DAYTON & KNIGHT LTD.
Consulting Engineers
P.O. BOX 91247, (612 CLYDE AVENUE), WEST VANCOUVER, BRITISH COLUMBIA, CANADA V7V 3N9
TELEPHONE: (604) 922-3255 FAX: (604) 922-3253

FAX TRANSMITTAL

TO: FISHERIES & OCEANS
ATTN: MR. U. ORR
PRINCE RUPERT

FROM: J. SELENAR

YOUR FAX NUMBER: 604-6273480

DATE: APRIL 9. 1996

FILE: 23.4

NO. OF PAGES 9 (including this sheet)

ORIGINAL TO FOLLOW:
YES ✗ NO ____

AS DISCUSSED WE ENCLOSE INFORMATION ON THE PROPOSED SEWAGE TREATMENT AT PORT EDWARD.
THE ORIGINALS OF THE LETTERS PLUS THE SEWERAGE REPORT ARE BEING COURIERED.

REGARDS.

COPY TO: _____

_____

DAYTON & KNIGHT LTD.
Per: J. SELENAR

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October 20, 1995

Mr. Robert Earle
Clerk/Administrator
District of Port Edward
567 ~~Sunset Drive~~
Port Edward, B.C.
V0V 1G0

Dear Mr. Earle:

RE: Sewage System

This letter responds to your request to provide an updated estimate of cost for a sewage system that incorporates a new treatment plant and marine outfall for the District.

Background

The Dayton & Knight Ltd. 1991 Sewerage Study developed a preliminary plan for the provision of a trunk sewer system to intercept existing raw sewage outfalls in the core area of the District and a pre-treatment facility to allow the sewage to be accepted by the Skeena Cellulose Mill for final treatment and disposal with Mill wastewater. The District has been unable to reach an agreement with the Mill that would permit the joint treatment and disposal plan to proceed.

The District, accordingly, has determined that it will build its own treatment plant and marine outfall. District owned land near the works yard can be used for the plant site.

The District has an overall budget of $2.4 million for the project which is scheduled for implementation in 1996.

Criteria

The present population in the District is about 750 people. There are two fish processing plants that should be connected to the sewer system. The District wishes to provide for a 1500 population equivalent in the initial design with provisions for a long term population of up to 7500 people.

Flow and organic loading criteria set out in the 1991 report have been used for development of the preliminary treatment and disposal options. The unit costs for the trunk sewer system have been increased by 10% to reflect 1996 construction.

The criteria assume a secondary level of treatment will be required (BOD_5 = 45 mg/L, SS = 60 mg/L). The plant will be sized initially for a 1500 population equivalent. The effluent discharge from the plant will be into Porpoise Harbour on the Nelson Drive alignment. The

existing Nelson Drive outfall is assumed to be not suitable for extension, thus requiring a new outfall.

System Components and Estimate

The sewage system will comprise the trunk sewers, the treatment plant and the outfall.

1.0 Trunk Sewer

The Alternate 2 trunk sewer system set out in the 1991 report is assumed applicable. This system includes a gravity sewer starting at the Aero Trading outfall and running to a pumping station near Alder Street. The sewage is then pumped in a forcemain to a second pumping station on Bayview Avenue that discharges through a forcemain to the treatment plant site adjacent to the works yard. A third pumping station provides service to the Nelson Drive area and discharges into the common forcemain. The required facilities and the cost estimate are as follows:

•	Trunk Sewer connection to Fish Plants	
	- sewer, 200 mm, 450 m	$58,000
	- rock	10,000
	- pumping station (2-5 HP)	80,000
	- forcemain, 250 mm, 100 m	15,000
		$163,000
	- 30% Engineering and Contingencies	49,000
	TOTAL (1991 $)	$212,000
	- 10% Inflation	21,000
	TOTAL (1996 $)	$233,000
•	Trunk Sewer to Treatment Plant	
	- pump station (2-15 HP)	$125,000
	- forcemain, 300 mm, 1800 m	378,000
	- rock	55,000
	- pump station (2-5 HP)	100,000
		$658,000
	- 30% Engineering and Contingencies	198,000
	TOTAL (1991 $)	$856,000
	- 10% Inflation	86,000
	TOTAL (1996 $)	$942,000
•	Trunk Sewer Total	$1,175,000

2.0 Treatment Plant

District owned land that can be used for a treatment plant is located on the works yard property. Overall the site comprises three parcels totalling about 2.6 ha. This large parcel of land allows the District to use a long detention form of secondary treatment. Generally, long detention forms of treatment offer the benefit of stable, simple operation and low construction costs (if soils are favourable). For this concept level analysis two long detention systems, aerated lagoons and an oxidation ditch, have been developed and costed to provide an indication if the treatment and disposal works can be constructed within the available budget.

2.1 Aerated Lagoons

Aerated lagoons provide the benefit of simple operation, low operating costs, low capital costs (if on site soils can be used without need for a synthetic liner) and the ability to accommodate shock loads that can result from industrial contributions such as the fish processing plants.

The concept level design allows for two cells that are aerated to maintain oxygen dispersed throughout the liquid depth. Solids will accommodate on the bottom of the cells and undergo digestion and 10 years storage. The end of the second cell is quiescent to allow final settling of solids before effluent discharge. Overall about 20 days detention time will be needed. Balanced cut and fill is assumed to allow use of a site soils to construct the basins. A synthetic liner is assumed to be needed to prevent leakage through the soils.

The estimated cost for the lagoon treatment system is as follows:

-	Earthworks; ± 22,000 m^3	$150,000
-	Liner; ± 12,000 m^2	297,000
-	Piping, Effluent Pump and Flow meter, allowance	144,000
-	Aeration Equipment, allowance	105,000
-	Fencing, allowance	80,000
-	Access Road and Power, allowance	10,000
		$786,000
-	30% Engineering & Contingencies	236,000
	TOTAL (1996 $)	$1,022,000

2.2 Oxidation Ditch

The oxidation ditch detains the sewage for a period of about 1 day and utilizes a clarifier for removal of the suspended solids to produce a clear effluent. Balanced cut and fill earthworks are assumed with synthetic liner on the earth berms and a center baffle in the ditch. Diffused aeration and mechanical mixers are needed within the ditch to provide mixing energy and air. The biosolids collected in the clarifier will need to be wasted periodically to an aerobic digester. The digester would be a single cell, lined, aerated basin. A second basin would be used for 10 years storage of digested biosolids.

The estimated cost for this system is as follows:

-	Earthworks, 6000 m^3	$70,000
-	Liner, 2400 m^2	60,000
-	Concrete, allowance	50,000
-	Mechanical Equipment, allowance	280,000
-	Electrical Work, allowance	90,000
-	Blower Building	10,000
-	Fencing	20,000
-	Access Road and Power Supply	10,000
		$590,000

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April 9, 1996

Fisheries & Oceans
Room 225
417 - 2nd Avenue West
Prince Rupert, B.c.
V8J 1G8

Attention: Mr. Uriah Orr
Habitat Technican

RE: District of Port Edward
Sewage Treatment Pre-Design Study

During the recent conversation we outlined the proposed sewage treatment and disposal system for the District of Port Edward. Further details of this project are outlined in this letter.

In 1991 the District developed a preliminary plan for the joint treatment of their sewage in the Skeena Cellulose Mill Treatment Plant. This plan is outlined in the enclosed Dayton & Knight Ltd's Sewerage Study.

The District has been unable to reach an agreement with the Mill that would permit this plan to proceed. However, a preliminary investigation indicated that, using the available funding from the Federal-Provincial program, the District would be able to build its own treatment plant and marine outfall. A concept level evaluation of this plan is outlined in the enclosed Dayton & Knight Ltd's letter dated October 20, 1995.

A more detailed evaluation of this plan was authorized by the District and a draft pre-design report would be completed in April 1996.

The treatment plan would be located on the District owned land next to the works yard. A new marine outfall is proposed to be located in the vicinity of one of the two existing outfalls as shown in the enclosed Sketch No. 1.

Considering, that the untreated sewage is discharged into Porpoise Harbour at the present, addition of the biological sewage treatment is very desirable.

Yours truly,

Dayton & Knight Ltd.

Jerry Sklenar, P.Eng.

JS/yv
23.4
Encls.
cc: Mr. R. Earle

-	30% Engineering & Contingencies	177,000
	TOTAL (1996 $)	$767,000

3.0 Outfall

The outfall can be laid in the same trench as the influent trunk sewer from the plant site to Nelson Drive. The outfall will be laid through the existing culvert to pass under the railway and then extended by about 200 m to discharge into Porpoise Harbour through a diffuser section. The estimated cost for the outfall is as follows:

-	land portion, 300 mm, 500 m	$75,000
-	marine portion, 300 mm, 200 m	95,000
		$165,000
-	30% Engineering and Contingencies	50,000
	TOTAL (1996 $)	$215,000

4.0 Cost Estimate Summary

The two treatment options are compared in terms of economics as follows:

	Lagoon Treatment	Oxidation Ditch
Trunk Sewer	$1,175,000	$1,175,000
Treatment Plant	1,022,000	767,000
Outfall	215,000	215,000
Administration & Financing	200,000	200,000
TOTAL	$2,612,000	$2,357,000

Administration allows for MFA financing, interim financing, GST, legal and administrative costs. Included in the cost estimates is 15% for engineering and 15% for contingencies.

Discussion

The oxidation ditch technology is a cost effective form of secondary treatment that will be well suited to the needs of Port Edward. It provides a relatively long detention form of treatment that can accommodate a variation in influent loads. The oxidation ditch technology is used extensively in Europe and is gaining favour in North America. It provides an excellent quality secondary effluent that will easily comply with Ministry of Environment proposed new discharge criteria. The District of Campbell River has chosen an oxidation ditch for its new treatment plant that will serve 52,000 people.

While the aerated lagoon system is even more stable, the large area requirements and the need for lined cells makes this alternative expensive and in excess of the budget amount.

This preliminary analysis indicates the District can construct its own secondary treatment plant and marine outfall for a design population equivalent of about 1500 people and within an overall $2.4 million budget.

As a next step, this concept level evaluation should be advanced to the preliminary design level. Preliminary design should in more detail evaluate the trunk sewer and outfall systems to

finalize the system components (gravity vs pumped), the pipeline alignments and provide a better estimate of costs. The preliminary design should also evaluate other treatment options such as Trickling Filter - Solids Contact and Rotating Biological Contactor for comparison with the oxidation ditch option. A budget of $20,000 will be suitable for the preliminary design phase of this project. Two months should be scheduled for completion of the pre-design work.

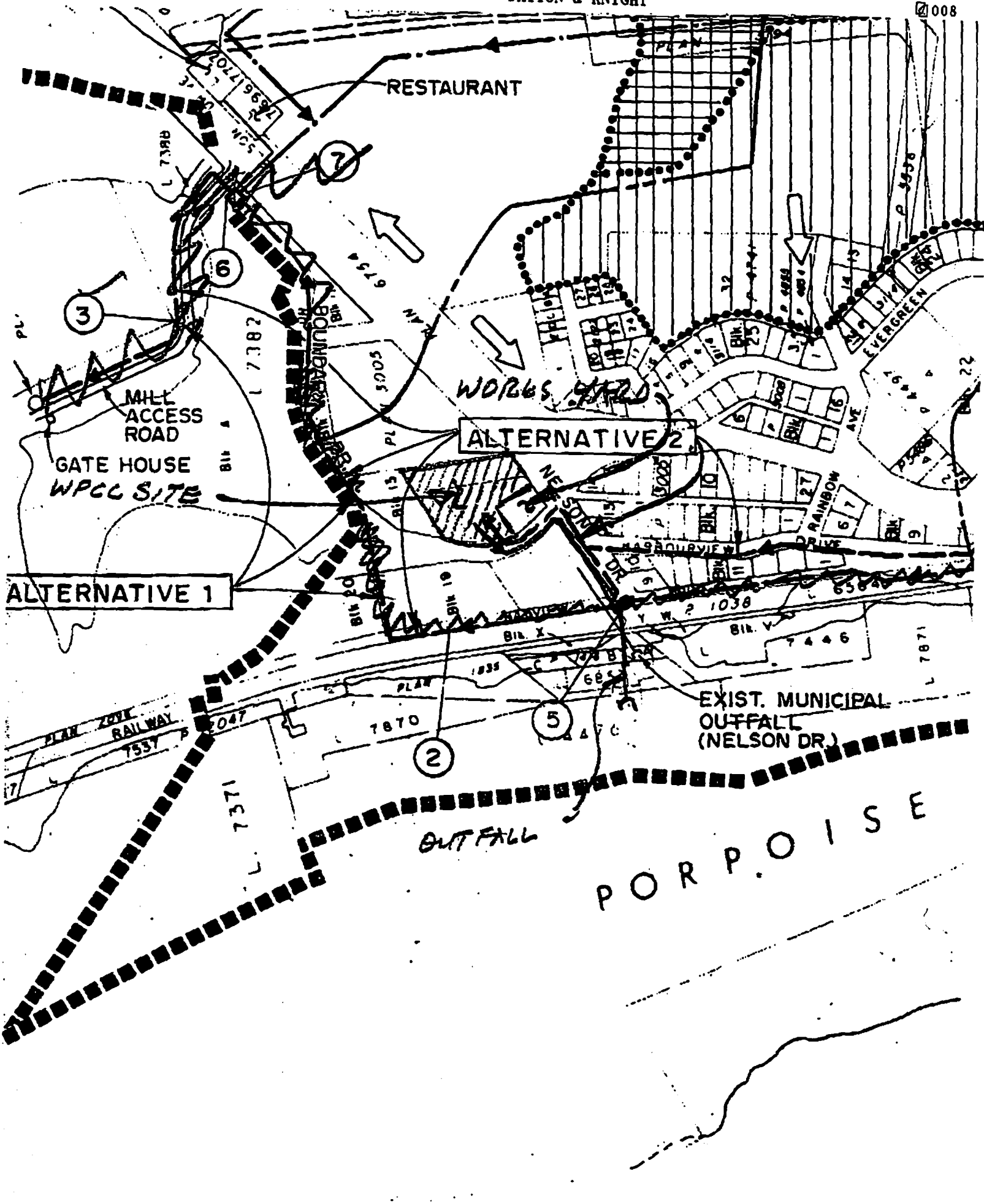
Let us know, please, if this is not adequate for your present needs.

Yours truly,

Dayton & Knight Ltd.

Brian L. Walker, P.Eng.

BLW/ad
23.1


RESTAURANT
WORKS YARD
ALTERNATIVE 2
ALTERNATIVE 1
MILL ACCESS ROAD
GATE HOUSE
WPCC SITE
EXIST. MUNICIPAL OUTFALL (NELSON DR.)
OUTFALL
PORPOISE
BOUNDARY BAY
EVERGREEN AVE
RAINBOW DRIVE
RAILWAY
1
2
3
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6
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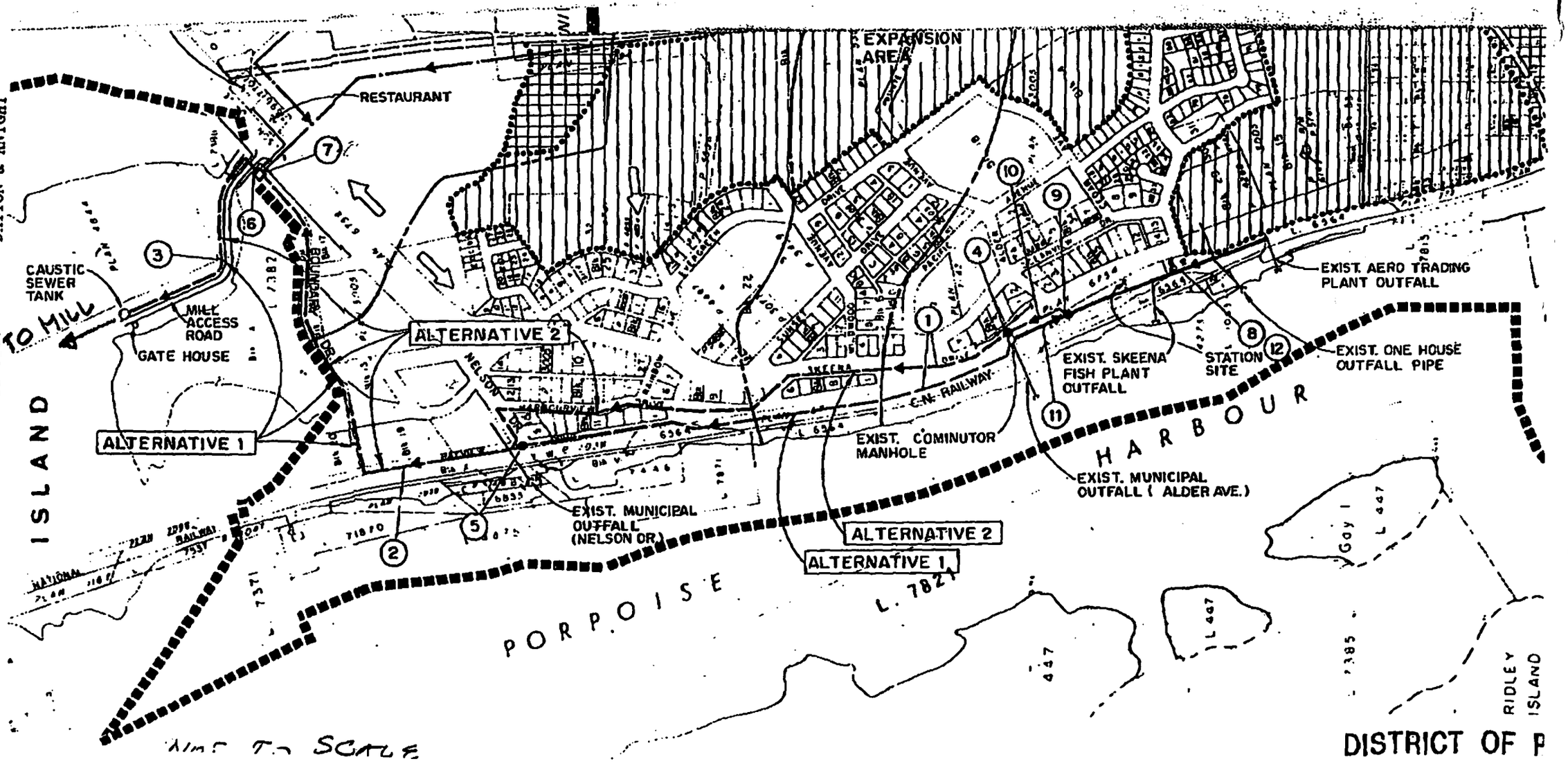
SKETCH No 1


EXPANSION AREA
RESTAURANT
CAUSTIC SEWER TANK
TO MILL
MILL ACCESS ROAD
GATE HOUSE
BOUNDARY DR.
ALTERNATIVE 2
ALTERNATIVE 1
NELSON
SKEENA
C.N. RAILWAY
EXIST. COMINUTOR MANHOLE
EXIST. MUNICIPAL OUTFALL (NELSON DR.)
EXIST. SKEENA FISH PLANT OUTFALL
STATION SITE
EXIST. AERO TRADING PLANT OUTFALL
EXIST. ONE HOUSE OUTFALL PIPE
EXIST. MUNICIPAL OUTFALL (ALDER AVE.)
ALTERNATIVE 2
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ISLAND
HARBOUR
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RIDLEY ISLAND
DISTRICT OF P

NOT TO SCALE

DISTRICT OF PORT EDWARD

SEWERAGE STUDY

OCTOBER, 1991

DISTRICT OF PORT EDWARD
SEWERAGE STUDY

CONTENTS

DISTRICT OF PORT EDWARD
SEWERAGE STUDY

1.0 OBJECTIVE

1.1 Objective

The purpose of this study is to develop a conceptual design for transporting sewage from the District of Port Edward to Skeena Cellulose Mill for joint treatment and disposal. Joint treatment is an alternative to a new District sewage treatment plant.

1.2 Conduct of Study

This study has been conducted as a joint venture between Levelton Associates Ltd. and Dayton & Knight Ltd.

The participation of two parties involved:

Levelton Associates:

- Liaison with District, Skeena Cellulose Mill and industrial sewage contributors.
- Data assembly

Dayton & Knight Ltd.:

- Data analysis
- Definition of alternate systems
- Sizing of systems for present and future requirements
- Preparation of the report including cost estimates

Since the authorization of this study the Village of Port Edward has been elevated to the District of Port Edward

1.3 Terms of Reference

The terms of reference were developed in the proposal for this study submitted to the District on November 28, 1990 as follows:

(1) Data Gathering & Analysis

Obtain relevant data from Port Edward including Official Community Plan (OCP), development plan, plan of existing sewage collection system, topographic plans, Waste Management Branch effluent discharge permits, estimates of existing sewage flows, water consumption records. Analyze data and lay out preliminary alignments for sewage conveyance facilities.

(2) Site Visit

Visit Port Edward. Meet with District officials to review study objectives and to agree on schedule and direction. Visit local industries that discharge to harbour under private permits to determine their waste quantity and quality. Visit Skeena Cellulose to discuss the mill's requirements for accepting Village wastewater. Inspect likely routes for conveyance facilities from District to mill. Determine pumping requirements and arrange for preliminary field survey if needed. Estimate the quantity of rock excavation for alternate routes.

(3) Plan Development and Evaluation

Should the data analysis and site visit determine that several alternative conveyance options warrant consideration, then develop the alternate plans and evaluate them. At this preliminary stage it is anticipated that alternate alignments and pumping requirements will need evaluation. The evaluation will consider initial capital cost, operating costs, ability to service future development areas, social impact and environmental impact. The sewage collection plans will provide for future OCP development with appropriate staging to handle present day flows. Determine connection requirements to eliminate private outfalls to harbour.

(4) Pretreatment Requirements

Size pretreatment works and provide a pre-design for the unit processes. It is anticipated this will include screening, flow measurement, possibly a degree of flow equalization and a monitoring program. Determine site requirements for pretreatment facilities and suggest appropriate site.

(5) Cost Estimate

For the selected conveyance option and pretreatment works provide an estimate of cost for initial stage construction.

(6) Report

Summarize study findings in an illustrated report. Submit draft for Village review and meet with District and Skeena Cellulose to discuss. Finalize and submit fifteen (15) copies.

1.4 Acknowledgements

The assistance of the staff of the District of Port Edward gratefully acknowledged, in particular Mr. T. Wright.

Thanks is also due to Mr. R.S. Grantham, P.Eng. and Mr. T. Cant of Skeena Cellulose Inc. for providing information on the Mill's treatment system.

1.5 Abbreviations

ha	-	hectares
ac	-	acres
m	-	metres
ft	-	feet
m^3/d	-	cubic metres per day
gpd	-	imperial gallons per day
lpcd	-	litres per capita per day
gpcd	-	gallons per capita per day
kg/d	-	kilograms per day
°C	-	temperature, degrees Celsius
mg/L	-	milligrams per litre
BOD_5	-	biological 5-day oxygen demand
SS	-	suspended solids

2.0 DEVELOPMENT AND GROWTH

2.1 Study Area Characteristics

The District of Port Edward includes approximately 17,735 hectares of land as illustrated in Figure 1. The District western boundary runs along Wainwright Basin, Watson Island, Porpoise Harbour and Lelu Island. The southern boundary is formed by Inverness Passage and the Skeena River. The eastern boundary parallels the McNeil River. To the North the District boundary is formed by generally a straight line between Minerva Lake and Wainwright Basin.

Approximately 90 hectares of land adjacent to Porpoise Harbour is presently developed for residential and commercial use and an additional 220 hectares immediately to the east are designated for future development as illustrated in Figure 2. The study area includes the existing and future development areas.

Sewer services to a potential future commercial development on Lelu Island which is located approximately 1.5 km to the south are also discussed.

2.2 Existing Development

The existing development is concentrated within an approximately 500 metres wide and 1800 metres long strip of land adjacent to Porpoise Harbour.

The Canadian Pacific railway line and commercial development including a fish processing plant, warehouses, wharfs, docking facilities and a public boat ramp are situated along the shoreline.

The residential development occupies a hillside above Porpoise Harbour. It includes approximately 235 single family houses, an eightplex, a fourplex and a couple of duplexes.

In addition there are approximately 30 vacant serviced lots, 45 infill lots which can be serviced by the existing sanitary sewers and 25 to 30 easy to service lots near the existing sewers.

The present residential population is estimated by the District at 700 people.

Skeena Cellulose pulp mill is situated on Watson Island just outside and to the west of the District. A causeway and an access road connect Watson Island with the Highway approximately 500 metres east of Port Edward. The Wolf Creek Fish Hatchery and a small restaurant are located on the south side of this intersection.

2.3 Future Development

Future development within the District of Port Edward is regulated by Zoning Bylaw (ZB) No. 236, 1987 and Official Community Plan Bylaw (OCP) No. 240, 1987. Schedule A of the OCP is enclosed as Figure 1 to illustrate the District boundary. The Residential Expansion Area and the Long Term Residential Expansion Area designated in the OCP are shown in Figure 2.

Main development trends outlined in the above Bylaws are:

(1) Initial residential growth should be concentrated within the existing and infill lots, and lots which can be easily serviced by an extension of the existing utilities.

(2) The Residential Expansion Area between the existing development and the future Port Edward alternate road will be developed next.

(3) Residential development south and east of the Port Edward alternate road will require significant upgrading and expansion of municipal services. This area is designated as "Long Term Residential Expansion Area".

(4) The commercial development is proposed for the Skeena Drive and Nelson Drive area.

(5) Light industrial developments such as building material storage, warehousing and manufacturing is proposed for the Porpoise Harbour waterfront between Nelson Drive and Lelu Island Slough.

(6) Industrial uses that require community water and sewer services and create a level of environmental disturbance incompatible with residential development shall be located in the Bayview Drive area north of Nelson Drive.

(7) Industrial uses that do not require community water and sewer service will be located along Inverness Passage, Morse Basin and at Tyee.

(8) Lelu Island is proposed to be developed as an industrial area complete with municipal water and sewer services.

2.4 Population

Present and future residential population in Port Edward is estimated in Table 2.1. The present population estimate of 700 people is based on 235 developed lots and an average of 3 people per lot. Future population is estimated using either 3 people per lot or 30 people per hectare.

TABLE 2.1
POPULATION ESTIMATES

Area	No. of Lots	Area (Hectares)	Estimated Residential Population
Developed lots	235	--	700
Vacant serviced lots	30	--	100
Vacant infill lots	45	--	120
New lots easy to serve	30	--	80
Sub-total	**340**	**90**	**1000**
Residential Expansion Area	--	50	1500
Long Term Residential Expansion Area	--	170	5000
Total	**--**	**310**	**7500**

The estimated existing population is 700 people. Development of vacant serviced lots, infill lots and easy to service lots may add approximately 300 people for a total of 1000 people.

The Residential Expansion Area can accommodate approximately 1500 people and the Long Term Residential Expansion Area can house 5000 people for a total future population of 7500.

3.0 SEWERAGE SYSTEM

3.1 Existing Sewerage Facilities

The presently sewered area includes approximately 90 hectares (220 acres) of land. The existing public sewerage facilities consist of approximately 7.2 kilometres of sewers, one pump station and two outfalls.

The collector sewer system discharges to a comminutor chamber located west of Skeena Drive and north of Alder Avenue. The chamber contains one comminutor and a by-pass channel. From this chamber sewage is discharged to Porpoise Harbour to a depth of 30 metres via a main ocean outfall.

Port Edward is authorized to discharge a maximum of 910 m^3 per day of the typical comminuted domestic sewage through this main outfall, under Waste Management Branch (WMB) Permit No. PE-4557.

One store and the Public Works Yard are connected to a combined sewer line in Nelson Drive which discharges via a secondary public outfall to Porpoise Harbour at the foot of Nelson Drive. No WMB permit has been issued for this outfall.

In addition one house service connection discharges into the Harbour south of Hillcrest Avenue.

There are two known private outfalls to the Harbour. One is from Aero Trading Company. This is a fish processing plant which is authorized by the WMB to discharge a maximum of 116 m^3/d of a typical quality effluent from fish processing plants screened on No. 25 mesh screen plus septic tank domestic effluent. A second outfall is from the Skeena Fish warehouse and office building. According to Skeena Fish officials, their outfall carries only septic tank domestic effluent.

3.2 Sewage Quantity and Quality

Flows discharged through the main public outfall are measured monthly in the comminutor chamber.

A weir installed for the duration of the measurement in the comminutor by-pass channel is used to manually measure instantaneous flows. The measurements are usually conducted between 8 and 10 a.m. The recorded 1990 sewage flows are summarized in Table 3-1.

TABLE 3.1
1990 SEWAGE FLOWS

Dates	Instantaneous Recorded Flows	
	gpd	m^3/d
January	Not avail.	Not avail.
February 27	116,200	527
March 7	136,500	617
April 10	143,700	652
May 29	143,700	652
June 25	151,200	688
July 17	143,700	656
August 14	136,500	620
September 11	151,200	686
October	Not avail.	Not avail.
November 6	166,700	757
December 11	151,200	686
TOTAL	1,440,600	6,543
AVERAGE	144,060	654

The average recorded flow is 654 m^3/d (144,060 gpd) and the peak recorded flow is 757 m^3/d (166,700 gpd). Assuming the population of 700 people the related unit recorded flows are 935 lpcd (275 gpcd) and 1080 lpcd (238 gpcd).

The measurements were conducted between 8:30 and 10:00 a.m. when, in small British Columbia communities, flow rates are usually close to the daily average. Consequently, the above measured flows should represent approximate daily flows.

The recorded flows appear to be approximately 70 percent higher than is typical for comparable B.C. coastal communities. This may indicate either a higher then normal inflow and infiltration or inaccurate flow measurements. The District monitoring procedures should be reviewed to confirm the flow rates. Until more reliable records are available a per capita contribution of 545 L/day (120 gals/day) average annual flow, a threefold increase for peak day flow and ninefold increase for peak hour flow, is being used in this report. The population and related residential average and peak flows are summarized in Table 3.2.

The only significant industrial wastewater contributor is the Aero Trading Co. fish processing plant. According to the information received from the plant manager the total yearly discharge and the peak month discharge are estimated at 1000 m^3 and 500 m^3 respectively.

Assuming a 6-day work week, 12 hour shifts and a peaking factor of 2, estimated average day and peak day flows are 18 m^3/d and 36 m^3/d respectively.

No sampling of either domestic or industrial wastewater has been conducted. Consequently, wastewater quality monitoring programs should be initiated to obtain data on sewage quality. For this report an average allowance applicable to B.C. communities of a comparable size of 200 mg/L BOD_5, 200 mg/L SS, 6 mg/L total P and 25 mg/L total Kjeldahl N has been used. These figures include allowance for the present fish process wastewater and future commercial development.

Total loadings for the present and future development are summarized in Table 3.2.

TABLE 3.2
POPULATION, SEWAGE FLOWS AND SEWAGE QUALITY

Population	Avg. Flow (m^3/d)	Peak Day Flow (m^3/d)	Peak Hour (m^3/d)	Avg. BOD_5[1] (kg/d)	Avg. SS[2] (kg/d)	Avg. P[3] (kg/d)	Avg. N[4] (kg/d)	Temp °C
700 (present)	382	1146	3438	76	76	2.3	10	8° - 20°
1000	545	1635	4905	109	109	3.3	14	8° - 20°
2500	1363	4089	12267	273	273	8.2	34	8° - 20°
5000	2725	8175	24525	545	545	16	68	8° - 20°
7500	4090	12260	36790	817	817	24	102	8° - 20°

1 - assumes 200 mg/L, which includes allowance for present fish process/wastewater
2 - assumes 200 mg/L, which includes allowance for present fish process/wastewater
3 - assumes 6 mg/L total P
4 - assumes 25 mg/L total kjeldahl N

The design sewage flows and loadings were developed for the present population of 700, the population of 1000 (which relates to the development of all the remaining vacant, infill and easy to service new lots), the population of 2500 (which relates to the development of the Residential Expansion Area), the population of 5000 (which relates to the development of a half of the Long Term Residential Expansion Area) and finally the population of 7500 (which relates to the development of all the OCP designated residential land).

An allowance for the related commercial and industrial development is included in the above figures.

3.3 Sewage Conveyance and Treatment

Sewage generated in Port Edward is presently discharged via the two public and two private outfalls into Porpoise Harbour. Except for the comminution at the main public outfall and screening at one private outfall the sewage is not treated.

In this study conveyance of this sewage for joint treatment and disposal with Skeena Cellulose wastewater was investigated.

In general, the proposed system would intercept the existing outfalls and carry the sewage to the Mill system. Provision would be made for the upgrading of this system to accommodate the future development.

The proposed system includes the pre-treatment facilities and conveyance facilities as detailed below.

3.3.1 Pre-treatment Facilities

Initial discussions with Skeena Cellulose officials have indicated that Port Edward sewage would have to be pre-treated and its quality monitored before discharge to the Mill treatment system. Also, should substances potentially harmful to the Mill treatment process be detected in the sewage, the flow would have to be diverted away from the Mill system.

The location of the pre-treatment facility would have a major impact on the configuration of the conveyance system. Two locations, the Bayview Dr./Nelson Dr. area and the Boundary Dr./Mill access road area were considered. The later location is recommended because it is at a junction of all the initial and future sewers discharging to the Mill including gravity sewers from the Fish Hatchery and restaurant as well as a new green house (which is being considered for the area between the Highway and Boundary Drive) and the future Residential Expansion Area (a portion east of Alternate Road) and Long Term Expansion Residential Area development to the pre-treatment system. This location is illustrated in Figure 2.

It is recommended that the pre-treatment system include the following facilities:

a) Mechanical bar screen complete with enclosed screening storage and a provision for trucking the screenings to landfill.
b) Flow measuring and recording system.
c) Automatic sewage sampling system complete with provision for detecting harmful substances in sewage (gas, oil, toxins), connected to an alarm system.
d) Provision for the diversion of sewage through the existing outfalls.
e) Stand-by generator to permit operation of the pre-treatment system during power outages.

The pre-treatment facility is schematically shown in Figure 3. A pump station which would pump the pre-treated sewage to the Mill would be integrated with the pre-treatment facilities. The pump station wet well would be oversized to serve as a holding tank to store sewage when the discharge to the Mill needs to be discontinued for a short time (for example to investigate an alarm indicating unacceptable sewage quality).

The pumps would be sized to pump the pre-treated sewage to the Mill acid wastewater tank which is located near the gatehouse in the Mill.

Mixing of the small domestic sewage flow with the large Mill acid flow would disinfect the domestic sewage. Consequently, no disinfection system would be needed at the pre-treatment facilities.

The pumps would also be sized to pump the sewage from the Fish Hatchery and restaurant and in future from the green house and the Residential Expansion Areas back to the Nelson Drive outfall, when the discharge to the Mill system would have to be discontinued (for example because the sewage quality would be unacceptable to the Mill or the Mill system would be out of order).

3.3.2 Conveyance System

The conveyance system would, in general, include pump stations and forcemains. Where, however, a sufficient discharge head from the existing sewers would be available, an initial gravity system could be considered and construction of pump stations could be deferred until the gravity capacity of the system is exceeded.

The conveyance system would include initial facilities required to serve the existing development, optional facilities which would be required, should the existing private outfalls be intercepted and future expansion of the above facilities to accommodate new development.

For preliminary sizing of the conveyance facilities it was assumed that 90 percent of the existing population of 700 people and 90 percent of the future population up to the total of 2500 people would be tributary to the Alder Avenue outfall. The remaining 10 percent of the above populations would be tributary to the Nelson Drive outfall. The Long Term Residential Expansion Area would be tributary by gravity to the pre-treatment plant at Boundary Drive/Mill access road.

It is recommended that the initial system be designed for a total population of 1000 people with a provision for the staged upgrading for the future development.

The flow distribution between the collector system discharge points should be, however, reviewed in the future in conjunction with the construction of the Port Edward alternate road as a new sewer along this road could be built to divert sewage from the new development to the pre-treatment plant by gravity. This would reduce the future loading on the Alder Avenue and Nelson Drive conveyance systems.

Ideally, the conveyance system should follow the low land along the shoreline so that pumping requirements would be minimized and possibly a gravity system could be utilized during the initial stage. Topography and availability of right-of-ways would affect the location of the sewers.

The proposed conveyance system is illustrated in Figure 2. It includes the three principal sections: Alder Avenue to Nelson Drive, Nelson Drive to the pre-treatment plant and the pre-treatment plant to the Mill. The pumping stations would be located at the vicinity of Alder Avenue (if a gravity system would not be feasible), Nelson Drive and at the pre-treatment plant.

Additional collectors and a pumping system would be required should the existing Aero Trading and Skeena Fish plants be connected.

Two principle alternatives for the conveyance system were considered in this report and are described hereafter.

Alternative 1

Location of Alternative 1 facilities is illustrated in Figure 2 and a schematic hydraulic profile is shown in Figure 4.

Alternative 1 would take an advantage of a relatively high invert elevation at the existing collector system discharge (approximately 8.5 metres at the existing comminutor) to convey sewage by gravity from the comminutor at Alder Avenue to the proposed Nelson Drive pump station (approximate wet well water elevation 3 metres).

The gravity (surcharged) pipe would have to be located below the respective hydraulic grade line. Consequently it would have to be constructed within a narrow bench between the shoreline and the toe of the steep rocky bank.

Most of this bench is within the CN Rail right-of-way. Consequently the pipe would have to be constructed in the proximity of the railway tracks within or just outside the right-of-way. Construction would be difficult because of the confined space, rock excavation and the train traffic. Because of these conditions CN Rail may be reluctant to grant permits for the construction and easements.

Sewage from the above gravity pipe and from the existing Nelson Drive outfall as well as from the adjacent existing and future development would discharge into the Nelson Drive pump station and then it would be pumped via a forcemain to the pre-treatment plant. This forcemain would be located along Bayview Drive, an easement and Boundary Drive.

A preliminary design to confirm the location of the railway R/W and the rock profile along the potential sewer alignments would be required before a more reliable estimate could be developed and the feasibility of this route could be confirmed.

The feasibility of Alternative 1 also depends on the willingness of CN Rail to issue a permit for the work within their right-of-way.

Alternative 2

Location of Alternative 2 facilities is illustrated in Figure 2 and a schematic hydraulic profile is shown in Figure 5.

The main difference between this and the previous alternative is the use of a pump station and a forcemain to convey sewage from the Alder Avenue comminutor to Nelson Drive area in order to avoid the difficult construction along the railway.

The Alder Avenue pump station would be beside the comminutor.

The forcemain would follow Skeena Drive, the existing sewer easement west of Block 5, Harbourview Drive and Nelson Drive to Bayview Drive and then along the Alternate 1 route to the pre-treatment plant.

The main disadvantage of this forcemain route is that the ground along Harbourview Drive rises to an approximate elevation of 20 metres. Consequently, the pump station static head would be over 12 metres.

During the initial stage, the sewage would be pumped over the high point and then it would flow by gravity to the pre-treatment plant. During the subsequent stages, when large pumps would be required, the pipe would be pressurized.

The Nelson Drive area would be served by a pump station located at Bayview Drive and Nelson Drive. This station would discharge to a common forcemain which would follow the Alternative 1 route to the pre-treatment plant.

3.3.3 Optional Facilities

The optional facilities would allow diversion of the Aero Trading Co. and Skeena Fish Co. effluents into the municipal conveyance system.

Both plants are located on the low land beside the railway and north of the existing comminutor chamber. Consequently, the pumping would be required to either the Alternative 1 or Alternative 2 facilities. The pumping system could be either private or public.

The private system would most likely include a separate pump station and a forcemain from each of the two plants. Alternatively, a joint system could be installed if both parties would be willing to cooperate.

The public system would include a short gravity collector along the railway with service connections from the both plants, a satellite pump station (located on or in the vicinity of Station Site) and a forcemain discharging into either the Alternative 1 or Alternative 2 sewerage system.

The public system should be oversized to accommodate the future tributary development along the railway and initial smaller pumps could be later replaced with larger units.

3.3.4 Alternative 2a

Should Alternative 2 as well as the optional public service to Aero Trading Co and Skeena Fish Co. be selected for the initial construction, Alternative 2 could be modified to eliminate the satellite pump station.

Under this option, designated as Alternative 2a, the Alternative 2 pump station would be relocated to the low land near the railway.

The collector serving the two existing commercial operations would be as per the Optional Facilities.

A short gravity pipe and a parallel forcemain would be required to connect the relocated pump station with the Alternative 2 forcemain near the comminutor.

The main advantage of Alternative 2a would be the elimination of one small pump station. The main disadvantage would be the increased pumping head (by approximately 7 metres) for the major flows (tributary to the existing comminutor).

3.3.5 Service to Lelu Island

Under the OCP, Lelu Island (approximately 125 ha)is proposed to be developed as an industrial area complete with municipal water and sewer services. An access causeway or a bridge to the Island would be located approximately 1500 metres north of the existing Alder Avenue outfall.

In general, sewage generated by the development on the Island could be either treated in a treatment facility located on the Island or pumped to the upstream end of the conveyance system for the treatment and disposal with the District sewage in the Skeena Mill treatment system. Feasibility of either system would have to be evaluated once the development becomes a reality.

To estimate the magnitude of sewage flows which could be generated by the development, it is assumed that equivalent population density of 8 persons per hectare over an area of 125 ha would result in a total design population of 1000 people. Consequently the volume of sewage generated on the Island could be equivalent to the initial design population and flow considered for Port Edward in this study.

Because of the uncertainty regarding the extent and timing of the development it appears premature to oversize the initial conveyance facilities for the Island sewage. Should a large volume of the sewage from the Island eventually be disposed, the conveyance system and the pre-treatment facility would have to be upgraded (larger pumps, doubling some forcemains).

3.4 Cost Estimate

The cost estimates provide for 1991 concept level construction costs, and contingencies and engineering at 30 percent. No allowance is included for land acquisition and financing.

The estimates were developed for the sewerage system sized for 1000 people and for of the system upgrading for 2500 and 5000 people. The estimates are detailed in Table 3.4. The item numbers in the estimates refer to Figure 2.

Operation and maintenance of the initial facilities constructed as per Alternative 1 would cost about $25,000/yr., which allows for one operator for 2 hours per day, 5 days per week plus an allowance for electricity and miscellaneous expenses. The initial O & M costs for Alternative 2 are estimated at $30,000 per year.

TABLE 3.4
COST ESTIMATES

Item	Description	Cost Estimates ($1000)					
		Initial Facilities for 1000 People	Upgrading From 1000 to 2500 People	Upgrading From 2500 to 5000 People	Initial Facilities for 1000 People	Upgrading From 1000 to 2500 People	Upgrading From 2500 to 5000 People
		Alternative 1			Alternative 2		
	BASIC FACILITIES						
	Forcemains						
1	Alder Ave - Nelson Dr						
	- 1000 m of 300 ϕ @ $210/m	210					
	- 1300 m of 300 ϕ @ $210/m				273		
	- Allowance for rock excavation	50			30		
	- Allowance for difficult construction	50					
2	Nelson Ave - Pre-treatment Plant						
	- 850 m of 300 ϕ @ $210/m	180			180		
	- Allowance for rock excavation	25			25		
3	Pre-Treatment Plant - Mill						
	- 460 m of 300 ϕ @ $210/m	97		97	97		97
	Pump Stations						
4	Alder Ave.		140 (2-30 HP)		125 (2-15 HP)	90 (3-30 HP)	
5	Nelson Dr.	100 (2 - 5 HP)	60 (3 - 25 HP)		100 (2 - 5 HP)	60 (2 - 10 HP)	
6	Pre-treatment (Pumps only, for structure see Pre-treatment plant)	20 (2 - 10 HP)	40 (2 - 25 HP)	40 (2 - 25 HP)	20 (2 - 10 HP)	40 (2 - 25 HP)	40 (2 - 25 HP)
7	**Pre-Treatment Plant** — **Cost Est. ($1000)**						
	a) Excavation — 5						
	b) Concrete — 50						
	c) Architecture — 40						
	d) Bar Screen — 50						
	e) Misc.Metal Mat. — 15						
	f) Stand-by Gen.Set — 50						
	g) Electrical, Vent., Alarms — 50						
	h) Sampler — 30	300	50	100	300	50	100
	h) Flow Recorder — 10						
	Subtotal - (Items 1 to 7)	1032	290	237	1150	240	237
	30% Engineering and Contingencies	310	87	71	345	72	71
	TOTAL - BASIC FACILITIES (Items 1 to 7)	1342	377	308	1495	312	308

TABLE 3.4
COST ESTIMATES (CONT'D)

Item	Description	Cost Estimates ($1000)					
		Initial Facilities for 1000 People	Upgrading		Initial Facilities for 1000 People	Upgrading	
			From 1000 to 2500 People	From 2500 to 5000 People		From 1000 to 2500 People	From 2500 to 5000 People
		Alternative 1			Alternative 2		
	OPTIONAL FACILITIES						
8	Gravity Pipe - 450 m @ 200 ϕ @ $130/m - Allowance for rock excavation	58 10			58 10		
9	Satellite Pump Station	80 (2 - 5HP)			80 (2 - 5HP)		
10	Forcemain - 100 m of 200 ϕ @ $150/m	15			15		
	Subtotal - (Items 8 to 10) 30 % Engineering & contingencies TOTAL - OPTIONAL FACILITIES (Items 8 to 10)	163 49 212			163 49 212		
	ALTERNATE 2A FACILITIES Additional cost to Alternative 1 or 2						
11.	300 ϕ Forcemain & 300 ϕ gravity (in common Trench) - 100 m @ $350/m				35		
12	Gravity Collector - 450 of 200 ϕ @ $150/m - Allowance for rock				68 20		
13	Adler Ave. Pump Station - Allowance for larger pumps				20 (2 - 25HP)	20 (3 - 35HP)	
	Subtotal - (Items 11 to 13) 30% Engineering & Contingencies TOTAL - ALTERNATIVE 2A (Items 11 to 13)				143 43 186	20 7 27	

TABLE 3.4
COST ESTIMATES

Item	Description	Cost Estimates ($1000)					
		Initial Facilities for 1000 People	Upgrading From 1000 to 2500 People	Upgrading From 2500 to 5000 People	Initial Facilities for 1000 People	Upgrading From 1000 to 2500 People	Upgrading From 2500 to 5000 People
		Alternative 1			Alternative 2		
	BASIC FACILITIES						
	Forcemains						
1	Alder Ave - Nelson Dr						
	- 1000 m of 300 ϕ @ $210/m	210					
	- 1300 m of 300 ϕ @ $210/m				273		
	- Allowance for rock excavation	50			30		
	- Allowance for difficult construction	50					
2	Nelson Ave - Pre-treatment Plant						
	- 850 m of 300 ϕ @ $210/m	180			180		
	- Allowance for rock excavation	25			25		
3	Pre-Treatment Plant - Mill						
	- 460 m of 300 ϕ @ $210/m	97		97	97		97
	Pump Stations						
4	Alder Ave.		140 (2-30 HP)		125 (2-15 HP)	90 (3-30 HP)	
5	Nelson Dr.	100 (2 - 5 HP)	60 (3 - 25 HP)		100 (2 - 5 HP)	60 (2 - 10 HP)	
6	Pre-treatment (Pumps only, for structure see Pre-treatment plant)	20 (2 - 10 HP)	40 (2 - 25 HP)	40 (2 - 25 HP)	20 (2 - 10 HP)	40 (2 - 25 HP)	40 (2 - 25 HP)
7	Pre-Treatment Plant — Cost Est. ($1000)						
	a) Excavation — 5						
	b) Concrete — 50						
	c) Architecture — 40						
	d) Bar Screen — 50						
	e) Misc.Metal Mat. — 15						
	f) Stand-by Gen.Set — 50						
	g) Electrical, Vent., Alarms — 50						
	h) Sampler — 30	300	50	100	300	50	100
	h) Flow Recorder — 10						
	Subtotal - (Items 1 to 7)	1032	290	237	1150	240	237
	30% Engineering and Contingencies	310	87	71	345	72	71
	TOTAL - BASIC FACILITIES (Items 1 to 7)	1342	377	308	1495	312	308

TABLE 3.4
COST ESTIMATES (CONT'D)

Item	Description	Cost Estimates ($1000)					
		Initial Facilities for 1000 People	Upgrading		Initial Facilities for 1000 People	Upgrading	
			From 1000 to 2500 People	From 2500 to 5000 People		From 1000 to 2500 People	From 2500 to 5000 People
		Alternative 1			Alternative 2		
	OPTIONAL FACILITIES						
8	Gravity Pipe - 450 m @ 200 ϕ @ $130/m - Allowance for rock excavation	 58 10			 58 10		
9	Satellite Pump Station	80 (2 - 5HP)			80 (2 - 5HP)		
10	Forcemain - 100 m of 200 ϕ @ $150/m	15			15		
	Subtotal - (Items 8 to 10) 30 % Engineering & contingencies TOTAL - OPTIONAL FACILITIES (Items 8 to 10)	163 49 212			163 49 212		
	ALTERNATE 2A FACILITIES Additional cost to Alternative 1 or 2						
11.	300 ϕ Forcemain & 300 ϕ gravity (in common Trench) - 100 m @ $350/m				35		
12	Gravity Collector - 450 of 200 ϕ @ $150/m - Allowance for rock				 68 20		
13	Adler Ave. Pump Station - Allowance for larger pumps				20 (2 - 25HP)	20 (3 - 35HP)	
	Subtotal - (Items 11 to 13) 30% Engineering & Contingencies TOTAL - ALTERNATIVE 2A (Items 11 to 13)				143 43 188	20 7 27	

DISTRICT OF PORT EDWARD
SEWERAGE STUDY

4.0 SUMMARY AND RECOMMENDATIONS

4.1 Summary

1. The purpose of this study is to develop a conceptual design for transporting sewage from the District of Port Edward to Skeena Cellulose Mill for joint treatment and disposal. This joint treatment is an alternative to a new District sewage treatment plant.

2. Sewage generated in Port Edward is presently discharged via the two public and two private outfalls into Porpoise Harbour.

3. Except for the comminution at the main public outfall and screening at one private outfall the sewage is not treated.

4. The sewage conveyance system should be sized for the present development with a provision for its upgrading for future development.

5. The present population in Port Edward is estimated at 700 people. This population may increase to 1000 people if all the vacant and easy to service lots are developed and to 2500 and 7500 people if the designated Residential Expansion Area and Long Term Residential Area are developed.

6. The conveyance system was evaluated for the initial design population of 1000 people and for the future population of 2500 and 5000 people.

7. The sewage flows recorded by Port Edward appear to be high (by as much as 70 percent) and should be confirmed. No records on sewage quality are available.

8. In absence of the reliable records average sewage flow and quality allowances applicable to B.C. coastal communities of a comparable size were used in this report.

9. Initial discussions with Skeena Cellulose officials have indicated that Port Edward sewage would have to be pre-treated and its quality monitored before discharge to the Mill's treatment system. Also, should substances potentially harmful to the Mill treatment process be detected in the sewage, then the flow would have to be diverted away from the Mill system.

10. To comply with the above preliminary Skeena Cellulose conditions the District should consider installation of the following pre-treatment facilities.

    a) Mechanical bar screen complete with enclosed screenings storage and a provision for trucking the screenings to landfill.
    b) Flow measuring and recording system.

c) Automatic sewage sampling system complete with provision for detecting harmful substances in sewage (gas, oil, toxins), connected to an alarm system.
d) Provision for the diversion of sewage through the existing outfalls.
e) Emergency stand-by generator

11. The proposed conveyance system should intercept the existing outfalls and carry the sewage to the Mill system. Provision should be made for the upgrading of this system to accommodate future development.

12. A major impact on the configuration of the conveyance system would have the location of the pre-treatment facility. Two locations, the Bayview Dr./Nelson Dr. area and the Boundary Dr./Mill access road area were considered. The later location is recommended because it is at the junction of all the initial and future sewers.

13. For preliminary sizing of the conveyance facilities it is assumed that 90 percent of the development is tributary to the Alder Avenue outfall and 10 percent to the Nelson Drive outfall.

14. Assuming the pre-treatment facility at the Boundary Dr./Mill access road area, two conveyance alternatives were evaluated.

15. Alternative 1 would include a gravity pipe from the existing comminutor chamber near Alder Avenue to Nelson Drive constructed along the CN Rail R/W, a pump station at Nelson Drive, a forcemain to the pre-treatment facilities complete with the pump station and a forcemain to the Mill.

16. Alternative 2 would include a pump station near the existing comminutor at Alder Avenue, a forcemain along Skeena Drive, the existing sewer easement and Harbourview Drive to a pump station on Nelson Drive. From Nelson Drive to the Mill Alternatives 1 and 2 are the same.

17. The advantage of Alternative 1 is the gravity service between the comminutor and Nelson Drive during the initial stage (1000 people) and it will serve up to approximately 1300 population. Disadvantages are the difficult construction along the railway and the need for construction and easement permits from CN Rail which may be difficult to obtain. The Alternative 1 initial stage concept level construction cost is estimated at $1,342,000 and the O & M cost is estimated at $25,000 per year. The concept level upgrading construction costs from 1000 to 2500 people and from 2500 to 5000 people are estimated at $377,000 and $308,000 respectively.

18. Alternative 2 would be relatively easy to construct and no permits from CN Rail would be required. It would, however, include one more pump station (at Alder Avenue) than Alternative 1.

The Alternative 2 initial stage concept level construction cost is estimated at $1,495,000 and the concept level O & M cost is estimated at $30,000 per year. The concept level upgrading construction costs from 1000 to 2500 people and from 2500 to 5000 people are estimated at $312,000 and $306,000 respectively.

19. Under the Optional Facilities item the District may consider accepting the Aero Trading and Skeena Fish plants wastewater to the conveyance system. This wastewater would have to be pumped by either a private system (constructed and financed by both users) or a public pumping system. The concept level construction cost of the public system is estimated at $212,000.

20. Should Alternative 2 be selected and should the public service be extended to Aero Trading Co and Skeena Fish Co., the relocation of the Alder Avenue pump station as per Alternative 2a could be considered. Under this alternative, the satellite pump station otherwise needed to pump commercial wastewater to the Alternative 2 system would not be required. An additional cost over and above the Alternative 2 and Optional Facilities costs is estimated at $188,000.

21. Alternative 1 appears to be the least expensive and is preferred. Feasibility of this alternative, however, depends on the cooperation of CN Rail regarding issuance of working and easement permits as well as the on amount of rock which would have to be excavated. Detail survey, a preliminary design and approvals in principal from CN Rail are required before the feasibility of Alternative 1 can be confirmed. Should Alternative 1 not be feasible, Alternative 2 or Alternative 2a would have to be considered.

22. A provision in the design of any alternative should be made for an emergency discharge of Port Edward sewage through the existing outfalls when the sewage cannot be discharged into the Mill system. The existing Alder Avenue outfall and the comminutor should be maintained in an operational condition. The existing Nelson Avenue outfall should be upgraded and a WMB permit should be obtained for its emergency use.

23. Lelu Island is proposed to be developed for industrial use. Sewage generated by this development could be either treated on the Island on discharged into the proposed conveyance system. Timing and extent of the development is uncertain and therefore it appears premature to oversize the initial conveyance facilities for the sewage from the Island. Should the island development proceed, a study of the wastewater disposal should be undertaken.

4.2 Recommendations

Based on the findings of this conceptual level study the following recommendations are made:

1. The District should initiate negotiations of an agreement with Skeena Cellulose on the joint treatment and disposal of District of Port Edward sewage.

2. The concept of the joint treatment of District sewage in the Skeena Cellulose treatment plant should be reviewed with the Waste Management Branch.

3. The District should initiate the sewage flow and quality monitoring program. A chart flow recorder complete with a flow totalizer should be installed to continuously monitor the flow. Grab samples should be collected and analyzed to confirm sewage quality. The following should be monitored: BOD_5, SS, P, N, temperatures.

4. Should the monitoring program confirm high inflow and infiltration into the collection system the District should develop a plan for the most effective inflow and infiltration control measures.

5. The District should complete the preliminary design of the Alternative 1 pipe along the railway between the Alder Avenue comminutor and Nelson Drive, complete with a preliminary rock excavation estimates and discuss the feasibility of this route and required easements with CN Rail.

6. The District should consider acceptability of the Aero Trading Co. and Skeena Fish Co. wastewater for the joint treatment.

7. Should the development of Lelu Island proceed, a study of the wastewater disposal should be undertaken.