Sanitary Sewer System 2018 Annual Report

Town of Oliver

March 2019

Project No. 306-088-006

ENGINEERING ■ PLANNING ■ URBAN DESIGN ■ LAND SURVEYING

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Revision Log

Revision #	Revised by	Date	Issue / Revision Description
1	N.A.	July 18, 2018	Town of Oliver Report Revisions

Report Submission

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Mar 13 /2019

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List of Acronyms

AC	Asbestos Cement
BOD_5	5-Day Biological Oxygen Demand
CPE	Chlorinated Polyethylene
EOCP	Environmental Operators Certification Program
FLNRO	Ministry of Forests, Lands, and Natural Resource Operations
GIS	Geographic Information Systems
HDPE	High Density Polyethylene
I&I (I/I)	Inflow and Infiltration
LS	Lift Station
LWMP	Liquid Waste Management Plan
MOE	Ministry of Environment and Climate Change Strategy
MPN	Most Probable Number
MSR	Municipal Sewage Regulation
MWR	Municipal Wastewater Regulation
OC	Operational Certificate
OCP	Official Community Plan
OIB	Osoyoos Indian Band
PVC	Polyvinyl Chloride
TRUE	TRUE Consulting
TSS	Total Suspended Solids
WMP	Waste Management Plan

Units of Measure

km	kilometre
L/d	Litres per day
L/m	Litres per minute
L/s	Litres per second
lpcd	Litres per capita per day
m	metre
m^3/day	cubic metre per day
mg/L	milligrams per Litre
mm	millimetre

Referenced Reports

TRUE Consulting Group (2002). *Town of Oliver 2002 Liquid Waste Management Plan Update.*

TRUE Consulting Group (2018). *Town of Oliver Wastewater Treatement System Capacity Improvements.*

1.0 Operational Data

The paragraphs following summarize the operational data for the Town of Oliver's Sanitary Sewer System for 2018. The operational report for 2018 is formatted in a "source" to "final disposal" format. Each section also includes a reference to the appropriate sections of the Operational Certificate (OC) for the system. Appendix A of this report contains a complete copy of the Operational Certificate for PE 13717 issued by the Ministry of Environment (MOE) on December 14,1995.

As per Section 1 of the OC, specific authorized discharges and requirements are summarized as follows:

- The Town is authorized a maximum discharge rate of 2,200 m^3 per day from the aerated lagoons to the reclaimed wastewater storage reservoir.
- There is no maximum authorized rate of discharge from the storage reservoir for beneficial use as irrigation water.
- It is required that effluent discharged from the aerated lagoons to the storage reservoir not exceed a 5-Day Biological Oxygen Demand (BOD_5) of 45 mg/L and Total Suspended Solids (TSS) of 60 mg/L.
- Maintain a minimum reservoir retention time of 60 days prior to irrigation use.
- Reclaimed wastewater utilized for irrigation shall conform to the effluent irrigation guidelines developed by the BC Ministry of Health. Fecal coliforms shall not exceed 200 MPN per 100mL for agricultural, silvicultural and low public use lands, or exceed 2.2 MPN per 100 mL for high public use land.

To assist the reader in assessing the system operational data, the following drawings are included:

- Figure 1-2: Overall Plan - Reclaimed Water Supply System and Irrigation Areas
- Figure 1-3: Aerated Lagoon Treatment System

1.1 Influent

1.1.1 Influent Works (OC 6.4.2)

Influent from the sanitary sewer collection system is pumped through influent screens and piped into a two-cell flow equalization system ("equalization basins"). The original equalization basin was constructed in 1984 and lined with a Chlorinated Polyethylene (CPE) membrane. The second equalization basin was constructed in 2009 and lined with a 60mil HDPE membrane. These liners provide a transfer barrier for liquids from the basins to the native subsurface material. There is no piped interconnection between the Okanagan River and the equalization basins.

A detailed description of the treatment process can be found in the Town of Oliver's *2002 Liquid Waste Management Plan Update Report* prepared by TRUE Consulting.

1.1.2 Influent Flow Data (OC 7.1.2 and 7.2.4.7)

Wastewater is pumped from the equalization basin to the aerated lagoons via the High Lift Station. Daily flow data for the lift station is presented in Appendix B. The total volume pumped to the aerated lagoons in 2018 was 666,376 m^3, which equates to an average daily flow of 1,826 m^3/day. This is a decrease of 22,720 m^3 (3%) compared to 2017. For comparison, total influent flows for the period 1996 to 2018 are summarized in Table 1-1 and Figure 1-1 as follows:

TABLE 1-1: ANNUAL TOTAL AND AVERAGE DAILY INFLUENT FLOW DATA

Year	Total Influent Volume (m^3)	Average Daily Flow (m^3/d)
1996	654,361	1,788
1997	682,480	1,870
1998	666,322	1,826
1999	688,193	1,885
2000	702,688	1,920
2001	678,052	1,858
2002	726,354	1,990
2003	751,139	2,058
2004	766,048	2,093
2005	783,947	2,148
2006	829,413	2,272
2007	823,011	2,255
2008	777,154	2,123
2009	758,308	2,078
2010	701,475	1,922
2011	693,045	1,899
2012	658,002	1,798
2013	697,377	1,911
2014	634,649	1,739
2015	679,542	1,862
2016	639,794	1,753
2017	689,098	1,888
2018	666,376	1,826

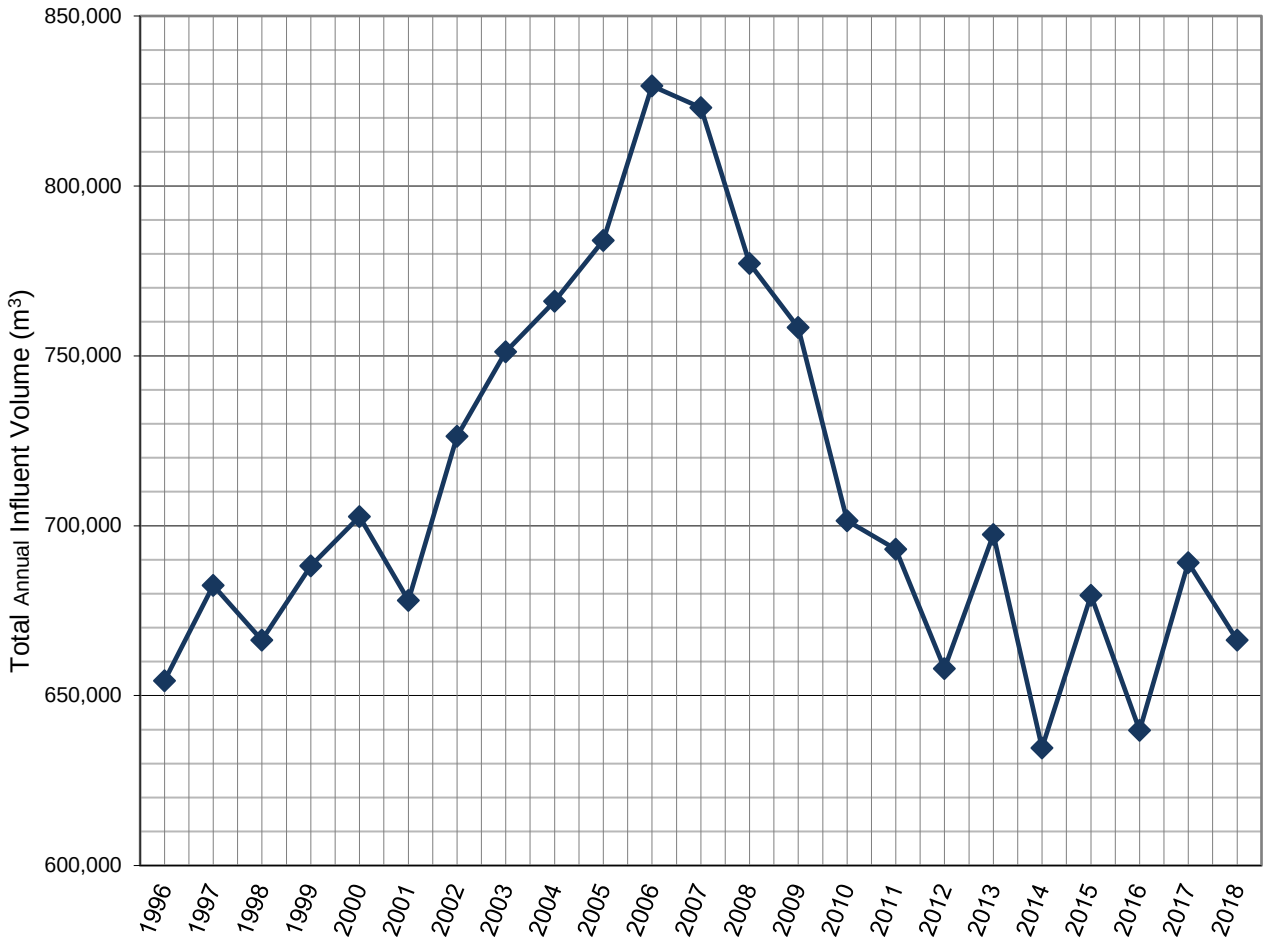

FIGURE 1-1: TOTAL ANNUAL INFLUENT SEWAGE FLOWS FOR 1996 TO 2018

1.1.3 Influent Wastewater Sampling (OC 6.1 and 7.1.2)

Influent sampling data for total phosphorus and orthophosphate concentrations is presented in Table 1-2. The average total phosphorous and orthophosphate concentrations from March and September 2018 sampling was 5.63 mg/L and 1.89 mg/L, respectively. The 2018 average concentration for total phosphorous is higher than that measured in 2017, but generally within the historical range observed for influent wastewater.

TABLE 1-2: INFLUENT SEWAGE QUALITY DATA

Year	Date	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)
1996	Mar. 22	5.44	
	Sep. 12	5.18	
1997	Mar. 19	5.87	
1998	Mar. 18	5.6	
	Sep. 9	5.89	
1999	Mar. 11	6.66	
	Sep. 23	4.89	
2000	Mar. 23	6.48	4.69
	Sep. 28	8.67	3.04
2001	Mar. 22	4.57	2.3
	Sep. 19	4.13	1.88
2002	Mar. 19	4.53	3.84
	Sep. 10	4.52	2.55
2003	Mar. 10	3.78	3.78
	Sep. 30	4.48	4.38
2004	Mar. 16	5.23	4.76
	Sep. 14	5.15	3.75
2005	Mar. 22	5.24	4.63
	Oct. 5	6.74	5.58
2006	Sep. 14	7.05	5.96
2007	Mar. 13	5.03	6.43*
	Sep. 11	6.03	5.03
2008	Sep. 3	7.44	3.3
2009	Mar. 5	8.18	3.84
	Sep. 1	5.31	1.38
2010	Mar. 9	4.26	0.558
	Sep. 2	3.36	2.16
2011	Mar. 8	4.9	0.316
	Sep. 8	11	0.859
2012	Mar. 1	6.16	2.23
	Sep. 11	7.76	3.72
2013	Mar. 7	5.75	2.57
	Sep. 11	4.62	1.89
2014	Mar. 5	4.28	0.82
	Sep. 17	3.82	not tested
2015	Mar. 11	5.36	2.66
	Sep. 16	4.55	2.96
2016	Mar. 7	4.17	1.21
	Sep. 6	2.35	0.36*
2017	Mar. 7	3.77	2.42
	Sep. 6	4.69	2.13
2018	Mar. 7	5.37	1.95
	Sep. 4	5.89	1.83
Average for Period of Record		**5.45**	**2.88**

* Suspected error

TREATMENT CELLS 2 AND 3

PROPOSED FUTURE TREATMENT CELL 1

EFFLUENT STORAGE

HUGGINS ±4 ha

EX SUPPLY MAIN

ALONSO ±1 ha

EFFLUENT SUPPLY MAIN

RAPID INFILTRATION BASIN

FAIRVIEW MOUNTAIN GOLF COURSE

CEMETERY ±2.0 ha

250Ø FORCEMAIN CONVERTED TO RECLAIMED WATER SUPPLY

350Ø FORCEMAIN (AS CONSTRUCTED 2004)

350Ø FORCEMAIN (AS CONSTRUCTED 2004)

IRRIGATION AIRSTRIP AREA ±12.6 ha
FUTURE LEASE AREA ±9.8 ha

RODEO GROUNDS

OLIVER SECONDARY SCHOOL ±1.6 ha

FAIRVIEW PARK ±0.3 ha

KIWANIS PARK ±0.6 ha

PARK ±0.6 ha

HIGH SCHOOL PARK ± 0.6 ha

OLIVER PARKS &RECREATION BALL DIAMONDS ±8.6 ha

IRRIGATION SERVICE TO COMMUNITY PARKS ±10 ha

PUBLIC WORKS YARD ±0.6 ha

IRRIGATION SUPPLY TO AIRPORT

350Ø FORCEMAIN CONNECT TO EXISTING

SAWMILL RD (91st ST)

SIMILKAMEEN AVE

CESSNA ST (89th ST)

MAPLE AVE (91A ST)

OAK AVE (94th AVE)

CANADIAN PACIFIC RAILWAY

IRRIGATION DITCH

IRRIGATION CHANNEL

LEGEND

EXISTING RECLAIMED WATER IRRIGATION AREAS (2006)

RECLAIMED WATER IRRIGATION EXPANSION AREAS

0 250

No.	DATE	DESCRIPTION	BY	APVD

ISSUES / REVISIONS

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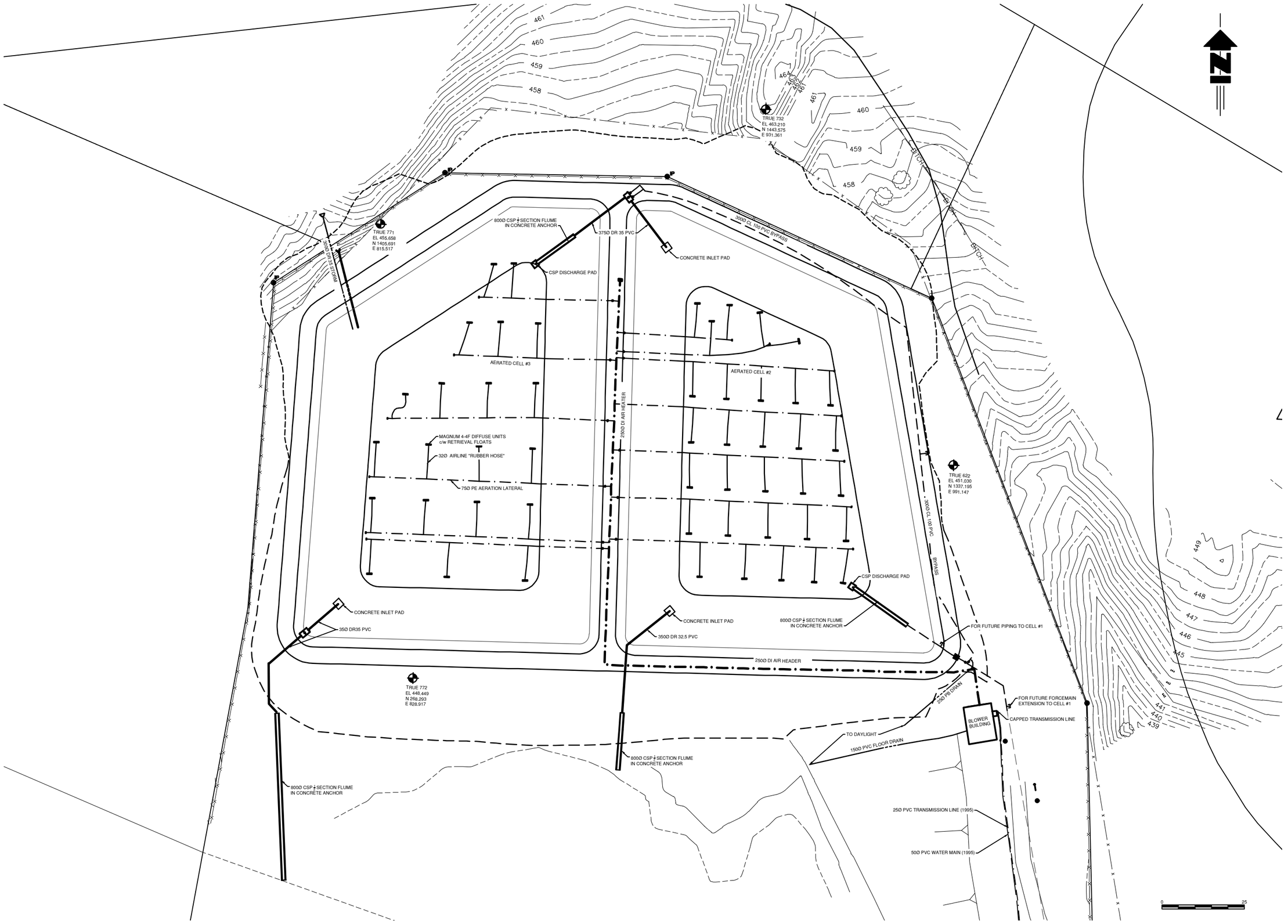
Town of Oliver

SANITARY SEWER ANNUAL REPORT

OVERALL PLAN RECLAIMED WATER SYPPLY SYSTEM AND IRRIGATION AREAS

SCALE	N.T.S. (11x17)
DESIGN BY	TRU
DRAWN BY	NA
DATE	JANUARY 2018
PROJECT REFERENCE No.	306-088-005
DRAWING No.	FIG 1-2
SHEET	1 OF 1
ISSUE/REV.	



No.	DATE	DESCRIPTION	BY	APP'D

ISSUES / REVISIONS

CONSULTANT SEAL

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BRITISH COLUMBIA Town of Oliver

SANITARY SEWER ANNUAL REPORT

AREATED LAGOON TREATMENT SYSTEM LAYOUT AND INTERCELL PIPING

SCALE	1:500 (24x36)
DESIGN BY	TRU
DRAWN BY	NA
DATE	JANUARY 2018
PROJECT REFERENCE No.	306-088-005
DRAWING No.	FIG 1-3
SHEET	1 OF 1
ISSUE/REV.	

1.2 Wastewater Treatment (OC 6.2 and 7.1.2)

Effluent sampling results from the aerated lagoon system (Cell No. 3) prior to reservoir storage are tabulated in Table 1-3. Exceedances above the OC limit of ≤ 45mg/L for BOD_5 was observed in June and July. No exceedances above the OC limit of ≤ 60mg/L for TSS were observed in 2018.

Exceedances in June and July are modest and could be the result of low dissolved oxygen concentrations in the treatment cells. It is important to note that the August sample result is well within the permit limits.

TABLE 1-3 CELL NO. 3- EFFLUENT BOD_5 AND TSS

Date	BOD_5 (mg/L)	TSS (mg/L)
OC Limits	**45**	**60**
Jan-03 (2018)	23	19
Feb-05 (2018)	38	28
Mar-07 (2018)	44	41
Apr-09 (2018)	25	19
May-14 (2018)	34	31
Jun-04 (2018)	53	22
Jul-04 (2018)	46	23
Aug-07 (2018)	13	21
Sep-04 (2018)	6	14
Oct-01 (2018)	26	10
Nov-05 (2018)	36	14
Dec-04 (2018)	20	9

The complete 2018 effluent sampling program for Cell #3 is included in Appendix B. A summary of semi-annual sampling for total nitrogen, ammonia and nitrate from 1997 - 2018 is presented in Table 1-4. Sampling was completed on March 7th and September 4h in 2018.

TABLE 1-4: CELL NO. 3 EFFLUENT - NITROGEN

Year	September/October			March
	Total Nitrogen (mg/L)	Ammonia (mg/L)	Nitrate (mg/L)	Total Nitrogen (mg/L)
1997	9.34	0.006	7.7	20.7
1998	10.8	0.005	8.89	25.1
1999	11.3	0.46	8.31	23.9
2000	No Data	0.48	9.77	29.1
2001	34.3	4.37	7.92	31.3
2002	17.7	0.013	16.3	23.6
2003	No Data	0.71	3.9	26.9
2004	9.8	8.46	0.29	17.2
2005	26.4	14.2	No Data	36.4
2006	12.1	0.78	5.97	No Data
2007	20	13.2	0.92	25.7
2008	10	9.55	0.297	24.1
2009	17	14	1	No Data
2010	16.3	8.44	3.6	27.8
2011	26	13.7	3.27	33.5
2012	5.28	1.95	2.17	32.2
2013	10.10	0.289	9.43	43.7
2014	No Data	No Data	No Data	32.8
2015	19.10	17.6	0.966	No Data
2016	12.80	1.82	5.33	33.2
2017	18.50	0.384	14.7	32
2018	11.9	0.916	8.2	32

The generally accepted range for total nitrogen in domestic wastewater is 20 to 50 mg/L. Total nitrogen was within this range for both the September/October and March sampling dates.

Historically, from 1997 to 2002, a significant proportion of ammonia and nitrogen was nitrified through the Town's aerated lagoon system. From 2003 to 2015, the Town accepted wastewater influent from Vincor, resulting in modest levels of nitrification. In January 2012, Vincor implemented a pre-treatment system, resulting in a 90%+ reduction in BOD. This resulted in reduced loadings which in turn resulted in increased nitrification. As of July 1, 2015, Vincor has been disconnected from the Town's wastewater treatment system.

1.3 Winter Effluent Storage Reservoir (OC 6.5)

Weekly storage reservoir level data for 2018 is presented in Appendix C. All elevations given are relative to geodetic datum. The elevation data has been converted to total volume in storage above the minimum 60-day storage level. The calibration curve is also included within Appendix C.

As per Section 1.1.1 of the OC, the Town is authorized a maximum effluent discharge rate of 2,200 m^3 per day from the aerated lagoon sewage treatment system to the reclaimed wastewater storage reservoir, averaged on a monthly basis. A flow meter is located at the High Lift Station, which pumps wastewater from the equalization basins to the aerated lagoons.

It is assumed that all effluent flows from aerated lagoon Cell No. 3 to the storage reservoir. The metered influent flow provides a conservative value for the discharge volume from Cell No. 3 to storage, as losses due to evaporation and seepage are not included. Monthly volumes are presented in Table 1-5 as follows:

TABLE 1-5: MONTHLY EFFLUENT DISCHARGE QUANTITIES

	Monthly m^3/day	Average m^3/day
January	48,513	1,565
February	46,929	1,676
March	56,527	1,823
April	56,302	1,877
May	69,861	2,254
June	63,282	2,109
July	61,543	1,985
August	60,044	1,937
September	51,556	1,719
October	49,658	1,602
November	54,118	1,804
December	48,044	1,550
Total	666,376	
Average		1,825

Annual operating data for the storage reservoir is summarized in Table 1-6. This includes a comparative summary from 2002 to 2018.

TABLE 1-6: EFFLUENT STORAGE RESERVOIR LEVEL DATA

Year	Date	Elevation (m)	Volume (m^3)
2002	Max. 22-Apr-02	443.73	228,000
	Min. 16-Sep-02	440.05	34,000
	End 23-Dec-02	441.35	90,000
2003	Max. 22-Apr-03	443.96	240,000
	Min. 22-Sep-03	440.66	59,000
	End 29-Dec-03	443.46	213,000
2004	Max. 19-Apr-04	445.77	377,000
	Min. 06-Dec-04	444.22	260,500
	End 31-Dec-04	444.35	272,000
2005	Max. 18-Apr-05	446.4	390,000
	Min. 24-Oct-05	441.18	81,000
	End 27-Dec-05	443.38	205,000
2006	Max. 24-Apr-06	446.2	380,000
	Min. 30-Oct-06	440.81	67,000
	End 31-Dec-06	443.24	199,000
2007	Max. 30-Mar-07	446	370,000
	Min. 23-Sep-07	440.34	40,000
	End 31-Dec-07	442.76	170,000
2008	Max. 13-Apr-08	445.28	339,000
	Min. 29-Oct-08	440.39	49,000
	End 31-Dec-08	442.7	167,000
2009	Max. 14-Apr-09	445.45	344,000
	Min. 11-Oct-09	440.72	61,000
	End 31-Dec-09	443.24	198,000
2010	Max. 06-Apr-10	445.64	352,000
	Min. 21-Oct-10	440.95	71,000
	End 31-Dec-10	443.64	222,000
2011	Max. 11-Apr-11	445.75	357,000
	Min. 26-Sep-11	441.09	76,000
	End 31-Dec-11	443.24	197,000
2012	Max. 02-May-12	445.36	338,000
	Min. 10-Oct-12	440.99	72,000
	End 31-Dec-12	443.46	211,000
2013	Max. 25-Apr-13	445.52	355,000
	Min. 21-Aug-13	441.67	106,000
	End 31-Dec-13	444.56	284,000
2014	Max. 31-Mar-14	446.06	374,000
	Min. 15-Sep-14	441.39	92,000
	End 29-Dec-14	443.65	223,000
2015	Max. 07-Apr-15	445.62	351,000
	Min. 07-Oct-15	441.52	101,000
	End 04-Jan-16	443.5	214,000
2016	Max. 04-Apr-16	445.47	343,000
	Min. 19-Sep-16	441.60	105,000
	End 19-Dec-16	444.02	247,000
2017	Max. 22-May-17	446.17	379,000
	Min. 16-Oct-17	442.75	167,000
	End 18-Dec-17	444.43	275,000
2018	Max. 02-Apr-18	446.41	391,000
	Min. 10-Sep-18	443.17	193,000
	End 24-Dec-18	444.63	289,000

Winter effluent storage reservoir year-end, maximum and minimum operating elevations for the period 2007 to 2018 are illustrated graphically in Figure 1-4. Referring to this figure:

- The maximum elevation for 2018 (446.41 m on April 2, 2018) is the highest observed in the 12-year period of record.
- The 2018-year end volume in storage of 289,000 m^3 is the highest in 12 years.

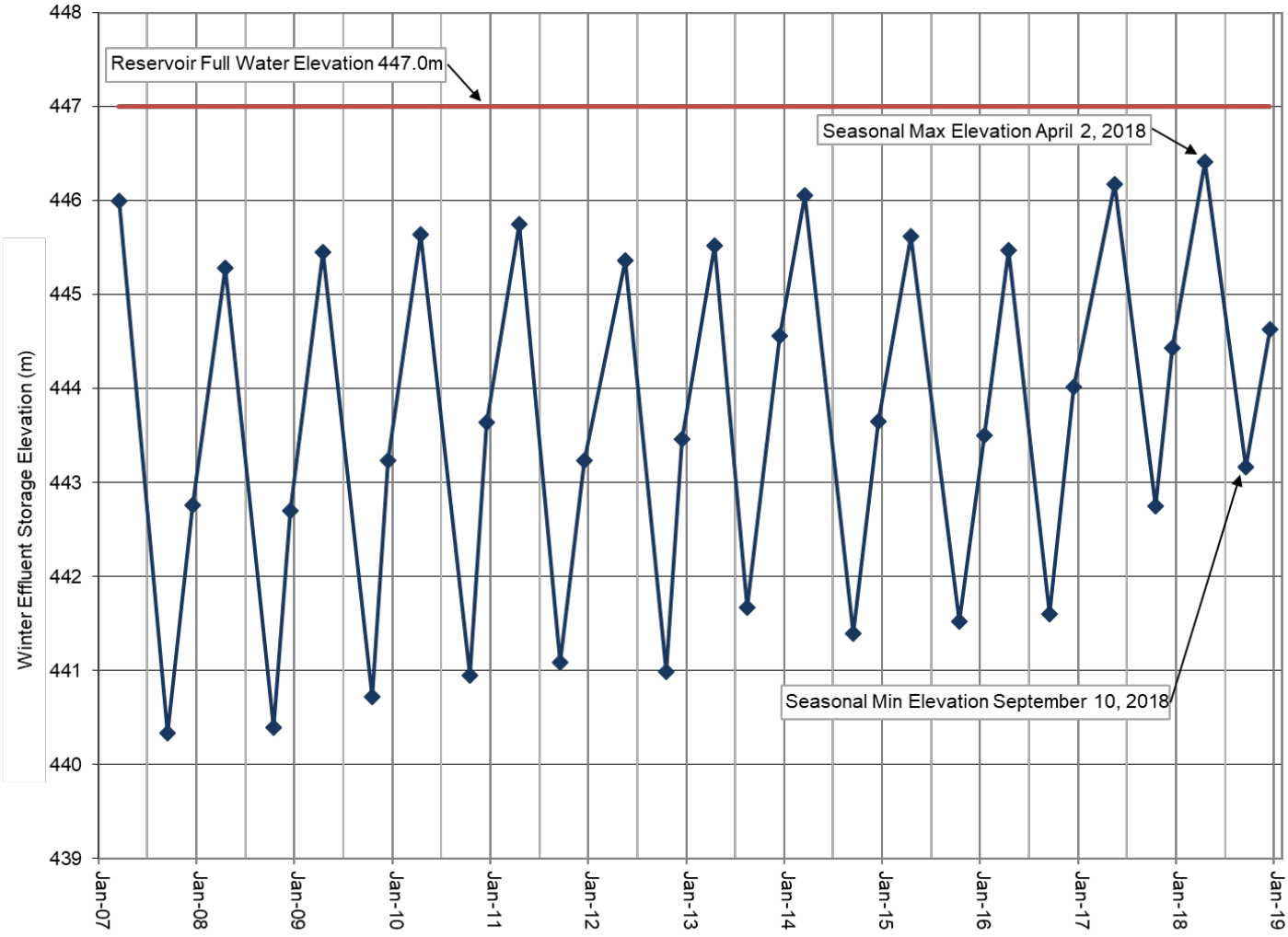


FIGURE 1-4: EFFLUENT STORAGE RESERVOIR LEVELS FOR 2007 TO 2018

1.4 Reclaimed Water Quantities and Quality

1.4.1 Irrigation Plan (OC 1.8)

The Town of Oliver currently provides reclaimed water to the Fairview Mountain Golf Course, Alonso Property, Higgins Property, High School Park, Fairview Park, Oliver Secondary School, Public Works, the Airstrip and Cemetery for irrigation purposes. This area has expanded since that outlined in Site Plan A of the Operational Certificate.

On December 13, 2018, the Town submitted a new site plan for review and approval by the Ministry (see Appendix D). These irrigation areas are consistent with the 2002 Liquid Waste Management Plan Update approved by the Ministry on August 6, 2002 (see Appendix D). Following submission of the 2018 Sanitary Sewer System Annual Report, the Town will work with the Ministry to amend the current OC.

1.4.2 Irrigation Volumes (OC 7.2.4.2 and 6.4)

Total reclaimed water usage is measured by a flow meter located at the booster station, located adjacent to the reclaimed water storage reservoir. Meters are also installed at the Cemetery, Linear park, Airport, Public Works Yard, Alonso property, Southern Okanagan Secondary School and Huggins property for the purposes of measuring total reclaimed water use at each location.

A SCADA system was installed at Fairview Park in 2018. This will be included in subsequent annual reporting. There is no flow meter on the irrigation service to the Fairview Mountain Golf Course. Usage at the Fairview Mountain Golf Course and Fairview Park are therefore calculated as the total annual irrigation volume, less all other metered usage. Table1-7 summarizes reclaimed irrigation water usage by the seven users.

TABLE 1-7: ANNUAL RECLAIMED WATER USE BY CUSTOMER

Location	2011	2012	2013	2014	2015	2016	2017	2018
Fairview Mt. Golf Course and Fairview Park	290,036	297,875	248,521	316,368	346,520	322,048	311,899	281,186
Cemetery	16,339	14,607	19,160	15,996	14,354	14,843	13,400	12,651
Gala Street[1] Linear Park	6,232	6,622	8,051	8,749	7,647	8,360	1,030*	5,928
Airport	147,688	153,841	185,687	124,892	115,743	98,511	101,780	99,601
Public Works Yard	5,164	6,409	7,086	7,393	7,380	8,095	8,341	6,261
Alonso	1,671	7,015	6,715	3,893	3,851	2,364	2,498	1,794
Huggins	3,787	2,872	1,290	0	8,554	0	0	0
Southern Okanagan Secondary School	0	0	0	4,874	0	0	2	0
Infiltration Basin	0	0	0	0	0	0	23,322	38,391
Total Use	470,917	489,241	476,510	482,164	504,049	454,221	461,241	445,812

[1]Gala Street was previously described as 103rd Street.

From flow data contained in Appendix C, reclaimed water quantities for each "user" is described as follows:

- **Lot 723, Plan 2361 - Fairview Mountain Golf Course and Fairview Park PID 012-869-92**

Total Usage	281,186 m^3
Crop Type	Turf and rough areas
Irrigated Area	45 ha
Irrigation Application Rate	0.63 m
Irrigation Period	April to October

- **Lot A, Plan 24065 - Oliver Cemetery**

Total Usage	12,650 m^3
Crop Type	Lawn, trees & shrubs
Irrigated Area	2.3 ha
Irrigation Application Rate	0.55 m
Irrigation Period	April to October

- **Gala Street Linear Park**

Total Usage	5,930 m^3
Crop Type	Lawn & trees
Irrigated Area	0.74 ha
Irrigation Application Rate	N/A
Irrigation Period	April and October

- **Lot A, Plan 38173 – Oliver Airport**

Total Usage	101,780 m^3
Crop Type	Forage Crops
Irrigated Area	12.6 ha
Irrigation Application Rate	0.81 m
Irrigation Period	April to October

- **Lot A, Plan 33094 – Oliver Public Works Yard**

Total Usage	6,261 m^3
Crop Type	Lawn, landscaping, compost piles
Irrigated Area	0.6 ha
Irrigation Application Rate	N/A
Irrigation Period	April to October

The principal use of reclaimed water at the Public Works Yard is for composting operations, lawn care and landscaping. Because composting use is not separately metered, application rates for the lawn and landscaping areas cannot be calculated independently.

- **Lot A, Plan 37929 – Alonso (former Moir)**

Total Usage	1,794 m^3
Crop Type	Vineyard
Irrigated Area	approximately 1.0 ha
Irrigation Application Rate	0.18 m
Irrigation Period	April to October

As shown in Table 1-7, reclaimed water was not used by the Southern Okanagan Secondary School or Huggins Property in 2018.

Over the years of record, reclaimed water use on the Fairview Mountain Golf Course has varied significantly on a year to year basis. Table 1-8 has been prepared adding seasonal precipitation to reclaimed water usage to derive an annual total. A summary of seasonal precipitation from 1992-2018 can be found in Appendix E. The tabulation shows that the sum of seasonal precipitation and reclaimed water use for 2018 is 0.83 m applied. This is consistent with historical usage.

The decrease in application rates since 2009 is partially due to the metering of the Alonso and Huggins properties, recognizing the water use for the golf course is approximated as the total annual irrigation volume less all other metered usage. Prior to 2010, Huggins and Alonso usage

were assumed to be modest and included in the estimated volume supplied to the Fairview Mountain Golf Course.

Since 2016, reclaimed water has been used to irrigate Fairview Park (approximate area 0.3 ha). A metering system was installed in 2018 and will be included in future annual reporting. The total application rate for 2018 as presented in Table 1-8 includes the Fairview Mountain Golf Course and Fairview Park.

TABLE 1-8: ANNUAL TOTAL APPLICATION RATE AT THE FAIRVIEW MOUNTAIN GOLF COURSE

Year	Total Usage (m^3)	Application Rate (m)	Seasonal Precipitation (mm)	Total (m)
1995	413,000	0.92	124	1.04
1996	426,000	0.95	216	1.16
1997	345,000	0.77	324	1.09
1998	430,580	0.96	214	1.17
1999	342,424	0.76	162	0.92
2000	362,353	0.81	126	0.93
2001	376,353	0.84	178	1.01
2002	433,620	0.96	83	1.05
2003	401,022	0.89	94	0.98
2004	329,575	0.73	231	0.96
2005	373,292	0.83	131	0.96
2006	362,055	0.80	144	0.95
2007	414,225	0.92	88	1.01
2008	417,228	0.93	74	1.00
2009	358,375	0.80	161	0.96
2010	274,877	0.61	221	0.83
2011	290,036	0.64	151	0.80
2012	297,875	0.66	223	0.88
2013	248,521	0.55	180	0.73
2014	316,367	0.70	175	0.88
2015	346,520	0.77	136	0.91
2016	332,048	0.74	166	0.90
2017	311,899	0.69	133	0.82
2018	281,186	0.62	210	0.83

1.4.3 Rapid Infiltration

In 2018, the Town discharged effluent from the reclaimed water reservoir to the rapid infiltration basin (see location Figure 1-2). A total volume of 38,391 m^3 was discharged in 2018. The infiltration basin was used from January 17th - March 30th and October 30th - December 24th in 2018.

1.4.4 Hydraulic Balance (OC 7.2.4.1)

The annual overall system hydraulic balance (January 1st to December 31st) for the period 2009 to 2018 is summarized as follows:

TABLE 1-9: HYDRAULIC BALANCE DATA FOR 2009-2018

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Volume in Storage on Jan. 1	167,000	200,000	223,000	197,000	211,000	284,000	223,000	214,000	247,000	275,000
(+) Total Influent	758,308	701,475	693,045	658,002	697,377	634,649	679,500	639,793	689,098	666,376
(-) Effluent Irrigation	520,530	519,803	470,917	489,241	476,510	482,164	504,049	454,221	437,919	407,422
(-) Rapid Infiltration	0	0	0	0	0	0	0	0	23,322	38,391
(-) Unaccounted Losses	206,778	159,672	248,128	154,761	147,867	213,485	184,451	152,572	199,857	206,564
Net Storage at Year-End (m^3)	198,000	222,000	197,000	211,000	284,000	223,000	214,000	247,000	275,000	289,000

There is no freshwater contribution to the system. Unaccounted losses within the hydraulic balance include evaporation losses from the treatment lagoons and storage reservoir, seepage losses from both the treatment and storage cells, and flow meter inaccuracies. Unaccounted losses of 206,564 m^3 were calculated for 2018.

1.4.5 Irrigation Water Quality Data (OC 5.1 and 6.3)

Effluent quality for reclaimed water prior to irrigation is presented in Table 1-10. Section 5.1 of the OC requires that fecal coliforms do not exceed 200 MPN per 100 mL for agricultural, silvicultural and low public use lands, or exceed 2.2 MPN per 100mL for high use public land. As seen, results for the 2018 irrigation season, are consistent with the OC requirements.

TABLE 1-10: SUMMARY OF RECLAIMED WATER QUALITY DATA

	Date	Fecal Coliforms	Total Coliforms	Total P	Total N	Chloride	Sodium	Free CL Res
OC Limit		**#2.2 MPN/100 ml**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
Unit		**MPN/100ml**	**MPN/100ml**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
April	9	<2.2	<2.2	4.69	19.2	146	103	0.21
May	14	<2.2	<2.2	4.14	22.3	160	101	0.33
June	4	<2.2	<2.2	4.65	23.8	146	106	0.34
July	4	<2.2	<2.2	4.75	21.9	162	103	0.31
August	7	<2.2	<2.2	4.38	18.1	149	89.8	0.39
September	4	<2.2	<2.2	4.66	13.2	115	121	0.34
October	1	<2.2	<2.2	4.84	14.4	177	109	0.25

To provide background data to assist with future soil assessment studies, the Town of Oliver continued with an expanded monitoring programme to include phosphorus, nitrogen, chloride and sodium through 2018. Data for these parameters are tabulated in Table 1-10.

Seasonal (April to October) averages for total phosphorus, total nitrogen and sodium sampled at the chlorine contact basin for the period 2000 to 2018 are summarized in Table 1-11.

TABLE 1-11: HISTORICAL RECLAIMED WATER QUALITY DATA

Year	Seasonal Average Total Phosphorus (mg/L)	Seasonal Average Total Nitrogen (mg/L)	Seasonal Average Sodium (mg/L)
2000	2.92	12.5	
2001	2.46	14.1	
2002	2.75	13.4	
2003	1.2	6.8	114.3
2004	1.36	9.3	103.5
2005	2.87	11.9	94.4
2006	2.4	11.6	84.4
2007	3.91	11.9	84.2
2008	3.93	14.2	89.5
2009	3.27	12.1	93.7
2010	3.61	13.8	97.1
2011	3.88	16.9	111.2
2012	4.01	14.3	114.6
2013	4.77	19.4	112.6
2014	5.90	26.6	120.6
2015	4.04	20.3	112.3
2016	4.0	14.9	107.0
2017	4.5	16.9	108.0
2018	4.6	19.0	104.7

As seen, the average total phosphorus concentration in 2018 is consistent with values seen in previous years. The total nitrogen levels are higher than observed in 2017 but have decreased compared to 2014.

In 2018, sodium concentrations were consistent with the sampling between 2011 to 2017. Concerns regarding elevated sodium concentrations in the reclaimed water have been expressed by the Fairview Mountain Golf Course. Average seasonal sodium concentrations for the period 2003 to 2018 are illustrated graphically in Figure 1-5. As seen, concentrations were lowest between 2005 and 2010.

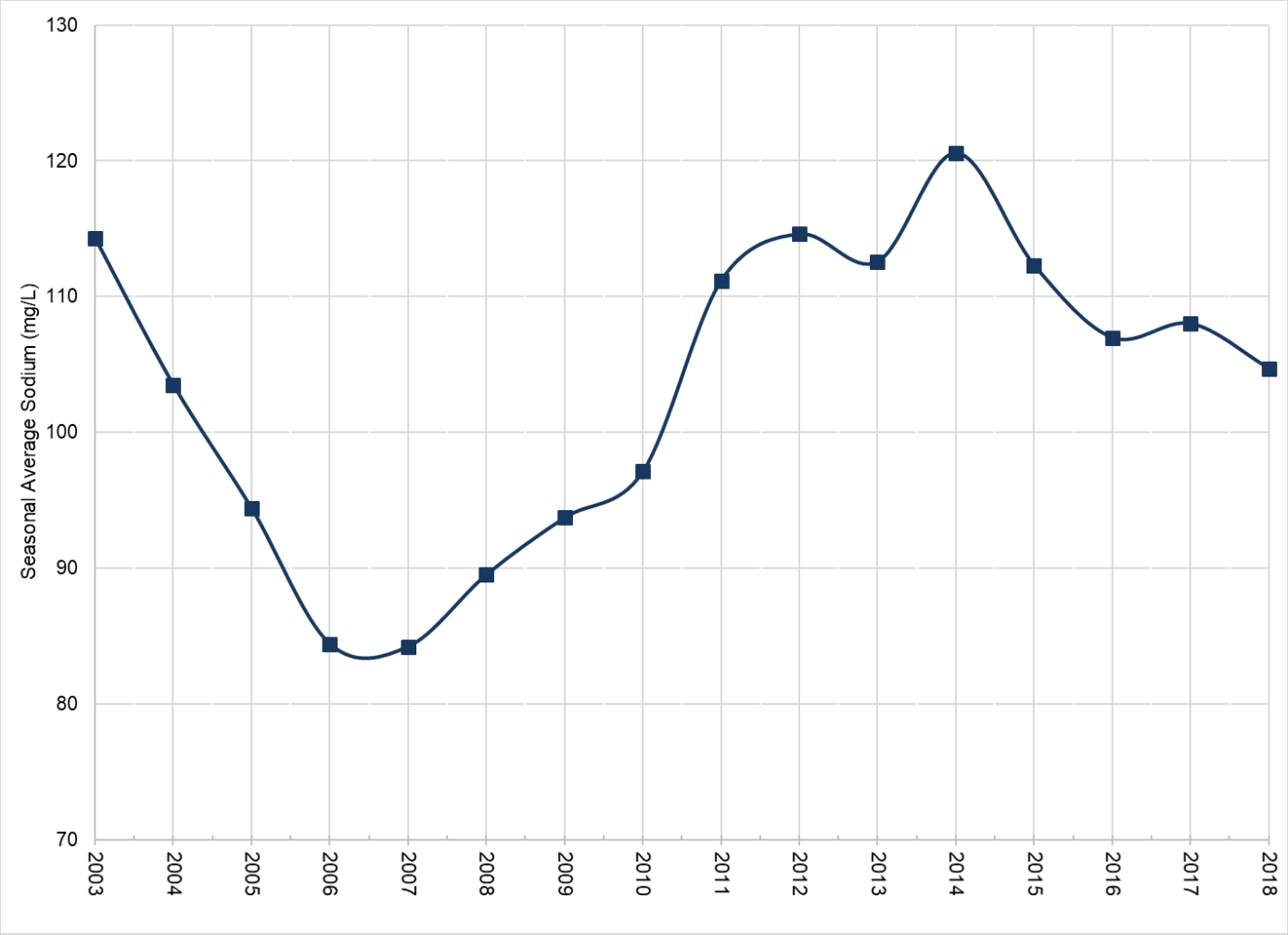


FIGURE 1-5: AVERAGE SEASONAL SODIUM CONCENTRATIONS FOR 2003 TO 2018

1.5 Summary of 2018 Operational Data

Operation of the Town of Oliver's wastewater collection, treatment and reclaimed water system for 2018 is summarized as follows:

- Total influent quantities were 666,376 m^3, a decrease of 22,720 m^3 or 3.4% as compared to 2017. The 2018 annual influent quantity is comparable to previous years.
- Wastewater effluent quality for BOD_5 in the Town's aerated lagoons had very modest exceedances above the OC limits of 45mg/L in June and July. These were 54mg/L and 46 mg/L, respectively.
- Reservoir storage maximum water level was 446.4m. This is the highest observed for the period of record.
- Reclaimed water quality prior to irrigation use complied with the OC requirements for bacteriological quality.

2.0 Supplemental Information

2.1 Facility Classification and Operator Certification (OC 3.2 and 3.3)

The Town of Oliver wastewater treatment facility (Facility No. 317) is classified as a Municipal Wastewater Treatment II (MWWT-II) under the Environmental Operators Certification Program.

In compliance with OC Section 3.3 operator certifications are summarized as follows:

Operator	EOCP Certification
Arvid Bensler	Wastewater Treatment Level I
Darren Bjornson	Wastewater Collection Level I
Hector Murillo	Wastewater Collection Level I
Ryan Seiling	Wastewater Treatment Level I Wastewater Collection Level I
Martin Schori	Wastewater Treatment Level II Wastewater Collection Level I
Adrian Zandvliet	Wastewater Treatment Level I Wastewater Collection Level I

2.2 Capital Improvements

Capital improvements completed in 2018 include the following:

- Preparation of a Sanitary Capital Plan. This document includes an update to the 2002 Liquid Waste Management Plan and is to carry forward for completion in 2019.
- Station Street Sewer Upgrade.

2.3 Inspection Updates

A facility inspection was completed by the Ministry of Environment on July 18, 2018 for all works and compliance items pertaining to Operational Certificate 13717. The following sections provide an update to Report Number 098581, issued on November 19, 2018.

2.3.1 New Works and As-Built Plans (OC 2.5)

Copies of record drawings for the effluent treatment system where submitted to the Regional Waste Manager as follows:

- Reclaimed Water Irrigation Plan: February 2nd - 19th, 2019
- As-Built List: December 19, 2018

Submissions included new works, modifications and additions to the works authorized in the OC.

2.3.2 Operation & Maintenance Manual (OC 3.1)

The Town is currently updating their Operation & Maintenance (O&M) Manual for the sewage collection, sewage treatment, and reclaimed wastewater utilization systems. This includes modifications made to the system since preparation of the 1997 O&M Manual. Upon completion, this document will be submitted to the Regional Waste Manager.

2.3.3 Facility classification (OC 3.2)

The EOCP facility classification number was renewed by the Town and submitted to the Ministry on December 19, 2018.

2.3.4 Water Conservation Program (OC 3.4)

The reclaimed water supply system extends through the core are of the Town and represents a water conversation opportunity unique to the Town of Oliver, as it irrigates areas that would otherwise utilize domestic water. Several water conservation strategies have historically been implemented in the Town to reduce wastewater generation volumes. This includes:

- Major user audits.
- Universal metering.
- Participation in the Okanagan Water Wise program called “Make Water Work”.

2.3.5 Contingency Plan (OC 3.7 and 7.2.4.5)

The Town is preparing a 2019 Comprehensive Contingency Plan for the wastewater treatment facility works as it relates to conveyance, treatment and disposal. Upon completion, this document will be submitted to the Regional Waste Manager.

2.4 Influent Waste Bylaw (OC 3.6 and 7.2.4.4)

Sanitary Sewer System Use Bylaw No. 547 was included in its entirety in Appendix 5 of the 1997 Annual Report. This bylaw establishes regulations respecting the type, volume and characteristics of wastewater discharged to the sanitary sewer system.

In January 2002, the Town of Oliver received an application from Vincor requesting approval to connect its winery located on the Osoyoos Indian Reserve, north of the Town boundaries, to the Town's sewerage system. This application relates to both process water and normal domestic sewage and was approved by the Town.

Vincor was connected to the Town's sewerage system from October 2002 to July 01, 2015. During this period, Vincor's wastewater was sampled by the Town at least twice per month to confirm compliance with the terms and conditions of the connection agreement and for invoicing purposes. Since 2015, there has been no influent received from Vincor.

2.4.1 Infiltration, Inflow and Cross Connection Reduction (OC7.2.4.3 and 7.2.4.4)

The Town of Oliver has an ongoing video camera inspection program for the sewer collection system. In addition, they are preparing a 2019 Sanitary Capital Plan. Within the report, SCADA data is analyzed for possible Inflow & Infiltration (I&I) from 2015 to present. This I&I analysis will allow for correlations between peak rain events, surface water diversions and failures within the pipe infrastructure.

The Town regulates provisions to identify, eliminate and prevent cross connections with non-potable water sources through Bylaw No. 1043

2.5 Sludge Management Plan (OC 3.8 and 7.2.4.6)

A Sludge Management Plan was prepared by TRUE in 1997. This plan was updated in February 2019 and is included in Appendix F. The plan provides an overview of the system design, sludge characterization, sludge sampling and monitoring, sludge removal and system recommendations.

Consistent with historical practices, the Town undertook depth and analytical sampling of the sludge in Aerated Lagoon Cell No.2 in 2018. The analytical data is provided in Appendix F.

2.6 Groundwater Monitoring Plan (OC 6.8)

In compliance with Section 6.8 of the OC, the Town of Oliver retained the services of Golder Associates to prepare a groundwater monitoring plan in 1997 (see Appendix G). Groundwater table measurements and sampling data for the 2018 sampling programme are discussed in the paragraphs following. Figure 2-1 provides a site plan of the groundwater monitoring wells in the airport area. Groundwater level and water quality data is included in Appendix G.

2.6.1 Airport Monitoring Wells No. 1 to 3

There is a total of three monitoring wells at the airport site. These wells are all located down gradient from the reclaimed water use area (see Figure 2-1). In 2011, streets were renamed in the Town. Historic street names are referenced in parenthesis. Groundwater level data and water quality data from Appendix G are summarized in Table 2-1.

Overall, the average groundwater table elevation in the Air Cadet well was the lower than observed in previous years. However, similar minimum depths have been recorded. The average groundwater table elevation for 91A Street was similar to that measured in 2017. It is also observed that the groundwater level in 91A Street well has increased by an average of 0.59 m since 2007. All three well locations had groundwater depths within the historical range.

Sampling of the three monitoring wells, in the vicinity of and at the airport, was initiated by the Town in September 2007. Table 2-2 summarizes the groundwater quality data for the three airport area monitoring wells from 2007-2018.

TABLE 2-1: SUMMARY OF GROUNDWATER DEPTHS FOR AIRPORT MONITORING WELLS

Monitoring Well	Year	Minimum Depth (m)	Maximum Depth (m)	Average Depth* (m)	Range of Depth (m)
Air Cadet (Well #1)	2007	9.59	10.68	10.18	1.09
	2008	10.52	10.79	10.69	0.27
	2009	10.77	11.40	10.93	0.63
	2010	10.31	11.03	10.76	0.72
	2011	10.33	10.80	10.55	0.47
	2012	9.84	10.78	10.50	0.94
	2013	9.78	10.44	10.11	0.66
	2014	9.98	10.58	10.33	0.60
	2015	10.01	10.51	10.28	0.50
	2016	10.21	10.5	10.36	0.29
	2017	9.9	10.59	10.32	0.69
	2018	9.65	10.29	10.03	0.64
Rodeo Grounds (Well #2)	2007	5.89	6.40	6.10	0.51
	2008	6.11	6.38	6.25	0.27
	2009	5.83	6.54	6.20	0.71
	2010	5.69	6.35	6.04	0.66
	2011	5.84	6.34	6.09	0.50
	2012	5.84	6.54	6.20	0.70
	2013	5.62	6.24	5.91	0.62
	2014	5.84	6.27	6.08	0.43
	2015	5.69	6.66	6.08	0.97
	2016	5.66	5.97	5.82	0.31
	2017	5.98	6.3	6.16	0.32
	2018	5.81	6.24	5.99	0.43
91A St. (Well #3)	2007	1.52	2.19	1.81	0.67
	2008	1.50	2.34	1.78	0.84
	2009	1.47	2.05	1.77	0.58
	2010	1.45	1.64	1.54	0.19
	2011	1.31	1.55	1.46	0.24
	2012	1.38	1.54	1.46	0.16
	2013	1.20	1.39	1.27	0.19
	2014	1.11	1.65	1.37	0.54
	2015	1.21	1.66	1.41	0.45
	2016	1.13	1.43	1.28	0.30
	2017	1.06	1.38	1.23	0.32
	2018	0.87	1.51	1.2	0.64

**Depth indicates the measurement from the top of casing to the water level.*

TOWN MW
RODEO GROUNDS
N 5449579.38
E 314155.26
TOC ELEV 306.56m

TOWN MW
AIR CADET
N 5450056.46
E 314330.99
TOC ELEV 308.52m

TOWN MW
91A ST
N 5449834.34
E 314453.92
TOC ELEV 295.00m

AIRPORT

COLUMBIA ST (103rd ST)
KETTLE CT (103RD ST)
NICOLA ST (103RD ST)
OKANAGAN ST (101st ST)
MAIN ST (HWY 97)
(HIGH WAY 97)
AIRPORT ST (95th ST)
TAMRISK ST (95th ST)
CESSNA ST (93rd ST)
YARROW ST (93rd ST)
No. 1 ROAD
No. 1 ROAD (340th AVE)
SOUTHWIND AVE
GRANBY AVE
SIMILKAMEEN AVE (345TH AVE)
SIMILKAMEEN AVE (346th AVE)
CO-OP AVE (348th AVE)
PACKINGHOUSE LN
OAK AVE (342nd AVE)
MAPLE AVE (91A ST)
SAWMILL RD (91st ST)
FIR AVE (347th AVE)
SPRUCE AVE (345th AVE)
HEMLOCK ST (89th ST)

0 100

No.	DATE	DESCRIPTION	BY	APVD

ISSUES / REVISIONS

CONSULTANT SEAL

TRUE CONSULTING
201 - 2079 Falcon Road ■ Kamloops BC ■ V2C 4J2
tel 250.828.0881 ■ fax 250.828.0717
info@TRUE.bc.ca

Town of Oliver

SANITARY SEWER ANNUAL REPORT

AIRPORT AREA GROUNDWATER MONITORING WELLS SITE PLAN

SCALE	N.T.S (11x17)
DESIGN BY	TRU
DRAWN BY	NA
DATE	JANUARY 2018
PROJECT REFERENCE No.	306-088-005

DRAWING No. **FIG 2-1**

SHEET 1 OF 1

ISSUE/REV.

TABLE 2-2: SUMMARY OF WATER QUALITY DATA FOR THE AIRPORT MONITORING WELLS

Monitoring Well	Sample Date	Chloride	Ammonia	Nitrate/Nitrite	Total Hardness	Sodium
Air Cadet (Well #1)	Sep-19-2007	24.6	< 0.02	7.71	535	13.9
	Apr-09-2008	9.97	0.09	2.84	773	24.1
	Sep-11-2008	12.6	0.04	1.3	817	21.7
	Apr. 07, 2009	11.1	0.02	0.7	1220	27.3
	Sep-18-2009	9.23	0.02	2.3	437	17.7
	May-19-2010	13.5	0.06	12.7		
	Sep-07-2010	13.8	< 0.02	12	383	22.1
	Apr-28-2011	17.5	0.15	12.1	217	9.33
	Sep-28-2011	12.7	0.12	7.87	400	18.4
	Apr-24-2012	16.4	0.04	7.59	464	20.0
	Oct-16-2012		0.034	9.7	481	19.8
	Apr-09-2013		0.034	10.1	384	18.5
	Sep-09-2013		< 0.020	20.2	383	17
	Apr-16-2014		0.027	21.6	542	18.1
	Sep-04-2014	19.8	< 0.020	23.9	402	19.5
	Apr-14-2015	20.7	0.102	24.4	485	20.5
	Sep-16-2015	15.9	0.079	20.5	590	23.5
	Sept-13-2016	13.7	0.032	15	386	19.1
	Apr-10-2017	14.2	0.033	12	388	19.5
	Sep-11-2017	10.4	<0.020	6.97	392	18
	14-May-2018	11.9	0.025	6.75	363	19.1
	10-Sep-2018	9.92	<0.020	7.97	344	16.8
Rodeo Grounds (Well #2)	Sep-19-2007	9.24	< 0.02	0.25	2330	
	Apr-09-2008	7.76	0.03	0.5	1690	23.7
	Sep-11-2008	12.7	0.08	1.14	890	21.7
	Apr. 07, 2009	10.2	< 0.02	1.28	346	15.2
	Sep-18-2009	9.01	< 0.02	0.36	677	19.1
	May-19-2010	9.69	0.04	0.08		
	Sep-07-2010	8.93	< 0.02	0.26	686	22.3
	Apr-28-2011	11.9	0.05	0.05	531	9.13
	Sep-28-2011	9.33	0.02	2.18	491	16.1
	Apr-24-2012	10.6	0.01	0.749	572	17.4
	Oct-16-2012		0.021	0.263	661	17.8
	Apr-09-2013		0.047	0.121	384	18.4
	Sep-09-2013		0.023	0.115	889	18
	Apr-16-2014		0.024	0.123	392	15.9
	Sep-04-2014	8.47	0.02	0.584	370	15.9
	Apr-14-2015	9.05	0.094	0.865	494	18.5
	Sep-16-2015	6.56	0.037	0.3	1120	31.6
	Sept-13-2016	6.54	0.032	0.628	1110	19.2
	Apr-10-2017	7.6	0.072	0.343	914	20.4
	Sep-11-2017	6.1	0.02	0.124	959	17.1
	14-May-2018	7.2	0.1	0.122	2550	20.3
	10-Sep-2018	7.07	0.037	0.138	2090	18.9
91A St. (Well #3)	Sep-19-2007	7.46	0.06	0.05	7340*	15.1
	Apr-09-2008	10	0.03	0.05	972	27.5
	Sep-11-2008	14.9	0.12	0.04	5010	38.4
	Apr-07-2009	11.8	0.02	0.026	1270	31.6
	Sep-18-2009	9.39	0.11	< 0.02	1070	24.6
	May-19-2010	12.2	0.06	< 0.02		
	Sep-07-2010	15.1	0.35	0.35	2300	37.7
	Apr-28-2011	23.1	0.04	0.44	633	15.3
	Sep-28-2011	18.5	0.1	0.32	1160	36.8
	Apr-24-2012	18.4	0.09	0.270	1470	36.9
	Oct-16-2012		0.04	0.033	924	31.6
	Apr-09-2013		0.049	0.074	834	23.9
	Sep-09-2013		0.07	0.101	1430	24.6
	Apr-16-2014		0.028	0.058	399	16.9
	Sep-04-2014	125	0.023	0.032	438	21.8
	Apr-14-2015	8.99	0.086	0.106	631	18.9
	Sep-16-2015	7.59	0.047	0.035	496	18.5
	Sept-13-2016	8.01	0.032	0.214	389	17.2
	Apr-10-2017	8.07	0.059	0.334	366	16.7
	Sep-11-2017	7.64	<0.020	0.042	346	15.2
	14-May-2018	8.31	0.024	0.0507	381	15.4
	10-Sep-2018	8.05	0.031	0.739	355	14.4

* Suspected error.

Related to the water quality data for the airport area groundwater monitoring wells:

- The influence of reclaimed water on groundwater quality is generally reflected in ammonia and/or nitrate concentrations in the monitoring wells. Since 2007, the three wells have not had any samples with ammonia concentrations significantly above background.
- Since 2015, there has been a decrease of approximately 50% in nitrate/nitrite concentrations in the Air Cadet well. It should be noted that background concentrations for nitrate in water wells influenced by the agricultural industry are typically in the range of 6 to 10 mg/L. The nitrate concentrations downgradient of this well at 91A St. are well below this range, with an average concentration of 0.14 mg/L over the eleven-year period.
- The total hardness in Well #2 is higher than observed in previous years and reflects historical, pre-irrigation values. This can likely be attributed to reduced irrigation in that area.

2.6.2 Fairview Monitoring Wells No. 1 to 7

In compliance with the approved groundwater monitoring plan, the Town of Oliver has seven groundwater wells down gradient of the Fairview area. Referring to Figure 2-2, Monitoring wells MW 1 to 3 are located south of the Town's effluent storage site in an area used for infiltration in the mid-1990s. With infiltration of effluent near these wells discontinued in the mid-1990s, the Town does not sample or measure groundwater elevations in MW 1 to 3. Groundwater depth for MW 4 to 7 are presented in Appendix G and summarized in Table 2-3.

MW 4 and 5 were sampled for water quality in 2018, with results tabulated in Table 2-4 and attached in Appendix G. A comparison of 2004 to 2018 sampling data for chloride, nitrate/nitrite, and sodium (parameters generally accepted to be indicative of the influence from reclaimed water) is presented following.

MW 4 is influenced by surface water from the toe drain of the reclaimed water storage reservoir dam and therefore has chloride and sodium levels that are comparable to reclaimed water.

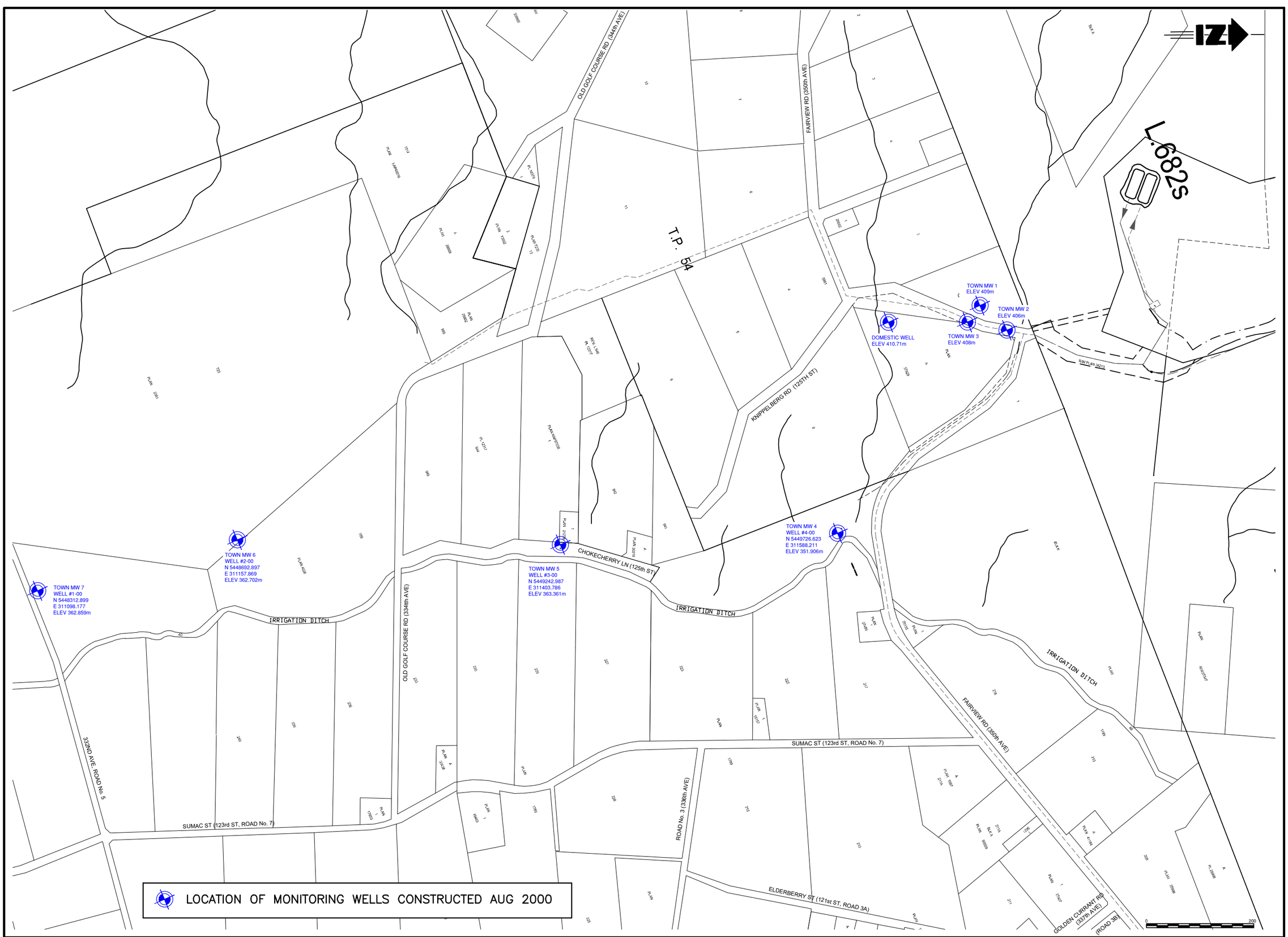
No infiltration of reclaimed water on lands up gradient of MW 5 has occurred since 2004 and water quality at MW 5 is considered representative of background conditions. The nitrite/nitrate and chloride concentrations continue to be indicative of agricultural land use in the area and are consistent with historical data.

TABLE 2-3: SUMMARY OF GROUNDWATER DEPTHS FOR FAIRVIEW MONITORING WELLS

Monitoring Well	Year	Minimum Depth (m)	Maximum Depth (m)	Average Depth (m)	Range of Depth (m)
Test Well #4 (Sand Pit)	2003	9.24	11.13	9.76	1.89
	2004	8.16	9.56	8.77	1.40
	2005	8.12	10.33	8.91	2.21
	2006	8.35	11.16	9.45	2.82
	2007	8.55	11.36	10.06	2.81
	2008	8.70	11.34	10.06	2.64
	2009	8.80	11.30	10.15	2.50
	2010	8.28	10.61	9.32	2.33
	2011	8.36	11.24	9.74	2.88
	2012	8.48	10.85	9.79	2.37
	2013	8.21	10.64	8.89	2.43
	2014	7.43	9.62	8.57	2.19
	2015	8.08	10.20	8.92	2.12
	2016	7.79	8.98	8.38	1.19
	2017	6.24	8.33	7.71	2.09
	2018	1.99	8.13	6.75	6.14
Test Well #5 (125th Street)	2003	7.30	9.48	8.68	2.18
	2004	7.95	10.59	9.57	2.64
	2005	7.77	10.22	9.25	2.45
	2006	7.44	9.74	8.83	2.30
	2007	7.64	9.92	8.99	2.28
	2008	9.57	11.32	10.41	1.75
	2009	10.17	10.81	10.47	0.64
	2010	8.26	11.97	10.20	3.71
	2011	5.38	9.69	8.12	4.31
	2012	6.41	9.54	8.48	3.13
	2013	5.59	9.23	7.95	3.64
	2014	8.13	9.77	9.04	1.64
	2015	-	-	-	-
	2016	4.57	9.90	7.70	5.33
	2017	4.56	10.57	7.93	6.01
	2018	5.28	9.09	7.78	3.81
Test Well #6	2003-2018	*13.92 (Dry)*			
Test Well # 7 (Road No. 5)	2003	25.87	25.89	25.88	0.02
	2004	25.89	25.89	25.89	0.00
	2005	25.44	25.89	25.86	0.45
	2006	25.00	*25.91 (Dry)*	25.56	0.91
	2007-2018	*25.91 (Dry)*			

TABLE 2-4: SUMMARY OF THE WATER QUALITY DATA FOR FAIRVIEW MONITORING WELLS

Monitoring Well	Sample Date	Chloride	Nitrate/Nitrite	Sodium	Ammonia	Total Hardness
Test Well #4 (Sand Pit)	Apr. 20, 2004	111	0.97	73.1	0.04	1130
	Sep. 4, 2004	123	0.35	108	0.02	3280
	Apr. 12, 2005	102	1.44	85.1	<0.01	1060
	Apr. 9, 2008	103	2.46	104	<0.02	1170
	Apr. 7, 2009	128	2.21	103	<0.02	1030
	Sep. 16, 2009	108	0.74	125	0.09	4980
	May 19, 2010	137	2.43		0.02	
	Sep. 7, 2010	135	1.02	128	0.03	1310
	Apr. 28, 2011	135	2.95	108	0.08	1020
	Apr. 24, 2012	130	2.39	101	0.04	1110
	Oct. 16, 2012		0.691	119	0.034	1420
	Apr. 9, 2013		1.78	118	0.091	1070
	Sep. 9, 2013		2.06	146	0.156	1350
	Apr. 16, 2014		3.02	115	0.073	1050
	Sep. 4, 2014	125	1.68	127		
	Apr. 14, 2015	141	3.56	120		
	Sep. 16, 2015	135	1.53	127	0.023	1440
	Sep. 13, 2016	129	1.63	19.2	0.021	1700
	Apr. 10, 2017	121	10.2	108	0.084	820
	Sept. 11, 2017	110	3.05	11.5	<0.020	387
	May 14, 2018	111	4.12	100	0.035	725
	Sep. 10, 2018	96	2.99	87.1	0.043	838
Test Well #5 (125th Street)	Apr. 20, 2004	30.4	3.6	23.8	0.03	395
	Sep. 4, 2004	22.3	6.52	32.4	0.02	447
	Apr. 12, 2005	34.2	5.81	25.5	<0.01	409
	Sep. 7, 2005	46.5	12.4	25.7	<0.01	537
	Jun. 15, 2006	34.8	8.62	27	<0.01	543
	Sep. 21, 2006	34.6	6.05	28	1.65	399
	May. 1, 2007	34.4	2.15	26	0.41	355
	Sep. 13, 2007	27.5	2.95	30.2	0.03	388
	Apr. 9, 2008	29.1	3.62	35.9	0.08	399
	Sep. 11, 2008	36	2.8	33.7	0.13	512
	Apr. 7, 2009	76	6.1	35.1	<0.02	407
	Sep. 16, 2009	77.7	5.72	21.6	<0.02	480
	May 19, 2010	53.9	3.03		0.03	
	Sep. 7, 2010	37.3	1.03	29.2	0.03	467
	Apr. 28, 2011	26.3	2.1	41	0.04	639
	Sep. 28, 2011	38.5	2.75	48.7	0.35	423
	Apr. 24, 2012	48.8	3.19	22.4	1.9	460
	Oct. 16, 2012		2.94	19.3	0.025	446
	Apr. 9, 2013		1.11	15.9	0.036	381
	Sep. 9, 2013		0.652	12.4	0.071	398
	Apr. 16, 2014		0.577	13.1	0.022	465
	Sep. 4, 2014	14.7	0.683	14		
	Apr. 14, 2015	16.7	1.31	14.7		
	Sep. 16, 2015	27.7	0.794	31.6	< 0.020	456
	Sep. 13, 2016	23.9	1.11	20.4	0.022	960
	Apr. 10, 2017	17	1.21	14.1	0.052	481
	Sept. 11, 2017	16.5	1.11	88.4	0.089	917
	May 14, 2018	16	0.569	12.8	0.058	400
	Sep. 10, 2018	15.6	1.59	10.3	0.066	348



No.	DATE	DESCRIPTION	BY	APVD

ISSUES / REVISIONS

CONSULTANT SEAL

TRUE CONSULTING

201 - 2079 Falcon Road ■ Kamloops BC ■ V2C 4J2
tel 250.828.0881 ■ fax 250.828.0717
info@TRUE.bc.ca

BRITISH COLUMBIA Town of Oliver

SANITARY SEWER ANNUAL REPORT

AIRPORT AREA GROUNDWATER MONITORING WELLS SITE PLAN

SCALE	N.T.S. (11x17)
DESIGN BY	TRU
DRAWN BY	NA
DATE	JANUARY 2018
PROJECT REFERENCE No.	306-088-005

DRAWING No.

FIG 2-2

SHEET 1 OF 1

ISSUE-REV.

2.7 Soils Assessment (OC 5.4, 5.5, 6.9)

In accordance with Section 6.9 of the OC, a soils assessment of the irrigated areas is summarized herein. This information is compiled to substantiate that the irrigation areas are capable of accepting reclaimed water for irrigation purposes. Soils are identified using a detailed soil survey of the central and southern Okanagan and lower Similkameen Valley. This information was published in the *MOE Technical Report 18 Soils of the Okanagan and Similkameen Valleys, March 1986.*

A summary of the soil classifications, characteristics, physical properties, and drainage for the reclaimed water irrigation areas is presented in Table 2-5. Detailed individual profile descriptions and an overview map of the soil parent materials is provided in Appendix H. As seen, all irrigated areas are well to rapidly drained except for the Public Works Yard. At this location, reclaimed water is used for compost operations and landscape irrigation, therefore it does not present an issue with respect to surface runoff or surfacing of reclaimed water.

TABLE 2-5 SOILS OVERVIEW RECLAIMED WATER IRRIGATION AREAS

Irrigation Location	Soil Name	Soil Texture	Drainage	Coarse Fragment	Parent Material
Cemetery[1,2]	Ponderosa	Sandy Loam	Well-drained	65	FLUV
Oliver Secondary School[1,2]	Rutland	Sandy Loam	Rapidly-drained	63	GLFL
High School Park[1]	Rutland	Sandy Loam	Rapidly-drained	63	GLFL
Public Works Yard[1,2]	Cawston	Silt Loam	Rapidly-drained	15	FLUV
Airport[1]	Rutland	Sandy Loam	Rapidly-drained	63	GLFL
Alonso	Approved in Operational Certificate PE-13717				
Huggins	Approved in Operational Certificate PE-13717				
Fairview Mountain Golf Course	Approved in Operational Certificate PE-13717				

[1]Approved in Principle by the Ministry in August 2002.
[2]Previously irrigated with freshwater, simple replacement.

2.7.1 Soil Descriptions (OC 6.9)

Ponderosa Soils

Ponderosa soils only occur in the vicinity of Oliver. They have developed in a gravelly, moderately coarse textured fluvial veneer between 10 to 50 cm thick, overlying gravelly coarse textured fluvial fan deposits. Surface and subsurface textures are gravelly or very gravelly sandy loam or gravelly loam. Subsoils are very gravelly loamy sand. The soil drainage class is well to rapid.

Rutland Soils

Rutland soils occupy significant areas throughout the Okanagan Valley. The parent material is a moderately coarse textured veneer between 10 and 25 cm thick, which overlies gravelly and stony, very coarse textured glaciofluvial deposits. Surface soil textures are dominantly sandy loam or loamy sand. Subsurface are gravelly sand or gravelly loamy sand. The soil drainage class is rapid.

Cawston Soils

Cawston soils occur on the Okanagan River floodplain. They have developed in medium textured recent fluvial deposits generally between 50 to 100 cm thick, overlying moderately coarse textured materials. Surface and subsurface textures are silt loam or loam. Subsoil textures are gravelly sandy loam or gravelly loamy sand. They are moderately pervious, have a high water holding capacity and slow surface runoff. Their soil drainage class is dominantly poor, ranging to imperfect.

2.7.2 Surface Runoff (OC 5.4)

To date, the Town has not observed surface water runoff generated from reclaimed water irrigation use. As outlined in the soil profiles, the parent material at each irrigation area is well-drained. In this arid climate, runoff has not been an operational issue.

2.7.3 Surfacing Reclaimed Wastewater (OC 5.5)

There irrigation system is designed and managed to ensure that there is no surfacing of irrigation tail water down slope of the point of irrigation. A hydrogeological study of the rapid infiltration basin was completed by Golder Associates in 1998. The system capacity of 355 m^3/day was derived on the basis of the natural discharge capacity of the subsurface soils such that surfacing of effluent will not occur within 150m of the site.

APPENDIX A

Operational Certificate for PE 12717

Province of British Columbia

MINISTRY OF ENVIRONMENT, LANDS AND PARKS

BC Environment

Environmental Protection
#201-3547 Skaha Lake Rd.
Penticton, British Columbia
V2A 7K2
Telephone: (604) 490-8200
Fax: (604) 492-1314

RECEIVED
DEC 20 1995
TOWN OF OLIVER

Date: December 14, 1995 File: 76750-40/PE-13717 (01)

REGISTERED MAIL

The Corporation of the Town of Oliver
PO Box 638
Oliver BC V0H 1T0

Attention: Tom Szalay, Administrator

FILE:
ROUTING:

COMMENTS:
right-in
out.

COPIES:
JS
SH

Enclosed is a copy of the Operational Certificate No. PE-13717 issued under the provisions of the Waste Management Act. This Operational Certificate supersedes Permit PE-00102 which is cancelled in accordance with Section 16(13) of the Waste Management Act. Your attention is respectfully directed to the terms and conditions outlined in the Operational Certificate. An annual Permit fee will be determined according to the Waste Management Permit Fee Regulation.

This Operational Certificate does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority shall rest with the Operational Certificate holder.

This Operational Certificate is issued pursuant to the provisions of the Waste Management Act to ensure compliance with Section 34(3) of that statute, which makes it an offence to discharge waste without proper authorization. It remains the responsibility of the Operational Certificate holder to ensure that all activities conducted under this authorization comply with any other applicable legislation which may be in force from time to time.

The administration of this Operational Certificate will be carried out by staff from our Regional Office located in Penticton, (telephone 490-8200). Plans, data and reports pertinent to the Operational Certificate are to be submitted to the Environmental Protection office, Suite 201, 3547 Skaha Lake Road, Penticton, British Columbia, V2A 7K2. - 30th Street, Vernon, British Columbia, V1T 9G3.

This decision may be appealed by any person(s) who considers themselves aggrieved by this decision, in accordance with Part 5 of the Waste Management Act. Written notice of intent to appeal must be received by the Regional Waste Manager within twenty-one (21) days of the date of notification of this decision.

Yours truly,

T.R. Forty, P.Eng.
Assistant Regional Waste Manager
Okanagan Sub-Region

Enclosure

PROVINCE OF
BRITISH COLUMBIA

Environmental Protection
#201 - 3547 Skaha Lake Road
Penticton
British Columbia, V2A 7K2
Telephone: (604) 490-8200

MINISTRY OF ENVIRONMENT,
LANDS AND PARKS

OPERATIONAL CERTIFICATE

PE 13717

Under the Provisions of the Waste Management Act

TOWN OF OLIVER

P.O. Box 638

Oliver, British Columbia

V0E 1T0

is authorized to discharge reclaimed wastewater to the ground by irrigation, from a municipal sewage collection and aerated lagoon sewage treatment facility located at Oliver, British Columbia, subject to the conditions listed below. Contravention of any of these conditions is a violation of the Waste Management Act and may result in prosecution.

1. SPECIFIC AUTHORIZED DISCHARGES AND RELATED REQUIREMENTS

The discharge of effluent to which this sub-section is applicable is from a municipal sewage treatment facility located approximately as shown on the attached Site Plan A and Site Plan B. The reference number (S.E.A.M. site number) for this discharge is E222150.

1.1 Discharge Quantity

1.1.1 The maximum authorized rate of effluent to be discharged from the aerated lagoon sewage treatment system to the reclaimed wastewater storage reservoir, averaged on a monthly basis:

1995 - 1950 m^3 per day
1996 - 2000 m^3 per day
1997 - 2050 m^3 per day
1998 - 2100 m^3 per day
1999 - 2150 m^3 per day
2000 - 2200 m^3 per day

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Assistant Regional Waste Manager

Date Issued: December 14, 1995
Amendment Date:
(most recent)

1.1.2 There is no maximum authorized rate of reclaimed wastewater to be discharged from the storage reservoir for beneficial use as irrigation water.

1.2 Discharge Quality

1.2.1 It is recommended that to ensure reclaimed wastewater is adequately renovated prior to irrigation, the characteristics of the effluent discharged from the aerated lagoon treatment system to the reclaimed wastewater storage reservoir not exceed:

5 Day Biochemical Oxygen Demand, 45 mg/L; and

Total Suspended Solids - 60 mg/L.

1.3 Permit Fee Calculations for Reclaimed Wastewater Discharge to Land

1.3.1 The characteristics of the reclaimed wastewater discharged from the storage reservoir and beneficially used for irrigation, for the purposes of permit fee calculations, the following discharge factors have been assumed:

5 Day Biochemical Oxygen Demand, 10 mg/L; and

Total Suspended Solids - 10 mg/L.

1.4 Authorized Works

The works authorized are: sewage collection system, sewage treatment plant concrete tankage for emergency containment, influent screen, flow equalization basin, pumping station, pressure forcemain to aerated lagoons, aerated lagoon treatment system, reclaimed wastewater storage reservoir sized to provide a minimum retention time of 60 days prior to spray irrigation, post storage chlorination, pressure forcemain to the golf course and related irrigation supply mains and sprinkler irrigation equipment, infiltration basin, and other related appurtenances, approximately as shown on the attached Site Plan A.

1.5 Source of Discharge

The source of discharge and sewage collection system services the Town of Oliver and surrounding area.

T.R. Forty, P.Eng.
Assistant Regional Waste Manager

1.6 Location of Works

The location of the sewage collection, flow equalization basin and effluent pumping station is: Block 47 of District Lot 2450s, Similkameen Division of Yale District.

The location of the effluent aerated lagoon treatment facilities, reclaimed wastewater storage reservoir, chlorination and withdrawal facilities is: District Lot 763s, and Block B, District Lot 682s, Similkameen Division of Yale District. The location of the potential infiltration basin sites: Block K, Plan 1789 (Town Sand Pit) and Lot 2, Plan 5881 (Town Gravel Pit).

1.7 Location of Discharge

The location where reclaimed wastewater may be irrigated is described generally as Oliver and the surrounding area.

1.8 Irrigation Plan

Submit for review, and obtain written authorization from the Regional Waste Manager, an "Irrigation Plan" of all new areas of land to be irrigated prior to commencement of irrigation with reclaimed wastewater. Areas for effluent irrigation are as indicated in the Oliver Waste Management Plan and as indicated on Site Plan A.

2. GENERAL REQUIREMENTS

2.1 Maintenance of Works, Emergency Procedures and Noncompliance Reporting

Inspect the pollution control works regularly and maintain them in good working order. In the event of an emergency or any condition which prevents continuing operation of the approved method of pollution control or results in noncompliance with the terms and conditions of this Operational Certificate, immediately notify the Regional Waste Manager and take appropriate remedial action.

2.2 Bypasses

The discharge of effluent which has bypassed the designated treatment works is prohibited, unless the consent of the Regional Waste Manager is obtained and confirmed in writing.

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2.3 Process Modifications

Notify the Regional Waste Manager, and his written consent obtained, prior to implementing changes to any process that may affect the quality and/or quantity of the discharge.

2.4 Alternate Water Supply

Provide alternate water supplies if any privately owned well is adversely affected by the land disposal scheme as determined by the Regional Waste Manager.

2.5 Plans - New Works

2.5.1 Plans of modifications and/or extensions to the existing works shall be signed and sealed by a Professional Engineer licensed to practise in the Province of British Columbia.

2.5.2 Copies of all "as-built" plans and drawings for the effluent treatment system, signed and sealed by a Professional Engineer licensed to practise in the Province of British Columbia, shall be submitted to the Regional Waste Manager on completion of construction.

2.5.3 Plans and specifications of any proposed new works, modifications or additions to the works authorized in this Operational Certificate, including the infiltration basin plans, and with the exception of the sewage collection system, shall be submitted to the Regional Waste Manager, and his written consent obtained before construction commences. The works shall be constructed in accordance with such plans.

2.5.4 Retain a copy of all "as-built", plans of modifications and/or extensions to the sewage collection system for perusal by the Regional Waste Manager, or his designate, upon request.

2.5.5 Plans for modifications of, and/or extensions to, the existing reclaimed wastewater irrigation system shall be approved by a person qualified in the design of irrigation systems.

2.5.6 Design and construct the irrigation works in accordance with best current agricultural practice and:

The "Pollution Control Guidelines for Municipal Effluent Application to Land", dated January 1983, and any amendments thereto, issued by the Ministry of Environment of British Columbia.

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The "B.C. Sprinkler Irrigation Manual" 1989 issue, prepared by the B.C. Ministry of Agriculture and Fisheries.

The "Health and Safety Criteria for the Use of Reclaimed Wastewater", 1991, developed by the Ministry of Health and the Ministry of Environment.

3. GENERAL REQUIREMENTS - ALL DISCHARGES

3.1 Operation and Maintenance

Develop and maintain both an Operational and Maintenance Manual for the sewage collection, sewage treatment and reclaimed wastewater utilization. A copy of the Operational and Maintenance Manuals shall be retained at the treatment facility for inspection by the Regional Waste Manager or their designate.

3.2 Facility Classification

Maintain the wastewater treatment facility classification as authorized in Section 1.4 with the "British Columbia Water and Wastewater Operators Certification Program Society" (BCWWOCPS). The new aerated lagoon treatment facility is presently classified as a Level II facility.

3.3 Operator Certification

3.3.1 All operators in training (OIT) working at this Level II facility classified by the BCWWOCPS shall be required to successfully pass an OIT examination within three (3) months of commencement of employment at the facility. The OIT certificate shall be valid for fifteen (15) months from the date of issue. Prior to the expiry date of the OIT certificate, but not sooner than twelve (12) months from the date when the OIT commenced facility operation, the OIT shall successfully complete a Class I certification examination in order to continue to operate at the facility.

3.3.2 The facility is currently classified by the BCWWOCPS at Level II. Designate at least one operator to be the "Chief Operator" of the facility by **December 1, 1996.** The "Chief Operator" shall be certified at a Class II level, at a minimum.

After **December 1, 1996,** no person shall have "Direct Responsible Charge", as defined by the BCWWOCPS, of a municipal wastewater

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treatment facility classified at Level II or higher unless they possess a valid operator's certificate not more than one level below the classification level of the facility. **"Direct Responsible Charge" is the "Chief Operator" of the facility, the identifiable senior person who is in charge of the plant.**

3.3.3 Should the facility be reclassified by the BCWWOCPS at Level III, designate a "Chief Operator", certified at a Class III level by **December 1, 1998.**

3.3.4 Should the facility be reclassified by the BCWWOCPS at Level IV, designate a "Chief Operator", certified at a Class IV level by **December 1, 1998.**

3.4 Water Conservation

Establish a water conservation program to encourage a reduction in the volume of domestic and industrial wastewaters discharged to the sewage collection system.

3.5 Sewage Collection System - Groundwater Infiltration, Inflow and Cross Connections

Inspect and maintain the sewage collection system works so as to minimize the possibility of cross connections between the storm sewer and the sanitary sewer systems, to minimize infiltration of groundwater, to minimize inflow of water from basement sump pumps and roof drains, and minimize exfiltration of the collected sewage from the sewage collection system to the ground.

3.6 Influent Wastes Bylaw

Subject to being declared a Sewage Control Area under Section 17 of the Waste Management Act, and in order to minimize the potential effect of heavy metals or other toxic materials in the effluent and/or sludge, prepare, implement and/or amend an Influent Wastes Bylaw, Building Bylaw, or other similar bylaws, to regulate the input of such wastes to the sewage collection system. Devices to process household putrescible waste for disposal to the sewage collection system shall be prohibited.

3.7 Contingency Plan

Prepare a Contingency Plan that will address the appropriate course of action to be taken in any particular preconceived emergency situation. The Contingency Plan shall include chlorine leaks and any potential point of concern in the collection, treatment and disposal systems. Attention is to be given to public

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safety and the protection of the environment. The Contingency Plan is to be continually updated as necessary to reflect the current operation. A copy of the Contingency Plan shall be forwarded to the Regional Waste Manager on or before December 31, 1997.

3.8 Sludge Management Plan

The rationale of sludge management, including frequency of withdrawal of sludge from the sewage treatment plant and the location(s) used for disposal and/or utilization shall be developed into a Sludge Management Plan. The Sludge Management Plan shall be prepared and submitted to the Regional Waste Manager for approval on or before December 31, 1996.

3.9 Odours

Should odours become objectionable, additional works shall be provided when so directed in writing by the Regional Waste Manager.

3.10 Fencing

Erect a fence around the sewage treatment facility, storage reservoir and such other areas as required by the Regional Waste Manager. The height and type of fencing shall meet the approval of the Regional Waste Manager.

3.11 Surface Water Diversionary Works

Surface water shall be intercepted and diverted away from the effluent treatment facilities to the greatest extent possible.

3.12 Signage

3.12.1 A suitable sign erected at the main entrance to the site shall have the appropriate emergency phone numbers for use by the general public and others.

3.12.2 Prominent "NO TRESPASSING", signs shall be erected around agricultural and silvicultural sites irrigated with reclaimed wastewater, warning persons of the possible health hazard during the irrigation season and advising that the water used for irrigation is NOT POTABLE. The wording shall be in language or symbols readily comprehensible by the general public. eg. "NO TRESPASSING - RECLAIMED WASTEWATER - DO NOT DRINK"

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4. GENERAL REQUIREMENTS - EFFLUENT STORAGE RESERVOIR

4.1 Leakage

Operate and maintain the reclaimed wastewater storage reservoir to minimize fluid leakage. Leakage shall not aggravate or produce soil or bedrock instability or erosion elsewhere or contaminate ground or surface water.

5. GENERAL REQUIREMENTS - EFFLUENT IRRIGATION

5.1 Disinfection - Chlorination

5.1.1 Adequate chlorination shall be maintained and provide not less than one hour's contact time at average flow rates in the reclaimed wastewater discharging from the chlorination facility to the irrigation system.

5.1.2 Reclaimed wastewater utilized for irrigation shall conform to the effluent irrigation guidelines developed by the B.C. Ministry of Health. Fecal coliforms shall not exceed 200 MPN per 100 mL for agricultural, silvicultural and low public use lands, or exceed 2.2 MPN per 100 mL for high public use lands.

5.2 Annual Irrigation

5.2.1 The authorized discharge period for irrigation is during the period March 15 to October 31, inclusive.

5.2.2 With the written authorization of the Regional Waste Manager, the irrigation schedule may be extended on a weekly basis beyond these limits. Any extension will be considered only upon receipt of a substantiated written request.

5.3 Buffer Zones

5.3.1 The requirement for formal buffer zones surrounding lands irrigated with reclaimed wastewater is no longer in effect, however, a buffer zone may be specified by the Regional Waste Manager.

5.3.2 Reclaimed wastewater applied by irrigation shall not be applied to the ground any closer than 15 metres from the edge of flowing streams or bodies of water.

5.3.3 There shall be no reclaimed wastewater irrigated within 30 metres of any well or inground reservoir for domestic supply.

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5.4 Surface Runoff

There shall be no surface runoff of irrigated reclaimed wastewater from the irrigated lands.

5.5 Surfacing Reclaimed Wastewater

Irrigation shall be managed in such a fashion as to preclude surfacing of irrigation tail water down slope of the point of irrigation.

5.6 Spray Irrigation Drift

The reclaimed wastewater irrigation system shall be managed in such a fashion as to preclude aerosol drift from leaving the irrigated lands.

5.7 Irrigation Rates

5.7.1 Irrigation rates shall not exceed the rates given in "B.C. Sprinkler Irrigation Manual", dated 1989, prepared by the B.C. Ministry of Agriculture and Fisheries.

5.7.2 Soils of the irrigated lands shall be monitored to prevent saturation, erosion, and instability.

5.8 Agricultural Products Lag Time

5.8.1 A three day lag time is required before uninspected livestock intended for human consumption are permitted on areas irrigated with reclaimed wastewater. No lag time is required if livestock are subjected to the federal meat inspection program.

5.8.2 A six day lag time is required before dairy cattle are permitted in areas irrigated with reclaimed wastewater.

5.8.3 A three day lag time, after irrigation has ceased, is required before a crop intended for animal feed is harvested.

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6. MONITORING REQUIREMENTS

6.1 Influent Sampling Program - (Equalization Basin)

6.1.1 Install and maintain a suitable sampling facility at the equalization basin outlet, (S.E.A.M. site number E222152), and obtain a grab sample of the plant influent **semi-annually** (a proportional continuous sampler may be used).

6.1.2 Obtain analyses of the influent sample for the following:

total phosphorus and ortho phosphorus, expressed as P in mg/L;

6.2 Effluent Sampling Program - (Cell #3, prior to storage reservoir)

6.2.1 Install and maintain a suitable sampling facility on the outlet of the aerated treatment lagoon, Cell #3, (S.E.A.M. site number E222151), and obtain a grab sample of the effluent before it is discharged to the storage reservoir, for analysis by a suitably accredited laboratory, a proportional continuous sampler may be used, provided that prior written approval has been obtained from the Regional Waste Manager.

6.2.2 Obtain analyses of the effluent sample for the following:

total suspended solids (non-filterable residue), (**monthly** analysis), mg/L;

5-day biochemical oxygen demand, (**monthly** analysis), mg/L;

total phosphorus, ortho phosphorus and total dissolved phosphorus, (**quarterly analysis during 1996, and semi-annually** analysis, thereafter), all expressed as mg/L P; and

total nitrogen, ammonia nitrogen, nitrate nitrogen, nitrite nitrogen, and organic nitrogen, (**quarterly analysis during 1996, and semi-annually analysis thereafter**), all expressed as mg/L N.

6.2.3 Occasional full chemical analysis of the main cations and anions and other characteristics may be required at the discretion of the Regional Waste Manager.

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Assistant Regional Waste Manager

Date Issued: December 14, 1995
Amendment Date:

6.3 Effluent Irrigation Sampling Program - (Chlorine Contact Chamber, prior to Irrigation)

6.3.1 Install a suitable sampling facility after the chlorine contact chamber, prior to irrigating, (S.E.A.M. site number E222150) and obtain a grab sample of the reclaimed wastewater during the irrigation season.

6.3.2 Obtain analyses of the sample, parameters and frequency as follows:

faecal coliforms, M.P.N./100ml, on a monthly basis;

total coliforms, M.P.N./100ml, on a monthly basis;

total phosphorus, mg/L, on a monthly basis;

total nitrogen, mg/L, on a monthly basis; and

chlorine residual, mg/L, on a weekly basis.

6.3.3 Occasional full chemical analysis of the main cations and anions and other characteristics may be required at the discretion of the Regional Waste Manager.

6.4 Effluent Irrigation Monitoring Program

6.4.1 Provide and maintain a suitable flow measuring device to measure total volume of reclaimed wastewater irrigated annually and record the areas where it is utilized.

6.4.2 Provide and maintain a suitable flow measuring device to measure the amount of fresh water make-up from Okanagan River to the equalization basin in m^3/day, and totalize this make up water volume on an annual basis in m^3/year.

6.4.3 Provide and maintain a suitable flow measuring device and record once per day the reclaimed wastewater volume irrigated over a 24-hour period. Record the flows for each calendar month and for each calendar year.

6.5 Storage Reservoir Level Monitoring Program

6.5.1 Provide a suitable staff gauge or other similar device as approved by the Regional Waste Manager in the storage reservoir and take weekly measurements of the water level in the storage reservoir on a year round basis.

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Assistant Regional Waste Manager

6.6 Sampling and Analytical Requirements

6.6.1 Proper care should be taken in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage, etc.

6.6.2 Occasional full chemical analysis of the main cations and anions and other characteristics may be required at the discretion of the Regional Waste Manager.

6.6.3 Analyses are to be carried out in accordance with procedures described in the second edition of "A Laboratory Manual for the Chemical Analysis of Waters, Wastewaters, Sediments and Biological Materials, (March 1994 Permittee Edition)", or by suitable alternative procedures as authorized by the Regional Waste Manager.

The above manual may be purchased from Queens Printer Publications Centre, 2nd Floor, 563 Superior Street, Victoria, B.C., V8V 4R6, 1-800-663-6105. The manual may also be reviewed at any Environmental Protection Program Office.

6.6.4 Sampling and flow measurement shall be carried out in accordance with the procedures described in "Field Criteria for Sampling Effluents and Receiving Waters", April 1989, 17 pp., or by other suitable alternative procedures as authorized by the Regional Waste Manager.

6.6.5 The Permittee is required to follow the terms and conditions of the Quality Assurance Regulation (EQDA). Ten percent of the samples collected shall be duplicated to provide data quality assurance. Quality control information generated by the Permittee lab while analyzing parameters required by this Permit shall also be provided with the data required to be reported.

6.7 Sludge Sampling and Monitoring Program

Develop and maintain a record keeping system for measuring and recording the depth of sludge collecting in the lagoons and volume of sludge removed from the treatment lagoons during desludging operations, the location where the sludge was discharged, and the amount of sludge discharged at each location. The Regional Waste Manager is to be notified in writing at least two weeks prior to the commencement of desludging operations. Analysis of the sludge may be required by the Regional Waste Manager.

T.R. Forty, P.Eng.
Assistant Regional Waste Manager

6.8 Groundwater Monitoring Program

A Groundwater Monitoring Program, shall be submitted to the Regional Waste Manager. The Groundwater Monitoring Program shall be designed by a Professional Engineer or a Hydrogeological Technologist licensed to practice in the Province of British Columbia, to establish with acceptable scientific accuracy, the groundwater flow pattern and nutrient removal capability of the soil to ensure reasonable notice of impending high phosphorus or nitrate levels that may adversely affect surface water, groundwater or domestic waterwells. The sampling, measurement frequency and analyses shall be conducted in accordance with the Groundwater Monitoring Program upon its written authorization by the Regional Waste Manager. The Groundwater Monitoring Program to be submitted to the Regional Waste Manager by December 31, 1997.

6.9 Soils Assessment Program

A ground assessment of any new areas to be irrigated, as shown in the "Irrigation Plan", shall be performed by a suitably qualified professional, using best current climate and soils data to substantiate that the land is capable of accepting reclaimed wastewater for irrigation purposes. This assessment is to include any suggested restrictions or recommendations that the suitably qualified professional deems necessary. This Soils Assessment shall be submitted to the Regional Waste Manager for review prior to the initial commencement of irrigation annually. Further review and ongoing soils assessments may be required by the Regional Waste Manager.

7. REPORTING

7.1 General Reporting

7.1.1 Maintain the monitoring data required in Section 6 for inspection.

7.1.2 The influent/effluent water quality analyses and flow data is to be submitted to the Regional Waste Manager such that they are received by the Regional Waste Manager within 30 days of the results being sent out by the testing agency.

7.1.3 Monitoring data shall be submitted in an electronic and/or printed format satisfactory to the Regional Waste Manager.

T.R. Forty, P.Eng.
Assistant Regional Waste Manager

7.2 Annual Reporting

7.2.1 Submit an Annual Report which includes a summary of the results of all sampling and monitoring programs as specified in this permit, data interpretation and trend analyses by a suitably qualified professional.

7.2.2 This report is to be in a format which is suitable for review by the public and/or other government agencies.

7.2.3 The first report is due on or before 60 days of the end of a calendar year for that year's monitoring. Raw data are to be attached as appendices to the report.

7.2.4 Maintain and submit records of the following as a part of the annual report:

7.2.4.1 Records of reclaimed wastewater balance, that is, the flows to and from the storage reservoir. This balance, must also include the freshwater make-up.

7.2.4.2 Records of the duration, intensity, property owner, acreage, location, and type of reclaimed wastewater irrigation.

7.2.4.3 Records of efforts to reduce infiltration, inflow and cross connections for inspection by the Regional Waste Manager or his designate.

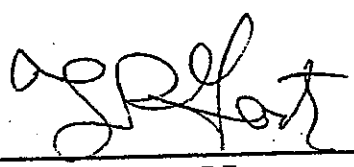
7.2.4.4 Records of efforts to administer the Influent Wastes By-law(s) for inspection by the Regional Waste Manager or his designate. Include as an attachment, any amendments to the Influent Wastes By-law(s) that have been made during the past year.

7.2.4.5 Copy of the Contingency Plan.

7.2.4.6 Copy of the Sludge Management Plan.

7.2.4.7 Copy of the Annual Flow Summaries.

7.2.4.8 Copy of the Annual Irrigation Summaries.



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Assistant Regional Waste Manager

APPENDIX A

Requirements of Reclaimed Wastewater Users

The holder of this Operational Certificate (The reclaimed wastewater supplier) shall be responsible for ensuring that the contractual agreement with the Reclaimed Wastewater User is in accordance with the Operational Certificate. A copy of this Appendix is to be provided to each user prior to the commencement of irrigation EACH YEAR.

1 GENERAL REQUIREMENTS

1.1 Plans - New Works

1.1.1 Plans for modifications and/or extensions to the existing reclaimed wastewater irrigation system shall be approved by a person qualified in the design of irrigation systems.

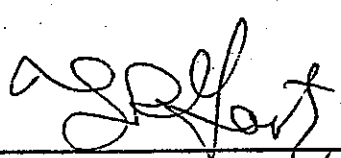
1.1.2 Design and construct the irrigation works in accordance with best current agricultural practice and the "Pollution Control Guidelines for Municipal Effluent Application to Land", dated January 1983, and any amendments thereto, issued by the Ministry of Environment of British Columbia, and also in accordance with the "B.C. Sprinkler Irrigation Manual", dated 1989, prepared by the B.C. Ministry of Agriculture and Fisheries.

1.2 Construction Criteria

1.2.1 All reclaimed water user valves, shall be of a type or secured in a manner that permits operation by only personnel authorized by each wastewater user. All piping, valves and outlets should be marked to differentiate reclaimed wastewater from domestic water. All reclaimed wastewater controllers, valves, etc., shall be affixed with reclaimed wastewater warning signs.

1.2.2 Use or installation of hose-bibbs on any irrigation system presently operating, or designated to operate with reclaimed wastewater, regardless of the hose-bibb construction or identification, is not permitted.

1.2.3 There shall be at least a 3 metre horizontal and a 0.3 metre vertical separation (with domestic water pipeline above the reclaimed water pipeline) between all pipelines transporting reclaimed water and those transporting domestic water.



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Assistant Regional Waste Manager

1.2.4 There shall be no connection between a potable water supply, irrigation water or industrial well, and piping containing reclaimed wastewater, except through an air gap separation or reduced pressure principle device.

1.3 Fencing

The Reclaimed Wastewater User MAY be required by the Regional Waste Manager to erect a fence around the disposal area to restrict public access. The height and type of fencing shall meet the approval of the Regional Waste Manager.

1.4 Signage

1.4.1 Prominent "NO TRESPASSING", signs shall be erected around agricultural and silvicultural sites irrigated with reclaimed wastewater, warning persons of the possible health hazard during the irrigation season and advising that the water used for irrigation is NOT POTABLE. The wording shall be in language or symbols readily comprehensible by the general public. eg. "NO TRESPASSING - RECLAIMED WASTEWATER - DO NOT DRINK"

1.4.2 Warning signs shall be posted in sufficient numbers and size and at strategic locations to advise the public that reclaimed water is being used. Additional signage may be required as directed by the Regional Waste Manager.

2 GENERAL REQUIREMENTS - RECLAIMED WASTEWATER IRRIGATION

2.1 Buffer Zones

2.1.1 The requirement for formal buffer zones surrounding lands irrigated with reclaimed wastewater is no longer in effect, however, a buffer zone may be specified by the Regional Waste Manager.

2.1.2 Reclaimed wastewater applied by irrigation shall not be applied to the ground any closer than 15 metres from the edge of flowing streams or bodies of water.

2.1.3 There shall be no reclaimed wastewater irrigated within 30 metres of any well or inground reservoir for domestic supply.

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Assistant Regional Waste Manager

2.2 Surface Runoff

2.2.1 There shall be no surface runoff of irrigated reclaimed wastewater from the irrigated lands.

2.2.2 The maximum ground slope shall not exceed 20% without the written consent of the Regional Waste Manager.

2.3 Surfacing Reclaimed Wastewater

2.3.1 Irrigation shall be managed in such a fashion as to preclude surfacing of irrigation tail water down slope of the point of irrigation.

2.3.2 Irrigation shall be managed as to prevent ponding.

2.4 Spray Irrigation Drift

2.4.1 Reclaimed wastewater shall be confined to the area designated and approved for reclamation. The reclaimed wastewater irrigation system shall be managed in such a fashion as to prevent aerosol drift from leaving the irrigated lands.

2.4.2 Precautions shall be taken to ensure that reclaimed water will not have contact with any facility or area not designated for reclamation, such as passing vehicles, buildings, domestic water facilities, fruit and vegetable gardens, or food handling facilities.

2.4.3 Drinking water facilities shall be protected from direct or wind blown reclaimed wastewater spray.

2.5 Irrigation Rates

2.5.1 Irrigation rates shall not exceed the rates given in "B.C. Sprinkler Irrigation Manual", dated 1989, prepared by the B.C. Ministry of Agriculture and Fisheries.

2.5.2 Soils of the irrigated lands shall be monitored periodically or as otherwise directed by the Regional Waste Manager or the Town of Oliver, to prevent saturation, erosion, and instability .

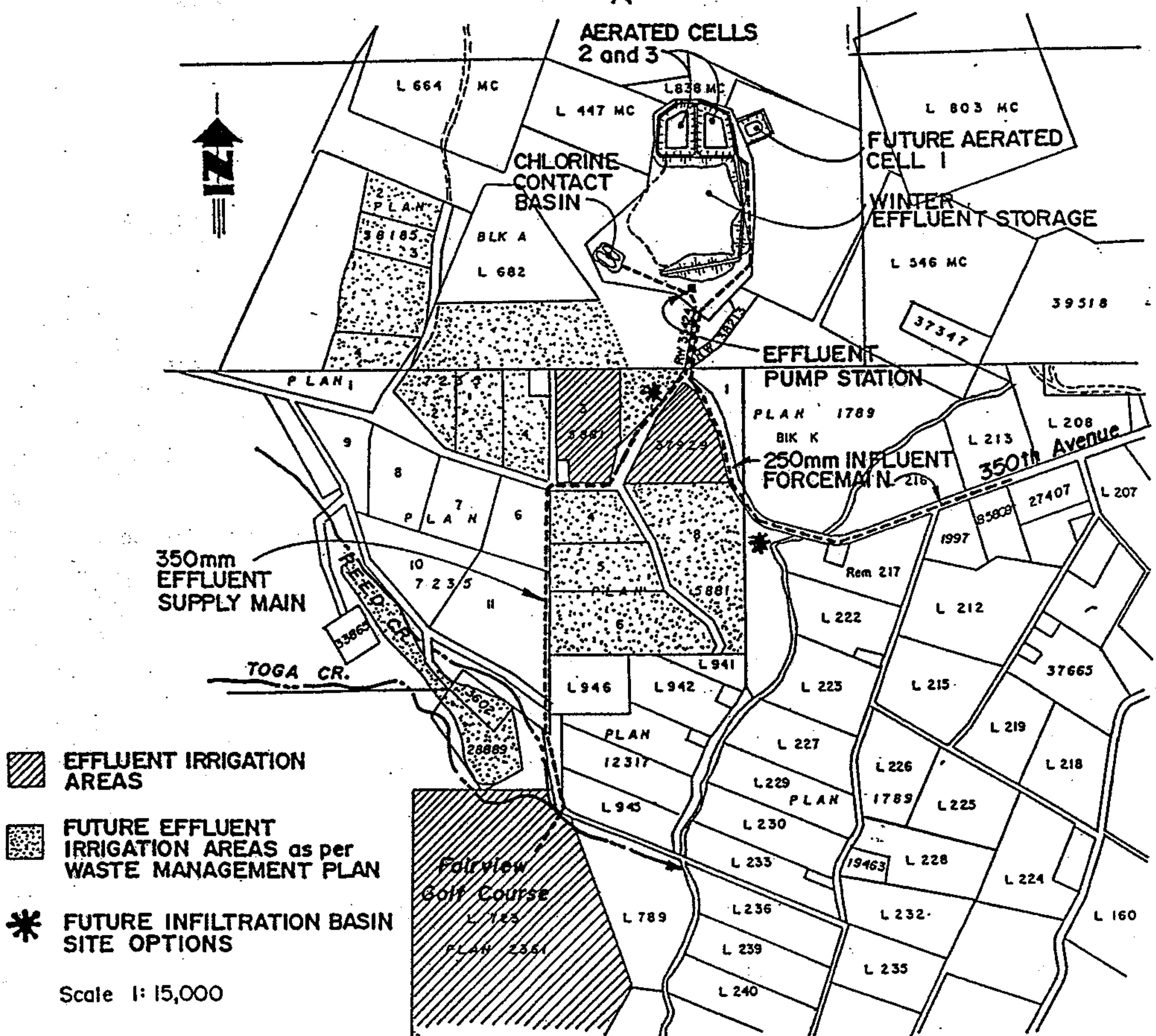
T.R. Forty, P.Eng.
Assistant Regional Waste Manager

Province of
British Columbia
Ministry of Environment,
Lands and Parks

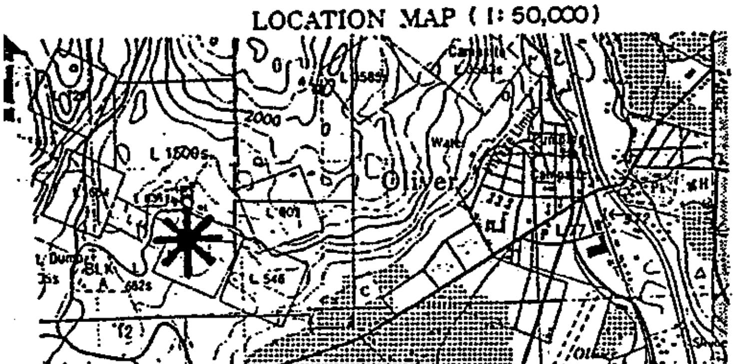
BC Environment

ENV?ONMENTAL PROTECTION DIVISION

SITE PLAN A



LOCATION MAP (1: 50,000)



(FOR OFFICE USE ONLY)

December 14, 1995
Date Issued

Date Amended.

T.R. Forty, P.Eng.
Assistant Regional Waste Manager

Page

Permit No./Approval No. PE 13717

2.6 Agricultural Products Lag Time

2.6.1 A three day lag time is required before uninspected livestock intended for human consumption are permitted on areas irrigated with reclaimed wastewater. No lag time is required if livestock are subjected to the federal meat inspection program.

2.6.2 A six day lag time is required before dairy cattle are permitted in areas irrigated with reclaimed wastewater.

2.6.3 A three day lag time, after irrigation has ceased, is required before a crop intended for animal feed is harvested.

2.7 Insect and Vector Control

Adequate measures shall be taken to prevent the breeding of insects and other vectors of health significance, and the creation of odors, slimes or unsightly deposits.

2.8 Irrigation of Public Areas

2.8.1 Irrigation on golf courses or cemeteries shall only be practised when the public are not present.

2.8.2 Golf score cards shall indicate that reclaimed wastewater is used for irrigation on the golf course lands.

T.R. Forty, P.Eng.
Assistant Regional Waste Manager

APPENDIX B

Influent and Effluent Sampling Data

TOWN OF OLIVER

PE - 13717 - Chlorine Contact Chamber Prior to Irrigation - EMS ID E222150

		Anions	General Parameters	Calculated Parameters	Dissolved Metals	Microbiological Parameters		
	Date	**Total Chloride**	**Total P**	**Total N**	**Sodium**	**Total Coliforms**	**Fecal Coliforms**	**Free CL Res**
OC Limit		n/a	n/a	n/a	n/a	n/a	2.2 MPN/100 ml	n/a
Unit		mg/L	mg/L	mg/L	mg/L	MPN/100ml	MPN/100ml	mg/L
Frequency		monthly	monthly	monthly	monthly	monthly	monthly	weekly
April	9	146	4.69	19.2	103	<2.2	<2.2	0.21
May	14	160	4.14	22.3	101	<2.2	<2.2	0.33
June	4	146	4.65	23.8	106	<2.2	<2.2	0.34
July	4	162	4.75	21.9	103	<2.2	<2.2	0.31
August	7	149	4.38	18.1	89.8	<2.2	<2.2	0.39
September	4	115	4.66	13.2	121	<2.2	<2.2	0.34
October	1	177	4.84	14.4	109	<2.2	<2.2	0.25

* Note: The operational permit limit for fecal coliform in re-claimed water applied to agricultural land is 200 MPN per 100mL. Most of the re-claimed water in Oliver is applied on the Fairview Mountain Golf Course which is classified as high public use, hence the lower limit of 2.2 MPN per 100 mL.

TOWN OF OLIVER

PE-13717 - Effluent Sampling - Cell #3, prior to storage reservoir - EMS ID E222151

	Date	BOD5	TSS	Nitrate (as N)	Nitrite (as N)	Phosphate (as P)	Ammonia (as N)	N Tot Kjedahl	Phosphorus Tot P	Phosphorus Tot Diss	N Tot	N Organic
OC Limit		45 mg/L	60 mg/L									
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Frequency		monthly	monthly	semi-annual	semi-annual	semi-annual	semi-annual	semi-annual	semi-annual	semi-annual	semi-annual	semi-annual
January	3	22.7	19									
February	5	38.3	28									
March	7	44.4	41									
March	7					1.95			5.37			
March	7			0.282	0.048	3.21	31.10	31.8	5.18	4.03	32.2	<1.00
April	9	24.8	19									
May	14	33.8	30.5									
June	4	52.9	22									
July	4	45.8	23.2									
August	7	13.2	21.2									
September	4	5.8	14									
September	4					1.83			5.89			
September	4			8.2	0.649	4.02	0.916	3.01	5.42	5.04	11.9	2.10
October	1	26.1	9.6									
November	5	35.7	14.4									
December	4	20.4	8.8									

Influent Sampling

Semi- Annual

Town of Oliver Sewer Flows - PE - 13717

	High Lift Station					
January	Daily Flow m3/day	Total Monthly m3/day	Monthly Average m3/day	Total Daily m3/day (3)	Total Monthly m3/day	Monthly Average m3/day
1	550			0.0		
2	1460			0.0		
3	1614			0.0		
4	1542			0.0		
5	1619			0.0		
6	2409			0.0		
7	1500			0.0		
8	480			0.0		
9	1740			0.0		
10	1705			0.0		
11	1582			0.0		
12	1609			0.0		
13	2351			0.0		
14	1499			0.0		
15	480			0.0		
16	1740			0.0		
17	1609			0.0		
18	1581			0.0		
19	1615			0.0		
20	2504			0.0		
21	1633			0.0		
22	478			0.0		
23	1734			0.0		
24	1722			0.0		
25	1711			0.0		
26	1717			0.0		
27	2719			0.0		
28	1653			0.0		
29	533			0.0		
30	1720			0.0		
31	1704			0.0		
		48513	1565		0.0	0
	OC Limit	n/a	2050m3/day		n/a	n/a

Notes:

(1) These readings have been calculated by subtracting the flows read at the rapid infiltration site, from the flows read on the main meter in the Chlorine Booster Station. Both the irrigation flows and the rapid infiltration flows travel through this meter.

(2 & 3) These are the flows that have been read at the main meter located in the Chlorine Booster Station.

Town of Oliver Sewer Flows - PE - 13717

	High Lift Station					
February	Daily Flow m3/day	Total Monthly m3/day	Monthly Average m3/day	Total Daily m3/day (3)	Total Monthly m3/day	Monthly Average m3/day
1	1701			0.0		
2	1721			0.0		
3	2634			0.0		
4	1718			0.0		
5	559			0.0		
6	1761			0.0		
7	1731			0.0		
8	1746			0.0		
9	1727			0.0		
10	2565			0.0		
11	1729			0.0		
12	493			0.0		
13	1740			0.0		
14	1711			0.0		
15	1714			0.0		
16	1695			0.0		
17	2575			0.0		
18	1665			0.0		
19	547			0.0		
20	1712			0.0		
21	1709			0.0		
22	1717			0.0		
23	1730			0.0		
24	2600			0.0		
25	1708			0.0		
26	642			0.0		
27	1697			0.0		
28	1683			0.0		
29						
30						
31						
		46929	1676		0.0	0
	OC Limit	n/a	2050m3/day		n/a	n/a

Notes:

(1) These readings have been calculated by subtracting the flows read at the rapid infiltration site, from the flows read on the main meter in the Chlorine Booster Station. Both the irrigation flows and the rapid infiltration flows travel through this meter.

(2) These flows are read at two, 2 inch water meters located at the rapid infiltration site.

(3) These are the flows that have been read at the main meter located in the Chlorine Booster Station.

Town of Oliver Sewer Flows - PE - 13717

March	High Lift Station					
	Daily Flow m3/day	Total Monthly m3/day	Monthly Average m3/day	Total Daily m3/day (3)	Total Monthly m3/day	Monthly Average m3/day
1	1693			0.0		
2	1785			0.0		
3	2774			0.0		
4	1814			0.0		
5	596			0.0		
6	1752			0.0		
7	1924			0.0		
8	1780			0.0		
9	1732			0.0		
10	2758			0.0		
11	1539			0.0		
12	993			0.0		
13	1755			0.0		
14	1884			0.0		
15	1793			0.0		
16	1855			0.0		
17	2797			0.0		
18	1857			0.0		
19	782			0.0		
20	1746			0.0		
21	1738			0.0		
22	1723			0.0		
23	2158			0.0		
24	2774			0.0		
25	1876			0.0		
26	767			0.0		
27	1740			0.0		
28	1707			0.0		
29	1687			0.0		
30	1889			0.0		
31	2861			0.0		
		56527	1823		0.0	0
	OC Limit	n/a	2050m3/day		n/a	n/a

Notes:

(1) These readings have been calculated by subtracting the flows read at the rapid infiltration site, from the flows read on the main meter in the Chlorine Booster Station. Both the irrigation flows and the rapid infiltration flows travel through this meter.

(2) These flows are read at two, 2 inch water meters located at the rapid infiltration site.

(3) These are the flows that have been read at the main meter located in the Chlorine Booster Station.

Town of Oliver Sewer Flows - PE - 13717

April	High Lift Station					
	Daily Flow m3/day	Total Monthly m3/day	Monthly Average m3/day	Total Daily m3/day (3)	Total Monthly m3/day	Monthly Average m3/day
1	1969			0.0		
2	769			0.0		
3	1835			0.0		
4	1833			0.0		
5	2002			1268.5		
6	2797			3169.0		
7	2532			0.0		
8	1988			0.0		
9	796			2752.4		
10	2439			0.0		
11	2093			2298.0		
12	1954			0.0		
13	702			1320.9		
14	2293			0.0		
15	2079			0.0		
16	713			1952.2		
17	2024			2220.7		
18	1946			1266.4		
19	1943			1735.9		
20	1908			2262.1		
21	3009			666.6		
22	2132			0.0		
23	991			1655.1		
24	1497			1047.0		
25	2033			713.7		
26	1972			120.5		
27	1950			984.6		
28	3031			1281.4		
29	1850			649.8		
30	1221			339.6		
31						
		56302	1877		27704.3	923
	OC Limit	n/a	2050m3/day		n/a	n/a

Notes:

(1) These readings have been calculated by subtracting the flows read at the rapid infiltration site, from the flows read on the main meter in the Chlorine Booster Station. Both the irrigation flows and the rapid infiltration flows travel through this meter.

(2) These flows are read at two, 2 inch water meters located at the rapid infiltration site.

(3) These are the flows that have been read at the main meter located in the Chlorine Booster Station.

Town of Oliver Sewer Flows - PE - 13717

	High Lift Station					
May	Daily Flow m3/day	Total Monthly m3/day	Monthly Average m3/day	Total Daily m3/day (3)	Total Monthly m3/day	Monthly Average m3/day
1	2077			1371		
2	1942			1667		
3	1941			2990		
4	2028			3013		
5	2943			1786		
6	2075			1417		
7	1078			1977		
8	1965			2131		
9	2028			1688		
10	2524			2026		
11	2102			1508		
12	2703			2003		
13	2688			2436		
14	1158			4004		
15	2211			3050		
16	2345			2361		
17	2239			3372		
18	2349			1276		
19	3486			0		
20	2468			1028		
21	1475			3543		
22	2207			3269		
23	2527			2453		
24	2477			3869		
25	2432			2294		
26	4086			2393		
27	2511			2241		
28	1494			2706		
29	1759			2351		
30	2500			2646		
31	2047			2675		
		69861	2254		71545.6	2308
	OC Limit	n/a	2050m3/day		n/a	n/a

Notes:

(1) These readings have been calculated by subtracting the flows read at the rapid infiltration site, from the flows read on the main meter in the Chlorine Booster Station. Both the irrigation flows and the rapid infiltration flows travel through this meter.

(2) These flows are read at two, 2 inch water meters located at the rapid infiltration site.

(3) These are the flows that have been read at the main meter located in the Chlorine Booster Station.

Town of Oliver Sewer Flows - PE - 13717

June	High Lift Station					
	Daily Flow m3/day	Total Monthly m3/day	Monthly Average m3/day	Total Daily m3/day (3)	Total Monthly m3/day	Monthly Average m3/day
1	2396			2379		
2	3345			2499		
3	2098			2122		
4	1282			2481		
5	1807			2415		
6	1759			3240		
7	2151			2321		
8	2379			2437		
9	3267			0		
10	2027			701		
11	1143			384		
12	1981			2369		
13	2002			2741		
14	1658			4284		
15	2089			3797		
16	2983			2770		
17	2718			3006		
18	521			3884		
19	2023			3756		
20	2014			3301		
21	2042			4183		
22	2032			4493		
23	3059			2967		
24	2773			3094		
25	630			1779		
26	2017			344		
27	2000			2904		
28	1976			3440		
29	2038			0		
30	3069			0		
31						
		63282	2109		74092.0	2470
	OC Limit	n/a	2050m3/day		n/a	n/a

Notes:

(1) These readings have been calculated by subtracting the flows read at the rapid infiltration site, from the flows read on the main meter in the Chlorine Booster Station. Both the irrigation flows and the rapid infiltration flows travel through this meter.

(2) These flows are read at two, 2 inch water meters located at the rapid infiltration site.

(3) These are the flows that have been read at the main meter located in the Chlorine Booster Station.

Town of Oliver Sewer Flows - PE - 13717

	High Lift Station					
July	Daily Flow m3/day	Total Monthly m3/day	Monthly Average m3/day	Total Daily m3/day (3)	Total Monthly m3/day	Monthly Average m3/day
1	2591			0		
2	162			396		
3	2029			3131		
4	2035			3155		
5	2042			4096		
6	2097			4162		
7	3346			2742		
8	2066			3119		
9	1088			3744		
10	1790			2548		
11	2043			1758		
12	2107			3493		
13	2050			3529		
14	3342			2813		
15	1971			2306		
16	2046			2567		
17	1159			2825		
18	1670			2795		
19	2070			2885		
20	2030			3246		
21	3284			3467		
22	1982			2994		
23	1123			3928		
24	1596			3493		
25	2041			3551		
26	1983			3566		
27	1916			1864		
28	3198			4195		
29	1920			2934		
30	1142			4045		
31	1625			4380		
		61543	1985		93728.0	3023
	OC Limit	n/a	2050m3/day		n/a	n/a

Notes:

(1) These readings have been calculated by subtracting the flows read at the rapid infiltration site, from the flows read on the main meter in the Chlorine Booster Station. Both the irrigation flows and the rapid infiltration flows travel through this meter.

(2) These flows are read at two, 2 inch water meters located at the rapid infiltration site.

(3) These are the flows that have been read at the main meter located in the Chlorine Booster Station.

Town of Oliver Sewer Flows - PE - 13717

August	High Lift Station					
	Daily Flow m3/day	Total Monthly m3/day	Monthly Average m3/day	Total Daily m3/day (3)	Total Monthly m3/day	Monthly Average m3/day
1	1591			3621		
2	2233			3613		
3	1890			3830		
4	4988			6672		
5	1907			2561		
6	784			3051		
7	1521			2885		
8	2343			3475		
9	1991			3885		
10	1823			3916		
11	3058			3648		
12	2419			3204		
13	61			2837		
14	1703			2498		
15	3562			4386		
16	1806			2030		
17	1859			1645		
18	2832			1705		
19	2041			1628		
20	704			2328		
21	1566			3229		
22	1685			2054		
23	2035			2097		
24	1582			1904		
25	2836			1920		
26	1934			536		
27	783			1029		
28	1496			2554		
29	1612			1860		
30	1680			1592		
31	1717			1605		
		60044	1937		83797.5	2703
	OC Limit	n/a	2050m3/day		n/a	n/a

Notes:

(1) These readings have been calculated by subtracting the flows read at the rapid infiltration site, from the flows read on the main meter in the Chlorine Booster Station. Both the irrigation flows and the rapid infiltration flows travel through this meter.

(2) These flows are read at two, 2 inch water meters located at the rapid infiltration site.

(3) These are the flows that have been read at the main meter located in the Chlorine Booster Station.

Town of Oliver Sewer Flows - PE - 13717

	High Lift Station					
September	Daily Flow m3/day	Total Monthly m3/day	Monthly Average m3/day	Total Daily m3/day (3)	Total Monthly m3/day	Monthly Average m3/day
1	2719			2082		
2	1973			1468		
3	727			1567		
4	1749			847		
5	1579			2553		
6	1968			2119		
7	1659			2304		
8	3148			1221		
9	1503			1268		
10	709			2273		
11	1665			1812		
12	1946			1278		
13	1594			0		
14	1756			565		
15	2492			0		
16	1828			530		
17	629			0		
18	1589			1022		
19	1603			1125		
20	1564			2176		
21	1571			899		
22	2385			1454		
23	1437			0		
24	1076			1023		
25	1545			1703		
26	1569			1834		
27	1544			370		
28	1507			851		
29	2413			1470		
30	2108			0		
31						
		51556	1719		35811.5	1194
	OC Limit	n/a	2050m3/day		n/a	n/a

Notes:

(1) These readings have been calculated by subtracting the flows read at the rapid infiltration site, from the flows read on the main meter in the Chlorine Booster Station. Both the irrigation flows and the rapid infiltration flows travel through this meter.

(2) These flows are read at two, 2 inch water meters located at the rapid infiltration site.

(3) These are the flows that have been read at the main meter located in the Chlorine Booster Station.

Town of Oliver Sewer Flows - PE - 13717

	High Lift Station					
October	Daily Flow m3/day	Total Monthly m3/day	Monthly Average m3/day	Total Daily m3/day (3)	Total Monthly m3/day	Monthly Average m3/day
1	235			509		
2	1688			0		
3	1717			0		
4	1656			0		
5	1646			510		
6	2599			0		
7	1822			0		
8	721			0		
9	1606			0		
10	1551			0		
11	1603			505		
12	1716			746		
13	2582			1066		
14	1794			0		
15	713			2295		
16	1619			4233		
17	1575			4305		
18	1572			3693		
19	1608			549		
20	2496			0		
21	1746			807		
22	722			1512		
23	1598			0		
24	1595			0		
25	1599			12		
26	1478			0		
27	2684			0		
28	1833			0		
29	651			1		
30	1599			0		
31	1633			0		
		49658	1602		20742.5	669
	OC Limit	n/a	2050m3/day		n/a	n/a

Notes:

(1) These readings have been calculated by subtracting the flows read at the rapid infiltration site, from the flows read on the main meter in the Chlorine Booster Station. Both the irrigation flows and the rapid infiltration flows travel through this meter.

(2) These flows are read at two, 2 inch water meters located at the rapid infiltration site.

(3) These are the flows that have been read at the main meter located in the Chlorine Booster Station.

Town of Oliver Sewer Flows - PE - 13717

	High Lift Station					
November	Daily Flow m3/day	Total Monthly m3/day	Monthly Average m3/day	Total Daily m3/day (3)	Total Monthly m3/day	Monthly Average m3/day
1	1634			0.0		
2	1605			0.0		
3	2512			0.0		
4	1500			0.0		
5	886			0.0		
6	1581			0.0		
7	1609			0.0		
8	1581			0.0		
9	1591			0.0		
10	2425			0.0		
11	1632			0.0		
12	491			0.0		
13	1605			0.0		
14	1683			0.0		
15	1654			0.0		
16	1666			0.0		
17	2287			0.0		
18	1594			0.0		
19	568			0.0		
20	1646			0.0		
21	1632			0.0		
22	1596			0.0		
23	1558			0.0		
24	2241			0.0		
25	1630			0.0		
26	634			0.0		
27	2245			0.0		
28	3849			0.0		
29	5415			0.0		
30	1568			0.0		
31				0.0		
		54118	1804		0.0	0
	OC Limit	n/a	2050m3/day		n/a	n/a

Notes:

(1) These readings have been calculated by subtracting the flows read at the rapid infiltration site, from the flows read on the main meter in the Chlorine Booster Station. Both the irrigation flows and the rapid infiltration flows travel through this meter.

(2 & 3) These are the flows that have been read at the main meter located in the Chlorine Booster Station.

Town of Oliver Sewer Flows - PE - 13717

	High Lift Station					
December	Daily Flow m3/day	Total Monthly m3/day	Monthly Average m3/day	Total Daily m3/day (3)	Total Monthly m3/day	Monthly Average m3/day
1	2461			0.0		
2	1626			0.0		
3	472			0.0		
4	1640			0.0		
5	1603			0.0		
6	1575			0.0		
7	1625			0.0		
8	2491			0.0		
9	1668			0.0		
10	483			0.0		
11	1656			0.0		
12	1658			0.0		
13	1626			0.0		
14	1606			0.0		
15	2369			0.0		
16	1475			0.0		
17	677			0.0		
18	1582			0.0		
19	1550			0.0		
20	1599			0.0		
21	1564			0.0		
22	2424			0.0		
23	1567			0.0		
24	581			0.0		
25	1426			0.0		
26	1391			0.0		
27	1613			0.0		
28	1594			0.0		
29	2437			0.0		
30	1491			0.0		
31	516			0.0		
		48044	1550		0.0	0
	OC Limit	n/a	2050m3/day		n/a	n/a

Notes:

(1) These readings have been calculated by subtracting the flows read at the rapid infiltration site, from the flows read on the main meter in the Chlorine Booster Station. Both the irrigation flows and the rapid infiltration flows travel through this meter.

(2 & 3) These are the flows that have been read at the main meter located in the Chlorine Booster Station.

APPENDIX C

Reclaimed Water Storage Reservoir Level and Flow Data & Volume Calibration Curve

TOWN OF OLIVER

RECLAIMED WATER USE BY CUSTOMER
(Readings in m3)

LOCATION	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
AIRPORT	221400.0	238400.0	203100.0	161600.0	131800.0	201050.0	147688.3	153841.2	185686.70	124891.7	115743.3	98510.9	101779.8	99601.3
CEMETERY	14015	14125	17325	17000	18215	13311.2	16338.73	14607.36	19159.94	15996.1	14354.03	14843.27	13399.67	12651.17
PUBLIC WORKS YARD	7720	12535	7580	5575	5795	6155.8	5163.96	6408.64	7085.72	7393.22	7380.1	8094.8	8340.74	6260.65
103 STREET PARK	4555	9255	7090	5280	6345	5377.24	6232.1	6621.86	8051.37	8749.04	7647.12	8359.52	**1030.6***	5927.68
SOSS										48457	4873.58	0	1.55	0
ALONSO						3495.31	1670.9	7014.59	6714.65	3892.74	3850.51	2364.03	2498.39	1794.43
HUGGINS						15536.5	3787.05	2872.33	1290.33	meter off	8554.16	0	0	0

*September and October only (2017)

Other Users Not Metered:

- Fairview Mountain Golf Course
- Fairview Park (new 2015)

TOWN OF OLIVER
STORAGE RESERVOIR
LEVEL DATA

	JANUARY		FEBRUARY		MARCH		APRIL	
DAY	ELEVATION	VOLUME IN STORAGE*	ELEVATION	VOLUME IN STORAGE*	ELEVATION	VOLUME IN STORAGE*	ELEVATION	VOLUME IN STORAGE*
1								
2	444.75	296,000					446.41	391,000
3								
4								
5			445.36	338,000	446.00	370,000		
6								
7								
8	444.88	308,000					446.27	384,000
9								
10								
11								
12					446.12	376,000		
13			445.53	346,000				
14								
15								
16	445.05	319,000					446.24	382,000
17								
18								
19			445.68	354,000	446.30	385,000		
20								
21								
22	445.1	322,000						
23							446.1	375,000
24								
25								
26			445.81	360,000	446.04	372,000		
27								
28								
29	445.21	330,000						
30								
31								

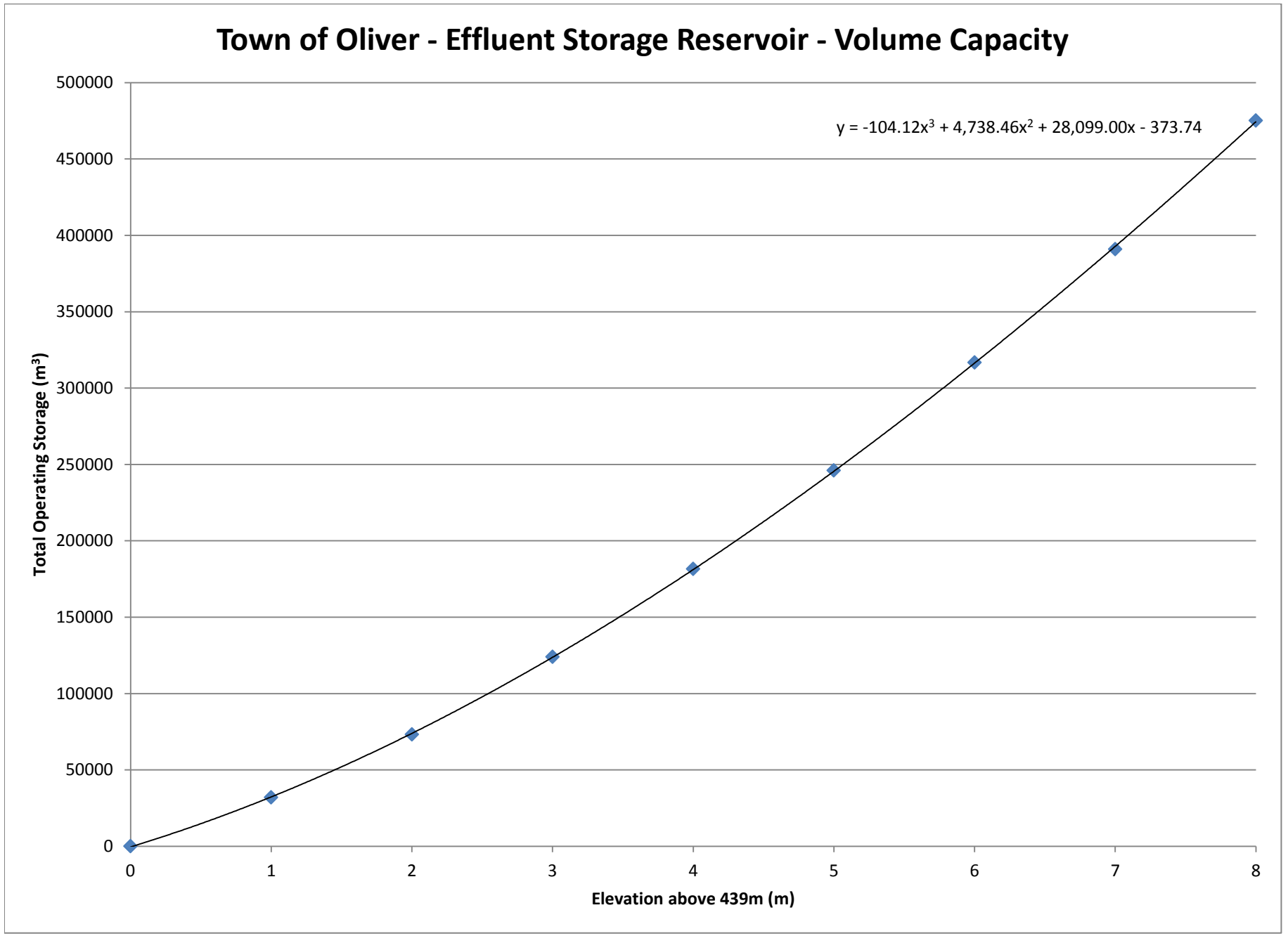
* Volume in Storage above Elevation 439.00
Elevation 439.00 is minimum 60 day average operating level

DAY	MAY		JUNE		JULY		AUGUST	
	ELEVATION	VOLUME IN STORAGE*	ELEVATION	VOLUME IN STORAGE*	ELEVATION	VOLUME IN STORAGE*	ELEVATION	VOLUME IN STORAGE*
1								
2	446.12	376,000						
3					444.93	312,000		
4								
5								
6							443.77	230,000
7								
8								
9					444.73	295,000		
10								
11			445.62	351,000				
12								
13								
14	445.98	369,000						
15								
16								
17								
18								
19								
20							443.41	208,000
21								
22	445.80	360,000						
23					444.31	266,000		
24								
25								
26								
27								
28	445.76	358,000						
29								
30								
31								

* Volume in Storage above Elevation 439.00
Elevation 439.00 is minimum 60 day average operating level

DAY	SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
	ELEVATION	VOLUME IN STORAGE*	ELEVATION	VOLUME IN STORAGE*	ELEVATION	VOLUME IN STORAGE*	ELEVATION	VOLUME IN STORAGE*
1								
2								
3							444.4	276,000
4	443.25	197,000						
5					444.05	249,000		
6								
7								
8								
9								
10	443.17	193,000					444.48	279,000
11								
12								
13					444.19	257,000		
14								
15			443.58	219,000				
16								
17	443.26	198,000					444.55	284,000
18								
19					444.31	266,000		
20								
21								
22			443.44	209,000				
23								
24	443.29	200,000					444.63	289,000
25								
26					444.44	276,000		
27								
28								
29			443.59	219,000				
30								
31								

* Volume in Storage above Elevation 439.00
Elevation 439.00 is minimum 60 day average operating level



R:\Clients\300-399\306\306-084\04 Design\Effluent Storage Reservoir Calculation.xlsx

Town of Oliver - Effluent Storage Reservoir - Volume Capacity

Reservoir Elevation (m)	Elevation above 439m (m)	Measured Volume (m^3)	Calculated Volume (m^3)	% Difference from Measured
439	0	0	-374	N/A
440	1	32000	32360	1%
441	2	73300	73945	1%
442	3	124000	123758	0%
443	4	181600	181174	0%
444	5	246000	245568	0%
445	6	316800	316315	0%
446	7	391000	392791	0%
447	8	475200	474370	0%

APPENDIX D

2018 Irrigation Plan

December 13, 2018 Our File: 306-088-005

Ministry of Environment & Climate Change Strategy
102 Industrial Place
Penticton, B.C.
V2A 7C8

Attn: Regional Waste Manager

Dear Sir/Madam:

RE: *Town of Oliver – Update to Reclaimed Water Irrigation Plan - OC PE-13717*

The Town of Oliver requests approval from the Ministry for expansion of their reclaimed water irrigation system as authorized in Operational Certificate PE-13717. The current works authorized within this Operational Certificate are outlined in Site Plan A, dated December 14, 1995. The areas include:

Location	Legal Description
Fairview Mountain Golf Course	Lot 1, Plan KAP62023, DL2450S, SDYD
Alonso	Lot A, Plan KAP37929, Sec 12, Township 54, SDYD
Huggins	Lot 3, Plan KAP5881, Sec 12, Township 54, SDYD

The Town requests authorization for expansion of the irrigation system. The expansion areas are shown in Figure 1 enclosed herein. They are identified as Reclaimed Water Irrigation Expansion Areas (2006). Their location and legal descriptions of the expansion areas are as follows.

Location	Legal Description
High School Park	- Lot 2H, DL 2450S, SDYD, Townsite of Oliver - Southern portion of Block C, DL 2450S, SDYD, Irrigation Lateral SRW shown on PL 330, Lot 2G BLF52 on Oliver Townsite map
Fairview Park	- Lot 2J, DL 2450S, SDYD, Townsite of Oliver - Block 34, DL 2450S, SDYD, Townsite of Oliver, Incl Closed Rd PL B7567
Oliver Secondary School	Block 32, Plan KAP4297, DL 2450S, SDYD
Public Works	Lot 2, Plan KAP54258, DL 2450S, SDYD
Airstrip	Lot 2, Plan KAP38137, DL 2450S, SDYD
Cemetery	Lot 1, Plan KAP 24065, DL 2450S, SDYD, Portion L 203A

.../2

Total reclaimed water use is measured by a flow meter located at the booster station, adjacent to the reclaimed water storage reservoir. Meters have also been installed at the Cemetery, Airport, Public Works Yard, Alonso Property, Southern Okanagan Secondary School, High School Park and Huggins Property for the purposes of measuring total reclaimed water use at each location. There is no flow meter on the irrigation service to the Fairview Mountain Gold Course. Usage is calculated as the total annual irrigation, less all other metered usage. Annual reporting of the irrigated areas will be consistent with the reporting requirements as outlined in PE-13717 and include the total usage, crop type, irrigated area, irrigation application rate, and irrigation period.

Groundwater monitoring plans are established for the airport and Fairview Mountain Gold Course sites, the two largest users of reclaimed water. Sampling data is included in annual reporting.

As per the operational certificate, no reclaimed wastewater will be applied to the ground any closer than 15 metres from the edge of flowing streams or bodies of water. Additionally, no reclaimed wastewater is irrigated within 30 metres of any well or inground reservoir for domestic supply.

Should questions arise or for additional information, please do not hesitate to contact the undersigned.

Yours truly,

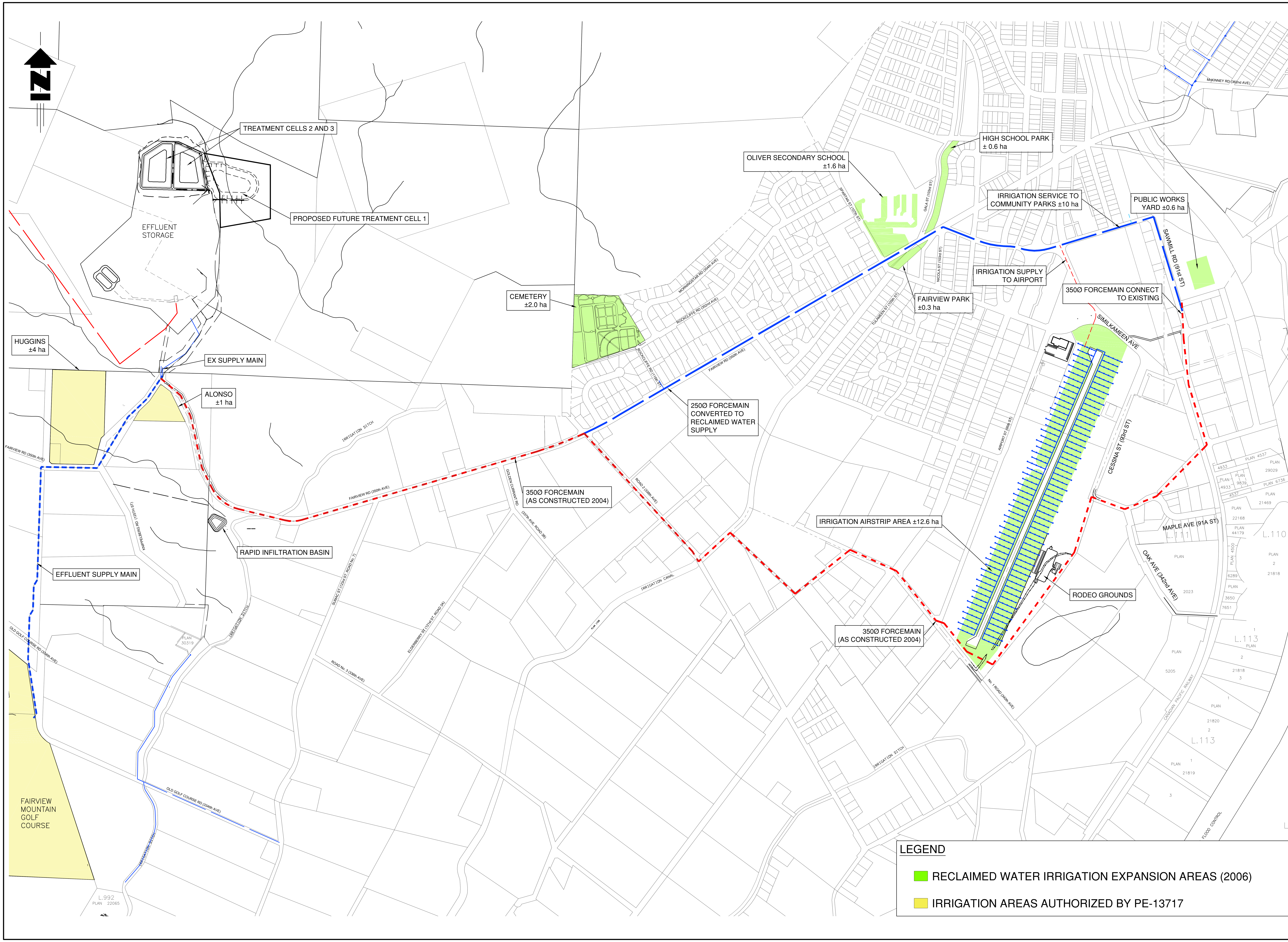
TRUE CONSULTING

Steve Underwood, P. Eng.

Enclosures

NA/

R:\Clients\300-399\306\306-088-005\02 Correspondence\Outgoing\To MoE\306-088-005-MoE-Oliver Treated Effluent Irrigation Area Expansion Notification-2018 12 13.docx


N
TREATMENT CELLS 2 AND 3
PROPOSED FUTURE TREATMENT CELL 1
EFFLUENT STORAGE
HUGGINS ±4 ha
EX SUPPLY MAIN
ALONSO ±1 ha
RAPID INFILTRATION BASIN
EFFLUENT SUPPLY MAIN
FAIRVIEW MOUNTAIN GOLF COURSE
CEMETERY ±2.0 ha
OLIVER SECONDARY SCHOOL ±1.6 ha
HIGH SCHOOL PARK ± 0.6 ha
IRRIGATION SERVICE TO COMMUNITY PARKS ±10 ha
PUBLIC WORKS YARD ±0.6 ha
IRRIGATION SUPPLY TO AIRPORT
350Ø FORCEMAIN CONNECT TO EXISTING
FAIRVIEW PARK ±0.3 ha
250Ø FORCEMAIN CONVERTED TO RECLAIMED WATER SUPPLY
350Ø FORCEMAIN (AS CONSTRUCTED 2004)
IRRIGATION AIRSTRIP AREA ±12.6 ha
RODEO GROUNDS
350Ø FORCEMAIN (AS CONSTRUCTED 2004)
SAWMILL RD (91st ST)
SIMILKAMEEN AVE
CESSNA ST (93rd ST)
MAPLE AVE (91A ST)
OAK AVE (342nd AVE)
FAIRVIEW RD (350th AVE)
OLD GOLF COURSE RD (334th AVE)
IRRIGATION DITCH
IRRIGATION CANAL
LEGEND
RECLAIMED WATER IRRIGATION EXPANSION AREAS (2006)
IRRIGATION AREAS AUTHORIZED BY PE-13717

No.	DATE	DESCRIPTION	BY	APPD

ISSUES / REVISIONS

CONSULTANT SEAL

TRUE CONSULTING

201 - 2079 Falcon Road ▪ Kamloops BC ▪ V2C 4J2
tel 250.828.0881 ▪ fax 250.828.0717
info@TRUE.bc.ca

British Columbia — Town of Oliver

SANITARY SEWER SYSTEM

OVERALL PLAN RECLAIMED WATER SYPPLY SYSTEM AND IRRIGATION AREAS

SCALE N.T.S. (11x17)

PROJECT REFERENCE No. 306-088-005

DRAWING No. **FIG 1**

SHEET 1 OF 1

ISSUE/REV.

January 17, 2019 Our File: 306-088-005

Ministry of Environment & Climate Change Strategy
102 Industrial Place
Penticton, B.C.
V2A 7C8

Attn: Jen Pape, Environmental Protection Officer, Municipal Liquid Waste

Dear Ms. Pape:

RE: *Town of Oliver – Irrigation Area Expansion Notification - OC PE-13717*

In response to your email dated January 10, 2018, the following supplemental information is provided to support the Update to Reclaimed Water Irrigation Plan submitted to the Ministry on December 13, 2018.

1. The Town currently provides treated reclaimed water to the Alonso and Huggins vineyards for irrigation purposes. The Huggins service is turned off, but this service provides a backup source to the user in the event of a drought period. Both vineyards use drip irrigation to water crops. There are no supplemental food crops in the irrigation area.

2. The following drawings of the Town of Oliver Effluent Infiltration Basin are enclosed herein:
    a. General Location Map (Dwg. No. 306-1201-05)
    b. Effluent Infiltration Basin Plan and Profile (Dwg. No. 306-1322-03)

Should questions arise or for additional information, please do not hesitate to contact the undersigned.

Yours truly,

TRUE CONSULTING

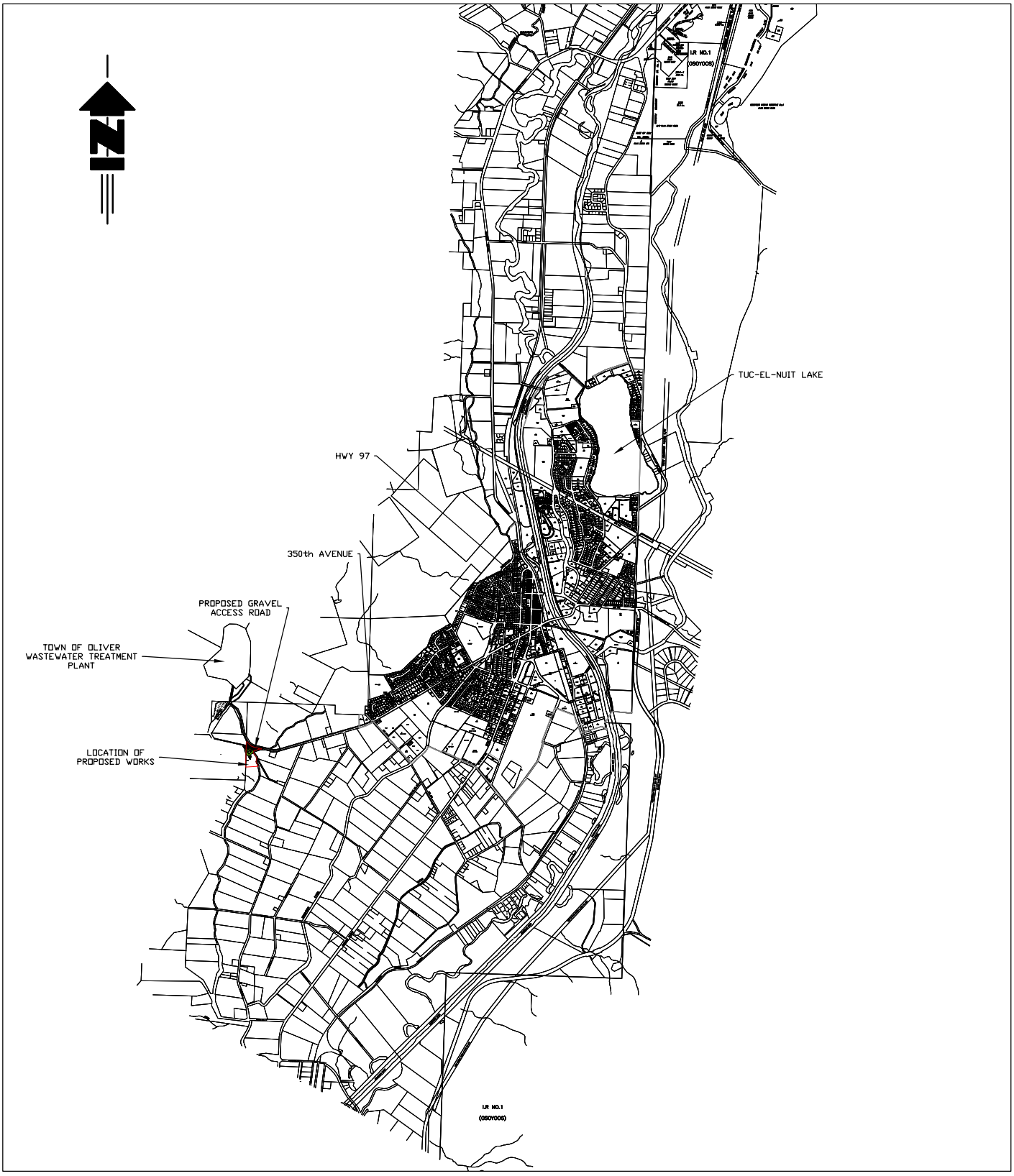
Natalie Alteen

Natalie Alteen, EIT

Enclosures

NA

R:\Clients\300-399\306\306-088-005\02 Correspondence\Outgoing\To MoE\Irrigation Area Expansion Notification\306-088-005-MoE-Oliver Treated Effluent Irrigation Area Expansion Notification-2019 01 17.docx



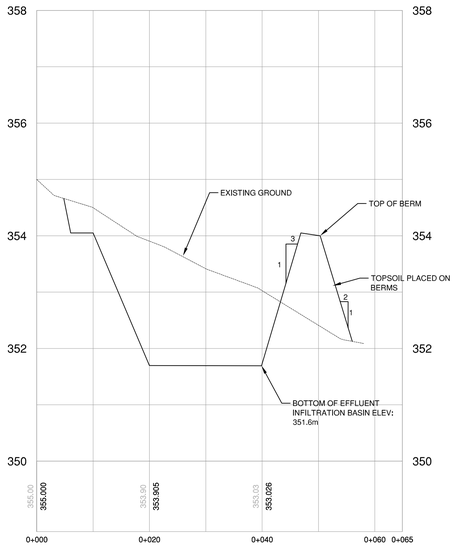
TOWN OF OLIVER

GENERAL LOCATION MAP

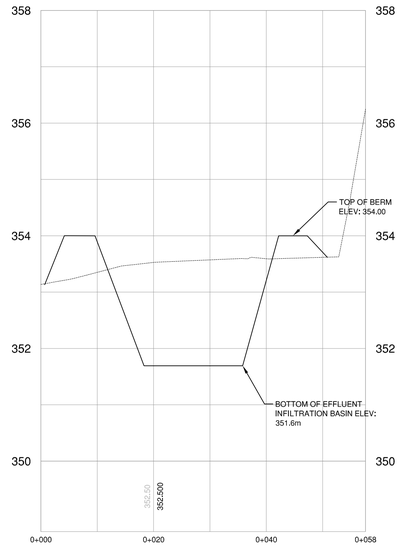
TRUE CONSULTING

DSGN. BY:	
SCALE:	1:50,000
DWG. NO.:	REV.:
306-1201-05	
DWN. BY: KK	
DATE: NOV 2011	

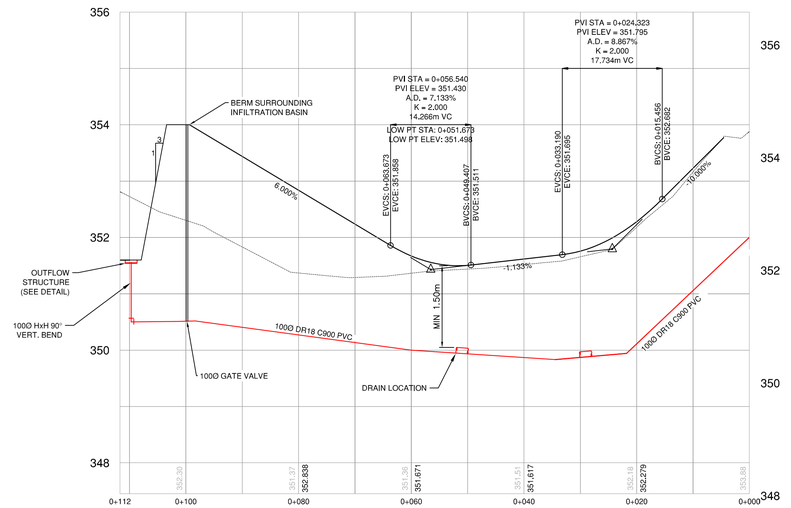
FILE: x:\landprojects2007\306-1201p\dwg\306-1201.dwg

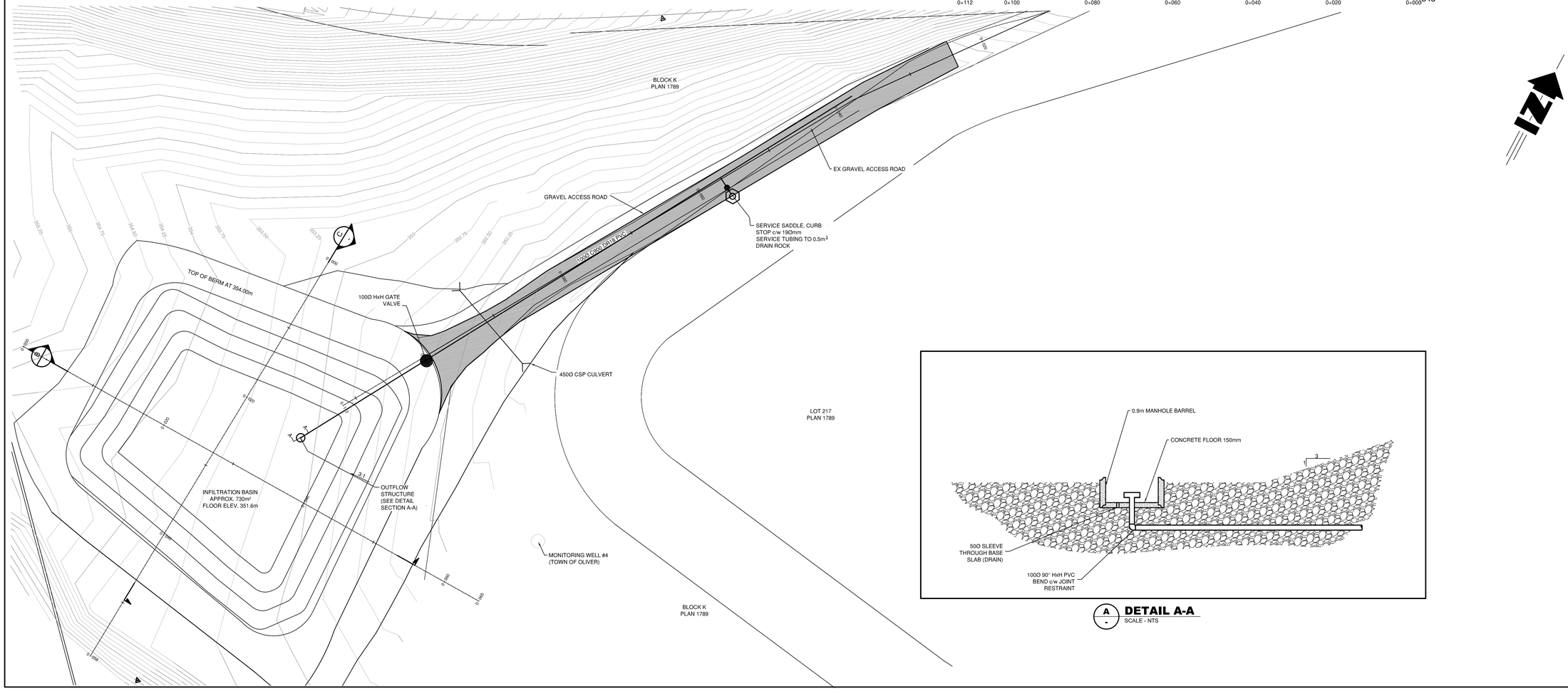


B - **EFFLUENT INFILTRATION BASIN SECTION B-B**
SCALE - 1:50



C - **EFFLUENT INFILTRATION BASIN SECTION C-C**
SCALE - 1:50





A - **DETAIL A-A**
SCALE - NTS

No.	DATE	DESCRIPTION	BY	APP'D
2	SEPT 25/14	RECORD DRAWING	SP	SU
1	SEPT 25/13	ISSUED FOR TENDER	SP	SU

ISSUES / REVISIONS

CONSULTANT SEAL

TRUE CONSULTING
201 - 2079 Falcon Road ≡ Kamloops BC ≡ V2C 4J2
tel 250.828.0881 ≡ fax 250.828.0717
info@TRUE.bc.ca

TOWN OF OLIVER

EFFLUENT INFILTRATION BASIN

PLAN AND PROFILE

SCALE	1:250 1:50
DESIGN BY	TRU/SU
DRAWN BY	WF/SP
DATE	SEPTEMBER 2013
PROJECT REFERENCE No.	306-1201
DRAWING No.	306-1322 **03**
SHEET	03 OF 03
REVISION	02

BRITISH COLUMBIA

Reference: 66483

AUG 06 2002

Her Worship Mayor Linda Larson
and Councillors
Town of Oliver
PO Box 638
Oliver BC V0H 1T0

Dear Mayor Larson and Councillors:

I am pleased to inform you that the update to the Town of Oliver's Liquid Waste Management Plan (LWMP) is hereby approved in principle in accordance with section 18 of the *Waste Management Act*.

I recognize that your LWMP update was rather complicated and required the concerted efforts of your staff and your consultant to complete. I commend your efforts and those of your consultant and wish you well in the continued implementation of your LWMP.

The implementation and administration of the LWMP will require resolution of details involving financial, engineering, operational and administrative elements, and I request that you continue to work closely with ministry staff on plan implementation details. I am sending a copy of this letter to my colleague, the Minister of Community, Aboriginal and Women's Services (formerly Municipal Affairs), the Honourable George Abbott so that he is aware of my support for your funding request for the continued implementation of this plan.

Best regards,

Joyce Murray
Minister

cc: The Honourable George Abbott, Minister of Community, Aboriginal and Women's Services

FILE:
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Ministry of
Water, Land
and Air Protection

Office of the Minister

Mailing Address:
Parliament Buildings
Victoria BC V8V 1X4

APPENDIX E

Seasonal Precipitation Data

Seasonal Precipitation Summary

Oliver STP

YEAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	SEASON TOTAL (mm)
1992	41.4	8.0	64.8	62.0	9.8	2.2	11.8	200.0
1993	50.6	34.5	48.0	67.9	39.5	18.4	14.8	273.7
1994	42.4	30.8	37.8	12.2	33.9	17.4	24.8	199.3
1995	17.5	17.9	37.6	10.2	22.6	7.5	10.6	123.9
1996	15.8	62.2	27.9	24.2	5.2	52.3	28.2	215.8
1997	35.3	41.8	87.9	47.6	18.5	63.4	29.0	323.5
1998	29.4	79.1	31.2	25.1	12.3	2.9	33.7	213.7
1999	20.1	28.9	40.3	15.5	44.1	1.2	11.7	161.8
2000	10.4	24.8	25.8	26.7	4.5	14.4	19.6	126.2
2001	37.6	16.4	39.4	32.2	15.0	13.6	24.1	178.3
2002	8.7	43.0	4.8	9.8	0.3	9.4	7.3	83.3
2003	29.4	18.4	12.9	0	0.0	11.4	21.7	93.8
2004	27.9	30.7	56.0	7.8	27.7	32.3	48.9	231.3
2005	12.4	41.1	48.4	2.9	1.3	2.9	22.4	131.4
2006	20.8	52.0	36.0	14.2	0.1	8.7	12.4	144.2
2007	4.9	3.2	24.1	29.0	2.8	12.2	11.6	87.8
2008	5.0	3.65	27.5	5.0	19.9	2.7	9.9	73.7
2009	4.8	26.8	13.4	28.6	27.8	20.2	39.5	161.1
2010	20.0	55.9	68.3	14.6	9.1	38.9	13.7	220.5
2011	12.5	69.6	24.4	18.7	0.0	3.4	22.4	151.0
2012	39.9	14.8	78.7	46	0.3	2	40.8	222.5
2013	16.5	30.5	35.0	8.6	36.6	47.5	5.6	180.3
2014	15.3	24.4	42.8	25	12.2	19.3	35.9	174.9
2015	2.2	54.4	13.2	17	19.9	3	26.3	136.0
2016	5.8	14.9	38.5	25.9	1.2	16.4	62.8	165.5
2017	40.5	61.2	21.2	0	0.0	4.8	5.3	133.0
2018	50.4	31.3	53.2	31.4	1.5	9.4	33.1	210.3
Avg.	22.9	34.1	38.5	22.5	13.6	16.2	23.3	171.0

1992 to 1996 data from Environment Canada
1997 - present data compiled from Town of Oliver daily records

APPENDIX F

2019 Sludge Management Plan

Sludge Monitoring (Quality) Data

TOWN OF OLIVER
PE-13717 - Effluent Sludge - Cell #2

ANALYTICAL REPORT - Sampled on November 13, 2018

			WALP Guidelines			
Parameter	***Unit***	**CELL 2 EFF SLUDGE-1**	**Agricultural Low Grade**	**Agricultural High Grade**	**Retail Low Grade**	**Retail High Grade**
Aluminum	ug/g	8170				
Antimony	ug/g	1.45				
Arsenic	ug/g	8.24	75	75	75	75
Barium	ug/g	334				
Beryllium	ug/g	0.22				
Bismuth	ug/g	17.7				
Cadmium	ug/g	2.07	25	20	20	5-20
Calcium	ug/g	14300				
Chromium	ug/g	33.5				
Cobalt	ug/g	2.72	150	150	150	150
Copper	ug/g	1210				
Iron	ug/g	8760				
Lead	ug/g	29.5	1000	500	500	500
Magnesium	ug/g	3230				
Manganese	ug/g	148				
Mercury	ug/g	4.06	10	5	5	5
Molybdenum	ug/g	19.4	20	20	20	20
Nickel	ug/g	19.5	200	180	180	180
Phosphorus	ug/g	7570				
Potassium	ug/g	850				
Selenium	ug/g	12.3	14	14	14	14
Silver	ug/g	17.3				
Sodium	ug/g	1330				
Strontium	ug/g	192				
Tellurium	ug/g	<0.10				
Thallium	ug/g	<0.10				
Tin	ug/g	23				
Titanium	ug/g	63.4				
Vanadium	ug/g	20.4				
Zinc	ug/g	921	2500	1850	1850	1850
Zirconium	ug/g	3.1				

Total Solids	%	9.9
Volatile Solids	%	36.6

Sludge Management Plan

Town of Oliver

March 2019

Project No. 306-088-006

TRUE

ENGINEERING ■ PLANNING ■ URBAN DESIGN ■ LAND SURVEYING

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1	1	Town of Oliver
	1	Ministry of Environment
1	1	TRUE Consulting

Revision Log

Revision #	Revised by	Date	Issue / Revision Description

Report Submission

Report Prepared By:

Natalie Alteen, EIT
Project Engineer

Report Reviewed By:

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
T. R. UNDERWOOD

Terry Underwood, P. Eng.
Project Engineer
Mar 13 / 2019

R:\Clients\300-399\306\306-088-006\05 Reports\2019 Sludge Management Plan\306-088-006-Oliver Sludge Management Plan-March 2019.docx

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List of Figures

List of Acronyms

BC MOE	British Columbia Ministry of Environment,
OC	Operational Certificate
OCP	Official Community Plan
OMRR	Organic Matter Recycling Regulation
TRUE	TRUE Consulting

Units of Measure

ft	feet
km	kilometre
L/d	Litres per day
L/m	Litres per minute
L/s	Litres per second
lpcd	Litres per capita per day
m	metre
mg/L	milligrams per Litre
mm	millimetre
NTU	Nephelometric Turbidity Units
psi	pounds per square inch
USgpm	US gallons per minute

Referenced Reports

Lambourne Environmental	“Lagoon Survey Report for Town of Oliver Cells 1 & 2,” December 2011
Canadian Council of Ministers of the Environment	“Guidance Document for the Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage,” 2012
TRUE Consulting	“Sanitary Sewer System 2017 Annual Report,” February 2018

1.0 Background

The wastewater treatment facility for the Town of Oliver has been in operation since 1965. From 1965 to 1984, the Town operated a treatment plant for municipal wastewater and discharged treated effluent to the Okanagan River. In response to regulatory agency requirements for reduced phosphorus loadings to surface water courses in the Okanagan River Basin, the Town constructed effluent storage and land disposal systems in the Fairview area in 1983 and 1984. Since 1985, the Town has utilized treated effluent in the Fairview area with the principle end user of treated effluent being the Fairview Mountain Fold Course. In 1995, a two-cell aerated lagoon system was constructed in the Fairview area (see Figure 1).

The existing treatment facility is comprised of influent screening, equalization storage, a two-cell aerated lagoon treatment system, winter effluent storage, chlorination contact chamber and reclaimed water irrigation.

In accordance with the Town of Oliver's Operation Certificate (OC) No. PE-13717 issued under the provisions of the Waste Management Act, the Town has prepared a Sludge Management Plan as it relates to the wastewater treatment facility. This document outlines the monitoring, management and beneficial use of the Town's municipal biosolids.

2.0 Characterization of Sludge

The Town of Oliver's wastewater collection system is generated primarily from residential and commercial buildings. The sludge is comprised of a mixture of fecal matter, organic and inorganic materials. Trace amounts of heavy metals, solvents, and petroleum products may enter the system as a result of municipal activities.

Source control initiative are imperative as they ensure the wastewater treatment facility functions properly, operator health and safety are protected, and the quality of treated effluent/biosolids is maintained. This mandate is included in the Town's Official Community Plan (OCP) Bylaw 1370, which prioritizes public awareness for potential groundwater contamination and health hazards related to the discharge of toxic substances into the municipal drainage system.

3.0 Sludge Sampling and Monitoring Program

3.1 System Design

Effluent is pumped from the equalization basins to the aerated lagoon Cells No. 2 and No.3 via the High Lift Station. Biological degradation and sedimentation of suspended solids is a primary function of the aerated lagoons system. Treatment is accomplished through the stabilization of organic wastes by bacteria and algae. Waste products include carbon dioxide (CO_2), ammonia and phosphates.

The aerated lagoon treatment system is comprised of two treatment cells, with aeration allowing for microbial degradation of organic material. Effluent enters Cell No.2 and then proceeds to secondary treatment in Cell No.3.

Cell No.2 provides primary digestion of influent. As such, sludge accumulates around the perimeter of the cell in the low current areas. This material sinks to the bottom of the cell, forming a sludge blanket. The capacity of Cells No.2 and No.3 are as follows. Each lagoon has a maximum operating depth of 5.3 m.

Cell No.2

Surface Area at FWL 11,000 m^2
Storage Volume 37,600 m^3

Cell No.3

Surface Area at FWL 10,100 m^2
Storage Volume 38,200 m^3

Anaerobic degradation occurs in areas with low dissolved oxygen and sunlight. Anaerobic bacteria produce water, carbon dioxide, nutrients, ammonia, alkalinity, hydrogen sulfide and methane as waste products.

On this basis, solids accumulations will occur in the aerated lagoons and require removal from the system. Excessive solids accumulations in the cells may result in odours, visible masses of floating solids on the lagoon surface, reduced detention time and degraded effluent quality.

The rate at which solids accumulate in the aerated cells and the point at which accumulations may significantly impair the operation of the system varies. Piping and other design provisions have been made for a future third cell construction east of the existing lagoons (see Figure 2).

Overall, the Operational Certificate for the system required the Town of Oliver to develop a strategy or plan to ultimately deal with sludge accumulations in the aerated cells. The OC specifies the following limits:

- Discharge rate – 2,200 m^3/day
- 5 Day Biochemical Oxygen Demand – 45 mg/L
- Total Suspended Solids – 60 mg/L

3.2 Theoretical Sludge Production Rates

Sludge accumulation rates within the system are dependent on the following variables:

- Amount of suspended solids entering the system in the raw sewage. Influent suspended solids to the treatment system are reduced as the influent is screened prior to entering the aerated lagoons.
- Operating temperature. As sludge accumulates on the floor of each cell, anaerobic digestion processes occur. This results in volatile solids removal and corresponding reductions in accumulated solids volume and mass. The digestion process is temperature dependent. Recognizing the geographic location of Oliver and generally "hot" summer weather conditions, anaerobic digestion processes on the floor of the cells represent a mechanism for significant sludge volume and mass reductions.
- Hydraulic load to the system and residence time.
- Sludge characteristics and compression. As sludge accumulates on the bottom of the lagoons, compression of the actual sludge mass will occur. This results in higher solids concentrations expressed as a % solids. Literature suggests that compression mechanisms are time and characteristic dependent.

Recognizing that influent is screened, there are favorable conditions for in-pond anaerobic digestion. The cells are adequately sized to allow for associated compression processes and there is no chemical addition to the system. Therefore, sludge accumulation within the lagoon cells is expected to be lower that other systems within the region.

A theoretical sludge accumulation rate calculation is presented herein. This rate is based on an assumed sludge production rate of 0.2 kg/kg of BOD removal. This sludge production rate is typical of extended aeration treatment plants in which digestion processes represent a mechanism for internal sludge quantity reductions:

	Influent BOD Loading	180 mg/L
	Average Influent Flow	2000 m^3/d
	Total BOD Daily Loading	360 kg/d
Cell No. 2	Average BOD removal Cell #2- 70% of influent	250 kg/d
	Theoretical Sludge Production- 250 x 0.2	50 kg/d
	Sludge Volume/day= 50 kg @ 10% solids	0.50 m^3/d
	Sludge Volume/year	182 m^3/yr
Cell No. 3	Average BOD removal Cell #3- 70% of Cell #2 effluent	80 kg/d
	Theoretical Sludge Production- 80 x 0.2	16 kg/d
	Sludge Volume/day= 16 kg @ 10% solids	0.16 m^3/d
	Sludge Volume/year	60 m^3/yr

The preceding calculations suggest that the sludge accumulation rate in Cell No.2 will occur at a rate at least three times greater than Cell No.3. This has been shown in accumulation surveys and described in Section 4.0.

3.3 Monitoring Methods

Sludge accumulation are to be measured by direct and indirect monitoring as described herein.

3.3.1 Direct Monitoring

Direct sludge monitoring should be undertaken every two years. It is important that sampling is completed at the same time each year. In this manner, inaccuracies related to temperature dependent digestion process will be eliminated. September or October are suggested as the most appropriate periods to undertake a sludge accumulation survey.

The primary objective is to define the amount of sludge accumulation by probing the cell bottom and recording the apparent sludge thickness and location on a plan of the lagoon system. Each successive monitoring activity should attempt to probe approximately the same locations to assist in the determination of the accumulation rate.

Anticipated primary areas of sludge accumulation will be in the general vicinity of the inlet piping in the relatively quiescent areas between air diffusers. Sludge will generally not accumulate in the vicinity of the aerators.

The design depth of the lagoons (5.3m) will make in-cell measurements of sludge accumulation less than straightforward. Sludge accumulation measurements may be simplified to some extent by lowering the operating levels of Cells No.2 and No.3 by lowering the slide gate in hydraulic structure S-3. Lowering of operating levels should be undertaken on a gradual basis.

Any deviation from normal operation (i.e. lowering of operating levels) will require notification and approval of the Ministry of Environment.

3.3.2 Indirect Monitoring

Indirect Monitoring of sludge accumulation can be accomplished via analysis of treated effluent water quality. If treated effluent water quality exceeds the permitted discharge concentration limits, assessment of the sludge accumulation depth is triggered.

3.4 Sludge Sampling

Which final disposal method for sludge removed from the lagoons will be dependent on the characteristics of the sludge and require approval from the MOE. To enable evaluation of sludge disposal options and to support a proposal/plan submission for approval to the MOE, it is recommended that a minimum of two sludge samples be taken during accumulation surveys for physical and chemical analysis.

Samples may be obtained by a pipe-type probe or at depth samplers. Analysis of the sludge samples should include the following parameters:

% solids	
% volatile solids	
Fecal Coliform*	MPN/g*
Arsenic	(mg/kg)*
Cadmium	(mg/kg)
Chromium	
Cobalt	
Copper	(mg/kg)
Mercury	(mg/kg)
Molybdenum	(mg/kg)
Nickel	(mg/kg)
Lead	(mg/kg)
Selenium	(mg/kg)
Zinc	(mg/kg)

*On a dried weight basis

All parameters listed above should be analyzed during the initial phases of the sludge monitoring program. As data is compiled some parameters may be identified as not representing a concern, and in consultation with the MOE, the scope of the analysis accordingly reduced.

The chemical and physical characteristics of the final sludge product will be a major factor in determining the disposal method which will be acceptable to the MOE. The Town must follow the Organic Matter Recycle Regulation (OMRR) process and quality criteria for the desired end use of the bioldoids.

3.5 Sludge Removal

Sludge accumulation monitoring will provide data on when scheduling of sludge removal should be undertaken. Excessive sludge accumulations have the potential to significantly impact the performance of the system. Conditions that suggest accumulated sludge may be negatively impacting the system will be evident in the south-east corner area of Cell No 2, in the vicinity of the influent pipe. Indicators of excessive sludge accumulations in the area may include:

- Black color of wastewater
- Low dissolved oxygen concentrations
- Floating sludge masses
- Localized odours
- What appears to be “air bubbles” covering the lagoon surface during warm weather periods.

Sludge removal options which may be considered by the Town include the use of specialized equipment while the system is in operation, or alternatively draining of the cell for removal using excavation equipment. Equipment that can be utilized include: a float or barge mounted “dredge” type pump, floating discharge line, and on-shore portable sludge dewatering system.

The second approach involves cell draining and removal using excavation equipment. Utilization of this approach related to Cell No.2 is described herein.

3.5.1 Cell No.2 Draining Procedure

The procedure to drain Cell No.2 for sludge removal with a reduced water content is described as follows:

i. Lower the operating level of Cells No.2 and No.3 by gradually lowering the overflow weir gate in hydraulic structure S-3. This procedure should be undertaken over a 3 to 5 week period. When complete, the adjustable slide gate in hydraulic structure S-3 will be in the fully down position.

   IMPORTANT NOTE: Lowering of the operating level of the system is required to reduce the hydraulic head difference across the common berm between the cell to be drained and the cell remaining in operation. Failure to reduce the system operating level as described herein may result in localized instability and soil slumping at the toe of the slope of the common berm in the drained cell.

ii. The system should then be operated in the Cell No.2 bypass mode.

iii. The air supply to the aeration system in Cell No.2 should be shut off by closing isolation valves on the air header. Cautionary aspects related to the aeration system include:

   - Ensure air flow to diffuser units remining in service do not exceed the manufacturer’s recommended maximum per unit flow.
   - Confirm blower operation remains within the accepted operation range specified by the manufacturer.

   Operation of the aeration system with partial flow release to the pressure relief valve on the blower discharge piping may be necessary to maintain operation of the aeration system in Cell No.3 within ranges specified by both the blower and aeration system manufacturer.

iv. Reduce the operating level in Cell No.2 by opening valve V-5. Opening of valve V-5 will enable partial draining of Cell No.2, by gravity**,** to the winter effluent storage reservoir. Valve V-5 should be gradually opened such that the drop in liquid level in Cell No.2 does not exceed 150 mm per day.

v. Set up portable pumping equipment and completed draining of Cell No.2. Ideally, the discharge from the drainage pump will be directed into the Cell No.3 side chamber of hydraulic structure S-2. In this manner, contents from Cell No.2 will be provided treatment in Cell No.3 prior to discharge into the storage reservoir. Care

should be given to ensure the discharge piping is securely fastened to hydraulic structure S-2.

CAUTION: During draining operation of Cell No.*2, simply pumping the contents across the common berm with the discharge piping laid on the berm is not recommended. The pump discharge, in this case, could result in serious erosion and localized instability of the exposed and/or submerged berm slope in Cell* No.*3.*

Locating the pump at the north end of Cell No.2 is recommended to minimize operational problems associated with sludge plugging the pump suction and/or sludge being drawn into the pump and simply relocated to Cell No.3.

vi. Upon completion of draining, allow the exposed sludge accumulation to air dry. The period necessary for air drying is difficult to estimate. An air-drying period of at least one month should be anticipated in the schedule planning of the desludging operation. The objective of the drying period is to reduce the water content of accumulated sludge, thereby making removal by excavation equipment more straightforward.

vii. Disconnect air feeder lines from laterals and remove from the lagoon. Temporary caps should be placed on cell lateral outlets to prevent sludge or other foreign material from entering the lateral piping.

CAUTION: Care is essential to ensure foreign material does not enter the lateral piping when the air feeder lines are removed. If foreign material ends up in the lateral piping, it will be carried after reassembly by air flowing into the diffusers, leading to clogging.

While the lagoon cell is drained, the aeration system should be thoroughly inspected and any corroded or “suspect” components replaced. Replacement of the air diffuser membranes and ropers to the retrieval floats is straightforward with the cell drained and should be scheduled to be done concurrent with the desludging operation.

viii. Remove accumulated sludge from Cell No.2. The most appropriate equipment required for the removal operation will be determined on-site based on the apparent water content of the material and the actual amount and location of the accumulations in the cell.

The preceding procedure would be followed in reverse to return the cell to service after de-sludging. In reassembling the aeration system, the manufacturer’s design details should be complied with in terms of connection fittings and anchor locations. It is important that the actual diffuser units be installed at the same level within tolerances recommended in the manufacturer’s Operation and Maintenance Manual. The lagoon cell should be filled to “just submerge” all aeration components at which time all laterals should be air tested by carefully partially opening (“cracking”) isolation valves on the air supply header.

CAUTION: The aeration system in Cell No.2 should not be returned to normal operation by opening of the isolation valve on the air header until the wastewater elevations in Cells No.2 and No.3 are equal.

3.6 Sludge Disposal

In British Columbia, the quality and beneficial use of biosolids for land application and composting is regulated under the Organic Matter Recycling Regulation (OMRR). This regulation applies to the construction and operation of composting facilities, as well as the production, distribution, storage, sale and use or land application of biosolids and compost.

When planning sludge removal operations, a written notification is to be provided to the Regional Waste Manager at least two weeks prior to the commencement of de-sludging operations. The notification should include the following requirements as outlined in the OMRR:

- An estimate of the total sludge volume based on monitoring data.
- Classification of the biosolids and an overview of the proposed treatment process.
- Analytical characterization derived from sampling data.
- A description of the proposed disposal method.

To a major extent, the analytical characterization of the sludge will determine what disposal options and sites will be acceptable to the Ministry. Compliance with pathogen and metal testing treatment objectives will be required. If the intended use is land application, a Land Application Plan (LAP) must be developed and signed by a Qualified Professional prior to any land application. Information required in this plan is set out in Schedule 7 of the OMRR.

Consistent with the strategy of the Town's wastewater treatment and disposal system, the objective of the sludge disposal method evaluation should be to provide the greatest flexibility possible for beneficial use. Options which may be considered consistent with this objective include:

3.6.1 Class A Biosolid

Composting to result in a Class A biosolid. These biolsolids must meet all of the following requirements:

- Schedule 1, Pathogen Reduction Processes;
- Schedule 2, Vector Attraction Reduction;
- Schedule 3, Pathogen Reduction Limits;
- Section 3 of Schedule 4, Quality Criteria;
- Schedule 5, Sampling and Analyses-Protocols and Frequency;
- Schedule 6, Record Keeping.

Class A biosolids can be applied in quantities greater than 5 cubic meters per year per parcel of land in accordance with the LAP and the soil substance concentrations specified in Schedule 10.1

of the OMRR. They must only be distributed in volumes that do not exceed 5 cubic meters per vehicle per day. If they are distributed in sealed bags for retail purposes, they are not to exceed 5 cubic meters, with no restrictions on the number of bags distributed per vehicle per day. They may be distributed in volumes greater than 5 cubic metres to composting facilities or biosolids growing medium facilities.

3.6.2 Class B Biosolids

Composting to result in a Class B biosolid. These biosolids must meet all of the following requirements:

- Schedule 1, Pathogen Reduction Processes;
- Schedule 2, Vector Attraction Reduction;
- Schedule 3, Pathogen Reduction Limits;
- Column 3 of Schedule 4, Quality Criteria;
- Schedule 5, Sampling and Analyses-Protocols and Frequency;
- Schedule 6, Record Keeping.

Class B biosolids must be applied to land in accordance with the LAP, the methodology specified in Schedule 8 and the soil substance concentrations specified in Schedule 10.1 of the OMRR. Class B biosolids may be distributed to composting facilities with no volume restrictions. They may be distributed to a biosolids growing medium facility with no volume restrictions if they meet the pathogen reduction and vector attraction requirements for Class A biosolids. They must not be applied to land in a watershed used as a permitted water supply under the Drinking Water Protection.

3.6.3 Biosolids Growing Medium

Biosolids that meet the requirements of all the following are biosolids growing medium:

- Column 2 of Schedule 4, Quality Criteria;
- Schedule 5, Sampling and Analyses-Protocols and Frequency;
- Schedule 6, Record-keeping;
- Schedule 11, Requirements for Biosolids Growing Medium.

Biosolids growing medium may be distributed with no volume restriction.

3.6.4 Disposal at the Sanitary Landfill

Sludge can be landfilled with other solid waste or used as a soil conditioner in final cover areas to enhance vegetation growth. Disposal at the landfill with sold waste should be considered as the least preferred option as no benefit is achieved and landfill “air space” is consumed. However, it should be recognized that the quality of the sludge may, in the final analysis, leave the landfill as the only feasible disposal option.

4.0 Recent Sampling

A sludge survey was completed by Lambourne Environmental in 2011 using a digital GPS and gridded sampling programme (see Appendix A). The dry down tell results for Cell No.2 range from 2.97 to 24.13 % solids, whereas Cell No.3 ranges from 3.82 to 7.12 % solids. As derived in theoretical calculations, Cell No.2 has an increased rate of sludge production due to the treatment system design.

The Town completed sludge sampling in 2017. Following sampling, Cell No.2 was lowered, and sludge was removed around the perimeter of the cell. Sludge accumulation sampling was again completed in 2018.

5.0 Recommendations

As the Town continues to advance their Sludge Management Plan, a reserve fund should be maintained for sludge removal and upgrading of the lagoons as required. Sludge sampling for thickness and density in Cell No.2 and No. 3 is to be completed every 2 years (at a minimum). Ongoing monitoring and maintenance will allow the Town to adapt to increases in population growth and reductions of water resources in a sustainable manner. Options for beneficial reuse of sludge should continue to be explored in the future.

Blk A
LOT 682s

LOT 682s

LOT 447 MC

CROWN LAND
OLIVER
MOUNTAIN
PARK

EXISTING
AERATED
CELL No. 3

EXISTING
AERATED CELL No. 2

CHLORINE
CONTACT
CHAMBERS

Blk B
LOT 682s

EFFLUENT STORAGE
RESERVOIR

LOT 838

LOT 682s

Lot 3
5881

LOT 763s

BLOWER BUILDING

UNSURVEYED
CROWN LAND
PID 015-086-721

Lot 2
5881

EFFLUENT
BOOSTER
STATION

TOP OF BERM

ACCESS ROAD

FAIRVIEW ROAD

R/W 35424

R/W 38213

EXISTING SANITARY
FORCEMAIN

UNSURVEYED
CROWN LAND
PID 014-879-361

Lot A
37929

Lot 2
5881

LOT 682s

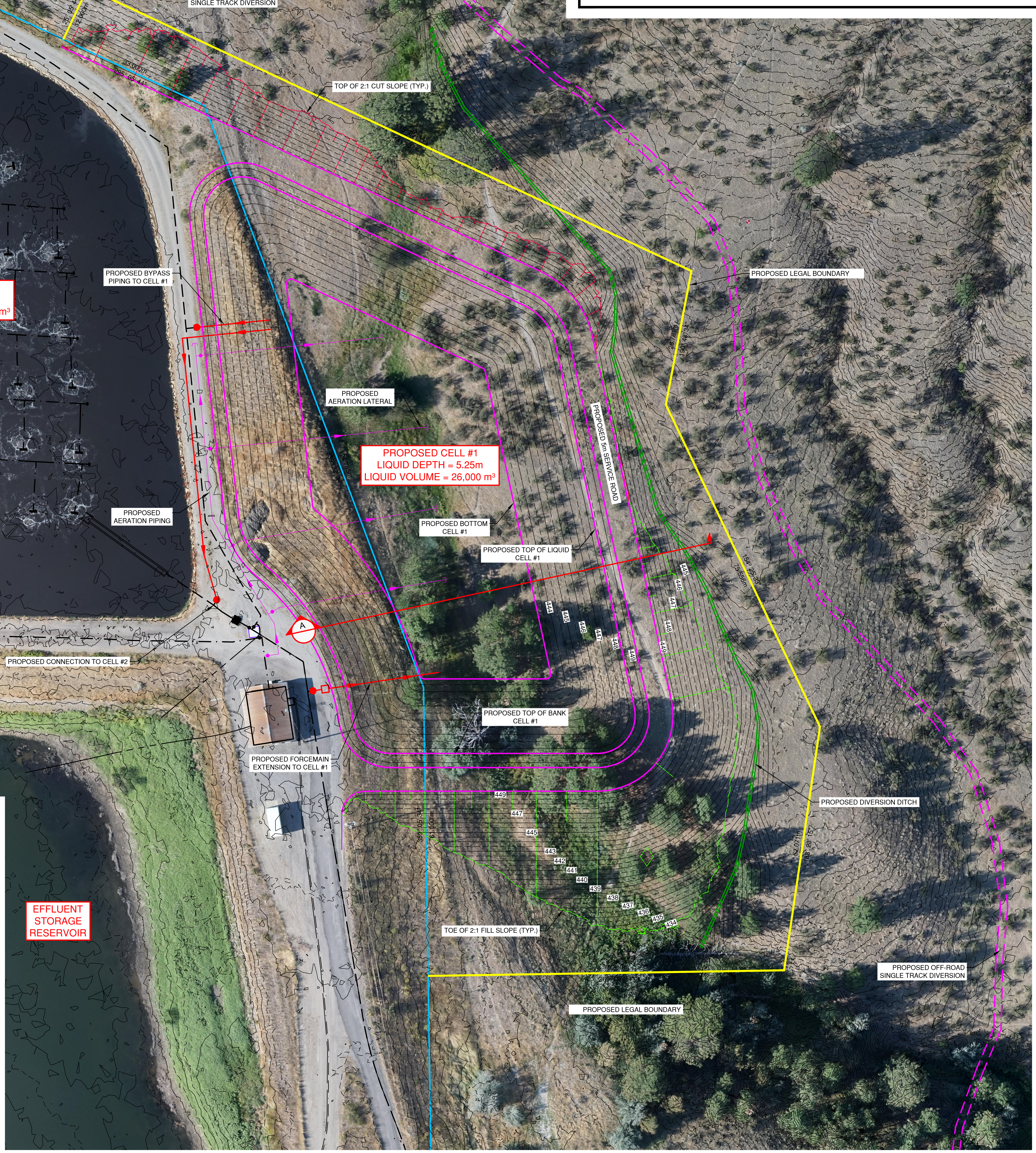
Blk K
1789

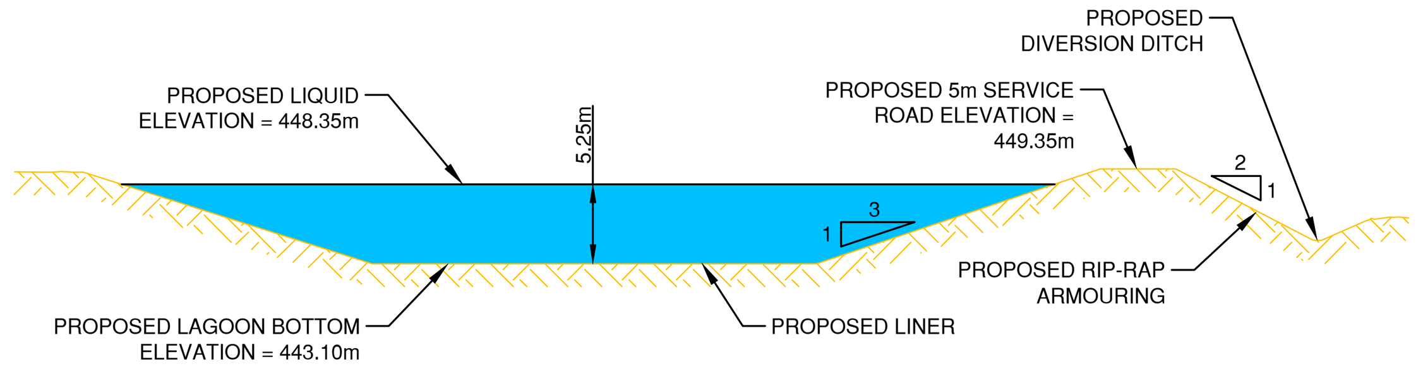
TOWN OF OLIVER
AERATED LAGOON TREATMENT SYSTEM
OVERALL SITE PLAN

TRUE CONSULTING

DESIGN BY: SAC
SCALE: 1 : 2,500
DWG NO.: Fig. 1 306-088-005
REV: 0
DRAWN BY: SAC/DL
DATE: JAN 2019

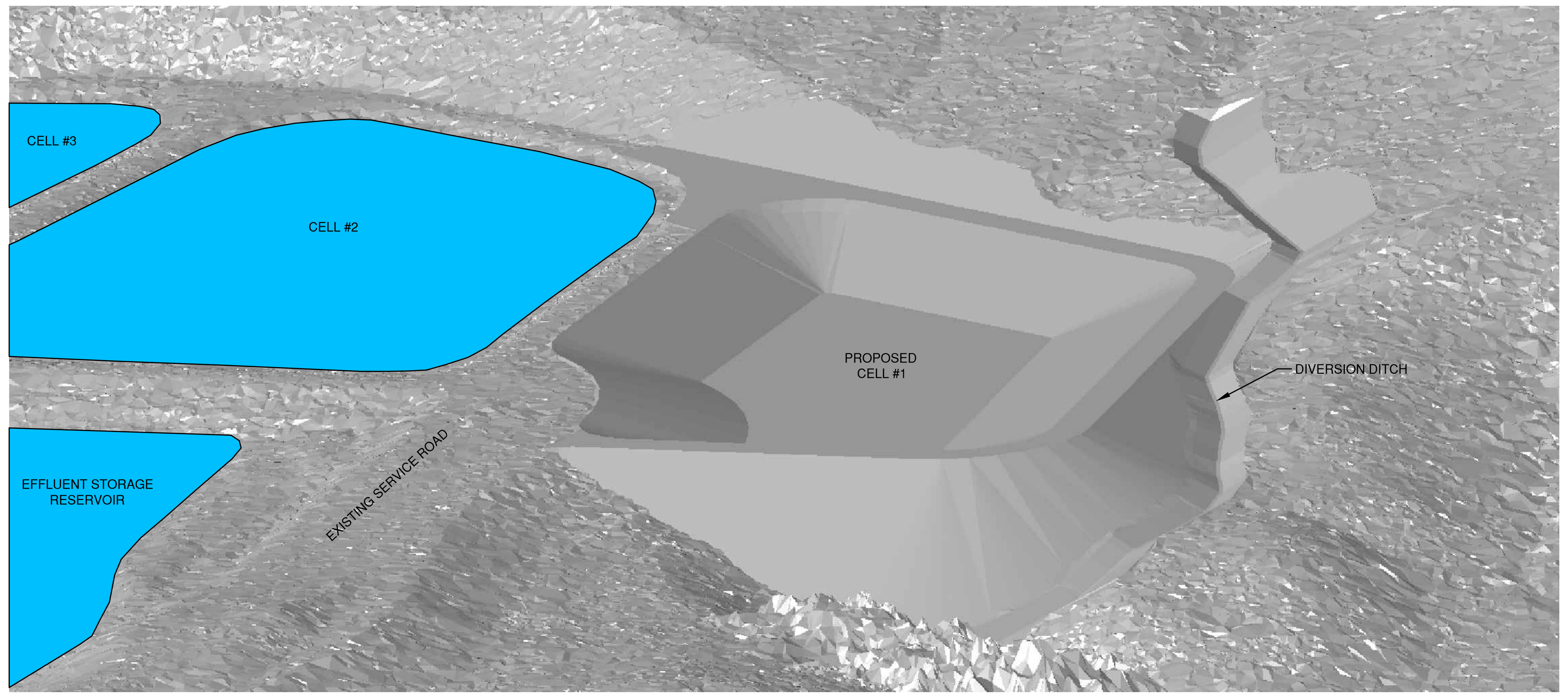
FILE:n:\clients\300-399\306\306-175\2\03 drawings\cad\02 design drawings\dwg\306-175-2.dwg



SECTION A - PROPOSED CELL #1 & DIVERSION DITCH

HORIZONTAL & VERTICAL
SCALE 1:500



CUT/FILL QUANTITIES

PROPOSED CELL #1 EARTHWORKS

24,000 m³ (CUT)
19,500 m³ (FILL)
NET 4,500 m³ (CUT)

NOT INCLUDING STRIPPING
APPROXIMATE VOLUME 3,900 m³ (CUT)

PROPOSED CELL #1 CAPACITY
26,000 m³

DRAFT

No.	DATE	DESCRIPTION	BY	APP'D
0	SEPT 07/2017	ISSUED FOR DISCUSSION	DF	SC

ISSUES / REVISIONS

CONSULTANT SEAL

TRUE CONSULTING
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tel 250.828.0881 ■ fax 250.828.0717
info@TRUE.bc.ca

BRITISH COLUMBIA Town of Oliver

AERATED LAGOON TREATMENT SYSTEM

PROPOSED CELL #1

SCALE	0 — 1:500 — 25
DESIGN BY	SU/SC
DRAWN BY	DF
DATE	SEPTEMBER, 2017
PROJECT REFERENCE No.	306-083 & 306-291
DRAWING No.	306-088-005
SHEET	1 OF 1
ISSUE/REV.	0

Fig. 2

FILE: r:\clients\300-399\306\306-985\03 drawings\cad\02 design drawings\dn-306-985-oliver treatment

APPENDIX A

Referenced Report

LAMBOURNE ENVIRONMENTAL Ltd.
51, 37337 Burnt Lake Trail, Red Deer County, AB T4S 2K5 Ph. (403)348-8298 Fax (403) 348-8290

December 15, 2011

Town of Oliver
35016 - 97 St.
PO Box 638
Oliver, BC
V0H 1T0
Attn: Shawn Goodsell

Re: Lagoon Survey Report for Town of Oliver, Cells 1 & 2

Dear Shawn,

Lambourne Environmental was contracted to conduct a sludge survey of cells 1 and 2 in Oliver. This survey was completed on November 17, 2011 and was conducted using a digital GPS system, with a boat being used to take the depth measurements and to gather samples from the lagoons. At the time of the survey, the lagoons were ice free and the aeration system had been turned off.

The calculation of volumes for the cells is shown in Table 1 below. The volume calculations were done using Carlson Civil 3D software. While collecting the samples for dry matter testing, it was difficult to find sludge in the second cell. The material in cell 2 was of low density and was found mostly along the east side of the cell. Several attempts to obtain samples in other areas of cell 2 yielded only gravel or stones and dark water. Cell 1 did contain some areas of accumulation and the sludge density varied considerably as seen in the dry down results obtained using our in-house single sample ovens. The majority of the sludge in cell 1 was around the perimeter of the cell indicating the aeration system is moving the material around and it is settling out in the low current area around the perimeter.

When calculating the dry tonnes, we typically see fairly consistent solids results. We take the average of the dry downs and multiply by the sludge volume to arrive at the dry tonnes. In this case, there were a few samples that showed significantly higher solids than the rest of the samples. We retested these samples on different dry down ovens to ensure consistent results. The average number used may skew the calculation of dry tonnes present, particularly in cell 1. The extent of the higher density material was not determined, but it may correspond to the location of the inlets to the cell or it could be material that has not been removed for some time. In the higher density samples, the biosolids did seem to contain a significant inorganic content of sand and grit.

Table 1

Cell #	Total Volume (m^3)	Biosolids Volume (m^3)	Average % solids	Calculated Dry Tonnes	Cell Depth (m)	Biosolids Height (m)
1	36,229	5,000	9.20%	460	5.6	0.1 – 1.95
2	36,278	3,000	5.13%	154	5.5	0 – 2.52
Total	72,507	8,000				

The following are the dry down test results from each cell.

Cell 1	
Sample #	% Solids
1-1	11.13
1-2	3.93
1-3	2.97
1-4	6.52
1-5	6.51
1-6	24.13

Cell 2	
Sample #	% Solids
2-1	7.12
2-2	3.82
2-3	4.99
2-4	4.59

I have also included the following drawing and data exhibits:

1. Cell 1 - Carlson drawing indicating the lagoon shape and points from where the depth measurements were taken.
2. Cell 1 - Table indicating the total depth measurements as well as the height of sludge in each location.
3. Cell 2 - Carlson drawing indicating the lagoon shape and points from where the depth measurements were taken.
4. Cell 2 - Table indicating the total depth measurements as well as the height of sludge in each location.
5. Cell 1 and 2 – Drawing indicating where the samples used for determining percent solids were collected from.

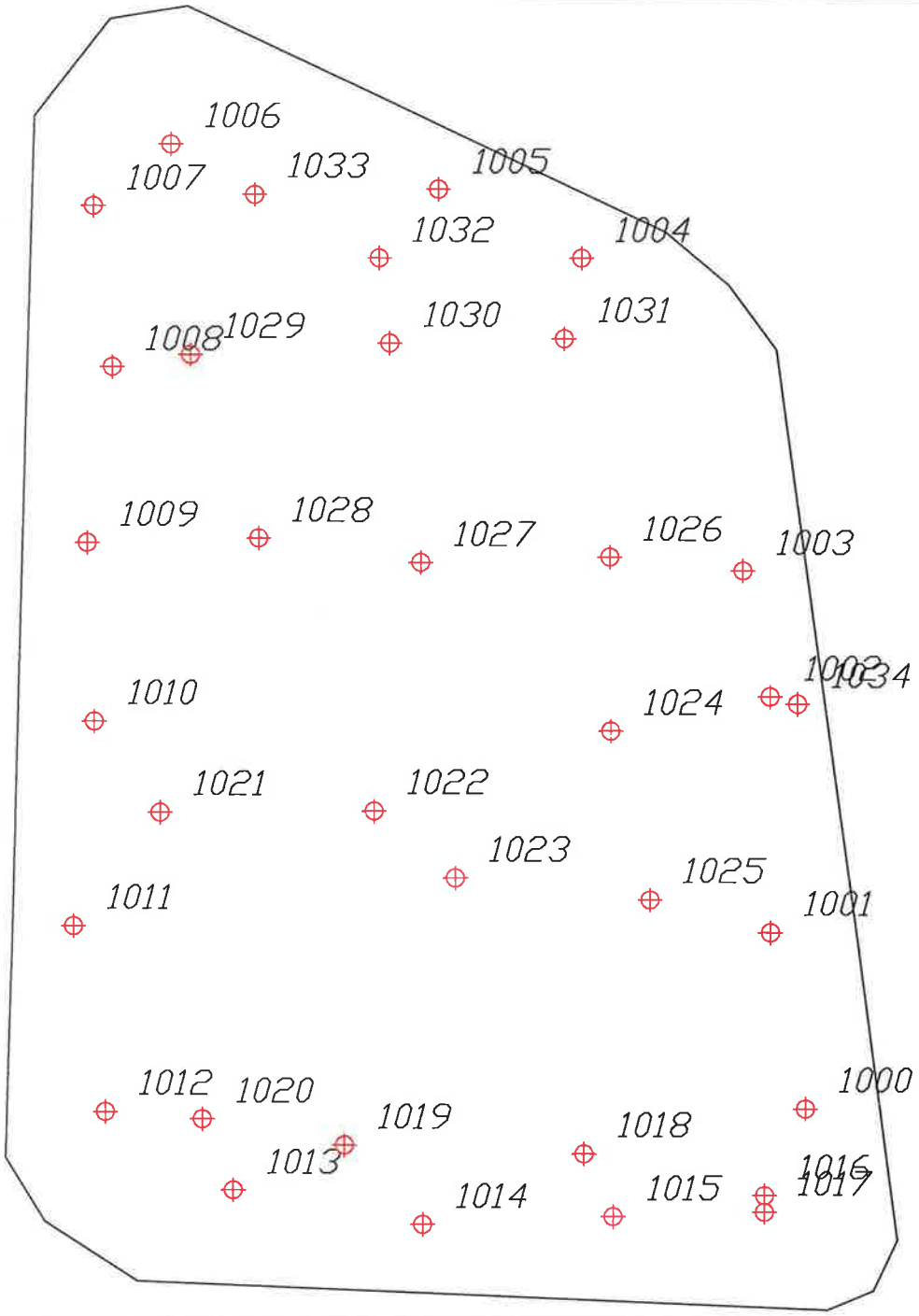
We appreciate the opportunity to work with you on this project. If there is any additional information you require, please let me know.

Yours truly,
Lambourne Environmental Ltd.

Blair Benn, P. Ag.
Vice-President

Encl.

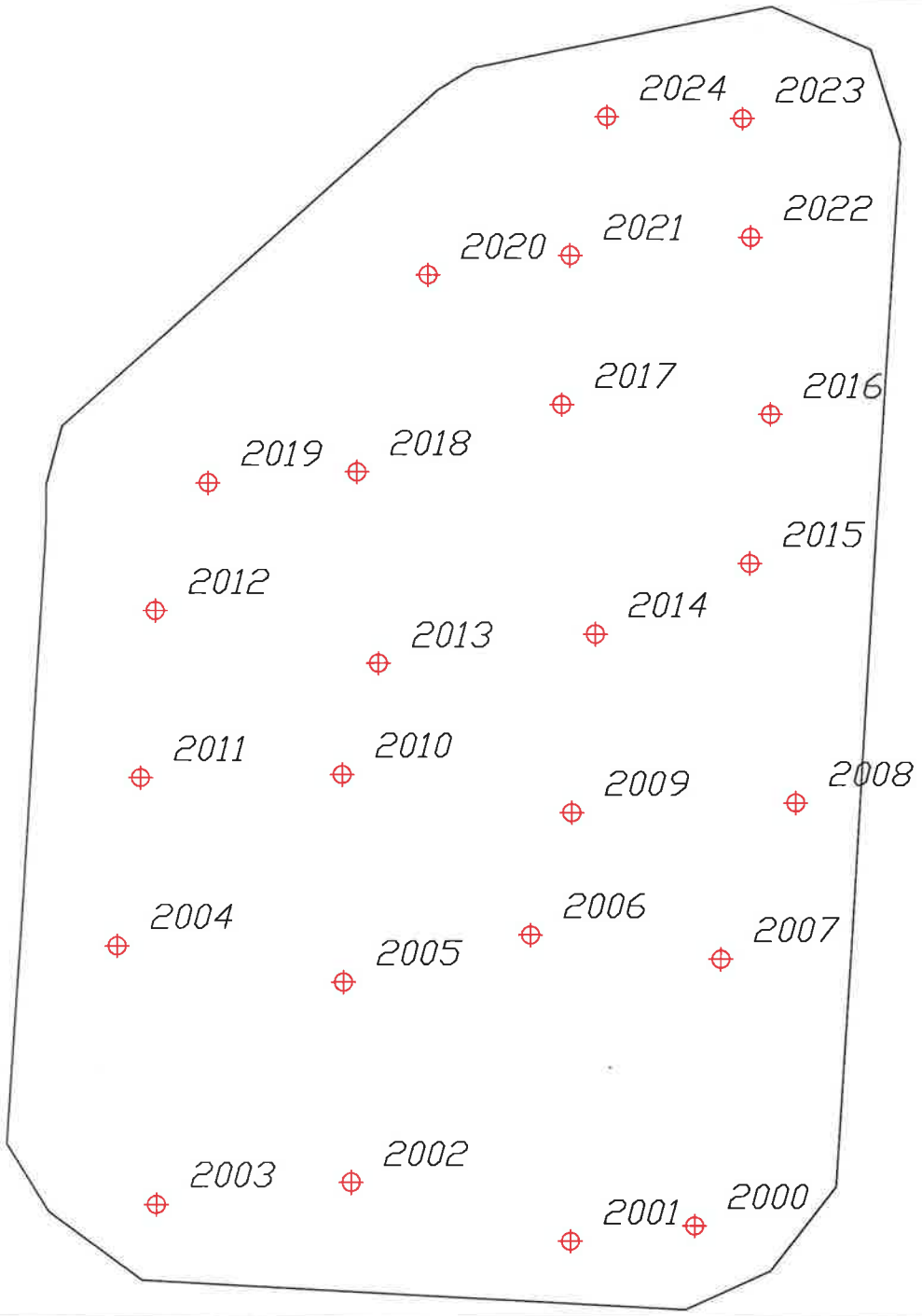
Cc: True Consulting Group Ltd. – Kaitlin Klamut



Survey Points

DRAWN BB	DATE 12/14/11	Lambourne Environmental
APPROVED	DATE	
SCALE	SHEET Cell 1	PROJECT NO. Oliver

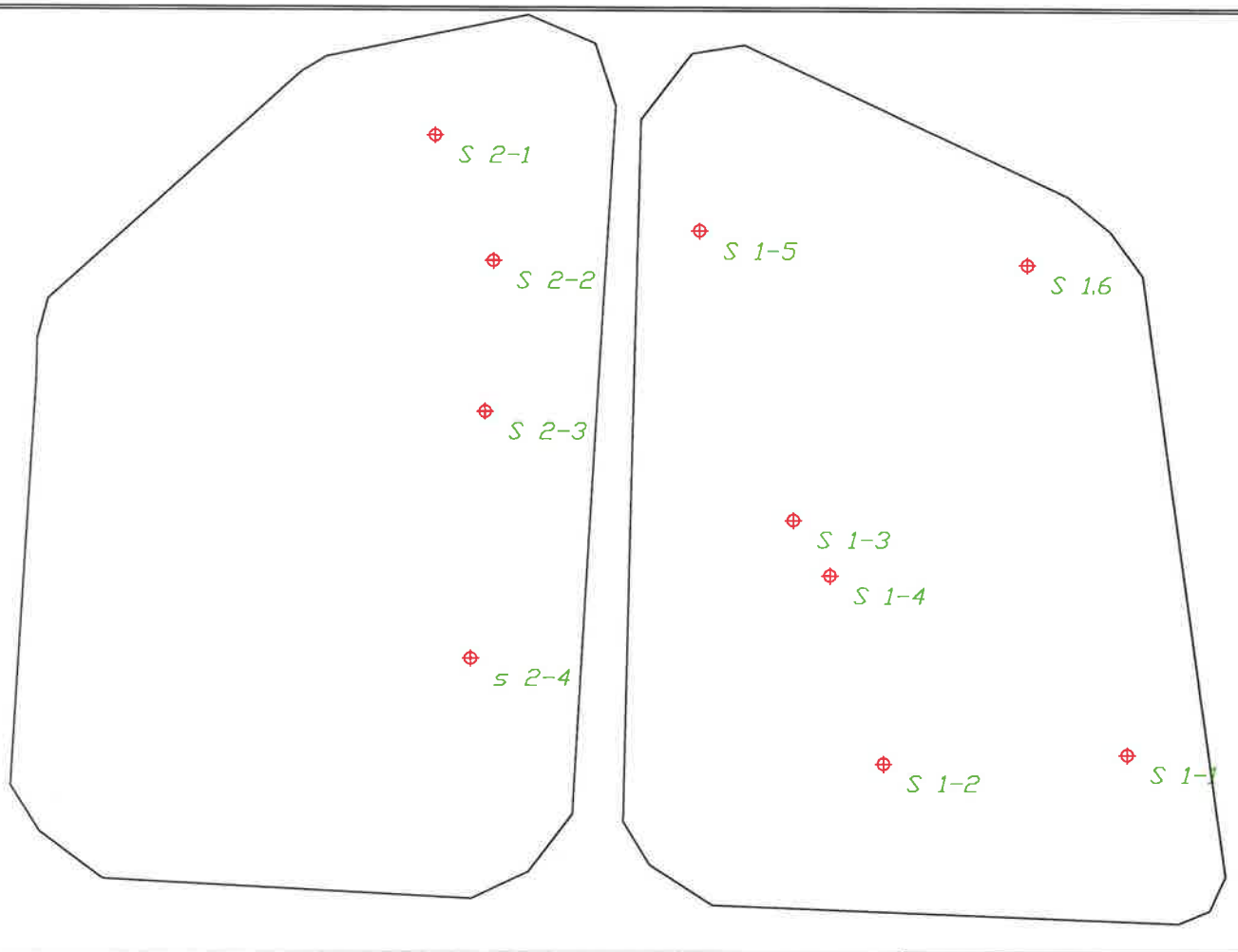
Oliver Cell 1		
Point #	**Total Depth**	**Sludge Height**
1000	2.64	1.54
1001	2.86	1.76
1002	1.87	0.67
1003	2.00	1.00
1004	1.60	0.60
1005	1.72	0.52
1006	2.76	1.86
1007	1.53	0.43
1008	2.18	0.88
1009	1.54	0.04
1010	2.06	1.36
1011	1.46	0.06
1012	2.12	0.12
1013	2.54	0.34
1014	1.71	0.01
1015	2.22	0.02
1016	2.72	0.62
1017	2.46	1.86
1018	4.18	0.18
1019	4.35	1.15
1020	4.37	0.87
1021	4.58	1.08
1022	5.50	0.00
1023	5.50	0.40
1024	5.67	0.67
1025	5.43	0.03
1026	5.61	0.01
1027	5.46	0.06
1028	5.42	0.02
1029	4.55	1.15
1030	5.45	0.05
1031	4.75	1.95
1032	5.13	0.03
1033	4.91	1.71
1034	0.97	0.47



Survey Points

DRAWN BB	DATE 12/15/11	Lambourne Environmental
APPROVED	DATE	
SCALE	SHEET Cell 2	PROJECT NO. Oliver

Oliver Cell 2		
Point #	**Total Depth**	**Sludge Height**
2000	1.53	0
2001	1.84	0
2002	3.78	0.68
2003	1.91	0
2004	3.23	0.03
2005	5.45	0.55
2006	5.53	0.63
2007	4.64	1.34
2008	2.08	0.00
2009	5.68	0.08
2010	5.54	0.04
2011	3.67	0.00
2012	3.58	0.58
2013	5.64	0.04
2014	5.67	0.37
2015	4.84	1.84
2016	3.64	0.54
2017	5.55	0.05
2018	4.81	0.00
2019	3.14	1.14
2020	1.70	0.00
2021	5.75	0.25
2022	4.72	2.52
2023	3.17	1.17
2024	3.32	0.42



Sample Points

DRAWN BB	DATE 12/15/11	Lambourne Environmental
APPROVED	DATE	
SCALE	SHEET Cell 1 & 2	PROJECT NO. Oliver

APPENDIX G

Groundwater Monitoring Data

Golder Associates Ltd.

243-1889 Springfield Road
Kelowna, British Columbia, Canada V1Y 5V5
Telephone (250) 860-8424
Fax (250) 860-9874

REPORT ON

DEVELOPMENT OF GROUNDWATER MONITORING PROGRAM SPRAY IRRIGATION AND RAPID INFILTRATION SYSTEMS

TOWN OF OLIVER, B.C.

Submitted to:

Town of Oliver
35016 - 97th Street
Oliver, B.C.
V0H 1T0

DISTRIBUTION:

3 copies -	Town of Oliver Oliver, B.C.
1 copy -	True Engineering Kamloops, B.C.
2 copies -	Golder Associates Ltd. Kelowna, B.C.

February 12, 1998

972-4198a

Golder Associates Ltd.

243-1889 Springfield Road
Kelowna, British Columbia, Canada V1Y 5V5
Telephone (250) 860-8424
Fax (250) 860-9874

February 12, 1998

Our Ref.: 972-4198a

Town of Oliver
35016 - 97th Street
Oliver, B.C.
VOH 1T0

Attention: Mr. Bruce Hamilton

RE: DEVELOPMENT OF GROUNDWATER MONITORING PROGRAM SPRAY IRRIGATION AND RAPID INFILTRATION SYSTEMS TOWN OF OLIVER, BRITISH COLUMBIA

Dear Mr. Underwood:

Golder Associates Ltd. (Golder) is pleased to provide this report, presenting the development of a groundwater monitoring program for the Town of Oliver. The purpose of the development of a groundwater monitoring program was to address the Town's Operational Certificate, such that the groundwater flow pattern in the area of the Town of Oliver's surplus treated effluent spray system and rapid infiltration system could be determined, and that the effects of these disposal systems on local groundwater quality could be determined.

1.0 BACKGROUND

According to TRUE Engineering Ltd., the Town of Oliver had an estimated effluent surplus volume of approximately 120,000 m^3 in storage in 1997. The effluent surplus was generated as a result of a decrease in the volume of treated effluent used for irrigation purposes at the Fairview Mountain Golf Course during the summer of 1996 and 1997. In order to resolve the additional effluent surplus issue, the Town of Oliver proceeded with a short term disposal plan involving the following: 1) the rapid infiltration using an infiltration basin located on Lot 2, Plan 5881, and 2) a high rate irrigation system located on Lots 4 and 5 of Plan 5881. In addition, the continued irrigation of the Fairview Mountain Golf Course using surplus treated effluent was conducted. The locations of the Fairview Mountain Golf Course, Lot 4 and 5 of Plan 5881 and Lot 2 of Plan 5881 are shown on Figure 1 and 2.

The spray irrigation system has been in use at the Fairview Mountain Golf Course since approximately 1983, during which time surplus treated effluent has been used by the golf course for irrigation purposes on an as-needed basis. The high rate irrigation system, located on Lots 4 and 5 of Plan 5881, has been operated by the Town of Oliver between August 19 and November 15, 1997, during which time surplus treated effluent was sprayed onto portions of the property. It is understood that the Town of Oliver proposes to change the high rate irrigation system to a conventional irrigation system in the future, disposing of surplus treated effluent of Lots 4 and 5, the northern portion of Lot 6 and the western portion of Lot 8, Plan 5881. In addition to the spray irrigation systems, the Town of Oliver had proposed to dispose of up to 600 m^3/d of surplus treated effluent within an infiltration basin system located on Lot 2 of Plan 5881. It is understood that the use of the high rate irrigation system and the infiltration basin to dispose of surplus treated effluent will only be used on a short-term, as-needed basis, in the event that the effluent storage lagoon exceeds its storage capacity.

Golder has recently conducted a hydrogeological investigation regarding the potential maximum volume of surplus treated effluent that could be discharged to the infiltration basin located on Lot 2, Plan 5881, the results of which are presented in our February, 1998 report (Ref. No. 972-4198A). During the course of the hydrogeological investigation, three monitoring wells (MW 1, MW 2 and MW 3) were drilled and installed at selected locations downgradient of the infiltration basin for future groundwater monitoring (Figure 2).

2.0 METHODOLOGY

In order to develop a comprehensive groundwater monitoring plan for the Town of Oliver, a site reconnaissance was conducted on September 16, 1997, during which time the various disposal methods for the surplus treated effluent (the spray irrigation at the Fairview Mountain Golf Course and Lots 4 and 5, Plan 5881 and the use of the infiltration basin) were examined. In addition, a review of BCE's water well logs was conducted for the area of the Fairview Mountain Golf Course, Lots 4 and 5 of Plan 5881 (high rate irrigation system) and Lot 2 of Plan 5881 (infiltration basin). All available water well logs are shown in Appendix I.

3.0 RESULTS

3.1 Review of Available Well Water Records

Two available water-well records were obtained from the Groundwater Section of the Ministry of Environment, in Victoria, B.C. for the area surrounding the Fairview Mountain Golf Course, Lots 4 and 5 of Plan 5881 (high rate irrigation) and Lot 2 of Plan 5881 (infiltration basin) (Appendix I). One water well was noted approximately 170 m east of the Fairview Mountain Golf Course (see W1 on Figure 2). The water well log indicated that well W1 encountered approximately 0.6 m of topsoil, followed by a layer of

fine sand to approximately 13.7 m below ground surface. This was underlain by a gravel deposit to a depth of approximately 36.6 m, at which depth the well was terminated. Groundwater was not encountered in well W1.

The second water well is located approximately 150 m to the south of the infiltration basin (Lot 2, Plan 5881) (see W2 on Figure 2). According to the well log, well W2 encountered approximately 7.3 m of sand and gravel, at which depth bedrock was encountered. Well W2 was terminated within the bedrock at a depth of 123.4 m below ground surface. Groundwater was encountered at MW 2 at approximately 16.7 m below ground surface. According to Mrs. Moir, the property owner, well W2 is used for domestic purposes.

3.2 Site Reconnaissance

During the site reconnaissance of the area of the Fairview Mountain Golf Course, Lots 4 and 5 of Plan 5881 (high rate irrigation system) and Lot 2 of Plan 5881 (infiltration basin), one additional water well was noted in the area to the north of the golf course (W3 Figure 2). A log for this well was not found in our review of BCE's water well records. However, according to a Town of Oliver employee, the water well belongs to Mr. Bill Eggert. Mr. Eggert was contacted and stated that there are actually two wells on his property (W3 and W4). Well W3 was originally drilled in 1979 to a depth of approximately 67 m as a test hole. According to Mr. Eggert, well W3 was redrilled and cased in 1987 to approximately 12.2 m below ground surface. Soil conditions encountered at well W3 consisted of 1.2 m of clay and gravel, followed by a clay and sand deposit to a depth of 4.9 m below ground surface. This deposit was underlain by a fine sand, with some gravel seams to a depth of 10.4m. The sand deposit was underlain with a thin silty clay deposit to a depth of 11.3 m. This was underlain by broken rock, till and bedrock. Well W3 was terminated at a depth of 12.5 m below ground surface within the bedrock. The recorded static water level within this well was 9.8 m on August 13, 1987, however, it is unknown at what depth groundwater was encountered. According to Mr. Eggert, well W3 has never been used. Well W4 is used for domestic purposes and is approximately 6 m in depth. The soil conditions encountered during the installation of W4 are unknown, however, it is located near Reed's Creek.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The review of available water well information in the area of the Fairview Mountain Golf Course, Lots 4 and 5 of Plan 5881 and Lot 2 of Plan 59881, indicated that there are only four existing water wells in the general area, with three wells in the area of the golf course (W1, W3 and W4) and one well located in the area of the infiltration basin (W2) (Figure 2). Based on a review of the available water well logs, only well W1 appears to be unsuitable for groundwater sampling, as the well is reportedly dry.

In order to evaluate the effects that the disposal of surplus treated effluent has on the local groundwater quality, it is recommended that a groundwater monitoring network be

installed in the three areas of effluent disposal (Fairview Mountain Golf Course, Lots 4 and 5 of Plan 5881 and Lot 2 of Plan 5881). Based on a review of available information, it appears that there are an inadequate number of existing monitoring wells in the area of the golf course and the high-rate irrigation area to monitor downgradient groundwater quality. It is therefore recommended that two groundwater monitoring wells be installed in the area downgradient of the Fairview Mountain Golf Course and that one groundwater monitoring well be installed downgradient of Lots 4 and 5 of Plan 5881, at the locations shown on Figure 2. As it is understood that the high-rate irrigation system on Lots 4 and 5, Plan 5881 may eventually change to a conventional irrigation system disposing of surplus treated effluent on Lots 4, 5, 6 (northern portion) and 8 (western portion) of Plan 5881, the proposed monitoring well location for this general area has been chosen to accommodate this change.

Upon completion of the drilling and installation of the three proposed monitoring wells it is recommended that groundwater be collected for chemical analyses. In addition, it is recommended domestic well W4, located side/downgradient of the Fairview Mountain Golf Course and MW 2 and domestic well W2, located in the area of the infiltration basin also be sampled. The following sampling frequency is recommended for the various disposal areas:

- *Fairview Mountain Golf Course:* As the spray irrigation system at the golf course is used yearly on an as-needed basis (primarily in the summer months), it is recommended that groundwater be sampled from the two proposed monitoring well locations and domestic well W4 two times prior to the start of the irrigation season at the golf course (February and May), in order to collect background groundwater quality information, and on a semi-annual basis (August and December) thereafter.

- *High-Rate Irrigation System*: It is recommended that groundwater be collected from the proposed monitoring well location downgradient of Lots 4 and 5, Plan 5881 and from domestic well W2 two times prior to using of the irrigation system in 1998, in order to collect background groundwater quality information, and on a semi-annual basis thereafter. The actual months samples should be collected is dependent on the months that the irrigation system is used. As the use of the high-rate irrigation system in this area is intended to be on a short-term, as-needed basis, should the disposal of surplus treated effluent on Lots 4, 5, 6 and 8 not occur during subsequent years, groundwater sampling from these monitoring wells need not be conducted.

- *Infiltration Basin:* It is recommended that groundwater be collected from monitoring well MW 2 and domestic well W2 two times prior to using the infiltration basin in 1998, in order to collect background groundwater quality information, and on a semi-annual basis thereafter. The actual months groundwater sampling should be conducted is dependent on the months that the infiltration basin is used. As the use of the infiltration basin system is intended to be on a short-term, as-needed basis, should the

disposal of surplus treated effluent into the basin not occur during any subsequent years, groundwater sampling from these monitoring wells need not be conducted.

It should be noted that domestic well W2 has been included in the monitoring program for both the high-rate irrigation system and the infiltration basin system. Should neither the high rate irrigation system nor the infiltration basin system be used during a subsequent year, the sampling of domestic well W2 would not be required. However, should one or both of these systems be in operation during a given year, it is recommended that well W2 be sampled according to the frequency outlined above.

All collected groundwater samples should be submitted for the analyses of the following parameters: conductivity, pH, chloride, nitrate, nitrite, ammonia, total nitrogen, dissolved phosphorous, ortho-phosphate, and total and fecal coliform. In addition, water levels within all monitoring wells should be measured during the sampling events. Discharge rates/volumes into the infiltration basin and the high-rate irrigation system should be monitored on a daily basis during operation. It is further recommended that the results of the groundwater monitoring program be reviewed by a qualified hydrogeologist on an annual basis.

5.0 CLOSURE

We trust the foregoing provides you with the information that you require at this time. Should you have any questions, please do not hesitate to contact the undersigned at your earliest convenience.

Yours truly,

GOLDER ASSOCIATES LTD.

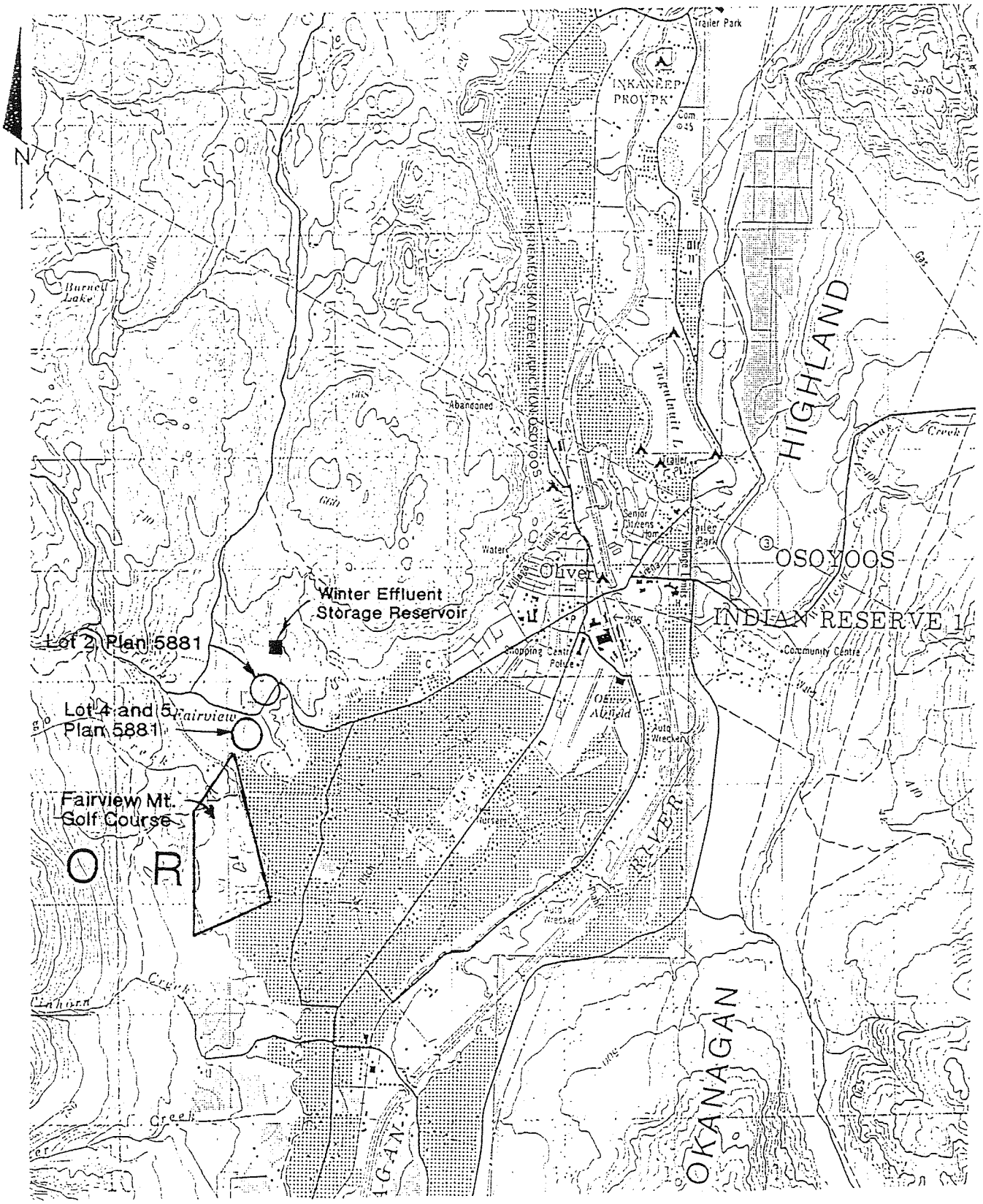
Jacqueline Foley, M.Sc.
Hydrogeologist

B. Carlsen, P. Eng.
Principal, Office Manager

MS/JDF/SO/BC/pjc
Encl.
n:\1997.100\972-4198\gwrpt.doc

KEY PLAN

Figure 1



Reference Map: Keremeos 82

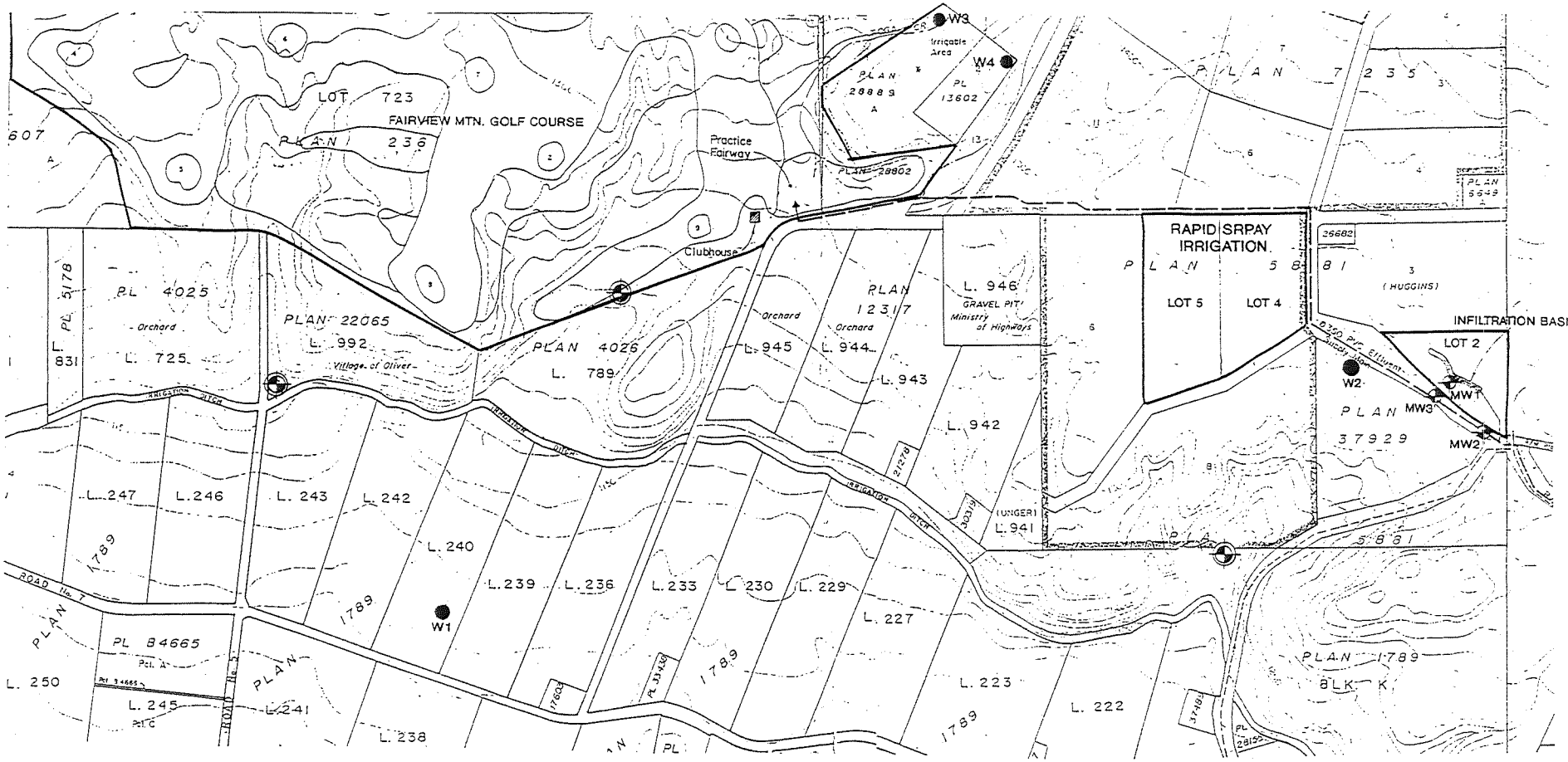
SCALE 1:50,000

PROJECT No. 972-4198a DRAWN LR REVIEWED JF DATE Oct/97

Golder Associates

GROUNDWATER MONITORING SITE PLAN

Figure 2



LEGEND

- MW1 — Approximate location of existing monitoring well
- W1 — Approximate location of water well
- Approximate location of proposed monitoring well

Approximate Scale: 1:6300

Drawing courtesy of True Engineering

Golder Associates

PROJECT: 972-4198.a	DRAWN BY: MS	DATE: DEC./1997	REVIEWED: JDF

TOWN OF OLIVER

GROUNDWATER MONITORING WELL #1 (AIR CADET)

	Anions			General Parameters				Calculated Parameters		Total Metals		
Sample Date	Chloride	Nitrate (as N)	Nitrite (as N)	Ammonia Total (as N)	Conductivity (EC)	Phosphorus Total (as P)	Phosphorus Total Dissolved	Hardness Total (as CaCO3)	Nitrate+Nitrite (as N)	Calcium Total	Magnesium Total	Sodium Total
May 14	11.9	6.73	0.025	0.025	700	0.0646	0.0071	363	6.75	111	20.8	19.1
Sept 10	9.92	7.97	<0.010	<0.020	761	0.028	0.0198	344	7.97	107	18.8	16.8

GROUND WATER MONITORING WELL #2 (RODEO GROUNDS)

	Anions			General Parameters				Calculated Parameters		Total Metals		
Sample Date	Chloride	Nitrate (as N)	Nitrite (as N)	Ammonia Total (as N)	Conductivity (EC)	Phosphorus Total (as P)	Phosphorus Total Dissolved	Hardness Total (as CaCO3)	Nitrate+Nitrite (as N)	Calcium Total	Magnesium Total	Sodium Total
May 14	7.2	0.122	<0.010	0.1	565	5.49	<0.020	2550	0.122	825	117	20.3
Sept 10	7.07	0.138	<0.010	0.037	562	16	0.0069	2090	0.138	651	113	18.9

GROUND WATER MONITORING WELL #3 (MAPLE AVENUE)

	Anions			General Parameters				Calculated Parameters		Total Metals		
Sample Date	Chloride	Nitrate (as N)	Nitrite (as N)	Ammonia Total (as N)	Conductivity (EC)	Phosphorus Total (as P)	Phosphorus Total Dissolved	Hardness Total (as CaCO3)	Nitrate+Nitrite (as N)	Calcium Total	Magnesium Total	Sodium Total
May 14	8.31	0.051	<0.010	0.024	683	0.0395	0.0042	381	0.0507	94.5	35.1	15.4
Sept 10	8.05	0.074	<0.010	0.031	693	0.499	0.0032	355	0.0739	86.8	33.5	14.4

GROUND WATER MONITORING WELL #4 (SAND PIT)

	Anions			General Parameters				Calculated Parameters		Total Metals		
Sample Date	Chloride	Nitrate (as N)	Nitrite (as N)	Ammonia Total (as N)	Conductivity (EC)	Phosphorus Total (as P)	Phosphorus Total Dissolved	Hardness Total (as CaCO3)	Nitrate+Nitrite (as N)	Calcium Total	Magnesium Total	Sodium Total
May 14	111	4.12	<0.010	0.035	1590	0.116	0.0836	725	4.12	183	64.8	100
Sept 10	96	2.99	<0.010	0.043	1670	1.02	0.133	838	2.99	216	72.4	87.1

GROUND WATER MONITORING WELL #5

	Anions			General Parameters				Calculated Parameters		Total Metals		
Sample Date	Chloride	Nitrate (as N)	Nitrite (as N)	Ammonia Total (as N)	Conductivity (EC)	Phosphorus Total (as P)	Phosphorus Total Dissolved	Hardness Total (as CaCO3)	Nitrate+Nitrite (as N)	Calcium Total	Magnesium Total	Sodium Total
May 14	16	0.569	<0.010	0.058	692	0.256	0.122	400	0.569	116	26.6	12.8
Sept 10	15.6	1.59	<0.010	0.066	708	0.166	0.011	348	1.59	102	22.5	10.3

TOWN OF OLIVER

GROUND WATER MONITORING WELL READINGS
(Note: The value recorded indicates the measurement from the top of casing to the water level expressed in meters.)

Month	Day	Air Cadet (Well #1)	Rodeo Grounds (Well #2)	Maple Ave (Well #3)	Test Well #2 (Corner 350th/T.L.)	Test Well #4 (Sand Pit)	Test Well #5	Test Well #6 (Golf Course)	Test Well #7 (Road #5 West)
January	10	10.29	6.24	1.27	fenced off	7.9	9.09	3.92 (dry)	25.91 (dry)
February	16	10.2	6.1	1.03	fenced off	7.6	8.97	3.92 (dry)	25.91 (dry)
March	26	10.24	6.1	0.87	fenced off	6.48	8.71	3.92 (dry)	25.91 (dry)
April	24	10.24	5.92	0.99	fenced off	1.99	6.12	3.92 (dry)	25.91 (dry)
May	14	10.17	5.81	1.03	fenced off	4.11	5.28	3.92 (dry)	25.91 (dry)
June	25	10.02	5.82	1.18	fenced off	7.76	6.86	3.92 (dry)	25.91 (dry)
July	24	10.04	5.9	1.38	fenced off	8	7.24	3.92 (dry)	25.91 (dry)
August	14	9.93	5.89	1.48	fenced off	8.11	7.4	3.92 (dry)	25.91 (dry)
September	10	9.85	5.92	1.51	fenced off	8.13	7.68	3.92 (dry)	25.91 (dry)
October	9	9.65	5.98	1.28	fenced off	7.92	8.21	3.92 (dry)	25.91 (dry)
November	6	9.75	6.05	1.2	fenced off	6.63	8.71	3.92 (dry)	25.91 (dry)
December	3	10.03	6.11	1.21	fenced off	6.38	9.03	3.92 (dry)	25.91 (dry)

APPENDIX G

Soil Classification and Description

CAWSTON SOILS (CA)

GENERAL COMMENTS

Cawston soils occur on the floodplain of the Similkameen River near Keremeos and Cawston and on the Okanagan River floodplain between Osoyoos Lake and Penticton. These Rego Humic Gleysol soils occupy slightly depressional to very gently sloping lower fluvial terraces, usually in association with Kinney, Chopaka, Gillanders and Keremeos soils.

Cawston soils have developed in medium textured recent fluvial deposits generally between 50 and 100 cm thick overlying moderately coarse textured materials. Surface and subsurface textures are silt loam or loam. Subsoil texture are usually gravelly sandy loam or gravelly loamy sand. The soils are poorly to imperfectly drained. They are moderately pervious, have a high water holding capacity and slow surface runoff.

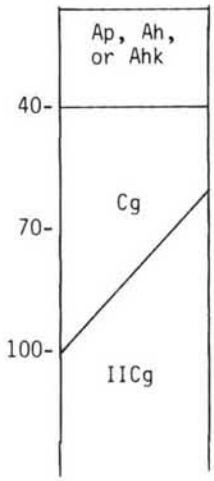
Cawston soils in association with Chopaka and Keremeos soils occupy the gently undulating middle portion of the photo.

Cawston soils are suited for most agricultural crops, particularly if artificial drainage is installed. Most areas are now cleared and cultivated. The more poorly drained areas are mostly used for forage production while the somewhat higher-lying, imperfectly drained areas are used for tree fruits, forages and vegetables. The few, uncleared areas support grasses, cattails, reeds and black cottonwood.

Cawston soils are constrained for urban and similar uses by moderately high water tables which impede basement and other excavations and restrict the operation of septic tank disposal fields.

GENERALIZED CAWSTON SOIL PROFILE

DEPTH (cm)



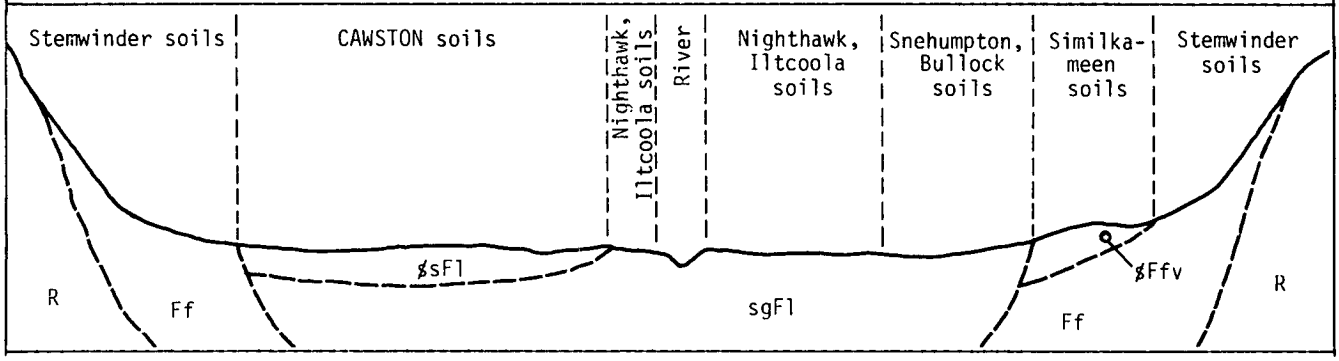
Dark grayish brown (10YR 4/2) to very dark grayish brown (10YR 3/2), silt loam or loam; weak to moderate, very fine subangular blocky structure; very friable consistence; weakly to moderately calcareous; none or few, fine, faint mottles.

Dark grayish brown or very dark grayish brown (10YR 3.5/2), sandy loam to silt loam; weak, fine pseudo-subangular blocky structure; very friable consistence; few, fine, faint mottles.

Dark brown (10YR 3/3) or brown (10YR 4/3), gravelly sandy loam to very gravelly loamy sand; weak, medium, pseudo-angular blocky structure or single-grain; loose or very friable consistence; few, coarse, prominent mottles.

TAXONOMIC SOIL CLASSIFICATION: Rego Humic Gleysol

CAWSTON SOIL LANDSCAPE CROSS SECTION



SOIL CHARACTERISTICS

DEPTH TO BEDROCK (m)	:	>2
PARENT MATERIAL	:	recent fluvial floodplain deposits
DEPTH TO FREE LIME (cm)	:	weakly to moderately calcareous in surface layer
SURFACE STONINESS CLASS	:	0
DEPTH TO WATERTABLE (m)	:	fluctuating, ranges from 50 cm to >1 m.
PERVIOUSNESS CLASS	:	moderate
SOIL DRAINAGE CLASS	:	dominantly poor, ranging to imperfect
DEPTH TO ROOT RESTRICTION (cm)	:	80; water table
TOPOGRAPHY	:	nearly level and very gentle slopes

PHYSICAL SOIL PROPERTIES	SOIL DEPTH		
	0-40 cm	40-80 cm	>80 cm
UNIFIED TEXTURE SYMBOL	ML-CL	SM-ML	GP, GM
AASHO TEXTURE SYMBOL	A-6; A-4	A-6; A-4; A-2-4	A-1
LIQUID LIMIT	30-35	25-35	NP
PLASTICITY INDEX	1-15	1-12	NP
SHEAR STRENGTH	medium to low	low to medium	high
SOIL TEXTURE	loam, silt loam	silt loam to sandy loam	very gravelly loamy sand, gravelly sandy loam
PERMEABILITY	moderate	moderate	rapid
AWSC	moderate	moderate to low	very low
COARSE >7.5 cm (%)	0	0	5-10
FRAGMENTS <7.5 cm (%)	0	0-5	35-60
PASSING # 4	100	100	5-10
SIEVES # 40	60-80	60-80	<5
#200	40-60	50-70	<2

CHEMICAL SOIL PROPERTIES	SOIL DEPTH		
	0-40 cm	40-80 cm	>80 cm
SOIL REACTION (pH) 1:1 H_2O	7.9-8.0	7.7-8.0	7.8-8.4
1:2 0.01M $CaCl_2$	7.6-8.0	7.4-7.6	7.6-8.0
SALINITY CLASS	non to very weakly saline	non-saline	non-saline
ORGANIC CARBON	moderate	very low	very low
NITROGEN	medium to high	very low	very low
EXCHANGE CAPACITY	high	medium	low to very low
EXCHANGEABLE CATIONS - Ca	high	high	high
- Mg	high	medium to high	low
- Na	low	low	low
- K	high	moderately high	low
BASE SATURATION (%)	100	100	100
PHOSPHOROUS	very low	very low	very low
SULFUR	moderately high	moderately high	moderately high

PONDEROSA SOILS (PO)

GENERAL COMMENTS

Ponderosa soils occur only in the vicinity of Oliver. They occupy nearly level to moderately sloping areas in association with Rutland, Glenfir, Ratnip and Burnell Lake soils.

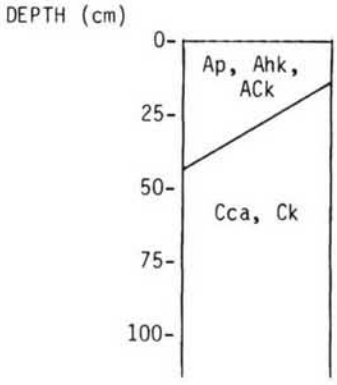
Ponderosa soils have developed in a gravelly, moderately coarse textured fluvial veneer between 10 and 50 cm thick, overlying gravelly coarse textured fluvial fan deposits. Surface and subsurface textures are gravelly or very gravelly sandy loam or gravelly loam; subsoils are very gravelly loamy sand. These Rego Dark Brown: calcareous phase soils are well to rapidly drained, rapidly pervious and have low water holding capacity.

Almost all areas of Ponderosa soils are cleared, cultivated and planted to tree fruits and vineyards. Small, scattered, uncleared areas located on steep slopes support scattered Ponderosa pine, sagebrush and grass in the understory.

Except for a few steeply sloping areas, Ponderosa soils are moderately well suited for most urban and related uses. Incomplete septic tank effluent filtration may occur in the coarse-textured subsoils.

A typical view of moderately sloping Ponderosa soils near Oliver.

GENERALIZED PONDEROSA SOIL PROFILE

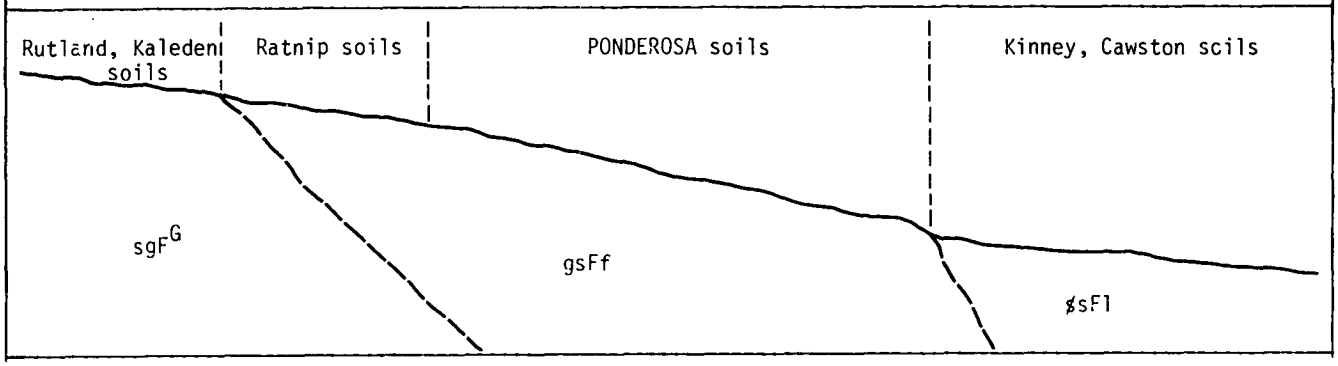


Dark grayish brown (10YR 4.5/2.5), gravelly sandy loam; weak, fine to very fine, granular structure; very friable consistence; moderately calcareous.

Pale brown (10YR 5.5/3 - 6/3.5), very gravelly loamy sand; weak, fine subangular blocky structure; very friable to firm consistence; strongly calcareous.

TAXONOMIC SOIL CLASSIFICATION: Rego Dark Brown: calcareous phase

PONDEROSA SOIL LANDSCAPE CROSS SECTION



SOIL CHARACTERISTICS

DEPTH TO BEDROCK (m)	:	>2
PARENT MATERIAL	:	fluvial fan deposits
DEPTH TO FREE LIME (cm)	:	calcareous to surface
SURFACE STONINESS CLASS	:	0-3
DEPTH TO WATERTABLE (m)	:	>2
PERVIOUSNESS CLASS	:	rapid
SOIL DRAINAGE CLASS	:	well to rapid
DEPTH TO ROOT RESTRICTION (cm)	:	none
TOPOGRAPHY	:	nearly level to moderate slopes

PHYSICAL SOIL PROPERTIES	SOIL DEPTH	
	0-50 cm	>50 cm
UNIFIED TEXTURE SYMBOL	GM-GC	GM-GP
AASHO TEXTURE SYMBOL	A-1	A-1
LIQUID LIMIT	15-25 or NP	NP
PLASTICITY INDEX	0.1-5 or NP	NP
SHEAR STRENGTH	high to medium	high to medium
SOIL TEXTURE	very gravelly sandy loam to gravelly loam	very gravelly loamy sand
PERMEABILITY	rapid	very rapid
AWSC	moderate to low	low
COARSE >7.5 cm (%)	5-15	20-40
FRAGMENTS <7.5 cm (%)	20-75	30-60
PASSING # 4	50-80	30-50
SIEVES (%) # 40	20-30	5-20
#200	5-10	<2

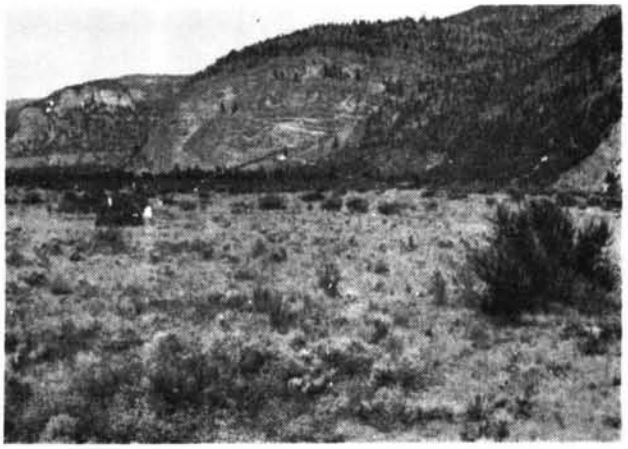
CHEMICAL SOIL PROPERTIES	SOIL DEPTH	
	0-50 cm	>50 cm
SOIL REACTION (pH) 1:1 H_2O	7.8-8.1	8.0-8.5
1:2 0.01M $CaCl_2$	7.4-7.6	7.5-7.8
SALINITY CLASS	non-saline	non-saline
ORGANIC CARBON	moderate	low
NITROGEN	low to very low	very low
EXCHANGE CAPACITY	low	low to very low
EXCHANGEABLE CATIONS - Ca	high	high
- Mg	low	medium to high
- Na	very low	very low
- K	medium	moderately high
BASE SATURATION (%)	100	100
PHOSPHOROUS	very low	very low
SULFUR	low	medium

RUTLAND SOILS (R)

GENERAL COMMENTS

Rutland soils occupy significant areas throughout the Okanagan Valley portion of the map area and also near Keremeos in the Similkameen Valley. Topography is usually level to gently sloping although some terrace scarps are extremely sloping. Soils commonly associated with Rutland soils include Faulder, Dartmouth, Keremos, Oyama and Skaha.

The parent material of Rutland soils is a moderately coarse textured veneer between 10 and 25 cm thick which overlies gravelly and stony, very coarse textured glaciofluvial deposits. Surface soil textures are dominantly sandy loam or loamy sand while subsurface and subsoil textures are gravelly sand or gravelly loamy sand. Stones and cobbles are also common. Rutland soils are classifed as Orthic Dark Brown. They are rapidly drained, rapidly pervious, have slow surface runoff and low water holding capacity.

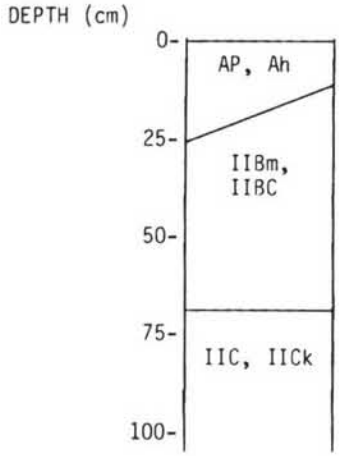


A very gently sloping area of undeveloped Rutland soils northeast of Oliver.

The main agricultural limitations are gravelly and stony textures, rapid permeability and low water holding capacity. Tree fruits and grapes are presently grown in most cultivated and irrigated areas. Typical native vegetation consists of a variety of grasses, sagebrush, rabbitbrush and scattered Ponderosa pine.

Rutland soils are well suited for urban and related uses. They are rapidly drained, have high bearing capacity and generally level topography. The depth of topsoil is shallow. Effluent from septic field installations may be incompletely filtered by the very gravelly, coarse-textured subsoil.

GENERALIZED RUTLAND SOIL PROFILE



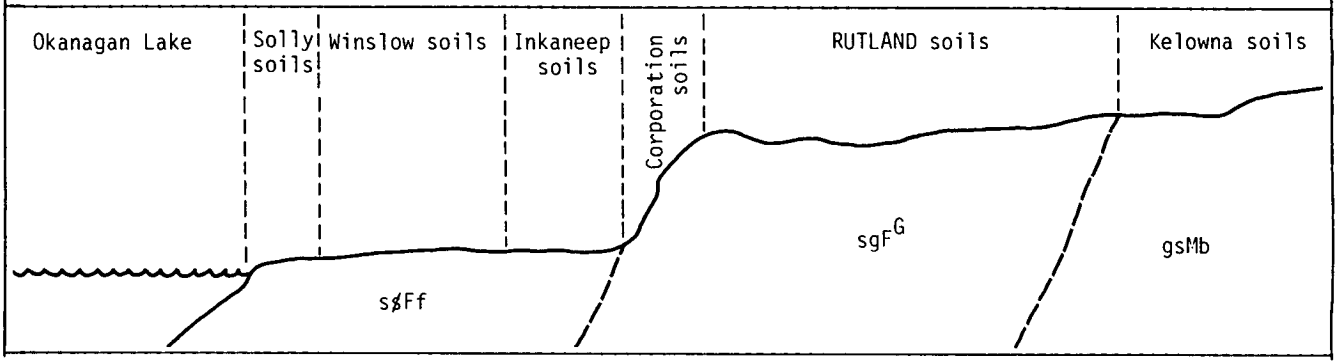
AP, Ah — Dark grayish brown or brown (10YR 4/2.5), sandy loam or loamy sand; weak, fine subangular blocky structure; soft consistence.

IIBm, IIBC — Brown (10YR 5/3), very gravelly sand or very gravelly loamy sand; weak, very fine subangular blocky structure; soft consistence.

IIC, IICk — Light gray to brownish-yellow (10YR 7/1-6/6), very gravelly sand; single-grain; loose consistence; weakly calcareous in upper part, grading to moderately calcareous at depth.

TAXONOMIC SOIL CLASSIFICATION: Orthic Dark Brown

RUTLAND SOIL LANDSCAPE CROSS SECTION

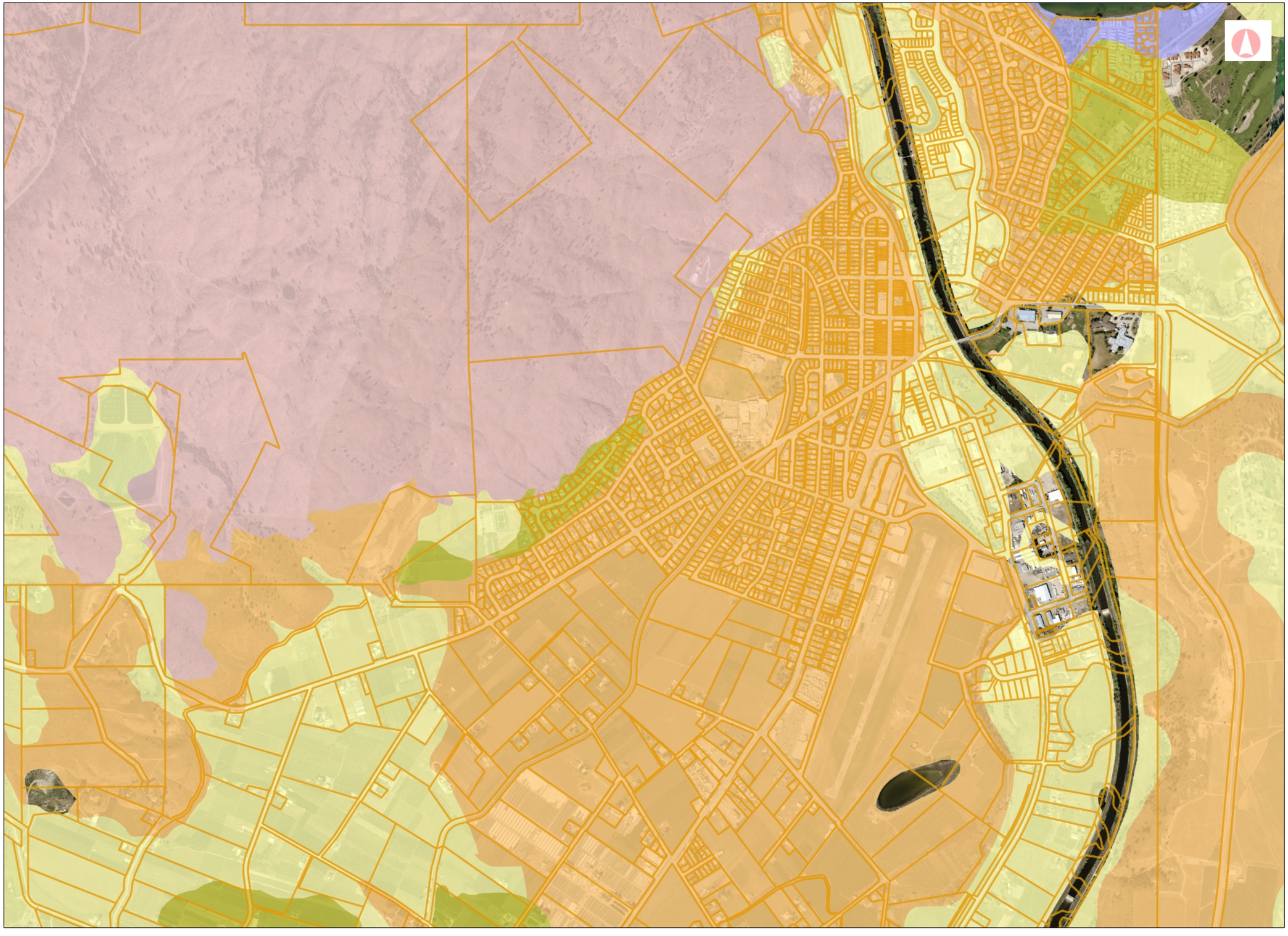


SOIL CHARACTERISTICS

DEPTH TO BEDROCK (m)	:	>2
PARENT MATERIAL	:	fluvioglacial deposits
DEPTH TO FREE LIME (cm)	:	>80
SURFACE STONINESS CLASS	:	1-4
DEPTH TO WATERTABLE (m)	:	>2
PERVIOUSNESS CLASS	:	rapid
SOIL DRAINAGE CLASS	:	rapid
DEPTH TO ROOT RESTRICTION (cm)	:	none, other than that due to gravelly and strong subsurface textures
TOPOGRAPHY	:	mostly nearly level to gentle slopes; some terrace scarps may be extremely sloping

PHYSICAL SOIL PROPERTIES	SOIL DEPTH	
	0-20 cm	>20 cm
UNIFIED TEXTURE SYMBOL	SM	GW-GP
AASHO TEXTURE SYMBOL	A-2-4	A-1
LIQUID LIMIT	NP	NP
PLASTICITY INDEX	NP	NP
SHEAR STRENGTH	medium	high
SOIL TEXTURE	sandy loam, loamy sand	gravelly loamy sand, very gravelly sand
PERMEABILITY	rapid	very rapid
AWSC	low	very low
COARSE >7.5 cm (%)	0-5	10-30
FRAGMENTS <7.5 cm (%)	0-10	30-80
PASSING # 4	60-100	50-80
SIEVES (%) # 40	40-80	1-5
#200	10-40	<4

CHEMICAL SOIL PROPERTIES	SOIL DEPTH	
	0-20 cm	>20 cm
SOIL REACTION (pH) 1:1 H_2O	6.6-7.4	7.2-8.0
1:2 0.01M $CaCl_2$	6.1-6.8	6.8-7.5
SALINITY CLASS	non-saline	non-saline
ORGANIC CARBON	moderate	very low
NITROGEN	low	very low
EXCHANGE CAPACITY	medium	low to very low
EXCHANGEABLE CATIONS - Ca	high	high
- Mg	high	high
- Na	very low	medium
- K	high	low
BASE SATURATION (%)	90-100	100
PHOSPHOROUS	medium	variable
SULFUR	low	low



BRITISH COLUMBIA

iMapBC Mapping

Legend

PMBC Parcel Cadastre - Ou

Soil Polygons - Parent Mate

- MDEP_1
- <Null>
- -
- Anthropogenic
- Colluvial
- Eolian
- Fluvial
- Organic - Fen Peat
- Organic - Forest Peat
- Glaciofluvial
- Glaciolacustrine
- Glaciomarine
- Lacustrine
- Marine
- Organic - Spaghnum Peat
- Till
- Undifferentiated Mineral
- Organic - Undifferentiated
- Volcanic

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Datum:	NAD83
Projection:	WGS_1984_Web_Mercator_Auxiliary_Sphere

Key Map of British Columbia