FERNIE ALPINE RESORTS UTILITIES CORPORATION

2005 SEWAGE TREATMENT PLANT ANNUAL REPORT

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2740.0001.01 / May 2006

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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 2005.

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. Wastewater is disinfected with ultraviolet (UV) lamps prior to discharge to the Elk River.

Beginning in mid-October 2005, construction began for major facility improvements including:

- Addition of a 500 m^3 aerated equalization tank and a 200 m^3 aerated sludge digester,
- Addition of a new valve control room and blower building,
- New sewer piping, control valves and manholes to divert raw sewage to the new equalization tank,
- Modification of process piping in the two activated sludge tanks to increase total reactor capacity,
- Modification of the existing clarifiers to extend weir length and improve settling,
- Modification of the waste sludge piping and addition of a dedicated waste sludge pump, and
- Improvements to electrical systems to increase operating reliability.

The new equalization tank and sludge digester were not operational at the close of 2005, though the clarifier modifications and activated sludge tank process changes had been implemented. The equalization tank and digester were not fully operational until February 2006.

During the December construction period, the plant experienced both high flows and the build up of biological solids, which resulted in decreased filter performance and subsequent filter bypass events. No other treatment process was bypassed and the quality of the released effluent remained high even during the bypass events, though there was an increase in suspended solids and phosphorous.

Removal of solids from the plant remained a concern in 2005. All vacuum truck hauling services were suspended by FARUC in March of 2005 due to concerns raised by the Ministry about the final disposal site. FARUC then instituted an increased sludge bagging program to address solids removal.

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 2005. Elevated phosphorous concentrations are to be addressed with the operation of the aerated sludge digester. The treatment plant's effluent passed the two toxicity tests in 2005.

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.

As with the 2004 Annual Report, this report includes additional information on wasted sludge volumes.

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.

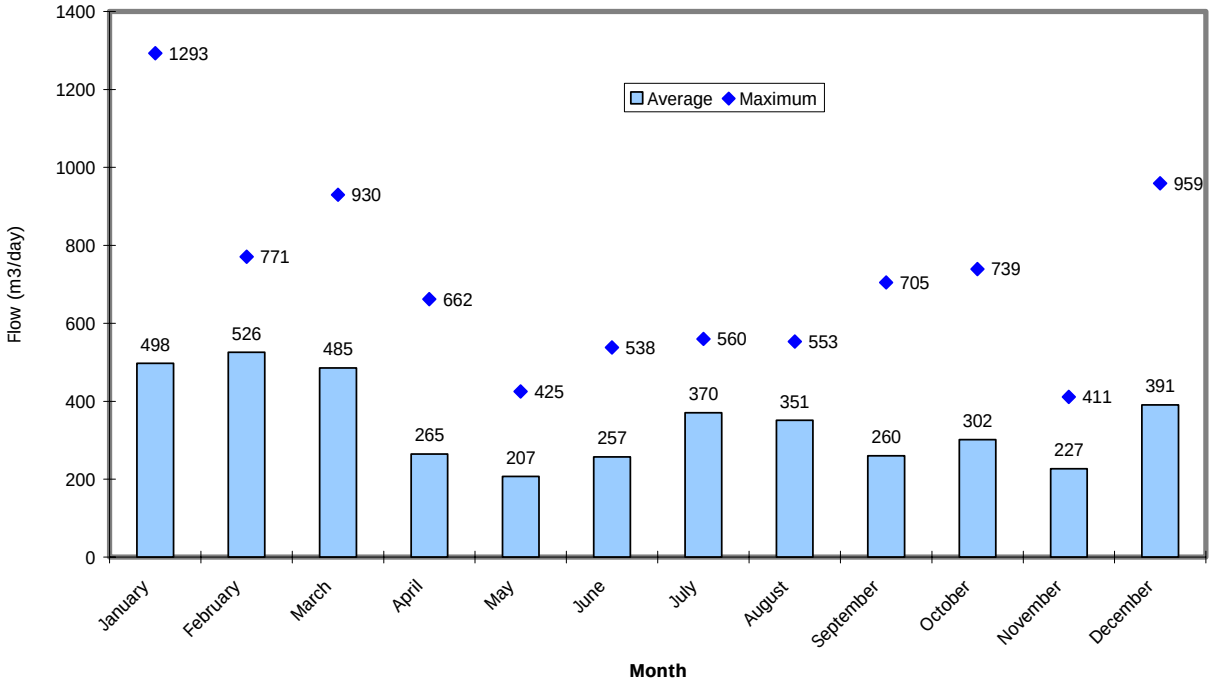
Total effluent flow from the WWTP for 2005 was recorded from the effluent flow meter as 125,699 m^3 for an average of 344 m^3 per day. The ski resort operates with a much higher winter and late spring demand than during any other period. The average daily plant flow through January, February and March of 2005 was 502 m^3 per day with the peak flows reaching 1,293 m^3/day on February 19, 2005.

Note that the 2004 flow records indicated annual average and winter average flows were 416 m^3/day and 690 m^3/day, respectively. The flow reduction in 2005 is at least partially attributable to the success of an infiltration reduction program at the ski hill.

Daily wastewater flows are strongly correlated to the number of day-users at the resort with the peak ski season having the highest flows. An increase in summer flows is due to non-skiing related recreational activities, generally hiking or mountain biking events. The lowest plant flows are experienced in the shoulder season periods (April to June and September to November).

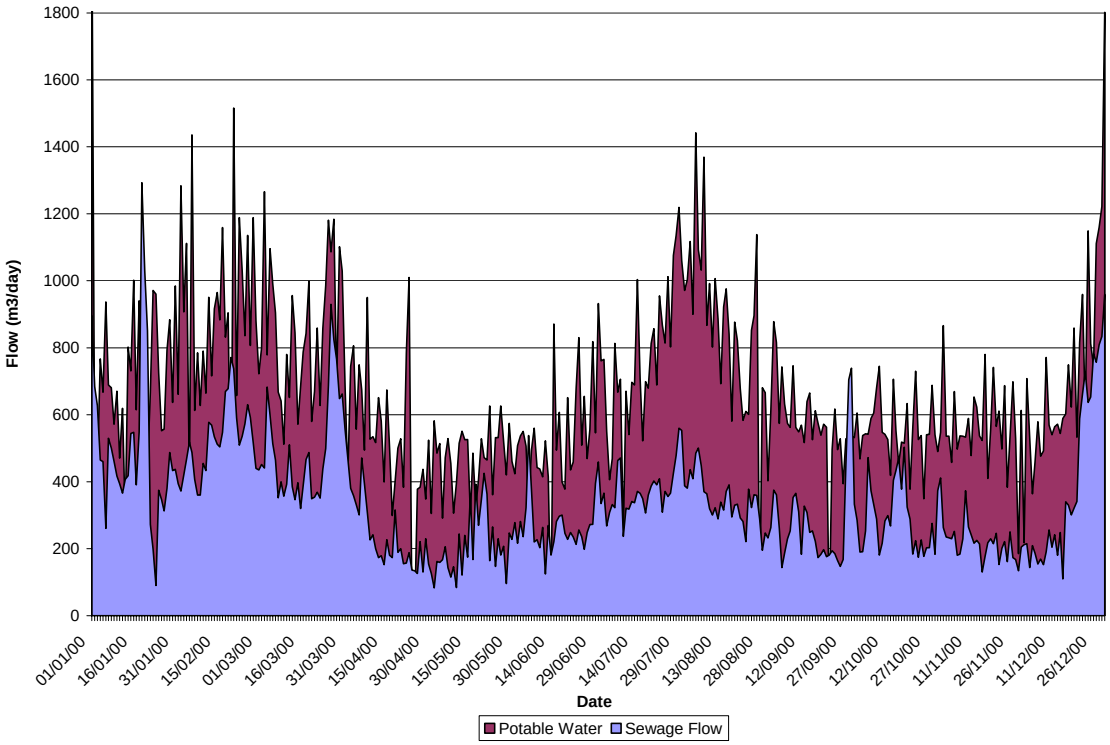
The approximately 70 permanent residents plus the contribution from several year-round restaurants providing services to casual visitors ensures that the sewage flows never drop to zero. Figure 1 provides monthly average and peak day sewage flows for 2005.

Figure 1
Sewage Effluent Average and Peak Flows by Month



The impact of the Resort's ongoing program to reduce sewer infiltration is demonstrated by the number of days where sewage flows exceeded water production (the excess is attributed to precipitation or snow melt entering the sewer); in 2004, there were 65 days of excess flow, while in 2005, the total number dropped to only 18, with the majority (13) taking place before improvements were implemented in the summer. Water use at the hill is compared to the amount of sewage received at the WWTP in Figure 2. The impact of rainfall and snowmelt on sewage flows has significantly decreased since 2004.

Figure 2
2005 Water Consumption and Sewage Generation



In 2004, approximately 70% of the annual potable water supplied (219,725 m^3) was returned to the WWTP (151,602 m^3). In 2005, the percentage of returned water dropped to 55%, while the total volume of sewage flow into the plant also dropped (125,699 m^3). The ratio of sewage generation to water demands is now below that typically expected in a municipality; further reduction of this operating ratio through the infiltration program will continue to benefit the WWTP.

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 2005 at the resort (same as 2004 projection). This is significantly higher than the 526 m^3/d average day flow at the resort during March 2005, the highest average flow month. The projected 2005 maximum day flow using standard wastewater generation rates ranks above the 99.5 percentile of actual recorded flows, indicating that maximum days are indeed rare. In 2004, the projected maximum day flow ranked in the 93.5 percentile for actual recorded flows.

Using a correction factor of 1.32 to account for the difference between the projected flow and the actual peak recorded flow of 1,293 m^3/d, the peak expected wastewater flows by year are provided in Appendix A for the Resort's planned expansion. By 2009, total peak day flow is projected to be approximately

1719 m^3/day if the ground and stormwater infiltration program does not produce further benefit and if flow restrictive devices are not utilized in new construction.

Flow restrictive devices are intended to be utilized in all new construction and the infiltration/ rehabilitation program is expected to be ongoing. 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 2005.

Table 3 provides a summary record of the Elk River test results for the period January 4, 2005 to December 27, 2005.

The first two samples taken in 2005 are part of the six samples required for the 2004/05 winter sampling period, started in December 2004. Due to heavy ice formation at the discharge point, initial dilution zone (IDZ) samples could not be collected for the January 20, 2005 tests; upstream and downstream samples were collected. The second sampling period began in late February and continued into early April; the final sampling period commenced in September ending in November. The first two samples of the winter program were taken in late December 2005.

There is no significant change in pH, TSS, coliform counts, phosphorous or nitrogen nutrient concentrations during any of the river sample periods. The October 17, 2006 sample indicates a major spike in river suspended solids, both upstream and downstream of the WWTP outfall. On the same day, plant effluent suspended solids were less than 1 mg/l.

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
2005 Elk River Sample Results

Sample Date	pH			TSS			Coliform			Ortho P			Total P mg/L			NH3			N-N03			N-N02		
	US	IDZ	DS	US	IDZ	DS	US	IDZ	DS	US	IDZ	DS	US	IDZ	DS	US	IDZ	DS	US	IDZ	DS	US	IDZ	DS
2005-01-04	8.30	8.40	8.30	1	1.20	0.80	1	1	1	0.01	0.01	0.01	0.05	0.05	0.05	0.001	0.001	0.001	0.25	0.48	0.28	0.01	0.01	0.01
2005-01-20	8.40	-	8.10	153	-	110.40	117	-	270	0.02	-	0.02	0.06	-	0.05	0.002	-	0.001	0.15	-	0.24	0.01	-	0.01
2005-02-28	8.50	8.50	8.50	0.5	0.80	1.20	1	1	1	0.03	0.03	0.01	0.05	0.05	0.05	0.047	0.048	0.067	0.33	0.52	0.45	0.01	0.01	0.01
2005-03-08	8.30	8.50	8.60	0.8	1.60	2.00	1	1	1	0.04	0.05	0.01	0.05	0.06	0.05	0.028	0.011	0.011	0.32	0.36	0.47	0.01	0.02	0.01
2005-03-14	8.50	8.50	8.50	0.8	1.20	1.60	1	1	1	0.06	0.05	0.06	0.07	0.06	0.07	0.020	0.030	0.029	0.35	0.40	0.38	0.01	0.01	0.01
2005-03-22	8.50	8.50	8.50	0.8	1.20	0.80	1	1	1	0.07	0.08	0.08	0.08	0.09	0.08	0.005	0.015	0.009	0.34	0.36	0.36	0.01	0.01	0.01
2005-03-29	8.60	8.40	8.50	4.4	6.00	4.40	1	6	1	0.04	0.04	0.03	0.05	0.05	0.05	0.026	0.021	0.029	0.41	0.33	0.39	0.02	0.02	0.02
2005-04-05	8.60	8.50	8.50	2.0	2.40	1.60	1	1	1	0.04	0.03	0.04	0.05	0.05	0.06	0.087	0.023	0.035	0.38	0.31	0.34	0.01	0.01	0.01
2005-09-26	8.70	8.70	8.70	1.6	1.60	1.20	1	1	1	0.03	0.02	0.03	0.05	0.05	0.06	0.017	0.003	0.010	0.32	0.44	0.46	0.01	0.01	0.01
2005-10-03	8.60	8.60	8.60	3.2	7.20	3.60	4	3	5	0.01	0.02	0.01	0.05	0.05	0.05	0.011	0.017	0.027	0.31	0.31	0.25	0.01	0.01	0.01
2005-10-10	8.70	8.70	8.60	1.2	0.80	0.80	1	1	1	0.01	0.01	0.01	0.06	0.05	0.05	0.004	0.013	0.016	0.37	0.39	0.37	0.01	0.01	0.01
2005-10-17	7.76	7.82	7.79	105	127.00	120.00	40	90	100	0.03	0.03	0.02	0.18	0.27	0.23	0.022	0.019	0.023	0.24	0.28	0.16	0.03	0.01	0.01
2005-10-24	8.30	8.30	8.30	3.6	2.80	3.20	4	1	1	0.02	0.01	0.02	0.13	0.05	0.03	0.002	0.010	0.010	0.25	0.31	0.26	0.01	0.01	0.01
2005-11-01	8.40	8.50	8.50	3.6	4.40	2.00	7	3	1	0.01	0.01	0.01	0.05	0.08	0.05	0.006	0.006	0.001	0.28	0.39	0.49	0.01	0.01	0.01
2005-12-20	8.30	8.30	8.30	0.4	1.20	1.60	16	17	17	0.04	0.05	0.03	0.05	0.06	0.05	0.055	0.023	0.006	0.31	0.42	0.33	0.01	0.01	0.01
2005-12-27	8.10	8.30	8.30	4.8	5.60	2.80	14	22	20	0.03	0.04	0.05	0.05	0.05	0.06	0.040	0.030	0.045	0.54	0.44	0.39	0.01	0.01	0.01
# Samples	**16**	**15**	**16**	**16**	**15**	**16**	**16**	**15**	**16**	**16**	**15**	**16**	**16**	**15**	**16**	**16**	**15**	**16**	**16**	**15**	**16**	**16**	**15**	**16**
Average	8.41	8.43	8.41	17.9	11.0	16.13	13	10	26	0.03	0.03	0.03	0.07	0.07	0.07	0.023	0.018	0.020	0.32	0.38	0.35	0.01	0.01	0.01
Maximum	8.70	8.70	8.70	153	127	120.00	117	90	270	0.07	0.08	0.08	0.18	0.27	0.23	0.087	0.048	0.067	0.54	0.52	0.49	0.03	0.02	0.02
Minimum	7.76	7.82	7.79	0.4	0.8	0.80	1	1	1	0.01	0.01	0.01	0.05	0.05	0.03	0.001	0.001	0.001	0.15	0.28	0.16	0.01	0.01	0.01

Note: Shaded squares show tests reported at less than the stated value, for calculations these are listed as equal to the value stated, i.e. <0.05 is now 0.05

5.0 OVERVIEW OF INFLUENT TEST RESULTS

This section provides data and analysis for the plant influent (raw sewage) samples taken during 2005.

Table 4 provides a summary record of the influent test results for the period January 4, 2005 to December 27, 2005.

Table 4
2005 Influent Results

Date	2005 Influent Results Summary				
	Flow	temp	pH	TSS	BOD
	m3/d**	C		mg/L	mg/L
2005-01-04	465	14.2	7.4	3100	1589
2005-02-28	516	12.8	8.0	648	404
2005-03-08	465	11.9	8.2	204	276
2005-03-14	385	12.1	8.3	228	378
2005-03-22	354	12.4	8.0	180	212
2005-03-29	824	11.9	8.2	196	235
2005-04-05	358	10.7	8.2	333	192
2005-05-03	126	9.0	7.7	202	102
2005-06-06	322	11.5	7.7	560	266
2005-07-03	335	14.4	8.1	162	258
2005-08-20	330	17.3	-	108	119
2005-09-26	165	14.0	7.9	152	75
2005-10-03	285	13.0	7.9	40	48
2005-10-10	288	14.0	8.0	124	106
2005-10-17	434	13.0	7.57	332	86
2005-10-24	224	12.9	7.5	540	107
2005-11-01	373	11.5	7.9	848	118
2005-12-20	321	12.1	8.3	154	149
2005-12-27	782	12.7	8.0	216	164
# Samples	19	19	18	19	19
Average	386.9	12.7	7.9	438.3	257.1
High	824.0	17.3	8.3	3100.0	1589.0
Low	126.0	9.0	7.4	40.0	48.0

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 1,589 mg/l on January 4, 2005 (though the result is likely not representative of the average BOD experienced on that date); the annual influent average BOD of 257 mg/l is considered moderately high for domestic sewage, though not above normal design parameters. Average

influent sewage strength increased from 222 mg/l in 2004 as expected due to a decrease in sewer line infiltration. Average BOD will continue to increase if the service population remains constant (or increases) and infiltration is reduced. The proportionately high number of resort restaurants, which typically discharge higher strength sewage than residences, contributes to the high strength sewage experienced at the WWTP.

6.0 OVERVIEW OF EFFLUENT RESULTS

This section provides data and analysis for the effluent (treated) samples and plant flows during 2005.

A total of 20 sample results were taken for all parameters except plant flow, which was collected daily. Effluent samples were collected on the same days as influent samples to permit an evaluation of plant performance. Note that no influent samples were taken on January 20, 2005.

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

Table 5
2005 MSR Parameter Compliance

Parameter	Unit	MSR Limit	No. of Samples	Average Value	Max. Value	Samples Over Limit
Flow	m^3/day	1280	365	344	1293	1
BOD_5	mg/L	45	20	< 5	8	0
TSS	mg/L	45	20	1.8	17.6	0
Total Phosphorus	mg/L	1.0	20	1.9	4.7	14
Ortho Phosphate	mg/L	0.5	20	1.7	4.5	19
Fecal Coliforms*	cfu/100 mL	200	20	8	73	0
96 hr LC_{50} Bioassay	-	Non-toxic	2	N/A	N/A	0

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

Table 6 provides a summary record of the effluent test results for the period January 4, 2005 to December 27, 2005.

The maximum flow rate was exceeded on one day in 2005, which has been attributed to unseasonal snowmelt conditions.

Table 6
2005 Effluent Results

Date	2005 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
2005-01-04	465	13.9	7.8	1	5	1	4.50	4.68	0.059	18.6	0.02
2005-01-20	1029	8.8	7.6	17.6	8	22	0.83	1.22	0.628	0.25	0.30
2005-02-28	516	13.7	7.5	1.6	5	1	2.54	2.69	7.8	14.8	0.58
2005-03-08	465	13.5	7.7	0.8	5	1	3.26	3.31	0.8	19.4	0.11
2005-03-14	385	13.4	7.5	2.4	5	1	3.46	3.51	0.111	25.1	0.16
2005-03-22	354	13.0	7.6	3.6	5	1	3.24	3.59	0.028	24.9	0.23
2005-03-29	824	12.7	7.5	2.0	5	11	3.05	3.39	1.947	22.4	0.20
2005-04-05	358	11.8	7.8	0.8	5	1	2.09	2.15	0.062	12.8	0.01
2005-05-03	126	10.6	7.8	0.4	5	1	1.03	1.24	0.028	15.3	0.02
2005-06-06	322	12.6	8.0	0.4	5	1	0.60	0.64	0.004	6.6	0.01
2005-07-03	335	14.6	7.8	0.4	5	23	1.43	1.53	0.034	18.8	0.01
2005-08-20	330	17.0	7.7	1.0	5	1	1.10	1.23	0.001	18.2	0.01
2005-09-26	165	14.4	8.2	0.4	5	1	0.71	0.81	0.026	14.0	0.01
2005-10-03	285	13.3	8.1	0.4	5	1	1.29	1.34	0.026	14.4	0.01
2005-10-10	288	13.9	8.1	0.4	5	1	0.71	0.73	0.014	15.5	0.01
2005-10-17	434	13.6	7.86	0.4	5	7	1.07	1.09	0.008	10.5	0.01
2005-10-24	224	13.2	7.8	0.4	5	1	0.53	0.90	0.001	10.5	0.01
2005-11-01	373	12.8	8.1	1.0	5	1	0.43	0.45	0.012	5.7	0.01
2005-12-20	321	11.8	8.1	0.8	5	1	0.77	0.83	0.011	15.9	0.01
2005-12-27	782	13.0	7.3	0.4	5	73	1.90	1.97	0.040	17.7	0.08
# Samples	20	20	20	20	20	20	20	20	20	20	20
Average	419.1	13.1	7.8	1.8	5.2	7.6	1.7	1.9	0.6	15.1	0.1
High	1029.0	17.0	8.2	17.6	8.0	73.0	4.5	4.7	7.8	25.1	0.6
Low	126.0	8.8	7.3	0.4	5.0	1.0	0.4	0.5	0.0	0.3	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	19	14	N/A	N/A	N/A

Note: Shaded squares show tests reported at less than the stated value, for calculations these are listed as equal to the value stated, i.e.; <0.05 is now 0.05

With one exception, all BOD samples were reported as less than 5 mg/l. TSS samples averaged less than 2.0 mg/l with a maximum concentration of 17.6 mg/l. These results show the plant is providing excellent BOD_5 and TSS removal with average removals of 98.0% and 99.6%, respectively.

The maximum effluent coliform concentration reached 73 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 effluent was found to be non-toxic.

Table 7
Toxicity Test Results

Sample Date	Result
2005/01/20	Pass
2005/09/05	Pass

Phosphorous concentrations in the effluent remain above limits set in the registration letter. The high ratio of ortho to total phosphorous indicates that nearly all the available nutrient has been biologically processed. As discussed in the 2004 Annual Report, the source of the high effluent discharges has been determined to be sludge that is 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. Construction began in October 2005 for a new aerated sludge digester to address this issue.

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 2006 will prevent the elevated concentrations of both total and ortho phosphorous found in 2003, 2004 and 2005.

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 2005, 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 was advised by the Ministry of Environment in 2005 that the contracted vacuum truck services were hauling liquid sludge to the RDEK's disposal site, which contravened the requirements set out in the registration letter. FARUC was unaware of the final liquid sludge destination and ceased all liquid sludge hauling immediately upon Ministry notification in April of 2005.

The use of vacuum truck services for the removal of 540 m^3 of liquid sludge in 2005 was considered to be an interim emergency step to remove solids from the facility during periods of heavy use. Hauling data for liquid sludge is provided in Table 8.

Table 8
Liquid Sludge Hauling Data

Date	Volume (l)
2005-01-07	54.6
2005-01-14	81.9
2005-02-20	21.0
2005-02-21	61.5
2005-02-26	41.0
2005-02-25	61.5
2005-03-04	38.2
2005-03-18	38.2
2005-03-26	81.0
2005-04-01	61.2
TOTAL	**540**

Hauling data for bagged solids are provided in Table 9.

Table 9
Bagged Solids Hauling Data

Date	kg
2005-01-31	9,080
2005-02-23	9,080
2005-02-28	9,080
2005-03-31	9,080
2005-04-30	9,080
2005-05-31	9,080
2005-06-30	9,080
2005-08-31	9,080
2005-09-30	9,080
2005-09-28	9,080
2005-10-08	9,080
2005-10-28	9,080
2005-10-31	9,080
2005-11-30	9,080
2005-12-14	9,080
2005-12-28	9,080
TOTAL	**145,280**

Construction of the aerated sludge digester, started in the fall of 2005, will allow storage of liquid sludge during peak production times (winter 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 AND OPERATIONS EVENTS

The sewage treatment plant has demonstrated an ability to deal with flows in excess of amounts expected based on the BC Health figures. Though reduced from 2004, remaining snow melt and rainwater infiltration has 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 526 m^3/d in March 2005. The plant could presently handle an additional 754 m^3/d of average day flow (compared to the 458 m^3 calculated in the 2004 report) without infiltration. Infiltration of surface water during rainfall and snowmelt events appeared to be an issue for only one day in calendar year 2005. The Resort's infiltration reduction program has markedly increased the capacity of the plant to treat average day flows.

Work carried out in 2005 included an ongoing program to seal manholes, divert storm ditches from sanitary sewer manholes, and the elimination of roof drains and sump pumps. The program has been highly successful though this type of work must be ongoing. FARUC expects that infiltration and future WWTP sewage flows will be further reduced as a result of sewer line rehabilitation work, flow monitoring and the implementation of flow restrictive devices in all new construction.

Two filter bypass events occurred in 2005; the first on February 19 and the second on December 8. Both bypass events resulted in elevated suspended solids in the effluent. Due to a lack of storage capacity in the 57 m^3 sludge tank, the plant's MLVSS concentration increased to a point where the filters had to be backwashed with more water than they were able to produce. This resulted in the filters being taken off-line with clarified effluent being sent directly to the UV disinfection unit. No other processes were bypassed when the filters were temporarily removed from service.

9.0 PLANT IMPROVEMENTS

This section describes completed and proposed WWTP upgrades undertaken in 2005.

In October 2005, the following construction projects started:

- Addition of a 500 m^3 aerated equalization tank and a 200 m^3 aerated sludge digester,
- Addition of a new valve control room and blower building,
- New sewer piping, control valves and manholes to divert raw sewage to the new equalization tank,
- Modification of process piping in the two activated sludge tanks to increase total reactor capacity,
- Modification of the existing clarifiers to extend weir length and improve settling,
- Modification of the waste sludge piping and addition of a dedicated waste sludge pump, and
- Improvements to electrical systems to increase operating reliability.

Improvements to the clarifiers and changes to activated sludge basins were completed in mid-December 2005. The operators reported an immediate improvement in sludge settling in the clarifiers though an ongoing problem with filamentous bacteria in the new clarifier centre wells was not solved until early 2006.

Other significant works were not completed until February 2006 when the equalization and sludge digester tanks were brought on-line.

No additional treatment processes or significant construction works are planned for calendar year 2006 at the facility.

10.0 ASSESSMENT SUMMARY

The plant has produced high quality effluent with BOD_5 and TSS consistently below the regulated limited of 45 mg/l and typically well below 5 mg/l during 2005. Coliform and ammonia results show the plant functioned well in 2005. The plant passed both toxicity tests.

Phosphorus reduction remains a problem at the plant though there was some improvement in the number of samples that were reported to be over limit, when compared to 2004. There has been no measurable impact of phosphorous releases on the Elk River background nutrient concentrations. Completion of an aerated sludge digester in early 2006 will reduce the re-release of precipitated phosphorous from anaerobic sludge. The 58 m^3 sludge storage tank was phased out of service in late 2005.

Hauling of liquid sludge from the WWTP ceased in July of 2005. FARUC implemented a three-shift dewatering program in 2005 to deal with sludge disposal with generally positive results. Commissioning of the 200 m^3 sludge digester in February 2006 will eliminate the need to resort to emergency sludge hauling services. The volume of the digester will allow operators to store biological solids during peak production periods for future dewatering.

The resort is expected to see significant growth over the next years with a projected peak flow of 1719 m^3 per day by 2009. The effluent discharge limit of 1280 m^3/day may need to be increased to account for the proposed growth, though the effect of the infiltration program has significantly reduced average flows. FARUC will continue to monitor flows and assess the need for any registration amendment.

Two filter bypass incidents in 2005 were directly related to a lack of sludge storage space. The new aerobic sludge digester will allow the plant to operate with greatly increased storage space in order to reduce the risk of future filter bypasses.

In summary, the activated sludge treatment process functioned well in 2005 with only phosphorous and sludge concerns outstanding. FARUC had completed significant improvements by February 2006 that were necessary to address sludge and phosphorous issues.

11.0 AUTHORIZATION AND CLOSING

This report, entitled *2005 Sewage Treatment Plant Annual Report Draft,* 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 (m3/day)

				Additional Sewage Flows Due to Expansion			
Existing Development	**Flow***	**2005**		**2006**	**2007**	**2008**	**2009**
	(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**	**2006**	**2007**	**2008**	**2009**
	(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**	**2006**	**2007**	**2008**	**2009**
	(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**	**2006**	**2007**	**2008**	**2009**
	(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**	**2006**	**2007**	**2008**	**2009**
	(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 Wastewater Flow (m^3/day) *	**979.2**	**979.2**	**1032.4**	**1261.4**	**1302.3**
Corrected Daily Peak Flow Projections**	**1293.0**	**1293.0**	**1363.2**	**1665.6**	**1719.5**

* Estimated Wastewater Flows from BC Health Act, Sewage Disposal Regulation
** Based on 2005 flow records for peak day flows