



# **Engineering Study of the Skaha Estates Water Supply System**

Prepared for:

**Skaha Estates Improvement District  
P.O. Box 455  
Okanagan Falls, B.C.  
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**Project No. # 1399**

Submitted by:

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## Executive Summary

The Skaha Estates Improvement District (SEID) was established on November 3, 1977 under the Water Act of British Columbia. The operations of the SEID are now regulated by the Municipal Act of British Columbia. The principle activity of the SEID is to provide water to the community of Skaha Estates.

The primary purpose of this engineering study was to determine the existing capacity of the water supply system and to assess the potential for future expansion of the system to supply additional lots in the area. The study also assessed the requirements for long-term maintenance and eventual replacement of the various components of the water supply system.

The existing water supply system, as presently operated with summer irrigation watering restrictions, can supply adequate volumes of water for the residents of Skaha Estates. There is sufficient system capacity to provide water for all of the lots within Skaha Estates west of Eastside Road.

There is also sufficient capacity to add approximately 20 new water users on Sovereign Road to the system.

In the range of 100 additional lots could be developed in the SEID service area east of Eastside Road. Presently there are only three homes and an orchard serviced in this area. The development of up to 100 additional lots would increase water demand by approximately 66%. The present water supply system would be at capacity to supply this new development. In addition, the existing reservoir is at too low an elevation to adequately service all of the potential new development areas. A new reservoir, or booster pump, would be needed. No funding is presently in place for the construction of a new reservoir, booster pump or additional water supply lines.

The intake and intake pipeline will need to be twinned or replaced with a larger intake to meet any water demand beyond the present SEID service area. No funding is presently in place to pay for these works.

The AC pipe used for watermain in Skaha Estates will need to be replaced in the next 10 to 15 years. Current reserve funds are insufficient to cover these costs.

Regardless of any future expansion, the present water supply system will require on-going maintenance and replacement as system components age. Current fees and reserve funds appear to be adequate to fund on-going operation and routine maintenance work. Additional funding is needed to finance replacement of the AC pipe watermain in the SEID. Funding in the range of \$20,000.00 per year should be added to the reserves to pay for eventual AC pipe replacement.

Undeveloped land east of Eastside Road will require system expansion to service. Discussions should be held with owners of these areas to determine the density of development planned and the timing of any development. Zoning and environmental issues will impact the type and density of development in these areas.

Once development trends are known, the SEID should prepare a plan to develop sufficient water supply capacity to service these areas. This will likely include a new reservoir as well as increased intake and pumping capacity.

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## 1.0 INTRODUCTION

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The Skaha Estates Improvement District (SEID) was established on November 3, 1977 under the Water Act of British Columbia. The operations of the SEID are now regulated by the Municipal Act of British Columbia. The principle activity of the SEID is to provide water to the community of Skaha Estates.

Skaha Estates occupies an area of approximately 95 hectares (ha) on the eastern shore of Skaha Lake 10 km south of Penticton, B.C. The rural residential community is part of the Regional District of Okanagan-Similkameen (RDOS). Future development and construction on currently vacant lots could raise the number of properties using the water system to over 150. In addition, development of two parcels of land east of Eastside Road could more than 100 additional lots requiring servicing.

The SEID is run by a three-person board comprising a chairman and two trustees. A part-time secretary for the SEID is based in the offices of the Okanagan Falls Irrigation District in Okanagan Falls. The secretary handles day-to-day administrative matters for the SEID.

The Board of the SEID retained Wildstone Engineering Ltd. (Wildstone) to complete an engineering study of the Skaha Estates water supply system. The primary purpose of this study was to determine the existing capacity of the system and to assess the potential for future expansion of the system to supply additional lots in the area. In part, the study was initiated in response to a request from a number of residents outside of the SEID water supply area to be added to the system.

In addition, the study was to assess the requirements for long-term maintenance and eventual replacement of the various components of the water supply system. The financial implications of future expansion and system maintenance/replacement work were also to be determined. Recommendations were to be presented to address future operations of the system including cost recovery measures to fund any expansion or replacement works.

## 2.0 PROJECT INFORMATION

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The following reference information was available for review as part of this study:

- J. W. Ngai, P.Eng., April 15, 1986. Skaha estates Improvement District – Pump Station. Letter prepared for the Ministry of Municipal Affairs.
- B.C. Ministry of Environment, Lands and Parks Water Licence Records.
- Skaha estates Improvement District Financial Statements dated December 31, 1998.
- Pump manuals and Schematics
- Pumping Records with Flow Meter Readings (1976 to 1999)
- Ministry of the Environment, November 24, 1983. Map of the Skaha estates Improvement District. Scale: 1:5000.

- Sketch Plan of the Skaha Estates Irrigation District Water Supply System. Undated, No Scale.
- Interior Engineering Services Limited, April 1966 (with revisions to December 1967). Domestic Water System Plan & Details. Prepared for Skaha Lake Properties Ltd.

Copies of all of these documents, plans and maps are included as Appendices 1 and 2 to this report.

### **3.0 WORK COMPLETED**

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Wildstone completed the following tasks as part of the engineering study of the SEID water supply system:

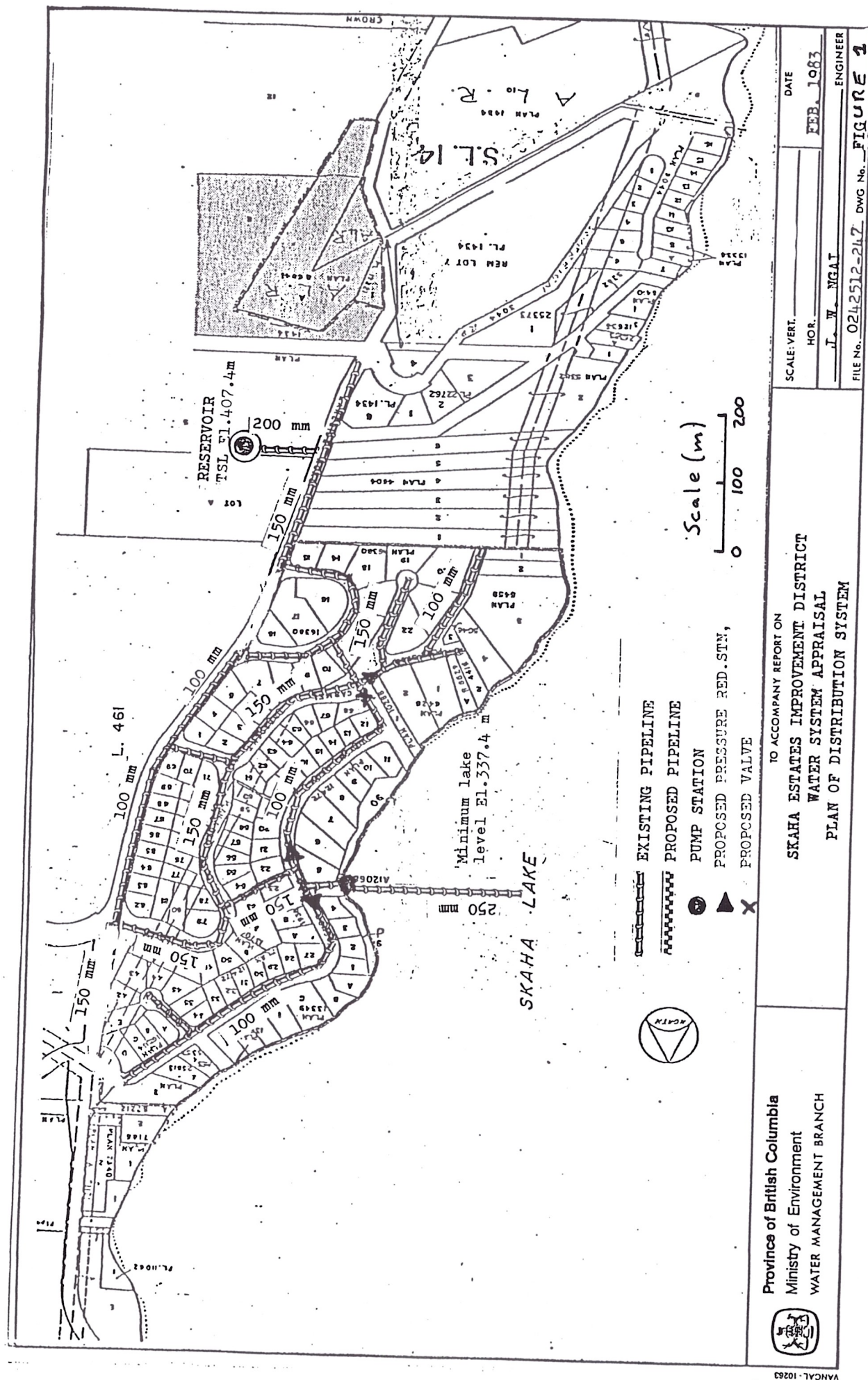
- Assembled and copied relevant maps, plans and reports, including those listed above.
- Reviewed pumping records, pump data and distribution system plans to determine the present and past operating characteristics of the water supply system.
- Interviewed Mr. Don Allbright, Chairman of the SEID board. Mr. Allbright is familiar with the history and current operating practices of the water supply system.
- Completed a visual inspection of the pump house and pumping equipment. Walked the Skaha Estates subdivision and potential development areas.
- Analysed the theoretical capacity of the existing water supply system based upon pump capacity, pipe sizes and distribution system configuration. Compared the theoretical capacity with actual pumping records.
- Reviewed existing water use and estimated potential future water use for the SEID water supply area. Prepared a likely scenario for future water demand.
- Estimated the probable life of existing system components, primarily piping, and suggested a strategy for replacement funding, as required.
- Reviewed water licence records and health requirements for the SEID water supply system.
- Prepared a report summarizing the work done and presenting the findings and recommendations of the study.

### **4.0 SKAHA ESTATES WATER SUPPLY SYSTEM**

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Figure 1, from Ngai (1986) shows the main components of the Skaha Estates water supply system. The SEID has two water licences that entitle the District to withdraw up to 24,820,000 gallons per year from Skaha Lake. Water is withdrawn from Skaha Lake through an intake line. The intake line is understood to be a 10 inch diameter pipe with a 30 by 40 inch mesh covered intake screen located approximately 18 feet below lake level and 1160 feet offshore due west of





the pump house. The intake line consists of two segments. From the intake shoreward, the first segment is 718 feet of 10 inch AC (asbestos concrete) with an additional 440 feet of 10 inch PVC completing the intake line to the pump house. The PVC replaces an earlier steel pipe.

The intake line connects to a wet-well system with two vertical turbine pumps (40 hp and 15 hp) in a pump house. The two pumps have a combined peak capacity of 29 litres per second (382.75 gallons per minute). A chlorinator adds chlorine directly into the outlet pipe from the pump house. The chlorine levels are monitored to ensure that sufficient residual chlorine is present in the distribution piping to disinfect the water. There is approximately 4000 m of distribution pipeline throughout the Skaha Estates development. These pipelines consist of 100 to 150 mm (4 to 6 inch) AC watermains with 12 control valves. There are hydrants connected throughout the system for fire protection. Individual homes are connected to the system by ¾-inch and 1-inch PVC pipe.

There is a 100,000-gallon concrete water reservoir situated above Eastside Road on the east side of Skaha Estates. Water is delivered from the pump house through the distribution piping to the reservoir. Pump controls are set to maintain the reservoir at a minimum of 52,000 gallons in the summer and 58,000 gallons in the winter.

## **5.0 SKAHA ESTATES EXISTING WATER USE**

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Peak water usage occurs during the summer months when residents are irrigating lawns and gardens. There are watering restrictions in place from June 1 to September 30 each year. No watering is allowed between 1 and 6 p.m. during this period. Peak daily water demand during 1998 was 309,038 gallons on July 25 with the lowest daily demand on January 5 at 10,118 gallons. Total water volume for 1998 was 33,107,567 gallons for an average daily rate of 90,706 gallons. This is equivalent to approximately 63 gallons per minute (gpm) on a continuous basis.

The peak day demand for 1998 is considered to be representative of high demand during a hot, dry summer. The existing pumps would have to pump for almost 13.5 hours to meet this demand. This is within the pump capacity if both pumps are operational, or if the larger of the two pumps (40 hp) is operational. The smaller (15 hp) pump does not have the capacity to meet this peak demand.

Several minimum flow rates must be maintained by the water system. The base flow rate can be taken as the minimum daily household requirement. Typical households are estimated to use an average of 55 gallons per day per person for washing, cooking, toilets, etc., exclusive of any irrigation uses. Statistics from the RDOS indicate that a typical household in this area consists of 2.3 people. If we assume that a typical household in Skaha Estates has up to three persons, then the average base use would be 165 gallons per day.

Skaha Estates currently has over 140 existing or potential lots that require servicing. A few of these lots (7) are seasonal and only require servicing for the summer months. A total of 150 lots was used to calculate a base water load for the community. This base water demand would be 24,750 gallons per day. Given the 1998 daily use range of approximately 10,000 to 310,000 gallons per day, 24,750 gallons per day is judged to be a reasonable base load for the SEID service area. This volume does not make any allowance for irrigation or other non-domestic water uses.



Peak day usage in the hot year of 1998 was about 310,000 gallons. Subtracting the base use volume from the peak volume, it can be concluded that peak day irrigation rates can be as high as 285,250 gallons, or approximately 2000 gallons per day per household. This is more than 10 times the estimated basic household requirements.

## **6.0 SKAHA ESTATES WATER SYSTEM CAPACITY**

There are several factors controlling the capacity of the existing water distribution system. These include the capacity of the pumps, the capacity of the intake pipeline, the size of the water reservoir and the flow capacity of the distribution piping.

The water reservoir has a capacity of 100,000 gallons. This is approximately 30% of the present peak day demand. During heavy irrigation demand periods, the pumps run at full capacity for over 55% of the time. Minimum water levels must be maintained in the reservoir to provide sufficient pressure for fire fighting purposes. Depending on the situation, the pumps may run at full capacity for much longer periods.

The present pumping arrangement can provide up to 29 litres per second when both pumps are operating. This flow volume is close to the maximum possible through the existing intake pipeline. A pumping rate of 29 litres per minute is more than adequate to supply the current peak demands of the SEID. Allowing for the complete loss of the larger pump, there is sufficient capacity in the existing system to sustain the basic water demands of the SEID for average daily uses, excluding heavy irrigation periods. It is calculated that the present pumping rates could provide basic water requirements for roughly double the number of households presently using the system.

There are issues regarding the water pressure in the system. Lower elevation areas experience relatively high water pressures while upper parts of the subdivision can experience low water pressures. It has been suggested that pressure regulation devices be installed throughout the system to balance these pressure differences.

Any additional development above the existing reservoir would require either a booster pump or a new reservoir to create an increased pressure distribution zone. Additional users may also necessitate a new reservoir to provide sufficient volumes of water for fire fighting purposes.

Based upon a peak day usage of 3000 gallons per household, there is sufficient capacity in the existing system for up to 170 households. This assumes no mechanical problems with the distribution system during peak demand periods. If we allow a 50% flow reduction, then the system can support the same 170 households with up to 1500 gallons per day. Various scenarios can be explored with respect to the capacity of the existing water supply system. In general, there appears to be enough capacity to allow expansion of the number of system users to between 150 and 170 without significantly affecting the existing users of the system.

As discussed below, future system expansion should consider replacing or twinning the intake pipeline, and providing additional reservoir capacity, probably at a higher elevation.



## **7.0 SKAHA ESTATES POTENTIAL FUTURE WATER USE**

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There are presently 131 serviced lots in Skaha Estates. This includes 7 seasonal water users. There are 151 landowners in the SEID. As discussed in previous sections, this leads to an estimated water demand equivalent to about 150 households or almost 350 people. The existing system can supply a sufficient volume of treated water to meet the demands of 150 households under present operating conditions. Present operating conditions include maintaining minimum reservoir water levels and implementing summer irrigation water restrictions.

There are approximately 40 ha of undeveloped land in the southeast portion of the SEID, east of Eastside Road. These lands are presently zoned as either Large Holdings (LH) or Comprehensive Development (CD) areas. These areas also include environmentally sensitive lands. The Ministry of Environment would have to review and approve any development proposed in these areas. A new (February 2000) access road has been constructed through two of these undeveloped lots.

The CD zoning allows for a variety of possible subdivision densities depending upon the level of servicing. As a minimum, the area could be developed at the same density as Skaha Estates, at 0.5 acre lot sizes. This type of development would be supplied with water from the SEID and use septic systems for sewage disposal. Increased density would be possible if an on-site sewage treatment system were installed.

Assuming that development proceeds at similar densities to the present Skaha Estates subdivision, these lands could potentially be developed to add more than 100 lots to the SEID. Adding 100 new households to the SEID would increase water demand by approximately 66%. This would increase the base daily demand to over 41, 000 gallons and peak day demands to as much as 500,000 gallons. With both pumps running continuously, the system can produce as much as 550,000 gallons per day.

Only a small portion of the new development areas east of Eastside Road can be serviced by the existing reservoir. A new reservoir at a higher elevation, or booster pumps would be needed to service these areas adequately. In addition, increased pumping capacity and larger capacity intake structure would also be needed to ensure an adequate water supply for this new development.

A group of property owners on Sovereign Road has requested to be included in the SEID service area. There are approximately 20 potential water users in this area. The present water supply system could be modified to accommodate these new users. The costs of extending the watermain into this area could be relatively expensive depending upon the route chosen for any new pipelines. Bedrock excavation would be required along some of the possible routes to service Sovereign Road.

## **8.0 SYSTEM COMPONENTS LIFE SPAN AND REPLACEMENT COSTS**

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Simplified, there are three main components of the water supply system. These are:

- Intake, intake pipe, pumps and pump house
- Distribution pipelines, valves and hydrants
- Water reservoir



Wildstone is presently constructing a new water reservoir for the Gordon Avenue development in the City of Penticton. We have used the costs for this reservoir and the associated distribution piping as the basis for estimating replacement costs for the SEID water supply system. Watermains are estimated to cost approximately \$65/m for incremental replacement with unit costs dropping to about \$50/m for replacement of the entire system.

Estimated replacement costs for system components are as follows:

Pump House/Pumps/Intake	\$100,000.00
Distribution System	\$300,000.00
Water Reservoir	\$250,000.00

The major system components are understood to be in generally good condition. The pumps were recently overhauled and reconditioned. The water reservoir is cleaned and inspected annually. The intake pipeline has been partially replaced with PVC and the intake screen is inspected on a regular basis. There will be locations where pipe breaks and other maintenance issues necessitate replacement of short sections of pipe. In addition, any new lots added to the service area may require extending the existing watermains.

With regular maintenance and inspection, the pumps and pump house equipment should not require replacement for 20 years. Overhaul and reconditioning should be included as operating budget items on a 10-year basis. Larger pumps and increased intake capacity will be required to meet potential new development water demand.

The watermains throughout Skaha Estates are almost exclusively AC pipe. This is not the present industry standard. New watermain installation use PVC or ductile iron pipe. The SEID should be planning to replace the AC pipe. A life span of 30 to 40 years is considered typical for this type of installation. The SEID AC pipe is nearing the end of its service life and should be replaced within the next 10 to 15 years. An annual cost in the range of \$20,000.00 should be budgeted for this replacement work. This does not imply that \$20,000.00 be spent each year, but rather that this amount be allocated and included in reserves for eventual pipe replacement work.

The water reservoir has an almost indefinite life span. Replacement of the present reservoir will be dependent upon new development requiring servicing above the elevation of the existing water reservoir. As shown above, the cost of a new reservoir will be in the range of \$250,000.00. It is not clear how this expenditure will be financed when new development takes place.

## **9.0 WATER SUPPLY FINANCIAL ISSUES**

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The SEID is required to operate and maintain the water supply system to service lots within Skaha Estates. Financing is required to operate the system and to provide servicing and periodic replacement of system components. In addition, there are requirements to provide water service to new development within the SEID.

Currently, the SEID collects fees from water users to operate and maintain the system. These fees pay for electricity, repairs/maintenance, administration, insurance and other on-going costs for the system. The fees are set to recover annual operating costs with no specific allowance to fund any system expansion. There is a *Replacement Reserve Fund* that had a balance of \$17,700.00 as of December 31, 1998.

The present fee structure is adequate to recover current operating and routine system maintenance expenses. There is insufficient reserve funding for the anticipated replacement of AC pipe over the next 10 years. There is also no funding in place for any system expansion that may be required by potential development within the SEID service area. Similarly, no cost allowance has been made for expanding the service area of the SEID.

## **10.0 CONCLUSIONS**

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The primary purpose of this engineering study was to determine the existing capacity of the system and to assess the potential for future expansion of the system to supply additional lots in the area. In addition, the study was to assess the requirements for long-term maintenance and eventual replacement of the various components of the water supply system.

It is clear that the existing water supply system, as presently operated with summer irrigation watering restrictions, can supply adequate volumes of water for the residents of Skaha Estates. There is sufficient system capacity to provide water for all of the lots within Skaha Estates west of Eastside Road.

There is also sufficient capacity to add approximately 20 new water users on Sovereign Road to the system.

In the range of 100 additional lots could be developed in the SEID service area east of Eastside Road. Presently there are only three homes and an orchard serviced in this area. This development would increase water demand by approximately 66%. The present water supply system would be at capacity to supply this new development. In addition, the existing reservoir is at too low an elevation to service these areas. A new reservoir would be needed. No funding is presently in place for the construction of a new reservoir.

The AC pipe used for watermains in Skaha Estates will need to be replaced in the next 10 to 15 years. Current reserve funds are insufficient to cover these costs.

The intake and intake pipeline will need to be twinned or replaced with a larger intake to meet any water demand beyond the present SEID service area. No funding is presently in place to pay for these works.

## **11.0 RECOMMENDATIONS**

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As requested, Wildstone has developed recommendations to meet the future operational and expansion requirements of the SEID water supply system.

Regardless of any future expansion, the present water supply system will require on-going maintenance and replacement as system components age. Current fees and reserve funds appear to be adequate to fund on-going operation and routine maintenance work. Additional funding is needed to finance replacement of the AC pipe watermains in the SEID. Funding in the range of \$20,000.00 per year should be added to the reserves to pay for eventual AC pipe replacement.

Undeveloped land east of Eastside Road will require system expansion to service. Discussions should be held with owners of these areas to determine the density of development planned and



the timing of any development. Zoning and environmental issues will impact the type and density of development in these areas.

Once development trends are known, the SEID should prepare a plan to develop sufficient water supply capacity to service these areas. This will likely include a new reservoir as well as increased intake and pumping capacity.

## **12.0 CLOSURE**

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We trust that the contents of this report meet your present requirements. If you have any questions regarding this work, please contact us at (250) 493-3947.

Respectfully submitted,

*Paul Glen*



*March 28, 2000*

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