and WPCC	The decommissioning of existing out fall would involve its abandonment in place.	The abandonment of the existing outfall may be considered as an ongoing alteration of habitat, however, its removal may result in potential sediment generation and alteration of substrate characteristics.	Fisheries Act. Discussions should be initiated with FOC and MWLAP to discuss the plan to abandon the outfall in place.		**Decommissioning of existing out fall would involve its removal. No- Leave pipe and abandon in place.**
	ii) Decommission Canoe forcemain along lakeshore	The decommissioning of existing Canoe Forcemainl would involve its abandonment in place.	The abandonment of the existing forcemain may be preferred over its removal given its location below EL 348.3m and the potential to generate sediment, and alter substrate characteristics and riparian habitat.	Fisheries Act. Discussions should be initiated with FOC and MWLAP to discuss the plan to abandon the forcemain in place.		Above or below EL 348.3. Assuming pipe will be removed. Or is it to be left in place? **It will be abandoned in place.**

Features	Assumption	Environmental Issue	Regulation		
iii) New outfall and Central Wastewater Treatment Plant located in area of mouth of Canoe Creek	Assume that the outfall will be laid on the surface of the substrate below EL 348.3m	**Footprint**: Potential for alteration of the substrate characteristics due to the footprint of the pipe. **Construction** Potential for sediment generation and/or alteration of substrate. **Operation**: Water quality.	Fisheries ACT: Regional FOC policy does not support activities below EL 348.3m and 30m upslope of the elevation. Potential for activity to be designated a HADD where a section 35(2) authorization will be required triggering CEAA review and the requirement for compensation..	Provincial Fisheries Act:Streamside Protection Regulation. Waste Management Act:Waste Management Act Municipal Sewage Regulation will likely trigger the need for an Environmental Impact Study (EIS).	Assume that work will occur below 348.3. Trenched or laid on top?
iv) New Forcemain crossing Salmon River (10th Ave)	Structures to be buried.	**Footprint**: Potential for alteration of the substrate characteristics and riparian area at stream crossings of Salmon River. **Construction** Potential for sediment generation and/or alteration of substrate/riparian area during construction. **Operation** Security of forcemain with respect to potential spill.	Fisheries ACT: Regional FOC policy does not support activities within 30m of the top of bank of these fish bearing watercourses. Potential for activity to be designated a HADD where a section 35(2) authorization will be required triggering CEAA review and the requirement for compensation..	Provincial Fisheries Act:Streamside Protection Regulation. Waste management Act:Waste Management Act Municipal Sewage Regulation will likely trigger the need for an Environmental Impact Study (EIS).	Pipe buried in ground
v) New Forcemain and Gravity Interceptor to Canoe Creek	Structures to be buried.	**Footprint**: Potential for alteration of the substrate characteristics and riparian area at stream crossings of Canoe Creek and its tributaries. **Construction**: Potential for sediment generation and/or alteration of substrate/riparian area during construction. **Operation**: Security of forcemain with respect to potential spill.	Fisheries ACT: Regional FOC policy does not support activities within 30m of the top of bank of these fish bearing watercourses. Potential for activity to be designated a HADD where a section 35(2) authorization will be required triggering CEAA review and the requirement for compensation..	Provincial Fisheries Act:Streamside Protection Regulation. Waste management Act:Waste Management Act Municipal Sewage Regulation will likely trigger the need for an Environmental Impact Study (EIS).	Buried pipe. Crossing some creeks.
vi) Gravity Interceptor in Canoe Creek Valley	Structures to be buried.	**Footprint**: Potential for alteration of the substrate characteristics and riparian area at stream crossings of Canoe Creek. **Construction**: Potential for sediment generation and/or alteration of substrate/riparian area during construction. **Operation** Security of interceptors with respect to potential spill.	Fisheries ACT: Regional FOC policy does not support activities within 30m of the top of bank of these fish bearing watercourses. Potential for activity to be designated a HADD where a section 35(2) authorization will be required triggering CEAA review and the requirement for compensation..	Provincial Fisheries Act:Streamside Protection Regulation. Waste management Act:Waste Management Act Municipal Sewage Regulation will likely trigger the need for an Environmental Impact Study (EIS).	Pipe buried in ground

				Federal	Provincial	
4	i) Decommission Canoe Forcemain along lakeshore	The decommissioning of existing Canoe Forcemainl would involve its abandonment in place.	The abandonment of the existing forcemain may be preferred over its removal given its location below EL 348.3m and the potential to generate sediment, and alter substrate characteristics and riparian habitat.	Fisheries Act. Discussions should be initiated with FOC and MWLAP to discuss the plan to abandon the forcemain in place.		Above or below EL 348.3. Assuming pipe will be removed. Or is it to be left in place?
	ii) Although no further expansion of the existing WPCC and outfall is proposed, it is proposed that a new Central Wastewater Treatment Plant and Outfall be constructed potentially in area of mouth of Canoe Creek	Assume that the outfall will be laid on the surface of the substrate below EL 348.3m	**Footprint**: Potential for alteration of the substrate characteristics due to the footprint of the pipe. **Construction** Potential for sediment generation and/or alteration of substrate. **Operation**: Water quality.	Fisheries ACT: Regional FOC policy does not support activities below EL 348.3m and 30m upslope of the elevation. Potential for activity to be designated a HADD where a section 35(2) authorization will be required triggering CEAA review and the requirement for compensation..	Provincial Fisheries Act:Streamside Protection Regulation. Waste Management Act:Waste Management Act Municipal Sewage Regulation will likely trigger the need for an Environmental Impact Study (EIS).	Assume that work will occur below 348.3. Trenched or laid on top?
	iii) New forcemain crossing Salmon River (10th Ave)	Structures to be buried.	**Footprint**: Potential for alteration of the substrate characteristics and riparian area at stream crossings of Salmon River. **Construction** Potential for sediment generation and/or alteration of substrate/riparian area during construction. **Operation** Security of forcemain with respect to potential spill.	Fisheries ACT: Regional FOC policy does not support activities within 30m of the top of bank of these fish bearing watercourses. Potential for activity to be designated a HADD where a section 35(2) authorization will be required triggering CEAA review and the requirement for compensation..	Provincial Fisheries Act:Streamside Protection Regulation. Waste management Act:Waste Management Act Municipal Sewage Regulation will likely trigger the need for an Environmental Impact Study (EIS).	Pipe buried in ground
	iv) New Forcemain and Gravity interceptor to Canoe creek	Structures to be buried.	**Footprint**: Potential for alteration of the substrate characteristics and riparian area at stream crossings of Canoe Creek and its tributaries. **Construction**: Potential for sediment generation and/or alteration of substrate/riparian area during construction. **Operation**: Security of forcemain with respect to potential spill.	Fisheries ACT: Regional FOC policy does not support activities within 30m of the top of bank of these fish bearing watercourses. Potential for activity to be designated a HADD where a section 35(2) authorization will be required triggering CEAA review and the requirement for compensation..	Provincial Fisheries Act:Streamside Protection Regulation. Waste management Act:Waste Management Act Municipal Sewage Regulation will likely trigger the need for an Environmental Impact Study (EIS).	Buried pipe. Crossing some creeks.

	v) Gravity Interceptor in Canoe Creek Valley	Structures to be buried.	**Footprint**: Potential for alteration of the substrate characteristics and riparian area at stream crossings of Canoe Creek. **Construction**: Potential for sediment generation and/or alteration of substrate/riparian area during construction. **Operation** Security of interceptors with respect to potential spill.	Fisheries ACT: Regional FOC policy does not support activities within 30m of the top of bank of these fish bearing watercourses. Potential for activity to be designated a HADD where a section 35(2) authorization will be required triggering CEAA review and the requirement for compensation..	Provincial Fisheries Act:Streamside Protection Regulation. Waste management Act:Waste Management Act Municipal Sewage Regulation will likely trigger the need for an Environmental Impact Study (EIS).	Buried pipe. Crossing some creeks.

	Features	Assumption	Environmental Issue	Regulation Federal	Regulation Provincial	
5	i) Upgrade current facilities - Outfall extension and expansion of WPCC	Extension will involve the addition of 1800m of pipe laid on the surface of the substrate.	**Footprint**: Potential for alteration of the substrate characteristics due to the footprint of the pipe. **Construction** Potential for sediment generation and/or alteration of substrate. **Operation**: Water quality at outfall off Sandy Point to deepwater location may conflict with anecdotal use of area as holding habitat for salmonids.	Fisheries ACT: Regional FOC policy does not support activities below EL 348.3m and 30m upslope of the elevation. Potential for activity to be designated a HADD where a section 35(2) authorization will be required triggering CEAA review and the requirement for compensation..	Provincial Fisheries Act:Streamside Protection Regulation. Waste Management Act:Waste Management Act Municipal Sewage Regulation will likely trigger the need for an Environmental Impact Study (EIS).	Outfall extension. Trenched or laid on top?
	ii) Replace Canoe Forcemain to serve urban core	Replacement of forcemain to occur below EL 348.3m	**Footprint**: Potential for alteration of the substrate characteristics and or riparian area due to the footprint of the pipe. **Construction**: Potential for sediment generation and/or alteration of substrate/riparian area during construction. **Operation**: Security of forcemain with respect to potential spill.	Fisheries ACT: Regional FOC policy does not support activities below EL 348.3m and 30m upslope of the elevation. Potential for activity to be designated a HADD where a section 35(2) authorization will be required triggering CEAA review and the requirement for compensation..	Provincial Fisheries Act:Streamside Protection Regulation. Waste management Act:Waste Management Act Municipal Sewage Regulation will likely trigger the need for an Environmental Impact Study (EIS).	Above or below EL 348.3
	iii) Rely on individual on-site systems to service areas outside urban core	Comprehensive monitoring and management of onsite systems is feasible.	Risk that monitoring and management protocols not adhered to with subsequent degradation of water quality of both ground and surface	Fisheries Act	Waste Management Act	Risk of maintenance of units resulting in potential water degradation.

DISTRICT OF SALMON ARM
LIQUID WASTE MANAGEMENT PLAN

APPENDIX 11

WPCC DRAFT OPERATIONAL CERTIFICATE

DRAFT

MINISTRY OF WATER, LAND AND AIR PROTECTION

OPERATIONAL CERTIFICATE
PE-__________

Under the Provisions of the Waste Management Act and in accordance with the District of Salmon Arm Liquid Waste Management Plan, the

District of Salmon Arm

450 – 2nd Avenue N.E.

P.O. Box 40

Salmon Arm, B.C.

V1E 4N2

is authorized to discharge effluent from a municipal wastewater collection and treatment system located at Salmon Arm, British Columbia to Salmon Arm Bay of Shuswap Lake, subject to the conditions listed below. Contravention of any of these conditions is a violation of the Waste Management Act and may result in prosecution. This Operational Certificate supersedes Waste Management Permit PE-1251.

1. AUTHORIZED DISCHARGES

1.1 This subsection applies to the discharge of effluent from a wastewater treatment plant serving the District of Salmon Arm in accordance with the approved Liquid Waste Management Plan. The site reference number for this discharge is E212492.

1.1.1 The maximum authorized rate of discharge is 8,200 m^3/d.

1.1.2 The characteristics of the discharge shall be equivalent to or better than:

5-day Carbonaceous Biochemical Oxygen Demand	15 mg/L
Total Suspended Solids	20 mg/L
Total Phosphorus (as P)	12-month 96 percentile not to exceed 1.5 mg/L 12-month 88 percentile not to exceed 1.0 mg/L 12-month moving average not to exceed 0.5 mg/L
Fecal coliform	200 CFU (or MPN)/100 mL

The percentile values given relate to the weekly values. For example, 96 percentile means that 96 percent of all weekly values throughout the preceding 12-months (2 samples out of 52) are not to exceed 1.5 mg/L Total Phosphorus as P.

1.1.3 The authorized works are a fixed growth–suspended growth secondary treatment plant with facilities for biological and/or chemical phosphorus removal, tertiary effluent filtration, ultraviolet light disinfection, thickening of waste biological solids, auto thermophilic aerobic digestion of waste primary and biological solids, solids dewatering, sludge handling facilities, outfall and related appurtenances approximately located as shown on attached Site Plan A.

1.1.4 The location of the facilities from which the discharge originates is Lot 1 of the NW ¼ of Section 14, Township 20, Range 10, West of the Sixth Meridian, Kamloops Division Yale District, Plan 26245.

1.1.5 The location of the point of discharge is unsurveyed Crown Land (all in the bed of Shuswap Lake).

2. GENERAL REQUIREMENTS

2.1 Maintenance of Works and Emergency Procedures

The District of Salmon Arm shall inspect the pollution control works regularly and maintain them in good working order. In the event of an emergency or condition beyond the control of the District of Salmon Arm, which prevents continuing operation of the approved method of pollution control, the District of Salmon Arm shall immediately notify the Regional Waste Manager and take appropriate remedial action.

2.2 Bypasses

The discharge of effluent which has bypassed the designated treatment works is prohibited unless the approval of the Regional Waste Manager is obtained and confirmed in writing.

2.3 Process Modifications

The District of Salmon Arm shall notify the Regional Waste Manager prior to implementing changes to any process that may affect the quality and/or quantity of the discharge.

2.4 Plans

Plans and specifications of works authorized in Subsection 1.1.3 shall be submitted to the Regional Waste Manager. Plans of the authorized works shall be signed and sealed by a Professional Engineer licensed to practice in the Province of British Columbia.

2.5 Posting of Outfall

The Regional District of Salmon Arm shall erect a sign along the alignment of the outfall above high water mark. The sign shall identify the nature of the works. The wording and size of the sign requires the approval of the Regional Waste Manager.

2.6 Outfall Inspection

The District of Salmon Arm may be required to inspect the outfall line. The inspection shall be conducted when directed by the Regional Waste Manager.

2.7 Biosolids Reuse and Disposal

Biosolids from the treatment plant shall be reused in accordance with the Organic Matter Recycling Regulation.

2.8 Standby Power

The District of Salmon Arm shall provide auxiliary power facilities to insure the continuous operation of the treatment works and operations building during power outages.

2.9 Odour Control

Should objectionable odours, attributable to the operation of the sewage treatment plant, occur beyond the property boundary, as determined by the Regional Waste Manager, measures or additional works will be required to reduce odour to acceptable levels.

2.10 Facility Classification and Operator Certification

The District of Salmon Arm shall have the works authorized by this Operational Certificate classified (and the classification shall be maintained) by the "Environmental Operators Certification Program Society" (Society). The works shall be operated and maintained by persons certified within and according to the program provided by the Society. Certification must be completed to the satisfaction of the Regional Waste Manager. In addition, the Regional Waste Manager shall be notified of the classification level of the facility and certification level of the operators, and changes of operators and/or operator certification levels within 30 days of any change.

Alternatively, the works authorized by this Operational Certificate shall be operated and maintained by persons who the District of Salmon Arm can demonstrate to the satisfaction of the Director, are qualified in the safe and proper operation of the facility for the protection of the environment.

3. MONITORING AND REPORTING REQUIREMENTS

3.1 Discharge Monitoring

3.1.1 Flow Measurement

The District of Salmon Arm shall provide and maintain a suitable flow measuring device and record once per day the effluent volume discharged over a 24-hour period.

3.1.2 Sampling and Analysis

The District of Salmon Arm shall obtain composite samples of the effluent. The composite samples shall comprise samples taken over a 24 hour period.

The following samples and analyses shall be obtained:

Parameters	Frequency
5-day Biochemical Oxygen Demand	weekly
Non-filterable Residue (total suspended solids)	weekly
Total Phosphorus	weekly
Ammonia	monthly
Nitrates	monthly
Fecal Coliforms	monthly
pH	monthly
Toxicity	annually

Proper care should be taken in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage, etc.

3.2 Monitoring Procedures

3.2.1 Analyses

Analyses are to be carried out in accordance with procedures described in the latest version of “British Columbia Environmental Laboratory Manual for the Analysis of Water, Wastewater, Sediment and Biological Materials, (March 1994 Permittee Edition)", or by suitable alternative procedures as authorized by the Regional Waste Manager.

Copies of the above manual may be purchased from Queens' Printer, P.O. Box 9452, Stn. Prov. Gov., Victoria, B.C., V8W 9V7 (1-800-663-6105).

Analyses for determining the toxicity of liquid effluent to fish shall be carried out in accordance with the procedures described in the "Laboratory Procedures for Measuring Acute Lethal Toxicity of Liquid Effluent to Fish" dated November, 1982.

Copies of the above manual may be purchased from the Ministry of Water, Land and Air Protection, P.O. Box 9342, Stn. Prov. Gov., Victoria, B.C., V8W 9M1.

3.2.2 Sampling Location and Techniques

All sampling locations, techniques and equipment require the consent of the Regional Waste Manager prior to use.

Sampling and flow measurement shall be carried out in accordance with the procedures described in "British Columbia Field Sampling Manual for Continuous Monitoring plus the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment and Biological Samples", as published by the Ministry of Water, Land and Air Protection, or by suitable alternative procedures as authorized by the Regional Waste Manager.

Copies of the above manual are available from the Ministry of Water, Land and Air Protection, P.O. Box 9342, Stn. Prov. Gov., Victoria, B.C., V8W 9M1.

3.5 Reporting

The District of Salmon Arm shall maintain data analyses and flow measurements for inspection, and every month, submit the data, suitably tabulated, to the Regional Waste Manager for the previous month.

3.6 Annual Report

The District of Salmon Arm shall submit an annual report on or before March 31 of the year.

The annual report shall review and interpret monitoring data for the preceding calendar year and provide graphical analysis with suitable interpretations of any trends in the monitoring results.

The annual report shall review the performance of the sewage treatment system and identify any necessary changes to the treatment process and for works.