Regional District of

Okanagan-Similkameen

Gallagher Lake Area
Sanitary Sewer Feasibility Study

Prepared for:
Regional District of Okanagan-Similkameen
101 Martin Street
Penticton, B.C.

January, *2007*
Project No. 97167

EarthTech
A Tyco International Ltd. Company

Table of Contents

DEFINITIONS AND ACRONYMS

ADF	Average Day Flow
BOD	Biological Oxygen Demand
LWMP	Liquid Waste Management Plan
MOE	Ministry of Environment
ML	Mega Litres (1,000,000 litres or 1,000 m^3)
PIF	Instantaneous Peak Flow
RDOS	Regional District of Okanagan Similkameen
ROW	Right-of-Way
RI	Rapid Infiltration
STP	Sewage Treatment Plant
TRUE	T.R. Underwood Engineering
TSS	Total Suspended Solids
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

Sanitary sewer servicing of the Gallagher Lake area was assessed under four servicing scenarios. The first option considered was to provide a tertiary treatment plant within the service area. The second option involved connecting to the proposed Osoyoos Indian Band treatment plant. The third option involved connecting to the Town of Oliver's sewer system. The fourth option involved expanding the Deer Park Estates sewage treatment. A summary of the key decision considerations for the options is provided in Table ES-1.

The preferred option is to connect to a new OIB facility (Option 2). Although Option 2 results in the second lowest life-cycle cost it has the least budgetary risk. In addition, the new facility is well situated to service properties within the RDOS along Tuc-ul-nuit Road and Highway 97.

The estimated capital cost for implementing the preferred option is $1,663,000. This includes provision of gravity trunks for sewage collection and two liftstations and a forcemain to convey wastewater to the new OIB facility. An initial capital cost contribution and annual servicing costs for treatment will need to be negotiated with OIB.

Therefore, it is recommended that the RDOS pursue a servicing option for Gallagher Lake which involves connecting to the proposed OIB plant. RDOS should begin negotiations with OIB on servicing the Gallagher Lake area. In particular, the capital cost contribution and parcel servicing cost should be defined. In the event that the costs are higher than estimated, the options should be re-evaluated.

Table ES-1: Summary of Major Considerations for Various Servicing Options

	Capital Cost		Annual O&M Costs	Life-Cycle (25 Years)[1]	Engineering Considerations	Environmental/Social Considerations
	Servicing/ Conveyance	Treatment				
Option 1: New STP Servicing the Gallagher Lake Area	$926,900	$4,650,000	$237,000	$8,840,000	- tertiary treatment plant has high O&M costs - low budgetary risk since treatment equipment is readily available	-proposed treatment process provides for nutrient removal - STP located in undeveloped RSM1 site and could pose future potential conflicts
Option 2: Connect to Proposed Osoyoos Indian Band Facility	$1,663,000	$3,780,000	$154,000	$7,490,000	- proposed 3.8 ha site will provide for future expansion and could become a regional facility, servicing other RDOS lands - low budgetary risk	- provision for a buffer exists -secondary process will not remove the nutrient stream
Option 3: Connect to Town of Oliver's Sewer System	$4,604,000	$920,000	$165,000	$7,730,000	- forcemain ROW acquisition to Oliver will be complex and costly - relatively high energy costs required to pump to Oliver - high budgetary risk due to uncertain capacity constraints in Oliver system and forcemain ROW acquisition	- high potential for sulphide generation in forcemain - effluent ultimately reused - Town council has passed a policy to limit expansion of the sewer system unless area is incorporated which makes support unlikely
Option 4: Expand Deer Park Estates STP	$926,900	$3,810,000	$150,000	$6,760,000	- capacity of infiltration basin will have to be expanded - will require taking over the existing RBC facility by RDOS - moderate budgetary risk due to infiltration basin uncertainties	- existing treatment plant site relatively close to existing & future homes should be moved to avoid potential conflict - landowner of existing RI basins does not support an expansion -secondary process will not remove the nutrient stream

Notes: 1.) Life cycle costs are based on a discount rate of 4% and 25 year time frame

1.0 INTRODUCTION

The Regional District of Okanagan Similkameen (RDOS) has undertaken this study to assess options for the provision of sanitary services to the Gallagher Lake area. The Gallagher Lake is a small community with the RDOS located approximately five kilometers north of the Town of Oliver.

1.1 SCOPE OF WORK

Preparation of the feasibility study has the following specific tasks:

- Definition of an appropriate sanitary sewer collection service area outside of that within the Ososyoos Indian Band lands;
- Preliminary layout of a collection piping network to provide sanitary sewer services to the area;
- Preliminary layout and sizing of any required sewage pump stations and pre-treatment stations;
- Assessment of any existing facilities in the context of the proposed options;
- Preliminary capital cost estimates and corresponding operations and maintenance cost estimates;
- Identification of environmental issues and mitigation measures;
- Assessment of needs for odour control;
- Determination of all current government agency approvals required to complete the recommended servicing scheme; and
- Consideration of the impacts of the servicing option on nearby residents.

2.0 BACKGROUND

The Gallagher Lake area can be characterized as a predominately tourist oriented community, with a large number of camping sites and recreational amenities near a small lake (Figure 2-1).

A Waste Management Plan (WMP) was undertaken by T.R. Underwood Engineering (TRUE) in 1987-88. The TRUE report presented two schemes for providing sanitary sewer service to the Gallagher Lake area. The first scheme entailed the provision of a sewage lift station to the west of the north end of Gallagher Lake on the west side of Highway 97, which would pump sewage to a sewage treatment plant and infiltration basin located on the east side of Highway 97 approximately 1.5 kilometres to the north.

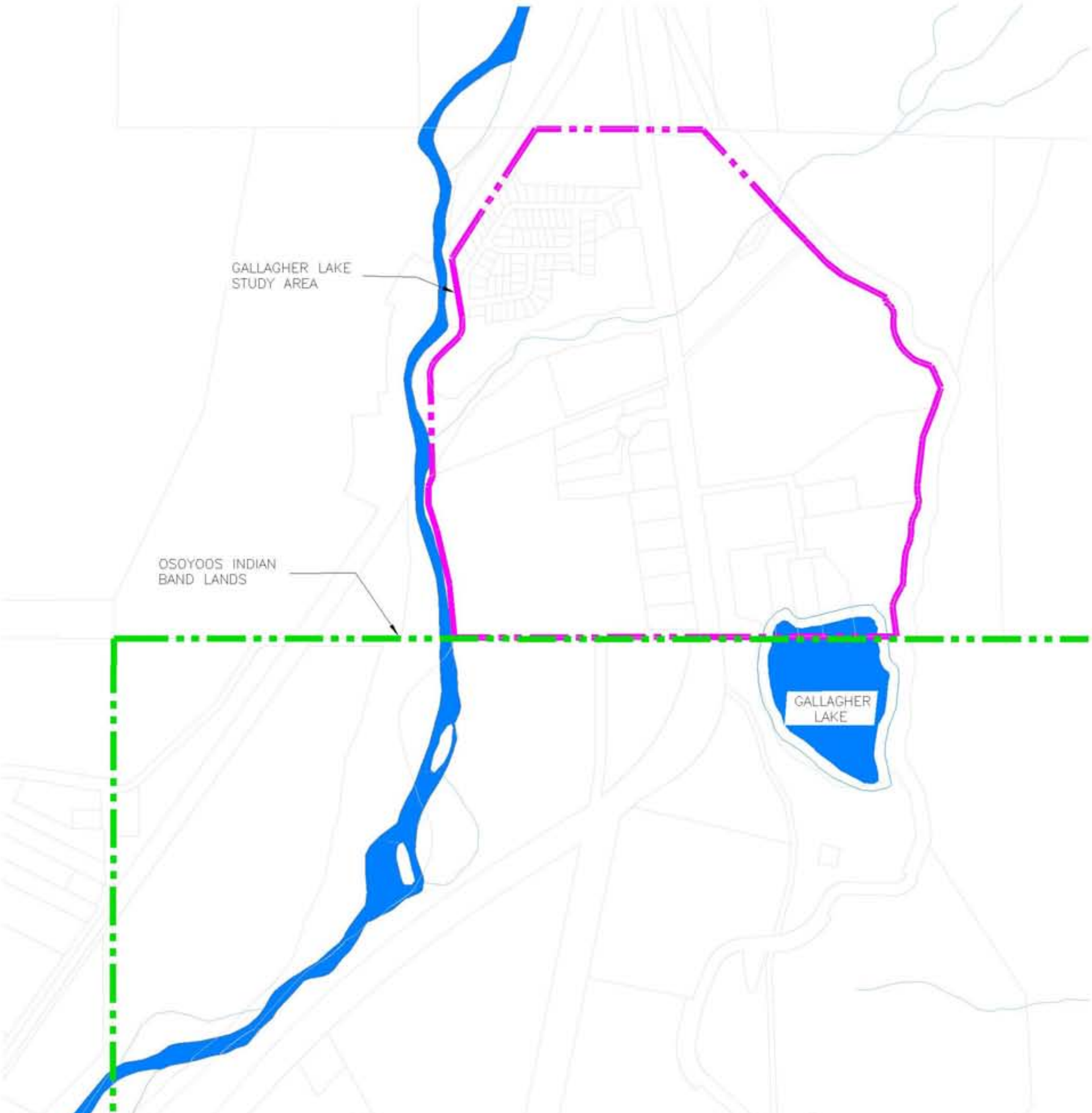
A second option entailed locating a sewage treatment plant on Osoyoos Indian Band (OIB) lands to the south. This second option was discounted because the anticipated cost savings were marginal and the site did not offer greater phosphorus removal efficiencies.

In 1992, RDOS initiated preliminary planning of a community sanitary sewer. Treatment and disposal sites were identified, in line with the 1987-88 WMP. In 1995, the Deer Park Estates development was constructed which involved implementation of a sewer system, secondary wastewater treatment plant and rapid infiltration (RI) basin for effluent disposal.

Currently, the OIB is considering construction of a wastewater treatment plant to service it future development plans. As a result, the RDOS has undertaken this feasibility study to review servicing options.

FIGURE 2-1
STUDY AREA BOUNDARY

SCALE 1:10,000



Earth Tech
A Tyco International Ltd. Company

3.0 SANITARY SEWER SERVICING OPTIONS

In this section, design assumptions are developed and assessment is made of 4 servicing options for the Gallagher Lake area.

3.1 EXISTING LAND USE

The Gallagher Lake study area is approximately 54 hectares in size. The area consists of approximately 136 mobile homes, 90 campsites, 10 single family homes and a few industrial and commercial buildings. The current permitted land-use for the area is provided at Figure 3-1.

KOA also owns land zoned for commercial tourism. This property is occupied seasonally from May to October and there are 90 campsites on the property with toilets. KOA and Gallagher Lake Lodge are located on the north shore of Gallagher Lake. The KOA campground and the Gallagher Lake Lodge septic systems have the potential to negatively impact Gallagher Lake on which much of the tourism of the community is based.

The multiple family zoned parcels include: Deer Park Estates (57 mobile homes), KOA (119 mobile homes), Gallagher Lake Lodge (17 mobile homes), and an 8.8 hectare plot of land currently being used for agriculture.

Except for Deer Park Estates, water supply for the community is by individual water wells. Deer Park Estates operates a community water system.

The majority of property in the Gallagher Lake area is zoned for multiple family residential use. The following is a list of the number of parcels included in each zone: 10 (RS1,RS2) single family residential, 10 (CT1,CT2) commercial tourism, 4 (RSM1,RSM2) multiple family, 2 (I1,I3) industrial, 1 (SH3) small holdings, and 1 (C1) commercial. Table 3-1 provides a summary of the existing land-use zoning and parcel distribution.

Table 3-1: Parcel Summary For Stage 1 and Stage 2 Servicing

	Low Density Residential (RS1, RS3)	Rural (RA, SH3)	Deer Park Estates (RSM2)	Manufactured Home (RSM1)	Commercial Tourism (CT1, CT2)	Industrial (I1,I3)	Commercial (C1)	TOTAL
Unserviced	10	1		3	10	2	1	27
Serviced			64					64

3.2 ASSUMED WASTEWATER GENERATION RATES

Table 3-2 provides a summary of the wastewater generation rates for each of the various types of land-uses found in the Gallagher Lake area.

Table 3-2: Assumed Future Build-Out Wastewater Generation Rates by Land-Use

Land -Use	Unit	Average Daily Wastewater Generation (Litres/Day/Unit)
Low Density Residential (RS1, RS3)[1]	Parcel	1,125
Rural (RA, SH3)[1]	Parcel	1,125
Manufactured Home (RSM1, RSM2)[2]	Area (ha.)	22,500
Commercial Tourism (CT1, CT2)[3]	Area (ha.)	40,000
Industrial (I3)[4]	Parcel	2,250
Commercial (C1)[5]	Parcel	2,250

Notes: 1.) Based on 2.5 persons per parcel
2.) Assumes max. density of 25 mobile homes per hectare and 2 persons per dwelling
3.) Assumes maximum 75 campsites per hectare and 525 L/campsite/day
4.) Assumes nominal wastewater input from natural gas substation
5.) Assumes 2 dwellings per parcel

The RDOS' design standard of 450 L/capita/day was used to derive the average daily wastewater generation rates summarized in Table 3-2. The assumed average per capita design rate, it should be noted, is higher than most other municipalities in the Okanagan. The per capita wastewater generation rate should be reviewed at the pre-design stage to assess whether it could be reduced.

As per Bylaw 2000, a peaking factor of 4 (ie, assuming a service population less than 1,000) will be used to calculate instantaneous peak flows.

3.3 WASTEWATER FLOW RATE ESTIMATES

This section presents detailed calculations for design wastewater flow rates generated under a build-out scenario, given the allowable densities provided in the RDOS' Zoning Bylaw (No. 2123).

Table 3-3 provides a summary of design wastewater volume calculations for the build-out scenario.

Table 3-3: Wastewater Generation for Future Build-Out Conditions

Land -Use	Number of Parcels	Area (ha)	Average Day Unit Wastewater Generation		Average Wastewater Flow[1] (L/day)	Peak Day Wastewater Flow[1] (L/day)	Infiltration/ Inflow Allowance (L/day)
Low Density Residential (RS1, RS3)	10	na	1,125	L/parcel	11,250	45,000	30,000 L/km Pipe
Rural (RA, SH3)	1	na	1,125	L/parcel	1,125	4,500	
Deer Park Estates (RSM2)	57	2.5	22,500	L/ha	136,000	544,000	
Manufactured Home (RSM1)	na	17	22,500	L/ha	381,600	1,526,400	
Commercial Tourism (CT1, CT2)	na	8.7	40,000	L/ha	346,760	1,387,040	
Industrial (I3)	2	na	2,250	L/parcel	4,500	18,000	
Commercial (C1)	1	na	2,250	L/parcel	2,250	9,000	

Notes: 1.) Does not include allowance for infiltration and inflow

The infiltration and inflow (I/I) allowance is provided in RDOS' Bylaw 2000 as 30,000 litres per kilometer of pipe. As a result, the total wastewater flowrate will depend on the length of pipe calculated and contributing area. Using a maximum estimated trunk length of 1.2 kilometres, wastewater generation rates in Table 3-2 and service parcel information summarized in Table 3-3, design flow rates can be established for assessing the servicing options.

If Deer Park Estates is assumed to be part of the sewerage area, the following design flow rates will be used:

Average Day Flow (ADF) = Average Wastewater Flow + Infiltration/Inflow Allowance
= 883,500 L/day + 30,000 L/day/km pipe x 1.20 km pipe
= 883,500 L/day + 36,000 L/day
= 919,500 L/day
= ***920,000 L/day*** *(11 L/s)*

Peak Instantaneous Flow (PIF) = Peaking Factor x ADF + Infiltration/Inflow Allowance
= 4 x 883,500 L/day + 30,000 L/day/km pipe x 1.20 km pipe
= 3,533,900 L/day + 36,000 L/day

=3,569,900 L/day
= ***3,570,000 L/day** (41 L/s)*

If Deer Park Estates is not considered part of the sewerage area, the average day flow is reduced by 130 m3/day. Under this scenario the design flow rates are:

Average Day Flow (ADF) = Average Wastewater Flow + Infiltration/Inflow Allowance
= 747,500 L/day + 30,000 L/day/km pipe x 1.20 km pipe
= 747,500 L/day + 36,000 L/day
= 783,500 L/day
= ***784,000 L/day** (9.1 L/s)*

Peak Instantaneous Flow (PIF) = Peaking Factor x ADF + Infiltration/Inflow Allowance
= 4 x 747,500 L/day + 30,000 L/day/km pipe x 1.20 km pipe
= 2,989,900 L/day + 36,000 L/day
= 3,025,900 L/day
= ***3,030,000 L/day** (35 L/s)*

Therefore, under the two servicing scenarios, the average day flow (ADF) and peak day flow (PDF) for wastewater treatment and conveyance facilities are provided as Table 3-4.

Table 3-4: Summary Wastewater Flow Rates

	Sewerage Area Which Includes Deer Park Estates	**Sewerage Area Which Does Not Include Deer Park Estates**
Average Day Flow (L/s)	11	9.1
Peak Instantaneous Flow (L/s)	41	35

3.4 OPTIONS ASSESSMENT

Four options for servicing the Gallagher Lake area are described and assessed below. The options are based on different approaches for providing for wastewater treatment and effluent disposal.

Capital cost estimates for each option is based on the unit costs provided in Appendix A.

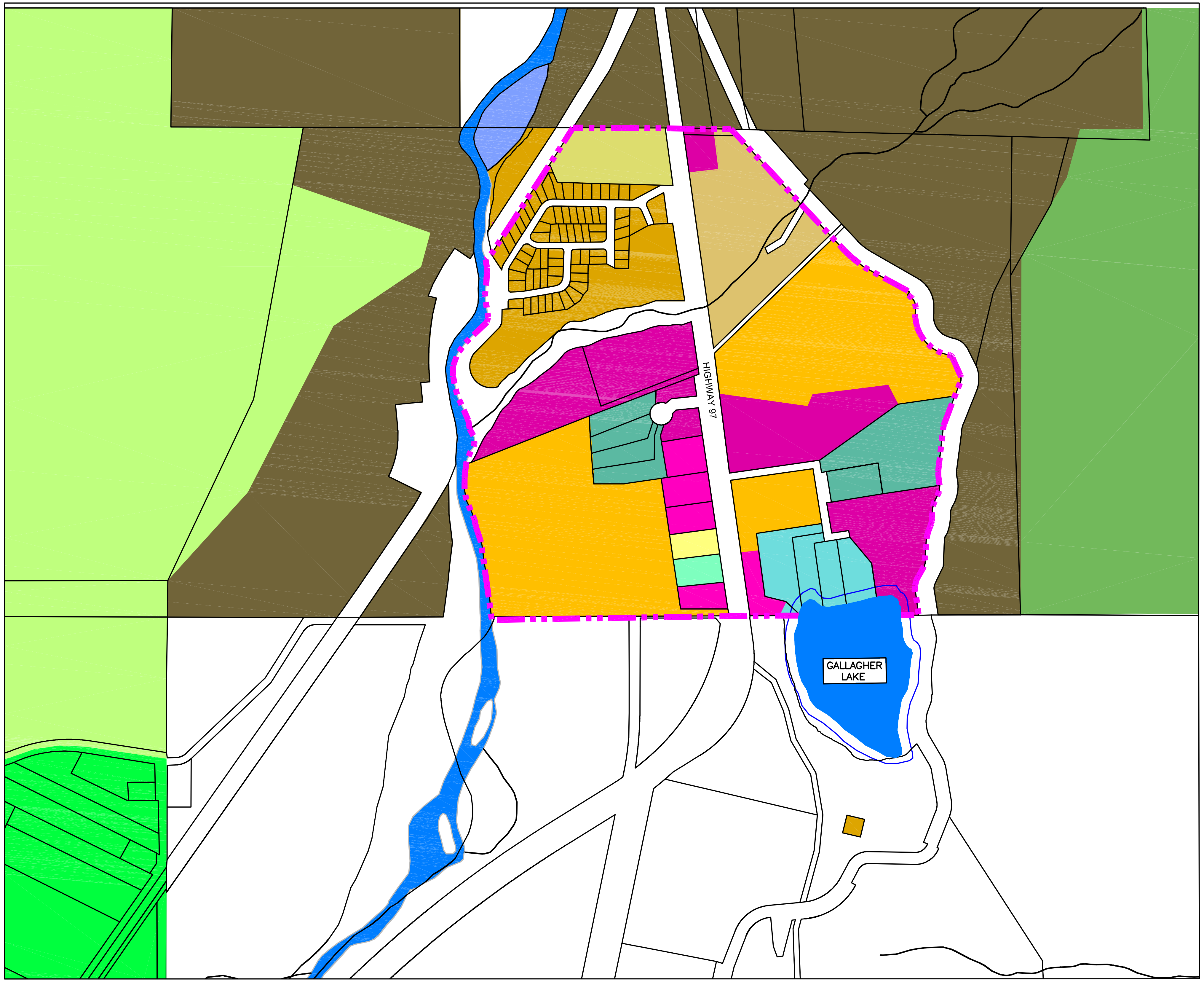


FIGURE 3-1

REGIONAL DISTRICT OF OKANAGAN-SIMILKAMEEN
GALLAGHER LAKE AREA LAND-USE

SCALE 1:7500

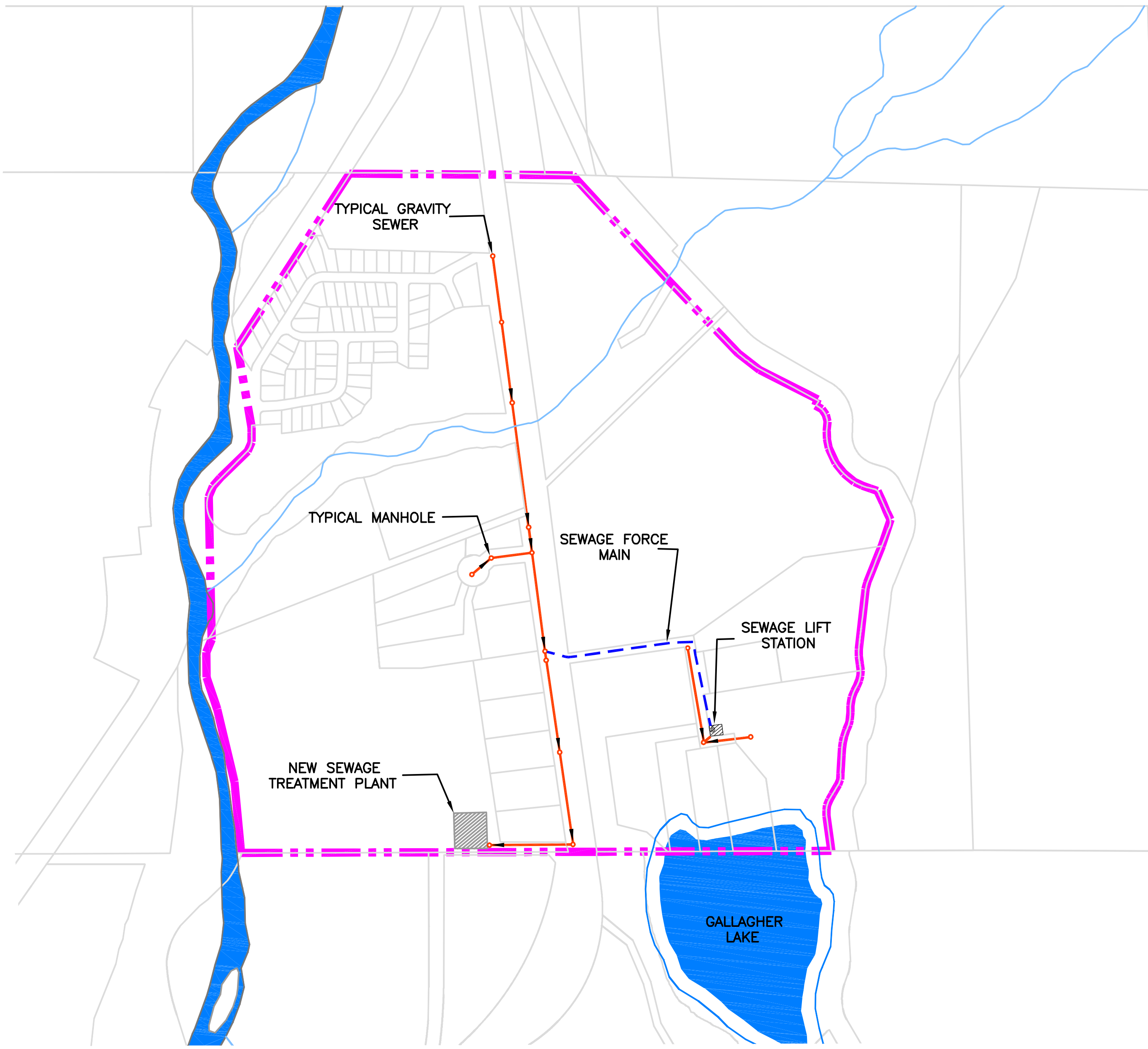
STUDY AREA BOUNDRY

CA	CONSERVATION AREA
C	COMMERCIAL
CT1	COMMERCIAL TOURIST ZONE 1
CT2	COMMERCIAL TOURIST ZONE 2
SH3	SMALL HOLDINGS 3
RSM1	RESIDENTIAL MULTIPLE ZONE 1
RSM2	RESIDENTIAL MULTIPLE ZONE 2
RS1	RESIDENTIAL SINGLE FAMILY ZONE
RS3	RESIDENTIAL SINGLE FAMILY ONE ZONE
AG1	AGRICULTURAL ONE ZONE
AG2	AGRICULTURAL TWO ZONE
RA	RESOURCE AREA ZONE
P	PARK ZONE
I3	INDUSTRIAL ZONE 3

EarthTech
A Tyco International Ltd. Company

FIGURE 3-2
OPTION 1: NEW STP SERVICING THE GALLAGHER LAKE AREA

SCALE 1:7500



EarthTech
A Tyco International Ltd. Company

Option 1: New STP Servicing the Gallagher Lake Area

The first option involves construction of a new sewage treatment plant facility to service the local area. For the purposes of this options assessment, a new STP location was identified at the south end of the study area (Figure 3-2).

For this option, it assumed that the Deer Lake Park development would not be included in the sewerage area since this development is already serviced by a treatment facility.

Effluent disposal is a key factor in determining the feasibility of a new treatment plant. The close proximity of Okanagan River to Gallagher Lake makes ground disposal of secondary effluent an unlikely scenario. Any effluent discharged to ground in this area would reach Okanagan River relatively quickly resulting in little effluent renovation. The effluent would introduce nutrients to the river and deteriorate the water quality of the river, as well as downstream lakes. Selection of an appropriate infiltration site is beyond the scope of this study. However, for the purposes of assessing feasibility, implementation of a tertiary treatment plant with local ground infiltration or direct river discharge will be used as a basis for costing this option.

Under the Province's Municipal Sewage Regulations (MSR), direct discharge to a water body must achieve the following minimum effluent water quality:

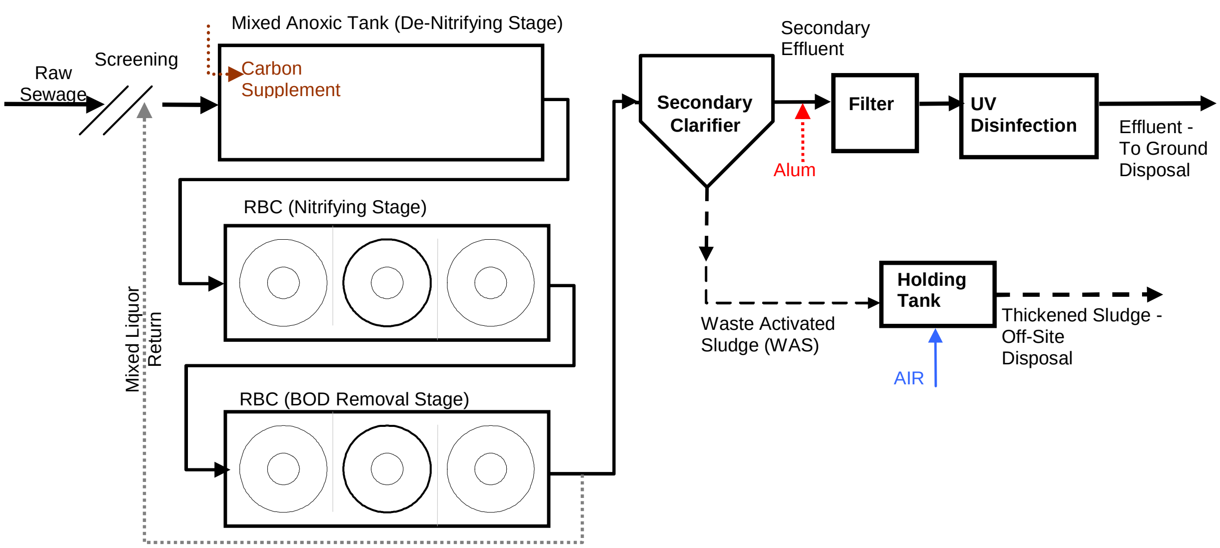
- BOD < 10 mg/L
- TSS < 10 mg/L
- Total Nitrogen < 6 mg/L
- Total Phophorus < 0.25 mg/L
- Coliforms < 50 cfu/100mL

In addition to the effluent water quality parameters above, the effluent discharge must meet minimum dilution requirements which it is assumed can be achieved in Okanagan River. Ultimately, an environmental assessment would be required to confirm these assumptions.

A schematic of a proposed tertiary treatment plant utilizing an attached growth media is provided as Figure 3-3. The media envisioned under this treatment scheme is a rotating biological contactor (RBC). RBC's are used extensively for secondary treatment but are less common in nutrient removal applications. However, with sufficient media, RBC's have been shown to nitrify. By providing an anoxic zone, de-nitrification or nitrogen removal is achievable. Furthermore, with provision of alum dosing and filtration a high degree of phosphorus removable is also possible. A final UV disinfection stage would limit coliforms in the effluent.

Waste sludge from this process can be managed by provision of a thickener and aerated holding tank for storage. The thickened waste sludge can be hauled to an approved facility on a regular (weekly) basis. The Campbell Mountain landfill could serve as a possible option.

Figure 3-3: Proposed Tertiary Process Schematic



A lift station and forcemain are required to service properties located on the east side of the Highway 97. The lift station location has been shown at the end of 95th Street, adjacent to the KOA campground. Selection of the lift station location is based on coarse elevation data. The lift station depth would need to be designed to provide gravity service to the nearby campground and residential homes. Given the proximity to the campsites, it is expected that the lift station would have provision for activated carbon air scrubbers to control odours. A review of the lift station location should be conducted at the pre-design stage to evaluate its ability to serve the area.

Table 3-5 summarizes summary of capital cost estimates for the Option 1 servicing strategy.

Table 3-5: Capital Cost Estimates for a Services and Local Treatment Facility

Conveyance Facilities

Item	Unit	Quantity	Cost/Unit	Cost Estimate ($)
1.) 200mm Diameter Gravity Sewer (incl. manholes, services, road/ROW restoration)	m	1,150	325	373,750
2.) Liftstation	LS	1	215,000	215,000
3.) Forcemain (100mm)	m	280	245	68,600
			Sub-Total	657,350
			Engineering & Contingency (35%)	230,073
			Taxes (6%)	39,441
			Sub-Total (Rounded)	***$926,900***

Tertiary Wastewater Treatment Plant (780 m^3 /day)

Item	Unit	Quantity	Cost/Unit	Cost Estimate ($)
1.) General (Mob/DeMob, Overhead, etc)	LS	1	200,000	200,000
2.) Civil	LS	1	125,000	125,000
3.) Structural	LS	1	275,000	275,000
4.) Process				
i. Headworks/Primary	LS	1	450,000	450,000
ii. RBC's (c/w covers)	LS	1	675,000	675,000
iii. Disk Filter	LS	1	200,000	200,000
iv. Clarifier Mechanism/Return Pumps	LS	1	100,000	100,000
v. UV Disinfection	LS	1	40,000	40,000
vi. Sludge Tank Aeration Equip., & Thickener	LS	1	180,000	180,000
vii. Alum/Carbon Dosing Facilities	LS	1	20,000	20,000
viii. Effluent Disposal	LS	1	75,000	75,000
iix. Miscellaneous	LS	1	50,000	50,000
5.) Building Mechanical	LS	1	80,000	80,000
6.) Electrical	LS	1	425,000	425,000
7.) Land Acquisition	m^2	3,000	135	405,000
			Sub-Total	3,300,000
			Engineering & Contingency (35%)	1,155,000
			Taxes (6%)	198,000
			Sub-Total (Rounded)	***$4,650,000***

Complete Gallagher Lake Area Servicing (Option 1)

TOTAL (Rounded)	***$5,580,000***

While the treatment process proposed is relatively straight-forward, it will require a full-time operator. Operation costs will also need to factor in supply of alum for phosphorus removal and supplementary carbon, residuals disposal and electrical costs. The operation and maintenance costs are estimated to be $237,000 (Table 3-6).

Table 3-6: Estimated Annual Operation & Maintenance Costs

Item	Cost Estimate ($)
1.) Full-Time Operator (c/w administration, expenses, etc)	130,000
2.) Chemical Supply	85,000
3.) Residuals Disposal	12,000
4.) Power	10,000
Total O&M Costs	***$237,000***

Option 2: Connect to the Proposed Osoyoos Indian Band Treatment Plant

Option 2 involves conveying wastewater generated in the Gallagher Lake area to a new wastewater treatment facility operated by the Osoyoos Indian Band (OIB). Figure 3-4 provides a schematic of this option.

The Osoyoos Indian Band has plans to implement a wastewater treatment facility. Land requirements for the treatment plant were set aside by the Band in the early 1990's and were based on a secondary treatment facility with disposal of effluent through ground infiltration. Hydro-geotechnical studies were conducted to validate ground infiltration capacity of the 3.8 hectare site.

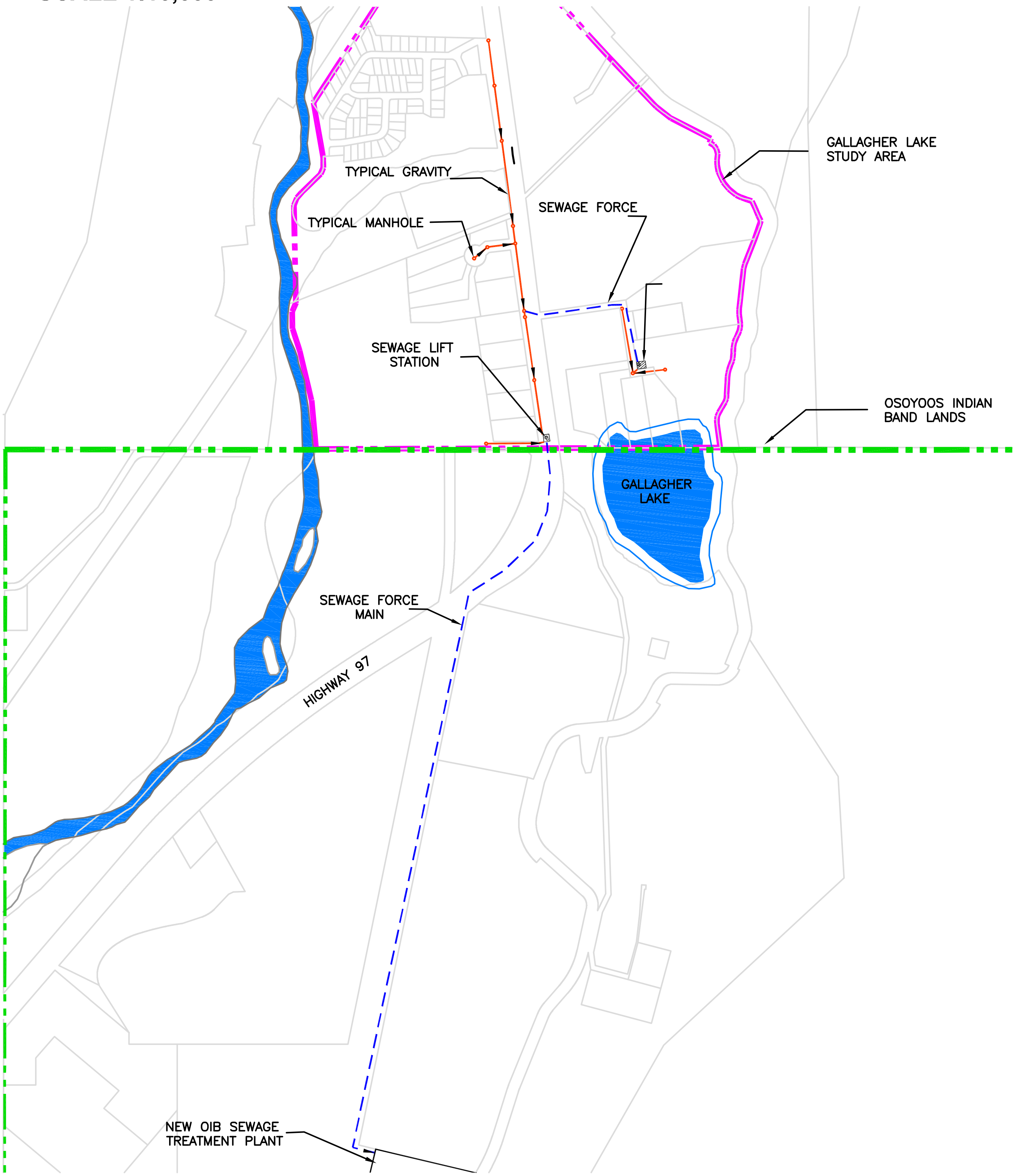
The OIB wastewater treatment plant has the potential to serve as a regional facility for both OIB and RDOS lands. The relatively large 3.8 hectare site should provide for future growth of the communities.

The proposed treatment plant site is located approximately 1.2 kilometres south of the Gallagher Lake area. In order to convey wastewater to the OIB plant, a lift station and forcemain would be required. Figure 3-4 provides a servicing schematic for the Gallagher Lake area to connect to a wastewater treatment plant on OIB lands. The lift station has been located within the Highway 97 right-of-way at the south end of the study area. Wastewater from the sewerage area would be pumped to the OIB plant through a 1,320 metre forcemain.

Given that Deer Lake Estates is currently serviced by a treatment plant, the existing and future developed area has been excluded from the assumed sewerage area serviced by this option.

FIGURE 3-4
OPTION 2: CONNECT TO PROPOSED OIB FACILITY

SCALE 1:10,000



EarthTech
A Tyco International Ltd. Company

Details of OIB's treatment facility, including costs, capacity, process type and cost, are not available. In order to assess the feasibility of this option, capital and operational cost estimates have been developed for a secondary treatment plant sized to service the Gallagher Lake area. This approach to estimating costs is conservative since there would economies of scale realized by the shared plant development. In essence, RDOS' share of the treatment plant cost is estimated as the cost to build a secondary treatment plant on the OIB site to treat wastewater flow from Gallagher Lake.

Table 3-7 summarizes capital cost estimate for servicing the Gallagher Lake area and provision of a treatment plant on OIB lands.

Table 3-7: Capital Cost Estimates for Connecting to the Proposed OIB Treatment Plant

Conveyance Facilities

Item	Unit	Quantity	Cost/Unit	Cost Estimate ($)
1.) 200mm Diameter Gravity Sewer (incl. manholes, services, road/ROW restoration)	m	1,100	325	357,500
2.) Liftstation	LS	2	215,000	430,000
3.) Forcemain	m	1,600	245	392,000
			Sub-Total	1,179,500
			Engineering & Contingency (35%)	412,825
			Taxes (6%)	70,770
			Sub-Total (Rounded)	***$1,663,000***

Secondary Wastewater Treatment Plant (780 m^3 /day)

Item	Unit	Quantity	Cost/Unit	Cost Estimate ($)
1.) General (Mob/DeMob, Overhead, etc)	LS	1	150,000	150,000
2.) Civil	LS	1	125,000	125,000
3.) Structural	LS	1	175,000	175,000
4.) Process				
i. Headworks/Primary	LS	1	150,000	150,000
ii. RBC's (c/w covers)	LS	1	475,000	475,000
iii. Clarifier Mechanism/Sludge Pumps	LS	1	100,000	100,000
iv. Sludge Tank Aeration Equip., & Thickener	LS	1	180,000	180,000
v. Effluent Disposal	LS	1	75,000	75,000
vi. Miscellaneous	LS	1	35,000	35,000
5.) Building Mechanical	LS	1	40,000	40,000
6.) Electrical	LS	1	275,000	275,000
7.) Land Acquisition (plant site plus RI basin)	m	7,500	120	900,000
			Sub-Total	2,680,000
			Engineering & Contingency (35%)	938,000
			Taxes (6%)	160,800
			Sub-Total (Rounded)	***$3,780,000***

Complete Gallagher Lake Area Servicing (Option 2)

TOTAL (Rounded)	***$5,440,000***

The cost estimates for the treatment plant costs are based on an RBC facility, similar to that in Option 1, except the process components required to achieve nutrient removal have been removed (ie, UV disinfection, disk filter, anoxic tank and nitrifying RBC's).

The annual operation and maintenance costs for this option are estimated to be $154,000 and include a full-time operator, residuals disposal and energy costs.

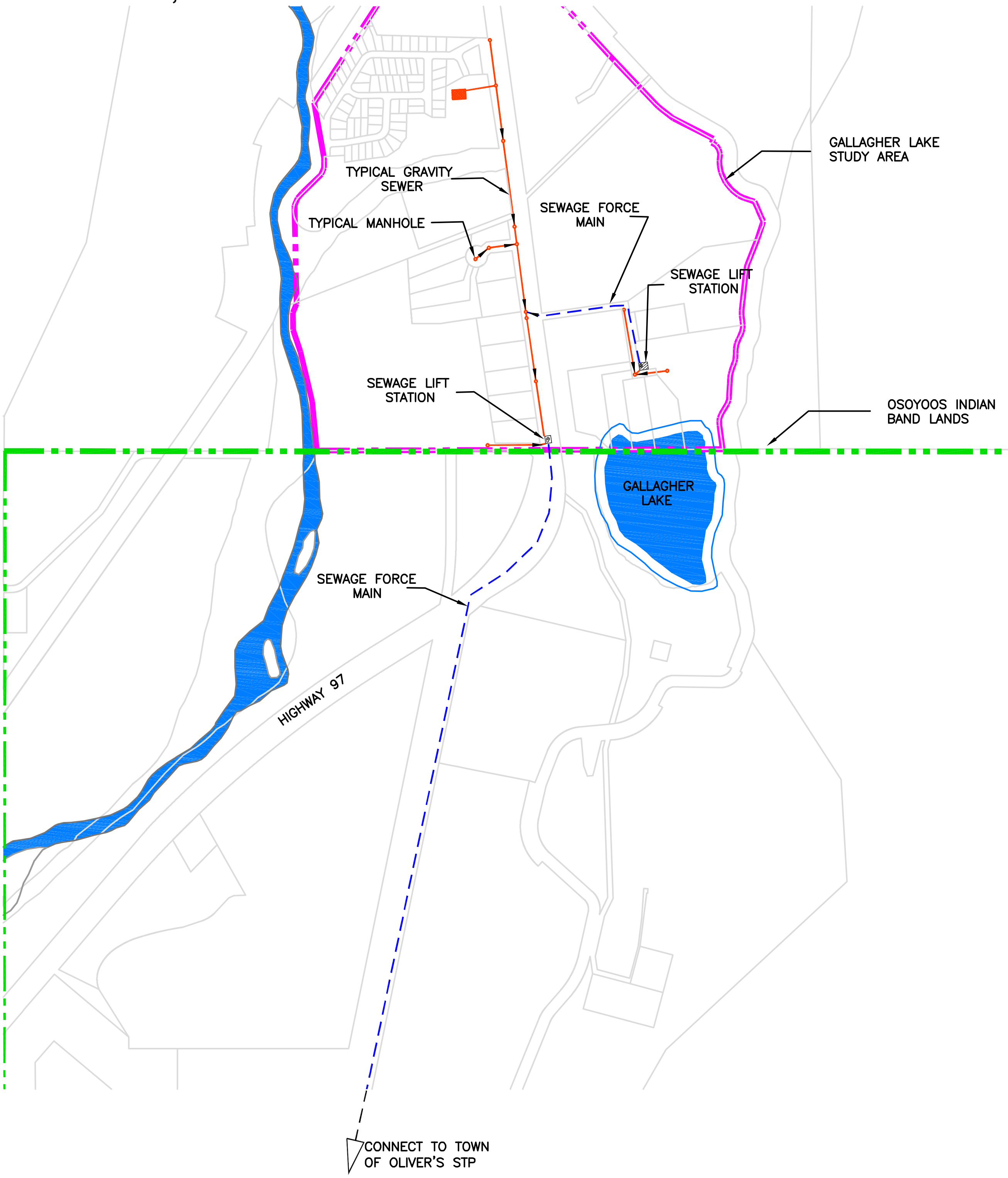
Option 3: Connect to the Town of Oliver's Sewage Collection System

A third option for providing treatment of wastewater from the Gallagher Lake area is to connect to the Town of Oliver's sewer system (Figure 3-5). The Town of Oliver operates a sewer system which extends as far as Tuc El Nuit Lake. From this area, the wastewater is conveyed by gravity to a liftstation near Rotary Beach. The wastewater is pumped from the Rotary Beach liftstation to a second liftstation at the Public Works yards where it is pumped to the Town's treatment plant.

In order to convey wastewater from Gallagher Lake, a pump station would need to be located near the southern boundary. The length of forcemain required to convey wastewater to the Town's sewer system is estimated to be 5,200 metres. The entire alignment of this forcemain would be within OIB lands. An alternative approach would be follow Highway 97 but this would involve a longer forcemain.

FIGURE 3-5
OPTION 3: CONNECT TO TOWN OF OLIVER SYSTEM

SCALE 1:10,000



EarthTech
A Tyco International Ltd. Company

Even assuming that a ROW would only need to be acquired for only half the alignment, the cost and length of time to assemble a feasible alignment would high.

The proposed forcemain is sufficiently long that hydrogen sulphide generation could create problems for the Town's sewer system. As a result, provision for chemical dosing has been included to address sulphide formation in the forcemain.

It assumed that the two liftstations owned by the Town that are required to convey wastewater to the treatment plant and no trunk or forcemain upgrades will be required. However, detailed modeling analyses will be required to confirm these assumptions if this option proceeds.

The existing Town of Oliver's wastewater treatment facility consists of an aerated lagoon. Effluent from the plant is used as irrigation water for a local golf course. The treatment plant has been designed to accommodate the local sewerage area. Residual capacity does not exist to provide for the design flows calculated for the Gallagher Lake area.

For the purposes of this study, installation of a fine screen filter is used as a basis for assessing the cost implications of connecting to the Town's STP to treat wastewater from the Gallagher Lake area. A fine screen filter can remove a portion of the total suspended solids (TSS) and biological oxygen demand (BOD) loading. A fine screen filter with a mesh opening of 500 microns can achieve a 20% reduction in the influent BOD and TSS with a corresponding increase in treatment capacity. Installation of a similar fine screen facility at the Okanagan Falls treatment plant has successfully increased the treatment capacity to accommodate summer peaks.

A fine screen filter at the Town of Oliver's STP could increase the lagoon treatment capacity to provide for servicing of the Gallagher Lake area. However, operation of the mechanical fine screen filters will require managing additional dewatered solids for disposal at a landfill. While residuals from the fine filter could be disposed of with screened material from the headworks there will be more operator attention required to complete these tasks.

There may be other options that could achieve the same capacity increase in a more cost-effective way. However, for the purposes of assessing costs, the filter option will be used.

Table 3-8 summarizes capital cost estimate for servicing the Gallagher Lake area and providing a connection to the Town of Oliver's sewer system.

Table 3-8: Capital Cost Estimates for Connecting to the Town of Oliver's Sewer System

Conveyance Facilities

Item	Unit	Quantity	Cost/Unit	Cost Estimate ($)
1.) 200mm Diameter Gravity Sewer (incl. manholes, services, road/ROW restoration)	m	1,100	325	357,500
2.) Liftstation (Local)	LS	1	215,000	215,000
3.) Liftstation to pump to Oliver's sewer system (c/w chemical dosing)	LS	1	390,000	390,000
4.) Forcemain	m	5,580	245	1,367,100
5.) Land Acquisition Allowance for ROW	m^2	7,800	120	936,000
			Sub-Total	3,265,600
			Engineering & Contingency (35%)	1,142,960
			Taxes (6%)	195,936
			Sub-Total (Rounded)	***$4,604,000***

Upgrades to Town of Oliver's Sewer System

Item	Unit	Quantity	Cost/Unit	Cost Estimate ($)
1.) Major Upgrade to Rotary Beach Lift Station	LS	1	90,000	90,000
2.) Minor Upgrade to Public Works Lift Station	LS	1	20,000	20,000
3.) Supply of Salsnes Fine Screen Filter	Each	2	240,000	480,000
4.) Filter Building	LS	1	25,000	25,000
5.) Electrical & Misc. Piping	LS	1	40,000	40,000
			Sub-Total	655,000
			Engineering & Contingency (35%)	229,250
			Taxes (6%)	39,300
			Sub-Total (Rounded)	***$920,000***

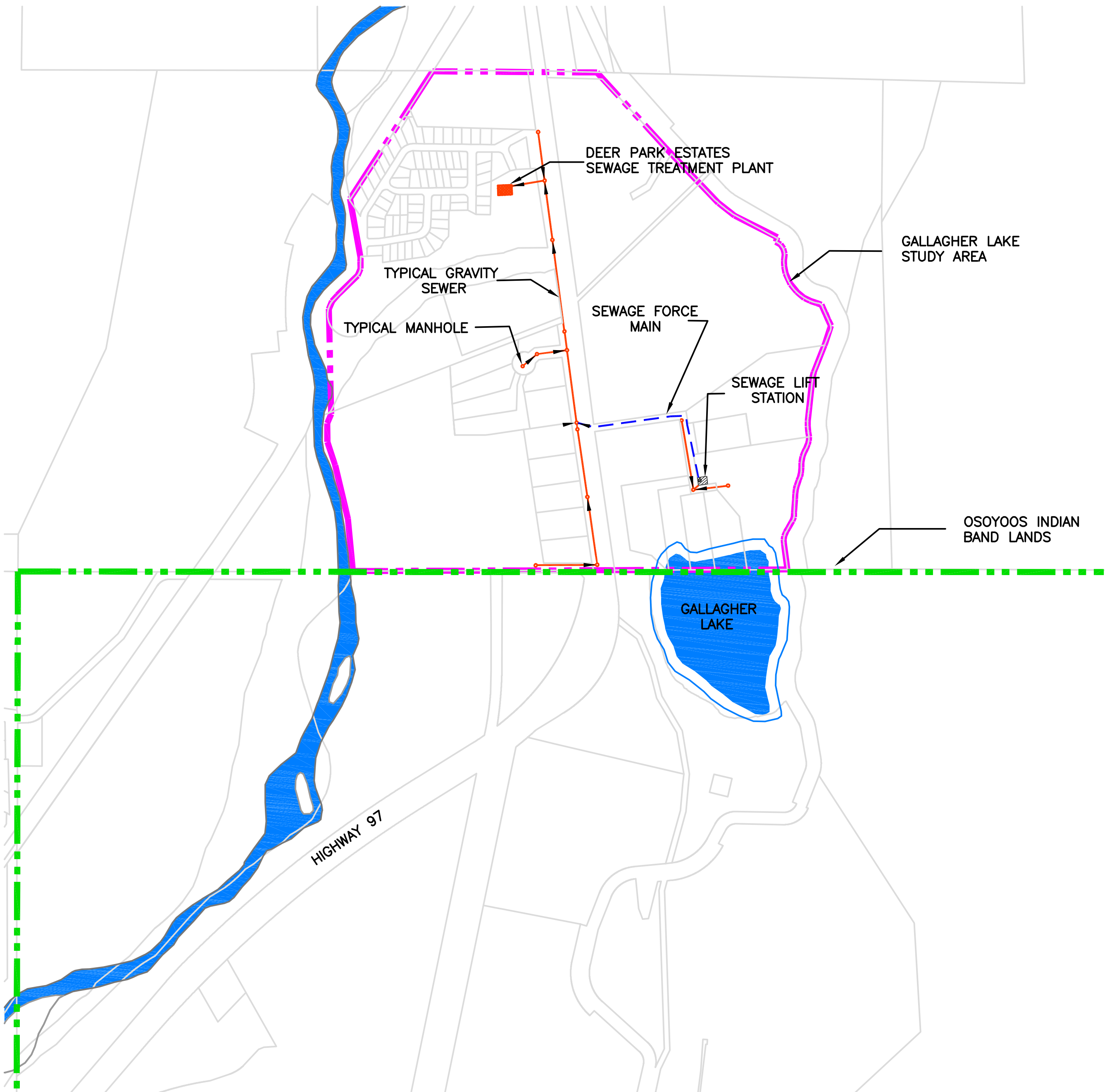
Complete Gallagher Lake Area Servicing (Option 3)

TOTAL (Rounded)	***$5,520,000***

The annual operation and maintenance costs for this option are estimated to be $165,000 and include a part-time operator to maintain the liftstation, residuals, power consumption, chemical supply for sulphide control and a sewer levy. The sewer levy imposed by the Town of Oliver is estimated to be $100,000 per year.

FIGURE 3-6
OPTION 4: EXPAND DEER PARK ESTATES STP

SCALE 1:10,000



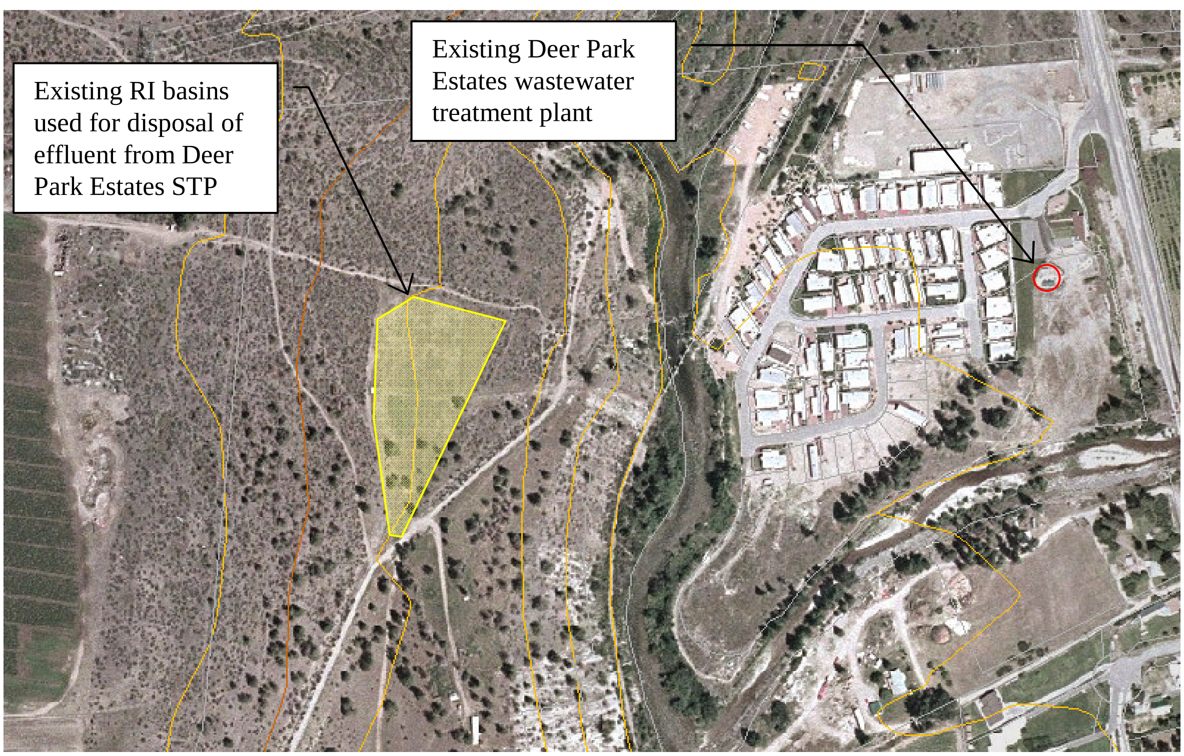
EarthTech
A Tyco International Ltd. Company

Option 4: Expand Deer Park Estates Sewage Treatment Plant

Option 4 involves connecting a new sewer system for the Gallagher Lake area to the Deer Park Estates wastewater treatment plant (Figure 3-6). Deer Park Estates operates a secondary wastewater treatment plant adjacent to Highway 97. Effluent from the treatment plant is pumped to a rapid infiltration (RI) basin located on a terrace above the development. The infiltration basin is approximately 60 metres in elevation above Deer Park Estates (Figure 3-7).

Currently, the Deer Park Estates STP is running at approximately 40 percent of its total capacity of 136 m^3/day. However, any residual capacity has been allocated for build-out of the remaining RSM2 site which is currently in the planning stages of development. As a result, tying-in to the treatment facility will require that the RDOS take over operation of the existing facility and expand its capacity to service the remaining Gallagher Lake area. Furthermore, the existing rapid infiltration basins used for effluent disposal will need to be expanded.

Figure 3-7: Location of Major Treatment Facilities Associated With Deer Park Estates



Given the proximity of the RI basins to the embankment adjacent to Okanagan River, there is uncertainty with respect to the ultimate infiltration capacity of the site. As the effluent flows increase to the RI site, as with a plant expansion, groundwater mounding will increase. At some increased flow, the groundwater mounding will be sufficiently high to cause a horizontal flow gradient, causing effluent to day-light on the slope above Okanagan River. A hydrogeological assessment is required to assess the maximum infiltration flow. However, the flow will be limited by the proximity of the steep slope.

Table 3-9 provides a summary of cost estimates for this option.

Table 3-9: Capital Cost Estimates for Expanding the Deer Park Estates STP

Conveyance Facilities

Item	Unit	Quantity	Cost/Unit	Cost Estimate ($)
1.) 200mm Diameter Gravity Sewer (incl. manholes, services, road/ROW restoration)	m	1,150	325	373,750
2.) Liftstation	LS	1	215,000	215,000
3.) Forcemain	m	280	245	68,600
Sub-Total				657,350
Engineering & Contingency (35%)				230,073
Taxes (6%)				39,441
Sub-Total (Rounded)				***$926,900***

Secondary Wastewater Treatment Plant Expansion (920 m^3/day)

Item	Unit	Quantity	Cost/Unit	Cost Estimate ($)
1.) General (Mob/DeMob, Overhead, etc)	LS	1	150,000	150,000
2.) Civil	LS	1	125,000	125,000
3.) Structural	LS	1	175,000	175,000
4.) Process				
i. Headworks/Primary	LS	1	150,000	150,000
ii. RBC's (c/w covers)	LS	1	475,000	475,000
iii. Clarifier Mechanism/Sludge Pumps	LS	1	100,000	100,000
iv. Sludge Tank Aeration Equip., & Thickener	LS	1	180,000	180,000
v. RI Basin Expansion	LS	1	75,000	75,000
vi. Upgrade effluent pump	LS	1	25,000	25,000
vii. Miscellaneous	LS	1	35,000	35,000
5.) Building Mechanical	LS	1	40,000	40,000
6.) Electrical	LS	1	275,000	275,000
7.) Land Acquisition (Plant and RI Basin Expansion)	m^2	7,500	120	900,000
Sub-Total				2,705,000
Engineering & Contingency (35%)				946,750
Taxes (6%)				162,300
Sub-Total (Rounded)				***$3,810,000***

Complete Gallagher Lake Area Servicing (Option 4)

TOTAL (Rounded)	***$4,740,000***

The annual operation and maintenance costs for this option are estimated to be $150,000 and include a full-time operator, residuals disposal and energy costs.

Summary of Options Assessment

A summary of the various considerations is provided in Table 3-10. Included in this summary is the life-cycle cost based on the capital and O&M costs for each of the options assessed above. The life-cycle cost provides an objective measure of the cost to construct and operate each of the options. Other important considerations include engineering, environmental and social factors.

Option 1, developing a new tertiary plant, has a moderate capital cost compared to the other options. However, the high operation and maintenance costs of the proposed facility results in the highest life-cycle cost estimate. Furthermore, siting of such a facility to provide a buffer zone from development within the Gallagher Lake area is difficult. On the basis of costs and siting, this option is eliminated from further consideration.

Option 2, connecting to a future OIB wastewater treatment facility, has the second lowest life-cycle cost of the four options. Connecting to the OIB facility and establishing a regional facility has merit. The site proposed is sufficiently large to provide for buffers and future growth. The site could also provide service to RDOS lands on Tuc-ul-nuit Road.

Option 3, connecting to the Oliver system has a moderate life-cycle cost estimate. In addition, the challenges of establishing a 5.3 kilometre forcemain alignment through several OIB and RDOS properties would make this option challenging to implement. Furthermore, provision for upgrades to the Town of Oliver system has been included but this estimate could easily be exceeded if any additional upgrades to the sewer system were required. As a result, the budgetary risk resulting from potential upgrades to the Town's sewer trunk system and delays in implementing the forcemain alignment is high.

Support for expansion of the Town of Oliver's wastewater treatment plant is also uncertain. The Town Council passed a sewer service policy on January 22, 2001 which resolves to restrict expansion of the sewer system except where is deems the development to be suitable and only if the area becomes incorporated into the Town.

Given these considerations, Option 3 is dropped from further consideration.

Option 4 has the lowest life-cycle cost estimate. However, Option 4 suffers similar problems as Option 1 regarding siting of the treatment plant and could pose an obstacle for taking over the existing facilty. The hydrogeological capacity of the area currently used as a RI basin is also uncertain. Furthermore, the owner of the land on which the current RI basins are situated (Gene Covert) has indicated he is not in support of expansion of the basins. Even if additional lands could be purchased to expand the existing RI basins, it is not clear if the slope would support the additional groundwater mounding that could result.

From a life-cycle costing perspective, Option 4, connecting to the Deer Park Estates STP is the least costly option. Option 4 benefits from relatively low capital and operating costs for the secondary treatment plant. Option 2, connecting to the OIB wastewater treatment plant is similar to Option 4. However, the added capital cost of providing a pump facility to convey wastewater to the OIB facility results in a higher life-cycle cost.

While Option 2 has a higher life-cycle cost than Option 4, there are strategic considerations for pursuing a plan to develop an OIB-RDOS facility. In particular, the new wastewater treatment facility would be well situated to service properties within the RDOS along Tuc-ul-nuit Road and Highway 97.

In light of these considerations, connecting to the proposed OIB plant is recommended. RDOS should begin negotiations with OIB on servicing the Gallagher Lake area. In particular, the capital cost contribution and parcel servicing cost should be defined. In the event that the costs, are higher than expected, the selection of options should be re-evaluated.

Table 3-10: Summary of Major Considerations for Various Servicing Options

	Capital Cost		Annual O&M Costs	Life-Cycle (25 Years)[1]	Engineering Considerations	Environmental/Social Considerations
	Servicing/ Conveyance	Treatment				
Option 1: New STP Servicing the Gallagher Lake Area	$926,900	$4,650,000	$237,000	$8,840,000	- tertiary treatment plant has high O&M costs - low budgetary risk since treatment equipment is readily available	-proposed treatment process provides for nutrient removal - STP located in undeveloped RSM1 site and could pose future potential conflicts
Option 2: Connect to Proposed Osoyoos Indian Band Facility	$1,663,000	$3,780,000	$154,000	$7,490,000	- proposed 3.8 ha site will provide for future expansion and could become a regional facility, servicing other RDOS lands - low budgetary risk	- provision for a buffer exists -secondary process will not remove the nutrient stream
Option 3: Connect to Town of Oliver's Sewer System	$4,604,000	$920,000	$165,000	$7,730,000	- forcemain ROW acquisition to Oliver will be complex and costly - relatively high energy costs required to pump to Oliver - high budgetary risk due to uncertain capacity constraints in Oliver system and forcemain ROW acquisition	- high potential for sulphide generation in forcemain - effluent ultimately reused - Town council has passed a policy to limit expansion of the sewer system unless area is incorporated which makes support unlikely
Option 4: Expand Deer Park Estates STP	$926,900	$3,810,000	$150,000	$6,760,000	- capacity of infiltration basin will have to be expanded - will require taking over the existing RBC facility by RDOS - moderate budgetary risk due to infiltration basin uncertainties	- existing treatment plant site relatively close to existing & future homes should be moved to avoid potential conflict - landowner of existing RI basins does not support an expansion -secondary process will not remove the nutrient stream

Notes: 1.) Life cycle costs are based on a discount rate of 4% and 25 year time frame

3.5 REGULATORY REQUIREMENTS

Construction of parts of the liftstation will occur within the 30 metre Gallagher Lake setback allowance of the Riparian Area Regulation (RAR). Therefore, application will need to be made for a variance to the set-back. The specific location of encroachments will need to be assessed at the design stage.

4.0 CONCLUSIONS & RECOMMENDATIONS

Sanitary sewer servicing of the Gallagher Lake area was assessed under four servicing scenarios. The first option considered was to provide a tertiary treatment plant with the service area. The second option involved connecting to the proposed Osoyoos Indian Band treatment plant. The third option involved connecting to the Town of Oliver's sewer system. The fourth option involved expanding the Deer Park Estates sewage treatment.

The preferred option is to connect to a new OIB facility (Option 2). Although Option 2 results in the second lowest life-cycle cost it has the least budgetary risk. In addition, the new facility is well situated to service properties within the RDOS along Tuc-ul-nuit Road and Highway 97.

The estimated capital cost for implementing the preferred option is $1,663,000. This includes provision of gravity trunks for sewage collection and two liftstations and a forcemain to convey wastewater to the new OIB facility. An initial capital cost contribution and annual servicing costs for treatment will need to be negotiated with OIB.

Therefore, it is recommended that the RDOS pursue a servicing option for Gallagher Lake which involves connecting to the proposed OIB plant. RDOS should begin negotiations with OIB on servicing the Gallagher Lake area. In particular, the capital cost contribution and parcel servicing cost should be defined. In the event that the costs are higher than estimated, the options should be re-evaluated.

Appendix A –

Costing Assumptions

APPENDIX A - COSTING ASSUMPTIONS

Gravity Sewer

Diameter	Pipe Cost	MH Cost	Sub-base & Base	Asphalt Cutting & Placement	Total Unit Cost
(mm)	($/m)				
200	130	50	90	55	325
250	150	50	90	55	345
300	180	50	90	55	375

Manholes

	Barrel	Base, Frame & Lid	Total Unit Cost
	($/unit)		
Each (3m depth)	2,500	2,000	4,500

Forcemain

Diameter	Pipe Cost	Sub-base & Base	Asphalt Cutting & Placement	Total Unit Cost
(mm)	($/m)			
100	100	90	55	245
150	125	90	55	270

Sanitary Liftstation

Size Range	Pump Supply Package	Electrical & Controls	Emergency Back-up Power	Installation & Restoration	Dewatering Premium	Odour Control	Total Unit Cost
	($/unit)						
Liftstation	30,000	100,000	45,000	25,000	10,000	5,000	215,000

Easement Acquisition

Property Type	Cost per m^2
Propety Acquisiton - Residential	135
Property Acquistion - Agricultural	120

Appendix B –

Letter of Support,

Osoyoos Indian Band