DISTRICT OF SECHELT/ SECHELT INDIAN GOVERNMENT DISTRICT

Stage 2 Liquid Waste Management Plan

January
2000

EXECUTIVE SUMMARY

An earlier Stage 1 LWMP was prepared for the Sunshine Coast Regional District, which included the District of Sechelt and the Sechelt Indian Government District, that covered the area from Secret Cove to Wilson Creek. It was decided in 1995 that the *Sechelt Sewage Facilities Commission* (SSFC), made up of the District of Sechelt and the Sechelt Indian Government District, would develop its own LWMP separate from the Sunshine Coast Regional District.

Associated Engineering (B.C.) Ltd. has been engaged by the SSFC to assist in the preparation of Stages 2 and 3 of a LWMP. The LWMP will lay the groundwork for wastewater management in the study area for the next 40 years.

The attached report is the final version of the Stage 2 LWMP. The report encompasses the assessment of the issues involved in wastewater management planning in the LWMP area and presents the results of the evaluation of eight options considered for wastewater management over the next 40 years.

Wastewater management strategies have a profound impact on the rate and type of development in a community. For this reason, the wastewater management options are developed around three different community growth scenarios: *moderately high, moderate, and low growth.*

- **Options 1-A and B** reflect a decision to service new development and the re-development of existing residential/commercial areas by extension of the municipal sewerage system outwards from the core urban area. This results in a *moderately high rate* of growth with residential populations rising from the current value of 8300 persons to 34,000 persons in the 2036. Options 1-A and B are similar - Option 1-A utilizes effluent reuse and marine disposal of the surplus effluent whereas Option 1-B would dispose of the surplus effluent using a rapid infiltration land disposal system located northeast of the urban area. Treatment would initially be provided at the two existing municipal plants (Dusty Road and Ebb Tide) with the Ebb Tide plant phased out in about a 10-year period.

- The **Option 2** series would see only a limited extension of the municipal sewerage system. This option would reflect a *moderate* growth rate with a year 2036 residential population of 23,400 persons.

  Option 2-A would have wastewater treatment provided by the existing two municipal plants for the entire 40-year period. Effluent from the plants would be utilized for reuse with the surplus effluent discharged to Trail Bay via an extended outfall. Outlying areas that have been potentially designated for urban density development such as the comprehensive development in Sandy Hook (Terraces Development) or existing residential / commercial areas such as in Davis Bay / Wilson Creek that will undergo re-development at higher densities would be serviced by local community collection, treatment, and reuse / disposal systems. The design of the local wastewater systems would be integrated into the local community incorporating a significant degree of effluent reuse. Individual on-site systems would be used elsewhere in the outlying areas.

  Option 2-B is similar to Option 2-A; however, long-term wastewater treatment would be provided only at the Ebb Tide plant. The Dusty Road plant would continue to be used for biosolids treatment over the 40-year planning period.

  Option 2-C, similar in all aspects to Option 2-B, was incorporated into the LWMP because of a request by the *Joint Public and Technical Advisory Committee* for the LWMP to consider immediate implementation of tertiary treatment at the Ebb Tide plant site. The request was motivated by committee receipt of an unsolicited proposal from a private sector design-build-operate contractor to provide tertiary treatment at the Ebb Tide plant. Due to the issue of timing, the *Joint Public and Technical Advisory Committee* and SSFC had to react to this proposed option prior to the finalization of the Stage 2 LWMP report. Based on a number of reasons, the *Joint Public and Technical Advisory Committee* and SSFC decided not to pursue Option 2-C. Therefore, no further evaluation of Option 2-C was conducted for the Stage 2 LWMP.

  Long-term wastewater treatment was assumed to occur only at the Dusty Road plant over the 40-year planning period in **Option 2-D**. The Ebb Tide plant was assumed to be phased out of operation in the next eight years. All other aspects of Option 2-D are similar to those of Option 2-A.

Option 2-E is identical in all aspects to Option 2-A, with the exception that the local community system for the Terraces Development in Sandy Hook is replaced with servicing by an extended municipal system.

- **Option 3-A** would be similar to Option 2-A except that all development outside of the core urban area would continue to utilize individual on-site disposal systems. This option, which essentially maintains the status-quo, would effectively limit urban development outside of the core area and would result in a *low* community growth rate with an expected residential population of 16,100 persons in the year 2036. New development outside of the sewered area would be at larger lot sizes thus maintaining the rural residential nature of the community.

The cost of managing wastewater in a community is a significant cost. This cost is paid through taxes or user fees if the property is serviced by a sewer system. Alternatively, it may be paid through maintenance and eventual replacement of a septic tank and tile field if the property utilizes on-site disposal. Clearly any scheme must be affordable to the users. This must thus be a major consideration in selecting an option under the LWMP.

While the affordability of the LWMP scheme is important, it is also necessary to consider several non-economic factors that have a bearing on the appropriateness of the scheme. In reviewing the available options and deciding on a long term LWMP strategy, there are four considerations that are important in the decision making.

- compatibility with the community visions of the District of Sechelt and the Sechelt Indian Government District
- integrated water management planning
- flexibility to deal with future change
- technological or environmental risk

The options have been compared in terms of both the economics and the non-economic factors. An numerical evaluation matrix has been used to rank the non-economic issues. The Series Two options have emerged as the best options to meet the goals of the community. A summary of the Series Two options is shown below.

Option Selection

Option	Costs			Non-Economic Factors Rating[c]
	Net Present Worth[a]	Annual User Cost[b] ($/lot)		
		Sewered Properties	Properties Using On-Site Disposal	
2-A	63.2	347	253	9.3
2-B	65.3	371	253	9.0
2-D	63.5	352	253	9.0
2-E	60.4	289	253	9.3

Notes:

[a]Net present worth of all costs over the 40-year period.

[b]Estimated cost for 2006.

[c]Ranking based on four factors. Highest possible score is 10.

In terms of the non-economic factors, Options 2-A and 2-E both ranked at the top. Option 2-A, which employs a local community system to service the Terraces / Sandy Hook area, offers an advantage in moving towards the goal of integrated water management. Option 2-E on the other hand, which uses an extension of the municipal sewerage system to service Terraces / Sandy Hook, offers less risk and greater flexibility.

In terms of affordability, both options are affordable with the proper financial planning to distribute the costs amongst the groups that benefit. Option 2-E however is less expensive than Option 2-A on a net present worth basis ($60.1 million vs $63.2 million). Annual user rates for Option 2-E are also generally slightly less than Option 2-A over analysis period. The annual user costs for both options are less than the Series One options over the majority of the 40-year planning period.

Based on the review of the described information, the Steering Committee has selected Option 2-E for implementation. The Stage 3 LWMP will evaluate the financing aspects related to the implementation of Option 2-E.

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1.1 OBJECTIVES

The Waste Management Act, introduced in 1982 as a replacement for the Pollution Control Act, introduces the concept of the Liquid Waste Management Plan (LWMP). A LWMP contains provisions or requirements for collection, treatment, handling, storage, utilization and disposal of wastewater within the whole or a specified part of a municipality or regional district. Once approved by the British Columbia Ministry of Environment, Lands and Parks (MELP), a municipality or regional district is authorized to discharge waste in accordance with the plan.

A streamlined, cooperative process has been established by the Ministry to provide for efficient development, review and approval of LWMP's. Technical staff of various ministries, including MELP, Municipal Affairs, and Health are intended to work with local officials and their consultants throughout this process by participating in a series of workshops.

An earlier Stage 1 LWMP (Dayton & Knight, 1992) was prepared for the Sunshine Coast Regional District, which included the District of Sechelt and the Sechelt Indian Government District, that covered the area from Secret Cove to Wilson Creek. It was decided in 1995 that the newly formed *Sechelt Sewage Facilities Commission* (SSFC), made up of the District of Sechelt and the Sechelt Indian Government District, would develop its own LWMP separate from the Sunshine Coast Regional District. The SSFC also took over administration of the municipal sewerage facilities at that time.

The District of Sechelt has a population of approximately 7,450 persons (District of Sechelt, 1996). The Sechelt Indian Government District (SIGD), encompassing Sechelt Band Lands (SBL's) 1, 2, 3, 4, 5 and 28 contains about 890 persons.

Associated Engineering (B.C.) Ltd. has been engaged by the SSFC to assist in the preparation of Stages 2 and 3 of a LWMP. The study area encompasses the District of Sechelt and the Sechelt Indian Government District. The LWMP will lay the groundwork for wastewater management in the study area for the next 40 years. The specific objectives of the study are as follows:

- Identify all wastewater concerns in the LWMP area.

- Identify and review all the wastewater management alternatives available to the SSFC and select technically feasible alternatives for detailed analysis.

- Develop discharge criteria for those technically feasible wastewater management options that involve discharge of sewage treatment plant effluent to surface waters or land.

- Evaluate the capital and operating costs of these technically feasible wastewater management options, both from an overall cost point of view and on a cost per user per annum basis under alternate funding and cost-sharing formulas.

- Select the most appropriate wastewater management strategy that can be economically achieved and which can be implemented in phases to meet short and long-term environmental goals.

The LWMP will be prepared in two phases:

- **Stage 2** will assemble background data, estimate future populations and waste generation, evaluate alternative concepts, and provide a preferred strategy; and

- **Stage 3** will carry out further refinement of the proposed strategy with the emphasis on financial planning to allow implementation in an affordable manner.

1.2 EXISTING WASTEWATER MANAGEMENT

Residential and non-residential wastewater generated in the study area is treated using on-site systems or the municipal wastewater treatment plants owned and operated by the SSFC.

The majority of on-site systems consist of septic tanks with tile field disposal of effluent. “Package” treatment plants have also been used in the study area to service developments (Dayton & Knight, 1992).

Almost one third of the existing (as of 1995) District of Sechelt residential properties are connected to the municipal system (District of Sechelt, 1996). The majority of Band commercial/residential developments on SBL No. 2 have also been connected to the District’s system; lots leased to non-Band members have not been connected to the municipal system.

At the present time, the District of Sechelt owns and operates two wastewater treatment plants:

- WWTP No. 1: Ebb Tide Plant; and,
- WWTP No. 2: Dusty Road Plant.

WWTP No. 1, originally constructed in 1978, is located in the urban area of Sechelt. The plant, which utilizes the trickling filter/solids contact secondary process, has been expanded and modified over the years and currently has a design population capacity of approximately 3300 equivalent persons.

WWTP No. 2 is located northeast of the urban core area. Construction was completed in late 1994. This plant, which utilizes the activated sludge secondary process, was originally designed for approximately 3000 residential persons and is capable of being expanded in the future. Biosolids from both plants are handled at this site.

1.3 STAGE 1 LWMP ACTIVITIES

The Stage 1 LWMP, prepared for the Sunshine Coast Regional District in 1992 by Dayton & Knight, included the area from Secret Cove to Wilson Creek. The study examined the current wastewater situation and land development status and reviewed waste integration alternatives. A public survey regarding septic tanks, opinions, wastewater goals and priorities was also conducted. Combinations between growth options and waste integration options were prepared and submitted for review by a steering committee, as well as the public, prior to being finalized.

The Stage 1 report recommended that the principal intent of a Stage 2 study be to develop several small sewage treatment plants within the study area.

.1 A **small regional plant** would be developed to serve Secret Cove and Halfmoon Bay and discharge into Welcome Passage.

.2 A **second regional plant** for Welcome Beach and Sargeant Bay that would discharge near Reception Point.

.3 The **third plant** would serve West Sechelt, West Porpoise Bay, downtown Sechelt and the SBL's. Effluent would be discharged into Trail Bay or possibly be disposed of by irrigation on lands east of Sechelt.

.4 A **fourth plant** to serve the sewered areas in Davis Bay and Wilson Creek with discharge to the White Islets.

Other unserviced areas would continue to use septic tank-tile field systems under increasingly more stringent standards. In 1993, the SCRD decided not to proceed with the plant in the Davis Bay / Wilson Creek area and instead to construct the plant at the Dusty Road site. Construction of the Dusty Road plant was completed in late 1994.

1.4 PUBLIC PARTICIPATION

The key to successful waste management planning is public participation during the preparation of the LWMP.

Over the next several decades, growth and the type of development within the area will depend to a certain extent on waste management decisions. The continued use of on-site systems or the expansion of community systems allowing higher density development will have a direct bearing on the future of the study area.

Input from the public has been solicited on a number of occasions during the development of the LWMP. These include:

.1 Formation of a public advisory committee (PAC). The committee, encompassing a wide range of community interests and stakeholders, provides a mechanism to involve the public in the planning process as well as providing opportunities for direct consultation with appropriate provincial and federal officials.

.2 Public information meetings for input into the Stage 2 report.

.3 Public availability of all final reports at each stage and the opportunity throughout the preparation of the LWMP to discuss concerns and approaches with the SSFC and MELP personnel.

1.5 STAGE 2 ACTIVITIES

The Stage 2 LWMP has been in preparation since mid 1996. Over this period, three full draft reports have been prepared and reviewed by the Joint Technical and Public Advisory

Committee (JTPAC) and the SSFC Steering Committee, culminating in the fourth and final present Stage 2 report.

The first draft Stage 2 report was completed in November 1996. This report presented two wastewater management options that would become known as Options 1-A and 1-B in subsequent reports. Both options assumed a moderately high rate of growth and development within the study area, differing only in the method of effluent disposal.

Upon review of the November 1996 draft report, the committees directed the consultant to add two additional options to the Stage 2 report. The next full draft of the Stage 2 report was completed in January 1997. This draft presented four options (Options 1-A, 1-B, 2-A, and 3-A), with the new options considering moderate and low development/growth rates. The new options also incorporated alternate methods of wastewater servicing that included local community wastewater systems and continued on-site wastewater management as opposed to major expansion of the municipal sewerage system from the District core outwards. Based on the preferred committee direction, Option 2-A was revised and developed into a new chapter that was later termed Option 2-B. Following a workshop held in early June 1997, Option 2-C (tertiary treatment at the Ebb Tide plant using a design-build-operate approach) was formulated for discussion and presented at a meeting held later in June 1997.

Work ceased on the LWMP until the SSFC, in the fall of 1997, initiated the Dusty Road plant short-term upgrading plan that is funded by a significant senior government infrastructure grant. An engineering consultant was retained by the District in early 1998 to conduct the upgrade design. In addition, the SSFC also decided to complete the Stage 2 LWMP as an integrated document incorporating the new options developed since the draft January 1997 report.

Further work on the draft Stage 2 report commenced in early 1998. However, due to ongoing discussions between the District and the consultant conducting the Dusty Road plant upgrading, the District stopped work on the LWMP until the Dusty Road plant upgrading plan was finalized in May 1998. Following the authorization to once again proceed, two additional new options (2-D and 2-E) were incorporated into the third draft Stage 2 report completed in June 1998. This report included all options developed to that date (Options 1-A, 1-B, 2-A, 2-B, 2-C, 2-D, 2-E and 3-A).

Following the final set of public information meetings (June 1998, February 1999) and committee meetings (August 1998), the Steering Committee selected the preferred option

(Option 2-E) and provided direction to revise the Stage 2 report in April 1999. Upon review of the April report by the Steering Committee and the SIGD, the Stage 2 report was finalized in October 1999 through the inclusion of review comments. This resulted in this fifth and final Stage 2 LWMP report.

1.6 REPORT FORMAT

The structure of the Stage 2 report is as follows:

- *Chapter 1.0 - Introduction*

  This section identifies the objectives, scope and constraints of the study.

- *Chapter 2.0 - Identification of Wastewater Management Issues*

  A description of existing physical, social and economic conditions and infrastructure is presented in this section.

- *Chapter 3.0 - Projected Development*

  This section presents projections of urban and rural residential, industrial and commercial development and populations over the 40-year planning period. The projections reflect three growth scenarios reflecting different wastewater management strategies.

- *Chapter 4.0 - Municipal Sewerage System*

  The existing wastewater collection system and the current sewered population is discussed in this section. Possible directions for future sewer expansion are also presented.

- *Chapter 5.0 - Source Control*

  Options for source control, public education, wastewater minimization, the use of holding tanks, and dealing with septage waste and marine craft wastes are discussed.

- *Chapter 6.0 - Effluent and Biosolids Reuse*

The potential for effluent reuse and biosolids utilization within the LWMP study area are presented. Possible programs for consideration under the wastewater management options are discussed.

- *Chapter 7.0 - Wastewater Treatment Technologies*

  The current performance of the District's wastewater treatment plants is reviewed with the identification of treatment issues. Alternative technologies for upgrading the municipal plants as well as for local community plants are discussed.

- *Chapter 8.0 - Effluent Disposal Alternatives*

  This section discusses marine and land based effluent disposal options specific to the study area. Results from the oceanographic modeling and analysis of land disposal areas are also presented in this section.

- *Chapter 9.0 - Development of a Wastewater Management Strategy*

  This section establishes the philosophy behind the development of the wastewater management options for the LWMP area. Eight options covering three different community growth scenarios are introduced. These include:

  - Option 1-A: Extension of Municipal Sewerage System / Marine Disposal
  - Option 1-B: Extension of Municipal Sewerage System / Land Disposal
  - Option 2-A: Limited Municipal Sewerage System Expansion (Dusty Road and Ebb Tide WWTPs)/ Local Community Systems
  - Option 2-B: Limited Municipal Sewerage System Expansion (Ebb Tide WWTP Only)/ Local Community Systems
  - Option 2-C: Limited Municipal Sewerage System Expansion / Implementation of Tertiary Treatment by Private Sector Contractor
  - Option 2-D: Limited Municipal Sewerage System Expansion (Dusty Road WWTP Only)/ Local Community Systems

- Option 2-E: Limited Municipal Sewerage System Expansion (Dusty Road and Ebb Tide WWTPs)/ Local Community Systems

- Option 3-A: Limited Municipal Sewerage System Expansion / On-site Wastewater Management

- *Chapter 10.0 - Option 1-A: Extension of Municipal Sewerage System / Marine Disposal*

  This option would see new development served by extension of the municipal sewerage system. This strategy would be consistent with a moderately high community growth scenario. Treatment would be provided in the longer term by a single large plant at the Dusty Road site with effluent management by a combination of reuse and marine disposal via an extended outfall in Trail Bay.

- *Chapter 11.0 -Option 1-B: Extension of Municipal Sewerage System / Land Disposal*

  This option is similar to Option 1-A except that the surplus effluent not used for effluent reuse would be disposed of in a rapid infiltration land disposal system located in the area of the Dusty Road plant northeast of the core urban area.

- *Chapters 12.0 to 16.0 - Option 2 Series: Limited Municipal Sewerage System Expansion / Local Community Systems*

  The Option 2 Series reflects a moderate growth scenario. The extension of the municipal sewerage system would be limited and specific, outlying areas identified for urban density development or re-development would be served by a local community wastewater system. Greater emphasis would be placed on the use of individual on-site disposal systems in other areas of the community. The municipal system would rely on a combination of effluent reuse and marine disposal from the municipal plants. The local community systems would be developed around a combination of effluent reuse, land disposal, and marine disposal.

  The major differences between the five sub-options within the Option 2 Series are centered around the location(s) for long-term wastewater treatment. In Option 2-A, both the Dusty Road and Ebb Tide plants would continue to operate over the 40-year planning period. Option 2-B would see long-term wastewater treatment only at the Ebb Tide plant, with the Dusty Road plant used only for biosolids treatment over the long term. Option 2-C is identical to Option 2-B, but would see a private sector design-build-operate contractor provide tertiary treatment at the Ebb Tide plant. The Dusty Road plant would provide long-term wastewater treatment in Option 2-D, with the Ebb Tide plant phased out of operation in the next eight years. Finally, Option 2-E is identical to Option 2-A except that the local community system servicing the proposed Terraces Development in Sandy Hook would be replaced by an extended municipal system.

- *Chapter 17.0- Option 3-A: Limited Municipal Sewerage System Expansion / On-site Wastewater Management*

  This option is similar to Option 2-A except that all development outside of the area served by the limited municipal sewerage system would be served by on-site wastewater management. This option reflects a low growth strategy that would effectively limit urban density development outside of the core sewered area.

- *Chapter 18.0 - Comparison of Options*

  A comparison of the present worth costs and the annual user costs are presented in this chapter. The chapter also presents a numerical evaluation matrix approach to decision making to assess the non-economic factors involved in selection of a wastewater management strategy for the LWMP area.

- *Chapter 19.0 - Storm Water Management*

  This section provides a preliminary assessment of the impact of storm water discharges on the receiving environment and recommendations for a strategy for further long term storm water management.

- *Chapter 20.0 - Public Involvement*

  This section discusses the methods of public involvement and participation used in the LWMP.

- *Chapter 21.0 - Summary*

  A summary of the Stage 2 LWMP will be presented in this section with identification of issues to be addressed in the following Stage 3 report.

1.7 ESTIMATED COSTS

All costs presented in the LWMP are based on 1996 dollars. This reflects an Engineering News Record (ENR) Index of 5600 (mid 1996).

Capital costs are estimated from unit costs or cost curves for various components developed from a number of references and/or previous construction cost data. Operation and maintenance costs for the various options are calculated on the basis of estimated labour, power, and chemical quantities and application of the appropriate unit cost. Maintenance costs are calculated as a percentage of original capital cost. Administration costs are based on data supplied by the District.

The costs are order of magnitude accuracy sufficient for the comparison of options. Actual costs will be dependent upon site-specific factors and could vary from the costs shown. Costs should be inflated to the year of construction using an appropriate inflation factor.

1.8 ACKNOWLEDGMENTS

A number of individuals and interested groups have assisted in the preparation of the LWMP, either through direct input at the committee level or through public information meetings. In particular, the consultant team would like to thank the elected members and staff of the District of Sechelt, and the Sechelt Indian Government District, as well as the members of the Sechelt Sewage Facilities Commission and the Joint Technical and Public Advisory Committee for their review and comments during the LWMP preparation.

IDENTIFICATION OF WASTEWATER MANAGEMENT ISSUES

SECTION 2

2.1 PHYSICAL SETTING

The LWMP study area encompasses the District of Sechelt and Sechelt Band Lands as shown in Figure 2-1. The District is bounded by, but not including, the communities of Halfmoon Bay in the west to Roberts Creek in the east (District of Sechelt, 1996). The District extends from the Strait of Georgia in the south to Sechelt Inlet in the north. Sechelt Band Lands 1, 2, 3, 4, 5 and 28 are also within the study area, as is Porpoise Bay Provincial Park.

The study area lies within the Georgia Depression physiographic region and is bounded by the Vancouver Island Mountains on the west and the Pacific Ranges of the Coast Mountains to the east (Golder, 1993). Glacial advances and retreats have resulted in the deposition of various marine, morainal and fluvial sediments in the Georgia Lowland area where the study area is situated. Bedrock outcrops are more commonly found higher on the slopes in the northern and western portions of the study area, as well as on portions of the shoreline.

Most of the creeks within the study area have catchments areas that lie outside of the study boundaries (Golder, 1993). The majority of creeks have catchments areas that are less than 1500 ha, with the exception of Gray and Chapman Creeks with watersheds of 5893 and 6953 ha, respectively. Both of these creeks are used for domestic water supply with Chapman Creek being the main source of water for both the District of Sechelt and the Sunshine Coast Regional District.

The LWMP area lies within the Pacific Climatic Region and is characterized by cool, dry summers and wet, mild winters (Golder, 1993). Annual precipitation averages about 1100 mm; July is the driest month and averages about 42 mm of precipitation. Gower Point to the east in the Town Gibsons is the nearest weather station with temperature data; extreme values of -10.5°C and 30.6°C have been recorded. The station has an annual mean daily temperature of 9.9°C.

2.2 COMMUNITY DEVELOPMENT

The District of Sechelt is divided into seven residential neighborhoods as shown in Figure 2-1 (District of Sechelt, 1996). The 1996 total population has been estimated to be 7450 persons, divided amongst the neighborhoods as shown in Table 2-1.

Table 2-1

District of Sechelt Residential Neighborhoods and Populations

Neighborhood	Estimated 1996 Population	Percent of Total Population
West Sechelt	1887	25.3
West Porpoise Bay	550	7.4
Sechelt Village	1762	23.7
East Porpoise Bay	270	3.6
Sandy Hook	445	6.0
Tuwanek	305	4.0
Davis Bay	2231	30.0
Total	**7450**	**100.0**

The majority of residential dwellings are single family units. There are some multi family dwellings in the Village, with the Village being the only area containing a significant number of apartment units.

The Village core contains most of the commercial space within the District. There is some commercial development within the Wilson Creek section of Davis Bay.

Sechelt Band Land's (SBL) 1, 2, 3, 4, 5 and 28 lie adjacent to the District of Sechelt and are also included in the LWMP study area (Figure 2-1). There are some lots on SBL's that are leased to individuals who are not members of the Band. Table 2-2 presents the estimated band membership living on the various SBL's along with the number of leased lots and estimated residential population on the leased lots.

Table 2-2

Sechelt Band Lands - Estimated Band and Leased Lots Population

Sechelt Band Land	Band Population	Number of Leased Lots	Estimated Population on Leased Lots
1	20[a]	94	190
2	520	73	160
3	0	0	0
4	0	0	0
5	0	0	0
28	0	0	0
Totals	**540**	**167**	**350**

Notes: [a] Estimated

Future development and land use has a significant impact on wastewater planning. A detailed discussion on projected development is presented in Chapter 3.

2.3 EXISTING UTILITIES

The Sunshine Coast Regional District (SCRD) is responsible for supplying water to the District of Sechelt (District of Sechelt, 1996) and SBL's 1, 2, 3, 4, 5 and 28. Surface water intakes, situated in Chapman Creek, and wells that supply Sechelt are located outside the District's boundaries. Six reservoirs and three pump stations, located within or adjacent to the District, supply water to the distribution system.

The majority of solid waste generated within the District of Sechelt is collected by private haulers, either under contract to the District or directly contracted by multi-family, commercial/industrial and institutional facilities, and disposed in a landfill operated by the SCRD (District of Sechelt, 1996). This landfill is located east of the municipal boundary. It is estimated that the landfill has sufficient capacity for another 20 years providing a waste reduction goal of 50% is achieved. The Sunshine Coast Recycling and Processing

Society operates a drop-off depot in Sechelt and receives various types of wastes.

Transportation within the study area consists of road networks, a provincial highway and public transit (District of Sechelt, 1996). Approximately 178 km of the 226 km of District roads are paved. Highway 101 is the main east-west connector between Sechelt and other Sunshine Coast communities. Public transit is in the form of a bus service, jointly operated by BC Transit and the SCRD, that operates three local routes within the District of Sechelt as well as other routes linking various areas along the Sunshine Coast.

Transportation to the study area from the Lower mainland is by ferry (BC Ferries) and air operations. The airport, located between Wilson and Chapman Creeks, is jointly owned by the Town of Gibsons and the District of Sechelt (District of Sechelt, 1996). Three commercial operations utilized the airport in 1995, however, the airport is mostly used for recreational purposes.

Hydro and gas services are supplied by BC Hydro and BC Gas, respectively (District of Sechelt, 1996). Most areas receive gas service, however, the areas of Tuwanek, Sandy Hook and East Porpoise Bay do not; new subdivisions are being serviced as they are developed.

2.4 MUNICIPAL SEWERAGE SYSTEM

The term *municipal sewerage system* is used in this LWMP to refer to the wastewater collection, treatment, and disposal works currently owned and operated by the Sechelt Sewage Facilities Commission. The municipal wastewater collection system currently serving the LWMP area consists of 47 km of pipe and six pumping stations (District of Sechelt, 1996). The collected wastewater is treated at one of two wastewater treatment plants and combined before being discharged through a 200 mm diameter outfall that extends approximately 500 m into Trail Bay at a depth of 28 m below low tide. Figure 2-2 contains a plan showing the location of the sewer system, treatment plants and outfall.

About one-third (as of 1995) of the existing residences in the District of Sechelt are connected to the municipal system, with approximately 100 connections from businesses and institutions (District of Sechelt, 1996). There are about 140 residential and 20 commercial/institutional connections on SBL 2.

The two municipal wastewater treatment plants are owned and operated by the District of Sechelt:

- WWTP No. 1: Ebb Tide Plant; and,
- WWTP No. 2: Dusty Road Plant.

The existing agreement between the District of Sechelt and the Sechelt Indian Government District allows for up to 228 m^3/d of wastewater generated on SBL's be collected and treated at these plants (District of Sechelt, 1996).

The Ebb Tide plant, originally constructed in 1978, is located in the urban area of Sechelt. The plant, which utilizes the trickling filter/solids contact secondary process, has been expanded and modified over the years and currently has a design population capacity of approximately 3300 equivalent persons. A review, carried out in 1993 by Associated Engineering (1993a), concluded that the life of the plant could range from two to more than ten years depending on decisions regarding plant phase-out. Approximately two-thirds of the wastewater presently collected in the study area is being treated at this plant.

The Dusty Road plant is located northeast of the urban core area. Construction was completed in late 1994. This plant, which utilizes the activated sludge secondary process, was originally design for approximately 3000 residential persons and is capable of being expanded in the future. About one-third of the current wastewater collected is treated at this plant. The plant was experiencing operational problems, was modified in 1998 to optimize plant performance.

Biosolids from both plants, as well as septage collected from septic tanks throughout the Sunshine Coast, are aerobically digested in an aerated lagoon situated at the Dusty Road plant. Treated biosolids are stored in an adjacent storage lagoon. Current plans call for the removal of biosolids once the lagoon is full, and allowing the biosolids to drain by gravity on an asphalt paved drying bed located next to the storage lagoon. Future use of dewatered biosolids is still being discussed, however, use as a soil amendment is one option being considered (District of Sechelt, 1996).

2.5 LOCAL COMMUNITY SYSTEMS / ON-SITE WASTEWATER MANAGEMENT

Local community wastewater systems refer to collection, treatment and effluent reuse / disposal systems that service a local residential, commercial, or mixed residential - commercial area.

Existing local community systems are used to treat wastewater from subdivisions, resorts and Porpoise Bay provincial park in the LWMP area. Depending on their size and method of effluent disposal, these systems are permitted by either the Ministry of Environment, Lands and Parks (MELP) or the Ministry of Health (MOH). Table 2-3 contains a listing of the larger plants permitted by MELP.

Table 2-3

Local Community Wastewater Management Systems

Location	Type of Treatment	Effluent Disposal	Maximum Permitted Discharge (m^3/d)
Wilson Creek Campground	Extended Aeration	Tile Field	27
Rockland Wynd Mobile Home Park	Rotating Biological Contactor	Tile Field	57
Porpoise Bay Provincial Park	Septic Tank	Tile Field	34
SBL #1 (under construction)	Secondary Treatment	Outfall at Mission Point	320

Key issues regarding local community systems include are the ownership and long term responsibility for operation and upgrading, effluent quality and possible tile field failures, and operational problems such as odours or local nuisance conditions. Within the District, a number of local community systems have been phased out in recent years and the development served by extension of the municipal sewerage system. The decision to extend the municipal system into the area was in part due to operational problems with the local community plants.

On-site wastewater management systems, as defined in this LWMP, include individual septic tanks or small “package plants” and tile fields serving residential dwellings or commercial establishments. The performance of on-site systems in the LWMP area has been mixed. In many areas, well drained permeable soils exist and tile field systems function well. In other areas, particularly near the shorelines, the soils are shallow and/or fine grain and tile fields perform poorly. Table 2-4 summarizes areas with existing or recent local community or on-site system failures within the District of Sechelt.

Table 2-4

Locations of On-Site System Failures within the District of Sechelt

Neighborhood	**Area**
West Porpoise Bay	Binnacle Street Shoal Way/Driftwood Lookout Drive Gale Avenue Fairway Road
East Porpoise Bay	Coracle Drive Stockwell Road Porpoise Drive
Davis Bay/Selma Park	Geer Road Laurel Road Little Lane older waterfront properties
West Sechelt	Norwest Bay Road Mason Road Norvan Road older waterfront properties

Several of the problem areas have been dealt with by extending the municipal sewerage system to service existing developments. Holding tanks, with the collected wastewater is pumped out about once per week and hauled to the municipal treatment plant, have also been used in certain areas to deal with on-site system failure on a temporary basis.

With all on-site systems, gradual plugging up of the tile field's underlying soils will occur and the field must be replaced. The frequency of this occurrence depends upon the soil type and the loading to the field. A typical tile field life of 15 to 25 years could be reasonably expected in the LWMP area.

2.6 MARINE ENVIRONMENT

Coastal areas, and in particular estuaries, can be considered sensitive environments due to the abundance and diversity of aquatic organisms present in these habitats. Estuaries are important rearing areas for several salmon species as well as providing specific habitat for other biota (Golder, 1993). The LWMP study area encompasses approximately 15 km of shoreline adjacent to Georgia Strait with another 12 km along Sechelt Inlet (District of Sechelt, 1996). Thus, consideration of potential environmental impacts on the marine environment, resulting from human activities, is of prime importance.

The key wastewater issues in the study area are the impact of on-site systems and the municipal wastewater system on the marine environment. Effluent quality and the dilution/dispersion capacity of the receiving waters are important parameters influencing the overall impact of wastewater discharge on the marine environment.

Evidence exists that suggest failed septic tank tile fields are allowing untreated or partially treated effluent to reach the ocean (Dayton & Knight, 1992). Compounding the problem of poor effluent quality from on-site systems is the movement of water in the near-shore areas. The “parallel to shore” movement of water in the Strait of Georgia, outside of the near-shore areas, provides a large amount of flushing to the region (Dayton & Knight, 1992). However, circular water movement in the bay areas tends to trap bay water. In addition, tidal currents within Sechelt Inlet are weak and there is very little exchange of water in the Inlet (Dayton & Knight, 1992).

The District’s effluent outfall, located in Trail Bay, has a minimal impact on the bay at the current effluent flows (Dayton & Knight, 1992). However, as the population and flow increase, the significance of the impact of the outfall on fecal coliform levels in Trail Bay could increase. The ability of Trail Bay to accept increased effluent flows through the existing outfall and/or outfall location is discussed in Chapter 8.

2.7 GROUNDWATER RESOURCES

At present, no groundwater wells used as drinking water sources exist within the District of Sechelt (Ministry of Health, 1996a). Any future wells that may be required to supplement surface water supplies would likely be located outside the LWMP study area and at elevations above residential areas. Therefore, tile field disposal of effluent from on-site systems would not negatively impact groundwater resources used for drinking water supply in the future.

2.8 OTHER ENVIRONMENTAL ISSUES

The steep beach front slopes found along Trail Bay and Davis Bay are susceptible to landsliding, slumping and soil creep (Golder, 1993). Uncontrolled drainage towards, and onto these slopes, compounds the problem. Effluent discharge from tile fields has been identified as a potential contributor to slope instability.

Although the LWMP area has experienced localized problems with individual on-site system failures, wastewater management and environmental issues are, in general, not a significant problem at the existing population levels. The challenge in the future will be to manage the wastewater generated in a manner that retains or improves the existing environmental situation in the face of increasing population and development over the next four decades.

PROJECTED DEVELOPMENT

SECTION 3

A key part of any Liquid Waste Management Plan is estimating the future population living in the LWMP study area and how this population could be distributed throughout the study area. This chapter reviews possible growth scenarios and distribution of future growth within the community.

3.1 COMMUNITY DEVELOPMENT

As discussed in Chapter 2, the Sechelt area has seen a relatively high rate of growth in the recent two decades. This growth has been based both on economic opportunities in the resource sector and on the lifestyle that the community offers. With the proximity to Greater Vancouver, this growth potential will undoubtably continue.

While the rate of growth cannot be entirely controlled, the location of growth and the ultimate buildout can be impacted to a significant degree by wastewater management decisions. For example, if the decision is made to develop an area of the community using on-site disposal systems, the lot sizes required will dictate a relatively low density of development and a low saturation population. Conversely, in the area is serviced by sewers, the constraint of a larger lot size for wastewater disposal is removed and in fact a higher density development is required to pay for the higher costs of the piped sewerage system. This ultimately results in a higher saturation population for the area as compared to the decision to utilize on-site wastewater management.

As the options for wastewater management in the LWMP area have not yet been developed, it is necessary to consider different growth scenarios for the LWMP area. For the purpose of the development of wastewater management options, three growth scenarios are assessed: moderately high, moderate, and low.

The *moderately high growth* scenario would reflect options where the municipal sewerage system would be extended from the existing core urban area outwards to service new development or re-development. Under this scenario, development will occur at urban or near urban densities within the areas served by the sewerage system. The *moderate growth* scenario would tend to reflect options where the extension of the municipal sewerage system is more limited with outlying areas developed on a selective basis. The *low growth* scenario on the other hand would be a result of a conscious decision to limit the ultimate growth through a limited extension of the municipal sewerage system and the use of on-site wastewater management in all outlying areas.

In terms of the Sechelt Band Lands, the SIGD may incorporate lands acquired by treaty to the nearest SBL. In this manner, these newly acquired lands would be subject to the same wastewater management requirements that will be developed in subsequent chapters for the impacted SBL's.

3.2 PLANNING HORIZON

Components of a sewerage system such as sewer pipes and building structures typically have a life of about 40 years. Mechanical and electrical works typically reach the end of their useful life in about 10 to 20 years. In planning wastewater systems, it is thus common to plan pipelines and structures on a 40-year horizon while phasing of the process and mechanical/electrical components over this time frame.

For the purposes of the LWMP, a 40-year time frame, to the year 2036, is used for the planning horizon.

3.3 POPULATION GROWTH

As discussed above, three growth scenarios have been developed for the LWMP. The OCP for the District of Sechelt selected an average growth rate of 4.5% per year for the next 20 years to reflect the most likely community development. This has been used as the basis for the LWMP *moderately high growth* rate. Moderate and low growth rates developed for the LWMP reflect the lower range of growth rates considered in the OCP.

Table 3-1 contains the growth rates used for projecting the future population within the District of Sechelt.

Table 3-1

Population Growth Rates for the District of Sechelt

Time Frame	Low Growth (% per year)	Moderate Growth (% per year)	Moderately High Growth (% per year)
1996 to 2016	2.0	3.5	4.5
2016 to 2036	1.5	2.0	3.0

Future populations for the Sechelt Band Lands have been estimated in a similar manner as those for the District of Sechelt. However, given the assumed low growth rates, the same rates were used for the entire 40-year planning period. Table 3-2 contains the growth rates used for projecting the future population within the Sechelt Band Lands.

Table 3-2

Population Growth Rates for the Sechelt Band Lands

Time Frame	Low Growth (% per year)	Moderate Growth (% per year)	Moderately High Growth (% per year)
1996 to 2016	0.75	1.0	1.5
2016 to 2036	0.75	1.0	1.5

Tables 3-3 and 3-4 contain the population projections for the District of Sechelt and the Sechelt Band Lands, respectively. These projections are shown graphically in Figures 3-1 and 3-2.

3.4 POTENTIAL AREAS OF DEVELOPMENT

Future residential development in the District of Sechelt can proceed in two ways: development of large new areas that are presently undeveloped and the redevelopment/infill of smaller areas within or adjacent to existing developed areas. The future development that the LWMP area will likely experience is based on planning strategy's provided by the District of Sechelt, as outlined in the OCP, and by the Sechelt Indian Government District. This section outlines the potential areas of future development within the study area, as well as the estimated populations that could be contained within these areas.

Figure 3-3 illustrates the future land development within the District of Sechelt as outlined in the current OCP. Four comprehensive development areas have been identified that could be developed in the future:

- 100 ha parcel adjacent to the downtown core (Sechelt Village) in West Sechelt;
- 55 ha parcel distributed within West Porpoise Bay (25 ha), West Sechelt (15 ha) and Sechelt Village (19 ha);

- 30 ha parcel in East Porpoise Bay; and
- 90 ha parcel in Sandy Hook.

Two additional comprehensive development areas proposed by private developers (District of Sechelt, 1996) have also been identified within the District of Sechelt (Figure 3-3):

- Mariner’s Watch (within West Sechelt); and
- the Terraces Development (south of Sandy Hook).

These areas would include a mix of single and multi family residential units as well as parks/open space and commercial/institutional developments. Mariner’s Watch, 70 ha of land in West Sechelt, would include about 850 residential units. The Terraces development would include a golf course, occupy 135 ha of land and incorporate approximately 775 residential units.

The estimated future populations for these areas, should they be fully developed, are given in Table 3-5. The density of residential units have been based on OCP values. The number of persons per unit used to calculate the estimated population was 2.25 (District of Sechelt, 1996).

Table 3-5

Estimated Populations for Future Comprehensive Development Areas

Location of Comprehensive Development Area	Density of Residential Units or Actual Units	Estimated Population
West Sechelt	22 units/ha	5000
West Porpoise Bay	22 units/ha	1238
Sechelt Village	22 units/ha	940
East Porpoise Bay	14.7 units/ha	992
Sandy Hook	14.7 units/ha	2977
Mariner’s Watch	840 units	1890
Terrace Development	775 units	1636
Total		**14,673**

Future infill development on existing land parcels within the District would be able to accommodate additional populations in the future. Table 3-6 indicates the available land areas for infill development. Population estimates have been made assuming a residential density of 15 units/ha and 2.25 persons/unit. Schedule C of the OCP was used to identify the locations for future infilling.

Table 3-6

Future Infill Development Areas and Estimated Populations

Location of Infill Development Area	Total Area for Infill Redevelopment (ha)	Estimated Additional Population
West Sechelt	120	4050
West Porpoise Bay	70	2363
Sechelt Village	20	675
East Porpoise Bay	60	2025
Sandy Hook	10	338
Tuwanek	0	0
Davis Bay	90	3038
Total	**370**	**12,489**

The OCP has estimated that approximately 2010 additional residential units could be provided on existing land parcels within the District of Sechelt. This would require limited redevelopment as well as development on parcels that have already received some level of planning approval. Based on 2010 units and 2.25 persons/unit, this would allow for an 4523 additional people. This number is believed to be conservative based on the potentially available area for infill development as indicated in Schedule C of the OCP.

The potential for future residential development on the SBL's is summarized in Table 3-7. It should be noted that there is a large degree of uncertainty associated with this data.

Table 3-7

Residential Development Potential for Sechelt Band Lands

Sechelt Band Land	Potential Development	Estimated Additional Population
1	159 townhouse units[a]	358
2	150 single family lots[b]	555
3	11 large single family lots[c]	41
4	N/A[d]	0
5	7 large single family lots[c]	26
28	108 townhouse units[c,e]	243
Total		**1223**

Notes

[a] Developer Information
[b] Dayton & Knight, 1994
[c] Associated Engineering, 1993
[d] No development plans at this time
[e] Development could also occur on single family lots. A total of 39 single family lots would yield a population of 144 persons.

The single family lots have been assumed to be occupied by Band members at 3.7 persons/unit based on 1996 Band data. The townhouse development population is based on 2.25 persons/unit.

3.5 FUTURE POPULATION DISTRIBUTION

The previous section discussed the potential areas, and associated populations, that could be developed in the future within the LWMP area. This section presents the estimated future residential population distributions for the low, moderate, and moderately high growth scenarios. A summary of estimated future residential populations for the three growth scenarios is contained in Table 3-8.

As shown in Table 3-8, the future residential development on the SBL's is estimated to be relatively minor compared to that within the District of Sechelt. However, the SIGD may decide to more rigorously pursue development on these lands over the next several decades. However, at this point, it is difficult to speculate on future developments and the possible impacts on the overall wastewater management within the LWMP study area.

3.5.1 Low Growth Scenario

The majority of growth over the next 20 years is assumed to mostly occur via infill development in West Sechelt, West Porpoise Bay and Sechelt Village. The low growth scenario assumes that the Mariner's Watch development would proceed within the next ten years and be fully developed by year 2036. Some development within the comprehensive development areas in West Porpoise Bay, West Sechelt and Sechelt Village has been assumed to occur between 2016 and 2036.

Future residential populations in Tuwanek, Sandy Hook, East Porpoise Bay and Davis Bay have been assumed to remain at essentially 1996 levels. The Terraces Development, if it proceeds, would be based on a reduced ultimate population.

3.5.2 Moderate Growth Scenario

Development under the moderate growth scenario has been assumed to progress in a similar manner as for the low growth scenario with the exception that some development of the comprehensive development area in West Porpoise Bay would occur in the next 20 years. Development of the large comprehensive area in West Sechelt has been assumed to occur between 2016 and 2036. The Mariner's Watch and Terraces developments have been assumed to be fully developed by years 2036 and 2016, respectively, under the moderate growth scenario.

Some minor growth has been assumed for the Sandy Hook area over the next 40 years. The Davis Bay/Wilson Creek area would see some growth basis on selective redevelopment of the commercial area possibly incorporating mixed higher density residential and commercial development.

3.5.3 Moderately High Growth Scenario

The moderately high growth scenario assumes that the Mariner's Watch and Terraces developments would be initiated within the next few years and to be fully developed by year 2016. These developments would accommodate about 3526 people (Table 3-5) which would leave approximately 7300 persons to be distributed throughout the study area between 1996 and 2016. The OCP has indicated that future development adjacent to downtown Sechelt Village is beneficial. As a result, it would be expected that the areas close to the downtown core would be the first to be developed. Development of the comprehensive development areas in West Sechelt and West Porpoise Bay, adjacent to the downtown core, would potentially accommodate up to 7672 persons (Table 3-5) and could contain the remaining population forecast to the year 2016 on their own. It would be expected that some infill development would occur in West Sechelt, West Porpoise Bay, Sechelt Village and Davis Bay over the next 20 years. Given the difficulty in providing municipal wastewater servicing to Sandy Hook and Tuwanek, it is unlikely that much development would occur in these areas over the next 20 years.

Development through to year 2036 would result in the infilling of remaining parcels of land and the development of the comprehensive development areas in East Porpoise Bay and Sandy Hook. The sum of the total populations accommodated by the various future developments and infills (Tables 3-5 and 3-6) is 27,162 persons. The forecasted increase in the total population in the study area by 2036 is 25,725 persons, therefore, the future populations should be able to be accommodated within the 20 year land use designations as outlined in Schedule C of the OCP. The estimated year 2036 populations for the various neighborhoods are shown in Table 3-8.

Table 3-8

Estimated Future Populations for Growth Scenarios

Area	Low Growth Scenario Estimated Population[a]		Moderate Growth Scenario Estimated Population[a]		Moderately High Growth Scenario Estimated Population[a]	
	2016	2036	2016	2036	2016	2036
West Sechelt	4669	6649	4526	10,513	8526	10,691
West Porpoise Bay	1000	2000	2262	2969	887	4151
Sechelt Village	2400	3010	3000	3378	3307	3307
East Porpoise Bay	270	270	270	270	300	3287
Terraces Development	0	0	1636	1636	1636	1636
Sandy Hook	445	445	480	501	500	3760
Tuwanek	305	305	305	305	300	350
Davis Bay	2231	2231	2345	2456	2458	5269
SBL 1	353	500	356	500	449	550
SBL 2	680	680	700	785	750	800
SBL 3	0	20	30	40	0	40
SBL 4	0	0	0	0	0	0
SBL 5	0	0	0	0	0	20
SBL 28	0	0	0	0	0	204
Total	**12,103**	**16,110**	**15,910**	**23,353**	**19,116**	**34,065**

Notes

[a] Populations shown are residential populations. Equivalent populations, that include commercial/ institutional/industrial components, for the purposes of wastewater planning, are discussed in Chapter 4.0.

3.6 COMMERCIAL, INSTITUTIONAL AND INDUSTRIAL DEVELOPMENT

Commercial, institutional and industrial development will continue to expand as residential development and population in the study area continues to grow.

Presently, only about 2% of the District of Sechelt's total land area is designated as commercial land (District of Sechelt, 1996). A small amount of commercial development also exists on SBL 2. Future increases in commercial land will focus on providing services which are conveniently located throughout the study area. The large comprehensive development areas will require commercial and institutional amenities as part of their overall development plan.

There is presently about 120 ha of industrially zoned land within the District of Sechelt (District of Sechelt, 1996). This includes a large industrial park east of Chapman Creek. The Sechelt Indian Government District is also providing industrial space on its Band lands. Past difficulties with servicing and subdividing industrially zoned lands has prevented previous development. However, resolution of these difficulties combined with continued population growth is expected to generate more demand for industrial lands. This development is expected to be "dry" industrial uses where the wastewater generated is domestic in nature from washroom facilities. "Wet" industries that produce a large quantity of process wastewater such as pulp mills are not expected and are not considered in this LWMP. Future industrial developments on SBL's are unknown at this time.

The projected development of the community over the next 40 years will be impacted by the decisions made on wastewater management. For the purpose of the development of wastewater management options, three growth scenarios are assumed. These growth scenarios (low, moderate, and moderately high) would see the existing residential population increase from 8300 persons in 1996 to 16,100 persons, 23,400 persons, and 34,000 persons, respectively, by the year 2036.

MUNICIPAL SEWERAGE SYSTEM

SECTION 4

4.1 EXISTING SEWERED POPULATION

The existing wastewater collection system in the LWMP study area serves portions of West Sechelt and West Porpoise Bay, all of Sechelt Village, and most of the non-leased lots on SBL 2. The existing sewer system was previously shown in Figure 2-2.

The sewered sections of the study area contain connections to residential dwellings as well as to commercial, institutional and industrial properties. “Equivalent” population values have been assigned to the non-residential properties so as to include their contribution of wastewater to the collection system. The flow from a commercial, institutional or industrial facility is divided by the residential per capita average flow value to determine the “equivalent population” for the facility. This method allows for the integration of residential wastewater generation with that from non-residential sources and enables a more accurate determination of wastewater flows in the overall planning process.

Table 4-1 summarizes the estimated residential population, for each neighbourhood and SBL in the LWMP study, connected to the municipal wastewater collection system in 1996. The residential populations served by on-site systems (including local community treatment plants) are also shown. Similarly, equivalent populations for the non-residential properties have been estimated and are contained in Table 4-1.

4.2 EXTENSION OF MUNICIPAL SEWERAGE SYSTEM

Future expansion of the wastewater collection system will occur in two ways:

- to service developed areas currently on on-site disposal; and
- to service new development areas.

In the former case, the decision to extend the sewers into an existing developed area may be driven by the need to rectify problems with the current on-site disposal systems. Alternatively, the area may be poised to undergo redevelopment that would increase the wastewater flows on a per lot basis to above the amount that can be accommodated by an on-site system. The Wilson Creek/Davis Bay area is an example of this situation. In the latter case, the development planned at an urban density will require the use of a sewer system. The Mariners Watch Development in West Sechelt is typical of this type of extension.

Another key question regarding sewer extensions is *when will the extension occur*? The timing of sewer extensions over the 40-year planning horizon will be driven by the overall community growth and the demand for housing, the severity of problems in existing on-site disposal areas, the pressures for redevelopment of areas on on-site disposal, and the availability of funding. To a large extent this may be governed by factors outside the community such as the general economy of the province and growth rates and real estate prices within the Greater Vancouver area.

The future sewered populations will depend upon the decisions made on extension of the municipal sewerage system under the various wastewater management options. The moderately high growth scenarios would require higher residential densities served by the municipal sewerage system. Conversely, the lower growth scenarios will see more reliance on local community systems and on on-site disposal. The future equivalent sewered populations are discussed under the various wastewater management options.

SOURCE CONTROL

SECTION 5

A major focus of the Ministry of Environment, Lands and Parks in the preparation of LWMPs is the issue of source control. Source control refers principally to the control of the quality and quantity of the inputs to the community sewer system. In the case of Sechelt, it also refers to the control of waste inputs into individual on-site septic tank systems as inappropriate waste input could lead to a deterioration in system life or in contamination of groundwater.

The control of waste inputs into either a municipal, a local community or an on-site wastewater management system is a key factor in the long term operation of the system. With municipal or local community systems, controlling the "quality" of the wastes prevents downstream problems with the quality of the effluent or biosolids generated from the treatment process. For individual on-site systems, controlling the waste input yields the maximum possible life from the tile field and can prevent the contamination of groundwater. Key elements of a source control program are as follows.

5.1 SOURCE CONTROL BYLAW

The principal means of controlling the input of waste into a community sewerage system is through a source control bylaw adopted by the municipality. The intent of the bylaw is to prevent the input of wastes into the sewer system that would have a detrimental impact on the treatment plant effluent or biosolids quality. The objective of the bylaw is to limit the incoming wastes to essentially "domestic" wastes that can be treated by the plant. Domestic wastewaters are considered to be wastewaters produced in residential, institutional, and commercial connections from bathrooms, kitchens, and laundry facilities.

Wastes with a high organic strength (BOD), excessive oil or grease, or high metals content from commercial or industrial operations would have to be pre-treated at the source prior to discharge to the sewer system. Pre-treatment of these wastes at source is less expensive and more effective in treating the wastes than after they have been diluted in the municipal wastewater stream. Wastes such as solvents, gasoline, paints, etc. would not be allowed into the sewer system. The intent of a source control bylaw is primarily as an education tool. Although it is necessary to establish penalties and fines under the bylaw, it is anticipated that knowledge of the bylaw in most cases will be sufficient to ensure that illegal discharges do not occur. In the case where chronic violations due occur, the bylaw gives the sewer authority a recourse in dealing with the situation.

Implementation of source control bylaw is not without its cost. Monitoring of the influent to the plant and possibly spot checks on commercial and industrial connections are required. Municipal staff time and expenses for laboratory analysis must be set aside on an annual basis. Controlling the waste input at source is however far more effective than dealing with the environmental consequences at the effluent reuse or disposal stage.

5.2 PUBLIC EDUCATION

Although the source control bylaw discussed above can be an effective tool in source control, it is necessary to ensure that the users of the sewerage system are aware of its contents and the general objectives of source control. This can be accomplished in a number of ways:

- mail-out brochure with the sewer service billing or tax notice;
- public information meetings such as under the LWMP;
- media notices or press releases; and,
- public school programs.

Of the above, the public school programs probably have the greatest long term effect. These can take the form of provision of information packets to the schools, presentations by interested members of the sewer utility, and/or tours of the wastewater system.

5.3 WASTEWATER MINIMIZATION

The reduction of the volume of wastewater to be treated reduces both the capital and the annual operating and maintenance costs of the system. Facilities such as pumps, piping, and concrete tankage can be made smaller if peak and average flows can be reduced. In terms of operating and maintenance costs, reduced flows translate to reduced power consumption and chemical usage. The two targets for wastewater reduction are:

- wastewater generation; and,
- infiltration/inflow.

The wastewater generated in the home or commercial establishment can be reduced through water saving devices such as pressure reducing valves, low flow toilets, reduced flow shower heads, and water saving appliances, as well as the installation of water meters. This type of program obviously benefits not only the wastewater collection and treatment system but also has direct benefits to the water supply and distribution system. Any plan to implement water savings programs, such as the installation of residential water meters, jointly involves the Sunshine Coast Regional District, the District of Sechelt, and the Sechelt Indian Government District. Opportunities for public involvement should also be incorporated into decision making processes.

Infiltration refers to the entrance of groundwater into the gravity sewer system through leaks in the sewer joints or into the manhole barrels. Inflow is rainfall or snow-melt that enters the sewer system primarily through the manhole frames and covers. Both of these inputs, termed I/I, increase the average amount of flow to be treated but more importantly increase the peak flow that must be delivered to the plant. With high I/I, the collection system, treatment plant, and disposal system must all be increased in size to accommodate the higher flow. The weaker influent wastewater and the high short-term peak flow can also cause problems with the treatment process.

High I/I is generally due to poor original sewer construction that is compounded in areas of high groundwater tables. Fortunately, analysis of the wastewater flows in the Sechelt collection system indicate that I/I is low to moderate reflecting the quality of the original construction. Analysis of the daily flow data for the year 1995 indicates that the ratio of the maximum daily flow to the average annual daily flow is about 1.5. Proper design and construction supervision of future sewers and maintenance and repair of existing sewers as required should allow this low I/I situation to be maintained over the LWMP planning horizon.

5.4 SEPTAGE WASTE

Portions of the District will continue to utilize on-site wastewater management systems. Although the extent of on-site system use will vary with the wastewater management strategy selected, the need for pump out of the septic tanks and disposal of the septage will continue to be required. This service is provided by private septic tank pump-out companies with the septage currently disposed of at the Dusty Road plant in the sludge treatment/storage lagoons.

Under the LWMP, a facility to safely dispose of septage waste should continue to be provided by the Sechelt Sewage Facilities Commission. The most logical approach is to continue to provide this facility at the Dusty Road plant. Upgrading of the disposal works at the plant will be required in the longer term as the plant is expanded. Future quantities of septage, originating within and outside of the District boundaries, will require consideration with respect to the processing capacity at the Dusty Road plant. The proposed upgrading would see the septage discharged to a septage receiving station where the incoming material can be screened and treatment provided with the biosolids stream. This will reduce the odour problems and produce a more consistent biosolids quality for reuse.

The charges to the private operators for this treatment and disposal service need to be examined to ensure that the revenues received adequately cover the cost of the service. This will be discussed further in the Stage 3 LWMP report.

5.5 HOLDING TANKS

Holding tanks have been used at a number of dwellings as an interim measure to handle failing on-site systems. With a holding tank there is no outlet and the tank must be pumped out on a frequent basis (typically once per week) using a septage pumping truck. The wastewater is then trucked to the sewer system or plant for disposal. Although suitable as a short-term remedy, holding tanks are expensive to operate and can create public health problems if pump-out service is interrupted due to contract disputes.

Under the LWMP, holding tank use for residential or commercial properties should not be encouraged and holding tanks in current use should be phased out as allowed by sewer expansions.

5.6 MARINE CRAFT

The discharge of wastewater from marine craft is a potential area of concern particularly in the poorly flushed areas of Sechelt Inlet. The discharge of wastewater from pleasure and non-pleasure crafts currently falls under the Federal *Pleasure and Non-Pleasure Craft Sewage Pollution Prevention Regulations* (Government of Canada, 1991a, b). Under these regulations, the District, in conjunction with assistance from the MELP, could apply to the Federal Government to have specific marine and inland waters designated as no discharge areas. Although Georgia Strait and Sechelt Inlet are not currently designated as no discharge water bodies, this could change over the planning horizon.

Marinas should be encouraged to provide pump-out facilities for marine craft to prevent the uncontrolled discharge of untreated wastewater in Trail Bay and Sechelt Inlet. The collected wastewater would then be discharged to the sewerage system.

Source control will be an important element of the LWMP. Components of a source control program that should be considered include a source control bylaw, a public education program, wastewater minimization strategies, and facilities to handle septage, holding tank, and marine craft wastes. These will be further defined in the Stage 3 LWMP report.

EFFLUENT AND BIOSOLIDS REUSE

SECTION 6

Effluent reuse is a major factor that the MELP requires to be addressed in the preparation of LWMPs. Effluent reuse is defined as the use of treated effluent in a beneficial manner. Of particular interest are applications where effluent could be used to offset the use of treated domestic water. This type of reuse can often lead to more efficient utilization of the domestic water resources and deferring the need to increase domestic water supplies to handle increasing urban growth.

The concept behind effluent reuse is that effluent should be considered as a resource. In many community situations, there are water uses where the water does not have to be treated to the same quality as for potable consumption. If effluent, treated to an appropriate degree, can be substituted for potable water from the municipal system there is a potential reduction in the delivery capacity of the water system. In actual practice, the water supply system capacity may not be reduced but rather capacity is freed up for additional potable water use thus deferring expenditures to expand the water supply system. Other areas of effluent reuse that do not necessarily offset potable water use may also be available. These include supplementing stream flows during low flow periods or the development of wetlands habitat.

In this LWMP, the term *effluent reuse* has a different meaning than the term *land disposal*. As described above, effluent reuse is where there is a net benefit in the end use of the effluent. Land disposal on the other hand refers to simply the disposal of effluent by applying it to land at as high an application rate as possible.

6.1 OPPORTUNITIES FOR EFFLUENT REUSE

Effluent, treated to an appropriate degree, can be used for applications ranging from agricultural irrigation to irrigation of residential lawns. The major question, however, is what is realistically and economically achievable? The use of treated effluent requires that a distribution system similar to the municipal water supply system be implemented to transport the effluent to the end users at the required pressure and delivery rate. Additional levels of treatment such as filtration and increased disinfection are often required depending upon the end use. The capital and annual operating and maintenance costs for distribution and additional treatment can be significant. In general, the economics of a major reuse system can only be justified where there is an offsetting revenue due to the high cost of domestic water supply. Nevertheless, local situations may exist where it is practical to offset domestic water use with reclaimed effluent.

The major opportunities for effluent reuse in the Sechelt area are:

- industrial operations;
- golf course irrigation; and,
- silviculture.

Construction Aggregates Ltd. (CAL) is a major construction aggregates producer located southeast of the Dusty Road treatment plant. CAL presently purchases between 455 and 2275 m^3/d from the municipal supplier, the Sunshine Coast Regional District. This water is used on a year-round basis in the gravel processing operations and represents a possible situation where reclaimed effluent could replace potable water use. CAL is also investigating site remediation options and the use of effluent is being explored for seasonal irrigation use. Discussions with CAL are currently underway regarding the potential for effluent reuse.

Golf courses are another ideal use for reclaimed effluent due to their high seasonal demands and use of automated irrigation systems. The Sechelt Golf Club in West Sechelt is an 18-hole course that presently employs municipal water for irrigation. Typical water use is about 910 m^3/d over a 125-day season (Dayton & Knight, 1995). A second golf course is in the planning stages in the Terrace Development in the Sandy Hook area.

The third area of potential effluent reuse is in silviculture operations such as nurseries. Although there are no silviculture operations in the area using municipal water, the supply of reclaimed effluent from the Dusty Road plant adjacent to Provincial Crown lands does offer the potential. The quantity of effluent required on a seasonal basis could be significant however no studies of the economic potential for a silviculture operation have been carried out to date.

Prior to initiating effluent reuse programs, the MELP will likely require the District, or other effluent end users, to conduct environmental impact studies in conjunction with a public consultation process as part of an approval process for effluent reuse programs.

6.2 EFFLUENT REUSE OPPORTUNITIES VERSUS SUPPLY

The Dusty Road plant currently (1996) discharges on average 800 m^3/d (approximately 1240 m^3/d are directed through the Ebb Tide plant). This represents the volume of effluent that is potentially available for effluent reuse at the present time. Based on the expected water demand for the CAL gravel processing operation site above (1365 m^3/d), all of the wastewater currently treated at the Dusty Road plant could be used for reuse. The quantity available for reuse in the future will depend upon the overall wastewater management strategy selected and the population growth served by the municipal wastewater management system. This is discussed under the individual wastewater management options.

As the wastewater flow treated by the Dusty Road plant increases in the future, the potential over the longer term to supply effluent to other users exists. Effluent could be supplied on an “as available” basis utilizing surplus flow from the plant. Alternatively, effluent storage could be provided to store effluent during the low demand months for use during the higher demand summer period. Given the climate of the area, the seasonal demand for irrigation water, and the steep topography at the Dusty Road site, the provision of a lined storage cell however would be expensive and difficult to justify on the basis of economic return.

6.3 BIOSOLIDS PROCESSING

Biosolids, or the sludge produced from the treatment process, are composed primarily of organic material and when suitably processed can be utilized in a beneficial manner as a soil conditioner. The Sechelt sewer system receives little in the way of industrial waste inputs. This fact, coupled with an effective Source Control Bylaw, should reduce the level of metal concentrations in the sludge that could interfere with utilization opportunities. The biosolids from the Sechelt plants, if processed appropriately, will thus provide an ideal material for use as a soil conditioner.

The processing method of choice depends upon the size of the plant and the end use of the biosolids. As the Dusty Road plant is a relatively small plant with limited operational staff time, the sludge processing operations should be as simple and as low maintenance as possible. As the site is compact, the size of the operations will become an important future consideration. At all treatment plant sites, odours are becoming an increasing concern. Plant design and operations must minimize the generation of odours and where necessary provide odour treatment facilities.

Under current regulations, end use of biosolids can range from “agricultural - low grade” to “retail - high grade”- the difference in the grades lies in the degree of stabilization, pathogenic destruction, metals content, and moisture content. In general, the “agricultural-low grade” quality is the lowest quality and would require restricted handling and site applications. On the other hand, “retail - high grade” is the highest quality and could be used directly by the public in bulk or bagged form.

There are a wide range of processes available to provide the desired biosolids end product. The processes selected depend upon the size of the plant, the operational expertise and labour available, and overall economics. Potential biosolids processing approaches that are applicable to the Sechelt situation are as follow:

- sludge stabilization and storage lagoons; and,
- mechanical aerobic digestion and dewatering.

Sludge stabilization and storage lagoons are the present method of sludge management. Although suitable in the near term, the large areas occupied by the lagoons will be needed for expansion of the plant. In addition, as development encroaches on the site, the odours generated from the lagoons will be an issue. With long enough storage, the stored sludge should be adequate for an “agricultural - low grade” use.

Mechanical digestion involves biologically stabilizing the incoming sludge in concrete tanks. These tanks occupy a smaller footprint than the lagoons and odours can be controlled by covering the tanks. Two processes are available for stabilization: aerobic digestion and ATAD (autothermal aerobic digestion). The former process is simple to operation and reliable; the second process is more complex to operate, requires a more complex odour control system, but produces better pathogen reduction. Mechanical dewatering can be provided by a variety of processes including screw presses, belt filter presses, and centrifuges. The type and degree of dewatering will depend upon the ultimate biosolids use.

Composting of the sludge either after lagoon storage or mechanical dewatering is a potential final process prior the biosolids utilization. A windrow type composting employing wood chips as the bulking agent is the most common approach used in this size of operation. The screened final compost product would meet the “retail - high grade” criteria and would be acceptable for use as a soil conditioner in municipal or public landscape applications.

6.4 BIOSOLIDS UTILIZATION OPPORTUNITIES

The current biosolids generation rate from the two municipal plants is about 200 dry tonnes per year. The opportunities for biosolids utilization include:

- landfill cover;
- site reclamation at gravel extraction operations; and,
- soil conditioner for landscaping applications.

The use of biosolids at the regional district landfill as a final cover will be an ongoing potential use. In this application, the dewatered sludge would likely be mixed with a coarse soil to produce a medium for revegetation of the cover. Alternately, composted biosolids could also be used for this application. CAL is currently using undewatered sludge from the Dusty Road plant for site reclamation activities on their property (Van Ham, 1998). CAL expects to continue to use the District's undewatered biosolids for the next ten years. In addition to the above, the use of biosolids in landscaping provides a very broad potential use over the long term.

The potential uses for biosolids in the Sechelt area will very likely exceed the amount of biosolids that are produced for a number of years. In arriving at a strategy for biosolids management, it is necessary to balance the economics of processing the biosolids with the end use. Such a program could see different grades of biosolids produced for different end uses. An example of this would be to use the stored sludge in the lagoon for an "agricultural-low grade" for site remediation in the short term and commence development of a composting facility to produce "retail -high grade" biosolids in the longer term. Development of a biosolids strategy is discussed further under the wastewater management options.

The MELP will likely require the District, or other biosolids end users, to carry out environmental impact studies as part of an approval process for biosolids reuse programs.

Opportunities exist for both effluent reuse and biosolids utilization in the LWMP area. Effluent reuse potential as industrial processing water exists on a year-round basis at the CAL operations adjacent to the Dusty Road plant. Other opportunities for seasonal use in irrigation also exist at CAL and at the Sechelt golf course. The demand for biosolids will likely exceed the available supply. Effluent and biosolids utilization approaches are further developed under the wastewater management options.

WASTEWATER TREATMENT TECHNOLOGIES

SECTION 7

7.1 OVERVIEW

The objective of wastewater treatment is to produce an effluent of acceptable quality for the effluent reuse and disposal strategies adopted in the LWMP. This treatment may be provided at either the two municipal wastewater treatment plants, at local community plants, or at individual on-site treatment systems. There are a wide variety of wastewater treatment technologies are available - these range from “natural” lagoon-based systems to relatively complex technologies. Some processes are aimed at the individual home treatment system while other processes are designed for very large scale municipal facilities.

At the present time, there are two municipal wastewater treatment plants that treat the majority of the collected wastewater in the community. These plants will continue to operate in the short term and, depending upon the LWMP option, may be upgraded and expanded to provide treatment over the 40-year planning horizon. A local community treatment plant has been constructed to serve the Port Stalashen development and the use of other local community plants is being considered under the LWMP options. The purpose of this chapter is to briefly review the current performance of the two municipal wastewater treatment plants and to review available wastewater treatment technologies that can be considered for upgrading the municipal plants and for use at local community plants.

7.2 EBB TIDE PLANT PERFORMANCE

The 18-year old Ebb Tide plant was originally based on the suspended growth extended aeration activated sludge process. The process was later converted to the hybrid trickling filter/solids contact (TF/SC) process to increase the capacity of the plant and to provide more reliable operation. Disinfection is provided by chlorine gas. No dechlorination is provided however the effluent is mixed with the dechlorinated Dusty Road plant effluent prior to discharge out the marine outfall. An aerobic digester is currently used to provide waste sludge digestion prior to discharging the sludge to the raw wastewater stream pumped to the Dusty Road plant.

Associated Engineering (Associated Engineering, 1993a) conducted a performance and condition/maintenance review of the Ebb Tide plant in 1993. This study was initiated when the District of Sechelt was in the process of taking over ownership of the plant and marine disposal system from the Sunshine Coast Regional District. Conclusions reached by the study included:

- the plant was producing a suitable quality effluent and was meeting the MELP permit criteria;
- 1993 performance levels should be able to be maintained in the future provided flows to the plant were kept at or near levels existing in 1993; and,
- the life of the plant without major expenditures could range from 2 to 10 years depending on decisions regarding plant phase-out.

The present flows to the Ebb Tide plant have been maintained close to 1993 levels by diverting surplus of the flow to the Dusty Road plant. As a result, the Ebb Tide plant continues to produce a reasonable BOD and TSS removal. The MELP permit for the system was revised in 1994 to include an effluent toxicity requirement of LC_{50} of 100%. This criteria, although met the majority of the time, was not achieved on occasion in 1996 and 1997. The failure is believed due to the high ammonia levels in the plant effluent during winter months.

7.3 DUSTY ROAD PLANT PERFORMANCE

The two-year old Dusty Road plant is based on the suspended growth extended aeration activated sludge process. The process configuration is termed an “oxidation ditch” due to the circular layout of the aeration basin. Disinfection using chlorine gas and dechlorination using sulphur dioxide at provided prior to marine disposal of the treated effluent. Sludge handling is provided by a mechanically aerated sludge lagoon followed by a non-aerated sludge storage lagoon. Septage and sludge from other small plants outside of the LWMP area are delivered to this plant.

A review of the plant design and operation has been carried out as part of the LWMP preparation process. The preliminary review of the plant has brought attention to the following points:

- poor BOD/TSS removal;
- potential deficiencies in the mechanical mixing equipment used in the aeration basin; and,
- a “baseline” sampling program is required to obtain data that would assist in formulating a strategy to improve the plant's performance.

A subsequent field investigation to measure aeration basin velocities confirmed the deficiencies in the aeration basin mixing equipment.

Given the current performance of the Dusty Road plant, and the fact that the Ebb Tide plant is presently operating near its maximum capacity, the District made the decision in late 1997 to upgrade the facility. Construction was completed in 1999.

7.4 MUNICIPAL AND LOCAL PLANT TECHNOLOGIES

Wastewater treatment technologies have historically been divided three categories: *primary, secondary, and tertiary*. With evolving effluent criteria issues, treatment descriptions that refer to levels between the typical definitions are also emerging. These include examples such as *enhanced primary treatment* that refers to a chemically enhanced BOD and TSS removal in a primary plant or *advanced secondary treatment* that describes the addition of nitrification to the conventional secondary process.

The focus of this LWMP will be on three treatment level definitions:

- secondary;
- advanced secondary; and,
- tertiary.

Secondary treatment refers to processes where the prime objective is the reduction of BOD and total suspended solids (TSS) concentrations. This level of treatment is referred to as *best available technology* (BAT) in the MELP’s 1993 draft criteria and in general forms the minimum level of treatment for marine or land disposal. **Advanced secondary**, as used in this LWMP, refers to processes where nitrification is incorporated to reduce ammonia levels. Elevated ammonia levels in the effluent can lead to a toxicity problem that will result in failure of the 100% LC_{50} toxicity test that is stipulated in some MELP permits for marine or freshwater discharges.

Tertiary treatment is defined as processes that incorporate a higher BOD and TSS removal than achievable by secondary treatment alone. Within an effluent reuse context, this higher removal is desirable in order to achieve a more effective disinfection of the effluent. Tertiary treatment generally requires the addition of a filtration step after secondary or advanced secondary treatment. Although tertiary treatment often refers to nutrient removal (phosphorus and/or nitrogen), this is not an issue for marine or land disposal in this LWMP area and the definition as used does not infer that nutrient removal is optimized within the tertiary process.

The secondary processes can be further divided into four general categories. These are described below and shown in Tables 7-1 to 7-4.

- **Suspended Growth Systems** - These processes rely on mechanical aeration systems to supply air (oxygen) to wastewater contained in tanks or reactors. Aeration keeps the wastewater aerobic and well mixed. In the presence of this air and the mixing systems, naturally present bacteria suspended in the wastewater use the soluble organics as food and begin to grow and multiply. An ecosystem comprised of a wide variety of bacteria (primary convertors), protozoa (grazers) and rotifers (predators) develops. Plant operators must maintain optimum food to microorganism (F:M) ratios and microbial concentrations (MLSS) by wasting some of the solids from the system. Solids are settled out in a secondary clarifier following the aeration tank. A large portion of these solids are returned to the aeration tank in order to maintain the proper MLSS concentration. The Dusty Road oxidation ditch plant is an example of a suspended growth system.

- **Fixed Film Systems** - These systems use some type of physical surface media, contained within a reactor, upon which a microbiological "slime" layer comprised of bacteria, protozoa and rotifers can be established. Oxygen is supplied to the organisms using some form of mechanical aeration. As with the suspended growth systems, solids are settled out in a secondary clarifier following the reaction tank.

- **Hybrid Systems** - These systems combine at least two types of treatment together in order to increase the treatment efficiency. The Ebb Tide trickling filter/solids contact plant is a hybrid system in that the trickling filter is a fixed growth system and the solids contact process is a suspended growth system.

- **Passive or Natural Treatment Systems** - In the context of this study, passive or natural treatment systems are defined as those which rely on natural energy inputs, i.e., sunlight and natural biological processes, and have a minimum of mechanical equipment associated with them. For example, algae supply the necessary oxygen for aerobic organisms rather than mechanical aeration equipment. The microbiological processes utilized in the former three processes are also used in passive treatment systems. However, passive systems can also utilize higher forms of biological organisms, such as aquatic plants, snails and even fish, to treat the incoming wastewater. Examples of passive systems include engineered artificial wetlands and constructed ecosystems contained within greenhouses.

One of the most significant differences between the passive systems, and the more conventional mechanical treatment plants, is in the rate of waste treatment. The mechanical systems are engineered for maximum efficiency, therefore, the size of the treatment facility can be orders-of-magnitude smaller in size than passive systems treating the same volume of wastewater.

TSS was previously identified as one of the parameters governing overall secondary effluent quality. The “mechanical” secondary treatment processes, as discussed, use clarifiers to separate the solids (contained in the raw wastewater and generated during the treatment process) from the treated wastewater. TSS levels in clarified wastewater, from properly designed and operated systems, are typically much lower than would be required for effluent disposal in the ocean or on land. Effluent reuse such as irrigation requires more stringent TSS levels, therefore, filters can be located after the clarifier to further reduce effluent TSS concentrations to appropriate levels.

Recently, membrane filtration technology has also been used in conjunction with small scale, modular, secondary treatment processes. Membrane filters essentially replace the secondary clarifier of a conventional system, and are capable of producing effluent TSS levels similar to those obtained by conventional systems using clarifiers and filters. Membrane filtration is typically used as part of proprietary systems. Current sizes of operating systems are generally of a small scale and the technology has not yet advanced to the stage of being economically competitive with clarifier technology at larger scales.

The evaluation of the various treatment technologies must consider several criteria, in addition to effluent quality, in order to decide on the most appropriate technology for the particular upgrading or new application. These criteria include:

- complexity of operation;
- availability of operational staff time;
- age of existing facilities and “reusability” of major components;
- land area constraints;

- capital costs; and,
- operation and maintenance costs.

In considering the upgrading or expansion of the two municipal plants, the existing processes and treatment components will have a major bearing on the processes that can be economically considered. In addition, the site area requirements will also play a major role in future process selection. At both sites, the area is restricted and the use of compact, mechanical treatment technologies will be heavily favoured.

For new local community systems, the selection of the process will be less constrained. Natural treatment systems that require a larger area can be incorporated if planned at the early stages of development. Alternatively, more complex technologies such as the membrane filtration process can also be considered due to the reduced scale. In selecting the treatment technology, the final effluent reuse and disposal must be considered as well as the impact of the plant on the local community.

Tables 7-1 to 7-4 show a short-list of treatment technologies that can be considered for upgrading or expansion of the municipal plants or for new local community systems. This list is used in subsequent chapters to develop options for evaluation under the LWMP.

It should again be emphasized that the LWMP is a *planning* document and it is not necessarily the objective to make the final selection of treatment technologies, particularly in the case of proposed local community plants that may only be in the very early planning stages. The more important considerations are what area will the plant serve, how will it be integrated into the community, and what will be the method of effluent reuse and disposal? Once these questions have been addressed, the decision of the treatment process technology can be more easily made.

A variety of wastewater treatment process technologies ranging from simple, natural treatment systems to complex mechanical-based systems are available. In upgrading the Dusty Road plant, optimizing the existing suspended growth activated sludge system is the best direction. If the Ebb Tide plant is rebuilt in the future, a variety of compact mechanical secondary or advanced secondary processes can be considered. If local community plants are selected as the LWMP strategy, both natural and complex mechanical plants can be evaluated based on the specific requirements of the local development.

SECTION 8

EFFLUENT DISPOSAL ALTERNATIVES

The opportunities for reuse of effluent has been discussed in Chapter 6. Although several prospects exist for reuse opportunities of the effluent generated from the municipal sewerage system, given the constraints imposed by the climate and by economics, complete reuse of effluent is not achievable. The surplus effluent must, therefore, be disposed of by either direct discharge to surface waters or by disposal on land. These alternatives are discussed below.

8.1 DISPOSAL TO MARINE ENVIRONMENT

Marine disposal of effluent is widely practiced by coastal communities around the world. Disposal of effluent, via an outfall into Trail Bay, is the current method of disposal from the two treatment plants.

The suitability of marine disposal for municipal effluents is based on two factors:

- the high initial dilution available due to the buoyant nature of the effluent plume; and,

- the significant secondary dilution produced by the currents in a well-flushed marine environment.

Initial dilutions, as the effluent is discharged from the outfall diffuser and mixes with the ambient seawater, are typically in the order of 100 to 1000:1 in a well located and designed system. The secondary dilution as the effluent field is carried by the currents, is lower, typically about 10 to 100:1. When these two actions are combined, the above dilutions are combined resulting in an overall dilution of 1000 to 100,000:1.

The potential impacts of marine discharges include the potential health risks to recreational water users, and to shellfish harvesting areas, due to pathogenic organism contamination, the possibility of nutrient enrichment, and the toxic effects of trace organics and inorganics such as pesticides and metals. The first issue can be effectively dealt with through effluent disinfection and locating the discharge in an area where reasonable dilution can be achieved. Nutrient enrichment, due to phosphorus and nitrogen additions, are not a problem where a high dilution can be achieved. The effects of trace contaminants are possibly of the most concern due to their possible persistence in the environment. As discussed elsewhere, an effective source control program to ensure these materials do not reach the sewer system, is the best combative approach.

Trail Bay and Georgia Strait are considered to be potential areas for marine disposal. Discharge to the poorly flushed Porpoise Bay, north of the urban area, is not considered to be a suitable disposal area and has been dismissed by the MELP in the past (Dayton & Knight, 1992).

The existing outfall discharges into Trail Bay about 500 m offshore in an average water depth of about 30 m. As a previous engineering report (Dayton & Knight, 1994) suggested that there may be a limit on the quantity of flow that can be discharged into Trail Bay, a comprehensive oceanographic modeling study has been carried out, as part of the LWMP process. The objectives of this study were to better determine the impact of the existing effluent discharge and to select the most suitable location for long term marine disposal, if this method of disposal is continued. This study provides the first stages of an environmental impact assessment for existing discharges that may be expanded in the future. In addition, since the study is done within the LWMP, also involves public consultation as part of the assessment.

The oceanographic modeling results are contained in Appendix A of this report. The key conclusions of the study are as follows:

.1 Tidal flushing is relatively weak in Trail Bay and there is a tendency for effluent to accumulate in the bay through several tidal cycles. During the winter months the plume from the existing outfall reaches the surface and, combined with the weak flushing, this may bring effluent into contact the shoreline in Trail Bay. Under this condition, the initial dilution is in the order of 400:1 with a secondary dilution of 10:1. Overall dilution is thus about 4000:1. During the summer months, the bay is stratified due to the temperature and density differences of the bottom and surface waters. This tends to trap the effluent plume at a distance below the surface, reducing the possibility of contact with the shoreline.

.2 Extending the outfall into deeper water along the existing outfall alignment, will provide better dilution at all shoreline locations in Trail Bay, even at the future effluent flows. At the shoreline at Sechelt, the secondary dilution will increase from 10:1 to 31:1 for an 1200 m long outfall. When combined with initial dilutions of in the order of 500:1, the total effective dilution would be 15,000:1 for the 1200 m long outfall if the plume surfaces. In actual fact, at this outfall location, the discharge depth would be about 70 m and the plume would likely remained trapped below the surface year-round.

.3 Increasing the outfall length beyond 1200 m, continues to improve the dilution at the Sechelt shoreline but will, in fact, *reduce* the dilution to the west in Sargeant Bay and to the east near Mission Point.

.4 An outfall location off Mission Point would need to be at least 1000 m offshore to achieve a performance similar to that for a 2200 m outfall, along the existing alignment, as the tidal current patterns tend to sweep wastewater at Mission Point around into Trail Bay.

The oceanographic modeling has confirmed that marine disposal in Trail Bay is an environmentally suitable means of effluent disposal. At the current effluent flows, the discharge location is suitable, given the secondary level of treatment and the disinfection of the effluent. With the low levels of fecal coliform in the effluent (less than 200 MPN/100 ml on average), the plume dilution is more than adequate to meet the bathing water standards at the shoreline.

In considering marine discharge as a disposal option in the future, a number of factors must be considered. First the quantity of effluent will increase over the planning period. This will decrease the performance of the existing outfall, and ultimately require that the outfall be replaced, due to lack of hydraulic capacity. A second factor is that water use activities in Trail Bay are changing and activities, such as wind surfing, are extending the recreational use period beyond the traditional summer period and into offshore water. Given the above, if marine disposal is continued, it would be prudent to extend the outfall into deeper water further offshore. Given the high dilutions that can be achieved, the existing level of secondary treatment, combined with effluent disinfection, are more than adequate to meet and exceed receiving water criteria. Advanced treatment to remove nutrients is not required.

Based on the oceanographic modeling, and the cost of outfall construction, it is recommended that an outfall extension to a distance of about 1000 m offshore and to a depth of 60 m along the existing alignment, be considered as a reasonable basis for option planning. The actual location would be subject to further oceanographic studies of bottom conditions and water column density profiles. Consideration can also be given to a phased extension to this depth, as the effluent flows increase. This discharge location, combined with secondary treatment and disinfection, will provide an environmentally suitable disposal option with a high factor of safety. The District could initiate an environmental monitoring program, involving water column and sediment sampling, to monitor the impacts of marine disposal on the receiving environment as part of an on-going environmental impact assessment.

For the purpose of the LWMP evaluation, marine disposal is considered a feasible disposal alternative and it is further developed as a wastewater management option.

8.2 DISCHARGE TO FRESHWATER ENVIRONMENTS

The discharge of effluent into rivers and lakes is commonly practiced in non-coastal areas. Disposal to rivers is generally favoured due to the high dilution that can be achieved with a large river flow and a properly designed diffuser. Lake discharges provide less opportunity for high dilutions as the density differences between the effluent and the lake water, as present for marine situations, are not available. Lake currents and thus available secondary dilution are also considerably less than in the marine environment.

Given the topography of the LWMP area, no major rivers or lakes exist, thus the possibility of disposal to freshwater is limited to relatively small creeks. Discharge to these creeks would require a high level of treatment, as the dilution available particularly in the summer, is low and the majority of creeks in the area of the two municipal treatment plants flow to the poorly flushed waters of Porpoise Bay.

Based on the above, the direct disposal of effluent to freshwater is only considered feasible where a very high quality of effluent is produced and adequate dilution is available in the creek. Given the large flows from the two municipal plants, disposal to freshwater is not considered an option. For a local community plant, located in the Wilson Creek/Davis Bay area, however, the use of a tertiary treated effluent for flow augmentation could be considered given the larger creeks and the smaller quantity of effluent flow. The MELP will require an environmental impact assessment study, in conjunction with public consultation, and amendment of the LWMP prior to the authorization of a new effluent discharge.

8.3 DISPOSAL TO LAND

Chapter 6 defines the difference between effluent reuse and land disposal, as used in this LWMP. To reiterate, effluent reuse is where there is *a net benefit in the end use* of the effluent. Land disposal, on the other hand, refers to simply *the disposal of effluent by* *applying it to land at as high an application rate as possible.*

In exploring the alternative of land disposal, three factors are important to consider:

- the ability of the surface soils to accept effluent at a high rate;
- the "renovative" capacity of the soils as the effluent travels through the unsaturated zone prior to encountering the groundwater; and,
- the travel path of the effluent.

For larger systems, effluent is typically discharged to the land using either rapid infiltration ponds or a high rate irrigation system. In the former method, annual application rates are in the order of 30 metres, while in the latter lower rates, typically 5 metres is used. Permeable surface soils such as sands or gravels are required to allow the high application rates. In smaller systems, the use of subsurface perforated pipes, similar to an individual on-site system, can be used.

The renovative capacity of the land disposal system is dependent upon the depth of unsaturated soil beneath the application area. Ideally depths in excess of 10 m or more, depending upon the soil texture, are required to obtain the desired long term removals. With the proper conditions and design, processes such as nitrification-denitrification can be achieved in the upper soil layers, reducing the migration of nitrates to the groundwater.

The travel path of the effluent is the most critical factor in determining the potential success of the land disposal system. Ideally, the travel path of the effluent as it moves through the soil is not confined, and the effluent can enter the groundwater flow or a surface water course without excessive groundwater mounding that leads to excessive down slope seepage. A common problem encountered is that a confining subsurface soil layer is present where the effluent, instead traveling vertically, moves horizontally and discharges as springs. In this case, interception of the springs and collection of the renovated effluent by either extraction wells or rock-filled drains, can be implemented to control the down slope seepage. The collected groundwater is then discharged to a surface water course.

In order to explore the alternative of land disposal for the effluent from the municipal sewerage system, soil maps and topography were examined to determine potential areas. The terrain northeast of the urban core was identified as a potential area, and a more detailed evaluation was carried out by the firm of Golder Associates, a hydrogeotechnical engineering firm with previous site experience at this location. Their report is contained in Appendix B.

The conclusions of this investigation are summarized below:

.1 Surface soils are generally favourable for effluent application at the higher rates required for rapid infiltration basin application. Numerical modeling, however, indicates that excessive mounding of the groundwater may occur, resulting in seepage of effluent along the slopes above the shores of Porpoise Bay. Application at lower rates will result in less seepage but a larger land area would be required.

.2 Stability of existing natural slopes, particularly along the banks of Burnet and Angus Creeks, is a concern. Local sliding on the creek ravine slopes could be triggered by effluent disposal.

.3 Stability problems may also exist in over steepened and unstable slopes of gravel pits, if effluent is introduced into up slope sediments.

.4 If land disposal is to be considered, a comprehensive site specific hydrogeological assessment involving test drilling and large scale infiltration testing, is required to determine the feasibility of effluent application rates.

In evaluating the question of whether land disposal is a feasible alternative for the LWMP, the question is not whether it can be accomplished, but whether or not it can be accomplished in an environmentally safe and economic manner. The problem of down slope seepage may be overcome through the extraction of the renovated effluent groundwater flow and discharge to local creeks. The issue of slope stability is critical and may limit the application rate of effluent. Another factor that must be considered, is the geographical extent of the area that will be impacted by the land disposal system. Although the actual application area could be purchased by the District, and the land use controlled, the path of the groundwater flow will intersect down slope private lands and seepage control mechanisms requiring land easements, may be required.

The difficulty in evaluating land disposal as an alternative to marine disposal, at this stage, is the uncertainty of the design and the ultimate capacity. This cannot be resolved without a comprehensive and expensive investigative program. Although a number of features make the area suitable, the problems of slope stability and down slope seepage, create a high degree of risk.

For the purpose of the LWMP, it is assumed that a land disposal system can be successfully implemented for the municipal sewerage system effluent and this is developed further under the wastewater management options. Land disposal of effluent is also an alternative that can be considered for local community systems particularly in locations of permeable, well drained soils.

Both marine disposal and land disposal are potential methods of disposal for effluent not used for reuse. Marine disposal is well proven and can be carried out in an environmentally acceptable manner. Land disposal, for large quantities of effluent, on the other hand presents some risk due to unknowns regarding effluent travel paths and downslope seepage. While land disposal can no doubt be implemented for smaller systems in the right geological conditions, larger systems will require comprehensive investigation and possibly downslope seepage control systems. Both alternatives are considered further under the wastewater management options.

DEVELOPMENT OF A WASTEWATER MANAGEMENT STRATEGY

SECTION 9

9.1 APPROACH TO OPTION DEVELOPMENT

The selection of a liquid waste management strategy has *a significant impact on the development and growth of the community* over the long term. In developing the range of options to be considered, input and direction was obtained from the previous engineering studies, the OCP, and from the Technical and Public Advisory Committees on the LWMP. Based on the various sources, a range of opinion clearly exists on the future of the community with some factions proposing moderately high growth at urban development densities and other groups preferring lower more, rural oriented growth. The wastewater management options presented for evaluation thus attempt to span the range of community development scenarios.

The objective of the LWMP is to develop a strategy and direction for wastewater management planning over the next four decades. Given this time frame, and changes that may occur in the development of the community and in the technology of wastewater management, it is important that the plan provide flexibility. In practice, the LWMP should be reviewed every five to ten years, in a similar manner to the OCP, to ensure that the strategy selected is still the best course of action.

The LWMP is an *engineering planning* document. It is not intended as a predesign report for the design and implementation of required components. In a number of instances, the technical analysis required to confirm assumptions needs to be carried out. In general, the LWMP goal is to provide direction and not make specific decisions on treatment plant details or equipment selection. This phase of work will come after the LWMP has been approved by the community and by the MELP. Elements of the LWMP that require further engineering investigation are noted in the options presented.

9.2 WASTEWATER MANAGEMENT STRATEGY PARAMETERS

In developing the options, it is necessary to establish several parameters and basic assumptions for option development. There are also elements of the LWMP that will be common to all options. These include:

- The *planning horizon* selected is 40 years. Wastewater system components such as concrete tankage and piping will have a service life of about 40 years. Mechanical and electrical components will require replacement or upgrading at about 20 year intervals. The selection of a 40-year planning and economic analysis period thus allows an optimum time frame for the development of a wastewater management strategy.

- *Population growth and development in the community will be variable depending upon the strategy selected*. An option focusing on extension of the municipal sewers will go hand in hand with a community growth strategy that will see urban density development around the existing core. Conversely, an option with a strong emphasis on on-site disposal and larger lot sizes will result in a lower long term growth rate. The differences in growth must be considered in comparing the economics of the various options.

- *The core area of the community will continue to be served by the municipal sewerage system*. Given the investment already made in the existing infrastructure and the life remaining in the system, the assumption is reasonable. The upgrading and expansion of the existing plants and the ultimate method of effluent reuse/disposal will vary under the different options.

- *On-site wastewater management will continue to be a key element of the overall wastewater management strategy*. Depending upon the particular option, however, the percentage of the population using on-site disposal over the long term will vary. The management of the septic tank/tile field systems and in particular the management of the septage generated from the occasional pumping out of the septic tanks needs to be addressed in the LWMP.

- *Source control and waste reduction* is a common element to all the options for wastewater management. Limiting or eliminating the entry of materials such oils and grease, paints, solvents, and metal solutions is the best approach to ensuring that problems with the collection system, treatment system, septic tank, or the final effluent or biosolids do not occur. The strategy of the LWMP should be to provide this control through a source control bylaw, combined with an education program.

The above elements of the LWMP are further discussed under the individual options. Implementation details will be provided in the Stage 3 LWMP document.

9.3 PROPOSED OPTIONS

The objective in developing options for review is to provide a range of strategies that will allow the elected officials, the technical groups, and the public to select a direction in which to proceed. Given the multitude of technologies available and the different growth scenarios, a vast number of options and sub-options could be developed for analysis. This approach however often results in confusion due to the magnitude of information presented particularly for members of the public who do not have the benefit of the technical background or the LWMP workshops.

The goal of this LWMP is to present a limited number of *comprehensive yet understandable* options that will cover different community growth scenarios. As discussed in Chapter 3, the OCP considered possible growth rates between 2.0 and 5.0% over a period from 1996 to 2016. A value of 4.5% was adopted in the OCP for guiding future decision making and identifying community servicing needs (OCP, 1996). For the purpose of the LWMP, three community growth scenarios are considered:

- *Moderately High Community Growth:* This growth scenario reflects a sustained "moderately high" growth rate over the planning horizon. Annual population growths of 4.5% in the first 20 years and 3.0% in the 20 to 40-year period for the District are assumed. Growth of this magnitude is assumed to reflect an emphasis on extending the existing municipal collection system into the southern, western, and northern areas of the community to accommodate development over the next 40 years.

  Options 1-A and 1-B are based on this approach. The differences between the options reflect different methods of disposal of the effluent.

- *Moderate Community Growth:* Under this growth scenario, annual population increases would reflect the "moderate" growth rate. Annual population increases are assumed to be 3.5% and 2.0% in the first and second halves of the planning horizon, respectively. This type of growth is assumed to reflect a wastewater management strategy that would see less emphasis on extension of the municipal sewer system. Wastewater management in the outlying areas would be by local community systems or by on-site wastewater management.

  Options 2-A, 2-B, 2-C, 2-D and 2-E are based on this growth strategy.

- *Low Community Growth:* This growth scenario would reflect community growth at the lowest rate considered in the OCP. Annual growth rates of 2.0% and 1.5% are assumed for the first 20 years and later 20 year period, respectively. These growth rates are fairly low based on historical growth in the area and would require a conscious effort to slow down or restrict development through the use of larger lot sizes in new development and to limit densification due to re-development. The focus of the wastewater management option would be the use of a piped sewerage system in the core area and a reliance on individual on-site systems in the outlying areas.

  Option 3-A reflects this community development strategy.

The above eight options are presented in Chapters 10 to 17. A comparison of the options is contained in Chapter 18.

9.4 ESTIMATED COSTS

The costs of wastewater management are a key aspect of the decision making process. The challenge in utilizing cost information in the LWMP process is to provide an *equitable* means of comparing the costs.

Options that reflect a lower growth rate will obviously have a lower capital cost than options that serve a larger population. In a similar manner, an option that emphasizes individual on-site systems will have a lower cost for collection, treatment, and disposal systems. The economic analysis in the LWMP attempts to get around this problem by showing the *total cost* for an option. Costs for both municipal, local community, and on-site management systems are presented. Comparisons of costs can then be provided by calculating an *annual cost per lot for sewered and non-sewered areas*.

It must be cautioned however that this type of economic analysis is by its nature *order-of-magnitude*. The actual cost to the property owner in the end will depend upon a large number of variables including the impact of cost sharing programs, development cost charges, the timing of servicing, and individual costs on the property. The analysis, however, does fulfil the intent of allowing an *equitable comparison of relative costs* between options.

The costs of individual options are presented in Chapters 10 to 17. A comparison of costs is contained in Chapter 18.

OPTION 1-A: EXTENSION OF MUNICIPAL SEWERAGE SYSTEM/MARINE DISPOSAL

SECTION 10

10.1 CONCEPT

The concept of this option is that new development within the District of Sechelt and Sechelt Band Lands would be generally be serviced through extension of the existing municipal sewerage system. Outlying areas that have not been designated for residential development would use individual on-site wastewater disposal systems.

At the present time, all of the effluent from the two municipal treatment plants is discharged to Trail Bay via a marine outfall. The concept of this option is to continue with and improve the marine disposal system and to integrate effluent reuse in a cost-effective manner. Option 1-A is shown schematically in Figure 10-1. The main components of this concept are:

.1 **Extend sewers to West Sechelt, West Porpoise Bay, Davis Bay/Wilson Creek, East Porpoise Bay, and Sandy Hook** in a phased manner over the next 40 years in accordance with the development guidelines set forth in the OCP.

.2 **Upgrade the Dusty Road plant** in the short term (Phase 2) to increase the plant capacity and improve the effluent quality to an advanced secondary level. In the longer term, continue to expand the plant capacity (Phases 3, 4 and 5) to handle the projected sewerage system expansion. Tertiary treatment, for part of the total effluent flow, will be phased in as demand for effluent for irrigating *Unrestricted Public Access* (e.g., golf courses) areas grow over time.

.3 **Continue to operate the Ebb Tide plant until about the year 2006.** At this time the plant would be decommissioned and the site converted to a public works/park area. The pumping station to pump wastewater to the Dusty Road plant would remain at the site.

.4 **Extend the existing outfall** to take the discharge point to a total distance of about 1000 metres offshore in a depth of 60 metres of water. Sections of the land and marine piping would be replaced to increase the capacity as required as flows increase.

.5 **Implement effluent reuse** focussing initially on the opportunities at the Construction Aggregates Ltd. gravel processing operations for demands for advanced secondary effluent. In the longer term opportunities for seasonal effluent reuse at golf courses, landscape irrigation, and silviculture would be explored that would include both advanced secondary and tertiary level effluents.

.6 **Implement a biosolids utilization program** based on production of two grades of biosolids suitable for land reclamation at the CAL operation and for unrestricted public use for landscaping.

This option would allow a gradual development of the community from the central area outwards as sewers are extended to accommodate new residential development. The option would be compatible with a *moderately high growth* scenario with an expected residential population of 34,000 persons by the year 2036. Extension of sewers into existing areas such as Davis Bay/Wilson Creek would remove the restrictions on lot size currently imposed by on-site disposal and would allow residential re-development and additional commercial development to occur.

10.2 EXPANSION OF WASTEWATER COLLECTION SYSTEM

For the purpose of LWMP, it is necessary to make some assumptions as to the areas that will be sewered over the 40-year planning horizon. Existing areas utilizing on-site disposal have been evaluated based on terrain and soil type, on the history of problems, and on the likelihood of redevelopment at higher densities. New development has been assessed on the basis of the recommended development densities in the OCP. In terms of the timing of the extensions, two periods have been considered:

- 1996 to 2016; and,
- 2016 to 2036.

Sewer extensions over the next twenty years are assumed to comprise existing developed areas experiencing significant on-site disposal problems and/or will likely see major re-development at a higher density once the disposal problem has been dealt with. New urban density development identified in the OCP will also likely be serviced in this time frame.

In the latter 20 years of the planning period, (2016 to 2036) extension of the sewers is assumed to continue to occur to areas more distant from the current urban core. This includes both redevelopment of existing areas, new development areas, and connection of developed areas on local community sewer systems.

Specific assumptions regarding sewerage system extension are as follows. The sewer extensions are shown in Figure 10-2.

.1 All of West Sechelt, with the exception of a small number of dwellings to the extreme west, will be connected to the municipal collection system by 2016. The remaining dwellings will continue to use on-site systems.

.2 New development within Sechelt Village will continue to be served by the municipal collection system.

.3 All of West Porpoise Bay will be connected to the sewer system by 2016.

.4 East Porpoise Bay will continue to use on-site systems in the near term and would eventually be connected to the municipal system by the year 2016.

.5 Sandy Hook will remain on on-site systems until 2016, and eventually be connected to the municipal system between years 2016 and 2036. The Terraces development, if it proceeds, would be served by extension of the municipal sewerage system prior to 2016.

.6 Tuwanek will remain on on-site systems over the 40-year period.

.7 All of Davis Bay will be connected to the sewer system by year 2016 with the exception of development east of Wilson Creek and dwellings adjacent to Hudson Creek located in the middle of the Davis Bay area; these areas would be connected by 2036.

.8 SBL 1 will be served by a local community wastewater system, that is being constructed as part of the current marina development, until 2016. After 2016, the area would be connected to the municipal system.

.9 All of SBL 2 will be serviced by the municipal system by year 2016.

.10 Development of SBL's 3, 5 and 28 is not expected until after 2016. These areas would be connected to the municipal system after 2016. The SIGD plans for these areas are not well defined at this time. If the SIGD were to elect to develop these areas at an earlier date, capacity would exist in the sewerage system to accommodate the increased wastewater flows.

Future extension of the municipal collection system involves servicing of existing dwellings in developed areas (currently using on-site systems), and servicing areas that will be developed in the future. Costs to service existing developments would have to be borne by either the District of Sechelt or the Sechelt Indian Government District. This would include the required trunk sewers, as well as collector laterals and service connections to the property line. Individual property owners would bear the cost of service connection on their property. This may also include the cost to install grinder pumps necessary to service dwellings that cannot be connected to the trunk or collector sewers by gravity connections.

The extension of the municipal sewer system into future development areas would be financed jointly by the developer and the District and/or SIGD. The developer would pay for the local laterals and service connections to the property line. The cost of the trunk sewers would be jointly borne by the developer and the Districts through development cost charges (DCCs). A more detailed discussion on financing and the role of DCCs is contained in the Stage 3 report.

10.3 DESIGN PARAMETERS

The populations served by both the municipal sewerage system and by on-site systems for the years 2016 and 2036 under this option are shown in Tables 10-1 and 10-2, respectively. The predicted wastewater flows to be handled by the sewerage system are presented in Table 10-3. Table 10-4 shows the design peaking factors for wastewater flows.

The total wastewater flow in a municipal wastewater collection system can be divided into three components: sanitary; industrial; and infiltration/inflow (I/I). The sanitary component originates from residential, institutional and commercial sewer connections. Wastewater that contains predominantly industrial wastes makes up the industrial component. The I/I component can be broken down into groundwater that enters the collection system through leaking pipe joints and cracks (infiltration) and storm water that enters the system through storm drain connections, roof connections, basement drains and manhole covers (inflow) (Metcalf & Eddy, 1991).

The sanitary and industrial component of wastewater that will require treatment at the municipal wastewater treatment plant is dependant upon the sewered residential and equivalent commercial/ institutional/industrial population within the LWMP study area. Using 1995 wastewater flow data and an estimation of the total equivalent sewered population, an average annual flow (AAF) of 360 litres/day/equivalent person was determined.

The current rate of I/I into the existing municipal collection system appears to be fairly low based on the estimated equivalent per capita AAF. This is likely the result of the topography within the LWMP study area. The relatively steep slopes would allow for fast surface runoff of rainfall and, therefore, limit the potential for storm water to enter the sewer system. In addition, the elevation of the groundwater table may be lower than the sewer pipes and thus minimize the amount of steady infiltration into the system. Extending the municipal collection system in the future would likely see continued low I/I contributions to the total wastewater flow as new construction materials and techniques should minimize I/I.

The design parameters for the effluent requirements are presented in Table 10-5. The effluent quality for marine disposal and effluent reuse is based on the draft MELP *Municipal Sewage Regulation Document*, April 1998.

The requirements for effluent quality for marine disposal are based on the above criteria for BOD_5 and total suspended solids (TSS) removal. As disinfection to reduce fecal coliform levels in the effluent is currently practiced at both plants, it is proposed that disinfection continue. Improvements would be made at the Ebb Tide plant to allow improved contact time and dechlorination using sulphur dioxide injection. With the longer outfall proposed in the future, the need for disinfection will be reduced due to increased dilution and dispersion available and the trapping of the plume below the surface. Disinfection however provides an additional margin of safety and ensures that the receiving water quality objectives for both recreational water use and shellfish extraction are met. In line with current design practice and regulatory trends, it is assumed that the Dusty Road plant would be converted from disinfection by chlorination/dechlorination to ultraviolet (UV) disinfection during the Phase 4 plant upgrade.

The existing MELP Permit for Sechelt treatment facilities has a requirement for effluent toxicity. The toxicity in an effluent from a primarily residential/commercial sewerage area is due to the presence of ammonia. Other toxic agents such as metals or trace organics are not present in high enough concentrations to produce a toxic effect. Ammonia, once it is diluted in the receiving water, is not toxic and is in fact a valuable nutrient in the marine environment. This has been recognized in the current Draft 4.1 Municipal Sewage Regulations 1998 criteria by the removal of the toxicity test requirement, although the proposed draft regulations indicate the MELP could impose the toxicity test where required to protect the receiving environment (MELP, 1998). The existing MELP Permit for the marine discharge does not recognize this situation and the *Sechelt Sewage Facilities Commission* has been sited by the MELP for the intermittent failure of the toxicity test.

The 1998 Stage 2 upgrade of the Dusty Road plant will allow full nitrification producing a non-toxic effluent (this is termed *advanced secondary*). Once this effluent is blended with the effluent from the Ebb Tide plant, that can only produce a partially nitrified effluent, the combined effluent should, on most occasions, pass the toxicity test as specified in the Permit. In the proposed *Operational Certificate* for the new works that will be prepared under the Stage 3 LWMP, it is suggested that the proposed 1998 criteria be applied and the toxicity test removed from the effluent monitoring requirements. The District will be required to demonstrate to the MOELP that the discharge will not have an adverse impact on the receiving environment.

In the longer term, once the Ebb Tide plant is phased out, the Dusty Road plant would continue to produce a fully nitrified effluent, with a portion of the effluent filtered for effluent reuse. Therefore, it would be possible to direct the effluent for marine disposal through the filtration system and thus provide tertiary treatment (nitrification, filtration, and disinfection) prior to the marine discharge.

The effluent requirements for effluent reuse depend upon the type of reuse to be practiced. For *Unrestricted Public Access* (UPA), as defined in the above 1998 criteria, tertiary treatment (filtration and disinfection) following the treatment provided for marine disposal would be required. This would produce an effluent quality suitable for irrigation use on parks, golf courses and high-use public areas. The use of the effluent for industrial process use in gravel extraction operations and silviculture/land reclamation would require treatment as described for *Restricted Public Access* (RPA) under the 1998 criteria. The effluent produced for marine disposal would meet this criteria. While the 1998 criteria allows for golf course irrigation to be considered under the RPA requirement, we have assumed the LWMP applies the more stringent UPA criteria.

10.4 PLANT UPGRADING

The approach to the upgrading and expansion over the LWMP period is to optimize the investments already made in the two plants as well as ensure that current technologies are incorporated into the plant design.

A key question is should both plants continue to operate over the 40-year planning horizon or should one plant be phased out? The Ebb Tide plant is the oldest plant and offers a limited opportunity for expansion due the space available and the adjacent residential neighborhood. The administrative center, however, is located at this plant and if the plant were to be decommissioned, administrative/ maintenance facilities would have to be constructed at the Dusty Road plant. One advantage to the Ebb Tide plant is that, if marine disposal is utilized, the wastewater does not have to be pumped to the higher elevation for treatment.

It estimated that the Ebb Tide plant could continue operation for another 10 years with moderate annual operating and maintenance costs. Improvements to the disinfection system are required and replacement of some equipment components would be necessary. After 10 years, major repairs to the steel tankage and other structural components are assumed to be required. At this point, if the plant was to continue in operation, replacement of major process units with newer, more advanced technologies would be the most cost effective long term approach.

In order to select the best long term plant upgrading strategy, a life cycle economic analysis over a 40-year period of continuing with the two plants or decommissioning the Ebb Tide plant in 2006 has been carried out. The details of this analysis are presented in Appendix C. The analysis assumes that if use of the Ebb Tide plant continues after 2006, a major replacement of process units would be carried out and new technology (sequencing batch reactor with nitrification and UV disinfection) incorporating a more compact arrangement would be employed. The plant would be essentially be a “liquid stream” treatment plant only with waste sludge pumped to the Dusty Road plant.

Based on the above analysis, phasing out the Ebb Tide plant in about the year 2006 is less expensive than rebuilding the plant. The life cycle costs of the two alternatives, however, are relatively close as the economics of a large, single plant are offset by the higher power costs of pumping to the more remote site. In terms on non-economic factors, phasing out the plant allows the site to be redeveloped as a park area which is a more compatible land use with the surrounding residential development. A portion of the site is still required however for the pumping station to pump the collected wastewater to the Dusty Road plant. Based on the above, for the purpose of this option it is assumed that the Ebb Tide plant would be phased out and all treatment would be provided at the Dusty Road plant.

The major components of the plant upgrading and expansion strategy for Option 1-A are as follows:

.1 **The Dusty Road plant will be upgraded in 1998** to improve the effluent quality to an advanced secondary level and increase the plant liquid stream capacity to about 6000 equivalent persons. As the existing plant is defined as Phase 1, this new upgrade is termed Phase 2. This upgrading would see the installation of an automated influent fine screening unit in the existing inlet channel, addition of aspirating aerators/mixers to the oxidation ditch to improve performance through enhanced aeration and mixing, modification of the oxidation ditch to establish anoxic and aerated zones, and addition of a new circular secondary clarifier. The old secondary clarifier will be decommissioned and later used in the Phase 4 upgrade. Other modifications will include the addition of an alkalinity control system, as well as washroom facilities. The outfall pipe between the Dusty Road and Ebb Tide plants will be used for chlorine contact, with relocation of the dechlorination equipment to the Ebb Tide site for dechlorination of the blended effluent.

On the solids processing side, a trucked waste receiving station will be installed adjacent to the aerated lagoon to provide septage screening and flow measurement.

.2 **A Phase 3 expansion of the Dusty Road plant would occur in 2002** to increase the liquid and solids stream capacities of the plant. Works would include the addition of a headworks building with relocation of the fine screening unit to the building, the addition of a second fine screening unit, and replacement of the aspirating aerators/mixers with horizontal brush aerators in the oxidation ditch to provide additional capacity to increase the liquid stream capacity to about 10,000 equivalent persons. Modifications to the biosolids handling system would include replacement of the aerated sludge lagoon with an aerobic digester utilizing concrete tankage.

.3 **The next expansion of the Dusty Road plant (Phase 4) will occur in about the year 2006**. This expansion would include a new oxidation ditch and secondary clarifier and replacement of the chlorination /dechlorination system with a UV disinfection system. The liquid stream capacity would be increased to about 27,800 equivalent persons. On the solids processing side, Phase 4 would see the installation a second aerobic digester, as well as sludge dewatering equipment in a new dewatering building.

.4 **The Ebb Tide plant will be shutdown and decommissioned once the Phase 4 works at the Dusty Road plant are in place.** Minor upgrading and changes to the disinfection system will be implemented in 1998. This includes conversion of the existing aerobic digester to a chlorine contact basin and addition of sulphur dioxide dechlorination. This will improve the disinfection as well as provide as positive method of ensuring zero chlorine residual prior to marine discharge. The elimination of the aerobic digester and the pumping of waste sludge to the Dusty Road site effectively makes the Ebb Tide plant a "liquid stream" treatment plant. This will reduce the potential for odours over the remaining life of the plant.

.5 **Phase 5 of the expansion of the Dusty Road plant will occur in about the year 2021.** At this time a third liquid-stream process train would be added to the plant, as well as additional aerobic digester and sludge dewatering capacity. This expansion should be sufficient to handle the projected flows to the year 2036.

10.4.1 Dusty Road Plant

The proposed layout of the site for the long term expansion is shown in Figure 10-3. The existing property can accommodate the required plant expansion to the year 2036, however, the biosolids composting operation would need to be relocated to another site. Alternatively, consideration could be given to acquiring adjacent property. This property is currently leased from the Crown by CAL.

For the Phase 2 upgrade, the Dusty Road plant will continue to utilize the extended aeration process with modified process parameters. Anoxic and aerobic zones will be utilized to obtain nitrification/ denitrification.

For the Phases 3, 4 and 5 expansions, it is assumed for the purposes of the LWMP option development that a higher rate activated sludge process would be used for biological treatment. This would allow the oxidation ditches and clarifiers to handle higher hydraulic and organic loadings, thus increasing their treatment capacities. In the actual design of the expansion, other processes should be considered to optimize site development based on decisions on site area availability and treatment process technology at that time.

Disinfection using chlorination/dechlorination that is presently practiced would be continued at Dusty Road plant in the near term. For the Phase 4 expansion, ultraviolet (UV) disinfection equipment installed in the old secondary clarifier/chlorine contact tanks would replace chlorination/dechlorination. The chlorine injection facilities would be retained for additional disinfection of the effluent going to reuse.

The additional plant processes for effluent reuse are discussed in Chapter 10.6.

Biosolids management at the Dusty Road plant will continue as currently practiced in the short term. In the Phase 3 expansion, replacement of the aerated sludge lagoon with an aerobic digester, or alternatively an autoheated thermophilic aerobic digester (ATAD), using concrete tankage is proposed. Mechanical sludge dewatering employing either a belt filter press, a rotary drum, or a screw press would be added in Phase 4.

Planning to instigate reuse of the accumulated sludge should commence in 1998. As discussed in Chapter 6, several approaches are feasible. The proposed approach under this option is as follows:

- *In the short-term (i.e., the next 8 to 10 years), utilize the stored, digested, undewatered biosolids from the sludge lagoons for reuse as a soil conditioner for reclamation activities at the CAL property*. This material should meet the MELP requirements for “low grade agricultural” use. The biosolids would be pumped from the storage lagoons into tanker trucks and hauled to the CAL property for use to augment the organic content of the gravel soils.

- *In the longer term, development of an on-site static aerated pile windrow composting system using chipped horticultural waste as the bulking agent.* The area around the existing paved area at the sludge storage lagoon would be converted to a compost area. Digested sludge from the aerobic digester, once dewatered, would be mixed with the chipped horticultural waste and composted in windrows under an open-sided, roofed structure. The final product would meet the MELP requirements for "unrestricted public use" thus allowing its use for landscaping operations.

10.4.2 Ebb Tide Plant

The strategy at the Ebb Tide plant is to obtain approximately an additional ten years of life out of the plant with the minimum of capital expenditure. This means that inflows to the plant will be controlled at the existing level and that the increasing future flows will be directed to the Dusty Road plant.

Upgrading of the disinfection system by converting the existing aerobic digester to a chlorine contact tank and adding sulphur dioxide dechlorination is proposed in 1998 to ensure compliance with regulatory requirements. These steps will improve the disinfection capability as well as provide a positive means of ensuring a zero chlorine residual in the effluent prior to discharge to the marine environment.

The pumping station to pump the wastewater flows to the Dusty Road plant will remain on the site once the Ebb Tide treatment works are shut down. Upgrading of this pumping station will include conversion of the pumping system to a single stage pumping system and installation of a standby power generator system (2006). At this stage, the pumping station will pump to a new booster pumping station on Dusty Road. At the same time, the existing outfall pipe from the Dusty Road plant will be switched to a force main. The combination of above changes will provide the required capacity at the Dusty Road pumping station up to the 2036 planning horizon.

Given that the Ebb Tide site will continue to house the pumping station and possibly other public works functions, the most appropriate end use following decommissioning is as a combined public works/park area. The existing treatment works would be removed and the area re-landscaped with walking/biking trails and open areas. Details of site decommissioning and land use planning would be the subject of future studies.

10.5 MARINE DISPOSAL

A comprehensive oceanographic investigation has been carried out as part of the LWMP to assess the impact of a marine discharge on Trail Bay and Georgia Strait. The investigations have concluded, that although the current velocities within the near shore areas of Trail Bay are low, the existing discharge has a very limited impact on receiving water quality and on the shoreline water uses given the high quality of the discharged effluent.

Even though there is no reason for concern with the existing marine discharge, effluent flows will increase significantly over the LWMP planning horizon and it is prudent to plan to improve the marine disposal situation. The oceanographic studies, as discussed in Chapter 8, have indicated that extending the outfall by an additional 500 m is a reasonable approach to obtaining a substantial improvement. This would move the discharge point a total distance of 1000 metres offshore into 60 metres of water depth. This extension is proposed to be carried out in about the year 2004.

The existing land and marine sections of the outfall also have limited capacity. Existing peak flows are at about 85% of available pipe capacity. This relates to an allowable equivalent sewered population increase of approximately 1100 persons. A preliminary review of the outfall system indicates that “twinning” about 900 metres of the land section of the pipe through the urban area of Sechelt with a new 450 mm diameter pipe will provide sufficient capacity for about another 8 years. Alternatively, the existing marine section could be replaced to provide the same hydraulic increase. For the purpose of the LWMP, the former approach has been included however both alternatives should be evaluated in more detail prior to the final decision. This work should be commenced in 1999.

In about the year 2006, the existing marine section would be replaced as part of the planned outfall extension. The remaining land section to the Dusty Road plant would be replaced with a new 450 mm diameter pipe and the existing pipe converted to a force main from the Ebb Tide pumping station as discussed above.

10.6 EFFLUENT REUSE

The strategy for effluent reuse is to implement reuse opportunities to replace existing or planned use of freshwater water resources as dictated by sound financial planning. The initial opportunity to be pursued is with Construction Aggregates Ltd. (CAL) on property near the Dusty Road plant. Based on current discussions, CAL has proposed to use secondary or advanced secondary effluent from the Dusty Road plant for subsurface irrigation of future silviculture areas on the CAL property. Excess collected tailwater would be used, as required, for gravel washing with excess tailwater discharged to the District's marine outfall. Due to the subsurface application, effluent disinfection would not be required for the silviculture irrigation; however, tailwater used for gravel washing would require disinfection to meet the criteria for *Restricted Public Access applications*.

Based on earlier discussions, opportunities appear to exist to provide between 455 and 2275 m^3/d of effluent for gravel washing operations on a year-round basis beyond any demands for silviculture irrigation.

The intent at this time would be to provide effluent on an "as available" basis without the construction of storage facilities. This will provide the most economic approach to introduce reuse into the long term wastewater management strategy. At a minimum, the following additional works are required to provide effluent for silviculture application on the CAL property:

- booster pumping station with 40 kW installed pumping capacity
- 350 mm diameter pipeline to Dusty Road plant/CAL property line

Other reuse opportunities, such as golf course irrigation, may require higher levels of treatment to meet the criteria for effluent application to *Unrestricted Public Access* areas. Treatment would include a gravity rapid sand filter system followed by effluent disinfection. These works would be housed in a building on the Dusty Road plant site to allow year-round effluent reuse supply.
Given the unknowns with other effluent reuse opportunities, only the following costs are included in the LWMP:

- costs to provide advanced secondary effluent for supply to the CAL property
- costs to provide filtration and effluent disinfection at the Dusty Road plant

Other effluent reuse opportunities should also be pursued during the planning for the CAL reuse. The reuse works at the plant would be designed for expansion and additional pipelines to deliver the effluent to the reuse points can be constructed as the economics allow.

10.7 ON-SITE WASTEWATER MANAGEMENT

On-site wastewater management will continue to play a significant role in wastewater management for the LWMP area, although this role will decrease over time. Based on the sewer extension projections, the number of residential properties using individual septic tank/tile fields or small package treatment systems, will decrease from the current figure of 60% to under 5% in 40 years time.

New development will generally be served by the municipal sewer system. Large scale use of individual on-site systems is not proposed. Many areas of the LWMP area are not well suited to tile field disposal due to the presence of shallow surface soils, poorly drained fine soils, or steep topography. As previously discussed, the Ministry of Health guidelines, citing a minimum lot area of 0.2 ha, should be used for general direction when on-site disposal is considered for specific areas. In the LWMP areas where problems with existing individual on-site disposal problems have been historically encountered, this situation will ultimately be rectified by extension of the sewers. In the interim, the use of holding tanks or the rebuilding of tile fields where feasible, can be considered. The use of small scale "innovative" systems may also offer some solutions in problem areas. The District should work closely with the Ministry of Health in this regard to ensure the applications are suitable and property owner is fully aware of the operational requirements and costs.

In some areas proposed for residential development, the schedule for extension of the sewers is some years away. In this situation, if it is deemed by the District that for planning reasons the development should proceed prior to the extension of sewers to the area and the site conditions are suitable, the use of temporary on-site systems and "dry sewers" could be considered. Dry sewers refer to the construction of the lateral sewers in the street and the service connections to near the house at the time of original construction. The houses initially utilize individual septic tanks and tile fields until the municipal trunk sewer is extended to the subdivision. Once the trunk sewers are in operation, the house plumbing is switched to the sewer system and the septic tank/tile field are decommissioned. This approach should only be considered where planning for the sewer system is in place and the schedules can be well defined.

10.8 LOCAL COMMUNITY SYSTEMS

In the LWMP, local community systems refer to wastewater collection, treatment, and disposal/ reuse systems serving a specific local development area. Historically, local community systems have not been successful in the District and in the adjacent regional district due to problems with private sector financing and plant operation and maintenance. Under this option, the use of new community systems is not encouraged as servicing will be provided by extension of the municipal sewer.

Some local community systems, such as the small secondary plant and outfall that will serve the Port Stalashen development in Wilson Creek, are already under construction. In this case, once the municipal sewer is extended to this area in about the 20-year time frame, the plant and outfall would be decommissioned and the wastewater pumped to the municipal system.

10.9 ESTIMATED COSTS

A summary of the estimated capital and annual operating and maintenance costs for Option 1-A are presented in Tables 10-6 and 10-7, respectively. The details of the estimated costs are contained in Appendix C.

The costs are order-of-magnitude costs suitable for comparison purposes and budgeting and give a reasonable idea as the expenditures for wastewater management in the community over the next 40 years. The costs shown are the *total expected wastewater management costs* of the LWMP area over the 40-year horizon. Costs for both the municipal sewerage system, local community systems if applicable, and on-site wastewater management systems are included. Local sewer costs are calculated on the basis on an average unit cost per serviced lot. On-site wastewater management costs are also calculated on the basis of unit costs per household. The cost includes the cost of a new septic tank and tile field for new development and replacement costs for existing tile fields once over the 40-year period.

The annual operating and maintenance costs show some revenue from reuse however the economics of reuse must be considered in greater detail prior to making final decisions. No revenue is shown at this time for biosolids utilization by others. This is a conservative assumption and some revenue stream may be achievable after the system is well established. On-site system operating and maintenance costs are based on pump out of the septic tank at a two-year frequency.

The capital costs include a 40% allowance for engineering, construction contingencies, and financing administration costs. The operating and maintenance costs are based on actual 1996 budget costs by the District extrapolated to future years based on the works proposed.

OPTION 1-B: EXTENSION OF MUNICIPAL SEWERAGE SYSTEM/LAND DISPOSAL

SECTION 11

11.1 CONCEPT

The concept of this option is identical to Option 1-A except that marine disposal would be phased out and effluent disposal would be accomplished through a land disposal system. Effluent reuse for irrigation purposes would be the same as for Option 1-A.

Option 1-B is shown schematically in Figure 11-1. The main components of this concept are:

.1 **Extend sewers to West Sechelt, Davis Bay/Wilson Creek, East Porpoise Bay, and Sandy Hook** in a phased manner over the next 40 years in accordance with the development guidelines set forth in the OCP.

.2 **Upgrade the Dusty Road plant** in the short term (Phase 2) to increase the plant capacity and improve the effluent quality to an advanced secondary level. In the longer term, continue to expand the plant capacity (Phases 3, 4 and 5) to handle the projected sewerage system expansion. Tertiary treatment, for part of the total effluent flow, will be phased in as demand for effluent for irrigating *Unrestricted Public Access* (e.g., golf courses) areas grow over time.

.3 **Continue to operate the Ebb Tide plant until about the year 2006.** At this time the plant would be decommissioned and the site converted to a public works/park area. The pumping station to pump wastewater to the Dusty Road plant would remain at the site.

.4 **Carry out detailed engineering and hydrogeological investigations for land disposal and implement the first phases of a rapid infiltration disposal system.** This system, located north and south of the Dusty Road plant, would employ a series of rapid infiltration basins with tailwater collection. Renovated effluent would be discharged to local drainage courses for ultimate discharge to Porpoise Bay.

.5 **Implement effluent reuse** focussing initially on the opportunities at the Construction Aggregates Ltd. gravel processing operations. In the longer term opportunities for seasonal effluent reuse at golf courses, landscape irrigation, and silviculture would be explored.

.6 **Implement a biosolids utilization program** based on production of two grades of biosolids suitable for land reclamation at the CAL operation and for unrestricted public use for landscaping.

In the same manner as for Option 1-A, this option would allow a gradual development of the community from the central area outwards as sewers are extended to accommodate new residential development. The option would be compatible with a *moderately high growth* scenario reflecting a residential population of 34,000 persons by the year 2036. Extension of sewers into existing areas such as Davis Bay/Wilson Creek would remove the restrictions on lot size currently imposed by on-site disposal and would allow residential re-development and additional commercial development to occur.

11.2 EXPANSION OF WASTEWATER COLLECTION SYSTEM

The expansion of the municipal wastewater collection system would be identical to the expansion described under Option 1-A.

11.3 DESIGN PARAMETERS

The design populations and wastewater flows are identical to Option 1-A. These values are shown in Tables 10-2 to 10-4 in Chapter 10.

The design parameters for the option are shown in Table 11-1. These are identical to the parameters for Option 1-A in terms of population and estimated future flows. Effluent criteria for land disposal using rapid infiltration (RI) basins are based on the draft MELP *Municipal Sewage Regulation Document*, April 1998. Effluent reuse criteria are as in Option 1-A.

Effluent criteria for rapid infiltration disposal are same as for marine disposal and *Restricted Public Access* effluent reuse in terms of BOD_5 and total suspended solids. Disinfection of the effluent prior to discharge to the rapid infiltration basins is not required under the 1998 criteria based on the premise that adequate pathogenic organism removal will occur during the movement of the effluent through the unsaturated soil layers.

The toxicity issue discussed under Option 1-A is not factor in land disposal; however, the buildup of nitrates in the groundwater can pose some concern. With proper design of the RI basins and intermittent loading, nitrification/denitrification can be accomplished in the upper soil layers to reduce the nitrate problem. In the case of the Dusty Road plant, nitrification/denitrification will occur in the advanced secondary process thus further reducing this potential.

11.4 PLANT UPGRADING

The basic plant upgrading concept is described in Chapter 10 and is similar to Option 1-A. The differences between the two options are summarized below:

.1 **The Dusty Road plant will be upgraded in 1998** as described in Option 1-A. It is assumed that land disposal could not be implemented until about 1999 due to the extensive testing required prior to construction. Once the rapid infiltration basins are in place, chlorination of the effluent to the RI basins would be phased out.

.2 **The next expansion of the Dusty Road plant (Phase 3) will occur in about the year 2002.** This is identical to Option 1-A.

.3 **The Ebb Tide plant will be shutdown and decommissioned once the RI basins are in place.** Marine disposal would be discontinued at this time.

.4 **Phase 4 and 5 of the expansion of the Dusty Road plant will occur in about the years 2006 and 2021.** This is identical to Option 1-A except that the disinfection works for the effluent to the RI basins would not be required. This expansion will provide treatment capacity to the year 2036.

Biosolids management at the Dusty Road plant would be identical to Option 1-A. Similarly, once the Ebb Tide plant is decommissioned, expansion of the pumping station at the Ebb Tide site would be the same as for Option 1-A.

11.5 LAND DISPOSAL

The option of land disposal has been developed to allow both an economic and environmental comparison to marine disposal. It must be emphasized however that at the present time the understanding of the risks and the unknowns in implementing land disposal are far greater than for marine disposal. Comprehensive feasibility evaluations including extensive test drilling are required to confirm that land disposal of the magnitude required can be implemented with a reasonable degree of confidence. Even with this comprehensive investigation, land disposal by its nature presents risks. In particular, if problems with groundwater contamination, uncontrolled down slope seepage, or slope stability occur, they can be very difficult and expensive to rectify.

A detailed discussion of land disposal in the selected area northeast of Sechelt is contained in Chapter 8 and Appendix B. Based on the current available information on the area, the following design basis is proposed for the land disposal system.

.1 Effluent disposal would be via a series of RI basins located northeast and southwest of the Dusty Road plant. Spreading out of the RI basins in this manner should allow for optimization of the down slope seepage paths and should minimize potential problems with slope stability.

.2 The design rate for average RI basin loading is 30 metres per year. This rate is typical for basins in highly permeable soils. Basins would be constructed in a cluster of 6 cells to allow the required intermittent loading - resting of the cells.

.3 The design will employ a tailwater recovery system using groundwater extraction wells. These wells are used to control the much increased groundwater flow to prevent uncontrolled seepage and damage at downslope properties. The renovated effluent will then be discharged to local drainage courses that ultimately flow to Porpoise Bay. Effluent renovation through the unsaturated soil zone should produce very high removals of nutrients and pathogenic organisms and a renovated effluent quality suitable for release to the bay.

Based on the above design parameters, a total RI basin floor area of 9.0 ha is required for the year 2016 flows. For the year 2036 flows, 20.0 ha would be required. This sizing assumes that the RI system would be designed to handle the total winter time effluent flows in the same manner as the outfall design in Option 1-A. If year-round effluent reuse opportunities could be found or if seasonal storage for the effluent reuse system is constructed, the RI area required could be reduced. As the planning for RI and reuse is in its early stages, it is believed prudent to plan the RI system to handle the full winter time flows.

Purchase of the land for the RI basins will be required. Purchase or easements will also be required for the down slope groundwater extraction wells.

11.6 EFFLUENT REUSE

The strategy for effluent reuse is under Option 1-B is identical to Option 1-A.

11.7 ON-SITE WASTEWATER MANAGEMENT

The overall strategy and the areas proposed for on-site wastewater management are the same as for Option 1-A.

11.8 LOCAL COMMUNITY SYSTEMS

As in Option 1-A, the use of new local community systems is not encouraged in this option. Existing local community systems would ultimately be served by the municipal sewerage system as described in Option 1-A.

11.9 ESTIMATED COSTS

A summary of the estimated capital and annual operating and maintenance costs for Option 1-B are presented in Tables 11-2 and 11-3, respectively. The details of the estimated costs are contained in Appendix C.

The basis of the costing is the same as in Option 1-A.

OPTION 2-A: LIMITED MUNICIPAL SEWERAGE SYSTEM EXPANSION (Dusty Road and Ebb Tide WWTPs)/LOCAL COMMUNITY SYSTEMS

SECTION 12

12.1 CONCEPT

The focus of Option 2-A is to utilize a combination of the existing municipal sewerage system, local community systems, and on-site wastewater management to provide a basis for more selective and slower growth than with the previous options.

The concept of this option is that the expansion of the municipal sewerage system would be limited and would primarily serve the existing core area and adjacent proposed development areas in West Sechelt and West Porpoise Bay over the 40-year horizon. SBLs 2 and 3 are also assumed to be serviced by the municipal sewerage system. Existing and future development elsewhere in the LWMP area would be served by on-site wastewater management or by local community systems.

The local community systems would be developed in concert with the overall neighborhood development utilizing a combination of mechanical and natural treatment technologies. Effluent reuse for irrigation or stream flow/groundwater flow augmentation would be emphasized. Major portions of the LWMP area would remain on on-site disposal and a greater proportion of new residential development areas would be based on larger rural/residential lot sizes.

Both the existing municipal plants would remain in operation over the 40-year period. The Ebb Tide plant would be upgraded as an advanced secondary "liquid stream" plant to handle about 50% of the ultimate flow from the municipal sewerage system. Effluent disposal from this plant would be via an extended marine outfall. The remaining wastewater flow and the waste sludge from the Ebb Tide plant would be pumped to the Dusty Road plant. Effluent from this plant would primarily be used for effluent reuse for industrial process use and for seasonal irrigation with the surplus effluent discharged to the marine environment.

Option 2-A is shown schematically in Figure 12-1. The main components of this concept are:

.1 **Extend sewers to West Sechelt, West Porpoise Bay, and SBLs 2 and 3** in a phased manner over the next 40 years.

.2 **Upgrade the Dusty Road plant** in the short term (Phase 2) to improve the effluent quality to an advanced secondary level and increase the plant capacity. In the longer term, continue to expand the plant capacity (Phase 3 and 4) to handle the projected sewerage system expansion.

.3 Continue to operate the existing Ebb Tide plant until about the year 2005. **At that time the plant would be reconstructed as an advanced secondary plant**. The pumping station to pump the excess wastewater to the Dusty Road plant would also be upgraded.

.4 **Extend the existing outfall** to take the discharge point to a total distance of about 1000 metres offshore in a depth of 60 metres of water. Sections of the land and marine piping would be replaced to increase the capacity as required as flows increase.

.5 **Implement effluent reuse** at the Dusty Road focussing initially on the opportunities at the Construction Aggregates Ltd. gravel processing operations. In the longer term opportunities for seasonal effluent reuse at golf courses, landscape irrigation, and silviculture would be explored.

.6 **Develop a biosolids utilization program** based on production of two grades of biosolids suitable for land reclamation at the CAL operation and for unrestricted public use for landscaping.

.7 **Implement local community wastewater management systems** for new comprehensive development in the Sandy Hook area and for new development/redevelopment in the Wilson Creek/Davis Bay area. These local systems would focus on providing a high level of wastewater treatment and effluent reuse opportunities. The LWMP should remain flexible to consider other areas of the community for local systems.

.8 **Encourage and support activities to bring innovative designs to individual on-site disposal systems** to deal with both existing problem areas, and to ensure future development served by on-site disposal is carried out in a sustainable and environmentally sound manner.

This option would allow a gradual development of the community from the central area outwards into West Sechelt and West Porpoise Bay at urban densities. Selected outlying areas, such as the comprehensive development area (Terraces Development) identified in Sandy Hook or areas of Wilson Creek/Davis Bay, where development is desirable would be serviced by the use of local community wastewater systems. Other outlying areas would retain their rural character through the use of larger lot sizes and on-site disposal.

This option would be compatible with a *moderate growth scenario* that would see a total residential population of about 23,000 persons by the year 2036.

Marine disposal is selected as the basis of municipal effluent management for effluent not used for reuse in this option. Marine disposal was chosen over land disposal due to the higher capital and annual O&M costs for land disposal as well as the greater operational uncertainties at this time. Land disposal opportunities using rapid infiltration systems, however, could be developed in the area of the Dusty Road plant to dispose of effluent from the Dusty Road plant that is not used for reuse. Land disposal of the total surplus effluent flow is not economic with this option as a separate pumping station / transmission main from the Ebb Tide plant the disposal area would have to be constructed to transport the effluent to the Dusty Road plant area *separately* from the raw wastewater that is pumped through the existing pumping system.

12.2 EXPANSION OF WASTEWATER COLLECTION SYSTEM

As compared to Options 1-A and 1-B, the expansion of the municipal wastewater collection system would be considerably reduced.

Specific assumptions regarding sewerage system extension are as follows. The sewer extensions are shown in Figure 12-2.

.1 All of West Sechelt, with the exception of a small number of dwellings to the extreme west, will be connected to the municipal collection system by 2016. The remaining dwellings will continue to use on-site systems.

.2 New development within Sechelt Village will continue to be served by the municipal collection system.

.3 All of West Porpoise Bay will be connected to the sewer system by 2016.

.4 East Porpoise Bay will continue to use on-site systems over the 40-year horizon.

.5 Sandy Hook will remain on on-site systems with the exception of the possible comprehensive development area (Terraces Development) identified in the OCP. This development would be served by a local community system.

.6 Tuwanek will remain on on-site systems over the 40-year horizon.

.7 In general Wilson Creek/Davis Bay will remain on on-site wastewater management. The exception to this is the assumption that after 2016, a local community system would be implemented to service a redeveloped commercial/higher density residential area.

.8 SBL 1 will be served by its own wastewater treatment plant as part of the local community system that is being constructed as part of the current marina development, until 2016. After 2016, the area would be connected to the above noted local community system.

.9 All of SBL 2 will be serviced by the municipal system by year 2016. Depending on the extent of future development, the Band has the option to consider implementation of a local community system to service this area at some time in the future.

.10 SBL 3 would be connected to the municipal sewerage system serving the West Porpoise Bay area by the year 2016. SBL 4 could also be served by the sewerage system if developed. SBL 5, and 28, if they are developed, would be served by on-site disposal systems if developed in the short term, with the potential to be connected to the sewerage system sometime in the future. All of these lands could be developed on a local system that would ultimately be connected to the municipal system. Depending on the time of the development, it may also be possible to connect to the municipal system at the initial development stage.

Future extensions of the municipal sewer system would be financed as described under Option 1-A. Existing and new properties using on-site disposal systems would be paid for by the individual property owners.

Local community systems could be developed and financed by one of two approaches. The first method would be as District system where the works would be owned by the District. Operation and maintenance could be by either District staff or by private contract. Financing of the system in this case would be similar to other municipal services and the regulatory approval would be by *Operational Certificate* under the LWMP. The second approach would be that the local community system is owned and operated by a private owner and financed through an initial property purchase/ maintenance fee arrangement. In this situation, the regulatory approval would be via a MELP Permit issued to the private owner. The latest draft of the *Municipal Sewage Regulation* allows for a design/build/maintain company to be the registered discharger.

Both approaches are possible under current legislation and precedents for both methods exist in other LWMP areas. The decision as to the best approach depends upon a number of variables and must be considered on a site specific basis.

12.3 DESIGN PARAMETERS

The populations served by both the municipal sewerage system, the local community systems and by on-site systems for the years 2016 and 2036 under this option are shown in Tables 12-1 and 12-2, respectively. The predicted wastewater flows to be handled by the municipal sewerage system are presented in Table 12-3.

The design parameters for the effluent requirements for marine disposal, land disposal, and effluent reuse are the same as for Options 1-A and 1-B. These are shown in previous Tables 10-5 and 11-1.

12.4 PLANT UPGRADING

As with the previous options, the approach in this option is to optimize the investments already made in the two existing municipal treatment plants as well as to ensure that current technologies are incorporated into the plant design in the future upgrades/expansions.

The major components of the plant upgrading and expansion strategy for Option 2-A are as follows:

.1 **The 1998 Phase 2 Dusty Road plant upgrade** will bring the plant into compliance with MELP effluent criteria and to optimize the capacity of the existing tankage to handle the flow from an equivalent population of 6,000 persons. Combined with the existing capacity at the Ebb Tide plant, the total treatment capacity available will be 9,300 equivalent persons. This upgrading would see the installation of an automated influent fine screening unit in the existing inlet channel, addition of aspirating aerators/mixers to the oxidation ditch to improve performance through enhanced aeration and mixing, modification of the oxidation ditch to establish anoxic and aerated zones, and addition of a new circular secondary clarifier. The old secondary clarifier will be decommissioned and later used in the Phase 4 upgrade. Other modifications will include the addition of an alkalinity control system, as well as washroom facilities. The outfall pipe between the Dusty Road and Ebb Tide plants will be used for chlorine contact, with relocation of the dechlorination equipment to the Ebb Tide site for dechlorination of the blended effluent.

On the solids processing side, a trucked waste receiving station will be installed adjacent to the aerated lagoon to provide septage screening and flow measurement.

.2 **The next upgrade of the Dusty Road plant (Phase 3) will occur in about the year 2005**. Modifications to the biosolids handling systems include replacement of the aerated sludge lagoon with an aerobic digester with concrete tankage, installation of sludge dewatering equipment in a dewatering building, and a biosolids composting facility and equipment. This upgrade does not increase the plant's liquid stream capacity. However, a UV disinfection system would replace the chlorination/ dechlorination system.

.3 **The final expansion (Phase 4) of the Dusty Road plant is required in 2024.** This expansion will see the addition of a new headworks building with two automated fine screening units, replacement of aerator/mixers in the oxidation ditch with horizontal brush rotors, and the addition of a second secondary clarifier that will increase the plant capacity to accommodate the flows from the year 2036 design population. The capacity of the aerobic sludge digestion and dewatering systems will also be increased.

.5 **Minor upgrading and changes to the disinfection system will be implemented at the Ebb Tide plant in 1998.** This includes conversion of the existing aerobic digester to a chlorine contact basin and addition of sulphur dioxide dechlorination. This will improve the disinfection as well as provide as positive method of ensuring zero chlorine residual prior to marine discharge. The elimination of the aerobic digester and the pumping of waste sludge to the Dusty Road site effectively makes the Ebb Tide plant a "liquid stream" treatment plant. This will reduce the potential for odours.

.6 **A major replacement of the process units at the Ebb Tide plant will occur in 2005.** The plant will provide an advanced secondary level of treatment incorporating nitrification and UV disinfection. The plant will continue as a "liquid stream" treatment plant with a capacity to treat the flow from an equivalent of 12,300 persons.

12.4.1 Dusty Road Plant

The proposed layout of the site for the long term expansion is shown in Figure 12-3. As the reduced flows only require one aeration basin, the site requirements as compared to Options 1-A and B are greatly reduced and can easily be accommodated on the existing property.

For Phase 2, the Dusty Road plant upgrading and expansion will continue to utilize the extended aeration process with modified process parameters. Addition of aspirating aerators/mixers will increase loading capacity and improve mixing. Anoxic and aerobic zones will be utilized to obtain nitrification/ denitrification. A new secondary clarifier will be added in Phase 2 to replace the existing unit, with a second secondary clarifier added in Phase 4. The oxidation ditch will be operated in a higher rate activated sludge mode in Phase 4; therefore, replacement of the aerators/mixers with horizontal brush rotors will allow the plant to meed the aeration demands.

Disinfection using chlorination/dechlorination that is presently practiced would be continued at Dusty Road plant in the near term. For the Phase 3 expansion, the use of ultraviolet (UV) disinfection instead of chlorination/dechlorination would be used by installing new UV tankage. The chlorine injection facilities would be retained for additional disinfection of the effluent going to reuse.

Biosolids management would include composting for volume and pathogen reduction. An open-walled roof structure would be constructed on the existing 20 metre by 75 metre asphalt pad for composting operations. The composting process proposed is a static aerated pile system, with a 21-day processing period. In this operation, the biosolids are mixed with a bulking agent such as hog fuel using a front end loader. Air is continuously drawn through the pile using a suction fan and flexible tubing within the pile. Following the initial processing, the pile is relocated to a curing area, where it is occasionally turned with the loader, over a curing period of 30 days.

12.4.2 Ebb Tide Plant

The strategy at the Ebb Tide plant is as follows:

- continue the existing plant operation in the short-term with a minimum of capital expenditure; and,

- replace the major process units in about the 2005 and continue operation of the plant through the remainder of the 40-year period.

Plant capacity will continue at about 3300 persons until 2005. After the plant upgrade, the effective plant capacity would be 12,300 persons. The plant in both phases will be a "liquid stream" plant treating a constant wastewater flow. Surplus wastewater will be pumped to the Dusty Road plant. Waste sludge from the plant will also be directed to the pumping station wet well and pumped to the Dusty Road plant at off-peak flow periods.

Operation from 1998 to 2005

Some upgrading work in the first phase of operation is required. Upgrading of the disinfection system by converting the existing aerobic digester to a chlorine contact tank and adding sulphur dioxide dechlorination is proposed in 1998 to ensure compliance with regulatory requirements. These steps will improve the disinfection capability as well as provide a positive means of ensuring a zero chlorine residual in the effluent prior to discharge to the marine environment.

Other expenditures for equipment repair and general maintenance will be required as part of on-going operation and maintenance. These expenditures would be directed at maintaining safe, reliable operation and not at long term replacement of equipment.

Operation from 2005 to 2036

The existing major secondary treatment process units will be replaced prior to 2006. By this time, the existing steel tankage will be approaching 30 years old and near the end of its useful life due to corrosion and structural deterioration. Although, the tankage could be removed from service and rehabilitated, the more cost effective approach is to replace the tankage will new process tankage incorporating newer process technology (Figure 12-4). The use of new technology will allow a reduction in unit sizing and optimization of the available plant area. For the purpose of developing this option, the use of sequencing batch reactor (SBR) with UV disinfection is assumed. This will provide an *advanced secondary* (nitrification and disinfection) effluent suitable for marine disposal. At the predesign stage, a number of other technologies should be evaluated including the emerging developments in membrane filter technology and biological aerated filters (BAF). The influent screw pump system and administrative/maintenance building would be retained in the plant upgrading.

The existing Ebb Tide pumping station to pump the wastewater not treated at the Ebb Tide plant to the Dusty Road plant would continue in operation. Over the 40-year period, pump capacity would be increased by adding the third set of pumps in the 2028. A standby generator set would also be added in the year 2006.

12.5 MARINE DISPOSAL

Under this option, the existing marine outfall would be extended as per Option 1-A. The discharge would be located 1000 m offshore in a depth of 60 m of water. This extension is proposed to be carried out in about the year 2004.

Sections of the land portion of the outfall between the Ebb Tide plant and the shore would be replaced in 1999 to provide the required increase in hydraulic capacity to handle the expected flow increase. The remaining land section of the outfall between the Ebb Tide and the Dusty Road plant would be replaced with a new 400 mm diameter outfall in about 2028 when the existing pipe is converted to a force main to transport wastewater to the Dusty Road plant.

12.6 EFFLUENT REUSE

The effluent reuse opportunities are as described in Options 1-A and B. Under this option, the thrust would be to balance the flows treated at the Ebb Tide plant and the flows at the Dusty Road plant to make optimum use of the wastewater treated at the Dusty Road plant for effluent reuse.

The percentage of the total effluent generated from the municipal system that can be directed to effluent reuse depends upon the reuse opportunities and the percentage of flow diverted to the Dusty Road plant. Based on development of the CAL gravel washing opportunity (1365 m^3/d year-round), *all of the flow* pumped to the Dusty Road plant between 2006 and 2013 could be used for effluent reuse. Additional effluent would also be used for silviculture irrigation at the CAL site, as well as irrigation of the Sechelt golf course.

If other opportunities for reuse can be developed, then the percentage of the total flow going to reuse can be increased. As discussed previously, the decisions on the capital and annual O&M cost investment in reuse should be based on an overall analysis of the economic benefits in terms of both wastewater and water management. It is likely that in the later stages of the LWMP period, that the value of treated water will increase and additional opportunities for reuse will emerge.

As the reuse applications are identical to Options 1-A and B, the process equipment required at the Dusty Road plant is as described in Chapter 10.

12.7 ON-SITE WASTEWATER MANAGEMENT

On-site wastewater management would play a more significant role in wastewater management for the LWMP area, as compared to Options 1-A and B. Based on the sewer extension projections and the use of local community systems, the number of residential properties using individual septic tank/tile fields or small package treatment systems, will decrease from the current figure of 60% to about 5% in 40 years time. This compares to about 2.5% in Options 1-A and B.

As previously discussed, the Ministry of Health guidelines, citing a minimum lot area of 0.2 ha, should be used for general direction when on-site disposal is considered for specific areas. However, given that optimum soil conditions for land disposal of effluent do not exist in all areas of the District, minimum lot sizes should be assessed on a site-specific basis for newly developed lots. In the LWMP areas, where problems with existing individual on-site disposal problems have been historically encountered, this situation may be rectified if the extension of the sewers is planned for the area. Alternatively, if the extension of municipal sewers are not planned, the rebuilding of tile fields where feasible can be considered. The use of small scale “innovative” systems may also offer some solutions in problem areas. The District should work closely with the Ministry of Health in this regard to ensure the applications are suitable and property owner is fully aware of the operational requirements and costs. The District should encourage the Ministry of Health to be actively involved with future innovative performance-based systems.

The comments in Option 1-A on the use of “dry sewers” to serve new developments where servicing is ultimately planned by extension of the municipal sewers also apply to this option.

12.8 LOCAL COMMUNITY SYSTEMS

Under this option, the use of local community systems in specific areas of the community is proposed. This is a major difference from Options 1-A and B and from Option 3-A, to be discussed in the next chapter.

The use of local community systems is proposed to allow the development or re-development of certain areas of the community at an urban density *that are not adjacent* to the urban core. This approach differs from simply extending the municipal sewers to these areas. If sewers are extended, as described in Options 1-A and B, development *between the core and the outlying proposed development areas* will undoubtably occur. This in-fill development may not be desirable in the view of many community residents.

Two areas are proposed for the use of local community systems:

- “comprehensive” development area in Sandy Hook; and,

- commercial/high density residential area of Wilson Creek/Davis Bay.

The comprehensive development area (Terraces Development), was noted as a possible development in the next 20-year period in the OCP and is currently undergoing a more detailed planning review by the District. The development would incorporate urban density residential housing for a population of about 1640 persons as well as a golf course. A local community system is already being investigated by the developer. The system would employ collection, treatment using membrane filtration technology, and effluent reuse for golf course irrigation. Surplus effluent would be disposed of via subsurface tile fields. Under Option 2-A, the LWMP would support the use of a local community system for this comprehensive development.

A local community system that serves the Port Stalashen residential/marina development in Wilson Creek is in place. A Permit for this system has been issued jointly in the name of the Sechelt Indian Government District and the developer. The system, incorporating secondary treatment using RBC technology and UV disinfection, utilizes an outfall into Georgia Strait for disposal. The permitted average daily flow for the system is 320 m^3/d, or about 900 equivalent population.

Under Option 2-A, the use of a local community system in the Davis Bay/Wilson Creek area will be expanded to allow re-development of the commercial area along the highway. This development, that could also incorporate higher density residential development, is assumed to occur after 2016. The use of a local community wastewater system will allow the re-development of the commercial area to proceed without the constraints imposed by on-site disposal if supported by the Davis Bay Neighbourhood Plan.

Development of a concept for this local community system is in the early stages as the proposed re-development is not defined. For the purpose of this option, it is assumed that the design equivalent population for the system is 2000 persons in the year 2036. It is assumed that the Port Shalashen system would be decommissioned once the new local community system is in place in about the year 2016. The system is assumed to incorporate a piped collection system that would direct wastewater to a new plant site located in the Chapman Creek valley. This site (Figure 12-1) was identified in the Stage 1 LWMP as a possible regional site. The new plant site would incorporate a combination of high technology pre-treatment processes and natural wetlands-based effluent polishing to produce a tertiary quality effluent. Effluent reuse for either seasonal irrigation in the area or flow augmentation of Chapman Creek is proposed. Surplus effluent not used for reuse would be discharged out the existing Port Shalashen system outfall.

With all of the local community systems, the ownership and operational responsibility needs to be clearly defined. As discussed above, under LWMP legislation a number of different options are possible in terms of approvals and ownership. As both developments are not yet fully defined and may in fact be some time in the future, it is proposed that, if Option 2-A is selected, that the LWMP identifies the use of local community systems as the desired wastewater management planning strategy. The plan should recommend that each situation be looked at on an individual basis in the future and a decision made as to whether the *Sechelt Sewage Facilities Commission* would own and operate the local community system or whether the system should be owned and operated by a private company. If the latter approach is taken, suitable financial arrangements must be in place to ensure proper long term operation and maintenance of the local community system.

12.9 ESTIMATED COSTS

A summary of the estimated capital and annual operating and maintenance costs for Option 2-A are presented in Tables 12-4 and 12-5, respectively. The details of the estimated costs are contained in Appendix C.

The cost basis for the municipal sewerage system and for on-site wastewater management are as discussed in Chapter 10. For Option 2-A, costs for local community systems are based on typical per capita costs for collection, treatment, and disposal/reuse.

The capital costs include a 40% allowance for engineering, construction contingencies, and financing administration costs.

OPTION 2-B: LIMITED MUNICIPAL SEWERAGE SYSTEM EXPANSION (Ebb Tide WWTP Only)/ LOCAL COMMUNITY SYSTEMS

SECTION 13

13.1 CONCEPT

This option is similar to Option 2-A except that only the Ebb Tide wastewater treatment plant would provide liquid-stream wastewater treatment over the long term. The Dusty Road plant would be utilized for trucked waste and biosolids management, without liquid-stream processing, for the remainder of the 40-year planning period beginning after year 2006.

The Dusty Road plant would be upgraded, in the short term, to optimize the capacity of the existing works and to bring the plant into compliance with the MELP effluent criteria. This upgrade would consist of improvements in the aeration/mixing system in the oxidation ditch and the construction of a new secondary clarifier. The changes would provide a plant capable of advanced secondary level treatment for a design equivalent population of 6,000 persons. Biosolids, from both the municipal treatment plants, will be managed at the Dusty Road plant site over the planning horizon. This plant will also continue to handle the trucked wastes from individual on-site systems and local community systems. Improvements will be made in the biosolids and trucked wastes processing, and biosolids composting will be initiated at the site in order to provide a final product for reuse as a soil conditioner.

In approximately seven years, the Ebb Tide plant would undergo a major expansion. The upgrade would incorporate new process technology capable of a tertiary level of treatment. The expansion would be phased over the remaining years of the planning period, with the plant ultimately capable of handling the flow from an equivalent population of 24,300 persons. Once the new Ebb Tide plant is operational, the liquid stream treatment works at the Dusty Road plant would be phased out.

Effluent reuse opportunities will be developed initially focusing on industrial process use (gravel washing and silviculture irrigation) at the CAL site. Once the tertiary effluent from the new Ebb Tide plant is available in 2005, additional seasonal reuse opportunities, such as irrigation at the Sechelt Golf Course or landscape irrigation could be implemented. Surplus effluent, not used for reuse, will be discharged via an extended outfall in Trail Bay.

Option 2-B is shown schematically in Figure 13-1. The main components of this concept are:

.1 **Extend sewers to West Sechelt, West Porpoise Bay, SBLs 2 and 3** in a phased manner over the next 40 years.

.2 **Upgrade the Dusty Road plant in 1998 to bring the effluent quality in compliance with the MELP criteria** and optimize the capacity of the existing works as described for Options 1A/B and 2-A**.** Following the upgrade, the capacity of the advanced secondary plant will be 6000 equivalent persons. Combined with the existing capacity at the Ebb Tide plant, the total treatment capacity available will be 9,300 equivalent persons. Based on growth projections, this capacity should be sufficient until 2005.

.3 Continue to operate the existing Ebb Tide plant until about 2005. **At that time the plant would be upgraded and expanded as a new tertiary treatment plant.** The expansion would be phased over the planning horizon, as dictated by sewered population growth, ultimately reaching a design population of 24,300 equivalent persons in 2036. The liquid stream treatment works at the Dusty Road plant would be decommissioned once the new Ebb Tide plant is operational.

.4 **Upgrade and expand the management of trucked wastes and municipal plant biosolids handling at the Dusty Road plant site** in 2006 (Phase 3) and 2024 (Phase 4). This would include utilization of existing concrete tankage for aerobic sludge digestion, and construction of a biosolids dewatering building and composting facility as described in Option 2-A. This facility would then provide all of the biosolids management for the municipal plant, the local community plants, and the trucked wastes over the remainder of the 40-year planning horizon.

.5 **Extend the existing outfall** to take the discharge point to a total distance of about 1000 metres offshore in a depth of 60 metres of water. This extension is assumed to occur in 2005, in conjunction with the Ebb Tide plant expansion. Sections of the land piping would be replaced in about 1998, to increase the capacity in the short term, to handle increasing flows.

.6 **Implement effluent reuse** focussing initially on the opportunities at the CAL gravel processing operations. In the longer term, opportunities for seasonal effluent reuse at the Sechelt Golf Course, landscape irrigation, and silviculture would be explored.

.7 **Develop a biosolids utilization program** based on the production of a soil conditioner product suitable for land reclamation at the CAL operations and for unrestricted public use for landscaping.

.8 **Implement local community wastewater management systems** for new comprehensive development in the East Porpoise area and for new development/redevelopment in the Wilson Creek/Davis Bay area. These local systems would focus on providing a high level of wastewater treatment and effluent reuse opportunities. The LWMP should remain flexible to consider other areas of the community for local systems.

.9 **Encourage and support activities to bring innovative designs to individual on-site disposal systems** to deal with both existing problem areas and to ensure future development served by on-site disposal, is carried out in a sustainable and environmentally sound manner.

The key to this option is flexibility and the phasing of expenditures to meet the community needs. The option considers the uncertainty of long term tenure at the Dusty Road site and proposes the major capital investments in municipal treatment works at the District owned Ebb Tide site. The investment made at the Dusty Road site, however, is optimized in the short term for liquid treatment capacity and in the long term for biosolids management. Following the upgrading of the Dusty Road plant in the short term, the blended effluent from the two municipal plants will meet the LWMP definition of advanced secondary treatment. After the new Ebb Tide plant is in place in about eight years, *all* municipal plant effluent will meet the tertiary treatment criteria.

The option gives equal emphasis to local community systems and individual on-site systems, recognizing that these approaches, along with the municipal system, will play a major role in the future of the community. Two specific areas, the Terraces Development and the Davis Bay/Wilson Creek area, have been identified as areas to be served by local community systems. The option, however, does not restrict the use of local systems to only these areas and over the planning horizon other local systems could be considered as an alternative to either the municipal system or individual systems.

13.2 EXPANSION OF WASTEWATER COLLECTION SYSTEM

Option 2-B is identical to Option 2-A with respect to expansion of the wastewater collection system.

13.3 DESIGN PARAMETERS

The design populations and wastewater flows are identical to those for Option 2-A. These values are shown in Tables 12-1 to 12-3 in Chapter 12.

13.4 PLANT UPGRADING

This option focuses the liquid treatment at the Ebb Tide plant over the long term. Biosolids management would be handled at the Dusty Road site. This approach considers both the possible uncertainty of long term ownership of the Dusty Road property, as well as the investment already made on infrastructure.

The existing liquid treatment works at the Dusty Road plant would be upgraded in 1998, to bring the effluent into compliance with MELP criteria, and optimize the capacity of the existing tankage. This modest expenditure allows the capacity of the Dusty Road plant to be increased to 6,000 equivalent population. This capacity, coupled with the 3,300 equivalent person capacity of the existing Ebb Tide plant, creates an overall municipal plant capacity of 9,300 persons. This capacity should be capable of handling the expected population growth until about 2005.

The Ebb Tide plant would be expanded and upgraded to a tertiary plant in 2005. The plant will be expanded in phases over the 40-year planning horizon ultimately handling all of the municipal wastewater flow. Expansion of the plant area into a portion of the existing works yard will be required, with additional space dedicated to expansion beyond 2036. The plant would incorporate current process technologies and state-of-the-art odour control systems to ensure the plant is compatible with the surrounding residential area.

A trucked waste receiving station (1998), aerobic digestion upgrades and biosolids dewatering (2006), and composting facility (2006) would be built at the Dusty Road plant site. This will allow both incoming biosolids and the stockpiled liquid sludge in the lagoons to be dewatered and composted. After the lagoons have been emptied, they would then be decommissioned. The liquid treatment works at the Dusty Road site would be phased out after the new Ebb Tide plant is constructed, with portions of the tankage converted to biosolids management (2006). Liquid waste sludge from the Ebb Tide plant would continue to be pumped to the Dusty Road facility, for biosolids processing through the existing raw wastewater force main, with the excess liquid fraction returned via the existing effluent pipeline.

The above plant concept reduces the long term capital expenditures at the Dusty Road site compared to Options 1-A and B. If long term tenure of the property is not possible, then the biosolids management works can be moved elsewhere with a minimum of disruption to the overall municipal treatment system. Some of the biosolids processing equipment could, in fact, be readily relocated to another site.

The major components of the plant upgrading and expansion strategy for Option 2-B are as follows:

.1 **The 1998 Phase 2 Dusty Road plant upgrade** will bring the plant into compliance with MELP effluent criteria and to optimize the capacity of the existing tankage to handle the flow from an equivalent population of 6,000 persons. Combined with the existing capacity at the Ebb Tide plant, the total treatment capacity available will be 9,300 equivalent persons. Based on growth projections, this capacity should be sufficient until 2005.

The upgrade will involve the same works described in the previous options.

.2 **Biosolids processing works will be added to the Dusty Road in 2006.** These works will consist of a new dewatering building complete with dewatering equipment, and composting. This upgrade is termed Phase 3. Phase 4 expansion of these facilities would occur in 2024.

.3 **A major upgrading and expansion of the Ebb Tide plant will occur in 2005.** As this will involve a virtual replacement of the existing plant, it is termed Phase 1. The initial plant capacity will be capable of handling the flow from an equivalent population of 16,200 persons. This will accommodate the total municipal wastewater flow to about the year 2020 at the assumed growth rates.

.4 Once the new Ebb Tide plant is in operation in 2006, the **existing liquid stream treatment units at the Dusty Road plant will be decommissioned** (Phase 3) and portions of the tankage converted to biosolids operations. The sludge lagoons at the site would also be phased out at this time.

.5 The next expansion (Phase 2) of the Ebb Tide plant would occur about the year 2020. At this time, the plant would be expanded to handle the flow from an equivalent population of 24,300 persons. This would provide capacity until the year 2036 based on the projected growth served by the municipal sewerage system.

13.4.1 Dusty Road Plant

The proposed layout of the site is shown in Figure 13-2. From 1998 to 2006, the plant site will provide both liquid stream treatment and biosolids management. After 2006, the site will be used for biosolids management only.

The same works will be completed for the Phase 2 upgrade in 1998 as described in previous options.

The excess liquid from the biosolids dewatering operation, would be returned to the oxidation ditch for treatment with the wastewater, from 1999 to 2006. Once the liquid stream treatment works are decommissioned in 2006, the excess liquid would be returned to the Ebb Tide plant via the former effluent main.

Phase 3, in about the year 2006, would see the liquid stream portion of the site decommissioned. The former oxidation ditch and secondary clarifiers would be converted to aerobic digesters and/or aerated storage tanks to provide additional unprocessed biosolids capacity. The old sludge lagoon ponds would be covered over and used as additional cured biosolids storage area.

13.4.2 Ebb Tide Plant

The strategy at the Ebb Tide plant is as follows:

- continue the existing plant operation in the short-term with a minimum of capital expenditure; and,

- replace the major process units in about 2005 and continue operation of the plant through the remainder of the 40-year period.

Plant capacity will continue at about 3300 persons until 2005. After the plant upgrade (termed Phase 1), the effective plant capacity would be 16,200 persons. The plant will be a “liquid stream” plant with waste sludge from the plant directed to the pumping station wet well and pumped to the Dusty Road site for processing.

Operation from 1998 to 2005

Some upgrading work over this period is required. Upgrading of the disinfection system by relocating the sulphur dioxide equipment from the Dusty Road plant is proposed to ensure compliance with regulatory requirements. This step will provide a positive means of ensuring a zero chlorine residual in the effluent prior to discharge to the marine environment.

Other expenditures for equipment repair and general maintenance will be required as part of on-going operation and maintenance. These expenditures would be directed at maintaining safe, reliable operation and not at long term replacement of equipment.

Operation from 2005 to 2036

The existing major secondary treatment process units will be replaced prior to 2005. By this time, the existing steel tankage will be approaching 30 years old and near the end of its useful life due to corrosion and structural deterioration. Although, the tankage could be removed from service and rehabilitated, the more cost effective approach is to replace the tankage will new process tankage incorporating newer process technology (Figure 13-3). The use of new technology will allow a reduction in unit sizing and optimization of the available plant area.

A number of tertiary process technologies could be considered for the plant. These include sequencing batch reactors (SBR) with filtration, biological aerated filters (BAF), or membrane filtration. The above processes would be followed by UV disinfection. In reality, by the time design commences on the plant in about 2003, process technology will have advanced and other processes or refinements of the above processes will be available. For this reason, it is not necessary or desirable to make a selection of the actual process at this time. This can await the predesign stage of the plant design.

The overall plant design should place a strong emphasis on plant architecture and landscaping, keeping in mind the residential development surrounding the facility. State-of-the-art odour control should be incorporated to ensure that the plant in compatible with the adjacent development.

The Phase 1 plant, constructed in 2005, should have two process trains with a design population of 16,200 persons. Phase 2 of the plant expansion will be required in about 2020 to accommodate population growth served by the municipal sewerage system. At this time, a third process train will be added increasing the capacity to 24,300 persons. This should provide capacity until the year 2036. The site should be laid out to allow an increase of the plant capacity beyond the 2036 design flow.

Biosolids processing will not occur at the Ebb Tide plant. Liquid waste biosolids will be pumped to the Dusty Road site for processing. The excess liquid after processing will be returned to the Ebb Tide plant for treatment with the wastewater stream. This allows the footprint of the Ebb Tide plant to be smaller and reduces the sources of potential odours. In the long term, the pipeline between the two plants may be valuable for the transmission of effluent for silviculture reuse, in the area of the Dusty Road site. If this occurs, biosolids dewatering can be added to the Ebb Tide plant and the concentrated biosolids trucked to the Dusty Road site for composting.

13.5 MARINE DISPOSAL

Under this option, the existing marine outfall would be extended as per Options 1-A and 2-A. The discharge would be located 1000 m offshore in a depth of 60 m of water. This extension is proposed to be carried out in about the year 2005. Sections of the land portion of the outfall between the Ebb Tide plant and the shore would be replaced in 1999 to provide the required increase in hydraulic capacity to handle the expected flow increase.

13.6 EFFLUENT REUSE

The effluent reuse opportunities are as described in Options 1-A/B and option 2-A.

13.7 ON-SITE WASTEWATER MANAGEMENT

Issues related to on-site wastewater management for Option 2-B are identical to those presented in Chapter 12 for Option 2-A.

13.8 LOCAL COMMUNITY SYSTEMS

Issues related to local community systems for Option 2-B are identical to those presented in Chapter 12 for Option 2-A.

13.9 ESTIMATED COSTS

A summary of the estimated capital and annual operating and maintenance costs for Option 2-B are presented in Tables 13-1 and 13-2, respectively. The details of the estimated costs are contained in Appendix C.

The cost basis for the municipal sewerage system and for on-site wastewater management are as discussed in Chapter 10. For Option 2-B, costs for local community systems are based on typical per capita costs for collection, treatment, and disposal/reuse.

The capital costs include a 40% allowance for engineering, construction contingencies, and financing administration costs.

OPTION 2-C: LIMITED MUNICIPAL SEWERAGE SYSTEM EXPANSION WITH IMPLEMENTATION OF TERTIARY TREATMENT BY PRIVATE SECTOR CONTRACTOR

SECTION 14

14.1 BACKGROUND

Option 2-C has been incorporated into the LWMP because of a request by the *Joint Public and Technical Advisory Committee* for the LWMP to consider immediate implementation of tertiary treatment at the Ebb Tide plant site. The request was motivated by committee receipt of an unsolicited proposal from a private sector design-build-operate contractor to provide tertiary treatment at the Ebb Tide plant. One of the key items of the proposal that attracted the committee's interest was a relatively abbreviated project schedule that may have assisted the SSFC to utilize senior government funding (i.e., Ministry of Municipal Affairs) within the MMA's limited time frame for project completion in October 1998.

Due to the issue of timing, the *Joint Public and Technical Advisory Committee* and SSFC had to react to this proposed option prior to the finalization of the Stage 2 LWMP report. Therefore, the purpose of this chapter is to briefly document the history, issues and decisions related to Option 2-C. This chapter provides an overview of the concept for Option 2-C, as well as providing a discussion on the flexibility and risk of this approach as considered by the committees. The chapter concludes with the SSFC decision on further consideration of this option.

14.2 CONCEPT

Similar to Options 2-A and 2-B, Option 2-C involves the limited expansion of the municipal wastewater collection system in conjunction with local community systems and on-site wastewater management. However, immediate implementation of tertiary treatment at the Ebb Tide plant site provides the key difference between Option 2-C and the previous options.

Option 2-C would see the immediate retrofit of the Ebb Tide plant with membrane filtration technology incorporated within the existing plant tankage. Following project completion, all wastewater collected by the municipal collection system within the LWMP area would be treated at the Ebb Tide plant. Effluent from the plant would be suitable for unrestricted effluent reuse, with surplus effluent disposed of using the marine outfall. The plant would have sufficient capacity to handle flows up to about the year 2020. At that time, the SSFC would expand plant capacity simultaneous with the replacement of the old tankage.

Under this option, the SSFC would not undertake any further upgrading or expansion of the liquid stream treatment facilities at the Dusty Road plant. Once the retrofitted Ebb Tide plant was brought on line, the Dusty Road plant would be used solely for processing waste sludge pumped from the Ebb Tide plant and trucked waste delivered to the Dusty Road plant by septage haulers.

14.3 FLEXIBILITY

Implementation of Option 2-C through a private sector contractor would have locked the SSFC into a specific direction and treatment technology. Option 2-C would result in *all* wastewater collected by the municipal sewer system receiving tertiary treatment. This approach would allow unlimited reuse of the effluent produced by the plant, however, it also results in a high degree of inflexibility. The inflexibility comes from immediate production of large volumes of high quality effluent, with associated increased capital and operations/maintenance expenditures, where effluent supply will significantly exceed the short-term demand for the effluent. Excess effluent, beyond demand requirements, would simply be disposed of in Trail Bay.

There was significant discussion, at the LWMP Workshops, of the need for tertiary treatment over advanced secondary treatment for marine disposal of effluent not used for reuse. After review of the technical issues and the costs, there was not a consensus at the time on whether tertiary was required immediately.

14.4 RISK

Option 2-C would involve several elements of risk for the SSFC. The first element involved the potential for the SSFC to utilize private sector operation and maintenance of the plant versus public operation/maintenance. The SSFC may decide at some point that this approach may be desirable. However, the SSFC would need to evaluate this aspect over a longer time frame than was allowed during initial consideration of this option.

Secondly, there is a technological risk associated with implementation of the proposed technology. Wastewater treatment processes are continually improving through research and operational experience. The membrane filtration technology, proposed by the private sector proponent, is but one example of emerging technologies that offer advantages in terms of performance and space savings. In order to assess these technologies, experience has shown that several years of operational data is desirable in order to track longer term reliability, performance, and maintenance costs. At the time of the proposal, there were no membrane filtration plants treating municipal wastewater in the size projected for the District of Sechelt. The two smaller plants in British Columbia had only been operating for less than six months.

Immediate implementation of a new technology, be it membrane filtration or another technology under Option 2-C, would have provided a minimal time for review and appropriate comparative evaluation.

14.5 CONCLUSION

Based on the issues discussed in the previous sections, the *Joint Public and Technical Advisory Committee* and SSFC decided not to pursue Option 2-C. Therefore, no further evaluation of Option 2-C was conducted for the Stage 2 LWMP.

It is important to realize, however, that the rejection of Option 2-C represents a decision to not proceed with the acceptance of an unsolicited proposal from the private sector. It does not represent a rejection of tertiary treatment at the Ebb Tide plant. Several other options (Options 2-A, 2-B, and 2-E) include consideration of this technology or other innovative, tertiary technologies when the Ebb Tide plant is upgraded within the next 10 years. In addition, tertiary treatment using effluent filtration, would be implemented at the Dusty Road WWTP, as dictated by the needs of the effluent reuse program. This is currently scheduled to occur by 2005.

OPTION 2-D: LIMITED MUNICIPAL SEWERAGE SYSTEM EXPANSION (Dusty Road WWTP Only)/ LOCAL COMMUNITY SYSTEMS

15.1 CONCEPT

The concept of Option 2-D is identical to that for Option 2-B, with the important exception that the focus for long term wastewater treatment is at the Dusty Road plant. The Ebb Tide plant will continue to provide a portion of the liquid stream treatment for about seven years and then be taken out of service. The management of trucked wastes and biosolids from both municipal plants will continue at the Dusty Road plant over the 40-year planning horizon.

The Dusty Road plant would be upgraded, in the short term, to optimize the capacity of the existing works and to bring the plant into compliance with the MELP effluent criteria as discussed in the previous options. The changes would provide a plant capable of advanced secondary level treatment for a design equivalent population of 6,000 persons.

In approximately seven years, the Dusty Road plant would undergo a two major expansion, with the plant ultimately capable of handling the flow from an equivalent population of 24,300 persons. Once the expanded Dusty Road plant is operational, the Ebb Tide plant would be phased out of service.

Biosolids, from both the municipal treatment plants, will be managed at the Dusty Road plant site over the planning horizon. This plant will also continue to handle the trucked wastes from individual on-site systems and local community systems. Improvements will be made in the biosolids and trucked wastes processing and biosolids composting will be initiated at the site in order to provide a final product for reuse as a soil conditioner.

Effluent reuse opportunities will be developed initially focusing on industrial process use (gravel washing and silviculture irrigation) at the CAL site. Additional seasonal reuse opportunities, such as irrigation at the Sechelt Golf Course or landscape irrigation could be implemented at a later time. Surplus effluent, not used for reuse, will be discharged via an extended outfall in Trail Bay.

Option 2-D is shown schematically in Figure 15-1. The main components of this concept are:

.1 **Extend sewers to West Sechelt, West Porpoise Bay, SBLs 2 and 3** in a phased manner over the next 40 years.

.2 **Upgrade the Dusty Road** plant in 1998 (Phase 2) to bring the effluent quality in compliance with the MELP criteria and optimize the capacity of the existing. In the longer term, continue to upgrade the plant capacity (Phases 3) to meet wastewater treatment demands.

.3 Continue to operate the existing Ebb Tide plant until about 2005. **At that time the plant would be shut down and decommissioned.** The Ebb Tide pumping station and force main would be upgraded, with the addition of a new booster pumping station on Dusty Road, to supply the additional wastewater to the Dusty Road plant.

.4 **Extend the existing outfall** to take the discharge point to a total distance of about 1000 metres offshore in a depth of 60 metres of water. Sections of the land and marine piping would be replaced over time to accommodate increasing flows.

.5 **Upgrade the management of trucked wastes and municipal plant biosolids handling at the Dusty Road plant site** in 1998 (Phase 2) and 2005 (Phase 3). This facility would then provide all of the biosolids management for the municipal plants, the local community plants, and the trucked wastes over the remainder of the 40-year planning horizon.

.6 **Implement effluent reuse** focussing initially on the opportunities at the CAL gravel processing operations. In the longer term, opportunities for seasonal effluent reuse at the Sechelt Golf Course, landscape irrigation, and silviculture would be explored.

.7 **Develop a biosolids utilization program** based on the production of a soil conditioner product suitable for land reclamation at the CAL operations and for unrestricted public use for landscaping.

.8 **Implement local community wastewater management systems** for new comprehensive development in the East Porpoise area and for new development/redevelopment in the Wilson Creek/Davis Bay area. These local systems would focus on providing a high level of wastewater treatment and effluent reuse opportunities. The LWMP should remain flexible to consider other areas of the community for local systems.

.9 **Encourage and support activities to bring innovative designs to individual on-site disposal systems** to deal with both existing problem areas and to ensure future development served by on-site disposal, is carried out in a sustainable and environmentally sound manner.

Community development, and use of local community systems and individual on-site systems, is identical to those concepts presented in Sections 13.1 and 13.2 for Option 2-B.

Similar to Option 2-B, the key to Option 2-D is flexibility and the phasing of expenditures to meet the community needs. However, this option assumes certainty of long term tenure at the Dusty Road site and proposes the major capital investments for the Dusty Road site over the planning horizon. Decommissioning the Ebb Tide plant will eliminate odour concerns and allow the plant site to be reintegrated into the surrounding residential area. After the Ebb Tide plant taken out of service in about seven years, and the Dusty Road plant is expanded, part of the municipal plant effluent will meet the tertiary treatment criteria for effluent reuse, with the remaining effluent being advanced secondary quality.

15.2 DESIGN PARAMETERS

The design populations and wastewater flows are identical to those for Option 2-A. These values are shown in Tables 12-1 to 12-3 in Chapter 12.

15.3 PLANT UPGRADING

The sequence of plant upgrading for option 2-D is similar to that presented in Options 1-A and 1-B because Option 1 also utilized only the Dusty Road plant for long term liquid and solids stream processing. The significantly lower wastewater flows, due to a smaller service population, form the main difference between Option 2-D and Option 1-A with respect to plant sizing and phasing of works.

The major components of the plant upgrading and expansion strategy for Option 2-D are as follows:

.1 **The 1998 Phase 2 Dusty Road plant upgrade** will bring the plant into compliance with MELP effluent criteria and to optimize the capacity of the existing tankage to handle the flow from an equivalent population of 6,000 persons as described in previous options.

.2 **The Phase 3 expansion of the Dusty Road plant** facilities in 2005 would be aimed at improving both biosolids processing at the plant site as well as increasing the liquid-stream capacity. The works would include the construction of an aerobic digester, dewatering equipment housed in a dewatering building, and composting facilities and equipment. This facility would then provide all of the biosolids management for the municipal plant, the local community plants, and the trucked wastes over the remainder of the 40-year planning horizon.

On the liquid-stream side, expansion works in 2005 would include replacing the aspirating aerators/mixers in the original oxidation ditch with horizontal brush rotors to increase plant capacity to 10,000 equivalent persons. This expansion would also see the addition of a headworks building with automated fine screening units, a second oxidation ditch complete with aeration rotors, and a new clarifier to serve the new oxidation ditch. This expansion would increase plant capacity to the 24,300 equivalent person requirements of year 2036.

A UV disinfection system would replace the existing chlorination/dechlorination system.

.3 The final **Phase 4 expansion in about 2024** would include increases in sludge digestion and dewatering capacities.

.4 Continue to operate the existing Ebb Tide plant until about 2005. **At that time the plant would be shut down and decommissioned.**

.5 **Upgrade and expand wastewater transmission facilities between the Ebb Tide and Dusty Road plants.** The pumps in the existing Ebb Tide pumping station would be replaced in 2006, and a booster pumping station located on Dusty Road would be constructed at the same time. A new large diameter force main would be constructed between the Ebb Tide pumping station, the new booster station, and the Dusty Road plant in 2006. A third pump would be installed in the booster station in about year 2016.

15.3.1 Dusty Road Plant

The proposed layout for the site is shown in Figure 15-2. The proposed upgrades for the Dusty Road plant are identical to those for Option 2-B described in Chapter 13.4.1. However, due to long term liquid treatment being conducted only at the

Dusty Road plant, the Phase 3 expansion of the liquid treatment facilities at the Dusty Road plant will be necessary to meet future flows as described in the previous section. Similarly, as described above, wastewater transmission facilities between the two plant sites will also require modification over time.

15.3.2 Ebb Tide Plant

The strategy at the Ebb Tide plant is to obtain approximately an additional seven years of life out of the plant with the minimum of capital expenditure. This means that inflows to the plant will be controlled at the existing level and that the increasing future flows will be directed to the Dusty Road plant.

Upgrading of the disinfection system by converting the existing aerobic digester to a chlorine contact tank and adding sulphur dioxide dechlorination is proposed in 1998 to ensure compliance with regulatory requirements. These steps will improve the disinfection capability as well as provide a positive means of ensuring a zero chlorine residual in the effluent prior to discharge to the marine environment.

The pumping station to pump the wastewater flows to the Dusty Road plant will remain on the site once the Ebb Tide treatment works are shut down. Upgrading of this pumping station will include conversion of the pumping system to a single stage pumping system and installation of a standby power generator system (2006). At this stage, the pumping station will pump to a new booster pumping station on Dusty Road. At the same time, a new large diameter force main will be installed from the Ebb Tide plant, to the booster station, and to the Dusty Road plant (i.e.the force main pipe to the Dusty Road plant will be switched to an outfall main as discussed in Chapter 15.4). An extra pump would be added to the booster station in about year 2016. The combination of above changes will provide the required capacity at the Ebb Tide and Dusty Road pumping stations up to the 2036 planning horizon.

Given that the Ebb Tide site will continue to house the pumping station and possibly other public works functions, the most appropriate end use following decommissioning is as a combined public works/park area. The existing treatment works would be removed and the area re-landscaped with walking/biking trails and open areas. Details of site decommissioning and land use planning would be the subject of future studies.

15.4 MARINE DISPOSAL

Under this option, the existing marine outfall would be extended to take the discharge point to a total distance of about 1000 metres offshore in a depth of 60 metres of water. This extension is assumed to occur in 2006. Sections of the land piping would be replaced in about 1999, to increase the capacity in the short term, to handle increasing flows. The land section of the outfall between the Dusty Road and Ebb Tide plants would be "twinned" in 2006, using the existing force main pipe between the two plants, to increase the capacity of this land section to handle flows up to the year 2036.

15.5 EFFLUENT REUSE

The concept in this option is to utilize the advanced secondary effluent available in 1998 from the Dusty Road plant to initiate effluent reuse at the CAL operations. As discussed in previous options, long term effluent reuse opportunities could be expanded to include such applications at the Sechelt Golf Course and landscape areas such parks or playgrounds. Effluent filtration units could be incorporated at the Dusty Road plant as dictated by the demand for tertiary effluent.

15.6 ON-SITE WASTEWATER MANAGEMENT

Issues related to on-site wastewater management for Option 2-D are identical to those presented in Chapter 12 for Option 2-A.

15.7 LOCAL COMMUNITY SYSTEMS

Issues related to local community systems for Option 2-D are identical to those presented in Chapter 12 for Option 2-A.

15.8 ESTIMATED COSTS

A summary of the estimated capital and annual operating and maintenance costs for Option 2-D are presented in Tables 15-1 and 15-2, respectively. The details of the estimated costs are contained in Appendix C.

The cost basis for the municipal sewerage system and for on-site wastewater management are as discussed in Chapter 10. For Option 2-D, costs for local community systems are based on typical per capita costs for collection, treatment, and disposal/reuse.

The capital costs include a 40% allowance for engineering, construction contingencies, and financing administration costs.

OPTION 2-E: LIMITED MUNICIPAL SEWERAGE SYSTEM EXPANSION (Dusty Road and Ebb Tide WWTPs)/LOCAL COMMUNITY SYSTEMS

SECTION 16

16.1 CONCEPT

Similar to Option 2-A, Option 2-E utilizes a combination of the existing municipal sewerage system, local community systems, and on-site systems for overall wastewater management. The concepts for Option 2-E are identical to Option 2-A, with one exception. Option 2-E differs from Option 2-A in that a local community treatment system would not be utilized for the Terraces Development adjacent to Sandy Hook. Instead, the municipal collection system would be extended along Sechelt Inlet Road to the southern boundary of the Terraces Development. East Porpoise Bay, north of Dusty Road, would also be serviced by the extended municipal system.

16.2 EXPANSION OF WASTEWATER COLLECTION SYSTEM

Specific assumptions regarding sewerage system extension are identical to those for Option 2-A, with the following exceptions:

.1 The Terraces Development would be served by extension of the municipal sewerage system. The pumping station and force main to service the initial phase of the development would be in place by 2000.

.5 Local sewer extensions to service existing development in East Porpoise Bay (Figure 16-1) will be constructed over the period from 2000 to 2006.

The assumptions are based on the District's approval of, and the developer's construction of the Terraces Development.

The OCP has identified other areas in East Porpoise Bay that could be considered for development. The SIGD has also indicated that SBL 28 may also be developed in the long term. The extension of sewers into East Porpoise Bay will allow these areas, shown in Figure 16-1, to potentially be served through extension of the municipal sewerage system.

As in Option 2-A, Sandy Hook (excluding Terraces Development) will remain on on-site systems.

16.3 DESIGN PARAMETERS

The populations served by both the municipal sewerage system, the local community systems and by on-site systems for the years 2016 and 2036 under this option are shown in Tables 16-1 and 16-2, respectively. The predicted wastewater flows to be handled by the municipal sewerage system are presented in Table 16-3.

The design parameters for the effluent requirements for marine disposal, land disposal, and effluent reuse are the same as for the previous options, as shown in the previous Tables 10-5 and 11-1.

16.4 PLANT UPGRADING

The major components of the plant upgrading and expansion strategy for Option 2-E are identical to those for Option 2-A, with the exception of capacity and timing requirements for the Phase 4 expansion of the Dusty Road plant. For the Phase 4 expansion, the Dusty Road plant will be sized to accommodate additional wastewater flow from the approximate 2,000 equivalent persons in East Porpoise Bay and the Terraces Development. In addition, the Phase 4 expansion will occur in 2020 rather than 2024 as in Option 2-A.

16.5 MARINE DISPOSAL

Marine disposal issues and works for Option 2-E are the same as those for Option 2-A.

16.6 EFFLUENT REUSE

Effluent reuse issues and works for Option 2-E are the same as those for Option 2-A.

16.7 ON-SITE WASTEWATER MANAGEMENT

On-site wastewater management issues and works for Option 2-E are the same as those for Option 2-A. Due to eventual servicing of East Porpoise Bay by extension of the municipal system, there is a small reduction in the percentage of equivalent persons utilizing on-site systems.

16.8 LOCAL COMMUNITY SYSTEMS

As for Option 2-A, the use of a local community system in the Davis Bay/Wilson Creek area will be expanded to allow re-development of the commercial area along the highway. This development that could also incorporate higher density residential development is assumed to occur after 2016. The use of a local community wastewater system will allow the re-development of the commercial area to proceed without the constraints imposed by on-site disposal.

Details for the Davis Bay/Wilson Creek community system are identical to those described in Option 2-A.

16.9 ESTIMATED COSTS

A summary of the estimated capital and annual operating and maintenance costs for Option 2-E are presented in Tables 16-4 and 16-5, respectively. The details of the estimated costs are contained in Appendix C.

The cost basis for the municipal sewerage system and for on-site wastewater management are as discussed in Chapter 10. Costs for local community systems are based on typical per capita costs for collection, treatment, and disposal/reuse as discussed in Chapter 12 for Option 2-A.

The capital costs include a 40% allowance for engineering, construction contingencies, and financing administration costs.

OPTION 3-A: LIMITED MUNICIPAL SEWERAGE SYSTEM EXPANSION (Dusty Road and Ebb Tide WWTPs)/ON-SITE WASTEWATER MANAGEMENT

SECTION 17

17.1 CONCEPT

Option 3-A is similar to Option 2-A except that the use of local community systems would not be encouraged and *all areas outside of the areas served by the municipal sewerage system would remain on individual on-site wastewater disposal systems.*

The expansion of the municipal sewerage system would be limited and would primarily serve the existing core area and adjacent proposed development areas in West Sechelt and West Porpoise Bay over the 40-year horizon. SBLs 2 and 3 are also assumed to be serviced by the municipal sewerage system. As in Option 2-A, both the Ebb Tide and the Dusty Road plants would remain in operation over the 40-year plan horizon. Effluent from the upgraded Ebb Tide plant would be discharged to the marine environment. Effluent from the Dusty Road plant would go primarily to effluent reuse with surplus effluent discharged via to Trail Bay via the common outfall with the Ebb Tide plant.

The major difference between this option and Option 2-A is that all areas outside of the areas served by the municipal system would remain on on-site disposal systems. This will effectively *eliminate any urban density development outside of the core community area*.

Option 3-A is shown schematically in Figure 17-1. The main components of this concept are:

.1 **Extend sewers to West Sechelt, West Porpoise Bay, and SBLs 2 and 3** in a phased manner over the next 40 years.

.2 **Upgrade the Dusty Road plant** in the short term (Phase 2) to improve the effluent quality to an advanced secondary level and increase the plant capacity. In the longer term, continue to upgrade the sludge management works (Phase 3) and expand the plant capacity (Phase 4) to handle the projected sewerage system expansion.

.3 Continue to operate the existing Ebb Tide plant until about the year 2006. **At that time the plant would be reconstructed as an advanced secondary plant**. The pumping station to pump the excess wastewater to the Dusty Road plant would remain at the site.

.4 **Extend the existing outfall** to take the discharge point to a total distance of about 1000 metres offshore in a depth of 60 metres of water. Sections of the land and marine piping would be replaced to increase the capacity as required as flows increase.

.5 **Implement effluent reuse** at the Dusty Road focussing initially on the opportunities at the Construction Aggregates Ltd. gravel processing operations. In the longer term opportunities for seasonal effluent reuse at golf courses, landscape irrigation, and silviculture would be explored.

.6 **Develop a biosolids utilization program** based on production of two grades of biosolids suitable for land reclamation at the CAL operation and for unrestricted public use for landscaping.

This option would allow a gradual development of the community from the central area outwards into West Sechelt and West Porpoise Bay at urban densities. Outlying areas would retain their rural character through the use of larger lot sizes and on-site disposal.

This option would be compatible with a *low growth scenario* that would see a total residential population of about 17,100 persons by the year 2036. This compares to future (2036) residential populations of 23,400 and 34,000 persons for Option 1 and Option 2, respectively.

17.2 EXPANSION OF WASTEWATER COLLECTION SYSTEM

The expansion of the municipal sewerage system would be as described in Option 2-A. As discussed above, there would be no local community collection systems.

17.3 DESIGN PARAMETERS

The populations served by both the municipal sewerage system and by on-site systems for the years 2017 and 2036 under this option are shown in Tables 17-1 and 17-2, respectively. The predicted wastewater flows to be handled by the municipal sewerage system are presented in Table 17-3.

The design parameters for the effluent requirements for marine disposal, land disposal, and effluent reuse are the same as for Option 2-A.

17.4 PLANT UPGRADING

The upgrading and expansion of the two municipal plants would be essentially as described under Option 2-A.

Due to the lower growth rates, the plant design capacities over the 40-year period would be slightly lower. The Ebb Tide plant, upgraded in 2006, would have a design capacity to handle the flow from an equivalent population of 6,600 persons.

The Dusty Road plant would be upgraded and expanded in the three phases as discussed in Chapter 12 to an ultimate capacity of 12,000 persons.

The operation and processes at the plants are identical to Option 2-A.

17.5 MARINE DISPOSAL

As in Option 2-A, the effluent from the Ebb Tide plant would be discharged to Trail Bay through an extended outfall system discharging into 60 metres of water depth.

Surplus effluent from the Dusty Road plant not needed for reuse would also be discharged to the marine environment through the common outfall with the Ebb Tide plant.

17.6 EFFLUENT REUSE

Effluent reuse at the Dusty Road plant would be identical to Option 2-A.

17.7 ON-SITE WASTEWATER MANAGEMENT

On-site wastewater management would play an even more significant role in wastewater management for the LWMP area then in Option 2. Based on the sewer extension projections, the number of residential properties using individual septic tank/tile fields or small package treatment systems, will be about 25% in 40 years time. This compares to under 5% in Options 1-A and B and 15% in Options 2-A, 2-B and 2-D.

All new development, not served by the municipal sewerage system, will occur on larger lot sizes. Although the Ministry of Health criteria for lot sizes will provide guidance, a conservative approach should be taken towards subdivision approval particularly in areas where a significant number of new lots are proposed. It should be emphasized that the objective of this option is *to ensure that long term development occurs in a rural manner and the character of the existing areas is maintained*. Trying to accommodate as many lots as possible in a given area using on-site disposal is not the goal of this option.

The replacement of septic tank and tile field systems at existing residences will be required over the 40-year horizon. In most of the areas, this will not be a problem as long as the size of the dwelling unit does not increase. In certain situations, the lot area for a replacement tile field will be limited and solutions must be identified on a site specific basis in conjunction with the Ministry of Health. The District should encourage the Ministry of Health to become actively involved with future “innovative/performance based”. Holding tanks, while possibly a reasonable solution on some lots, should not be encouraged on lots that are not proposed for ultimate connection to the municipal sewerage system.

17.8 ESTIMATED COSTS

A summary of the estimated capital and annual operating and maintenance costs for Option 3-A are presented in Tables 17-4 and 17-5, respectively. The details of the estimated costs are contained in Appendix C.

The cost basis for the municipal sewerage system and for on-site wastewater management are as discussed in Chapter 10. The capital costs include a 40% allowance for engineering, construction contingencies, and financing administration costs.

COMPARISON OF OPTIONS

SECTION 18

This chapter presents a comparison of the eight wastewater management options developed in the proceeding chapters. The sections describe the basis of comparison of the options and compare the options based on economic and non-economic factors. The final section summarizes the comparison and provides direction in option selection.

18.1 BASIS OF COMPARISON

18.1.1 Overview of Options

The eight options are summarized in Table 18-1.

Prior to reviewing the options, it is important to reflect on the context of their development. The Series One options were developed early in the planning process. These reflected thinking from the previous Stage 1 work by the regional district. Both options (Options 1-A and 1-B) reflected a regional sewerage system philosophy with expansion of the municipal sewerage system from the core outwards. These options were suited to a high growth scenario that reflected an aggressive development policy.

The initial Series Two options were developed mid-way through the plan to provide contrasting options to Options 1-A and 1-B. The Series Two options reflected a more limited extension of the municipal sewerage system and increased emphasis on servicing nodal development areas with local community sewer systems. On-site disposal would also play a more major role than in the Series One options.

The Series Three option (Option 3-A) was developed at the same time and essentially represented the “status quo”. There would be limited expansion of the municipal sewerage systems and all outlying areas would remain on individual on-site systems.

The latter part of the LWMP preparation concentrated on refinement of the Series Two options as this was the preferred direction of the advisory committees and the Steering Committee. A total of five Series Two options (Options 2-A; 2-B; 2-C; 2-D and 2-E), reflecting slightly different treatment plant upgrading and local sewer system approaches, were ultimately developed.

18.1.2 Economic Factors

The cost of managing wastewater in a community is a significant cost. This cost is paid through taxes or user fees if the property is serviced by a sewer system. Alternatively, it may be paid through maintenance and eventual replacement of a septic tank and tile field if the property utilizes on-site disposal.

Clearly any scheme must be affordable to the users. This must thus be a major consideration in selecting an option under the LWMP. In the previous chapters, the estimated costs for all aspects of wastewater management over the 40-year period are shown. This includes initial costs for construction sewers in new developments, costs to expand and upgrade wastewater treatment plants and reuse/disposal systems, and costs to construct and maintain individual on-site systems. In looking at the question of financial impact and thus affordability, it is necessary to determine *who pays what costs*?

Capital costs to upgrade wastewater system components are typically funded by the District through borrowing. These funds are then paid back as an annual debt repayment. On-going operating and maintenance costs are also typically paid on an annual basis. Debt repayment and annual operating and maintenance costs are usually recovered from the system users through taxes or annual user fees.

Capital costs for local sewer construction to service new developments are usually paid for in the cost of the property or dwelling by the new owner as part of the purchase price. A portion of off-site costs for trunk sewers and treatment/disposal is also paid for by the new property owner in the form of a development cost charge (DCC). In the case of an existing development, that is converting from on-site disposal to a sewerage system, the local sewer costs are typically paid by the benefiting property owners in the form of a specified area cost charge.

If a property is serviced by an individual septic tank and tile field, the property owner is responsible for the costs. This would include the original construction cost, the annual cost to pump out the septage for disposal, and the cost to replace the septic tank and tile field when they reach their useful life.

The financial impact analysis evaluates the costs of the options to the various users over the planning horizon of the LWMP.

18.1.3 Non-economic Considerations

While the affordabliity of the LWMP scheme is important, it is also necessary to consider several non-economic factors that have a bearing on the appropriateness of the scheme. In reviewing the available options and deciding on a long term LWMP strategy, there are four considerations that are important in the decision making. These are discussed below.

18.1.3.1 Compatibility with the Community Vision

Does the option fit with the community vision regarding long term development?

Through the LWMP process, the consultant team and the advisory committees have tried to establish a consensus of how the residents of the area envision what the community will look like over the next four decades. Although consensus, of course, is difficult to achieve, the general view is that the community should retain its current small town, rural ambience while at the same time allowing some development and growth to proceed. The vision is very much towards the philosophy of *sustainable development* - growth should not be excessive (i.e. ensure development does not impair the environment's ability to support future generations) and should encourage a sense of community in terms of commercial and residential development. These concepts are consistent with the District's OCP vision or "overall goal: An attractive, safe prosperous, healthy, diversified and ecologically sound community which is culturally and socially-fulfilling for its residents" (District of Sechelt, 1996).

The predominant feeling is that nodes of community development should be retained, intermixed with the rural corridors. Growth from the urban center , that would result in outward urban expansion and ultimately link the current residential nodes, is not preferred. The District of Sechelt (1996) OCP states that "Sechelt has become more of a compact community, avoiding urban sprawl through the use of green belts, preservation of sensitive and unstable lands, neighborhood nodes and the successful 'infill' redevelopment of the Downtown to a medium density."

The SIGD vision for its communities is "To create a complete community by providing housing, employment, recreational, and cultural opportunities for residents" (SIGD, 1999).

The LWMP needs to encompass these visions. The Series Two options recognize these approaches, while encompassing the desired community growth identified by the committees, and have been the focus of the latter part of the LWMP development.

18.1.3.2 Integrated Water Management Planning

Does the option fit with the concept of integrated water management planning?

The second fundamental issue in reviewing options and developing the final LWMP is the recognition that there is a need to have an integrated approach to water management planning. This approach sees wastewater as a resource and plans the overall community development considering all aspects of water supply, storm water management, and wastewater management.

While detailed integration of the water and wastewater management planning within the LWMP has been limited by jurisdictional differences and available budget, the LWMP has been able to focus on the issue of the integrated water management planning and identify a number of future opportunities for water reuse. These include replacing existing freshwater use with reclaimed effluent and utilizing effluent for alternative uses such as low flow stream augmentation.

The option selected needs to encompass the idea of integrated water management and allow opportunities for effluent reuse to be pursued in the future. Wastewater needs to be considered as a resource and, where appropriate and cost effective, utilized to replace or supplement freshwater flows.

18.1.3.3 Flexibility to Deal with Future Change

Is the option flexible enough to deal with changes in development and *technology?*

The LWMP is an "engineering planning" document. Its intent is set an approach or strategy to deal with wastewater management over the next four decades. Wastewater treatment technology will continue to evolve in the coming years. The option selected needs to be sufficiently flexible to take advantage of improving technologies. It also needs to be sufficiently flexible to deal with changes in the rate of growth of the community or in changes in development planning.

This flexibility must also ensure that the selected scheme can be implemented in an affordable manner. The timing of new capital expenditures needs to be geared to the population growth so that the users in the initial years are not burdened with a high debt repayment for system capacity that is not required for several years in the future.

18.1.3.4 Risk

What is the environmental, technological, or financial risk in implementing a particular option?

Wastewater treatment has been practiced for decades. As with any technological field, improvements are continually made in the process technology and in the understanding of the environmental aspects. In addition, the role of wastewater management in community planning is also undergoing continued metamorphous as demonstrated by the recent emphasis in integrated water management planning.

The key in developing a liquid waste management strategy is to continue to move forward to take advantage of changes and innovative thinking yet to not expose the public to an unacceptable degree of risk. An example of this risk is the premature use of a new technology that could ultimately prove to be unworkable and must be replaced at a high cost.

The option selected must thus balance the benefits with an acceptable degree of risk.

18.2 FINANCIAL IMPACT

A summary of the economic analysis of the options is shown in Table 18-2. The detailed spreadsheets are contained in Appendix C.

The analysis is in two parts: *net present worth* and the *annual user cost*. The results are described below.

Table 18-2
Summary of Economic Analysis

Option	Net Present Worth	Annual Cost Per Lot			
		Sewered Properties			Non-Sewered Properties
		2006	2016	2036	
1-A	$88,630,989	$385	$246	$77	$253
1-B	$95,237,542	$441	$282	$94	$253
2-A	$63,242,929	$347	$254	$103	$253
2-B	$65,284,694	$371	$276	$102	$253
2-D	$63,479,447	$352	$267	$89	$253
2-E	$60,448,350	$289	$207	$94	$253
3-A	$46,120,249	$274	$227	$88	$253

18.2.1 Net Present Worth

The net present worth analysis is a life cycle costing technique used to compare project alternatives on an equal economic basis. The net present worth (NPW) can be thought of as the amount of money that would have to set aside today, to gain interest at an annual interest rate, in order to pay for all future capital and operating and maintenance costs that are inflating at an annual rate of inflation. The annual interest and inflation rates are combined into a single discount rate called *the real discount rate*.

A real discount rate of 4% is used in the analysis, reflecting current municipal funding. The calculation excludes any senior government funding or development cost charges. The net present worth thus reflects the true cost of the expenditures.

In comparing the results of Table 18-2 for the various options, the three option series cannot be compared directly as they represent different population levels. It is thus necessary to compare options within a given option series.

- **Series One Options:** In the first series, Option 1-A has a lower present worth than Option 1-B ($88.6 million vs $95.2 million). This primarily reflects the higher capital costs to implement a land disposal system relative to marine disposal. The land disposal system (Option 1-B) also has higher power consumption compared to the marine disposal system (Option 1-A) due to need to pump the effluent to the disposal area. This increases the present worth of the annual O&M costs over the life of the system.

- **Series Two Options:** In the second option series, the net present worth of the options ranges from $60.1 to $65.3 million. These are lower than for the Series One options due to the lower population.

  The highest cost option ($65.3 million) is Option 2-B. Under this option, all the liquid stream treatment is provided at the Ebb Tide plant after 2006. This results in a higher capital cost overall as the dollars expended on the Dusty Road WWTP in the early years are not fully utilized prior to decommissioning of the liquid stream works.

  Option 2-D is the second highest cost at $63.5 million. In this case, all of the liquid stream treatment would take place at the Dusty Road WWTP after 2006. The high power costs to pump all of the collected wastewater to this plant in the future impacts the net present worth of this option.

  Option 2-A is slightly lower cost than Option 2-D ($63.2 vs $63.5 million. This option utilizes both plants for liquid stream treatment in the long term. Although this increases the capital cost slightly, the savings in power costs reduces the net present worth to below that of Option 2-D.

  The least expensive of the Series Two options is Option 2-E at $60.1

million. The option is similar to Option 2-A and utilizes both plants for liquid stream treatment in the long term. The difference between the two options is that the Terraces / Sandy Hook area is serviced by an extension of the municipal sewerage system instead of by a local community system. Given the relative proximity to the municipal sewerage system, the capital and O&M costs are less expensive to service this area by sewerage system extension than by a new local, wastewater treatment plant.

- **Series Three Option:** There is only one option in Series Three. The net present worth cost of this Option 3-A is lower than either the Series One or Series Two options. This is due to the lower population in this scenario. No direct comparison is thus possible with the present worth analysis.

18.2.2 Annual User Cost

The annual user cost is a reflection of the cost that the property owner would pay on an annual basis. This is a complex calculation that is impacted by the type of sewer servicing, the impact of private sector funding and development cost charges, future senior government grant programs, and the timing of development.

As all properties in the LWMP are not serviced in the same manner, it is necessary to calculate the annual user cost for two types of servicing:

- properties connected to a sewer system
- properties that employ an individual septic tank and tile field

The detail spreadsheets in Appendix C provide the annual user cost estimates for each of the 40 years. Table 18-2 provides a summary of these values for three periods (2006, 2016 and 2036).

The annual user costs are based on the premise of “user pays”. In other words, the actual costs for each type of servicing is paid by the user. For example, the property owner whose property is connected to a sewer system pays for the costs of the sewerage system. Similarly, if the property is served by a septic tank and tile field, the owner of the property only pays for the upkeep and replacement of that septic tank / tile field.

The analysis is presented here to allow a comparison of the options and to give an-order-magnitude estimate of likely costs over the 40-year period. All costs are in current dollars. Several issues and assumptions need to be realized. These include:

- *For the purpose of the analysis, it is assumed that costs for the municipal sewerage system and for local community systems are considered as "sewered property" costs.* The annual user costs are thus spread across all of the sewered lots. The reason for this assumption is that the decision to utilize local community systems will be made by the District on the basis of overall wastewater management and community planning factors. The District will in fact ultimately be responsible for the system operation even if the initial construction is implemented through a private-public partnership.

- *The cost of local sewers and service connections are excluded.* These are assumed to be borne either as a cost of the property purchase for new development or as a specified area cost if sewers are extended to existing development. This would typically be paid as either a hidden (new development) or direct (existing development) one-time cost. A typical value would be in the range of $5300 to $7900 per lot.

- *Senior government funding and development cost charges are included.* Traditionally in British Columbia, sewerage system construction has benefited from a grant from senior government covering from between 25% and 75% of the capital cost. At the time of writing, such grant programs have expired and future funding levels are uncertain.

  Certain capital expenditures are also eligible for development cost charges or DCC. These apply when the works required are due to the construction of new developments. In this case, the District can collect a DCC from the developer at the time of development and apply these funds to future sewerage works construction. The developer in turn recovers the costs from the sale of the lots.

For the purpose of the analysis, a figure of 50% is used to reflect an average value for both senior government funding and development cost charges on new works constructed after 1998. The 1998 program is eligible for 66% funding based on the *Federal Infrastructure Program*.

Annual user costs, unlike net present worth costs, can be compared across all of the options. The costs for sewered properties are discussed below in terms of the three option series.

The annual user cost for properties served by an individual septic tank and tile field are the same for all options. As with the cost of local sewers, the initial cost for the septic tank and tile field (approximately $4800) is assumed to be a one-time cost paid directly by the homeowner. The annual cost, $253 per lot, is composed of an average annual maintenance cost of $100 to have the tank pumped out on a biannual basis and a debt repayment cost to replace the tile field. As per previous analysis in the LWMP, it is assumed that the tile field is replaced once every 20 years. For the purpose of the cost analysis, it is assumed that the homeowner amortizes this debt on a 20-year basis. The debt cost is then averaged over the 40-year period.

- **Series One Options:** Option 1-A has a lower annual user cost than Option 1-B over the four decades. This is due to the higher capital cost and higher O&M of Option 1-B.

  In the early years, Option 1-A has a higher annual user cost than the Series Two options ($385 per lot vs a range from $289 to 371 per lot in 2006). This reflects the dilemma of regional sewerage systems when senior government funding is not high enough to ease the debt burden in the early years. The works such as major trunk mains must be sized to provide capacity for future populations. The debt on this borrowing however must be paid in the initial years by a limited population base.

  In the latter portions of the planning period (after 2027), the annual user costs of Option 1-A drop below the costs of the least expensive Series Two option. This reflects the advantage of scale that ultimately is seen with a regional sewerage approach.

- **Series Two Options:** Option 2-E has the lowest annual user cost of the Series Two options. The estimated annual user costs are $289 per lot and $207 per lot in 2006 and 2016, respectively. The other Series Two options show costs in the range of $347 to $371 per lot for 2006 and between $254 and $276 per lot for 2016. This difference, between Option 2-E and the other options, reflects the lower cost to service the Terraces / Sandy Hook development by extension of the municipal sewerage system.

  As discussed above, Option 2-E has a lower cost ($289 per lot vs $ 385 per lot in 2006) than the lowest cost Series One option, Option 1-A, in the early years of the planning period. This cost advantage continues for about 30 years into the planning horizon. After this time, Option 1-A shows a cost advantage.

  The lower cost of the Series Two options reflects the nature and size of the community in terms of sewer servicing. The areas of development are relatively spread out and the populations are relatively low. The scenario of limited municipal sewerage system extension and the use of local community systems better suits the community as compared to a large, regional sewerage system. This is reflected in the cost back to the users.

- **Series Three Option:** The single Series Three option (Option 3-A) has the lowest annual user cost in the early years of the planning horizon ($274 per lot vs $289 per lot for Option 2-E in 2006). About 20 years into the plan (year 2016), the costs are the second lowest of all the options ($227 per lot compared to $207 per lot for Option 2-E). In the final years, the annual costs for the sewered properties are similar to Option 2-E ($88 per lot vs $94 per lot).

  The low annual user cost reflects the status-quo nature of this option. Although the population base to pay for the costs is lower, the level of the expenditures is also lower.

18.3 NON-ECONOMIC CONSIDERATIONS

In addition to the question of affordability, non-economic factors are also important in the decision process. A comparison of the options under the four selected criteria are discussed below.

In order to assist in the comparison, an evaluation matrix is utilized. The purpose of this matrix, shown in Table 18-3, is to compile the conclusions on each option for each of the factors in a manner that allows an overall conclusion to be drawn. This is accomplished by "rating" each of the options on a scale of 1 to 10 for each factor. A rating of "10" is the highest rating. In other words, this option would best meet the goal of the non-economic factor. Other options would rate less than "10" depending on how, in the evaluator's perception, they meet the goal. In order to arrive at a single value, the factors are averaged. In the case of this analysis, all the non-economic factors are considered of equal importance and are thus weighted equally in the averaging.

Table 18-3
Evaluation Matrix
Non-Economic Factors

Option	Non-Economic Factors[a]				Average
	Compatibility with Community Vision	Integrated Water Management	Flexibility to Deal with Future Changes	Technological/ Environmental Risk	
1-A	6	8	6	9	7.3
1-B	6	8	6	6	6.5
2-A	10	10	8	9	9.3
2-B	10	10	7	9	9.0
2-D	10	10	7	9	9.0
2-E	9	9	9	10	9.3
3-A	7	8	6	10	7.8

Notes: [a]Ranking is from "1" to "10" with "10" indicating that the option best meets the goal of the factor.

18.3.1 Compatibility with Community Vision

Options 2-A, 2-B, and 2-D are considered the most compatible with the community's perceived vision of balanced development and maintenance of nodal community centers and rate a "10". These three options employ local community systems in Davis Bay / Wilson Creek and in Terraces / Sandy Hook. Option 2-D is ranked slightly lower as the Terraces / Sandy Hook area is served by an extension of the municipal sewer. The lower rating is due to the presence of a piped system between Sandy Hook and the urban core which will tend to encourage infill along the sewer route.

Option 3-A, which is essentially the status-quo situation, is rated below the Series Two options. While this option would retain the present rural nature of the community, it does not allow the controlled development that the community vision encompasses.

The Series One options, Options 1-A and 1-B, are both rated the lowest of all the options at "6". These options, that would see growth from the urban core outwards, are not considered to reflect the community vision.

18.3.2 Integrated Water Management

All of the options rate relatively high in the goal of integrated water management.

Options 2-A, 2-B, and 2-D rate the highest on this factor at "10". The approach in all of these options is to employ local community systems that offer opportunities for water reuse and the reduction of freshwater usage. Option 2-E rates slightly lower in this regard as one of the local community systems is eliminated.

Options 1-A, 1-B, and 3-A also rate relatively high (8 out of 10). These schemes, along with the Series Two options, provide water reuse opportunities from the municipal sewerage system for both industrial use and landscape / golf course irrigation.

18.3.3 Flexibility

This factor is a measure of how each option is able to deal with changes such as varying growth rates, development patterns or technological changes. No option is rated a "10" in this regard as once works are constructed some degree of flexibility is lost.

Option 2-E is rated the highest at "9". Provision of treatment at both municipal plants provides a high degree of flexibility to adjust expansion phasing to suit actual growth rates. Servicing of the Terraces / Sandy Hook area by extension of the municipal sewer system provides capacity to deal with varying sewering scenarios. Option 2-A, which utilizes a local sewer system in the Terraces / Sandy Hook area, is rated slightly lower than Option 2-E due to more restrictions in dealing with varying sewering plans. Options 2-B and 2-D are rated the lowest of the Series Two options as they both employ a single plant for liquid stream treatment for the municipal sewerage system. This provides less flexibility in terms of dealing with different expansion scenarios.

Options 1-A, 1-B, and 3-A are rated lower than the Series Two options. Options 1-A and 1-B are less flexible as decisions must be made in the early years as to the size of the trunk sewers to service the ultimate populations. This results in either oversized pipes if the population does not materialize or undersizing if the growth exceeds predictions. Option 3-A is rated at the lower end for the opposite reason - it is not capable of dealing with future high density development.

18.3.4 Technological / Environmental Risk

Options 2-E and 3-A are rated "10" in terms of their ability to limit technological and environmental risk. Option 2-E will see the majority of the sewer servicing provided in the short term by the municipal sewerage system. Upgrading of the Ebb Tide plant and construction of the local community system in Davis Bay / Wilson Creek are in the latter stages of the plan. Decisions on treatment processes that could be superseded by technological changes are thus not required in the short term. Option 3-A rates a "10" simply because maintenance of the status-quo means little in the way of technological risk.

The remaining Series Two options (Options 2-A, 2-B, and 2-D) all score a “9". With the greater use of local community systems, there is increased risk with the performance of the treatment systems particularly if emerging process technologies are selected. Option 1-A rates the same score primarily due to the commitment that constructing large trunk sewers in the short term entails. Once the trunk sewers are constructed, there is little opportunity to change courses to embrace new future technologies.

Option 1-B rates the lowest of all of the options. This is due to the number of unknowns in large scale land disposal systems in regards to the fate of the effluent in the groundwater, downstream seepage problems, and the difficulty in rectifying problems if they occur.

18.4 OPTION SELECTION

In going through both the economic and non-economic comparisons, it is clear that the Series Two options are the best choice. The question is - *which Series Two option should be selected?*

A summary of the Series Two options is presented in Table 18-4. In terms of the non-economic factors, Options 2-A and 2-E both ranked at the top. Option 2-A, which employs a local community system to service the Terraces / Sandy Hook area, offers an advantage in moving towards the goal of integrated water management. Option 2-E on the other hand, which uses an extension of the municipal sewerage system to service Terraces / Sandy Hook, offers less risk and greater flexibility.

Table 18-4
Option Selection

Option	Costs			Non-Economic Factors Rating[c]
	Net Present Worth[a]	Annual User Cost[b] ($/lot)		
		Sewered Properties	Properties Using On-Site Disposal	
2-A	63.2	347	253	9.3
2-B	65.3	371	253	9.0
2-D	63.5	352	253	9.0
2-E	60.4	289	253	9.3

Notes:

[a]Net present worth of all costs over the 40 year period.
[b]Estimated cost for 2006.
[c]Ranking based on four factors. Highest possible score is 10.

In terms of affordability, both options are affordable with the proper financial planning to distribute the costs amongst the groups that benefit. Option 2-E however is less expensive than Option 2-A on a net present worth basis ($60.1 million vs $63.2 million) and the lowest of all the options. Annual user rates for Option 2-E are also generally slightly less than Option 2-A over analysis period.

Based on the review of the described information, the Steering Committee has selected Option 2-E for implementation. The Stage 3 LWMP will evaluate financing and other aspects related to the implementation of Option 2-E.

STORM WATER MANAGEMENT

SECTION 19

19.1 OVERVIEW

Storm water management, in terms of environmental protection, has traditionally been in the context of hydraulically protecting riparian and aquatic habitats from uncontrolled runoff originating in developed urban areas. More recently, urban storm water runoff has been identified as a potentially significant non-point source of pollution to receiving waters.

Pollutants in urban storm water can originate from a wide variety of sources including, but not limited to, the following (Roberge and Wetter, 1995):

- fertilizers and pesticides used in gardening;
- industrial activities;
- accidental chemical spills;
- intentional dumping of hazardous materials into storm drains; and,
- atmospheric deposition of materials originating from the use of automobiles.

Storm water contaminants, originating from many sources, can be separated into the following general categories (Schueler, 1987):

- sediment;
- nutrients;
- bacteria;
- oxygen demanding material;
- oil and grease;
- trace metals;
- toxic chemicals;
- chlorides; and,
- thermal pollutants.

The environmental and receiving water impacts associated with storm water contaminants are as varied as the sources and the contaminants themselves. Impacts may include lethal stress to aquatic organisms due to the depletion of dissolved oxygen levels, taste and appearance problems in public drinking water supplies caused by turbidity/sediment, and health concerns associated with recreational activities (i.e., swimming, shellfish harvesting) in waters contaminated by fecal coliform (B.C. Environment, 1992).

The potential environmental impact of storm water, generated from a given urban area, is a function of the contaminant loading from the area, the amount of storm water that reaches a receiving water (versus the volume that enters the groundwater regime), and the environmental “sensitivity” of the receiving water. Therefore, areas experiencing the most growth and/or discharging to sensitive receiving waters are the most important in terms of storm water management planning. A 1993 District of Sechelt drainage study (Dayton & Knight, 1993) identified Sechelt Inlet, Porpoise Bay and large fish bearing creeks as environmentally sensitive areas.

The majority of development in the LWMP area over the next 20 years is expected to be in West Sechelt and Sechelt Village, and the Terraces Development east of Sandy Hook. Most of the new development in West Sechelt and Sechelt Village would occur in large, presently undeveloped, comprehensive development areas such as Mariner’s Watch. Storm water from these areas would be discharged into Trail Bay. A key issue for these developments, given the large land areas, would be maintaining post-development stream flows to pre-development levels so as to minimize erosion of the natural channels. This may be accomplished through a combination of technologies such as grass swales, retention ponds and storm sewers with outlets discharging to Trail Bay. Environmental impacts to Trail Bay would likely be minimal given the available flushing of Trail Bay with water from Georgia Strait. The Terraces Development proposes to use various storage ponds to provide retention of storm flows and sedimentation to minimize impacts to Shannon Creek and Porpoise Bay (Hamilton Associates, 1994).

Most of the new development, in the following 20 to 40 years, is expected to occur in Sandy Hook, East and West Porpoise Bay, and Davis Bay. The large comprehensive development areas in the former three areas may significantly increase pollutant loading to Porpoise Bay. The use of Best Management Practices (BMP’s), discussed in Section 14.3, may need to be applied to storm water generated in these areas given the potential environmental sensitivity of Porpoise Bay. Runoff originating from newly developed areas in Davis Bay would eventually discharge into Davis Bay and, similar to Trail Bay, would probably not be significantly impacted.

19.2 DESCRIPTION OF EXISTING FACILITIES

Sechelt Village and SBL 2 are the only areas within the LWMP study area that presently use storm sewers for collection and disposal of runoff. Storm water from Sechelt Village is discharged into Trail Bay and Porpoise Bay through outlets at the following locations (Dayton & Knight, 1993; Ashford & Associates, 1990):

- Trail Bay at Ocean Avenue;
- Trail Bay at Inlet Avenue;
- Porpoise Bay at Anchor Road; and,
- Porpoise Bay at Trident Avenue.

Storm water from SBL 2 is discharged through two outlets: one into Trail Bay, with the second into Porpoise Bay.

The remaining developed areas within the District of Sechelt and SBL's utilize open ditches and culverts for storm water collection and disposal.

There are no combined storm water/sanitary wastewater sewers in the LWMP study area. This removes the possibility of raw sewage bypassing the Ebb Tide wastewater treatment plant and being discharged through the sanitary sewer outfall and/or the overflow outlet into Trail Bay during periods of heavy rain. Similarly, as discussed in Section 5.3, inflow and infiltration (I/I) into the sanitary sewer system appears fairly low due to the "tight" construction of the sewer system. This also reduces the possibility of raw sewage bypassing the Ebb Tide plant, during periods of high precipitation, and being discharged into Trail Bay.

19.3 STORM WATER MANAGEMENT STRATEGY

The Ministry of Environment, Lands and Parks (MELP) has recognized the significance of non-point sources of pollution on receiving water quality, and considers storm water a valuable resource that should be conserved for use by aquatic life (Roberge and Wetter, 1995). To meet this objective, the MELP's approach is to maximize contaminant removal from storm water via source controls and education. More specifically, the source control methods would involve:

- seeking ways to minimize the production of pollutants; and,
- attempting to prevent contact of storm water with pollutants.

The realities of storm water runoff dictate that, regardless of source control measures, some degree of storm water contamination will occur. These situations would require the application of Best Management Practices (BMP's) that are essentially storm water treatment technologies (B.C. Environment, 1992):

- physical treatment BMP's:
  - oil/water separators,
  - swirl concentrators,
  - helical bend regulators,
  - dry ponds and,
  - extended detention dry ponds;

- physical-chemical treatment BMP's:
  - alum,
  - ferric chloride,
  - lime (calcium hydroxide) and,
  - chorine;

- biologically enhanced treatment BMP's:
  - wet ponds,
  - constructed wetlands,
  - biofiltration, including vegetated swales, filter strips and small wetlands and,
  - infiltration practices, including infiltration basins, infiltration trenches, porous pavements, concrete grid and modular pavements;

- urban forestry;

- treatment BMP's for highway runoff:
  - eliminate curbs,
  - strengthen litter enforcement,
  - control pesticides and herbicides,
  - avoid direct discharge,
  - reduce runoff velocities,
  - utilize grassed swales,
  - filter strips and,
  - vegetated rights of way.

Other considerations include long term maintenance and the long term fate of pollutants captured in the BMP's.

19.4 IMPLEMENTATION

The District of Sechelt is currently in the process of updating the 1993 drainage study, and the existing District subdivision control bylaw requires the installation of curbs and gutters with underground storm sewers in new development areas (OCP, 1996). These measures can form part of a larger overall storm water management plan for the LMWP study area. A comprehensive, long term Urban Storm Water Control Plan (USCP), formulated under the direction of the MELP, would provide a framework to identify storm water issues, information requirements and an overall strategy for storm water planning. The USCP could then be used for identifying specific storm water management requirements for new and existing developments. The following discussion provides a summary of topics, suggested by MELP, that should be addressed as part of a USCP (Roberge and Wetter, 1995).

The USCP would define environmental goals, and the methods and strategy used to achieve them. This would include priorizing areas with respect to environmental protection needs and formulating an evaluation strategy for monitoring the effectiveness of the plan. An important part of the plan would be providing education to both the public and private sectors, and allowing them to participate in the planning process. The USCP would also seek to obtain statements of concurrence from cooperating agencies.

The USCP would essentially update the 1993 drainage study in terms of identifying existing storm water collection and disposal facilities, and providing estimations of runoff volumes generated in the various drainages within the study area. Inspection schedules would be formulated that could then be used to identify inappropriate storm water connections. A storm water quality and environmental impacts monitoring plan would also be outlined.

In keeping with the overall philosophy of storm water management, proposed source controls for industrial, commercial and construction activities would be identified that could minimize the contaminant loading in storm water. By-laws would be one method of implementing source control; inspection and enforcement procedures would have to be developed in conjunction with proposed bylaws. Areas where land use restrictions would enhance BMP's used to treat storm water should be identified. The plan should also identify ways to deal with potentially contaminated sediments collected from treatment

BMP's. Finally, the USCP should outline funding of plan implementation and maintenance, and costs associated with controls presented in the plan.

The District and S.I.G.D. continue to assess and upgrade their storm water management systems. In order to incorporate storm water management into the overall liquid waste management plan, the District and S.I.G.D. should implement storm water management practices consistent with those described in the LWMP.

PUBLIC INVOLVEMENT

SECTION 20

The successful management of wastewater requires input from not only representatives of the municipalities and communities involved and the provincial government, but also the residents and industries who generate the waste. The LWMP requires a team effort, creating a co-operative, as opposed to a confrontational environment. Co-operation needs to be fostered through public information forums and dialogue, selected use of electronic and printed media, and by encouraging representation of all interested groups in the appropriate Public and Technical Advisory Committees.

The SSFC solicited public involvement in the Stage 2 LWMP in two ways. Firstly, the SSFC formed a Public Advisory Committee (PAC) at the onset of the project. To facilitate discussion with members of the Technical Advisory Committee (TAC), both committees were amalgamated to form the Joint Technical and Public Advisory Committee (JTPAC). During the Stage 2 portion of the LWMP, the JTPAC met twelve times and had approximately thirty-six hours of discussion with District staff and the consultant team. Topics of presentation and discussion included identification of wastewater management issues, working paper review and draft Stage 2 report review. Following each meeting, the consultant team or District distributed meeting minutes to the JTPAC members. The meeting minutes are available under separate cover from the District of Sechelt.

Secondly, the District conducted Public Information Meetings (PIM) held on March 25, 1997, June 23, 1998 and February 7, 1999 at the Sechelt Seniors Hall. Notices of the meetings were advertised in various media. The meetings included:

- An open house segment to allow members of the public to talk one-on-one with District Staff, LWMP committee members and the LWMP consultant.
- Presentation by a MOELP representative about the LWMP process.
- Presentation by the consultant on the Stage 2 activities and draft report.
- Question and answer session.

Approximately seventy people attended the March 1997 meeting, with a similar number in attendance at the June 1998 and February 1999 meetings. Each person attending the public information meetings received an informational handout and a questionnaire (Appendix D). Appendix D also contains a summary of questionnaire results.

During the course of the Stage 2 LWMP, the draft Stage 2 report has been revised based on comments received from the JTPAC membership and the general public to yield the final Stage 2 report.

SUMMARY

SECTION 21

The final Stage 2 LWMP report is the product of almost three years of intensive consultation with various stakeholders represented by the Joint Technical and Public Advisory Committee and the general public. The SSFC Steering Committee has recommended that this document be forwarded to the MELP.

> **Chapters 1 through 7** provide a comprehensive discussion of wastewater management issues that impact the LWMP and, where appropriate, provide direction on the alternative courses of action.
>
> **Chapter 8** discusses the two major disposal methods, marine disposal and land disposal, with reference to the comprehensive appendices that cover these alternatives.
>
> **Chapter 9** presents the philosophy behind the development of the options for wastewater management and establishes the parameters used for the formulation of the options.
>
> **Chapters 10 through 17** present the concepts, design parameters, and required components for the eight wastewater management options. The estimated capital and annual operating and maintenance costs over the 40-year period are also included in these chapters.
>
> **Chapter 18** provides a comparison of the options on an economic and non-economic basis. The chapter concludes with the recommended selection of Option 2-E for implementation.
>
> **Chapter 19** gives an overview of the storm water issues in the LWMP area and suggests a direction for comprehensive urban storm water planning for future development.
>
> **Chapter 20** describes the public involvement activities undertaken during the Stage 2 LWMP process.

The **Stage 3 report** will be a further development of the adopted Option 2-E LWMP strategy focusing in particular on the financial planning aspects of implementing the LWMP.

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OCEANOGRAPHIC MODELLING - SEACONSULTANT

APPENDIX

A

LAND DISPOSAL REPORT - GOLDER ASSOCIATES

APPENDIX
B

ECONOMIC ANALYSES

APPENDIX C

PUBLIC INFORMATION MEETING QUESTIONNAIRES AND SUMMARY OF RESPONSES

APPENDIX

D