

OPUS DAYTONKNIGHT

Columbia Shuswap Regional District

Community Sewer System Plan for Sorrento/Blind Bay Area 'C'

Summary Report



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1 Executive Summary

This report is a summary of engineering work to develop a cost effective and affordable implementation for the Community Sewer System Plan (Plan) for Sorrento, Blind Bay and Reedman Point which was previously studied and define in the 2009 Liquid Waste Management Plan for Columbia Shuswap Regional District (CSRD) Area 'C'.

The engineering work included four technical memoranda (TMs) which reviewed previous studies, evaluated financing methodologies, and assessed the hydrogeological conditions in the area. Based on all of this information, six options were developed with the objective to have an affordable initial phase of the Plan.

The community sewer system options developed for the CSRD were taken to an Advisory Committee for discussion. The Advisory Committee made a unanimous decision to select Option 3f as the preferred community sewer system option. Option 3f involves construction of separate satellite wastewater treatment facilities for the communities; a facility at the Fredrickson Road site will initially service priority 1 areas in Sorrento and Blind Bay, and at a later stage a facility in the Balmoral area will service all of Blind Bay and Reedman Point, and the Fredrickson Road will continue to serve Sorrento. Option 3f is expected to cost \$16.1 million at phase 1 and \$47.9 million at phase 2. Annual cost per household (if 2/3 senior government funding is received) at phase 1 for the properties served is \$871, plus the one-time connection costs for each property.

2 Introduction

In 2009 the CSRD completed a Liquid Waste Management Plan (LWMP) for Area 'C' which includes the communities of Sorrento, Blind Bay and Reedman Point. The need for a community sewer is driven both to reduce the impact of poorly performing septic tank systems in the area which are affecting the Shuswap Lake shore and local aquifer, and to permit additional development and densification for commercial and social benefit.

The LWMP recommended that a community sewer system be built for these communities where treated effluent initially is discharged to ground for infiltration but ultimately used for irrigation with the nearby agricultural areas which was strongly supported during the LWMP. Since completion of the LWMP, the CSRD have been waiting for grant funding to advance a community sewer system for these communities.

Opus DaytonKnight (Opus DK) was engaged by the CSRD to develop a Community Sewer System Plan for Sorrento and Blind Bay. The objective was to investigate a more affordable phase 1 system for CSRD to implement this part of the LWMP for Area 'C'.

3 Scope and Methodology

A review of the current LWMP was carried out with the aim of reducing initial costs, improving financial viability and increasing readiness for future infrastructure grant applications. Four technical memoranda (TMs) were produced documenting the findings from this appraisal.

3.1 TM1 – Service Area Characterisation

TM1 summarised the relevant information on options for the Sorrento and Blind Bay community sewer system contained within previous reports including:

- Stage 1, 2 and 3 LWMP Reports (EarthTech/AECOM for CSRD)
- Blind Bay Servicing Options Report (AECOM for CSRD)
- Sorrento Community Sewer Proposal (Sorrento Business Improvement Association)
- Proposed Official Community Plan for Area 'C' (CSRD)

TM1 was intended to provide background information on the LWMP process and inform the later tasks in the development of the Community Sewer System Plan. It was also intended to allow the study team and the Advisory Committee to ensure that decisions around the project were based on the most accurate information available.

There were two key findings from TM1. The first was that the LMWP sets out priority areas for sewer service. There are two priority 1 areas, one in Sorrento and one in Blind Bay. The priority 1 areas are located along the lakeshore, and target properties likely to provide the greatest environmental benefit by being taken off septic tank systems.

The second was that the LWMP identifies the following three potential locations for a wastewater treatment facility:

- the existing Shuswap Lake Estates treatment facility in Blind Bay;
- the Balmoral area close to potential reclaimed water irrigation users; and
- the Fredrickson Rd site in Sorrento which is suitable for disposal of effluent to ground using rapid infiltration.

3.2 TM2 - Financing Methodology

TM2 investigated servicing and financing methodologies for implementation of the project capital elements and how implementation options under the LWMP will be evaluated. Key findings from TM2 included:

- It is possible that the Federal Government will announce a new capital infrastructure program later this year. Recent federal-provincial (BC) programs have considered sanitary sewer a high priority community consideration, and that is expected to continue. A level of funding of from one-half to two-thirds would be expected under a new program.

- The potential contributions from other programs offering assistance for capital infrastructure programs are not expected to be significant due to the size of the project.
- Public-Private Partnerships (P3's) can be a very complex business arrangement and would likely only be recommended if no senior government grant could be obtained.
- CSRD already has policies in place for collecting money for operation and maintenance of a community sewer system.
- Gas tax grants are available up to \$1 million.
- Green Municipal Fund provides loans up to 80% to maximum of \$10 million.

3.3 TM3 – Hydrogeological Assessment

TM3 summarised the findings of a desktop hydrogeological assessment carried out by Piteau Associates Engineering Ltd. (Piteau) on behalf of Opus DK for sewage disposal in the Sorrento/Blind Bay area. The assessment included a review of previous investigations in the area and an evaluation of the ground disposal potential. The main findings from TM3 included:

- The surficial geology in the Balmoral area is dominated by lacustrine silt/clay soils, and hence the area is not suitable for infiltration of wastewater.
- The area around the previously identified Fredrickson Rd site are judged to be the best location for effluent disposal to ground. The capacity of the site is likely limited to 2,700 m³/day.
- Ground infiltration may also be viable at other sites near Fredrickson Rd, but further field work is required to confirm their suitability.

The significant conclusion from this TM was that ground water infiltration was not a viable secondary means of disposal which was assumed during the LWMP, so that instead of rapid infiltration basins, additional reservoir storage would be the necessary approach.

3.4 TM4 – Review of Treatment Strategies

TM4 built on the work completed in the previous TMs to develop a range of community sewer options that are more affordable for the communities of Sorrento, Blind Bay and Reedman Point. TM4 covered:

- Design criteria for the community sewer system including design flows and populations at the 20 year design horizon and at ultimate community build-out.
- Regulatory requirements.
- Components of a community sewer system and assumptions made about service area, phasing and infrastructure types.
- Community sewer system plan options.
- Preliminary estimates of capital, operating and maintenance and service connection costs
- Discussion on cost allocation.

The service and priority areas from the LWMP were used as the basis of the community sewer system options in TM4 and a two-phase implementation system assumed. No other sites were identified as potential treatment facility locations, so the community sewer system options were developed

assuming that treatment would occur at one or more of the locations identified in the LWMP (Fredrickson Road, in the Balmoral area, or at the existing Shuswap Lake Estates facility).

The Fredrickson Road site is limited by its rapid infiltration capacity, and is not suitable as a treatment facility for the entire service area. A satellite treatment facility at this site could initially service the priority 1 areas of Sorrento and Blind Bay, but could only service a portion of Sorrento in the long term; this facility would consist of partial-mix aerated lagoons and rapid infiltration.

The existing Shuswap Lake Estates (SLE) treatment facility has aerated lagoons followed by a number of storage ponds and chlorination. It is possible for the reclaimed water to be irrigated seasonally to the Shuswap Lake Estates Golf Course. This site would be suitable for a regional (Blind Bay, Sorrento and Reedman Point) or satellite (Blind Bay and Reedman Point) treatment facility, and much of the existing infrastructure could be reused. There are space constraints at this site that would require mechanical treatment units such as rotating biological contactors to be used in place of aerated lagoons, and large storage reservoirs for reclaimed irrigation water would have to be located offsite. A treatment facility at this site would consist of the existing aerated lagoons and storage ponds, new mechanical treatment units, emergency¹ and effluent storage reservoirs located offsite, and irrigation of reclaimed water in the Balmoral area.

A suitable site in the Balmoral area has not yet been confirmed, but the general area has been identified as a potential location for either a regional or satellite treatment facility. A facility at this site would consist of partial-mix aerated lagoons, effluent and emergency¹ storage and irrigation of reclaimed water in the Balmoral area.

Table 3.1 provides a brief summary of each of the options developed, and the estimate of probable capital cost.

Table 3.1 – Summary of Preliminary Capital Cost Estimates (\$million)

| OPTION | DESCRIPTION | PHASE 1 | PHASE 2 | TOTAL |
|--------|-----------------------------------------------------------------------------------------------------------------------|---------|---------|---------|
| 1 | Expansion of existing Shuswap Lake Estates treatment facility | \$20.67 | \$41.29 | \$61.96 |
| 2 | New regional treatment facility in Balmoral area | \$21.80 | \$38.95 | \$60.74 |
| 3 | Satellite Treatment Facilities: Fredrickson Rd for Sorrento; and ether SLE or Balmoral for Blind Bay. | | | |
| 3a | Blind Bay treatment at SLE (phase 1 and phase 2) | \$22.78 | \$42.56 | \$65.34 |
| 3c | Blind Bay treatment at Balmoral area (phase 1 and phase 2) | \$23.77 | \$39.95 | \$63.72 |
| 3e | Blind Bay treatment at SLE. Priority 1 areas in Sorrento and Blind Bay initially serviced at Fredrickson Rd | \$15.48 | \$51.02 | \$66.50 |
| 3f | Blind Bay treatment at Balmoral area. Priority 1 areas in Sorrento and Blind Bay initially serviced at Fredrickson Rd | \$15.48 | \$48.50 | \$63.97 |

¹ TM4 notes that Provincial Standards for the use of reclaimed water require that an alternate means of disposal is provided. Therefore options that rely on the irrigation of reclaimed water as their primary method of disposal are required to have emergency storage for up to 20 days' of effluent in lieu of a ground or surface water discharge.

TM4 summarised the overall annual costs per household for each of the options. The total capital costs were amortised as an annual cost assuming the following criteria:

- 2/3 Government funding received
- Interest rate 4% per annum
- Amortisation period 20 years

The overall costs per household for each option is summarised in Table 3.2 for phase 1 and in Table 3.3 for phase 2. For further information and detail of the cost estimates refer to TM4 in Appendix 4.

Table 3.2 – Annual Costs per Household for a Community Sewer System at Phase 1

| HOUSE - HOLD | COST | OPTION | | | | | |
|--------------|-----------------------|---------|---------|---------|---------|---------|---------|
| | | 1 | 2 | 3a | 3c | 3e | 3f |
| Priority 1 | Amortised Annual Cost | \$907 | \$957 | \$1,000 | \$1,043 | \$679 | \$679 |
| | Annual O&M | \$204 | \$277 | \$293 | \$353 | \$247 | \$247 |
| | Service Connection | \$5,000 | \$5,000 | \$5,000 | \$5,000 | \$5,000 | \$5,000 |
| Priority 2 | Amortised Annual Cost | \$- | \$- | \$- | \$- | \$- | \$- |
| | O&M | \$- | \$- | \$- | \$- | \$- | \$- |
| | Service Connection | \$- | \$- | \$- | \$- | \$- | \$- |

Table 3.3 – Annual Costs per Household for a Community Sewer System at Phase 2

| HOUSE - HOLD | COST | OPTION | | | | | |
|--------------|-----------------------|----------------------------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|
| | | 1 | 2 | 3a | 3c | 3e | 3f |
| Priority 1 | Remaining Annual Cost | Priority 1 households continue to pay O&M costs, plus any remaining amortised capital costs from Phase 1 | | | | | |
| Priority 2 | Amortised Annual Cost | \$554 | \$523 | \$571 | \$536 | \$685 | \$651 |
| | Annual O&M | \$125 | \$104 | \$155 | \$135 | \$163 | \$136 |
| | Service Connection | \$5,000 | \$5,000 | \$5,000 | \$5,000 | \$5,000 | \$5,000 |

4 Advisory Committee Workshops and Selection of Preferred Option

Two workshops with the Advisory Committee were held to discuss the Community Sewer System Plan options and costs. The four TMs were presented at these workshops and the merits of each option discussed. Option 3f was selected as the preferred option for the following reasons:

- Lowest cost option at phase 1 (with Option 3e), and the lower overall cost (than Option 3e).
- The satellite treatment facilities offer greater flexibility in phasing and timing of construction.
- Strikes a balance between disposal of effluent to ground, which is relatively inexpensive, and irrigation of reclaimed water, which requires more expensive infrastructure but addresses the demand for irrigation water in the area.
- It is fully compliant with the approved LWMP.

Other outcomes from the Advisory Committee Workshops included:

- The existing septage receiving business in the area (Reliable Septage) may continue to operate. It is CSRD's intent to address the long term septage handling plan for the area at Phase 2, whether this be to leave it to the private sector or to construct a CSRD owned and operated septage handling facility.
- Phase 1 cost allocation model of only charging properties being serviced was preferred, but it was agreed that the CSRD should do further work on developing a cost allocation strategy in the future.
- The Advisory Committee reviewed the priority 1 service area to explore whether other properties could be included in an effort to make phase 1 more affordable. The advisory committee found 20 properties in Sorrento and 33 properties in Blind Bay could be moved into the priority 1 service area and this is reflected in Section 4.1. A plan showing the updated service area is included in Appendix.
- Following review of previous investigations and discussions on local conditions, the advisory committee decided not to pursue a study by Piteau to further evaluate other potential rapid infiltration sites.

4.1 Outline of Preferred Option

Option 3f involves construction of satellite treatment facilities for Sorrento and Blind Bay. At phase 1, the priority 1 areas in Sorrento and Blind Bay would be serviced at a new treatment facility constructed at the Fredrickson Rd site in Sorrento. Effluent would be disposed of using rapid infiltration basins.

At phase 2, effluent from Blind Bay would be diverted to a new treatment facility constructed in the Balmoral area. The remaining priority 2 areas would be connected to the community sewer system, with Sorrento properties serviced by the Fredrickson Rd treatment facility, and properties in Blind Bay and Reedman Point serviced by the facility in the Balmoral area. More detail is provided in Table 4.1.

Table 4.1 – Outline of Option 3f

| AREA | BLIND BAY AND REEDMAN POINT | SORRENTO |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Treatment Facility Location | Phase 1 – Fredrickson Road Phase 2 - In Balmoral area | Fredrickson Rd |
| Serviced properties and design flows ² | Phase 1 – 303 properties 303 m ³ /day Phase 2 – 2,963 properties 2,340 m ³ /day | Phase 1 – 309 properties 310 m ³ /day Phase 2 – 999 properties 1,000 m ³ /day |
| Phase 1 | <ul style="list-style-type: none"> Collection system for priority 1 area in Blind Bay constructed and connected to Fredrickson Rd treatment facility | <ul style="list-style-type: none"> Collection system for priority 1 area in Sorrento constructed New partial-mix aerated lagoon treatment facility constructed at Fredrickson Rd (capacity 667 m³/day) New rapid infiltration basins constructed at Fredrickson Rd |
| Phase 2 | <ul style="list-style-type: none"> Collection system for priority 2 areas in Blind Bay and Reedman Point constructed Sewage from existing priority 1 area diverted to new Balmoral area treatment facility New partial-mix aerated lagoon treatment facility constructed (capacity 2,340 m³/day) in Balmoral area New effluent storage reservoir and emergency storage reservoir in Balmoral area Preparation of irrigation areas (in Balmoral) | <ul style="list-style-type: none"> Collection system for priority 2 area in Sorrento constructed Expansion of lagoon system to 1,000 m³/day |

There are a number of issues with Option 3f, some of which will need to be addressed at later design stages:

- It will result in three wastewater treatment facilities operating in parallel in the area (Fredrickson Road, in the Balmoral area and the existing Shuswap Lake Estates facility).

² The number of priority 1 properties has been updated from TM4 to reflect the outcomes of the Advisory Committee meeting. Note that the increase in the number of properties at phase 1 has an effect on the distribution of the total capital cost between phases and the per household costs as prepared in TM4. The total capital cost remains the same. The revised costs are presented in Table 4.2.

- Some residents in the vicinity of the Fredrickson Rd facility will need to be connected to the Sorrento water supply network to mitigate contamination of groundwater from the rapid infiltration basins

An estimate of the probable costs on associated with Option 3f are outlined in Table 4.2.

Table 4.2 – Annual Household Costs for Option 3f

| | PHASE 1 | | PHASE 2 | |
|------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | PRIORITY 1 HOUSEHOLDS | PRIORITY 2 HOUSEHOLDS | PRIORITY 1 HOUSEHOLDS | PRIORITY 2 HOUSEHOLDS |
| Total Capital Cost | \$16.1 | | \$47.9 | |
| Amortised Annual Cost ³ | \$646 | \$ - | \$ - ⁴ | \$663 |
| Annual O&M Cost | \$225 | \$ - | \$136 | |
| Service Connection Fee | \$5,000 | \$ - | \$ - | \$5,000 |

4.2 Potential Optimizations

There is a potential opportunity to significantly reduce costs at phase 2 by constructing a gravity conveyance from the Fredrickson Rd treatment facility direct to an irrigation storage reservoir in the Balmoral area. This would eliminate the need for a second treatment facility and the phase 1 ground infiltration basis (at Fredrickson) could be used as the required secondary means of disposal further decreasing the storage infrastructure. The alignment of the gravity conveyance would roughly match the existing Canadian Pacific Railway alignment and could be a combination of open channel and closed conduit.

5 Recommendations

This report and the supporting TM`s should provide sufficient information for the CSRD to make an application for grant funding, when a program is announced. There are a number of actions that should be done prior to any application for grant funding being made:

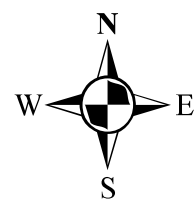
- A hydrogeological study at the Fredrickson Road site would confirm the infiltration capacity of the site.
- Negotiations between the CSRD and the Fredrickson Road site owner for a lease or sale arrangement for the land
- If the Fredrickson Road site is to be utilised, approximately 10 properties will need to be connected to the Sorrento Water Supply. No design has been carried out for this as part of this project.
- For phase 2, a suitable site in the Balmoral area needs to be identified and a business case made to the Agricultural Land Commission for use of the land for situating a facility there.

³ Calculated using Method A from TM4

⁴ Households may continue to pay amortised capital costs from Phase 1 if Phase 2 occurs within the 20 year amortisation period

Appendix 1

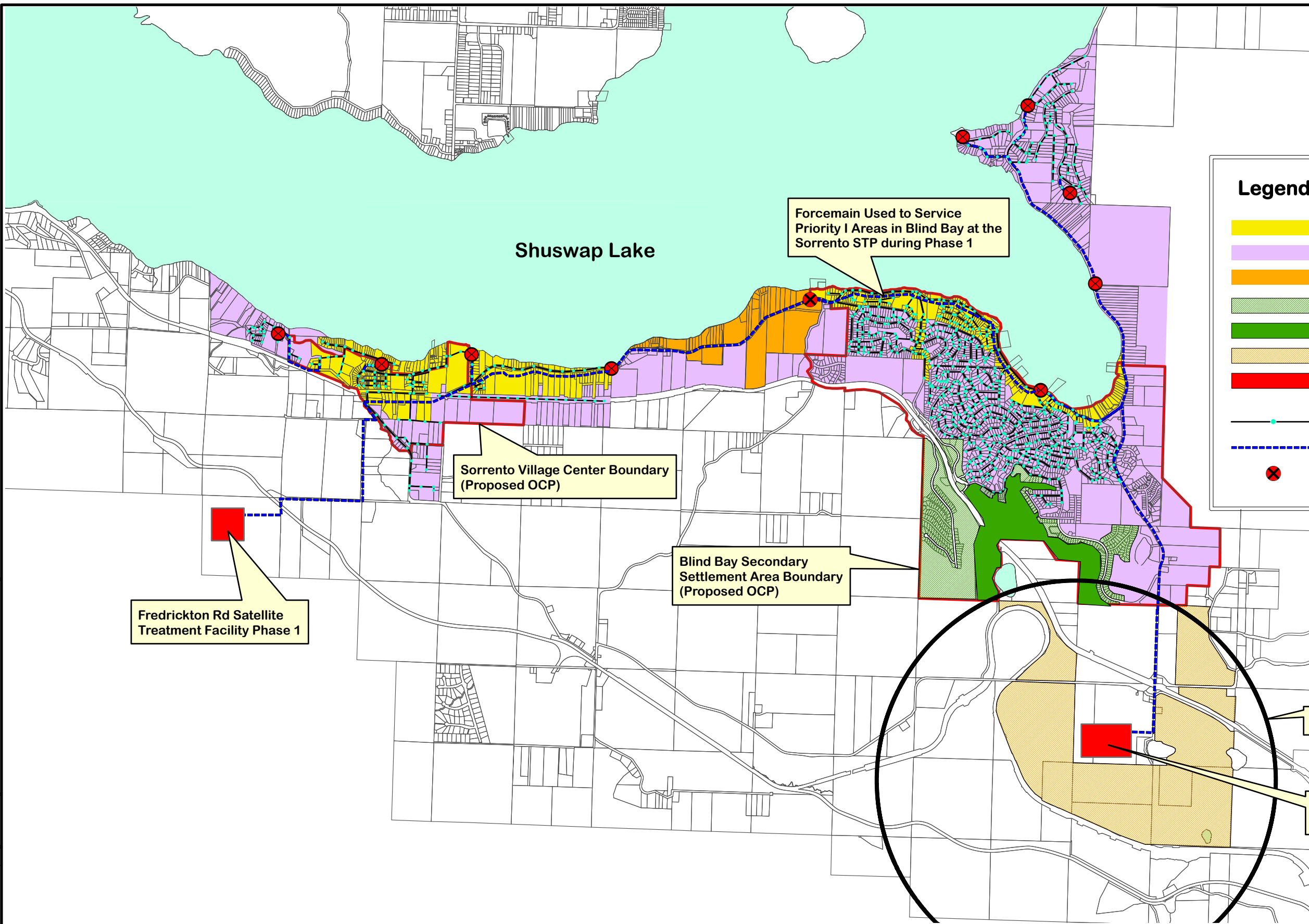
Updated Plan of Service Area



Legend

- Priority I
- Priority II
- Priority I or II (Note 1)
- Shuswap Lake Estates
- Shuswap Lake Estates Golf Course
- Potential Spray Irrigation Sites
- Proposed Wastewater Treatment Facility Site
- Gravity Sewer
Sanitary Forcemain
- X Lift Station

Notes:
1. Additional properties could be moved from Priority II to Priority I if additional collection system is added. To be reviewed at implementation.



Forcemain Used to Service Priority I Areas in Blind Bay at the Sorrento STP during Phase 1

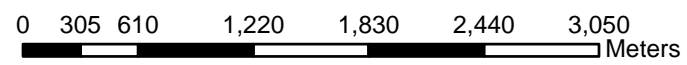
Sorrento Village Center Boundary (Proposed OCP)

Blind Bay Secondary Settlement Area Boundary (Proposed OCP)

Fredrickton Rd Satellite Treatment Facility Phase 1

Balmoral Area

New Satellite Treatment Facility (Location to be Confirmed) Phase 2



SCALE 1:40,000

Project Number: D-39901.00 Author: CWW Date: 05 Feb 2014



Columbia Shuswap Regional District
Blind Bay & Sorrento Community Sewer Plan
Option 3F Layout

FIGURE 1



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