FERNIE ALPINE RESORT UTILITIES CORPORATION

2004 SEWAGE TREATMENT PLANT ANNUAL REPORT

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APPENDICES

1.0 INTRODUCTION

The following annual report for the wastewater treatment plant at Fernie Alpine Resort (FAR) operated by Fernie Alpine Resort Utilities Corporation (FARUC) is compiled in accordance with the requirements of the Municipal Sewage Regulation. This report covers all of calendar year 2004.

In 2004, FARUC was contracted by Resorts of the Canadian Rockies Inc. (RCRI) to operate and maintain the sewage treatment plant and collection system at FAR.

The plant is subjected to a large seasonal swing in utilization with the winter ski period imposing the highest demands. The critical time for sewage flows at the resort is from mid-December to the end of March during the peak ski season. Summer utilization of the treatment works is generally low.

FARUC treats its wastewater at a tertiary treatment plant designed to remove BOD_5, suspended solids, ammonia, and phosphorous. UV lamps disinfect the wastewater prior to discharge to the Elk River.

Plant effluent quality has been high with the exception of phosphorous (both ortho and total phosphorous) concentrations which have been above discharge limits set in the MSR registration during 2003 and 2004. The treatment plant's effluent failed the first of the three toxicity tests in 2004; however, on retesting, the plant's effluent passed the toxicity tests which showed the effluent to be non-toxic.

2.0 REGISTRATION REQUIREMENTS

This section describes operating requirements as specified in RCRI's Registration Letter RE 17139. The registration describes parameters that must be tested for, operating conditions, sampling frequency, and sampling locations.

2.1 Parameters

The following parameters are to be monitored:

pH	Field sample
Temperature	Field sample, measured in Celsius
Flow	Field samples, measured as m^3/d
BOD_5	Five day biochemical oxygen demand, measured in mg/l
TSS	Total suspended solids or non-filterable residue, measured in mg/l
NH_3	Ammonia concentration, expressed as nitrogen in mg/l
NO_3	Nitrate concentration, expressed as nitrogen in mg/l
NO_2	Nitrite concentration, expressed as nitrogen in mg/l
Total-P	Total phosphorous concentration, measured in mg/l
Ortho-P	Orthophosphate concentration, measured in mg/l
Fecal coliform	Bacterial concentration, measured as colony forming units per 100 ml
Toxicity Bioassay	96 hour toxicity test, recorded as pass or fail

2.2 Registration Letter Operating Conditions

The treatment plant is required to meet the effluent discharge conditions outlined in Table 1.

Table 1
Effluent Limits

Parameter	Limit	Unit
Flow	1280	m^3/day
BOD_5	45	mg/l
TSS	45	mg/l
Total-P	1.0	mg/l
Ortho-P	0.5	mg/l
Coliforms*	200	CFU/100 ml
Toxicity Bioassay	pass	n/a

* Limit for recreational waters only, not included in RCRI registration letter.

Primary screenings and dewatered sludge are to be disposed of at the Crowsnest Pass/Pincher Creek landfill. Disposal at other sties requires authorization under the Waste Management Act.

Operators at the plant are required to be certified in accordance with Section 22 of the MSR.

2.3 Reporting Requirements

An annual report demonstrating the performance of the facility is to be publicly posted to the Internet within 120 days of the end of the calendar year. The report must include tabulated standards and results for all test samples, interpretation of the results, an indication of the state of compliance of the facility, and the total wastewater flow for the report period.

Additionally, the annual report is to include the following:

- Notification of significant operating events including discharge variances outside given limits,
- Recommendations for operational or facility modifications,
- Notification of proposed or implemented plant modifications,
- Details of proposed or implemented water conservation measures,
- A plan indicating existing and proposed developments,
- A comparison of projected and actual wastewater flows,
- Projected wastewater flows resulting from proposed development compared to the remaining WWTP capacity, and
- A comparison of water supply and wastewater flows.

For this report, additional information on wasted sludge volumes was requested.

2.4 Sampling Frequency

The MSR Registration requires RCRI and, as such, the contract operator FARUC, to undertake the environmental testing program outlined in Table 2 below.

Elk River testing requires that a minimum of 18 samples annually are taken from each of the upstream, initial dilution zone (IDZ) and downstream river locations, relative to the outfall diffuser. The sampling locations were identified in the April 2001 Environmental Impact Study.

A minimum of 12 influent samples are required for BOD_5 and TSS. Flow data is to be collected continuously.

At least 25 effluent samples are to be collected for all parameters except the continuously recorded discharge flow and the toxicity bioassay, where three annual samples are necessary.

The intent of the environmental testing procedure outlined in Table 2 is to collect influent and effluent samples during peak demand periods as indicated by resort bookings. To correspond with peak plant loading, river samples are to be collected on the same day as effluent samples.

In addition to the program and tests listed above, other in-plant testing is needed to permit operational control of the process.

Table 2
Sampling Location/Frequency/Type

Parameter	Location					
	Elk River	QTY	Influent	QTY	Effluent	QTY
pH	WS/G	18	--	--	M/G, WS/G	25
Temp	WS/G	18	--	--	--	--
Flow	--	--	D/C	n/a	D/C	n/a
BOD_5	--	--	M/G	12	M/G, WS/G	25
TSS	WS/G	18	M/G	12	M/G, WS/G, D/C	25
NH_3-N	WS/G	18	--	--	M/G, WS/G	25
NO_3-N	WS/G	18	--	--	M/G, WS/G	25
NO_2-N	WS/G	18	--	--	M/G, WS/G	25
Total-P	WS/G	18	--	--	M/G, WS/G	25
Ortho-P	WS/G	18	--	--	M/G, WS/G	25
Fecal Coliform	WS/G	18	--	--	M/G, WS/G	25
Toxicity Bioassay	--	--	--	--	3 Y/G	3

Where:

WS/G	Weekly seasonal grab sampling, required for three six-week periods during the winter peak, the spring after ice-out, and in the fall when river turbidity and flows are low.
D/C	Daily continuous sampling using an on-line instrument and data-logger.
M/G	Monthly grab sample (not required when weekly seasonal testing is taking place).
3 Y/G	Three samples per year to correspond with WS/G sampling periods.

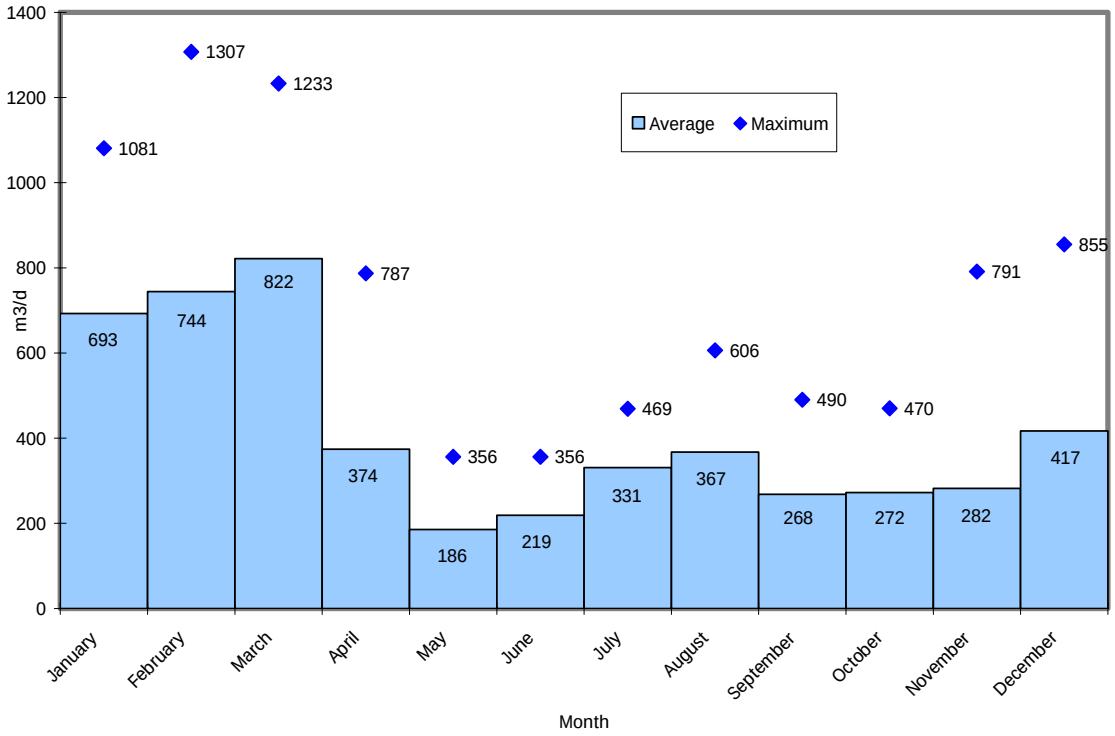
3.0 SEWAGE FLOW RECORDS

This section provides data and analysis regarding plant effluent flows and a comparison of water use and sewage generated.

Total effluent flow from the WWTP for 2004 was recorded from the effluent flow meter as 151,815 m^3 for an average of 416 m^3 per day. The ski resort operates with a much higher winter and late spring demand than during any other period. Average daily plant flows in January, February and March are above 690 m^3 per day with peak flows in excess of 1300 m^3/day.

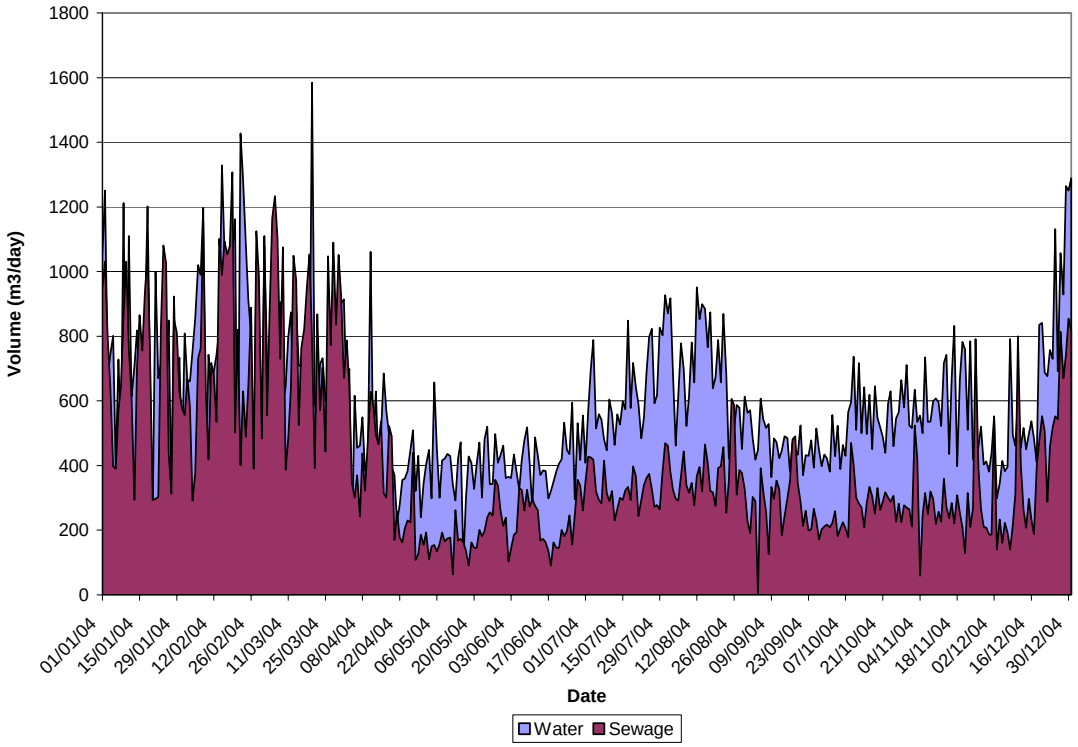
Population data show a strong correlation between plant flows and day-users at the resort. In addition to a permanent population of approximately 70 persons at the hill, there are several restaurants that operate year-round providing services to casual visitors, thus flows never drop to zero. Figure 1 provides monthly average and peak day sewage flows for 2004.

Figure 1
Sewage Effluent Average and Peak Flows by Month



While high day-user populations do have an impact on sewage plant utilization, it is apparent from Figure 2 that the amount of water consumed at the hill is often smaller than the amount of sewage received at the plant in the winter months. Rainfall and snowmelt appears to have a significant impact on sewage flows, as evidenced by the extreme flow of 1307 m^3/d on February 19, 2004 during an anomalous warming period.

Figure 2
2004 Water Consumption and Sewage Generation



It is apparent that during the winter period, infiltration is a problem for the plant flows, while during the remainder of the year, the ratio of sewage generation to water demands resumes a normal municipal type ratio.

FARUC has undertaken to inspect and test sewer lines to determine locations where infiltration remains an issue. Work will be ongoing to eliminate sources of groundwater in the sewer system, which will improve operation of the treatment plant.

Expected wastewater generation based on figures provided in the BC Health Act for various lodging types projects a maximum day flow of 979.2 m^3/day in 2004 at the resort. This is higher than the 822 m^3/d average day flow at the resort during March of 2004. Using a correction factor of 1.33 to account for the difference between the projected flow and the actual peak recorded flow of 1307 m^3/d, the peak expected wastewater flows by year are provided in Appendix A for the resort's planned expansion. By 2008, total expected flows will be approximately 1740 m^3 per day if ground and stormwater infiltration is not addressed and flow restrictive devices are not utilized in new construction.

Flow restrictive devices are intended to be utilized in all new construction and a major infiltration/ rehabilitation program is scheduled to begin in the fall of 2005. The intention is to reduce the amount of per unit sewage generation and to reduce the amount of ground and surface water infiltration into the sewer system. FARUC will monitor sewage flows to determine the efficacy of the program.

With the proposed level of expansion (see Appendix A), the Resort will require an amendment to the registration letter to permit discharge above the current limit of 1280 m^3/day. Sewage discharge rates will be monitored and an application will be submitted to increase the maximum daily discharge when warranted.

4.0 OVERVIEW OF ELK RIVER SAMPLE RESULTS

This section provides data and analysis for the Elk River samples taken during 2004.

Table 3 provides a summary record of the Elk River test results for the period March 22, 2004 to December 28, 2004.

The first six-week sampling period began March 22, 2004. The second sampling period began August 31, 2004 and the final period began November 30, 2004.

There is no noticeable change in river temperature, pH, TSS, phosphorous or nitrogen nutrient concentrations during any of the sample periods.

Overall, the analyzed concentrations remain constant between the upstream (US) sampling zone and the downstream (DS) sampling zone. The data indicates that the plant's effluent appears not to have any adverse effect on background nutrient concentrations in the Elk River.

Table 3
Elk River Sample Results

Sample Date	Temp (C)			pH			TSS (mg/l)			fecal coliforms (CFU/100 ml)			P-OPO4 (mg/l)			Total P (mg/l)			NH3-N (mg/l)			NO3-N (mg/l)			NO2-N (mg/l)		
	US	IDZ	DS	US	IDZ	DS	US	IDZ	DS	US	IDZ	DS	US	IDZ	DS	US	IDZ	DS	US	IDZ	DS	US	IDZ	DS	US	IDZ	DS
22/03/2004	3.4	3.6	3.5	8.44	8.41	8.39	1	2	2	0	0	0	0.00	0.01	0.01	0.1	0.1	0.1	0.1	0.1	0.0	0.2	0.2	0.2	0.01	0.01	0.01
29/03/2004	6.7	6.4	5.9	8.51	8.5	8.5	6	6	7	0	0	0	0.01	0.01	0.01	0.0	0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.3	0.02	0.01	0.01
05/04/2004	4.7	4.9	5.0	8.46	8.48	8.46	4	8	4	14	0	0	0.01	0.01	0.01	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.01	0.01	0.01
12/04/2004	6.5	6.6	7.0	8.23	8.23	8.26	8	8	9	0	1	3	0.01	0.01	0.01	0.1	0.2	0.1	0.0	0.0	0.0	0.3	0.2	0.3	0.01	0.01	0.01
19/04/2004	4.6	5.0	5.1	8.3	8.31	8.33	6	4	5	2	2	2	0.01	0.01	0.01	0.1	0.1	0.1	0.0	0.0	0.0	0.2	0.3	0.3	0.01	0.01	0.01
26/04/2004	8.4	8.3	8.5	8.33	8.4	8.42	3	7	4	0	5	0	0.01	0.01	0.01	0.1	0.1	0.1	0.0	0.1	0.0	0.2	0.2	0.2	0.01	0.01	0.01
31/08/2004	13.2	12.9	12.9	8.6	8.6	8.6	4	6	4	14	16	20	0.01	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.2	0.00	0.01	0.01
07/09/2004	10.4	10.4	10.4	8.6	8.6	8.6	1	2	1	7	5	10	0.00	0.00	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.01	0.01	0.01
14/09/2004	10.3	10.1	10.3	8.6	8.6	8.6	3	4	2	13	0	2	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.3	0.01	0.01	0.01
21/09/2004	9.0	8.7	8.7	8.6	8.6	8.6	4	2	2	0	0	0	0.01	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.3	0.01	0.01	0.01
28/09/2004	10.7	10.5	10.4	8.2	8.2	8.2	2	2	2	0	0	0	0.01	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.2	0.01	0.01	0.01
05/10/2004	8.5	8.5	8.5	8.5	8.5	8.5	1	1	1	0	0	0	0.00	0.01	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.4	0.01	0.01	0.01
30/11/2004	0.6	0.5	0.5	8.5	8.6	8.6	0	0	0	0	0	1	0.01	0.01	0.01	0.1	0.1	0.1	0.0	0.0	0.0	0.2	0.4	0.4	0.01	0.01	0.01
07/12/2004	1.1	1.0	0.9	8.9	8.9	8.9	0	0	0	0	0	1	0.00	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.4	0.5	0.01	0.01	0.01
14/12/2004	1.3	1.3	1.1	8.7	8.7	8.7	6	4	5	3	2	5	0.01	0.01	0.01	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.3	0.01	0.00	0.01
20/12/2004	1.7	1.7	1.6	8.4	8.4	8.4	0	1	1	1	2	2	0.01	0.01	0.01	0.1	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.5	0.01	0.01	0.01
28/12/2004	0.4	0.4	0.4	8.7	8.7	8.7	2	1	2	0	0	1	0.01	0.01	0.01	0.0	0.0	0.1	0.0	0.0	0.0	0.3	0.4	0.5	0.00	0.00	0.00
Average	**6.0**	**5.9**	**5.9**	**8.5**	**8.5**	**8.5**	**3.0**	**3.3**	**3.0**	**3.2**	**1.9**	**2.8**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.2**	**0.2**	**0.3**	**0.0**	**0.0**	**0.0**
Minimum	**0.4**	**0.4**	**0.4**	**8.2**	**8.2**	**8.2**	**0.4**	**0.4**	**0.4**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Maximum	**13.2**	**12.9**	**12.9**	**8.9**	**8.9**	**8.9**	**8.4**	**8.0**	**8.8**	**14.0**	**16.0**	**20.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.2**	**0.1**	**0.1**	**0.1**	**0.0**	**0.5**	**0.4**	**0.5**	**0.0**	**0.0**	**0.0**

5.0 OVERVIEW OF INFLUENT TEST RESULTS

This section provides data and analysis for the plant influent (raw sewage) samples taken during 2004.

Table 4 provides a summary record of the influent test results for the period December 29, 2003 (taken as indicative of early-January 2004 conditions) to December 28, 2004.

Table 4
Influent Results

Date	2004 Influent Results Summary		
	Flow	TSS	BOD
	m3/d**	mg/L	mg/L
29/12/2003	674	292	162
29/02/2004	985	668	458
22/03/2004	868	204	188
29/03/2004	836	1900	800
05/04/2004	301	328	254
12/04/2004	591	174	192
19/04/2004	490	408	233
26/04/2004	224	216	198
10/05/2004	174	67	96
14/06/2004	168	47	70
18/07/2004	293	138	111
31/08/2004	227	132	117
07/09/2004	256	72	87
05/10/2004	205	562	209
30/11/2004	187	40	92
07/12/2004	192	264	140
14/12/2004	207	84	119
20/12/2004	553	170	221
28/12/2004	670	504	471
# Samples	**19**	**19**	**19**
Average	**426.4**	**330.0**	**222.0**
High	**985.0**	**1900.0**	**800.0**
Low	**168.0**	**40.0**	**70.0**

*** Test results not regulated by registration letter or MSR, reported for comparison purposes only.**
**** Influent flows assumed from effluent flow meter.**

A total of 19 BOD and TSS samples were analyzed providing a minimum of one sample per month for the year. The influent flow rate was assumed to be the same as that recorded by the effluent flow meter. A daily effluent discharge is given in Table 4 for the sample dates.

Inlet BOD ranged as high as 800 mg/l during March 2004; the annual influent average BOD of 222 mg/l is considered moderately high for domestic sewage, though not above normal design parameters. The

number of restaurants at the resort is likely a contributing factor to the plant loading. The high BOD concentrations have been noted in previous annual reports. A new on-line raw sewage holding tank to be constructed in 2005 will permit flow and strength equalization, reducing the number of high-strength BOD values obtained in grab samples.

6.0 OVERVIEW OF EFFLUENT RESULTS

This section provides data and analysis for the effluent (treated) samples and plant flows during 2004.

A total of 22 sample results were taken for all parameters except coliform counts where 21 samples were collected. Effluent samples were collected on the same days as influent samples to permit an evaluation of plant performance.

Table 5 summarizes the number of days that samples exceeded MSR effluent requirements.

Table 5
MSR Parameter Compliance

Parameter	Unit	MSR Limit	No. of Samples	Average Value	Max. Value	Samples Over Limit
Flow	m^3/day	1280	365	414	1307	1
BOD_5	mg/L	45	22	< 5	< 5	0
TSS	mg/L	45	22	0.8	1.2	0
Total Phosphorus	mg/L	1.0	22	2.5	5.3	21
Ortho Phosphate	mg/L	0.5	22	2.3	4.4	22
Fecal Coliforms*	cfu/100 mL	200	21	3	32	0
Toxicity Bioassay	-	Non-toxic	3	N/A	N/A	1

* Limit for recreational waters only, not included in RCRI registration letter.

Table 6 provides a summary record of the effluent test results for the period December 29, 2003 (taken as indicative of early-January 2004 conditions) to December 28, 2004.

The maximum flow rate was exceeded on one day in 2004, which has been attributed to unseasonal snowmelt conditions.

Table 6
Effluent Results

Date	2004 Effluent Results Summary										
	Flow	temp	pH	TSS	BOD	Coliforms	P-OPO4	Total P	NH3-N	NO3-N	NO2-N
	m3/d	C		mg/L	mg/L	cfu/100 mL	mg/L	mg/L	mg/L	mg/L	mg/L
29/12/2003	674	13.6	7.83	1.2	5	1	2.57	2.45	6.800	18.2	0.95
29/02/2004	985	14.4	7.44	0.8	5	32	4.44	4.60	8.900	23.7	0.41
22/03/2004	868	13.3	7.58	0.4	5	2	2.98	3.31	7.900	21.7	0.25
29/03/2004	836	12.9	7.57	0.8	5	4	3.33	3.64	7.700	22.7	0.28
05/04/2004	301	12.6	7.75	1.2	5	1	4.17	5.27	0.074	21.7	0.01
12/04/2004	591	12.4	7.64	1.0	5	1	2.36	2.82	0.016	19.5	0.01
19/04/2004	490	11.9	7.74	1.0	5	1	2.45	2.69	0.001	23.0	0.01
26/04/2004	224	11.0	7.64	1.0	5	1	3.84	4.04	0.001	24.1	0.01
10/05/2004	174	11.1	7.72	1.0	5	1	2.36	2.71	0.015	15.9	0.01
14/06/2004	168	12.5	7.92	1.0	5	1	1.87	2.01	0.265	14.3	0.01
18/07/2004	293	16.7	7.99	1.0	5	1	2.17	2.30	0.126	14.5	0.01
31/08/2004	227	17.3	7.90	0.4	5	1	1.01	1.03	0.300	16.6	0.01
07/09/2004	256	16.0	8.10	1.0	5	1	1.96	2.01	0.014	14.5	0.01
14/09/2004	242.0	15.1	8.00	1.0	5	1	2.07	2.13	0.002	14.6	0.01
21/09/2004	213.0	14.7	8.10	1.0	5	1	2.07	2.11	0.001	13.5	0.01
28/09/2004	202.0	14.6	7.70	1.0	5	1	1.21	1.37	0.001	12.3	0.01
05/10/2004	205	13.6	8.00	1.0	5	1	1.36	1.50	0.024	11.9	0.01
30/11/2004	187	10.3	8.20	0.0	5	1	0.52	0.68	0.012	9.0	0.01
07/12/2004	192	13.2	8.40	0.4	5	1	1.49	1.55	0.022	9.6	0.11
14/12/2004	207	10.8	8.40	0.8	5	1	1.15	1.26	0.012	9.5	0.00
20/12/2004	553	12.1	8.20	0.0	5	1	1.96	1.98	0.050	20.5	0.04
28/12/2004	670	14.3	7.90	0.8	5		4.34	4.42	7.200	28.4	1.12
# Samples	**22**	**22**	**22**	**22**	**22**	**21**	**22**	**22**	**22**	**22**	**22**
Average	**398.1**	**13.4**	**7.9**	**0.8**	**5.0**	**2.7**	**2.3**	**2.5**	**1.8**	**17.3**	**0.2**
High	**985.0**	**17.3**	**8.4**	**1.2**	**5.0**	**32.0**	**4.4**	**5.3**	**8.9**	**28.4**	**1.1**
Low	**168.0**	**10.3**	**7.4**	**0.0**	**5.0**	**1.0**	**0.5**	**0.7**	**0.0**	**9.0**	**0.0**
Limit	**1280.0**	**N/A**	**N/A**	**45**	**45**	**200**	**0.50**	**1.00**	**N/A**	**N/A**	**N/A**
# Over Limit	**0**	**N/A**	**N/A**	**0**	**0**	**0**	**22**	**21**	**N/A**	**N/A**	**N/A**

Note: Shaded squares indicate results that were reported as 'less than' the stated value; for calculation purposes these have been converted to equal the value stated, ie <0.05 is now 0.05

All BOD samples were reported as less than 5 mg/l. TSS samples averaged less than 1.0 mg/l with a maximum concentration of 1.2 mg/l. These results show the plant is providing excellent BOD_5 and TSS removal with average removals of 97.7% and 99.8%, respectively.

The maximum effluent coliform concentration reached 32 CFU/100 ml, well below the limit set for recreational waters. Further, the Elk River sampling indicated no measurable impact of the effluent discharge in terms of background coliform counts.

Effluent ammonia concentrations are consistently low in the warmer months showing that the plant is effectively converting ammonia to nitrates and nitrites. Concentrations are higher in the winter months when biological processes are less efficient at ammonia oxidation. This result is expected and completely normal. There is no evidence from the river samples that the higher winter discharge of ammonia from the resort affects the Elk River basin.

The toxicity bioassay results (reported in Table 7) show the March 7, 2004 effluent was found to fail the test. A follow-up sample taken on April 4, 2004 was found to be non-toxic. The final sample taken August 22 was also found to be non-toxic.

Table 7
Toxicity Test Results

Sample Date	Result
07/03/2004	Fail
04/04/2004	Pass
22/08/2004	Pass

Phosphorous concentrations in the effluent remain above limits set in the registration letter with removal rates for total and ortho phosphorous at 59.5 and 77.6 percent, respectively. The high ratio of ortho to total phosphorous indicates that nearly all the available nutrient has been biologically processed. The source of the high effluent discharges was discussed at a site meeting between FARUC, USL and Dr. Bill Hyslop in March 2005 and was determined to be sludge that was re-releasing precipitated phosphorous under anaerobic conditions in the storage tank. The released phosphorous is internally recycled in the plant passing from dissolved to precipitated forms and back again with some of the surplus being released in the effluent. It was determined that a new aerobic sludge storage and digestion tank was required to alleviate the problem. FARUC has embarked on an upgrade program to implement this recommendation before the 2005 ski season begins.

The phosphorus concentrations in the plant effluent have no discernable impact on the Elk River, with upstream and downstream concentrations being virtually identical. A 2001 report by Highwood Environmental indicated that phosphorus releases would have a negligible impact on aquatic life in the Elk River. However, the implementation of continuously aerated sludge digestion in 2005 will prevent the elevated concentrations of both total and ortho phosphorous found in both 2003 and 2004.

There is also a need to continually monitor and optimize coagulant dosages for improved phosphorus removal. This work will be ongoing with the operation of the new sludge digester.

7.0 SLUDGE PRODUCTION AND DISPOSAL

For sludge disposal in 2004, FARUC utilized a combination of bagged and dewatered secondary and primary solids, and vacuum truck services hauling thickened settled secondary sludge. The solids were transported to the Crowsnest/Pincher Creek landfill. FARUC became aware in 2005 that the vacuum truck services were hauling to a private disposal site, which contravened the requirements set out in the registration letter as no prior approval was granted for this action.

The use of vacuum truck services for sludge removal was considered to be an interim emergency step to remove solids from the facility during periods of heavy use. Hauling data for both solids (Table 8) and sludge (Table 9) shows that 90% of the material was sent to the Crowsnest Pass facility and approximately 10% of the total annual disposal was directed to other facilities. Solids are assumed to comprise 20% of the total bag weight. The bagger unit is reported to be able to produce up to 60% solids by weight though no analysis has been completed for the plant. Secondary sludge is assumed to be 1.5% total solids with a specific gravity of 1.1.

Table 8
Bagged Solids Hauling Data

Date	Total kg	Solids kg
12-Jan-04	9,091	1,818
22-Jan-04	9,091	1,818
29-Jan-04	9,091	1,818
02-Feb-04	9,091	1,818
12-Feb-04	9,091	1,818
19-Feb-04	9,091	1,818
26-Feb-04	9,091	1,818
01-Mar-04	9,091	1,818
05-Mar-04	9,091	1,818
15-Mar-04	9,091	1,818
24-Mar-04	9,091	1,818
07-Apr-04	9,091	1,818
21-Apr-04	9,091	1,818
30-Apr-04	9,091	1,818
19-May-04	9,091	1,818
31-May-04	9,091	1,818
08-Oct-04	9,091	1,818
22-Dec-04	9,091	1,818
Total	**163,636**	**32,727**

Table 9
Secondary Sludge Hauling Data

Date	Volume	Solids
	l	kg
26-Jan-04	54,600	901
06-Feb-04	27,300	450
30-Apr-04	26,200	432
30-Apr-04	26,400	436
28-Dec-04	40,950	676
29-Dec-04	40,950	676
Total	**216,400**	**3,571**

The lack of sludge storage capacity in the plant is to be addressed through the construction of an aerated sludge digester in the fall of 2005. The use of the sludge digester will allow storage of sludge during peak production times (weekends) such that the dewatering unit can be used during slower (weekday) periods. The digester is to provide 60 days of retention, which will allow the sludge to thicken and improve dewatering.

8.0 PLANT CAPACITY

The sewage treatment plant has demonstrated an ability to deal with flows in excess of amounts expected based on the BC Health figures. Infiltration volumes have not affected the performance of the facility with BOD and TSS in the effluent remaining consistently low.

An indicator of remaining plant capacity is calculated by subtracting the ADWF from the peak day design capacity. The plant was expanded in 2002 to treat up to 1280 m^3/d while the maximum monthly average flow was 822 m^3/d in March 2004. The plant could presently handle an additional 458 m^3/d of average flow without infiltration. However, the infiltration of large volumes of surface water during rainfall and snowmelt events remains an issue that reduces this apparent remaining capacity.

Work carried out in 2003 included the sealing of manholes, diversion of ditches and the elimination of roof drains and sump pumps. Work still remains to be completed as the plant's inflow remain high during snowmelt events compared to the flows expected for the number of resort visitors. FARUC expects that infiltration and total sewage flows will be reduced as a result of sewer line rehabilitation work, flow monitoring and the implementation of flow restrictive devices in all new construction.

The plant capacity is also compromised by the size of the existing sludge holding tank. The proposed sludge digester is sized for 60 days of storage at 1800 m^3/day sewage inflow to the plant.

9.0 PLANT IMPROVEMENTS

FARUC has authorized USL to proceed with upgrades to the existing facility in order to implement recommended upgrades at the WWTP as discussed at the site meeting. This section describes the upgrades, design, the impact on phosphorous removals from the effluent stream once construction is complete, and the required operational changes needed to incorporate the new facilities into the process.

Improvements to the plant made in 2003 resulted in a more stable operation during 2004 with no major incidents being reported by the operators, excepting February's high flow event. The problem of high phosphorous concentrations in the effluent remains and is to be addressed through improvements planned for 2005.

Due to concerns regarding phosphorous concentrations in 2003/04, the Operators implemented a program to change the chemical coagulant, dosage and injection point in an attempt to improve removals. The results were not effective resulting in the contracting of Dr. Bill Hyslop in February 2004 to do a field plant assessment/operational report.

At an April 13, 2005 site meeting convened to create an action plan arising from Dr. Bill Hyslop's audit of the plant, which was attended by FARUC, USL and Dr. Hyslop, a number of concerns were raised including:

- The impact of extreme flows on plant operations,
- Difficulties operators face with sludge storage and disposal,
- The release of phosphorous from sludge stored in unaerated holding tanks,
- The quantity of solids overflowing the clarifier weirs, and
- The need to simplify plant operations and to remove obsolete equipment.

Modifications to the plant planned for 2005 are those intended to reduce peak hour loading on the treatment facilities, to reduce effluent phosphorous concentrations below MSR requirements, and to reduce the volume of sludge produced at the plant. The focus is to allow the operators increased flexibility to operate the works and to minimize the need to utilize sludge hauling services while meeting effluent quality criteria.

The modifications consist of the following:

- New 510 m^3 aerated equalization basin,

- Inlet flow metering,
- New 190 m^3 aerated sludge digester and thickening tank,
- Clarifier modifications,
- Electrical and control modifications, and
- Removal of obsolete equipment and piping.

These modifications are to be completed for the 2005 ski season. The plant is to remain in operation during the modifications.

9.1 Equalization Tank

The plant currently uses a 140 m^3 offline equalization tank without aeration. The tank is not sized to handle current demands, thus a new 510 m^3 on-line equalization basin will be constructed nearby the existing plant. To prevent odours and to encourage mixing, a sloped bottom tank, coarse bubble aerators and a new blower unit are to be installed. An inline pinch valve will be used to control sewage flows to the existing channel monster. A new influent magnetic flow meter will also be installed. The tank will be provided with bypass piping to divert raw sewage around the equalization tank directly to the auger monster for use during low demand periods.

The equalization tank valves, blowers and electrical control equipment will be housed in a new building adjacent to the proposed tank site.

The equalization tank will reduce fluctuations in both flow rate and mass loading to permit the existing facility to operate at a constant pace. The tank is sized for projected future sewage flows so that additional equalization tank capacity increases are not required as the resort develops.

Following equalization tank construction, the existing two activated sludge tanks will be operated at a constant volume to permit more precise control over MLVSS concentrations as only the rate of RAS will need to be set. The activated sludge tanks will flow by gravity to the existing clarifiers, eliminating the need for activated sludge pumps.

9.2 Sludge Digestion and Storage

Currently waste sludge is stored in an unaerated 58 m^3 storage tank used as a gravity thickener with the supernatant returned to the plant inlet. Because of the anaerobic conditions prevalent in the thickening tank, re-released phosphorous in the supernatant liquid is being recycled within the plant and causing

elevated concentrations in the effluent. During the peak ski season months, consistent processing of waste sludge has not been possible as the operations staff have not had sufficient bulk storage capacity to delay dewatering operations until slower periods. This has resulted in sludge sitting for extended periods and the need for vacuum hauling services.

A new 190 m^3 aerated sludge digester and supernatant decant system will be constructed to provide up to 60 days of storage at the anticipated future flow rate of 17400 m^3/day. Decanted supernatant will be returned to the equalization tank for further BOD reduction in the activated sludge system.

Aerobic sludge digestion will be used to reduce the total bulk volume of wasted sludge while eliminating the release of biologically stored phosphorous from the solids, thus reducing phosphorous concentrations below the levels required by the MSR.

With a large storage tank, the operators will be able to postpone sludge bagging operations until after peak loading periods have passed (during weekdays, for example). Digestion will also reduce the total volume of sludge to be dewatered.

9.3 Clarifier Modifications

Clarifier modifications, including the installation of a centre stilling well and feed piping will improve settling and limit solids overflow from the weirs. Replacement of the transfer pumps with a gravity overflow from the activated sludge tanks will reduce turbulence, improve settling and eliminate the need for pump maintenance. The weirs around the clarifiers will be extended and a centre catwalk will be added.

9.4 Plant Electrical Equipment

On-line instrument readings in the plant are not currently being logged in a central storage device. The TSS analyzer has an associated data logger though communication interference has prevented the stored information from being downloaded. Shielded cables or modem communication will be implemented to limit interference and allow the data unit to be directly connected to the plant's computer. Alarms will also be added to the callout device to alert operators to high effluent TSS conditions.

10.0 ASSESSMENT SUMMARY

The plant has produced high quality effluent with BOD_5 and TSS consistently below 5 mg/L during all of 2004. Coliform and ammonia results show the plant functioned well in 2004. The plant failed one toxicity test; however, upon retesting, the effluent did pass. The plant passed two of the three toxicity tests.

Phosphorus reduction remains a problem at the plant though there is no measurable impact of phosphorous releases on the Elk River background nutrient concentrations. FARUC will complete a sludge digester before the 2005 ski season to reduce the re-release of precipitated phosphorous from anaerobic sludge. The 58 m^3 sludge storage tank will be phased out of service.

Solids removal from the site has been problematic as vacuum truck services have disposed of secondary sludge in locations not approved of in the registration letter. The total mass of sludge removed in this way amounted to approximately 10% of the total solids disposed of in 2004. The new digester is intended to eliminate the need to haul secondary sludge and will provide the operators with a significantly large storage volume such that bagging operations can be carried out during slow periods.

The resort is expected to see significant growth over the next years with the projected peak flow reaching 1740 m^3 per day by 2008. The effluent discharge limit of 1280 m^3/day should be increased to account for the proposed growth.

Construction of a 510 m^3 aerated equalization tank in 2005 will allow the plant to handle increased peak loading without resorting to process modifications. The modified equalization basin will permit the activated sludge tanks to operate at a constant level, reducing the complexity of the plant process.

The operators reported no significant incidents during 2004 partly due to improvements implemented in 2003. FARUC is carrying out ground and stormwater infiltration studies to determine the source of higher than expected sewage flows during rainfall and snowmelt events. The work will be ongoing and is expected to significantly reduce peak inflows to the waste treatment facility.

In summary, the activated sludge treatment process functioned well in 2004 with only phosphorous and sludge hauling concerns outstanding. FARUC has committed to plan modifications that will see significant improvements to address sludge and phosphorous issues before the start of the 2005 ski season.

11.0 AUTHORIZATION AND CLOSING

This report, entitled *2004 Sewage Treatment Plant Annual Report,* was prepared for the FARUC by Urban Systems Ltd. The material in this report reflects the best judgment of Urban Systems Ltd. based on the information available at the time of preparation. Any use that a third party makes of this report, or reliance on or decisions made based on it, is the responsibility of the third party. Urban Systems Ltd. accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions taken based on this report.

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APPENDIX A

Peak Expected Wastewater Flows by Year

Fernie Alpine Resort Estimated Sewage Generation (m^3/day)

Existing Development	Flow*	2004		Additional Sewage Flows Due to Expansion 2005	2006	2007	2008
	(l/unit/day)	Units	Generation	Generation	Generation	Generation	Generation
Griz Inn	1,136	45	51.1				
Wolf's Den	318	42	13.4				
Cornerstone	1,136	26	29.5				
Timberline Condos	1,022	58	59.3				
Polar Peaks (4-Plex Units)	1,136	24	27.3				
Timberline Single Family & B&B	1,363	51	69.5				
	Subtotal	**246**	**250.1**	**0**	**0**	**0**	**0**

Infill Units	Flow*	Units	Generation	2005	2006	2007	2008
	(l/unit/day)	(each)	(m^3/day)	Generation	Generation	Generation	Generation
Timberline Infills	1,022	57	58.3		44.968		40.88
Timberline Single Family	1,363	2	2.7				
Timberline Infill	1,022	46	47.0			61.32	
Timberlanding Multifamily	1,022					59.972	
Timberlanding Single Family	1,363					42.924	
Highline Infill	1,022	26	26.6				
	Subtotal	**131**	**134.6**	**0**	**44.968**	**164.216**	**40.88**

Highline Subdivision	Flow*	Units	Generation	2005	2006	2007	2008
	(l/unit/day)	(each)	(m^3/day)	Generation	Generation	Generation	Generation
Single Family	1,363	43	58.6		8.178		
Duplexes	1,363	10	13.6				
Parcel 31-Condotel	318	61	19.4				
Parcel 32-Duplex	1,363	16	21.8				
Parcel 36-Hotel	318	101	32.1				
Parcel 37-Townhouses	1,363	8	10.9				
Parcel 38-Townhouses	1,363	23	31.3				
Parcel 3-Condominium	1,363	12	16.4				
Parcel 8-Condominium	1,363	42	57.2				
	Subtotal	**316**	**261.4**	**0**	**8.178**	**0**	**0**

Day Users	Flow*	Population	Generation	2005	2006	2007	2008
	(l/skier/day)	(each)	(m^3/day)	Generation	Generation	Generation	Generation
Skiers	36	5200	187.2			64.8	
	Subtotal	**5200**	**187.2**	**0**	**0**	**64.8**	**0**

Dining Facilities/Bars	Flow*	Area	Generation	2005	2006	2007	2008
	(l/m^2/day)	(m2)	(m^3/day)	Generation	Generation	Generation	Generation
Lizard Creek - Dining	97	54.7	5.3				
Lizard Creek - Bar	145	40.4	5.9				
Kelseys - Dining	97	204.4	19.8				
Kelseys - Bar	145	65.0	9.4				
Daylodge - Dining	97	358.6	34.8				
Daylodge - Bar	145	260.7	37.8				
Mean Bean	97	26.8	2.6				
Gabrielles	97	133.8	13.0				
Powder House Inn	97	232.2	22.5				
Bears Den	97	62.4	6.1				
	Subtotal	**1439**	**146.0**	**0**	**0**	**0**	**0**

Daily Estimated Wastewater Flow (m^3/day)	**979.2**	**979.2**	**1032.4**	**1261.4**	**1302.3**
Corrected Daily Flow Projections	**1307.0**	**1307.0**	**1377.9**	**1683.6**	**1738.2**

* Estimated Wastewater Flows from BC Health Act, Sewage Disposal Regulation