Report

District of Summerland

Waste Management Plan
Stage II Report

June 1991

ASSOCIATED ENGINEERING

ASSOCIATED
ENGINEERING (B.C.) LTD.

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June 27, 1991
File: VD92

The Corporation of the District
of Summerland
P.O. Box 159
SUMMERLAND, B.C.
V0H 1Z0

Attention: W.S. Fleming
Administrator

Dear Sirs:

Re: Waste Management Plan
Stage II Report

We are pleased to present fifteen (15) copies of our report entitled, Waste Management Plan - Stage II, June 1991. A further five (5) copies have been sent directly to the Ministry of Environment. A summary of the report is contained in the Executive Summary.

It has been a pleasure working with District staff on this project. We look forward to providing continued engineering services in the future.

Respectfully submitted,

ASSOCIATED ENGINEERING (B.C.) LTD.

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
J. R. E. CORBETT

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JREC/arp/Re.1

Enclosure

cc: P. Epp - OKWater, Penticton (5 copies)

EXECUTIVE SUMMARY

The District of Summerland, a farming and residential community of approximately 8,000 persons, is located in the Okanagan Valley of British Columbia. The District of Summerland is unique in the Okanagan Valley in that it has an urban core of some 5,000 persons utilizing on-site disposal. This situation has developed because the Town Centre is located on very permeable sands and gravels. If the soils had been less permeable, community sewers would likely have been constructed many decades ago. The lack of a community sewerage system is restricting redevelopment of the downtown core. In addition, on-site disposal is exhibiting a significant environmental impact in terms of phosphorus transmission to Okanagan Lake and nitrate levels in the groundwater.

The objective of the Waste Management Plan (WMP) is to establish a scheme for the management of wastewater within the District of Summerland over the next several decades.

The WMP is prepared in three stages:

Stage I outlines the possible treatment and disposal methods with rough preliminary costs, including ideas received at the first public information meetings.

Stage II outlines the various options with an implementation schedule. The various options are costed out in detail to give some appreciation of short and long-range user costs. The Stage II draft was presented at a final public information meeting where further public input was solicited.

Stage III is a short overview report or executive summary which gives the recommended course of action.

STAGE I REPORT

The Stage I report entitled, Waste Management Plan, Stage I, May 1988 identified the following areas as environmentally sensitive in terms of wastewater disposal due to high phosphorus transmission rates to surface waters and/or high density of development.

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

The report also identified a number of areas that could become problem areas in terms of wastewater disposal, if development utilizing on-site wastewater disposal is not controlled.

- Front Bench
- Prairie Valley
- Cartwright Mountain

A summary of constraints on on-site disposal for the various areas was presented. In addition, the report evaluated wastewater collection, treatment, and disposal techniques that could be considered for wastewater disposal improvement. Feasible techniques were identified for further investigation in Stage II.

STAGE II REPORT

The Stage II report presents nine options for wastewater management within the WMP area. These include:

Option 1: Regional Sewerage System
Option 2A: Lake Disposal
Option 2B: Lake Disposal
Option 3A: Effluent Irrigation
Option 3B: Effluent Irrigation
Option 4: High Rate Land Disposal
Option 5: Combined Irrigation/Lake Disposal
Option 6: Cluster Systems
Option 7: Enhanced On-site Disposal/Land Use Control

Option evaluation was carried out utilizing a decision matrix technique that considers both monetary and nonmonetary factors. The two highest ranking options were:

- Option 1: Regional Sewerage System
- Option 5: Combined Irrigation/Lake Disposal

The recommendations of the Stage II report are:

.1 Options and 5 have similar overall costs, however, Option 1, Regional Sewerage System, offers a number of advantages and is believed to be the most suitable scheme from a long-term regional viewpoint.

Discussions should be held between the District, the City of Penticton, and the Province on a regional sewerage scheme. if the outcome is favourable, Option 1, with a phased approach to reduce initial costs should be pursued. In the event that a regional sewerage scheme does not appear to have support, option 5 would be the second choice.

.2 The District of Summerland will require a high level of financial support from the senior governments as the collection system infrastructure, in place in other urban areas of the Okanagan, is not in place in the District. Discussions should be held with senior government to determine available funding on both an environmental and economic development basis.

.3 In the event of a delay in implementing either Options 1 or 5, the District should adopt the land use concept of Option 7, Enhanced On-Site Disposal/Land Use Control, in order to keep phosphorus inputs to the lake at their present level and to control future development. The recommendations presented in Section 12.0 of this report should be followed in order to minimize the environmental impact of future development.

The reader should note that there was approximately a two year delay between preparation of the draft Stage II report in April 1989 and finalization of the report on completion of the WMP in June 1991. During this two year period, the District of Summerland pursued the concept of Option 1 with the City of Penticton, the Regional District of Okanagan Similkimeen, and senior levels of government. The concept did not receive support and in February, 1991, the District decided to proceed with Option 5.

The Stage II report developed the options for comparative purposes. The selected option is developed further in the Stage III report. The reader should thus refer to the Stage III report for phasing of the scheme and updated cost estimates.

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DRAWINGS

LIST OF ABBREVIATIONS

BOD	Biochemical Oxygen Demand
du	dwelling unit
ha	hectare
kg/yr	kilogram per year
km	kilometer
m	metre
mg/L	milligram per litre
mm	millimetre
P	Phosphorus
SDG	Small Diameter Gravity
STEP	Septic Tank Effluent Pumping
WMP	Wastewater Management Plan

1.0 INTRODUCTION

1.1 WASTEWATER MANAGEMENT PLAN OBJECTIVES

The District of Summerland, a farming and residential community of some 8,000 persons, is located in the Okanagan Valley of British Columbia (Figures 1-1 and 1-2).

Wastewater management throughout the District is by on-site disposal utilizing primarily septic tanks and tile fields.

The Okanagan Basin Study in the early 1970's and subsequent updates have identified residential septic tanks/tile fields as a significant phosphorus source in areas where a combination of permeable soils, shallow depth to groundwater, and close horizontal proximity to surface waters allow high phosphorus transmission rates.

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

The objectives of the WMP are:

- To identify and review the wastewater management alternatives that are capable of adequately removing phosphorus and that are technically available to existing and potential development in Summerland and to select the technically feasible alternatives for detailed analysis.

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

- To 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 alternative funding and cost-sharing formulas.

- To evaluate the environment, social, public health, engineering, operational and financial advantages and disadvantages of technically feasible wastewater management options.

- To select the most appropriate wastewater management option or mix of options that can be economically achieved and which can be implemented in phases to meet short and long-term environmental goals.

The WMP will be prepared in three stages:

Stage I will outline possible treatment and disposal methods with rough preliminary costs, including ideas received at the first public information meetings.

Stage II will outline the various options with an implementation schedule. The various options will be costed out in detail to give some appreciation of short and long-range user costs. The Stage II draft will be presented at a final public information meeting where further public input will be solicited.

Stage III will be a short overview report or executive summary which gives a recommended course of action.

1.2 STAGE I REPORT

The Stage I report entitled, Waste Management Plan, Stage I, May 1988 identified the following areas as environmentally sensitive in terms of wastewater disposal due to high phosphorus transmission rates to surface waters and/or high density of development.

.1 Lower/Upper Trout Creek
.2 Town Centre
.3 Lower Town/Peach Orchard Road
.4 Crescent Beach
.5 Garnett Valley

The report also identified a number of areas that could be become problem areas in terms of wastewater disposal, if development utilizing on-site wastewater disposal is not controlled.

.1 Front Beach
.2 Prairie Valley
.3 Cartwright Mountain

A summary of constraints on on-site disposal for the various areas is presented in Table 1-1. In addition, the report evaluated wastewater collection, treatment, and disposal techniques that could be considered for wastewater disposal improvement. Feasible techniques were identified for further investigation in Stage II and are summarized in Table 1-2.

1.3 METHODOLOGY

The methodology adopted for Stage II of the WMP is as follows:

.1 Formulate a series of wastewater management options for the areas identified in Stage I.

.2 Carry out a present worth economic analysis of the options and calculate annual user costs based on a number of senior government cost sharing scenarios.

.3 Present a cost-benefit analysis utilizing a numerical matrix approval for monetary and non-monetary factors.

.4 Hold a technical workshop and public information meeting to present the above options and obtain input from government agencies and the public as to the preferred options.

.5 Finalize Stage II report.

1.4 PUBLIC PARTICIPATION

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

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

Input from the public will be solicited at a number of occasions during the development of the Stage II WMP.

.1 Public information meeting and questionnaire during Stage II.

.2 A response to written comments submitted by the public in the Stage II report.

.3 Public availability of all final reports at each stage and the opportunity throughout the preparation of the WMP to discuss concerns and approaches with District of Summerland and Ministry of the Environment personnel.

1.5 ESTIMATED COSTS

All costs presented in the WMP are based on early 1990 dollars. This reflects an Engineering News Record (ENR) Index of 4700.

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 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.

Unit cost data and cost assumptions for the various options are presented in Appendix A.

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.

TABLE 1-1

SUMMARY OF WMP AREAS AND CONSTRAINTS ON ON-SITE WASTEWATER DISPOSAL

AREA	1985 POPULATION[5]	PROJECTED 1996 POPULATION[5]	PHOS-PHORUS LOADING TO LAKE[6]	PERCENTAGE OF TOTAL P TRANSMISSION TO OKANAGAN LAKE[1]	PERCENTAGE P REMOVAL ACHIEVED[1]	CONSTRAINTS ON ON-SITE DISPOSAL	POTENTIAL FOR FUTURE DEVELOPMENT[2]	ENVIRONMENTAL SENSITIVITY	
								EXISTING DEVELOPMENT	FUTURE DEVELOPMENT
Lower Trout Creek	555	601	335	20	53	High P transmission due to coarse soils and high groundwater	High	Very High	Very High
Upper Trout Creek	214	208	83 418	7	70	High P transmission due to coarse soils and high groundwater	Moderate	High	Very High
Paradise Valley/ Southwest Summerland	405	637	36	2	93	None	Low	Low	Low
Front Bench	778	1653	118	5	88	Fine grain soils down gradient from coarse soils; cliff stability	High	Low	High
Prairie Valley	400	485	9	4	63	Fine grain soils and high groundwater	Low	Moderate	High
Town Centre	3600	3940	550	29	87	Limited lot area for tile fields due to high density	High	High	Very High
Lower Town/Peach Orchard Road . Lower Town . Peach Orchard Road	970[3]	1003[3]	 126 116	 7 7	 17 19	High P transmission due to proximity to lake; cliff stability	 High High	 Very High Moderate	 Very High High
Crescent Beach/Highway 97 . Crescent Beach . Highway 97	480[4]	692[4]	 138 92	 6 4	 17 79	High P transmission due to proximity to lake; cliff stability	 Low Moderate	 Very High Low	 Very High Moderate
Garnett Valley	345	340	147	9	66	High P Transmission due to coarse soils and proximity to Eneas Creek	Low	High	High
Cartwright Mountain/ North Prairie Valley	23	94	4	<1	88	Shallow bedrock/steep topography (Cartwright Mountain)	Moderate	Low	High

Notes:

1. Based on 1985 population. Overall percentage phosphorus removal achieved is 81 percent.
2. If wastewater disposal is no longer a constraint.
3. Total population for Lower Town and Peach Orchard Road.
4. Total population for Crescent Beach and Highway 97.
5. Total 1985 and 1996 populations are 7,700 and 9,643 persons, respectively.
6. Loading in kilograms per year for 1985 population. Total loading is 1836 kg/year.

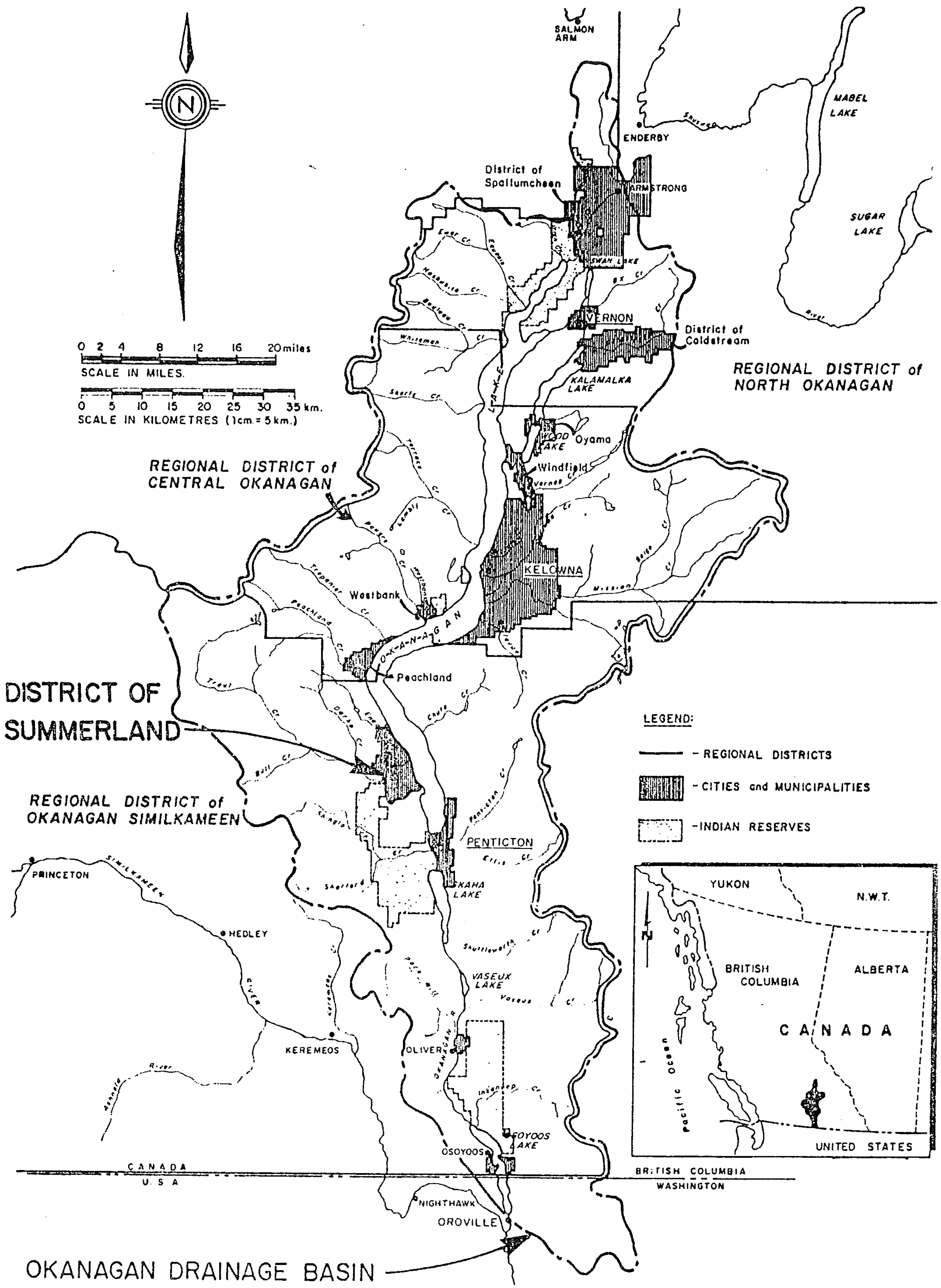
TABLE 1-2

SUMMARY OF WASTEWATER MANAGEMENT UPGRADING TECHNIQUES

TECHNIQUE	SELECTED FOR FURTHER INVESTIGATION IN STAGE II				
	LOWER/UPPER TROUT CREEK	TOWN CENTRE	LOWER TOWN/ PEACH ORCHARD RD.	CRESCENT BEACH	GARNETT VALLEY
1.0 ON-SITE DISPOSAL					
. Modification for Enhanced Nutrient Removal	Yes	No[1]	Yes	Yes	Yes
2.0 COLLECTION					
. Conventional Gravity Sewers	Yes	Yes	Yes	Yes	No[2]
. Pressure Sewers	Yes	No[3]	Yes	Yes	No[2]
. Vacuum Sewers	No[4]	No[4]	No[4]	No[4]	No[2]
. Small Diameter Gravity Sewers	Yes	No[3]	Yes	Yes	No[2]
3.0 TREATMENT					
. Preliminary Treatment	No[5]	No[5]	No[5]	No[5]	No[2]
. Primary Treatment (Community Septic Tank)	Yes	Yes	Yes	Yes	No[2]
. Biological Treatment					
- Fixed Growth Systems	Yes	Yes	Yes	Yes	No[2]
- Suspended Growth Systems	Yes	Yes	Yes	Yes	No[2]
. Phosphorus Removal					
- Chemical Precipitation	Yes[6]	Yes[6]	Yes[6]	Yes[6]	No[2]
- Luxury Uptake, i.e., Bardenpho	Yes[6]	Yes[6]	Yes[6]	Yes[6]	No[2]
. Nitrogen Removal					
- Nitrification/ Denitrification	Yes[6]	Yes[6]	Yes[6]	Yes[6]	No[2]
- Ion-exchange	No[7]	No[7]	No[7]	No[7]	No[2]
- Air-stripping	No[7]	No[7]	No[7]	No[7]	No[2]
- Breakpoint Chlorination	No[7]	No[7]	No[7]	No[7]	No[2]
. Nutrient Removal by Polishing Ponds	No[8]	No[8]	No[8]	No[8]	No[2]
. Disinfection	Yes	Yes	Yes	Yes	No[2]
4.0 DISPOSAL					
. Subsurface Fields	Yes	No[1]	Yes	Yes	No[2]
. Rapid Infiltration	Yes	Yes	Yes	Yes	No[2]
. Effluent Irrigation	Yes	Yes	Yes	Yes	No[2]
. Overland Flow	No[9]	No[9]	No[9]	No[9]	No[2]
. Conversion to Snow	No[10]	No[10]	No[10]	No[10]	No[2]
. Okanagan Lake	Yes	Yes	Yes	Yes	No[2]
5.0 REGIONAL SEWERAGE SYSTEM	Yes	Yes	Yes	Yes	Yes

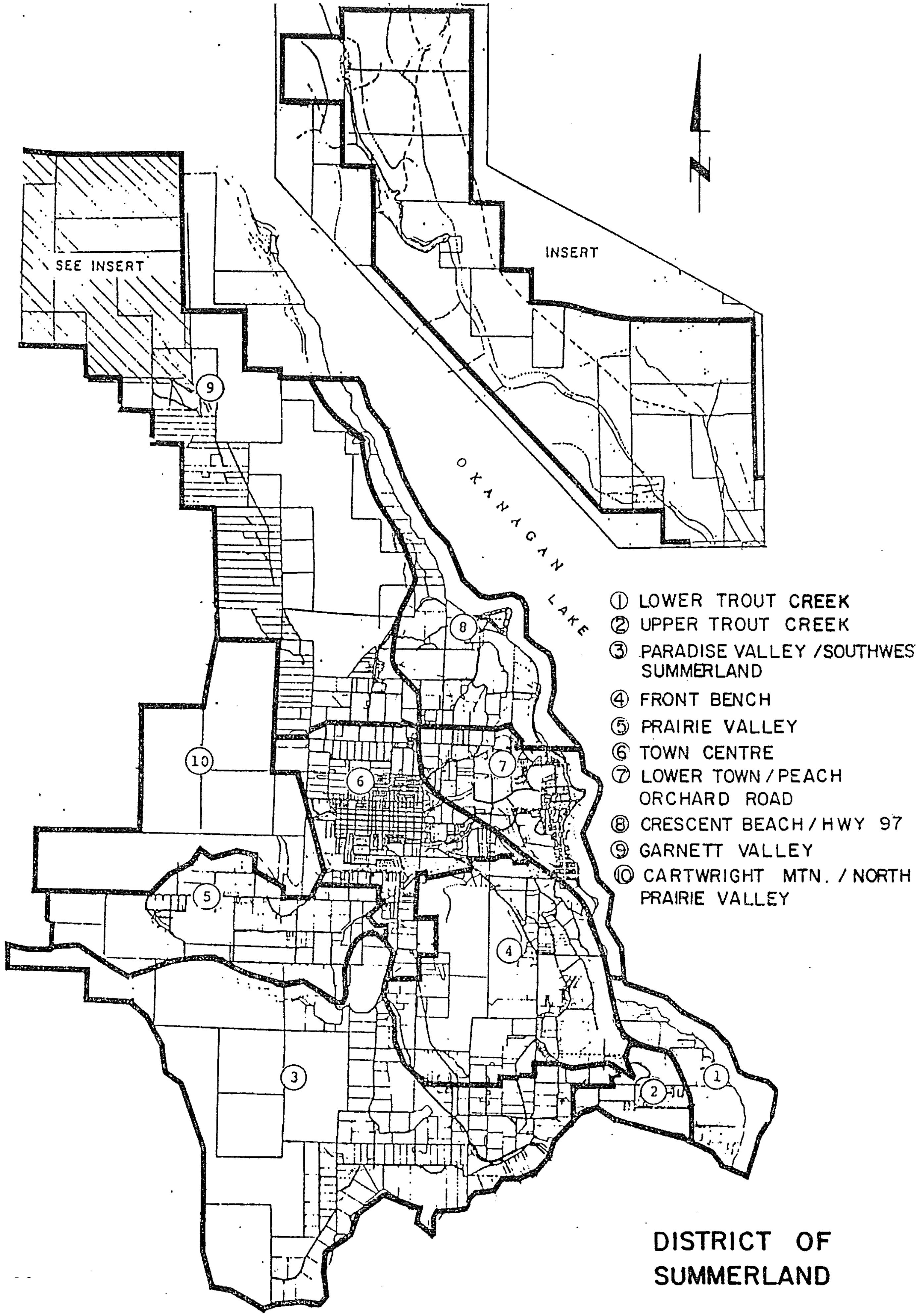
Notes:

1. Insufficient area for tile fields in commercial area.
2. Density of development is too low for a community collection, treatment, and disposal system.
3. High density of development in the commercial area favours the use of conventional gravity sewers.
4. Vacuum sewers are rejected due to high cost and complexity.
5. Does not provide a sufficient degree of treatment by itself.
6. With disposal to Okanagan Lake.
7. Rejected due to operational problems and/or high cost.
8. Rejected due to inconsistent cold weather performance.
9. Rejected due to the need for winter storage and difficulty with tailwater disposal.
10. Rejected due to inconsistent performances and lack of suitable climate/ disposal area.



LOCATION PLAN

FIG. 1-1



DISTRICT OF SUMMERLAND

FIG. 1-2

2.0 DEVELOPMENT OF WASTEWATER MANAGEMENT OPTIONS

2.1 DESIGN PARAMETERS

.1 Design Populations

The design year selected for the formulation of options is the 2008, or about 20 years in the future.

As the community plan has only estimated growth in the subareas to 1996, subarea populations are assumed to increase in the same ratio as the overall selected growth rate of 1.5 percent per annum. The populations assumed are shown in Table 2-1.

Growth will occur through a combination of in-filling, redevelopment, and new development. The impact of the particular wastewater management option on land use and future growth is discussed in the subsequent sections. Options incorporating a community sewerage system could result in increased growth rates in excess of those predicted. A community sewer system could also change the pattern on future development with increased development occurring in the sewered area.

.2 Per Capita Wastewater Flows

An average annual wastewater generation rate of 375 L/d per capita is assumed for community wastewater collection, treatment, and disposal systems serving a mixture of residential, commercial, and industrial areas. Smaller, cluster systems serving primarily residential areas assume an average annual generation rate of 300 L/d per capita.

2.2 EFFLUENT DISPOSAL CRITERIA

The Pollution Control Objectives for Municipal Type Waste Discharges in British Columbia, September 1975 are utilized as a basis for determining the effluent disposal criteria for the various options, with the following exceptions:

.1 Effluent discharged to Okanagan Lake requires a total phosphorus removal of 95 percent, or about 0.5 mg/L effluent concentration. Nitrogen removal is also assumed to be required.

.2 Effluent irrigation of orchard crops may be permitted in the future. It is assumed that secondary treatment followed by filtration and disinfection will be the minimum treatment requirement.

2.3 DEVELOPMENT OF OPTIONS

The options proposed are presented in Sections 3.0 to 9.0, inclusive.

There are seven base options, labelled Options 1 through 7. In addition, within Options 2 and 3 there are two sub-options. Estimated capital and annual operating and maintenance costs are presented for each option. Costing assumptions and details are contained in Appendix A.

Economic analysis of the options is presented in Section 10.0. Section 11.0 presents a decision matrix analysis to assist in option selection.

TABLE 2-1

DESIGN POPULATIONS[1]

AREA	POPULATION		
	1988	1996	2008
Lower Trout Creek	570	600	720
Upper Trout Creek	210	210	250
Paradise Valley/Southwest Summerland	460	640	765
Front Bench	960	1,700	1,980
Prairie Valley	420	490	580
Town Centre	3,690	3,940	4,750
Lower Town	260	270	325
Peach Orchard Road	720	730	880
Crescent Beach	120	145	175
Highway 97	410	540	645
Garnet Valley	345	345	415
Cartwright Mountain/North Prairie Valley	35	90	115
TOTAL	8,200	9,700	11,600

Note:

1. Population projections are based on extrapolation from the community plan growth rates that assume continued on-site disposal. Growth areas could change with options utilizing community sewerage systems.

3.0 OPTION 1: REGIONAL SEWERAGE SYSTEM

3.1 CONCEPT

Option 1 is a regional sewerage system that would collect raw wastewater from the Town Centre, Lower Town/Peach Orchard Road, Crescent Beach, and Trout Creek and pump it to the City of Penticton sewerage system. The option layout is shown in Drawing No. VD92-20-101.

The design population (Year 2008) is 7100 persons. The capacity could be increased beyond the year 2008 by increasing pump capacity or by adding an intermediate booster pumping station. It is assumed that the system would be in place by 1993.

The remainder of the study area would utilize on-site disposal.

.1 Collection

Wastewater from the sewerage area would be collected in a series of conventional gravity sewers and small pumping stations, eventually discharging to two larger pumping stations located in Lower Trout Creek and near the intersection of Highway 97 and Lakeshore Drive. The collected wastewater would be pumped from the two stations in a common pressure force main to the City of Penticton wastewater treatment plant.

The Trout Creek pumping station would be a duplex submersible station equipped with two 25 kW pumps. Each pump would have a capacity of 16 L/s at a TDH of 35 m and would be capable of handling 100% of the peak inflow.

The Highway 97 pumping station would also be a duplex submersible station. The two 55 kW pumps would each have a capacity of 85 L/s at a TDH of 35 m.

Both pumping stations would contain diesel generator sets for provision of backup power in the event of a main power failure.

The force main would vary from 350 to 400 mm dia. The total length from the Highway 97 pumping station to the City of Penticton treatment plant is approximately 14,000 m. The assumed route would follow the highway as shown. The actual route selected will depend upon discussions with the Ministry of Highways, construction conditions and right-of-way acquisition.

Due to limited capacity in the City of Penticton gravity collection system for the pumped flow, it is assumed that the force main would continue to the plant. Alternatively, the capacity of the gravity system could be increased by twinning or replacing existing trunk sewers, presumably on a cost sharing basis with the city. Both approaches should be evaluated at the preliminary engineering stage.

Due to the length of the force main, control of hydrogen sulphide generation to prevent odour problems at the treatment plant will be required. It is assumed that this will be accomplished by injection of a chemical oxidant such as chlorine, hydrogen peroxide, or oxygen at an intermediate point along the force main.

.2 Treatment and Disposal

No treatment would be provided by the District of Summerland.

The wastewater would be treated at the City of Penticton advanced wastewater treatment plant and discharged to the Okanagan River between Okanagan and Skaha Lakes. The plant is currently being upgraded to employ both phosphorus and nitrogen removal and long-term plans call for disposal of a portion of the effluent by irrigation.

3.2 DISCUSSION

It should be emphasized that approval to discharge to the City of Penticton sewerage system has not been obtained from the city nor have comprehensive discussions been held. This option is presented in order to compare the economics and the advantages/disadvantages of a regional management approach with an independent community wastewater management system for the District of Summerland.

In reviewing this option, regional wastewater management offers a number of advantages:

.1 A single treatment facility offers economy of scale. Both the capital and operating cost per litre of wastewater treated is reduced relative to the use of two separate plants.

.2 The discharge of effluent to either the lake or to the land in the Summerland area would be eliminated. This is attractive in reducing the phosphorus loading to Okanagan Lake.

The disadvantage of this option is that there is an increased quantity of effluent discharged to the Okanagan River channel north of Skaha Lake, increasing the nutrient load to the lake.

This option would remove any constraints on growth imposed by waste-water disposal. Residential, commercial, land industrial growth could proceed in accordance with desired planning criteria. This option in fact could lead to pressure to increase development densities in order to decrease the per capita cost of the sewerage system.

An effective phosphorus removal of 100 percent in the area serviced by the regional sewerage system. The overall phosphorus removal for the study area, neglecting the input from the Penticton wastewater treatment plant is 95 percent. If the actual input to Okanagan/ Skaha Lake system is considered, phosphorus removal would be the same as Option 2A.

3.3 ESTIMATED COSTS

The estimated capital and annual operations and maintenance costs for this option are shown in Tables 3-1 and 3-2, respectively.

The annual operation and maintenance costs include an annual user charge paid to the City of Penticton. This charge covers annual debt repayment and operational and maintenance costs for the city treatment and disposal system. The cost is calculated based on the selected Option 3 of the City of Penticton Waste Management Plan (1)* updated to recent plant phasing and construction costs and the addition of the District of Summerland flows.

With a City of Penticton only scenario, the next plant upgrading is scheduled for the year 2006. As the addition of Summerland increases the flow to the plant, this upgrading would be required sooner. Based on the schedule shown, the next phase of plant upgrading would be required in 1998.

The calculated user cost for the city and Summerland combined scheme is about $2/yr per user less than the city only scenario up to the 1998. Between 1998 and 2006, the overall user cost with the combined approach would be about $1 to 2/yr per user higher than a city only scheme due to the plant upgrading. After 2006, the user cost for the combined scheme would again be less than the city only approach.

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*Numbers in brackets refer to the list of references at the end of the report.

TABLE 3-1

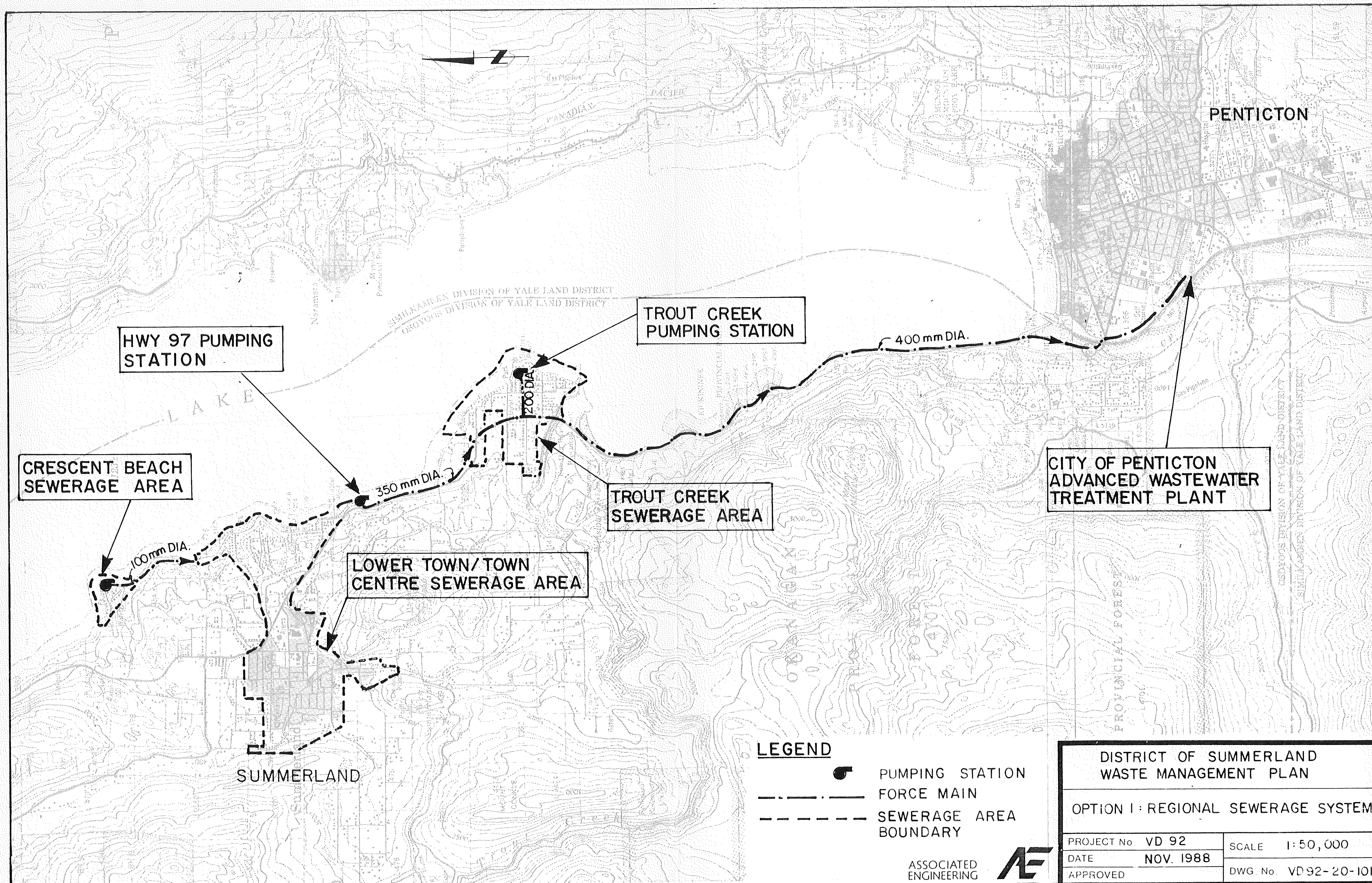
ESTIMATED CAPITAL COST
OPTION 1: REGIONAL SEWERAGE SYSTEM

COMPONENT	YEAR OF CONSTRUCTION	COST ($)
1.0 COLLECTION SYSTEM		
.1 Town Centre	1992	5,900,000
.2 Lower Town/Peach Orchard Road	1992	2,500,000
.3 Crescent Beach	1992	500,000
.4 Trout Creek	1992	2,000,000
2.0 MAIN PUMPING STATIONS		
.1 Trout Creek PS	1991	250,000
.2 Highway 97 PS	1991	750,000
3.0 FORCE MAIN TO PENTICTON	1991	3,300,000
SUBTOTAL		15,200,000
25% ENGINEERING AND CONTINGENCY ALLOWANCE		3,800,000
TOTAL - OPTION 1		19,000,000

TABLE 3-2

ESTIMATED OPERATION AND MAINTENANCE COSTS
OPTION 1: REGIONAL SEWERAGE SYSTEM

COMPONENT	ANNUAL O & M COST			
	1993	1998	2003	2008
Labour	60,000	60,000	60,000	60,000
Power	8,800	9,100	9,500	9,800
Chemicals	6,400	6,800	7,300	7,800
Maintenance	47,000	47,000	47,000	47,000
User Charge	304,000	386,000	376,000	366,000
TOTAL - OPTION 1	426,200	508,900	499,800	490,600



PENTICTON
TROUT CREEK PUMPING STATION
HWY 97 PUMPING STATION
400 mm DIA.
200 DIA.
CRESCENT BEACH SEWERAGE AREA
350 mm DIA.
TROUT CREEK SEWERAGE AREA
CITY OF PENTICTON ADVANCED WASTEWATER TREATMENT PLANT
100 mm DIA.
LOWER TOWN/TOWN CENTRE SEWERAGE AREA
LAKE
SUMMERLAND
LEGEND
PUMPING STATION
FORCE MAIN
SEWERAGE AREA BOUNDARY
ASSOCIATED ENGINEERING
DISTRICT OF SUMMERLAND WASTE MANAGEMENT PLAN
OPTION I : REGIONAL SEWERAGE SYSTEM
PROJECT No. VD 92
DATE NOV. 1988
APPROVED
SCALE 1:50,000
DWG. No. VD92-20-101

4.0 OPTION 2: LAKE DISPOSAL

4.1 CONCEPT

Option 2A would collect the wastewater from the Town Centre, Lower Town/Peach Orchard Road, Crescent Beach, and Trout Creek and direct it to an advanced wastewater treatment plant at Trout Creek. Treated effluent from the plant would be discharged to Okanagan Lake via a long, deep outfall. The Option 2A layout is shown in Drawing No. VD92-20-102.

Option 2B would be similar except that only lake front areas, i.e., Lower Town, Crescent Beach, and Lower Trout Creek, would be serviced. The Option 2B layout is shown in Drawing No. VD92-20-103.

The design population (Year 2008) for Option 2A and Option 2B are 7100 persons and 1250 persons, respectively. It is assumed that the system would be in place by 1993.

The remainder of the study area would utilize on-site disposal.

.1 Collection

Wastewater from the sewerage area would be collected in a series of conventional gravity sewers and small pumping stations, eventually discharging to two larger stations located in Lower Trout Creek and near the intersection of Highway 97 and Lakeshore Drive. The collected wastewater would be pumped from the two stations to the treatment plant located in Lower Trout Creek.

Both pumping stations would contain diesel generator sets for provision of backup power in the event of a main power failure.

.2 Treatment

The plant could be located in either Upper or Lower Trout Creek. For the purpose of developing this option, it is assumed that the plant for both Options 2A and 2B would be located between Highway 97 and the lakeshore in Lower Trout Creek. An area of approximately 3.0 ha is required to provide for suitable landscaping and buffering from residential areas and for future expansion.

As the majority of property in the area is privately-owned, agriculturally-zoned land, purchase of a suitable site will be required. No evaluation of property has been carried out in this study. The site shown is schematic only. If the plant site is located on lands within the ALR, exclusion from the ALR would be required.

The treatment plant will incorporate advanced wastewater treatment technology to obtain the effluent quality required. At this time, it is assumed that the plant would incorporate biological phosphorus and nitrogen removal technology, such as Bardenpho, backup alum precipitation, and final filtration to produce phosphorus effluent concentrations of less than 0.5 mg/L. Chlorination/dechlorination would be provided for effluent disinfection. The expected effluent quality from the plant is shown in Table 4-1.

Sludge management is assumed to be by on-site thickening followed by off-site composting. The final product will be suitable for use as a soil conditioner.

The plant would be designed to allow for a 100 percent expansion of capacity in the future. The architecture of the plant would be compatible with the surrounding development and the site would be landscaped with berms and treed areas to isolate the facility from the surrounding area.

.3 <u>Disposal</u>

Disposal of effluent would be to Okanagan Lake on a year-round basis via an outfall off Gartrell Point.

Preliminary assessment of the lake bottom contours indicates that the outfall and diffuser would be approximately 300 m in length, discharging at a depth of about 50 m.

The outfall diameter under Options 2A and 2B would be approximately 400 mm and 300 mm, respectively.

.4 <u>Discussion</u>

Option 2A services a major portion of the residential and commercial area within the District. Option 2B reduces the capital cost of the sewerage system by servicing only the lakeshore areas identified as contributing a significant degree of phosphorus to the lake. Option 2B would be designed so as to allow expansion in the future to service the Option 2A areas.

Advanced wastewater treatment and discharge to the lake effectively removes any constraints on development posed by wastewater disposal as the collection, treatment, and disposal system can be expanded to handle future growth. Once the disposal system is in place in fact, pressure to increase development densities can occur in order to reduce the per capita cost.

Advanced wastewater treatment and disposal to Okanagan Lake is practiced at the majority of communities situated along Okanagan Lake including Penticton, Westbank and Kelowna. Experience has indicated that a well designed, operated, and maintained advanced wastewater treatment and disposal system offers a reliable and economic wastewater management alternative. An effective phosphorus removal rate of approximately 95 percent would be achieved from the area serviced by the system. The overall phosphorus removal for the study area would be approximately 92 percent and 88 percent for Options 2A and 2B, respectively.

4.2 ESTIMATED COSTS

The estimated capital costs for Options 2A and 2B are shown in Tables 4-2 and 4-4, respectively. The estimated annual operating and maintenance costs for Options 2A and 2B are shown in Tables 4-3 and 4-5, respectively.

TABLE 4-2

ESTIMATED CAPITAL COST
OPTION 2A: LAKE DISPOSAL

COMPONENT	YEAR OF CONSTRUCTION	COST ($)
1.0 COLLECTION SYSTEM		
.1 Town Centre	1992	5,900,000
.2 Lower Town/Peach Orchard Road	1992	2,500,000
.3 Crescent Beach	1992	500,000
.4 Trout Creek	1992	2,000,000
2.0 TRANSMISSION		
.1 Highway 97 PS	1991	450,000
.2 Trout Creek PS	1991	150,000
.3 Force Main - Highway 97 PS to AWTP	1991	600,000
3.0 TREATMENT		
.1 Advanced Wastewater Treatment Plant	1991	4,000,000
4.0 DISPOSAL		
.1 Outfall	1991	350,000
SUBTOTAL		16,450,000
25% ENGINEERING AND CONTINGENCY ALLOWANCE		4,150,000
TOTAL - OPTION 2A		20,600,000

TABLE 4-3

ESTIMATED OPERATION AND MAINTENANCE COSTS
OPTION 2A: LAKE DISPOSAL

COMPONENT	ANNUAL O & M COST			
	1993	1998	2003	2008
Labour	170,000	170,000	170,000	170,000
Power	27,900	29,800	31,500	33,400
Chemicals	5,100	5,400	5,800	6,200
Maintenance	78,000	78,000	78,000	78,000
TOTAL - OPTION 2A	281,000	283,200	285,300	287,600

TABLE 4-4

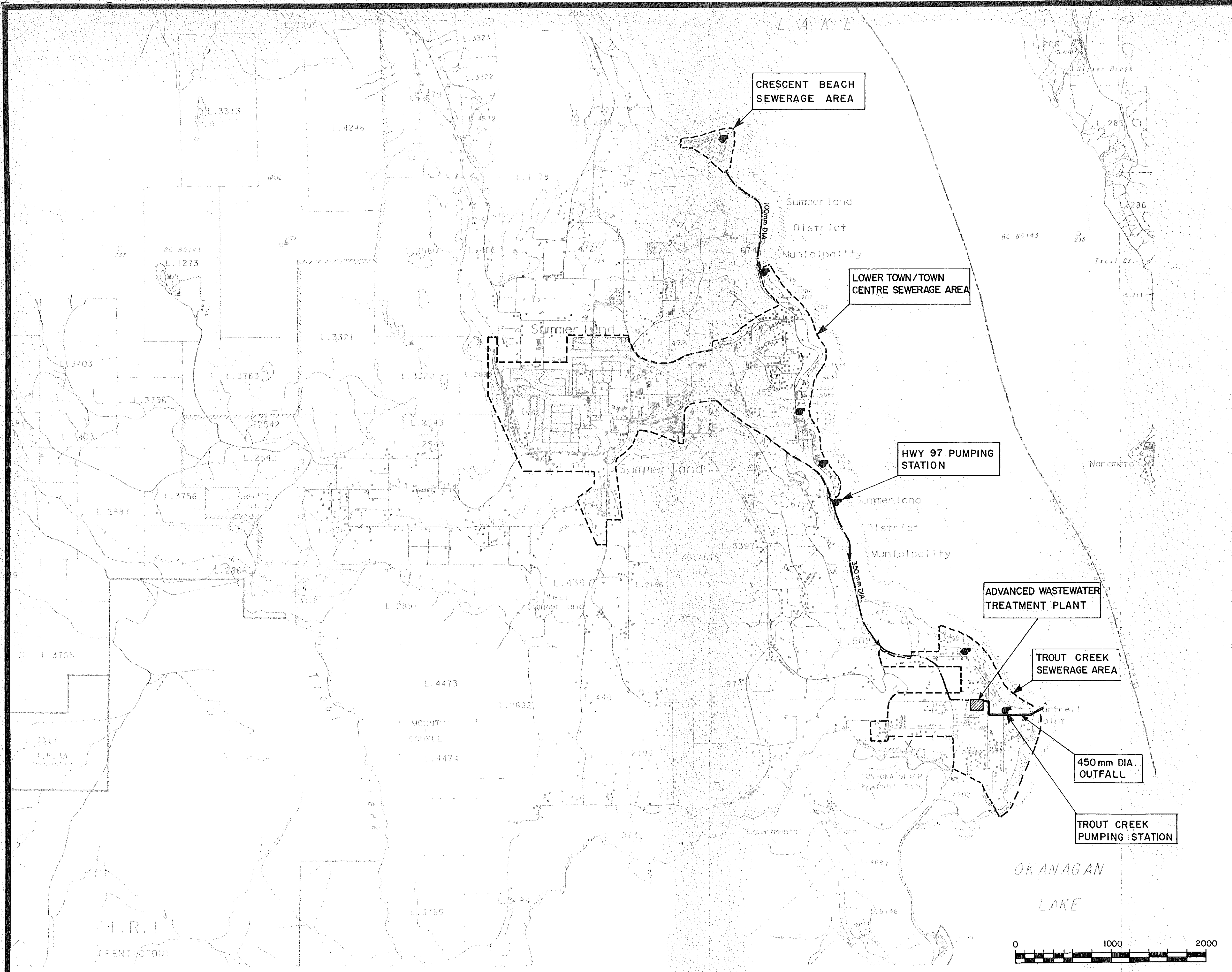
ESTIMATED CAPITAL COST
OPTION 2B: LAKE DISPOSAL

COMPONENT	YEAR OF CONSTRUCTION	COST ($)
1.0 COLLECTION		
.1 Lower Town	1992	1,000,000
.2 Crescent Beach	1992	500,000
.3 Lower Trout Creek	1992	1,400,000
2.0 TRANSMISSION		
.1 Lower Town PS	1991	150,000
.2 Trout Creek PS	1991	100,000
.3 Force Main - Lower Town PS to AWTP	1991	400,000
3.0 TREATMENT		
.1 Advanced Wastewater Treatment Plant	1991	1,200,000
4.0 DISPOSAL		
.1 Outfall	1991	250,000
SUBTOTAL		5,000,000
25% ENGINEERING AND CONTINGENCY ALLOWANCE		1,300,000
TOTAL - OPTION 2B		6,300,000

TABLE 4-5

ESTIMATED OPERATION AND MAINTENANCE COSTS
OPTION 2B: LAKE DISPOSAL

COMPONENT	ANNUAL O & M COST			
	1993	1998	2003	2008
Labour	110,000	110,000	110,000	110,000
Power	5,600	6,000	6,300	6,700
Chemicals	1,100	1,100	1,200	1,200
Maintenance	25,600	25,600	25,600	25,600
TOTAL - OPTION 2B	142,300	142,700	143,100	143,500



LEGEND

- - - - - - SEWERAGE AREA BOUNDARY

— · — · — FORCE MAIN

● PUMPING STATION

NO.	DATE	ENG.	BY	SUBJECT

REVISIONS

PROJECT NO.	VD 92
SCALE	AS SHOWN
DRAWN	V.W.
DESIGNED	J.R.C.
CHECKED	
APPROVED	
APPROVED	
DATE	NOV. 1988

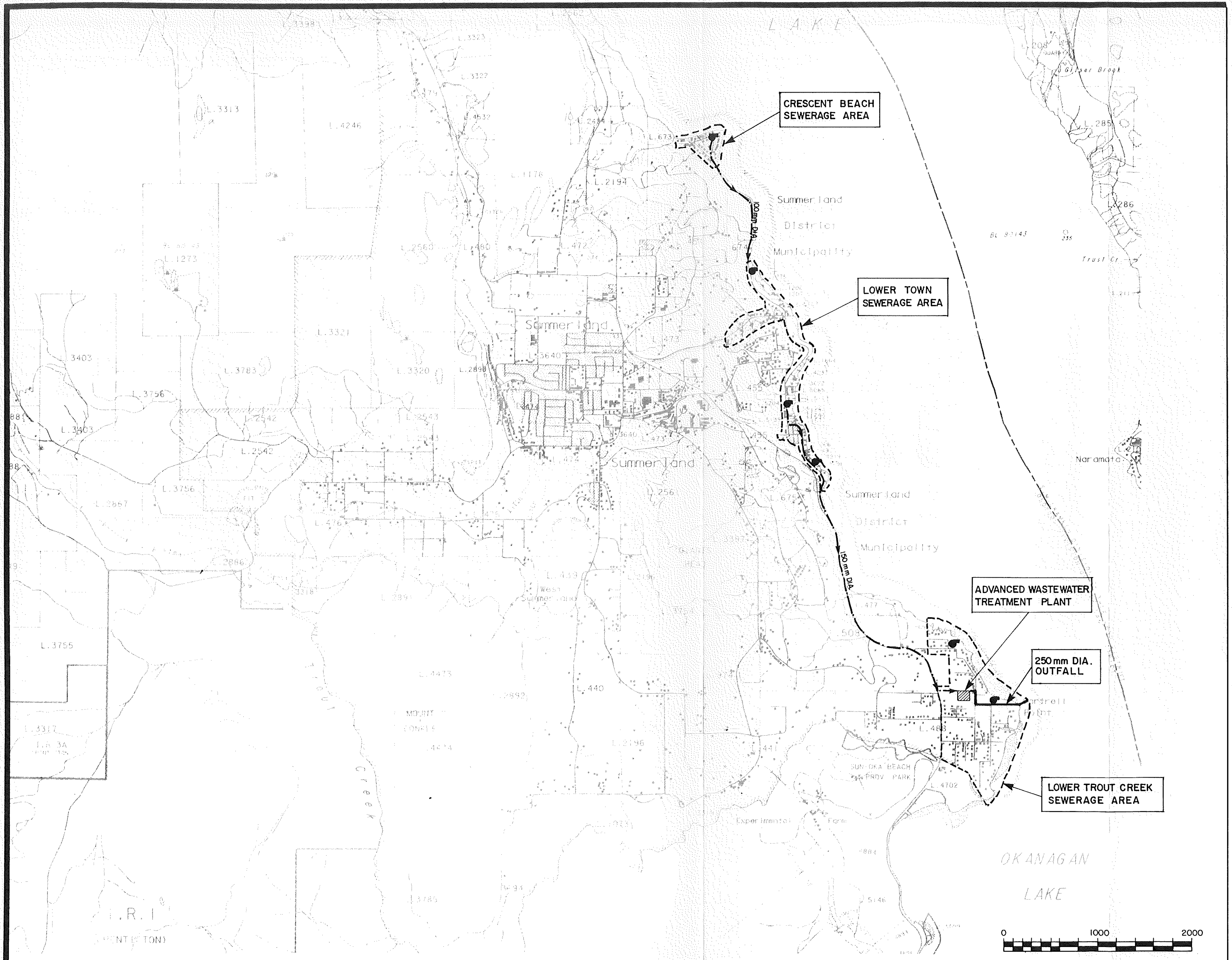
ASSOCIATED ENGINEERING

DISTRICT OF SUMMERLAND

WASTE MANAGEMENT PLAN

OPTION 2A : LAKE DISPOSAL

DRAWING NUMBER	REV. NO	SHEET
VD 92-20-102		



LEGEND

- - - - - - SEWERAGE AREA BOUNDARY
—·—·— FORCE MAIN
● PUMPING STATION

Serves - 1250 people

NO.	DATE	ENG.	BY	SUBJECT

REVISIONS

PROJECT NO.	VD 92
SCALE	AS SHOWN
DRAWN	V.W.
DESIGNED	J.R.C.
CHECKED	
APPROVED	
APPROVED	-
DATE	NOV. 1988

ASSOCIATED ENGINEERING

DISTRICT OF SUMMERLAND

WASTE MANAGEMENT PLAN

OPTION 2B: LAKE DISPOSAL

DRAWING NUMBER	REV. NO.	SHEET
VD 92 - 20 - 103		

5.0 OPTION 3: EFFLUENT IRRIGATION

5.1 CONCEPT

Option 3A is a large-scale effluent irrigation system utilizing winter effluent storage and, primarily, irrigation of orchard, grain, or forage crops. The area served by the wastewater collection system is the Town Centre, Lower Town/Peach Orchard Road, Crescent Beach, and Trout Creek. The Option 3A layout is shown in Drawing No. VD92-20-104.

Option 3B would be similar except that only the Town Centre would be serviced. The Option 3B layout is shown in Drawing No. VD92-20-105.

The concept is developed assuming that drip-irrigation of orchard crops will be allowed in the Province in the near future. Forage and grain crops or forested areas could also be irrigated under this option. Surplus effluent not utilized for irrigation would be disposed of by high-rate land application in the bench area west of the Town Centre.

The design populations (Year 2008) for Options 3A and 3B are 7100 persons and 4750 persons, respectively. It assumed that the system is in place by 1993.

The remainder of the study area would utilize on-site disposal.

.1 <u>Collection</u>

Under Option 3A, wastewater from the sewerage area would be collected in a series of conventional gravity sewers and pumping stations, eventually discharging to two larger pumping stations located in Lower Trout Creek and near the intersection of Highway 97 and Lakeshore Drive. The collected wastewater would be pumped from the two stations to a treatment plant site in Trout Creek.

Under Option 3B, wastewater from the Town Centre would be collected by conventional gravity sewers discharging to a pumping station near Highway 97. The collected wastewater would be pumped to a treatment plant east of the Town Centre.

The pumping stations would be equipped with standby diesel generator sets to prevent overflow in the event of a failure of the main power supply.

.2 Treatment

In Option 3A, the plant would be located in Upper Trout Creek. An area of approximately 2.9 ha is required to provide for suitable landscaping and buffering from adjacent development.

In Option 3B, the plant would be located east of the Town Centre near the terminus of the gravity collection system. An area of approximately 2.3 ha is required to provide for suitable landscaping and buffering.

The sites shown are schematic only as evaluation of actual sites has not been carried out.

The plant would be an aerated lagoon secondary plant. This type of process is simple to operate and provides flow equalization prior to effluent pumping. The plant would be a two-cell design with a total detention time of 15 days. The total surface area of the cells would be 1.4 ha for Option 3A and 1.0 ha for Option 3B. Aeration would be by submerged static tube aerators.

.3 Transmission and Storage

Under this option, effluent would be stored during the non--irrigation season. In addition, it is assumed that a minimum of 60 days of detention will be required at all times prior to irrigation. Assuming an irrigation season of four months, a total of ten months effluent storage must be provided as a minimum. For the design population of 7100 persons in Option 3A. This represents a live storage volume of 810,000 m^3. Option 3B would require a live storage volume of 540,000 m^3.

Potential reservoir sites were evaluated from topographic mapping and air photo analysis. Locating a reservoir of this size within the benchland surrounding the Town Centre is not practical due to residential and rural development and the generally permeable sandy/gravel soils. The closest potential reservoir site is located approximately 5 km northwest of the Town Centre at Elev. 790 m. The site is a small lake in a narrow saddle that could be developed by constructing earth fill dams at the north and south ends. Provision of 810,000 m^3 of live storage under Option 3A would require a flooded area of about 25 ha with a drawdown depth of 10 m. Option 3B would require about 21 ha of flooded area with a drawdown of 4 m. It is assumed that the reservoir can be developed without the use of liners. Geotechnical investigations of the site have not been carried out.

Under Option 3A, effluent would be pumped from the treatment plant to the storage reservoir via a 300-mm diameter, 13,000-m long transmission main. Due to the high static lift, an intermediate booster pumping station would be required. Both pumping stations would be equipped with two 125 kW pumps, each capable of pumping the maximum day wastewater flow.

Under Option 3B, effluent would be pumped to the storage reservoir via a 250-mm dia, 10,500-m long transmission main. Two pumping stations would be required, each equipped with two 60 kw pumps.

.4 Irrigation

The effluent from the storage reservoir would be distributed via pressure distribution system to the irrigation areas. The effluent would be chlorinated at the exit from the reservoir.

Based on a design population of 7100 persons in Option 3A and an average irrigation rate of 750 mm per season, a total of 130 irrigable hectares would be required. Option 3B would require 85 irrigable hectares. The community plan identifies approximately 223 ha within the municipal boundary in the North Prairie Valley area of potential new agriculture land that is currently not allocated irrigation water (2). In addition, there is also an estimated 96 ha in the same area, outside the municipal boundary. This area is proposed for the development of the initial phases of the effluent irrigation system due to its proximity to the storage reservoir and the desirability to establish an irrigation system.

During the initial years of establishing the irrigation system, surplus effluent would be disposed of by high-rate irrigation or rapid infiltration in the forested sandy/gravel area south of the reservoir. Once the system is established, it may be necessary to make up deficiencies in effluent quantity by adding fresh water to the system via a pressure connection equipped with backflow prevention.

5.2 DISCUSSION

Implementation of an effluent irrigation system is an expensive proposition that will require considerable planning.

The feasibility and the desire to establish an irrigation system in the area proposed must be determined. The viability of orchard or alternate crops must be evaluated from an agricultural and economic viewpoint.

As discussed in Stage 1, land control and ownership is a critical issue. It is not believed practical in the Summerland situation for the District to purchase land for irrigation and operate the effluent irrigation system. Sale of effluent to the farmers must thus be relied upon to dispose of the effluent produced. As the municipality loses direct control over the amount of effluent applied, a second method of disposal is required to dispose of surplus effluent. The backup disposal method in this case would be high-rate irrigation/rapid infiltration on District-owned or Crown land as discussed above.

This option assumes that future regulations will allow use of the effluent with zero buffer zone. As treatment requirements have not yet been formulated, the assumed level of treatment, i.e., secondary plus long term storage and disinfection, may have to be increased through the addition of effluent filtration. This would further increase the cost of this option.

The effective phosphorus removal rate for the area serviced is estimated at 98 percent. The overall removal within the study area for Options 3A and 3B would be 93 percent and 87 percent, respectively.

5.3 ESTIMATED COSTS

The estimated capital costs for Options 3A and 3B are shown in Tables 5-1 and 5-3, respectively. The estimated annual operating and maintenance costs for Options 3A and 3B area presented in Tables 5-2 and 5-4, respectively.

The revenue based on the sale of effluent irrigation water of \$100/ha is assumed. Fresh irrigation water currently sells for about \$150/ha. A lower price for effluent is proposed in order to gain initial acceptance.

TABLE 5-1

ESTIMATED CAPITAL COST
OPTION 3A: EFFLUENT IRRIGATION

COMPONENT	YEAR OF CONSTRUCTION	COST ($)
1.0 COLLECTION		
.1 Town Centre	1992	5,900,000
.2 Lower Town/Peach Orchard Road	1992	2,500,000
.3 Crescent Beach	1992	500,000
.4 Trout Creek	1992	2,000,000
.5 Pumping Stations and Force Mains	1991	1,200,000
2.0 TREATMENT		
.1 Secondary Treatment Plant	1991	1,200,000
3.0 EFFLUENT TRANSMISSION		
.1 Pumping Stations	1991	1,000,000
.2 Pressure Main	1991	2,100,000
4.0 STORAGE RESERVOIR	1991	3,000,000
5.0 IRRIGATION DISTRIBUTION SYSTEM/ R.I. BACKUP SYSTEM	1992	1,300,000
SUBTOTAL		20,700,000
25% ENGINEERING AND CONTINGENCY ALLOWANCE		5,200,000
TOTAL - OPTION 3A		25,900,000

ASSOCIATED ENGINEERING

TABLE 5-2

ESTIMATED OPERATION AND MAINTENANCE COSTS
OPTION 3A: EFFLUENT IRRIGATION

COMPONENT	ANNUAL O & M COST			
	1993	1998	2003	2008
Labour	120,000	120,000	120,000	120,000
Power	87,000	93,000	100,000	106,000
Chemicals	2,500	2,700	2,900	3,100
Maintenance	69,000	69,000	69,000	69,000
Revenue	(10,600)	(11,300)	(12,200)	(13,000)
TOTAL - OPTION 3A	267,900	273,400	279,700	285,100

TABLE 5-3

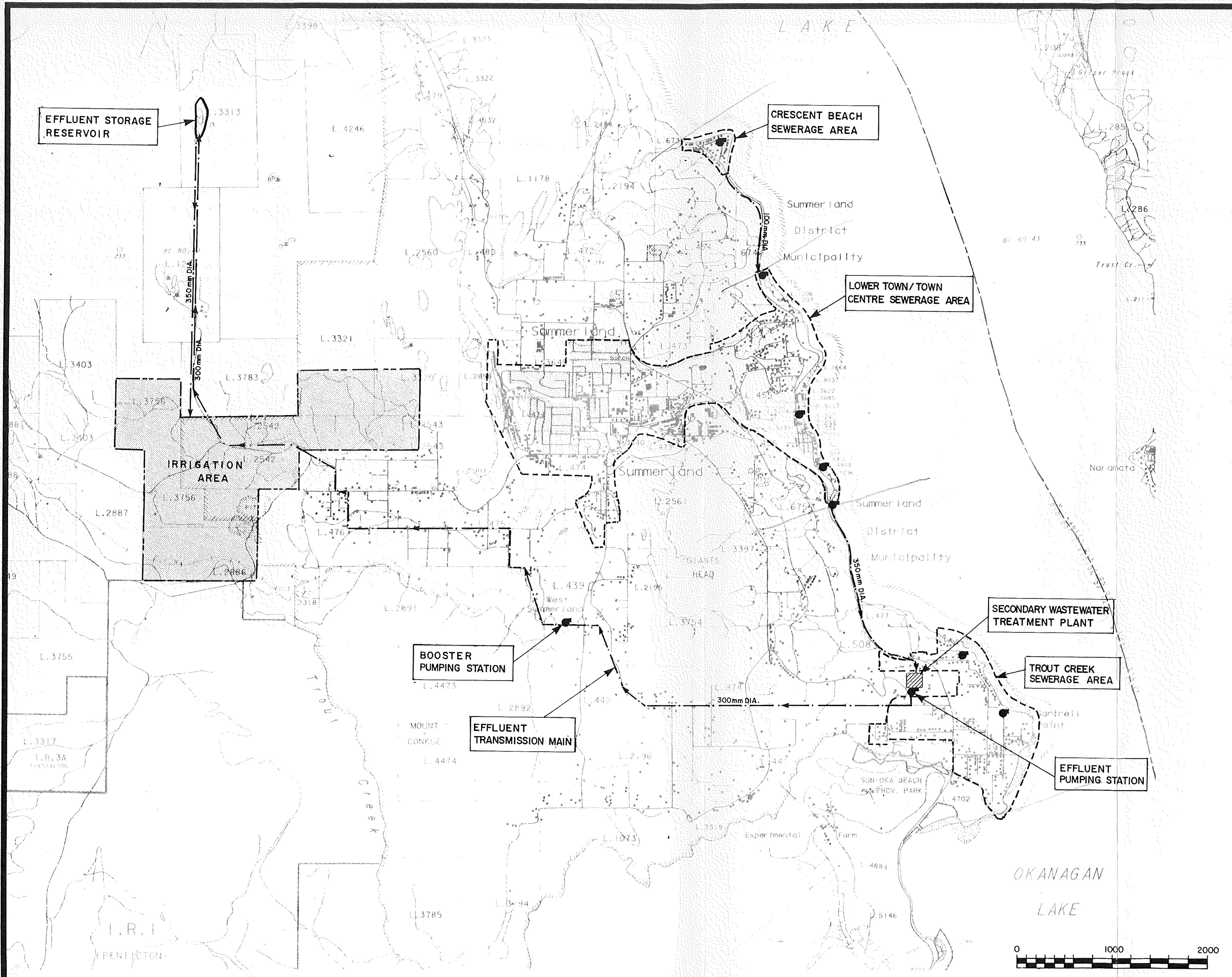
ESTIMATED CAPITAL COST
OPTION 3B: EFFLUENT IRRIGATION

COMPONENT	YEAR OF CONSTRUCTION	COST ($)
1.0 COLLECTION		
.1 Town Centre	1992	6,300,000
2.0 TREATMENT		
.1 Secondary Treatment Plant	1991	900,000
3.0 EFFLUENT TRANSMISSION		
.1 Pumping Stations	1991	500,000
.2 Pressure Main	1991	1,500,000
4.0 STORAGE RESERVOIR	1991	2,500,000
5.0 IRRIGATION DISTRIBUTION SYSTEM/ R.I. BACKUP SYSTEM	1992	1,000,000
SUBTOTAL		12,700,000
25% ENGINEERING AND CONTINGENCY ALLOWANCE		3,200,000
TOTAL - OPTION 3B		15,900,000

TABLE 5-4

ESTIMATED OPERATION AND MAINTENANCE COSTS
OPTION 3B: EFFLUENT IRRIGATION

COMPONENT	ANNUAL O & M COST			
	1993	1998	2003	2008
Labour	120,000	120,000	120,000	120,000
Power	45,000	49,000	53,000	56,000
Chemicals	1,700	1,800	1,900	2,000
Maintenance	42,000	42,000	42,000	42,000
Revenue	(6,800)	(7,300)	(7,900)	(8,500)
TOTAL - OPTION 3B	201,900	205,500	209,000	211,500



LEGEND

- SEWERAGE AREA BOUNDARY
- FORCE MAIN
- PUMPING STATION
- IRRIGATION AREA BOUNDARY

NO.	DATE	ENG.	BY	SUBJECT

REVISIONS

PROJECT NO.	VD92
SCALE	AS SHOWN
DRAWN	V. W.
DESIGNED	J. R.C.
CHECKED	
APPROVED	
APPROVED	
DATE	NOV. 1988

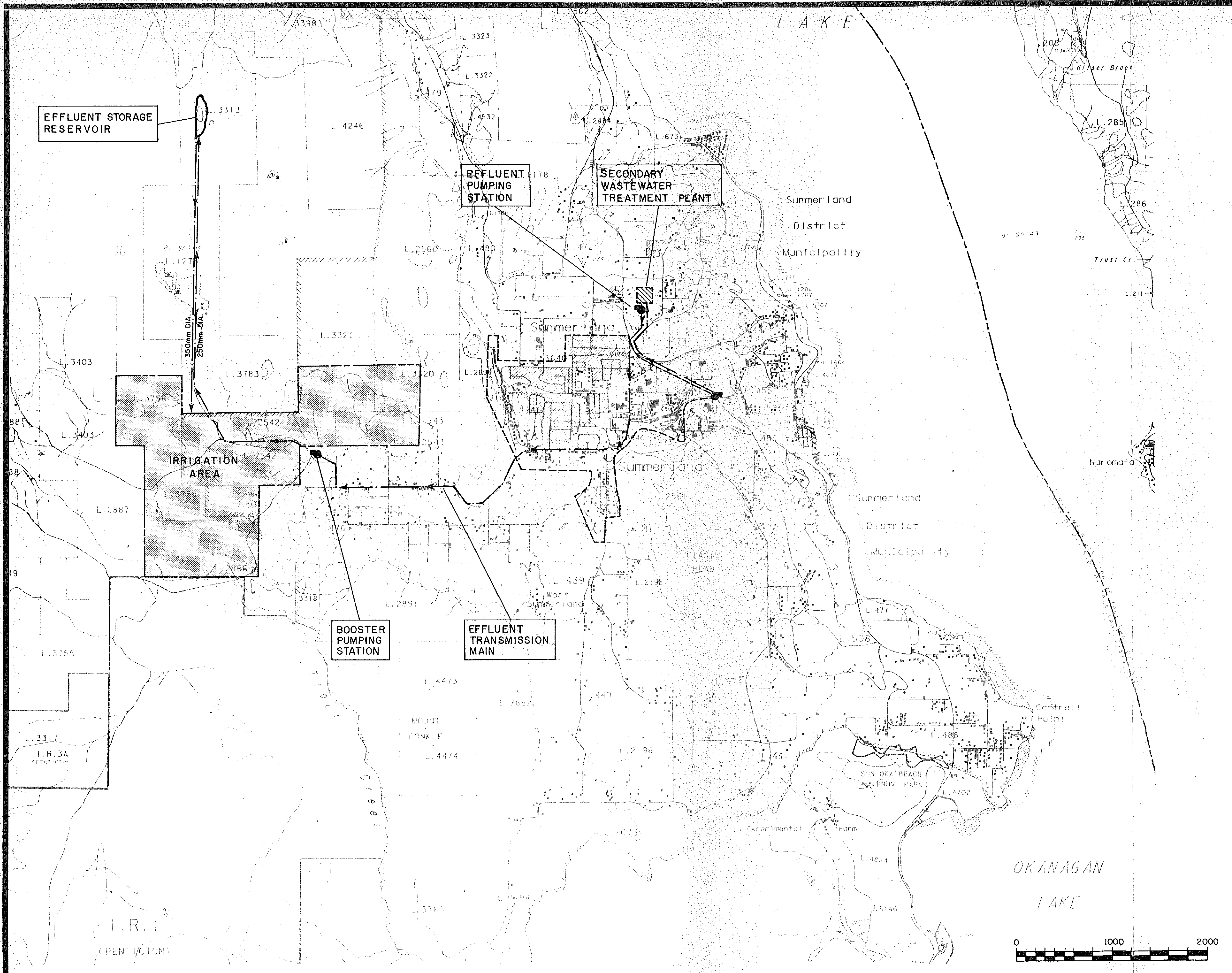
ASSOCIATED ENGINEERING

DISTRICT OF SUMMERLAND

WASTE MANAGEMENT PLAN

OPTION 3A: EFFLUENT IRRIGATION

DRAWING NUMBER	REV. NO.	SHEET
VD92-20-104		



LEGEND

- SEWERAGE AREA BOUNDARY
- FORCE MAIN
- PUMPING STATION
- IRRIGATION AREA BOUNDARY

NO.	DATE	ENG.	BY	SUBJECT

REVISIONS

PROJECT NO.	VD92
SCALE	AS SHOWN
DRAWN	H.
DESIGNED	J.R.C.
CHECKED	Jrc
APPROVED	
APPROVED	
DATE	JAN. 1989

ASSOCIATED ENGINEERING

DISTRICT OF SUMMERLAND

WASTE MANAGEMENT PLAN

OPTION 3B: EFFLUENT IRRIGATION

DRAWING NUMBER	REV. NO.	SHEET
VD92-20-105		

6.0 OPTION 4: HIGH RATE LAND DISPOSAL

6.1 CONCEPT

Option 4 would see a community collection, treatment and disposal system serving the Town Centre only. The objective of this option is to allow an increased density of residential development and redevelopment of the commercial area. The Option 4 concept is shown on Drawing No. VD92-20-106.

Treatment would be by an aerated lagoon secondary plant followed by disposal by rapid infiltration land disposal.

The design population (Year 2008) for Option 4 is 4750 persons.

The Lower Trout Creek, Lower Town and Crescent Beach would be serviced by cluster systems utilizing STEP collection and treatment with disposal in community subsurface disposal fields.

The remaining areas of the District would use on-site disposal.

It is assumed that the Town Centre, Lower Trout Creek, Lower Town and Crescent Beach systems would be in place by 1992.

.1 Collection

The Town Centre area would be serviced by a conventional gravity collection system discharging to a pumping station. Collected wastewater would be pumped to the treatment plant via a pressure force main. The station would be equipped with a diesel generator set to prevent wastewater overflow during failure of the main power.

.2 Treatment

The treatment plant would be located east of the Town Centre near the terminus of the gravity collection system. An area of approximately 2.3 ha is required to provide for suitable landscaping and buffering from adjacent development. The site shown is schematic only an evaluation of actual sites has not been carried out.

The plant would be an aerated lagoon secondary plant. This type of plant is simple to operate and provides flow equalization prior to effluent pumping. The plant would be a two-cell design with 5 days and 10 days detention in the first and second cells, respectively.

The total surface area of the cells would be 1.0 ha. Aeration would be by submerged static tube aerators.

.3 Rapid Infiltration Disposal

Effluent would be pumped from the plant to a rapid infiltration site about 1 km north of the Town Centre. The pumping station would be equipped with two 10 kW pumps, each capable of pumping 25 L/s at a TDH of 13 m. The 250-mm diameter transmission main would be approximately 800 m in length.

The rapid infiltration site would consist of a series of cells, with each cell operated on a intermittent basis to improve phosphorus removal and achieve nitrification/dentrification. Based on an application rate of 30 m per year, a total cell area of 2.0 ha would be required.

.4 Cluster Systems

The cluster system serving Lower Trout Creek, Lower Town and Crescent Beach would consists of septic tank-effluent pumping (STEP) pressure collection and treatment systems pumping to large community subsurface disposal fields.

These are discussed in detail under Option 6.

6.2 DISCUSSION

Option 4 utilizes land disposal to improve the existing wastewater situation.

The rapid infiltration system serving the Town Centre will allow redevelopment of the residential and commercial areas to a higher density and at the same time provide improved phosphorus and nitrogen removal through operational control of the RI site. The sewerage system, however, will have a finite capacity and cannot be readily expanded to handle a larger area in the future.

The cluster systems for the lakeshore areas of Lower Trout Creek, Lower Town and Crescent Beach will transport effluent to areas where there is improved phosphorus removal due to a larger depth of groundwater and a greater horizontal travel distance to the lake. These systems will also have a finite capacity and will effectively limit the growth that can occur.

Further geotechnical investigations will be required to confirm the feasibility of this option and to confirm the expected phosphorus removal performance. Based on phosphorus removal rates for the RI system and the cluster systems of 90 percent, the overall removal achieved by the District would be approximately 88 percent.

TABLE 6-1

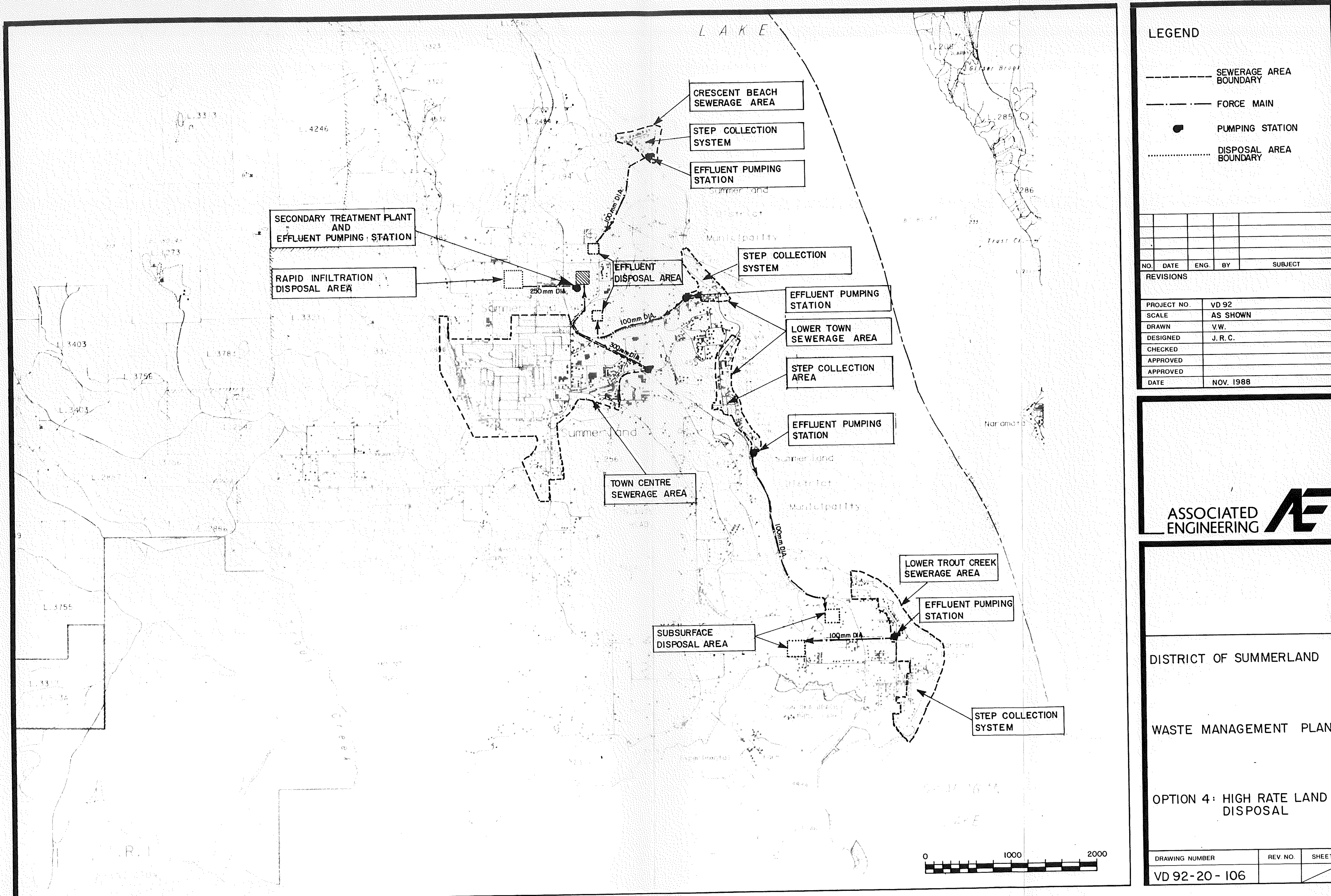
ESTIMATED CAPITAL COST
OPTION 4: HIGH RATE LAND DISPOSAL

COMPONENT	YEAR OF CONSTRUCTION	COST ($)
1.0 TOWN CENTRE SYSTEM		
.1 Collection	1992	6,300,000
.2 Treatment	1991	900,000
.3 Effluent Pumping and Transmission	1991	200,000
.4 RI Disposal	1991	350,000
2.0 LOWER TROUT CREEK		
.1 STEP Collection and Treatment	1992	550,000
.2 Transmission	1991	160,000
.3 Subsurface Disposal Fields	1991	400,000
3.0 LOWER TOWN		
.1 STEP Collection and Treatment	1992	610,000
.2 Transmission	1991	510,000
.2 Subsurface Disposal Fields	1991	440,000
4.0 CRESCENT BEACH		
.1 STEP Collection and Treatment	1992	220,000
.2 Transmission	1991	250,000
.3 Subsurface Disposal Fields	1991	210,000
SUBTOTAL		11,100,000
25% ENGINEERING AND CONTINGENCY ALLOWANCE		2,800,000
TOTAL - OPTION 4		13,900,000

TABLE 6-2

ESTIMATED OPERATION AND MAINTENANCE COSTS
OPTION 4: HIGH-RATE LAND DISPOSAL

COMPONENT	ANNUAL O & M COST			
	1993	1998	2003	2008
Labour	90,000	90,000	90,000	90,000
Power	22,600	23,700	26,100	27,300
Chemicals	-	-	-	-
Maintenance	79,000	82,000	85,000	88,000
TOTAL - OPTION 4	191,600	195,700	201,100	205,300


LAKE
CRESCENT BEACH SEWERAGE AREA
STEP COLLECTION SYSTEM
EFFLUENT PUMPING STATION
SECONDARY TREATMENT PLANT AND EFFLUENT PUMPING STATION
RAPID INFILTRATION DISPOSAL AREA
EFFLUENT DISPOSAL AREA
STEP COLLECTION SYSTEM
EFFLUENT PUMPING STATION
LOWER TOWN SEWERAGE AREA
STEP COLLECTION AREA
EFFLUENT PUMPING STATION
TOWN CENTRE SEWERAGE AREA
LOWER TROUT CREEK SEWERAGE AREA
EFFLUENT PUMPING STATION
SUBSURFACE DISPOSAL AREA
STEP COLLECTION SYSTEM
100mm DIA.
250mm DIA.
300mm DIA.
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LEGEND
SEWERAGE AREA BOUNDARY
FORCE MAIN
PUMPING STATION
DISPOSAL AREA BOUNDARY
NO. DATE ENG. BY SUBJECT
REVISIONS
PROJECT NO. VD 92
SCALE AS SHOWN
DRAWN V.W.
DESIGNED J.R.C.
CHECKED
APPROVED
APPROVED
DATE NOV. 1988
ASSOCIATED ENGINEERING
DISTRICT OF SUMMERLAND
WASTE MANAGEMENT PLAN
OPTION 4: HIGH RATE LAND DISPOSAL
DRAWING NUMBER REV. NO. SHEET
VD 92-20-106

7.0 OPTION 5: COMBINED IRRIGATION/LAKE DISPOSAL

7.1 CONCEPT

Option 5 is essentially the same as Option 2A, Lake Disposal, except that effluent from the treatment plant would be used directly for irrigation in the Trout Creek area during the irrigation season. The Option 5 concept is shown in Drawing No. VD92-20-107.

During the non-irrigation season, nutrient removal at the advanced wastewater treatment plant would be employed and effluent would be discharged to the lake.

The design population (Year 2008) of the system would be 7100 persons. It is assumed that the lake disposal portion of the system would be in place by 1992 and the land disposal portion by 1996.

.1 Collection

Wastewater collection would be as in Option 2A. The area served would include the Town Centre, Lower Town/Peach Orchard Road, Crescent Beach, and Trout Creek.

.2 Treatment

The treatment plant would be as in Option 2A.

The treatment plant would be operated to achieve the required phosphorus removal during the lake discharge period. During the irrigation season, effluent phosphorus levels would be allowed to increase to make use of the nutrient value of the wastewater. Prior to the termination of the irrigation season, the operation would be switched back to the lake disposal made by adjusting the process to increase phosphorus uptake and removal.

The process would incorporate the possibility of chemical precipitation in the final clarifier and ahead of filters in the event that a rapid conversion to the lake disposal mode is required.

Dechlorination of the final effluent would not be required under the land disposal mode.

.3 Disposal

The lake outfall would be as in Option 2A.

An irrigation system, independent of the District's combined irrigation and domestic water system, would be constructed and pressurized by an effluent pumping station at the treatment plant. An equalization storage pond with a minimum of two days capacity would be constructed at the plant to allow for fluctuations in daily demand.

Based on a design population of 7100 persons and an average irrigation rate of 750 mm extending over a 120 day period, approximately 43 ha of land could be irrigated in the Trout Creek area. There are currently approximately 100 ha under irrigation.

The effluent would be used on orchards with a drip irrigation system.

7.2 DISCUSSION

This option allows partial use of the nutrient value of wastewater effluent for agricultural production without the very high costs of development of wintertime effluent storage.

As two methods of disposal are available, the loss of control of effluent application rates by the municipality is not as critical an issue as in a system utilizing land disposal alone. Implementation of the irrigation system, however, will require careful planning and operational control in order to avoid fluctuations in effluent demand due to the limited storage at the plant site.

As in Option 3, this option assumes that future regulations will allow drip-irrigation of orchard crops with the degree of treatment proposed.

The lake disposal mode will achieve about 95 percent phosphorus removal over eight months. The irrigation system could be expected to achieve 98 percent over the remaining four months. This yields an average annual removal of 96 percent for the area serviced by the sewerage system and 93 percent removal for the overall District.

7.3 ESTIMATED COSTS

The estimated capital and annual operation and maintenance costs for Option 5 are shown in Tables 7-1 and 7-2, respectively.

TABLE 7-1

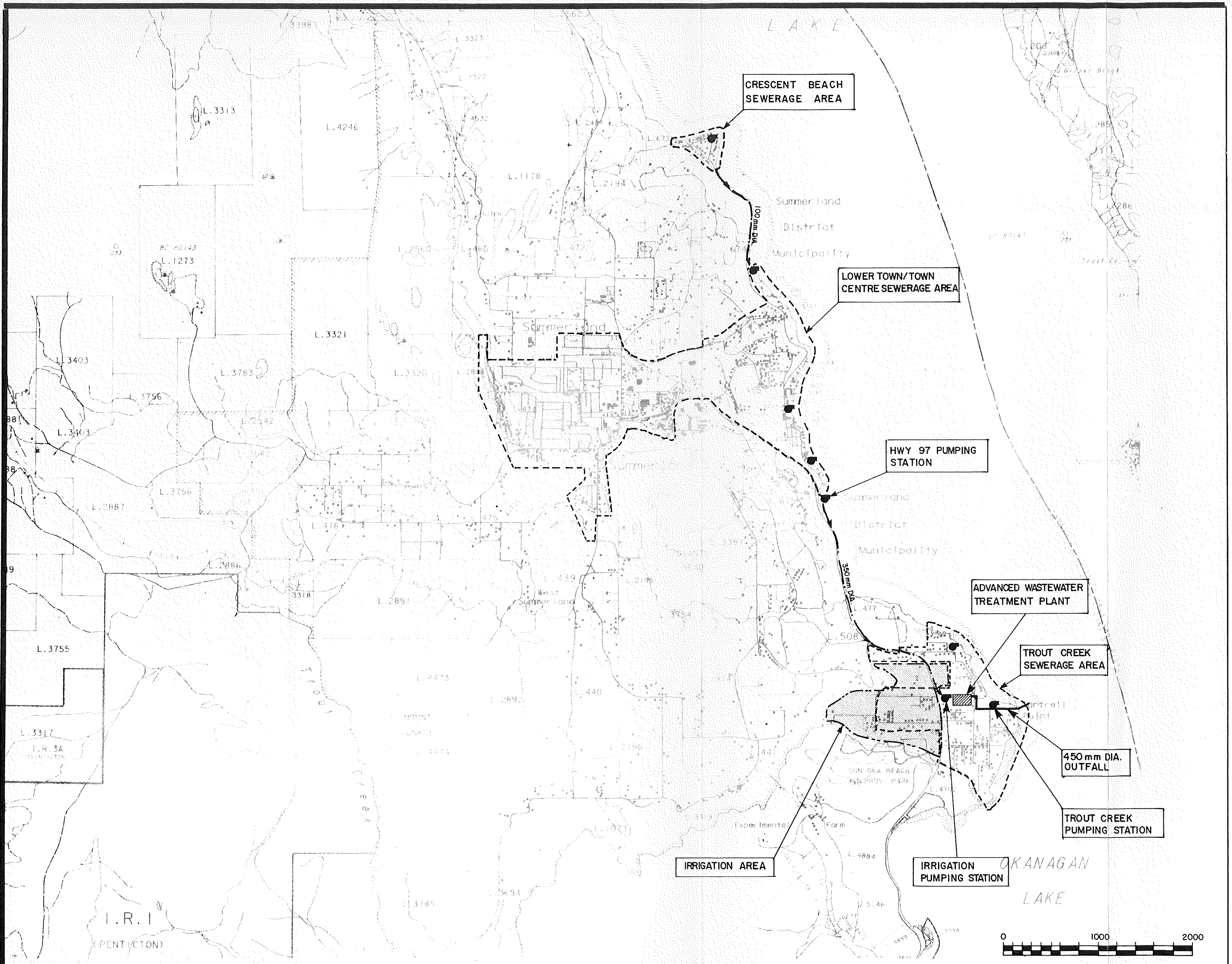
ESTIMATED CAPITAL COST
OPTION 5: COMBINED IRRIGATION/LAKE DISPOSAL

COMPONENT	YEAR OF CONSTRUCTION	COST ($)
1.0 COLLECTION (See Option 2A)	1992	10,900,000
2.0 TRANSMISSION (See Option 2A)	1991	1,200,000
3.0 TREATMENT		
.1 Advanced Wastewater Treatment Plant	1991	4,200,000
4.0 DISPOSAL		
.1 Outfall	1991	350,000
.2 Irrigation Distribution System	1996	550,000
SUBTOTAL		17,200,000
25% ENGINEERING AND CONTINGENCY ALLOWANCE		4,300,000
TOTAL - OPTION 5		21,500,000

TABLE 7-2

ESTIMATED OPERATION AND MAINTENANCE COSTS
OPTION 5: COMBINED IRRIGATION/LAKE DISPOSAL

COMPONENT	ANNUAL O & M COST			
	1993	1998	2003	2008
Labour	150,000	170,000	170,000	170,000
Power	27,900	33,100	35,000	37,100
Chemicals	5,100	4,500	4,800	5,100
Maintenance	78,000	82,500	82,500	82,500
Revenue	-	(3,500)	(3,900)	(4,300)
TOTAL - OPTION 5	281,000	286,600	288,400	290,400



LEGEND

- SEWERAGE AREA BOUNDARY
- FORCE MAIN
- PUMPING STATION
- IRRIGATION AREA BOUNDARY

NO.	DATE	ENG.	BY	SUBJECT

REVISIONS

PROJECT NO.	VD 92
SCALE	AS SHOWN
DRAWN	V.W.
DESIGNED	J.R.C.
CHECKED	
APPROVED	
APPROVED	
DATE	NOV. 1988

ASSOCIATED ENGINEERING

DISTRICT OF SUMMERLAND

WASTE MANAGEMENT PLAN

OPTION 5: COMBINED IRRIGATION/ LAKE DISPOSAL

DRAWING NUMBER	REV. NO.	SHEET
VD 92-20-107		

8.0 OPTION 6: CLUSTER SYSTEMS

8.1 CONCEPT

Option 6 consists of cluster, or satellite, community sewerage systems serving the lakeshore development areas only. The areas that would be serviced include Crescent Beach, Lower Town, and Lower Trout Creek. The objective of this option is to replace the existing on-site disposal systems transmitting a high degree of phosphorus to the lake with community subsurface disposal fields located in more favourable disposal areas away from the lake. The Option 6 concept is shown in Drawing No. VD92-20-108.

The areas of Lower Trout Creek, south Lower Town, north Lower Town and Crescent Beach would be serviced by four separate cluster systems each incorporating STEP collection and treatment, booster pumping station and transmission main, and subsurface disposal fields.

The total design population (Year 2008) for the cluster systems is 900 persons. It is assumed that the works would be in place by 1992.

The remainder of the study area would utilize on-site disposal.

.1 <u>Collection and Treatment</u>

Wastewater would be collected and treated by a septic tank-effluent pumping (STEP) system. As described in the Stage I report, a STEP system consists of a septic tank and a pumping chamber at each dwelling, a pressure laterial from the pumping chamber to the main, and a pressure main located in the road right-of-way.

The septic tank and pumping chamber would be owned by the District and an easement established on private property for access and service. The septic tank would be pumped out at a frequency of about once per year and the pump serviced on the same frequency.

The pressure main would range in diameter from 37 to 75 mm and be located at a depth of about 1.0 to 1.5 m. Air release valves, isolation valves, and cleanouts would be located at intervals along the mains. The pressure main system would direct the septic tank effluent to a booster pumping station. The effluent would be pumped from this point to the subsurface disposal field via a pressure force main.

The booster pumping stations would be duplex stations utilizing high head vertical turbine or submersible effluent pumps. Standby power is not required as the STEP units cannot pump effluent to the booster station during power outages.

.2 Disposal

Effluent disposal would be by subsurface tile field. The tile length required for each field is dependent upon the average effluent flow and the soil percolation rate. Based on the Provincial Waste Management Branch Guidelines and assuming an average percolation rate of 4 min/cm, the required tile field areas, including 50 percent standby area, are as follows:

Cluster System	Tile Field Area (ha)
Lower Trout Creek	2.7
South Lower Town	1.8
North Lower Town	1.1
Crescent Beach	1.5

The disposal fields would be located in agricultural areas rated as moderately low in terms of phosphorus transmission. Moderately-low transmission areas achieve an average 90 percent phosphorus removal.

The sites shown are schematic only. Site-specific investigations will be required to confirm the suitability and availability of the sites. As the majority of potential sites are privately-owned, purchase of suitable land will be required.

8.2 DISCUSSION

Option 6 utilizes community land disposal systems to reduce the phosphorus transmission to the lake from near lakeshore dwellings.

The disposal capacity of the systems is finite. Although the cluster systems would be designed to allow a moderate increase in wastewater flow through infilling, they would not have sufficient capacity to allow a significantly higher density development within the area serviced or the addition of wastewater flow from outside the sewerage area. This option would thus tend to limit growth in the lakeshore areas.

The systems are relatively simple to operate and reliable. In order to ensure that the required maintenance is carried out, it is proposed that the STEP units be owned by the municipality. Alternatively, the systems could be owned by the property owner and a maintenance contract established with the District. Annual pumping out of the septic tanks is critical to the operation of the system.

The effective phosphorus removal rate for the four areas serviced would increase to about 90 percent. The overall removal within the study area would be 87 percent.

8.3 ESTIMATED COSTS

The estimated capital and annual operation and maintenance costs for Option 6 are shown in Tables 8-1 and 8-2, respectively.

Costs for individual STEP units for existing dwellings are included in the capital costs. Future property owners would pay an initial cost of approximately $2,400 to $3,200 for the installation of a STEP unit.

Replacement of 80 percent of existing septic tanks is assumed.

TABLE 8-1

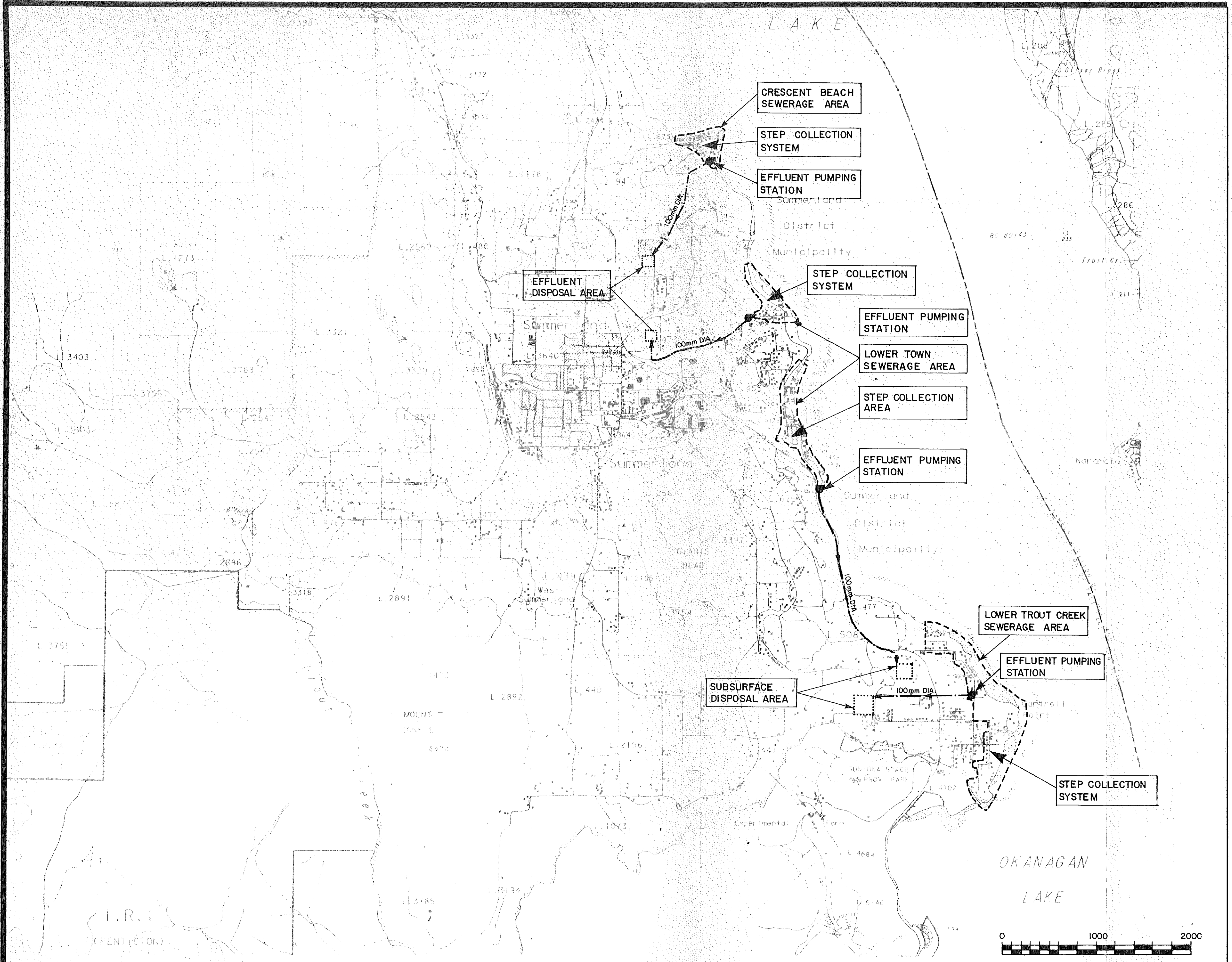
ESTIMATED CAPITAL COST
OPTION 6: CLUSTER SYSTEMS

COMPONENT	YEAR OF CONSTRUCTION	COST ($)
1.0 LOWER TROUT CREEK		
.1 STEP Units	1992	340,000
.2 Pressure Collection Mains	1991	210,000
.3 Booster PS and Transmission Main	1991	160,000
.4 Disposal Field	1991	400,000
2.0 LOWER TOWN - SOUTH		
.1 STEP Units	1992	260,000
.2 Pressure Collection Mains	1991	180,000
.3 Booster PS and Transmission Main	1991	260,000
.4 Disposal Field	1991	270,000
3.0 LOWER TOWN - NORTH		
.1 STEP Units	1992	70,000
.2 Pressure Collection Mains	1991	100,000
.3 Booster PS and Transmission Main	1991	250,000
.4 Disposal Field	1991	170,000
4.0 CRESCENT BEACH		
.1 STEP Units	1992	150,000
.2 Pressure Collection Mains	1991	70,000
.3 Booster PS and Transmission Main	1991	250,000
.4 Disposal Field	1991	210,000
SUBTOTAL		3,350,000
25% ENGINEERING AND CONTINGENCY ALLOWANCE		850,000
TOTAL - OPTION 6		4,200,000

TABLE 8-2

ESTIMATED OPERATION AND MAINTENANCE COSTS
OPTION 6: CLUSTER SYSTEMS

COMPONENT	ANNUAL O & M COST			
	1993	1998	2003	2008
Labour	60,000	60,000	60,000	60,000
Power	5,800	6,200	6,500	6,900
Chemicals	-	-	-	-
Maintenance	49,500	52,100	54,800	57,700
TOTAL - OPTION 6	115,300	118,300	121,300	124,600



LEGEND

- SEWERAGE AREA BOUNDARY (dashed line)
- FORCE MAIN (dash-dot line)
- PUMPING STATION (filled symbol)
- DISPOSAL AREA BOUNDARY (dotted line)

NO.	DATE	ENG.	BY	SUBJECT

REVISIONS

PROJECT NO.	VD 92
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APPROVED	
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ASSOCIATED ENGINEERING

DISTRICT OF SUMMERLAND

WASTE MANAGEMENT PLAN

OPTION 6: CLUSTER SYSTEMS

DRAWING NUMBER	REV. NO.	SHEET
VD 92-20-108		

9.0 OPTION 7: ENHANCED ON-SITE DISPOSAL/LAND USE CONTROL

9.1 CONCEPT

Option 7 is to continue to utilize on-site disposal throughout the study area. On-site disposal systems in lakeshore areas would be upgraded as discussed in the Stage I report to improve phosphorus removal. Land use controls would be implemented to either restrict development or even reduce or eliminate development in high phosphorus transmission areas.

The areas proposed for enhanced on-site disposal and land use controls are shown in Drawing No. VD92-20-109.

.1 Enhanced On-site Disposal

Enhanced on-site disposal techniques that could be utilized include:

- Chemical precipitation of phosphorus in the septic tank.
- Modification of the disposal field to increase the vertical travel distance to the groundwater.
- Replacement of disposal field native soil with materials exhibiting a high phosphorus removal capability.

On lots where satisfactory, on-site disposal cannot be achieved, replacement of the disposal system with a holding tank to allow off-site disposal could be utilized.

.2 Land Use Controls

Land use controls is generally considered as a "soft" approach to on-site wastewater management.

The intent in the long-term is to reduce development density to a point where on-site disposal systems can work satisfactorily either from a hydraulic or phosphorus transmission viewpoint.

In the lakeshore areas, zoning changes would be implemented to restrict further development. Renovation or rebuilding to a higher floor area - lot size ratio on small lots would be prevented. In this manner, the combining of small lots into larger properties with increased area for on-site disposal would be encouraged.

In specific situations, the District could consider purchasing lakeshore lots as they come on the market with the intent of preventing residential development and converting additional lakeshore areas to park use.

9.2 DISCUSSION

Phosphorus control through enhanced on-site wastewater management disposal is at a preliminary stage and experience elsewhere as to its success is not readily available.

This approach obviously requires a considerable degree of cooperation between property owners and the District. In order to ensure success of this concept, consideration could be given to the establishment of easement on private property for wastewater disposal and ownership of the on-site systems by the District.

Land use control of lakeshore property will not be universally popular with property owners. Restrictive zoning to reduce development potential will decrease the value of the properties. Conversely, however, many lakeshore property owners may feel that a low development density is appropriate.

If it is assumed that an effective phosphorus removal rate of 75 percent can be achieved through the combined use of enhanced on-site disposal and land use controls in the designated areas, the overall phosphorus removal rate for the study area would increase to 86 percent.

9.3 ESTIMATED COSTS

The estimated capital and annual operation and maintenance costs for Option 7 are shown in Tables 9-1 and 9-2, respectively.

The capital cost is based on utilizing enhancement techniques on all of the existing dwellings or commercial developments in the designated areas at an average initial cost of $5,000 per system.

For comparison with the other options, it is assumed that the modification would be in place by 1992. Due to the unproven success of this approach, implementation would likely occur over a longer period. This would tend to slightly reduce the present worth cost of the capital works and the benefits of improved phosphorus removal would not be achieved as quickly as with the other options.

No costs for land use controls has been included.

TABLE 9-1

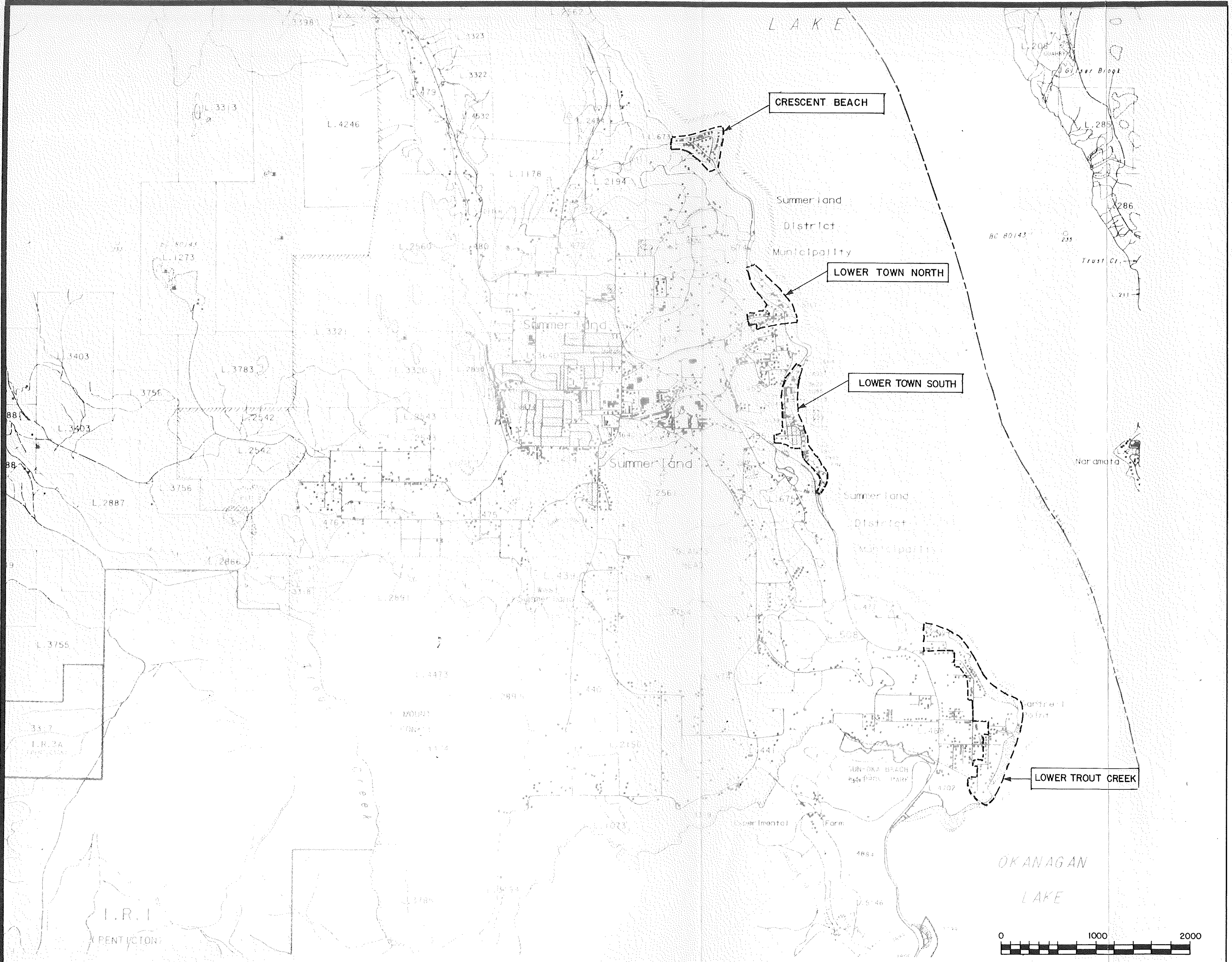
ESTIMATED CAPITAL COST
OPTION 7: ENHANCED ON-SITE DISPOSAL/LAND USE CONTROLS

COMPONENT	YEAR OF CONSTRUCTION	COST ($)
1.0 LOWER TROUT CREEK .1 113 Enhanced Systems	1992	565,000
2.0 LOWER TOWN .1 119 Enhanced Systems	1992	595,000
3.0 CRESCENT BEACH .1 48 Enhanced Systems	1992	240,000
SUBTOTAL		1,400,000
25% ENGINEERING AND CONTINGENCY ALLOWANCE		400,000
TOTAL - OPTION 7		1,800,000

TABLE 9-2

ESTIMATED OPERATION AND MAINTENANCE COSTS
OPTION 7: ENHANCED ON-SITE DISPOSAL/LAND USE CONTROLS

COMPONENT	ANNUAL O & M COST			
	1993	1998	2003	2008
Labour	60,000	60,000	60,000	60,000
Power	3,000	3,000	3,000	3,000
Chemicals	8,000	8,000	8,000	8,000
Maintenance	70,000	70,000	70,000	70,000
TOTAL - OPTION 7	141,000	141,000	141,000	141,000



LEGEND

- - - - - - ENHANCED ON-SITE DISPOSAL / LAND USE CONTROL BOUNDARY

NO.	DATE	ENG.	BY	SUBJECT

REVISIONS

PROJECT NO.	VD 92
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ASSOCIATED ENGINEERING

DISTRICT OF SUMMERLAND

WASTE MANAGEMENT PLAN

OPTION 7: ENHANCED ON-SITE DISPLAY LAND USE

DRAWING NUMBER	REV. NO.	SHEET
VD 92-20-109		

10.0 ECONOMIC ANALYSIS

10.1 PRESENT WORTH ANALYSIS

Present worth analysis is a technique used to compare project alternatives on an equal economic basis. The present worth value can be thought of as the amount of money that would have to be 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 inflation rate. The annual interest and inflation rates are generally combined into a real discount rate, i.e. a discount rate that takes inflation into account.

In publicly-funded municipal infrastructure projects, a real discount rate of about six percent has been used to reflect recent economic conditions. In order to determine the sensitivity of the various options to changing economic conditions a range of discount rate from four to eight percent, inclusive, has been utilized in the present worth analyses.

A summary of the present worth analysis is presented in Table 10-1.

The assumptions made for the present worth analysis are as follows:

.1 The time horizon is 20 years, with a base year of 1989.

.2 Future capital costs are in 1989 dollars, brought back to present worth at the real discount rate and then totalled.

.3 Annual operation and maintenance costs are calculated for each of the future years in 1989 dollars, brought back to present worth at the real discount rate and then totalled.

.4 Costs include an engineering and contingency allowance of 25 percent of construction cost. No allowance is included for interim financing or administration costs.

.5 Real discount rates of 4, 6, and 8 percent are assumed.

.6 Senior government assistance in the form of a 0, 25, or 75 percent grant on capital costs is assumed.

.7 The amortization period for debt repayment is 20 years.

A ranking of the options under the three real discount rate scenarios is presented in Table 10-2. As shown in the table, the only change in ranking is a reversal in Options 2A and 5 at the 8 percent discount rate, indicating that the options are not especially sensitive to changing economic conditions.

10.2 MONTHLY USER COST

In order to allow a comparison of the cost of the options to the user, a monthly user cost for each of the years between 1989 and 2008 has been calculated.

A summary of user costs in presented in Table 10-3. The monthly user costs shown are in 1989 dollars. The annual debt repayment would remain constant over the analysis period while the annual operating and maintenance costs would tend to increase with the normal inflation rate. Overall the monthly user cost would thus tend to increase at a rate less than the normal inflation rate.

The monthly user cost is based on an equivalent population that includes commercial developments. The average occupancy is assumed to be 2.5 persons per connection.

For the purpose of comparison, it is assumed that the option cost is shared by the users actually serviced by the sewerage system. In practice, debt repayment on capital expenditure would likely be obtained from property tax and annual operating and maintenance costs paid through a user charge. As the debt repayment would be shared by vacant developable properties, the actual cost to users connected to the system would be slightly lower than the cost shown.

10.3 COST VERSUS PHOSPHORUS REDUCTION

A reduction in phosphorus transmission to the lake is a key element in assessing the available options.

A comparison of the degree of phosphorus reduction achieved relative to the cost has been calculated for the design year 2008. The analysis excludes senior government funding in order to show the total cost of phosphorus reduction.

The results are shown in Table 10-4.

10.4 DISCUSSION

A ranking of the economic analysis for the options is presented in Table 10-5. In reviewing the results of the economic analysis, it is important to recognize that all of the options cannot be compared directly as they serve varying populations.

Options 1, 2A, 3A, and 5 serve the same areas and have the same design population and thus can be directly compared. Option 2A, Lake Disposal, has the lowest total present worth cost with Option 1, Regional Sewerage System and Option 5, Combined Irrigation/Lake

Disposal slightly higher. Option 3A, Effluent Irrigation is considerably higher than Options 1, 2A, and 5.

User cost for the above options follow a similar trend. Option 2A has the lowest monthly user cost under all scenarios for government funding. Under 25 percent government funding, Option 1 is only slightly higher followed by Option 5. At 75 percent funding, Option 5 ranks second and Option 1 ranks third.

Options 6 and 7 both serve the immediate lakeshore areas only. Option 7, Enhanced On-Site Disposal/Land Use Control, has the lower total present worth and the lower monthly user cost of the two options.

Options 2B, 3B, and 4 fall between the two groups of options discussed above. Option 4, High Rate Land Disposal, has a total present worth about mid-way in the ranking of the options but shows the lowest monthly user cost. Option 2B, Lake Disposal, has the third lowest total present worth and the second highest monthly user cost of all the options.

Option 3B, Effluent Irrigation, serving the Town Centre only ranks about mid-way in total present worth and monthly user cost.

The cost of the options versus the incremental phosphorus reduction achieved indicates that the two options that specifically address the problem of phosphorus transmission to the lake from lakeshore dwellings (Options 6 and 7) show the best value in terms of dollars per kilogram of phosphorus removed. In comparing the options that serve a larger portion of the community and offer greater growth potential, Option 5, Combined Irrigation/Lake Disposal, shows the greatest value for the dollar spent followed closely by Option 1, Regional Sewerage System and Option 2A, Lake Disposal.

10.5 SUMMARY

In summary, if economics only are considered, Option 2A, Lake Disposal and Option 4, High Rate Land Disposal, show the lowest monthly user costs followed closely by Options 1 and 5.

In comparing dollar value versus incremental phosphorus reduction, Option 7, Enhanced On-Site Disposal/Land Use Control shows the best return and has the lowest total present worth cost of all of the options.

TABLE 10-1

SUMMARY OF PRESENT WORTH ANALYSIS

OPTION	SENIOR GOV'T FUNDING (%)	TOTAL PRESENT WORTH ($ x 1,000,000)		
		DISCOUNT RATE 4%	DISCOUNT RATE 6%	DISCOUNT RATE 8%
1	0	22.0	20.2	18.7
2A	0	21.5	20.1	18.8
2B	0	7.2	6.6	6.2
3A	0	26.0	24.4	22.9
3B	0	16.5	15.4	14.5
4	0	14.6	13.6	12.7
5	0	22.2	20.7	19.4
6	0	5.1	4.7	4.4
7	0	3.1	2.7	2.4
1	25	17.7	16.1	14.8
2A	25	16.9	15.6	14.6
2B	25	5.8	5.3	4.9
3A	25	20.2	18.9	17.7
3B	25	12.9	12.0	11.2
4	25	11.4	10.6	9.9
5	25	17.4	16.1	15.0
6	25	4.1	3.8	3.5
7	25	2.7	2.3	2.1
1	75	9.1	8.0	7.1
2A	75	7.6	6.8	6.2
2B	75	2.9	2.6	2.3
3A	75	8.6	7.8	7.2
3B	75	5.7	5.2	4.7
4	75	5.2	4.7	4.2
5	75	7.8	7.0	6.4
6	75	2.2	1.9	1.7
7	75	1.9	1.6	1.3

Legend:

Option 1: Regional Sewerage System
Option 2A: Lake Disposal
Option 2B: Lake Disposal (reduced scale)
Option 3A: Effluent Irrigation
Option 3B: Effluent Irrigation (reduced scale)
Option 4: High Rate Land Disposal
Option 5: Combined Irrigation/Lake Disposal
Option 6: Cluster Systems
Option 7: Enhanced On-site Disposal/Land Use Control

TABLE 10-2

ECONOMIC SENSITIVITY OF PRESENT WORTH[1]

RANKING	OPTIONS		
	DISCOUNT RATE 4%	DISCOUNT RATE 6%	DISCOUNT RATE 8%
Highest Cost	3A	3A	3A
	5	5	5
	1	1	2A
	2A	2A	1
to	3B	3B	3B
	4	4	4
	2B	2B	2B
	6	6	6
Lowest Cost	7	7	7

Note:

1. Assumes 0 percent senior government funding.

Legend:

Option 1: Regional Sewerage System
Option 2A: Lake Disposal
Option 2B: Lake Disposal (reduced scale)
Option 3A: Effluent Irrigation
Option 3B: Effluent Irrigation (reduced scale)
Option 4: High Rate Land Disposal
Option 5: Combined Irrigation/Lake Disposal
Option 6: Cluster Systems
Option 7: Enhanced On-site Disposal/Land Use Control

TABLE 10-3

SUMMARY OF MONTHLY USER COSTS

OPTION	SENIOR GOVERNMENT FUNDING (%)	MONTHLY COST PER CONNECTION 1993			MONTHLY COST PER CONNECTION 2008		
		DEBT REPAYMENT	O & M COST	TOTAL	DEBT REPAYMENT	O & M COST	TOTAL
1	0	91	16	107	75	14	89
2A	0	99	10	109	81	8	89
2B	0	172	29	201	141	24	165
3A	0	123	10	133	101	9	110
3B	0	117	11	128	93	10	103
4	0	79	8	87	69	8	77
5	0	100	10	110	84	9	93
6	0	156	32	188	128	29	157
7	0	68	39	107	68	39	107
1	25	68	16	84	56	14	70
2A	25	74	10	84	61	8	69
2B	25	129	29	158	105	24	129
3A	25	92	10	102	75	9	84
3B	25	88	11	99	69	10	79
4	25	60	8	68	51	8	59
5	25	75	10	85	63	9	72
6	25	117	32	149	97	29	126
7	25	50	39	89	50	39	89
1	50	46	16	62	38	14	52
2A	50	50	10	60	41	8	49
2B	50	86	29	115	70	24	94
3A	50	61	10	71	50	9	59
3B	50	58	11	69	46	10	56
4	50	40	8	48	34	8	42
5	50	50	10	60	42	9	51
6	50	78	32	110	64	29	93
7	50	34	39	73	34	39	73
1	75	23	16	38	19	14	33
2A	75	25	10	35	21	8	29
2B	75	43	29	72	35	24	59
3A	75	30	10	40	25	9	34
3B	75	29	11	40	23	10	33
4	75	20	8	28	17	8	25
5	75	25	10	35	21	9	30
6	75	39	32	71	32	29	56
7	75	17	39	56	17	39	56

Legend:

Option 1: Regional Sewerage System
Option 2A: Lake Disposal
Option 2B: Lake Disposal (reduced scale)
Option 3A: Effluent Irrigation
Option 3B: Effluent Irrigation (reduced scale)
Option 4: High Rate Land Disposal
Option 5: Combined Irrigation/Lake Disposal
Option 6: Cluster Systems
Option 7: Enhanced On-site Disposal/Land Use Control

TABLE 10-4

COST VERSUS PHOSPHORUS REDUCTION

OPTION	CAPITAL COST ($)	ANNUAL COST[1] ($/yr)	INCREMENTAL PHOSPHORUS REDUCTION[2] (kg/yr)	CAPITAL COST PER KILOGRAM OF PHOSPHORUS REDUCTION ($/kg/yr)	ANNUAL COST PER KILOGRAM OF PHOSPHORUS REMOVED ($/kg/yr)
1	19,000,000	3,026,000	1285[3]	14805	2354
2A	20,600,000	3,048,000	1285	16000	2372
2B	6,300,000	988,000	689	9100	1434
3A	25,900,000	3,756,000	1509	17200	2489
3B	15,900,000	2,342,000	600	26500	3903
4	13,900,000	2,068,000	738	18800	2803
5	21,500,000	3,171,000	1376	15600	2305
6	4,200,000	688,000	620	6800	1109
7	1,800,000	382,000	386	4700	990

Notes:

1. Annual amortized capital cost plus the operating and maintenance cost for the year 2008 excluding senior government funding.

2. Incremental phosphorus reduction in the study area through implementation of the option for the year 2008.

3. Includes phosphorus addition to Skaha Lake. This amount will decrease when the City of Penticton implements combined lake/lane disposal.

Legend:

Option 1: Regional Sewerage System
Option 2A: Lake Disposal
Option 2B: Lake Disposal (reduced scale)
Option 3A: Effluent Irrigation
Option 3B: Effluent Irrigation (reduced scale)
Option 4: High Rate Land Disposal
Option 5: Combined Irrigation/Lake Disposal
Option 6: Cluster Systems
Option 7: Enhanced On-site Disposal/Land Use Control

TABLE 10-5

ECONOMIC RANKING OF OPTIONS

RANKING	OPTIONS			
	TOTAL PRESENT WORTH COST[1]	MONTHLY USER COST[2]		COST VERSUS PHOSPHORUS REDUCTION[2]
		25% Senior Government Funding	75% Senior Government Funding	
Highest Cost	3A	2B	6	3B
	5	6	2B	4
	1	7	7	3
to	2A	3A	3A	2A
	3B	3B	1	1[3]
	4	5	3B	5[3]
	2B	1	5	2B
	6	2A	2A	6
Lowest Cost	7	4	4	7

Notes:

1. Assumes 0 percent senior government funding and 6 percent discount rate.

2. Annual cost per kilogram of phosphorus removed (Table 10-4).

3. Options 1 and 5 will reverse ranking when the City of Penticton implements combined lake/land disposal.

11.0 OPTION EVALUATION

11.1 DECISION MATRIX

Long-term wastewater management decisions are not entirely based on economics. Nonmonetary factors and indirect effects must be considered in the overall decision-making process.

This section of the report presents a numerical methodology for evaluating the nonmonetary factors in the decision-making process. In this analysis, each parameter is weighted according to its importance in selection of a wastewater management option. Parameters are weighted out of a total of 1,000 points as shown in Table 11-1.

For subjective parameters, the scoring for each option is based on a grading system, with each grade assigned a percentage of the maximum score. The grading system is shown below:

Grade	Percentage of Maximum Score
Excellent	100
Very Good	80
Good	60
Satisfactory	40
Poor	20

The decision matrix for the nine options is presented in Table 10-2.

The scoring of the various options is discussed below. It should be realized that this evaluation technique is subject to individual assessment of the scoring. It does, however, provide a reference framework to ensure that the important factors in the decision-- making process are considered.

.1 <u>Economics</u>

The option with the lowest total present worth user cost receives 100 points. The remaining options are scored on a ratio basis relative to the least cost option. The total present worth cost assumes no senior government assistance and a six percent discount rate.

.2 User Cost

The option with the lowest monthly use cost receives 100 points. The remaining options are scored on a ratio basis relative to the least cost option. The year 2008 user cost assuming 75 percent senior government funding is assumed.

.3 Phosphorus Reduction

The option with the highest incremental phosphorus removal scores 200 points. The remaining options are scored on a ratio basis relative to the option with the highest incremental removal. Incremental phosphorus reduction is shown in Table 10-4.

.4 Environmental Impact

This parameter reflects the impact of a particular option on groundwater and/or surface water relative to the existing situation. Options with the lowest impact score the highest points. The maximum number of points is 200.

.5 Implementation/Operational Risk

Implementation/operational risk rates the difficulty in implementing the option from a technical or administrative viewpoint and the difficulty in successfully operating the option once it has been constructed. Options that can be easily implemented and present little operational risk score the highest points with a maximum possible of 150.

.6 Flexibility

Flexibility is a measure of the ability of an option to increase capacity to service additional areas and/or population or to react to operational problems or changes in regulations or technology. The options showing the greatest degree of flexibility score the highest points. The maximum number of points is 150.

.7 Land Use Impact

Land use impact measures the relative amount of land area that must be dedicated to construction and/or operation of the option. The options that require the least land area and have the least impact on surrounding area score the highest points with a maximum possible score of 100.

The option with the highest overall score is the most favourable option from an overall decision matrix viewpoint. The option with the lowest score is the least favourable.

11.2 DISCUSSION

A ranking of the option based on the decision matrix and the monthly user cost is presented in Table 11-3.

Option 1, Regional Sewerage System, ranks first in the decision matrix and fifth in the monthly user cost comparison. The option offers a high degree of phosphorus reduction and environmental protection. It also offers a great deal of flexibility in terms of future development and is attractive to Summerland as there is virtually no impact on land use by structures or by effluent disposal. If the scheme is agreed to by the City of Penticton and the Province, implementation is straight forward with minimal operational risk. It should be noted that if a time frame beyond 20 years is considered, the economics of this option would be more favourable.

Option 5, Combined Irrigation/Lake Disposal, scores the second highest in the decision matrix and has the third lowest monthly user cost. This option combines the ease of implementation of a lake disposal system with the added benefit of nutrient utilization and increased removal of effluent irrigation without the technical, economic and implementation difficulties of an effluent irrigation system alone. The option thus scores well in the categories of phosphorus reduction, environmental impact and implementation/ operational risk. As the system can be readily expanded and adapted to changing technology, it also scores fairly high in terms of flexibility. Under the category of land use impact, Option 5 requires that land be dedicated for the advanced wastewater treatment plant site. As there are two disposal modes, however, the land for irrigation disposal is not necessarily tied up in perpetuity for wastewater disposal. This option thus scores slightly higher than other effluent irrigation options.

Option 2A, Lake Disposal, scores third highest in the decision matrix and has the second lowest monthly user cost. It offers the advantages of relatively high phosphorus removal, low environmental impact, ease of implementation with low operational risk, flexibility and low land use impact. It scores slightly lower than Option 5 as lower cost does not fully offset the other advantages of Option 5.

Option 3, Effluent Irrigation, ranks fourth and sixth in the decision matrix and the monthly user cost comparison, respectively. The costs of this option are very high and it would be difficult to implement. As effluent irrigation is the sole method of disposal, large areas of land would be tied up for treatment, storage and irrigation. The option however scores highly in terms of phosphorus reduction and environmental impact.

Option 2B, Lake Disposal, ranks fifth in the decision matrix and has the second highest monthly user costs. Although this option is a down-scaled version of Option 2A that ranks the second highest, Option 2B scores lower as the overall phosphorus removal for the study area is lower and the system is less flexible in terms of future upgrading.

Option 4, High Rate Land Disposal, ranks sixth in the decision matrix. The option, however, has the lowest monthly user cost. This option achieves a lower incremental phosphorus removal relative to the options serving a larger area of the community and thus scores lower in this category. Detailed geotechnical investigation would be required to confirm the feasibility of rapid infiltration disposal in the areas proposed and thus this option rates relatively low in the category of implementation and operational risk. The impact of nitrate addition on the groundwater would not be substantially improved with this option and thus it scores lower under the category of environmental impact than effluent irrigation options. Although the system could be expanded to allow for limited future growth, the ultimate disposal capacity is finite and thus this option scores slightly lower than the options incorporating lake disposal. Option 4 requires a relatively large quantity of prime agricultural/future residential land to be tied up for wastewater treatment and disposal. The option therefore scores relatively low under land use impact. In summary, although Option 4 shows the lowest monthly user costs, it ranks about mid-way in terms of its overall benefits.

Option 7, Enhanced On-Site Disposal/Land Use Control, ranks seventh in the decision matrix and has the third highest user cost. The capital cost of this option is the lowest of all of the options, however, the technology and performance has not been proven and thus this option scores the lowest in terms of implementation/operational risk. It is interesting to note that although Option 7 has the lowest overall cost, the monthly user cost is the second highest of all the options due to the small number of dwellings served.

Option 6, Cluster Systems, ranks the eighth in the decision matrix and has the highest monthly user cost. This option scores low in terms of the incremental phosphorus removal and does not appreciably change the impact of nitrate on the groundwater. This option scores fairly low in terms of implementation due to the difficulty in obtaining the land areas, the geotechnical investigations required to confirm the feasibility, and obtaining the cooperation of the property owners along the lakeshore. The cluster systems have a finite disposal capability and are thus not amenable to future development. Finally, the cluster systems tie up a significant land area for wastewater disposal.

Option 3B, Effluent Irrigation for the Town Centre area only, ranks last in the decision matrix and sixth lowest in terms of monthly user cost. This option has similar problems in terms of difficulty of implementation and high cost as Option 3A with the added factor that it does not address the existing wastewater disposal situation along the lakeshore.

TABLE 11-1

DECISION MATRIX PARAMETERS

PARAMETER	MAXIMUM POINTS
Economics	100
User Cost	100
Phosphorus Reduction	200
Environmental Impact	200
Implementation/Operational Risk	150
Flexibility	150
Land Use Impact	100
TOTAL POINTS	1,000

TABLE 11-2

COST-BENEFIT MATRIX

PARAMETER	OPTION 1: REGIONAL SEWERAGE SYSTEM	OPTION 2A: LAKE DISPOSAL	OPTION 2B: LAKE DISPOSAL	OPTION 3A: EFFLUENT IRRIGATION	OPTION 3B: EFFLUENT IRRIGATION	OPTION 4: HIGH RATE LAND DISPOSAL	OPTION 5: COMBINED IRRIGATION/ LAKE DISPOSAL	OPTION 6: CLUSTER SYSTEMS	OPTION 7: ENHANCED ON-SITE DISPOSAL/ LAND USE CONTROL
Economics	15	15	45	10	20	20	15	60	100
User Cost	75	85	50	75	75	100	85	40	45
Phosphorus Reduction	180	170	95	200	80	100	180	80	50
Environmental Impact	180	160	160	200	120	160	180	160	160
Implementation/ Operational Risk	100	120	120	60	60	90	100	90	60
Flexibility	150	120	80	100	80	80	150	80	80
Land Use Impact	100	80	80	60	60	70	70	70	100
TOTAL	800	750	630	705	495	620	780	580	595

TABLE 11-3

RANKING OF OPTIONS

RANKING	OPTIONS	
	DECISION MATRIX RANKING	MONTHLY USER COST RANKING[1]
Most Attractive	1	4
	5	2A
	2A	5
to	3A	3B
	2B	1
	4	3A
	7	7
	6	2B
Least Attractive	3B	6

Note:

1. Year 2008 monthly user costs assuming 75 percent senior government funding.

ASSOCIATED ENGINEERING

12.2 LOWER TROUT CREEK

At a minimum, enhanced on-site disposal and/or land use control, as described under Option 7, should be considered for the lakeshore areas. Alternatively, servicing of the lakeshore areas by a community sewer system will reduce the problem of phosphorus transmission to the lake.

Under Option 7, the non-lakeshore areas would remain on on-site disposal. As this area exhibits relatively high phosphorus transmission, development should be effectively stopped at its present level. Residential zoning densities should not be increased from the current levels and conversion of agriculture lands to residential development should not be entertained. Increased commercial activity should be evaluated on a site-specific basis.

12.3 UPPER TROUT CREEK

Under Options 1, 2A, 3 and 5 portions of Upper Trout Creek would be serviced by a community sewer system. Increased development in accordance with planning criteria would thus be possible.

Under other options, Upper Trout Creek would remain on on-site disposal. The majority of the area is zoned A2 (agriculture - 2 ha minimum) with a limited area of RS zoning (single family - 800 m^2 minimum). Increased commercial and/or limited residential development at RC-2 zoning (country residential - 0.14 ha minimum) could be considered based on site specific assessments.

12.4 PARADISE VALLEY/SOUTHWEST SUMMERLAND

Under all options, this area would remain on on-site disposal.

The majority of the area is zoned as FG (forestry grazing - 20 ha minimum) and A2 (agriculture - 2 ha minimum) with minor areas zoned RC-2 (country residential - 0.14 ha minimum).

The area, in general, exhibits a low phosphorus transmission potential and offers favourable on-site disposal conditions. The eastern portion of the area and the area along Trout Creek falls within the "red" and "orange" areas in terms of silt cliff stability. Development in the "red" area is currently not recommended. Future development in the "orange" area is limited to a 0.4 ha minimum lot size.

Development from an on-site wastewater management viewpoint can proceed based on current zoning and stability criteria. Proposed development in excess of current densities (RC-2) should be evaluated on a site specific basis.

12.5 FRONT BENCH

Under all options, this area would remain an on-site disposal.

The majority of the area is zoned as A2 (agriculture - 2 ha minimum) and RC-2 (country residential - 0.14 ha minimum) with small areas of RSM (mobile home park) and RS (single family - 800 m^2 minimum). The area has been identified as a future growth area in the community plan.

The phosphorus transmission potential of the soils generally ranges from moderate to low. The primary constraint on development density is stability consideration regarding the silt bluff. The area immediately west of Hwy. 97 falls within the "red" and "orange" zones. Development with the "red" zone is not recommended. Future development in the "orange" zone should be limited to a minimum lot size of 0.4 ha. Areas falling within the above zones should be developed following the slope stability guidelines.

The remainder of the Front Bench area lies within the "white" stability designation. This category is subdivided into D1 and D2. Future development in the D1 area should be limited to 0.14 ha minimum lot size (RC-2 zoning). Development within the D2 area is not constrained by stability considerations and should follow current zoning (RC-2 zoning). Site specific studies should be carried out for proposed developments at densities greater than RC-2 zoning.

12.6 PRAIRIE VALLEY

The Prairie Valley area would remain on on-site disposal under all of the options.

The majority of the area is currently zoned A-2 (agriculture - 2 ha minimum) with limited areas of RC-2 (country residential - 0.14 ha minimum) and FG (forestry-grazing - 20 ha minimum).

Development is constrained in the valley floor area by limitations on on-site disposal caused by impermeable soils and high water tables. Development densities in this area should not be increased from the current zoning (A2 and RC-2) without site specific studies.

Conditions for on-site disposal on the valley sides is more favourable due to the more permeable soils and greater depth to groundwater. Large-scale development, however, could lead to seepage problems below the development. Development densities should not be increased beyond RC-2 zoning without site specific studies.

12.7 TOWN CENTRE

The majority of the Town Centre would be serviced by a community sewer system under Options 1, 2A, 3, 4, and 5. With a sewer system in place, wastewater disposal would not be a constraint to redevelopment under Options 1, 2A, 3, and 5. Option 4 allows development of the core area but has limited potential for expansion.

Under Options 2B, 6, and 7, the Town Centre area would remain on on-site disposal. As discussed in the Stage 1 report, the majority of the development should be consistent with the stability criteria guidelines.

12.9 CRESCENT BEACH/HIGHWAY 97

Crescent Beach would be serviced by a community sewer system under Options 1, 2A, 2B, 3, 4, 5, and 6. Under Option 7, enhanced on-site disposal and land use controls would be utilized to reduce phosphorus transmission and to control development. The Highway 97 area would remain an on-site disposal under all options.

The area on the bench above Crescent Beach is currently zoned A2 (agricultural) with limited areas of RS (single family), RM3 (multi-family), RSM (mobile home park), RC2 (country residential), and M1 (light industrial).

The area is generally suitable for low density development utilizing on-site disposal. The northern portion of the area exhibits bedrock outcrops and shallow soil in some areas. Development in these areas should be governed by site specific studies to determine the suitability of on-site disposal. The areas near the silt bluffs are in the "red" and "orange" stability zones. This presents the major constraint for further development.

In general, stability criteria should control future development. In areas of bedrock outcropping, or where densities higher than RS (single family) are proposed, site specific studies should be carried out.

12.10 GARNETT VALLEY

The Garnett Valley area will remain on on-site disposal under all of the options.

The area is generally zoned A2 and A8 (agricultural) and FG (forestry grazing) with limited area of RC1 and RC2 (country residential).

The area has been identified as being environmentally sensitive in terms of phosphorus transmission due to the permeable soils and proximity of Eneas Creek. Future development in the valley adjacent to the creek should thus not be considered without controls to minimize phosphorus transmission. Development on the valley sides and bench land area between Eneas Creek and Okanagan Lake will be limited by topography, shallow soil, and bedrock. Rezoning of the area for residential development should be proceeded by site specific investigation into the suitability of the area for on-site disposal.

12.11 CARTWRIGHT MOUNTAIN/NORTH PRAIRIE VALLEY

This area would develop an on-site disposal under all of the options. The potential, however, does exist to service the Cartwright Mountain area by community sewer under Options 1, 2A, 3, and 5, in the long term.

The area is generally zoned as A8 (agricultural) and FG (forestry--grazing), although a significant area of Cartwright Mountain is zoned RS (single family). Development with the RS zoning is currently very limited.

The western portion of the area offers generally favourable conditions for development of on-site disposal. The soils are relatively permeable with a large depth to the groundwater table. Due to the distance from surface watercourses, the potential for phosphorus transmission is low.

The eastern portion of the area (Cartwright Mountain) presents more constraints to on-site disposal. The area is characterized by moderately steep topography, bedrock exposures, and shallow soils in many areas. As portions of this area are currently zoned RS (single family), on-site disposal problems may limit development potential. It is recommended that proposed subdivision development within the RS zone be proceeded by site specific investigations to ensure that on-site disposal is feasible, and that the area is developed at densities compatible with on-site disposal capacity.

12.12 REGULATORY CONTROLS

On-site wastewater disposal will continue to play a major role in overall wastewater management within the District regardless of the option selected. In particular, if Option 7 is selected, wastewater management will be entirely by on-site treatment and disposal.

In order that on-site disposal systems function to their optimum, more extensive and effective controls are required to ensure satisfactory initial and continued performance of the systems. This is particularly critical in areas of high phosphorus transmission, and in areas of high density development such as the Town Centre core.

Enhanced on-site disposal management for lakeshore areas is discussed under Option 7. Regulatory controls that could be considered by the District for other areas on on-site disposal include:

.1 In conjunction with the Ministry of Health, approve plans and installation of initial or replacement disposal works. Initiate a data file on system age, design details, soil types, etc., for future building permits, assistance in repair of problems, and prediction of failure rates in aging systems.

.2 Protect tile field areas and backup areas with restrictive covenant.

.3 Monitoring of the frequency of pump out of individual septic tanks or holding tanks to ensure this is carried out on a regular basis.

The actual pump out could be handled by private contractor or by the District. Pump out costs could be billed annually with property taxes.

.4 Access authority to inspect existing installations including the installation of monitoring wells if required.

.5 Authority to require modifications to existing systems if deemed a requirement due to system age or performance.

.6 Mandatory site specific investigation prior to rezoning to densities greater than RC-2 and prior to subdivision at densities greater than RC-2. The investigation should address the ability and life expectancy of the site to adequately accept and dispose of effluent including the geotechnical aspects of water loading from all sources and the impact on adjacent properties.

In addition to regulatory controls, the use of low or no phosphate detergents should be encouraged on a District or valley-wide basis, in order to reduce phosphorus loading to the lakes. Water conservation should also be encouraged to reduce the potential for hydraulic problems in less permeable soils.

12.13 FUTURE SERVICING

In proposed development areas, where eventual sewer servicing is expected, zoning and planning should consider the most cost-effective sewer layout. Consideration could be given to initially selling double lots such that the dwelling is constructed on one lot and the tile field on the second lot. After sewer servicing, the second lot could then be sold and a dwelling constructed.

TABLE 12-1

ZONING DEFINITIONS

DESIGNATIONS	DESCRIPTION
FG	Forestry-Grazing (20 ha minimum)
A8	Agriculture (8 ha minimum)
A2	Agriculture (2 ha minimum)
RC1	Country Residential (0.8 ha minimum)
RC2	Country Residential (0.14 ha minimum)
RS	Single Family (800 m^2 minimum per unit)
RD	Two Family (550 m^2 minimum per unit)
RSM	Mobile Home Park (2 ha minimum)
RM3	Multi-Family (20 two BR units per 0.4 ha)
C1	Local Commercial
C2	Commercial Centre (Shopping Centre)
C3	Central Business
CT1	Tourist Commercial (Motels)
CT2	Tourist Commercial (Campground)
CA	Commercial Amusement (Outdoor)
CS1	Service Station
CS2	Service Station/Convenience Store
CS3	Service Commercial (Sales Lots)
CM	Heavy Commercial (Warehousing, Storage)
M1	Light Industrial
M2	General Industrial (Landfill, Gravel Processing)
I	Institution (Hospital, Churches, Library)
P	Parks (Parks, Golf Courses, Cemeteries)

TABLE 12-2

SUMMARY OF WMP AREAS AND GUIDELINES FOR FUTURE DEVELOPMENT UTILIZING ON-SITE DISPOSAL

AREA	PHOSPHORUS TRANSMISSION POTENTIAL TO OKANAGAN LAKE	POTENTIAL FOR HYDRAULIC CAPACITY LIMITATIONS	POTENTIAL OF SILT BLUFF STABILITY CONCERNS	GUIDELINES FOR FUTURE DEVELOPMENT
Lower Trout Creek	Very High	Moderate	None	On-site disposal limits future developments due to P transmission.
Upper Trout Creek	High	Low	None	On-site disposal limits future developments due to P transmission.
Paradise Valley/ Southwest Summerland	Low	Low	None to High	On-site disposal at current zoning does not limit development. Bluff stability criteria apply in eastern portion.
Front Beach	Low to Moderate	Low to Moderate	Moderate to High	On-site disposal does not limit development at current zoning. Bluff stability criteria apply in eastern portion.
Prairie Valley	Low	High	None	On-site disposal limit future developments due to hydraulic problems.
Town Centre	Moderate	Moderate	Low	On-site disposal limits future redevelopment in core area due to the high density.
Lower Town	Very High	Low to Moderate	None	On-site disposal limits future development due to P transmission.
Peach Orchard Road	Low to Moderate	Moderate	Moderate to High	On-site disposal limits higher density development. Bluff stability concerns are the primary constraint.
Crescent Beach	Very High	Moderate	None	On-site disposal limits future development due to P transmission.
Highway 97	Low to Moderate	Moderate to High	Moderate to High	On-site disposal limits development in areas of shallow soil or bedrock. Bluff stability in eastern portion.
Garnett Valley	Low to High	Low to High	None	On-site disposal limits development near Eneas Creek due to P transmission. Development on hillsides may be limited by shallow soils and bedrock.
Cartwright Mountain/ North Prairie Valley	Low	Low to High	None	On-site disposal at current zoning does not limit development in western area. In the eastern area (Cartwright Mountain) topography, bedrock and shallow soils may limit development.

13.0 PUBLIC INPUT

13.1 PUBLIC INFORMATION MEETING

A public information meeting was held in February 1989 to present the findings of Stage II of the WMP and to solicit input from the public.

The format of the meeting was a one hour presentation followed by a question and answer period and open house.

The meeting was attended by about 200 persons. The information handout and questionnaire available at the meeting are presented in Appendix C.

13.2 QUESTIONNAIRE RESULTS

A total of 85 questionnaire forms were returned.

The responses to the questions were as follows:

	Yes	No	No Response
Would you prefer a community system serving your property?	52%	36%	12%
Would you like to see an expansion of the Town Centre commercial/high density residential area that would be possible with a community disposal system?	52%	39%	9%
Would you like to see rebuilding of the Lower Town area that would be possible with a community disposal system?	48%	39%	13%

Which Option(s) do you prefer?

Option 1:	Regional Sewerage System	15%
Option 3A:	Effluent Irrigation	15%
Option 5:	Combined Irrigation/Lake Disposal	16%
Option 7:	Enhanced On-Site Disposal Land Use Control	9%
Other Options		8%
No response		37%

What would your family be willing to pay for a community sewerage system serving your property?

Less than $20/month	40%
$20 to $30/month	35%
$30 to $50/month	11%
Over $50/month	4%
No response	10%

14.0 SUMMARY

The District of Summerland is unique in the Okanagan Valley in that it has an urban core of some 5,000 persons utilizing on-site disposal. This situation has developed because the Town Centre is located on very permeable sands and gravels. If the soils had been less permeable, community sewers would likely have been constructed many decades ago.

The lack of a community sewerage system is restricting redevelopment of the downtown core. In addition, on-site disposal is exhibiting a significant environmental impact in terms of phosphorus transmission to Okanagan Lake and nitrate levels in the groundwater. Options 1, 2A, 3A, 3B, 4, and 5 involve implementation of a community sewerage system on a large-scale basis. Capital costs are in the order of $14 to $26 million for collection, treatment, and disposal, with collection making up about 70 percent of the cost.

Options 2B, 6 and 7 deal essentially with the high phosphorus transmission areas along the lakeshore. Although the capital costs are considerably lower, the monthly user costs are higher than the above options due to the low number of property owners contributing to the costs.

Option evaluation was carried out utilizing a decision matrix technique that considers both monetary and non-monetary factors. A summary of the options is presented in Table 14-1. The two highest ranking options are:

Option 1: Regional Sewerage System

Option 5: Combined Irrigation/Lake Disposal

Option 1 involves a regional sewerage scheme with the City of Penticton. Wastewater from the District of Summerland is pumped to the City of Penticton, treated in an advanced wastewater treatment plant, and disposed of by a future combined surface water/effluent irrigation system. The scheme is attractive to the District of Summerland as there is minimal impact on land use within the District. The scheme is also attractive on a regional basis as the wastewater is removed from the Okanagan Lake watershed, servicing of the area between Summerland and Penticton would be feasible, and the larger scale of the system allows long-term economic savings and the operation of a single advanced wastewater treatment facility. Although the City of Penticton has expressed interest in pursuing the concept with the District, approval of the scheme has not been secured.

Option 5 is the most suitable scheme if the District of Summerland proceeds on its own. The scheme offers a high degree of environmental protection, redevelopment of the urban areas, and flexibility in terms of effluent disposal.

Based on the Stage II of the WMP, the following recommendations are presented:

.1 Options 1 and 5 have similar overall costs, however, Option 1, Regional Sewerage System, offers a number of advantages and is believed to be the most suitable scheme from a long-term regional viewpoint.

Discussions should be held between the District, the City of Penticton, and the Province on a regional sewerage scheme. If the outcome is favourable, Option 1 with a phased approach to reduce initial costs should be pursued. In the event that a regional sewerage scheme does not appear to have support, Option 5 would be the second choice.

.2 The District of Summerland will require a high level of financial support from the senior governments as the collection system infrastructure, in place in other urban areas of the Okanagan, is not in place in the District. Discussions should be held with senior government to determine available funding on both an environmental and economic development basis.

.3 In the event of a delay in implementing either Options 1 or 5, the District should adopt the land use concept of Option 7, Enhanced On-site Disposal/Land Use Control, in order to keep phosphorus inputs to the lake at their present level and to control future development. The recommendations presented in Section 12.0 of this report should be followed in order to minimize the environmental impact of future development.

TABLE 14-1

SUMMARY OF WASTEWATER MANAGEMENT OPTIONS

OPTIONS	CAPITAL COST ($ x 10^6)	MONTHLY USER COST[1] ($)	RANKING IN DECISION MATRIX[2]	COMMENT
Option 1: Regional Sewerage System	19.0	33	1	Recommended option.
Option 2A: Lake Disposal	20.6	29	3	Option 5 provides additional advantages at slightly higher cost. Option not pursued.
Option 2B: Lake Disposal	6.3	59	5	Limited opportunity for future growth and high user cost. Option not pursued.
Option 3A: Effluent Irrigation	25.9	34	4	High cost and difficult to implement due to land ownership question. Option not pursued.
Option 3B: Effluent Irrigation	15.9	33	9	Similar to Option 3A and does not address lakeshore problem. Option not pursued.
Option 4: High Rate Land Disposal	13.9	25	6	Unknown performance and risk of technical problems out weighs low cost. Option not pursued.
Option 5: Combined Irrigation/ Lake Disposal	21.5	30	2	Recommended option if Option 1 not favoured by the City of Penticton and Provincial Government.
Option 6: Cluster Systems	4.2	61	8	Limited opportunity for growth. Option not pursued.
Option 7: Enhanced On-site Disposal/Land Use Control	1.8	56	7	Limited opportunity for growth. Land use concept of this option recommended as interim step if delay in implementing Option 1 or Option 5 is encountered.

Notes:

1. Year 2008 monthly user costs per connection assuming 75 percent senior government funding.

2. The lowest number is the most attractive and the highest number is the least attractive in the decision matrix.

LIST OF REFERENCES

1. Regional District of Okanagan Similkameen, Addendum to the the Technical Supplement of Summerland's Community Plan, March 1986.

2. Stanley Associates Engineering Ltd., City of Penticton Wastewater Management Plan, Stage II Report , November 1986.

3. Golder Associates, Report to the Corporation of the District of Summerland on Stage II and Stage III Program to Assist the Development of Municipal Policy for Subdivision and Building Construction in Areas of Potentially Unstable Soils, District of Summerland, January 1980.

APPENDIX A

ESTIMATED COST DATA

TABLE A-1

UNIT COSTS[5]
WASTEWATER COLLECTION

ITEM	COST ($)
1.0 GRAVITY SEWERS[1]	
.1 200 mm dia.	150/m
.2 250 mm dia.	170/m
.3 300 mm dia.	190/m
.4 375 mm dia.	250/m
.5 House Connection[2]	1,000/DU
2.0 STEP SEWERS	
.1 38 to 75 mm dia.[3]	80/m average
.2 STEP Unit[4]	3,200/DU

Notes:

1. Includes lateral to property line.
2. Laterial from house to property line and decommissioning of septic tank.
3. Includes pressure laterial to property line.
4. New septic tank, pumping tank, and pressure lateral to property line. Decommissioning of old septic tank. If septic tank is not required, cost is assumed to be $2,400.
5. Excludes engineering and contingency allowance. ENR cost index is 4700.

TABLE A-2

UNIT COSTS[1]
WASTEWATER TRANSMISSION

ITEM	COST ($)
FORCE MAINS	
.1 100 mm dia.	80/m
.2 150 mm dia.	100/m
.3 200 mm dia.	115/m
.4 250 mm dia.	140/m
.5 300 mm dia.	160/m
.6 350 mm dia.	190/m
.7 400 mm dia.	225/m

Note:

1. Excludes engineering and contingency allowance. ENR cost index is 4700.

TABLE A-3

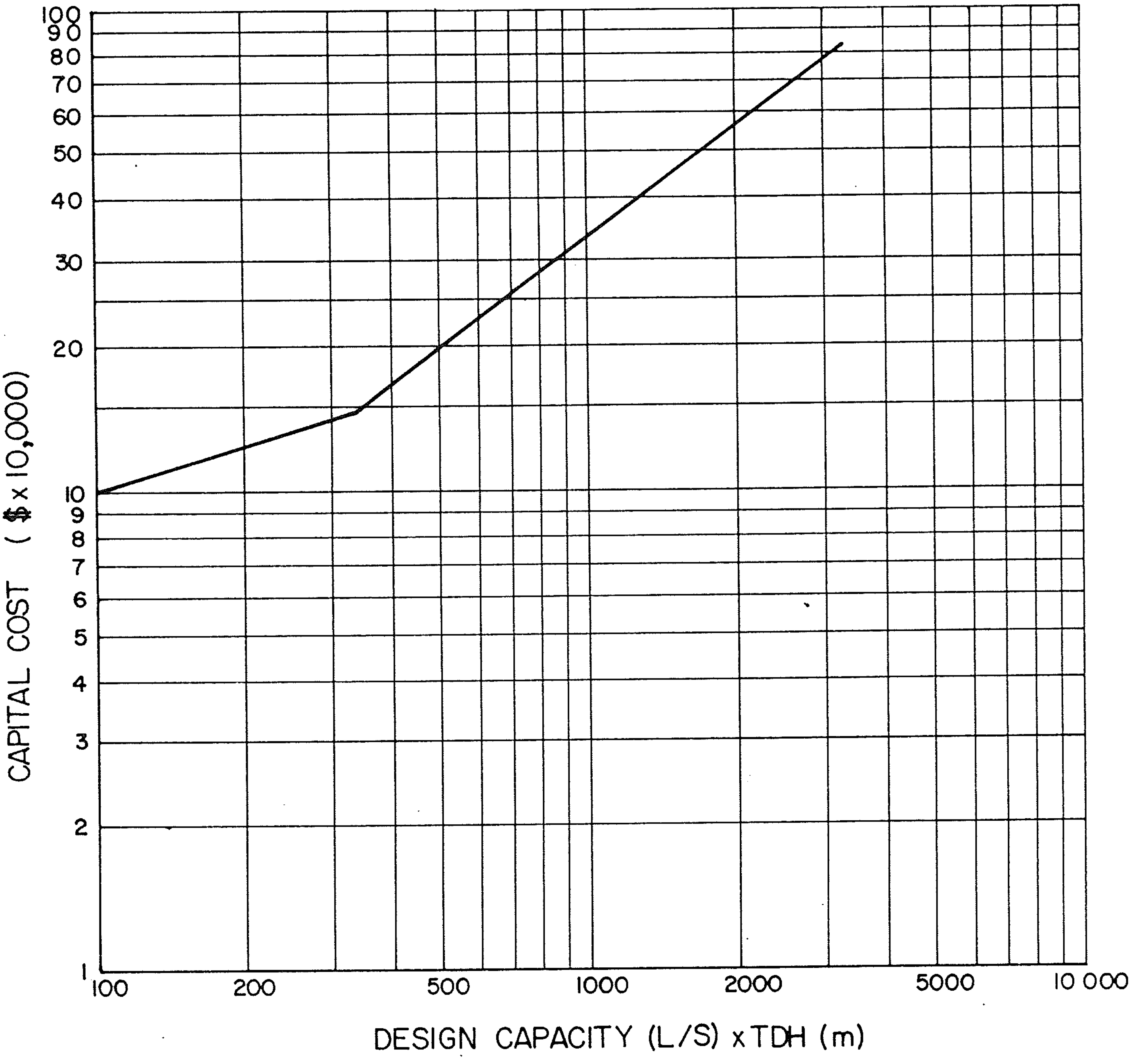
UNIT COSTS[1]
OPERATION AND MAINTENANCE

ITEM	COST
1.0 LABOUR	
.1 Operator (average)	$30,000/man-year
.2 Superviser (AWT Plant)	$50,000/man-year
2.0 POWER	$0.048/kWH
3.0 CHEMICALS	
.1 Chlorine	$0.80/kg
.2 Sulphur Dioxide	$1.60/kg
4.0 MAINTENANCE[2]	
.1 Gravity Sewer, Force Main, Storage Reservoirs, Outfalls	0.25% of Construction Cost
.2 Aerated Basin Treatment Plants	0.50% of Construction Cost
.3 Pumping Stations, Mechanical Treatment Plants	1.0% of Construction Cost
.4 STEP Units	5.0% of Construction Cost

Notes:

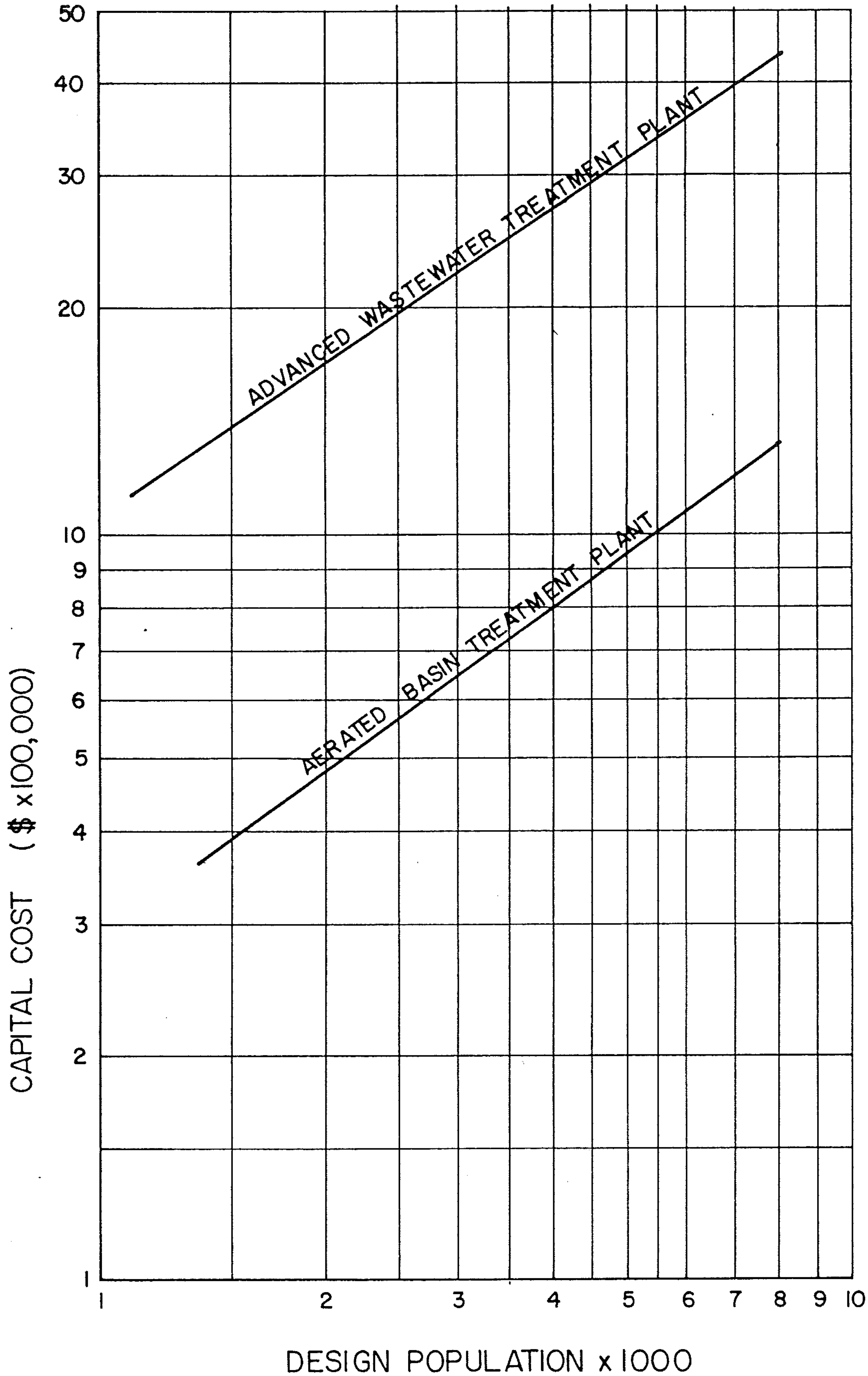
1. ENR cost index is 4700.

2. Average annual cost.



ENR 4700
EXCLUDES ENGINEERING
AND CONTINGENCY ALLOWANCE
INCLUDES STANDBY POWER

RAW WASTEWATER
PUMPING STATION COST



ENR 4700
EXCLUDES ENGINEERING
AND CONTINGENCY ALLOWANCE

WASTEWATER TREATMENT PLANT COSTS

APPENDIX B

GOLDER ASSOCIATES REPORT

Golder Associates
CONSULTING GEOTECHNICAL AND MINING ENGINEERS

REPORT TO
ASSOCIATED ENGINEERING (B.C.) LTD.
ON A
REVIEW OF POTENTIAL RAPID INFILTRATION SITED
WASTE MANAGEMENT PLAN
DISTRICT OF SUMMERLAND

June 9/95

Peter tells me Myles has this

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Golder Associates

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

December 13, 1988

Associated Engineering (B.C.) Ltd.
Suite 300, 4940 Canada Way
Burnaby, B.C.
V5G 4M4

ATTENTION: Mr. R. Corbett, P. Eng.

Re: District of Summerland
Waste Management Plan
Review of Potential
Rapid Infiltration Sites

Gentlemen:

Golder Associates has completed a review of three potential rapid infiltration sites in the vicinity of Summerland as identified in the site plan submitted. The purpose of the review is to determine which site(s) appear feasible and the extent of further work needed to confirm the suitability of the site(s) for rapid infiltration disposal of waste water. A fourth area was added as a potential site for rapid infiltration and was also considered for cluster community tile field disposal of waste water.

A two phase approach was used in conducting the review. Phase I consisted of:

- a detailed review of available information on the soil types, geology, and hydrogeology. Information reviewed included government publications, in-house geotechnical engineering reports, and reports by other consultants;

- a review of all water well records on file with the Ground Water Section, Water Management Branch of the Ministry of Environment; and,

- a review of air photographs of the area.

The second phase of the assessment began once all the data from Phase I had been reviewed. Phase II consisted of:

- a site visit by an experienced hydrogeologist;
- a review of all compiled data and a site visit by an experienced senior geotechnical engineer; and,
- preparation of a report documenting our findings, conclusions and recommendations.

AREA 1

Area 1 is located approximately 650 meters northwest of the reservoir for the Municipality of Summerland's domestic and irrigation water supply (Figure 1). A design flow rate of 644,000 cubic meters per year, on a year round basis, has been proposed by Associated Engineering (B.C.) Ltd. (AE) for this site. An application rate of 30 meters per year was used as a guideline for the review of this area.

The proposed site is located near the contact between outwash terrace deposits and morainal ridge deposits. The outwash deposits are stratified drifts that are built beyond the limits of the glacier by streams flowing from the melting ice. The high energy outwash depositional environment causes finer particles to remain in suspension, resulting in a coarse grained deposit of sands and gravels. Morainal ridges are ridge-like deposits of glacial debris formed by the direct action of the glacier ice. The morainal depositional environment is a low energy environment that results in a poorly sorted deposit of re-worked sediments. A large glacial lake deposit of very fine grain material lies to the east of the moraine ridges.

The outwash terrace deposits are loose, coarse grained, well sorted and permeable sediments. Moraine ridge deposits consist of poorly sorted, compact, fine to coarse grained sediments and are less permeable than the outwash terrace deposits. The moraine deposits are sufficiently low in permeability to retain water in the District's reservoir, however, seepage along the eastern face of the reservoir was observed during the site visit. The lacustrine deposits which lie to the east of the site consist of soft clayey silt and are relatively impermeable.

Ground water flow direction from the site is believed to be to the east and southeast towards Prairie flats (the glacial lake deposits). Some component of the flow system may be directly south from the site towards Trout Creek.

The ability of water to infiltrate unsaturated sediments is a function the moisture tension head, moisture content and hydraulic conductivity of the sediments. A soil system with a low initial moisture tension head and moisture content coupled with a high hydraulic conductivity would result in a large capacity to infiltrate water. The outwash terrace deposits appear to have favorable properties for rapid infiltration of waste water however, based on review of the glacial history of the area it is doubtful that the permeable outwash deposits are continuous to the lake, which would be the ultimate receiving body of the wastewater. If the outwash deposits are limited in extent, back-up and surfacing of wastewater would be expected. A drilling investigation will be required to define the nature and extent of the permeable outwash deposits and determine continuity to Okanagan Lake.

AREA 2

Area 2 is located within the central portion of the district of Summerland (Figure 1). A design flow rate of 644,000 cubic meters per year, on a year round basis, has been proposed by AE for this site. An application rate of 30 meters per year was used as a guideline for the review of this area.

Outwash terraces, kame terraces and meltwater channels underlie the site. Kame terrace deposits consist of stratified drift deposits between a glacier and the valley wall; after the melting of the glacier the deposit remains as a flat-topped terrace along the valley wall. Meltwater channel deposits are fluvial deposits derived from melting glacial ice water.

The outwash terrace deposits consist of dense, coarse grained well sorted and permeable sediments. The outwash deposits are thought to be continuous eastward towards Okanagan Lake however, this has not been established through drilling and therefore the thickness and permeability of these deposits is presently unknown.

Ground water flow direction from the site is believed to be towards the east. The depth to the water table surface is not known as there are no borehole records in the immediate vicinity of the site. A ground water monitoring well was constructed by Golder Associates on December 11, 1979 as part of regional geotechnical study of the area. The borehole is located 1.8 km southeast of the proposed area at an approximate elevation of 435 meters above mean sea level (MSL). The water table surface was encountered at approximately 7 meters below ground surface on January 15, 1980 (428 m above MSL). Approximately 17 meters of saturated sand and gravel underlying 8 meters of saturated silt was encountered in the borehole. The proposed infiltration site is approximately 487 meters above MSL. The elevation of Okanagan Lake is approximately 342 meters above MSL. Due to the very coarse nature of the sediments underlying the site a considerable depth to the water table surface is likely, however, the underlying bedrock may be controlling the water table elevations since the sand and gravel unit is seen to be completely saturated southeast of the proposed infiltration area at an elevation of approximately 62 meters lower than the site area. Alternatively this may be evidence that there is some interruption in the continuity of the outwash sands and gravels or a constriction of this soil unit.

A review of the geological and geotechnical reports suggests that the coarse grained glacial fluvial deposits should be continuous eastward into Okanagan Lake. This site would be a good candidate area for further assessment as a potential rapid infiltration waste water disposal site. A drilling investigation is required to identify the nature and extent of the outwash sands and gravels and to confirm that these soils are continuous to Okanagan Lake.

AREA 3

Area 3 is situated in the southwest corner of the Municipality on the north side of Trout Creek (Figure 1). This area is known as Paradise Flats. A design flow rate of 972,000 cubic meters per year, on a year round basis, has been proposed by AE for this site. An application rate of 30 meters per year was used as a study guideline.

A review of the literature suggests that due to slope instability, this area does not possess suitable criteria for the disposal of waste water via rapid infiltration and should not be considered further.

AREA 4

The fourth area is under consideration for both rapid infiltration and cluster community tile field disposal of waste water. A design flow rate of 977,000 cubic meters per year and an application of 30 meters per year, on a year round basis, has been proposed by AE for this site if it is to be considered as a potential rapid infiltration area.

Area 4 is located approximately 4 km southeast of Summerland on a gently sloping alluvial fan of Trout Creek (Figure 1). The surface of the fan has an area of approximately 250 hectares and a slope of 1:100.

The sediments underlying the proposed site consist of coarse grained sandy gravel and cobbly gravels with large areas of predominantly sand and silty sand. The sand and silty sand has accumulated in the lower part of the fan (east of highway 97) while the coarse, more pervious gravels occur higher up towards the head of the fan.

There are numerous water supply wells and observation wells within the study area. Historical data indicate that the depth of the water table surface ranged from 1.6 to 4.4 meters below the ground surface (bgs) during the 1972 flooding of Trout Creek, and from 4.2 to 8.0 meter bgs prior to and after the flooding. Ground water flow direction is towards the east into Okanagan Lake.

Since water table levels occur at relatively shallow depth and the water table is seen to be significantly affected by flooding of Trout Creek this site does not appear to be suitable for rapid infiltration of waste water. This area does have the potential for cluster community tile field disposal of waste water and this option should be further evaluated through a drilling program which identifies the nature and extent of soils in the area and determines the continuity of permeable soils to the Lake.

SLOPE STABILITY

The stability of the silt bluff is controlled by the topography, soil stratigraphy and ground water conditions in the lower town of Summerland along Okanagan Lake. The results of previous studies by Golder Associates have included hazard zoning regulations and development controls in the area adjacent to the silt bluff. When considering the stability of the lacustrine silt sediments in the bluff area one of the main factors is local infiltration of surface water together with the location of the regional ground water table.

It is our conclusion that local water infiltration and local soil conditions will have a greater effect on the stability of the silt bluff than a minor change in the regional ground water level. Future investigations should include an assessment of the change in the ground water level along the silt bluffs adjacent to the Okanagan Lake.

Failure of the lacustrine silt sediments has been documented in the past. Safe guidelines for set back along the crest of the slopes were established and hazard zones were created.

CONCLUSIONS AND RECOMMENDATIONS

Rapid infiltration disposal of waste water appears possible and worth considering further at two of the proposed areas, Area 1 and Area 2. Based on the literature review and a site visit, the physical characteristics possessed by Area 2 may be more favorable for waste water disposal than Area 1. Area 2 appears more favorable because: (1) underlying gravels are likely to be continuous to Okanagan Lake and (2) the close proximity of the site to the lake would minimize further investigative costs. Area 1 appears to be less favorable because: (1) it is unclear whether or not the underlying gravels are continuous to the Lake (Okanagan Lake) and (2) the site is located approximately 5.5 kilometers west of the lake and the costs, related to further investigation of the continuity of the gravels, would be greater. Further evaluation of site suitability should begin with Area 2. Area 3 does not possess the necessary physical characteristics for the proposed development and should not be considered for further evaluation.

Rapid infiltration and cluster tile field disposal of waste water was considered at Area 4. High water table conditions preclude the use of this area for rapid infiltration however, cluster tile field disposal does appear to be a feasible option and further assessment is recommended.

We trust that this report is adequate for your present needs and we look forward to involvement with further hydrogeological studies.

Yours very truly,

GOLDER ASSOCIATES (WESTERN CANADA) LTD.

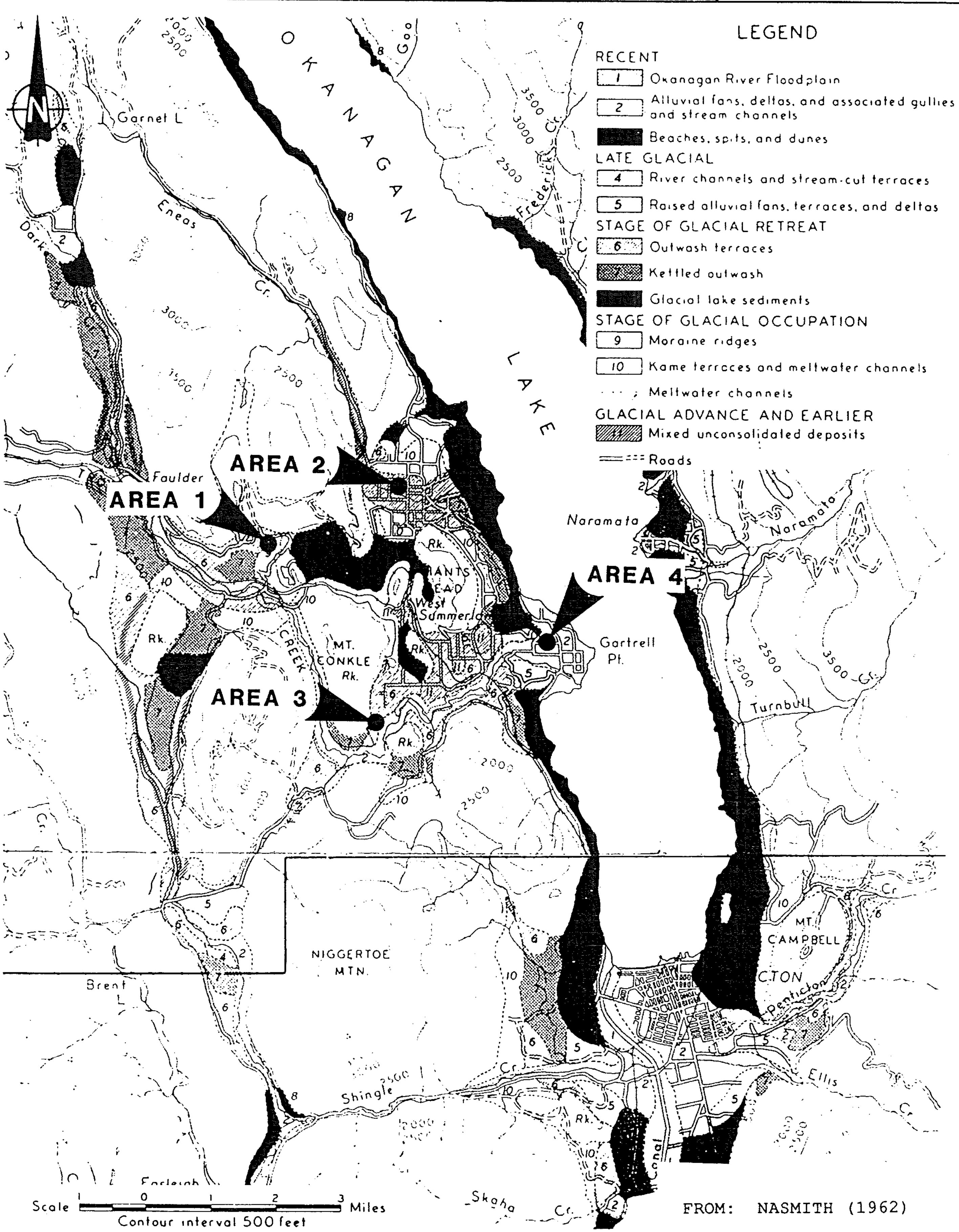
Gary Hamilton
Hydrogeologist

R.S. Guiton
Associate/Hydrogeology

GH/RSG/mk
882-1210

POTENTIAL RAPID INFILTRATION AREAS
DISTRICT OF SUMMERLAND
WASTE MANAGEMENT PLAN

Figure 1



Golder Associates

PROJECT NO. 882/2/0 DRAWN .... REVIEWED .... DATE ....

APPENDIX C

PUBLIC INFORMATION HANDOUT AND QUESTIONNAIRE

Information Handout

District of Summerland

Waste Management Plan
Public Information Meeting No.2

February 1989

The District of Summerland is currently preparing a Waste Management Plan (WMP) that will lay the groundwork for wastewater management in the District for the next 20 to 40 years.

Stage 1 of the WMP was completed in May 1988. The Stage 1 report, available for viewing at the District office, identified that the use of on-site (septic tank and tile field) disposal is limiting development in the Town Centre, Lower Trout Creek, and Lower Town areas. The areas of Trout Creek, Lower Town, and Crescent Beach were also identified as contributing a high degree of phosphorus to Okanagan Lake through on-site disposal systems.

Stage II of the WMP is currently underway. Nine options for the District have been formulated and are summarized on the attached sheets. Plans showing the nine options are on display. The options include a regional sewerage system with the City of Penticton, advanced wastewater treatment with disposal to Okanagan Lake, various land disposal schemes, and continued on-site disposal. The capital cost of the options range from $2 million to $26 million.

The options were reviewed at a technical workshop, consisting of Council members and personnel from a number of government agencies, in early December 1988. The favoured options are Option 3A: Effluent Irrigation and Option 5: Combined Irrigation/Lake Disposal. Option 5 is considered the preferrable option as it offers a number of advantages over Option 3A and is less expensive.

All of the community sewerage options will require a high level of senior government funding in order to bring the costs within economic reach of the community. The level and commitment of funding is unknown at this time.

Members of the audience are urged to fill out the questionnaire and return it at the meeting or to the District office.

OPTION 1: REGIONAL SEWERAGE SYSTEM

DESCRIPTION: Wastewater collected from the Town Centre; Crescent Beach; Peach Orchard Road/Lower Town; and Trout Creek and pumped to the City of Penticton sewerage system for ultimate disposal to the Okanagan River and Skaha Lake.

DESIGN POPULATION: 7100 persons

CAPITAL COST: $19.0 million

ANNUAL OPERATING AND MAINTENANCE COST: $480,000

MONTHLY USER COST WITH 75% SENIOR GOVERNMENT FUNDING: $33 per connection

ADVANTAGES

- Removal of wastewater from the Okanagan Lake watershed
- Reduction of nitrate level in the groundwater
- Redevelopment of Town Centre and Lower Town possible

DISADVANTAGES

- High capital cost
- High annual O&M cost
- Acceptance by the City of Penticton required

OPTION 2A: LAKE DISPOSAL

DESCRIPTION:	Wastewater collection as in Option 1. Advanced wastewater treatment and disposal to Okanagan Lake via a deep outfall.
DESIGN POPULATION:	7100 persons
CAPITAL COST:	$20.6 million
ANNUAL OPERATING AND MAINTENANCE COST:	$288,000
MONTHLY USER COST WITH 75% SENIOR GOVERNMENT FUNDING:	$29 per connection

ADVANTAGES

- High degree of nutrient removal
- Reduction of nitrate level in the groundwater
- Redevelopment of Town Centre and Lower Town possible

DISADVANTAGES

- High capital cost
- Requires skilled advanced wastewater treatment plant operator

OPTION 2B: LAKE DISPOSAL

DESCRIPTION: As in Option 2A but serving only the lakeshore areas of Crescent Beach, Lower Town, and Lower Trout Creek.

DESIGN POPULATION: 1250 persons

CAPITAL COST: $6.3 million

ANNUAL OPERATING AND MAINTENANCE COST: $144,000

MONTHLY USER COST WITH 75% SENIOR GOVERNMENT FUNDING: $59 per connection

ADVANTAGES

- Reduces the phosphorus input from lakeshore development
- Redevelopment of Lower Town possible

DISADVANTAGES

- High cost per user
- Does not allow redevelopment of Town Centre
- Nitrate levels in groundwater are not reduced
- Requires skilled advanced wastewater treatment plant operator

OPTION 3A: EFFLUENT IRRIGATION

DESCRIPTION: Wastewater collection as in Option 1. Secondary treatment with total effluent disposal by irrigation of land west of the Town Centre. Wintertime storage of effluent required.

DESIGN POPULATION: 7100 persons

CAPITAL COST: $25.9 million

ANNUAL OPERATING AND MAINTENANCE COST: $285,000

MONTHLY USER COST WITH 75% SENIOR GOVERNMENT FUNDING: $34 per connection

ADVANTAGES

- Nutrient value of effluent is utilized for crop growth
- Reduction of nitrate level in the groundwater
- Redevelopment of Town Centre and Lower Town possible

DISADVANTAGES

- Very high capital cost
- High annual O&M cost due to high pumping head
- Uncertainties in implementation
- Operational risk due to lack of control over effluent irrigation by private landowners

OPTION 5: COMBINED IRRIGATION/LAKE DISPOSAL

DESCRIPTION: Wastewater collection as in Option 1. Advanced wastewater treatment and disposal to Okanagan Lake in the non-irrigation season. Disposal by effluent irrigation in the Trout Creek area during the irrigation season.

DESIGN POPULATION: 7100 persons

CAPITAL COST: $21.5 million

ANNUAL OPERATING AND MAINTENANCE COST: $290,000

MONTHLY USER COST WITH 75% SENIOR GOVERNMENT FUNDING: $30 per connection

ADVANTAGES

- High degree of nutrient removal
- Reduction of nitrate level in the groundwater
- Redevelopment of Town Centre and Lower Town possible
- Effluent irrigation allows conservation of freshwater irrigation supply
- Nutrient value of effluent is utilized for crop growth

DISADVANTAGES

- High capital cost
- Requires skilled advanced wastewater treatment plant operator
- Ministry of Health approval for drip irrigation of orchard crops required

OPTION 6: CLUSTER SYSTEMS

DESCRIPTION: Wastewater collected from Crescent Beach, Lower Town, and Lower Trout Creek utilizing "cluster" or satellite STEP collection systems with disposal by community subsurface tile fields in more favourable areas away from the lake.

DESIGN POPULATION: 900 persons

CAPITAL COST: $4.2 million

ANNUAL OPERATING AND MAINTENANCE COST: $125,000

MONTHLY USER COST WITH 75% SENIOR GOVERNMENT FUNDING: $61 per connection

ADVANTAGES

- Reduces the phosphorus input from the lakeshore development

DISADVANTAGES

- High cost per user
- Does not allow redevelopment of Town Centre
- Limited expansion potential
- Nitrate levels in the groundwater are not reduced

OPTION 7: ENHANCED ON-SITE DISPOSAL/LAND USE CONTROL

DESCRIPTION:	Continued on-site disposal with modifications to enhance or improve phosphorus reduction in lakeshore areas. Land use controls to restrict or eliminate development in high phosphorus transmission areas.
DESIGN POPULATION:	700 persons
CAPITAL COST:	$1.8 million
ANNUAL OPERATING AND MAINTENANCE COST:	$141,000
MONTHLY USER COST WITH 75% SENIOR GOVERNMENT FUNDING:	$56 per connection

ADVANTAGES

- Low capital cost
- High phosphorus removal achieved per dollar spent

DISADVANTAGES

- High user cost
- Restricts future growth
- Implementation is difficult
- On-site phosphorus removal technology is unproven

QUESTIONNAIRE

DISTRICT OF SUMMERLAND
WASTE MANAGEMENT PLAN
STAGE II

The District of Summerland is currently preparing a Waste Management Plan to lay the groundwork for wastewater treatment and disposal planning for the next 20 to 40 years. The purpose of this questionnaire is to assit in gathering base data for the plan and to allow input by the public. **PLEASE FILL OUT THIS QUESTIONNAIRE AND RETURN IT AT THE PUBLIC MEETING OR TO THE DISTRICT OFFICE.**

Location of Dwelling
(i.e., Trout Creek, Town Centre, etc.) ______________________________

	YES	NO
Would you prefer a community system serving your property?	☐	☐
Would you like to see an expansion of the Town Centre commercial/high density residential area that would be possible with a community disposal system?	☐	☐
Would you like to see rebuilding of the Lower Town area that would be possible with a community disposal system?	☐	☐

Which Option(s) do you prefer? ______________________________

What would your family be willing to pay for a community sewerage system serving your property?

	YES	NO
Less than $20/month	☐	☐
$20 to $30/month	☐	☐
$30 to $50/month	☐	☐
Over $50/month	☐	☐

Comments: ______________________________

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