File No. 0580-20/25-45

October 23, 2025

Sec. 22(1) personal information

Re: **Request for Access to Records under the *Freedom of Information and Protection of Privacy Act* ("the Act")**

In response to your request for records with respect to the Stantec Consulting 2006 and Associated Engineering studies regarding the Sage Mesa Water System, the Regional District is pleased to provide the following responsive records to you.

A portion of the records you requested contain information the disclosure of which may affect the interests of a third party. The third party is being given an opportunity to make representations concerning disclosure and a decision will be made within 30 days about whether or not to provide access to the subject records. We will advise you at that time whether we are able to provide those records.

Under Section 52 of the Act, you may ask the Information and Privacy Commissioner to review the Regional District's response to your request. You have 30 days from receipt of this notice to request a review by writing to:

Office of the Information and Privacy Commissioner
PO Box 9038, Stn Prov Govt,
Victoria, BC V8W 9A4
Telephone: (250) 387-5629, Fax: (250) 387-1696.

If you wish to request a review, please provide the Commissioner's office with:

1. Your name, address and telephone number;
2. The request number assigned to your request (the "file number" quoted at the top of this letter);
3. The type of request that you made to the public body, i.e., access, correction, fee complaint, time limit complaint, etc., or a copy of the request;
4. A copy of the Regional District's decision; and
5. The reasons or grounds upon which you are requesting the review.

Please contact me at (250) 490-4146 if you have any questions about this letter.

Sincerely,

Sec. 22(1) personal information

Tracey Batten
Corporate Officer
Freedom of Information Head

# Final Report

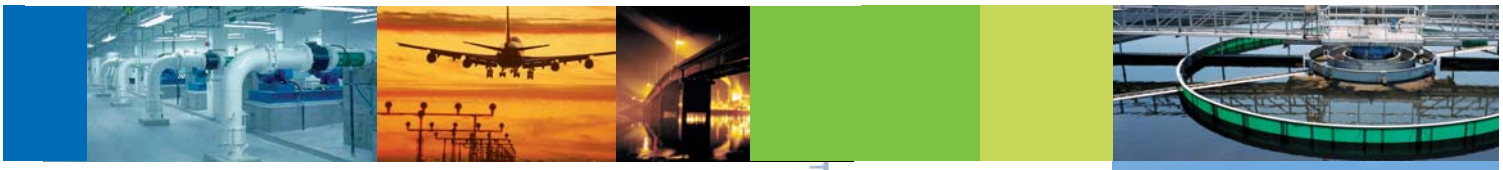
Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

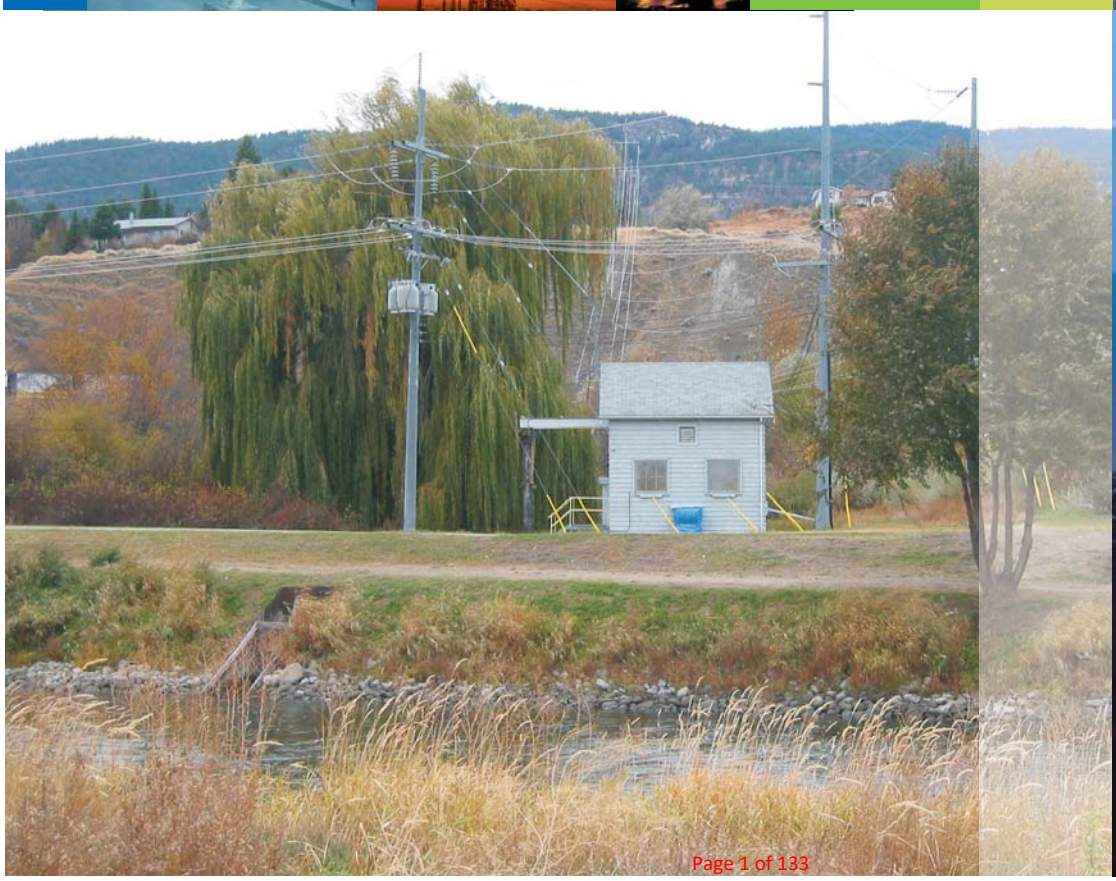
## Regional District of Okanagan-Similkameen

### West Bench Water Supply Improvements

### Options Review Study

**August 2007**







File: 0580-20/2025-45 AE Aug

**CONFIDENTIALITY AND © COPYRIGHT**

This document is for the sole use of the addressee and Associated Engineering (B.C.) Ltd. The document contains proprietary and confidential information that shall not be reproduced in any manner or disclosed to or discussed with any other parties without the express written permission of Associated Engineering (B.C.) Ltd. Information in this document is to be considered the intellectual property of Associated Engineering (B.C.) Ltd. in accordance with Canadian copyright law.

This report was prepared by Associated Engineering (B.C.) Ltd. for the account of Regional District of Okanagan-Similkameen. The material in it reflects Associated Engineering (B.C.) Ltd.'s best judgement, in light of the information available to it, at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Associated Engineering (B.C.) Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Associated Engineering (B.C.) Ltd.
Suite 420 - 1628 Dickson Avenue
Kelowna, British Columbia, Canada V1Y 9X1

TEL 250.763.3638
FAX 250.763.8880
www.ae.ca

September 19, 2007
File: 20062941.00.E.05.00

Andrew Reeder
Engineering Services Manager
Regional District of Okanagan-Similkameen
101 Martin Street
Penticton, BC
V2A 5J9

**Re: WEST BENCH WATER SUPPLY IMPROVEMENTS OPTIONS REVIEW STUDY**

Dear Mr. Reeder:

We are pleased to submit the above captioned final report.

The report presents a review of potential water sources, water quality requirements, water treatment strategies, and development of eleven different water supply and treatment options to address the West Bench Water Supply requirements. The report also includes a comparative assessment of all options under criteria including cost and cost risks, source capacity and water quality, treated water quality and health, operation and security, and environmental impacts.

The report has been organized into the following sections:

- Summary Report
- Technical Memorandum No. 1 – System Options Development
- Technical Memorandum No. 2 – Evaluation and Comparison of System Options

We look forward to working with the Regional District in the next phase of the project.

Yours truly,

Sec. 22(1) personal information

Gary T. Hussey, P.Eng.
Area Manager

Sec. 22(1) personal information

W.J. (Bill) Harvey, P.Eng.
Study Manager

GTH/WJH/cm

# Table of Contents

# 1 Overview

This report provides a summary of the findings and recommendations relative to options for upgrading the West Bench water supply and treatment facilities. It includes a review of water demands, water quality objectives, water treatment requirements, and options for supply water to the West Bench service area.

More detailed information is available from the following Technical Memoranda which are appended hereto:

- Technical Memorandum No. 1 – System Options Development
- Technical Memorandum No. 2 – Evaluation and Comparison of System Options

# 2 Background

The West Bench water system has been historically managed by the West Bench Irrigation District (WBID). Over the past 15 years the WBID has undertaken a program of distribution system improvements, focussing mainly on upgrading of the water distribution system. The District has not performed any significant upgrades to their water treatment facilities.

Recently, the Regional District of Okanagan-Similkameen (RDOS) was successful in obtaining a $2.35 million grant for upgrading the WBID water system. In 2006 the West Bench Water Advisory Committee (WBWAC) was established as a select committee of the Regional Board to advise and assist the RDOS relative to the possible transfer of the WBID to local government. RDOS then drafted an action plan to provide the WBWAC with a purpose to move forward with proposed system improvements. One item in the action plan was to complete a feasibility review of all options available to the RDOS to provide all users in the WBID with potable water that meets the 4-3-2-1-0 objectives set by the Interior Health Authority (IHA).

The Regional District retained Associated Engineering through a proposal call process in December 2006 to undertake the West Bench Water Supply Improvements Options Review Study.

# 3 Existing West Bench System

The existing West Bench water system consists of the following components:

- ***Lake Okanagan Intake:*** The existing intake consists of 500 metres of 600 mm corrugated steel pipe in the lake and 670 metres of 500 mm steel pipe on shore. The lake portion includes an intake screen at an approximate depth of 13.5 metres.

- ***Supply Pump Station:*** The pump station consists of three 150 HP pumps and one 75 HP pump, a chlorine injection system, and associated mechanical and electrical equipment. It is located on the west side of the Okanagan Channel north of the Highway 97 Bridge.

- ***Treated Water Reservoir:*** The existing treated water reservoir is a 1,020 mm diameter circular concrete structure. It is located on West Bench Road south of Jonathan Drive.

***Existing West Bench Pump Station***

- ***Distribution System:*** The existing distribution system consists of underground pipelines ranging in diameter from 75 mm to 300 mm diameter of varying materials.

- ***Service Connections:*** The WBID serves 351 domestic and irrigation connections. None of these service connections are presently metered.

Previous reports have identified concerns regarding the condition of the land portion of the existing intake pipe, the existing pump station, and certain portions of the existing distribution system. For the purpose of this report we have assumed that the following improvements would be common to all upgrading options:

- Upgrading to the West Bench distribution system pipe network.
- Installation of flow meters on all service connections.

# 4 Existing Sage Mesa System

The Sage Mesa system consists of a shallow lake intake, two pump stations to lift water to two separate pressure zones, and two treated water reservoirs to serve the two pressure zones. The Sage Mesa system consists of 265 service connections, where 175 metered connections are currently in the Upper Pressure Zone and 90 un-metered connections in the Lower Pressure Zone. Some of the options evaluated herein include jointly serving West Bench and Sage Mesa.

***Existing Sage Mesa Pump Station***

# 5 Water Demand Criteria

***Agricultural Land Use in the Core of the West Bench***

Technical Memorandum No. 1 provides information on historical water demands and the basis for water demand projections included in this report. The results are summarized below.

### West Bench Maximum Day Demand

- Residential Demand – 4.5 ML/d
- Agricultural Demand – 2.5 ML/d

### Sage Mesa Maximum Day Demand

- Residential Demand – 2.5 ML/d
- Agricultural Demand – 0.5 ML/d

# 6 Water Quality Objectives

The water quality objectives used for this study have been based on Interior Health Authority's 2006 water quality guidelines. The basic requirements under these guidelines are summarized as follows:

- 4 log virus removal
- 3 log Giardia and Cryptosporidium removal
- 2 stages of treatment
- 1 NTU turbidity maximum
- 0 coliforms

Additional information regarding these guidelines is included in Technical Memorandum No. 1. Several contacts were made with IHA during the course of this study to clarify their water treatment expectations. In order to meet the water quality objectives, the IHA insists that all treatment facilities of surface water include filtration. IHA has, however, issued a draft issue paper on Filtration Deferral, which defines certain criteria that may allow deferral of filtration installations to a later date to minimize initial cost impacts.

The implications of this deferral option are significant for this project. IHA would require proper background data and construction assurances to indicate that the WBID can meet the criteria for deferral. Okanagan Lake water is currently being supplied and treated successfully with ultraviolet in nearby communities. We believe that the Filtration Deferral is a reasonable option for this project. The suggested criteria for this process are outlined in an Issue Paper: Filtration Deferral, which can be found in Appendix 3. The final analysis will report on all options presented, with or without filtration. This report does not suggest whether filtration is required or not.

# 7 Water Treatment Strategy

There are numerous technologies available to treat Okanagan Lake water and meet IHA's guidelines. As IHA insists on filtration, we have selected conventional filtration to compare options. This process includes chemical coagulation and mixing, flocculation, clarification, filtration, and chlorine disinfection. Conventional filtration is the treatment process currently used by the City of Penticton for treating lake water. Other types of non-conventional filtration methods include membranes or pressure filtration through media.

If the water treatment can have the filtration component deferred, as described in the previous section, then the treatment components required include chlorine disinfection and Ultraviolet (UV) disinfection. UV disinfection is possible where raw water transmissivities are at least 85 percent and typically, low turbidity. Strict raw water controls are required at the source to minimize turbidity, where high levels can significantly decrease the effects of chlorination and UV.

# 8 Water Supply and Treatment Options

Six options were developed for comparison purposes. The options are defined in more detail on Technical Memorandum No. 1. Options 2, 3, 5 and 6 are potential options for filtration deferral. These additional options are denoted with a UV suffix. The following is a brief description of each option:

- **Option 1 – City of Penticton Supply**
  Option 1 involves making a connection to the City of Penticton treated water distribution system in the northwest part of the City and providing a booster station and supply pipeline to deliver water to the West Bench. In order to cost this option the City of Penticton provided a resolution from council dated July 20, 2007. A copy of the Resolution is included as part of Technical Memorandum No. 1.

- **Options 2 and 2-UV – Upgrade Existing West Bench System**
  Option 2 involves upgrading the existing Lake Okanagan Intake, converting the existing pump station to a low lift pumping facility, adding a new water treatment plant and high lift pumping facility, and a supply line to deliver water to the West Bench.

- **Options 3 and 3-UV – Joint West Bench – Sage Mesa System**
  Option 3 involves combining the West Bench and Sage Mesa water systems into a single water supply system. This alternative would involve dissolving both utilities and creating one water system owned and operated by the RDOS. There are already some political, governance and asset transfer issues that may have to be resolved in order to proceed with this option. The two systems operate at different operating pressures, with Sage Mesa having two pressure zones (lower zone 454 m and upper zone 620 m) and West Bench

having one pressure zone between the two Sage Mesa zones. The new supply system would therefore consist of a new lake intake, raw water pump station and supply line to a treatment plant; a high lift treated water pump station in the vicinity of the KVR; and new treated water supply pipelines, supplying West Bench via a connection to an existing main on West Bench Drive, and supplying Sage Mesa via a new supply main to a tie-in near the lower Sage Mesa Reservoir.

- **Option 4 – City of Penticton Domestic Supply and Separate Irrigation System**
  Option 4 involves making a connection to the City of Penticton treated water distribution system in the northwest part of the City and providing a booster pumping station and supply pipeline to deliver residential water to the West Bench. Irrigation water would be supplied from the existing supply system which would have to be upgraded to address corrosion and maintenance issues. An irrigation distribution pipeline would be constructed along the CPR right of way to serve irrigated parcels along this corridor.

- **Options 5 and 5-UV – Upgrade Existing West Bench System and Separate Irrigation System**
  Option 5 involves upgrading the existing Lake Okanagan intake, converting the existing pump station to an irrigation pumping facility, adding a new water treatment plant, a new high lift pumping facility and a treated water supply line to deliver treated water to the West Bench. A new irrigation supply main would be installed along the CPR right of way to serve agricultural parcels along this corridor.

- **Options 6 and 6-UV – Joint West Bench/Sage Mesa System and Separate Irrigation System**
  Option 6 involves combining the West Bench and Sage Mesa domestic water systems and converting the existing intakes and supply pump stations to irrigation supply facilities. This alternative would involve dissolving both utilities and creating one water system owned and operated by the RDOS. The new domestic supply system would consist of:
  - a new lake intake,
  - raw water pump station and supply line to a treatment plant in the vicinity of the KVR,
  - new treated water supply pipelines supplying West Bench via connections to the existing mains in West Bench Drive, and
  - supplying Sage Mesa via a new supply main to a tie-in near the Lower Sage Mesa Reservoir.

- **Options 7 – City of Penticton Domestic Supply to West Bench and Sage Mesa**
  Option 7 involves making a connection to the City of Penticton treated water distribution system in the northwest part of the City and constructing a booster pump station and supply pipelines to deliver treated water to the West Bench and Sage Mesa as a combined irrigation and domestic system. In addition to pipeline upgrades, a new pressurized pipe main, servicing Sage Mesa, would be constructed along Highway 97 and connected to the

existing intake pipeline. This option is conceptual only, and assumes that all land negotiations and combining of the Districts can be achieved. Use of the highway right-of-way would need to be agreed to by the Ministry of Transportation.

The existing West Bench and Sage Mesa intake pump stations and supply lines would be converted to irrigation supply facilities by replacing pumps and doing upgrades to the existing pump station structures.

# 9 Cost Estimates

Capital cost estimates for each option for filtered and unfiltered systems were prepared based on 2007 dollars. The net capital cost was calculated on the assumption that the project would be eligible for ⅔ funding assistance on all onsite capital costs. Life cycle costs were calculated using the net capital costs plus the 20 year operation and maintenance costs inflated at 2.1% per annum. Costs for the City of Penticton options were based on information provided by the City, using the same inflation factor. Table 1 summarizes the capital and life cycle costs.

For each option the calculated increase in annual taxes per connection has been shown in Table 1. This cost represents the increased annual cost for debt retirement and operation and maintenance that will have to be covered by the West Bench ratepayers if the improvements are implemented. These costs are over and above the existing taxes of $1,000 per connection.

If IHA's requirement for filtration can be deferred to a later date, as noted in Section 6, then the new treatment system must also include Ultraviolet disinfection and Chlorination. This process does not have the capability of reducing water turbidity. UV treatment requires a smaller building footprint, is simpler to operate, and eliminates the requirement for residuals management. It therefore has a significant impact on the life cycle costs. This impacts Options 2, 3, 5 and 6 (identified as Options 2-UV, 3-UV, 5-UV and 6-UV).

Table 2 summarizes the same as Table 1, however, limits the grant obtained to $2.35 M (and not 2/3 of Capital Cost).

**Table 1**
**Treatments – Filtration and Chlorination and UV and Chlorination Only**
**Life Cycle Cost Summary**

| Option | Name | Capital Cost | Capital Cost Based on Gov't Grant of ⅔ of Capital Costs | Inflated O&M Life Cycle Cost – 20 year | No. of Connections | Net Life Cycle Cost Per Connection | Increase in Annual Taxes Per Connection |
|---|---|---|---|---|---|---|---|
| 1 | City of Penticton Supply | $4,563,000 | $1,521,000 | $10,881,000 | 351 | $38,911 | $1,690 |
| 2 | Upgrade Existing System | $8,583,000 | $2,861,000 | $8,372,000 | 351 | $37,641 | $1,626 |
| 2-UV | Upgrade Existing System (UV & Cl only) | $5,580,000 | $1,860,000 | $4,553,000 | 351 | $21,935 | $841 |
| 3 | West Bench/Sage Mesa | $11,637,000 | $3,879,000 | $10,950,000 | 616 | $28,430 | $1,165 |
| 3-UV | West Bench/Sage Mesa | $7,347,000 | $2,449,000 | $5,594,000 | 616 | $15,645 | $526 |
| 4 | City of Penticton Domestic Supply and Separate Irrigation | $4,708,000 | $1,570,000 | $7,701,000 | 351 | $29,505 | $1,219 |
| 5 | Upgrade and Separate Existing System | $7,476,000 | $2,492,000 | $6,141,000 | 351 | $29,507 | $1,219 |
| 5-UV | Upgrade and Separate Existing System (UV & Cl only) | $5,545,000 | $1,848,000 | $3,686,000 | 351 | $19,410 | $715 |
| 6 | Upgrade and Separate Joint West Bench/ Sage Mesa System | $10,154,000 | $3,385,000 | $8,095,000 | 616 | $22,436 | $866 |
| 6-UV | Upgrade and Separate Joint West Bench/ Sage Mesa System (UV & Cl only) | $7,151,000 | $2,384,000 | $4,275,000 | 616 | $13,486 | $418 |
| 7 | City of Penticton to West Bench and Sage Mesa | $7,172,000 | $2,391,000 | $16,047,000 | 616 | $32,616 | $1,375 |

**Table 2**
**Life Cycle Cost Summary**
**Assuming only $2.35M Grant Available to Project**

| Option | Name | Capital Cost | Capital Cost Based on Gov't Grant of $2.35M only | Inflated O&M Life Cycle Cost – 20 year | No. of Connections | Net Life Cycle Cost Per Connection | Increase in Annual Taxes Per Connection |
|---|---|---|---|---|---|---|---|
| 1 | City of Penticton Supply | $4,563,000 | $2,213,000 | $11,085,000 | 351 | $42,248 | $1,856 |
| 2 | Upgrade Existing System | $8,583,000 | $6,233,000 | $8,372,000 | 351 | $53,893 | $2,439 |
| 2-UV | Upgrade Existing System (UV & CI only) | $5,580,000 | $3,230,000 | $4,552,000 | 351 | $28,538 | $1,171 |
| 3 | West Bench/Sage Mesa | $11,637,000 | $9,287,000 | $10,951,000 | 616 | $43,281 | $1,908 |
| 3-UV | West Bench/Sage Mesa | $7,347,000 | $4,997,000 | $5,494,000 | 616 | $22,642 | $876 |
| 4 | City of Penticton Domestic Supply and Separate Irrigation | $4,709,000 | $2,359,000 | $7,701,000 | 351 | $33,308 | $1,409 |
| 5 | Upgrade and Separate Existing System | $7,476,000 | $5,126,000 | $6,141,000 | 351 | $42,201 | $1,854 |
| 5-UV | Upgrade and Separate Existing System (UV & CI only) | $5,545,000 | $3,196,000 | $3,685,000 | 351 | $25,902 | $1,039 |
| 6 | Upgrade and Separate Joint West Bench/ Sage Mesa System | $10,154,000 | $7,804,000 | $8,095,000 | 616 | $34,572 | $1,473 |
| 6-UV | Upgrade and Separate Joint West Bench/ Sage Mesa System (UV & CI only) | $7,151,000 | $4,801,000 | $4,275,000 | 616 | $20,125 | $750 |

# 10 Evaluation and Comparison of Options

Although cost is an important factor in this study, it is not the only factor. In recommending an appropriate alternative, it is important to evaluate each option based on its importance to the people in the District, the risks involved, operational costs and issues, as well as the environmental impact of such an alternative. An assessment and evaluation of the various options is detailed in Technical Memorandum No. 2. The following summarizes the major criteria that the options were evaluated, including:

- ***Cost and Cost Risk*** – including capital cost, life-cycle cost per lot, government funding dependency, constructability, potential political implementation risk, direct ability to control future costs, and facilities site availability.

- ***Source Capacity/Quality*** – including available source capacity, raw water quality, and source resilience to water quality deterioration.

- ***Treated Water Quality*** – including treatment conformance with IHA requirements, risk of human consumption of lower quality water, and flexibility for phasing filtration.

- ***Operation and Security*** – including operational robustness, operational flexibility, and security.

- ***Environmental Impact*** – including construction impacts and operational impacts.

This brief analysis was performed to assess the various risks associated with the construction of any of these options. Criteria for assessing the weighting of importance were based on discussions with RDOS Board and staff members.

It is immediately evident that Options 1 and 4 provide the required treatment at the least initial capital cost. Upon further examination however, high operational costs, as well as inability for West Bench users to control their future water costs, increase the risks of these options substantially.

The highest ranked options are Options 2-UV and 5-UV, where initial capital costs are higher, however long-term operational costs are significantly lower. The greatest risk with these options are that they rely on the IHA Filtration Deferral Policy, which permits the delay of filter installation to a later date. If filters become a requirement in the future, the capital costs of these options increase significantly.

# 11 Recommendations

We respectfully recommend the following:

1. The Regional District review this report with the Community at Large to receive feedback on the options presented herein and impacts on taxes.

2. Confirm with the provincial government the potential for obtaining additional provincial government funding for any scope changes to the project.

3. Based on successful UV treatment of Okanagan Lake water by other local communities in the area, a treatment option that includes filtration deferral (UV and Chlorination) can be chosen.

4. Obtain written clarification from IHA regarding acceptable treatment strategies for the West Bench project.

5. Limnological studies on Okanagan Lake near the intake should proceed immediately to obtain the necessary data for obtaining the IHA Construction Approvals and filtration deferral, as well as proceed with design.

Please note that there are cost sensitivities to cost in some of these options if the RDOS is unable to receive additional grant funding. The $2.35 M initial grant was based on construction of a UV plant for West Bench only. Any other uses will require provincial approval.

Respectfully submitted,

W.J. (Bill) Harvey, P.Eng.
Project Manager

WJH/cm

# Technical Memorandum No. 1

Associated Engineering

GLOBAL PERSPECTIVE. LOCAL FOCUS.

## Regional District of Okanagan-Similkameen

### West Bench Water Supply Improvements Options Review Study

### System Options Development

**August 2007**



File: 0580-20/2025-45 AE Aug

# TECHNICAL MEMORANDUM NO. 1

**West Bench Water Supply Improvements**
**Options Review Study**
**System Options Development**

***Issued:*** August 31, 2007
***Previous:*** August 20, 2007

## 1 Objective

The objective of this Technical Memorandum is to identify and develop water supply options for the West Bench water system.

## 2 Previous Reports

In preparing this Technical Memorandum Associated Engineering obtained copies of and reviewed the following reports:

1. West Bench Irrigation District Assessment Study prepared for Regional District of Okanagan-Similkameen, Stantec Consulting Ltd., December 2001.

2. West Bench Irrigation District Water Supply Options prepared for West Bench Irrigation District, Stantec Consulting Ltd., April 2006.

3. Sage Mesa Water and Public Service Company Assessment Report prepared for Regional District of Okanagan Similkameen, True Consulting Group, January 2000.

Some information contained in the above reports has been re-used in the preparation of this Technical Memorandum.

## 3 Existing System

### 3.1 Existing Infrastructure

The existing West Bench water system has been historically managed by the West Bench Irrigation District (WBID). Over the past 15 years the WBID has undertaken a program of distribution system improvements. The system includes the following existing components.

- ***Lake Intake*:** The existing Lake Okanagan intake consists of 500 metres of 600 mm corrugated steel pipe in the lake and 670 metres of 500 mm steel pipe on shore. Sections of the land portion of the existing intake pipe are apparently corroding. The lake portion includes an intake screen at an appropriate depth of 13.5 metres. Based on previous inspection the lake portion appears to be in good condition, however the screen does not meet current standards.

- ***Supply Pump Station*:** The existing pump station consists of three 150 HP pumps and one 75 HP pump, a chlorine feed system and associated mechanical and electrical equipment. The proven capacity of the pump station utilizing two 150 HP pumps and the 75 HP pump is reported to be approximately 105 l/sec. A need has been identified to upgrade/replace the existing facility due to its poor structural condition and extensive mechanical wear and tear.

- ***Water Reservoir:*** The existing water reservoir has a capacity of 1,020 $m^3$. The 2001 report indicated that it has a capacity shortfall of approximately 700 $m^3$ to provide balancing and fire storage to the system. The 2006 report doesn't include any allowance for reservoir upgrading. The need for additional storage capacity has not been included in this study but should be addressed during pre-design.

- ***Distribution System*:** The existing distribution system consists of pipes ranging in diameter from 75 mm to 300 mm diameter of varying material. The system serves approximately 351 domestic and irrigation connections, including 145 acres of irrigated lands at pressures ranging from 275 to 690 kPa.

- ***Supply Pipelines*:** The existing supply pipelines are 400 mm and 300 mm diameter ductile iron pipe installed in 1979. They are assumed to be in reasonable condition.

It is our understanding that the West Bench water supply and distribution system is currently being operated by the City of Penticton under contract to the West Bench Irrigation District.

The previous reports have noted some questions regarding the legal status of the rights of way that the land portion of the lake intake pipe and the Supply Pump Station are located on. They also indicate similar issues with some of the existing distribution mains.

Based on our review of existing reports, we have assumed, for the purposes of this study that the existing land portion of the lake intake and the existing supply pump station require complete replacement if they are to be integrated into the system upgrading. Certain distribution system upgrades should also be undertaken and these are identified in a subsequent section of this Technical Memorandum.

### 3.2 Existing Operating Costs

Information was obtained from the West Bench Irrigation District (WBID) regarding current operating costs. The following table summarizes the 2007 budgeted operating costs excluding special projects or one-time type expenditures:

**Table 1-1**
**WBID 2007 Projected Operating Costs**

| | |
|---|---|
| Administration | $84,900 |
| Operating Contract | $55,700 |
| Water Distribution Maintenance | $12,000 |
| Pumping System Maintenance | $5,000 |
| Chlorination | $4,000 |
| Power | $24,600 |
| Water Quality Monitoring | $2,000 |
| Miscellaneous Expenses | $12,800 |
| **Total** | **$201,000*** |

*Note: There is approximately $54,000 in additional costs related to special projects, pump rebuilding, etc. budgeted for 2007 not included in the above summary.*

Out of the above costs, the administration, water distribution maintenance, water quality monitoring, and miscellaneous costs totalling $111,700, would continue to be incurred for all options. In addition to the above administration and operating costs, the WBID has budgeted $149,567 for debt retirement.

## 4 Water Demand Design Criteria

Previous studies have been undertaken by others which have included reviews of water demands. These studies have included reviews of historical demands and projection of current estimated demands for the purposes of establishing water demand criteria. As part of this study we have not undertaken a detailed review of previous demand projections.

The water supply and treatment components should be designed to meet maximum day demand. The following therefore confirms the water demand design criteria used in this report for the purposes of comparing options.

## 4.1 West Bench

- ***Historical Water Demands:*** Historical maximum day demands for the period between 2000 and 2005 are summarized as follows:

  2000 – 6.36 ML/d
  2001 – 6.50 ML/d
  2002 – 6.94 ML/d
  2003 – 6.23 ML/d
  2004 – 5.62 ML/d
  2005 – 5.60 ML/d

- ***Residential Demand*:** The West Bench area consists of 351 connections. For the purposes of this report, residential demand is defined as the combined indoor and outdoor water demand for a typical (non-agricultural) lot in the West Bench. Previous reports have utilized a residential demand of 2 usgpm (0.126 L/s) per lot. This equates to a demand as follows:

  MDD = 351 x 0.126 L/sec = 44.2 L/sec = 3.82 ML/d

- ***Agricultural Demand*:** According to previous reports, the agricultural land usage presently totals approximately 29 Ha (72 acres). Using a design criteria of 6 usgpm (0.378 L/s) per acre, this equates to the following demand:

  MDD = 72 x 0.378 L/sec = 27.2 L/sec = 2.35 ML/d

- ***Total Combined Demand*:** Based on the above, the total combined demand would equate to 6,172 $m^3$ /day. The previous reports have suggested that this calculation may underestimate the actual demands due to orchards that have been converted to irrigated lawns that could be returned to agricultural use in the future. Based on a review of historical maximum day demand records, an MDD of 7,000 $m^3$ /day was recommended. This would appear to be a reasonably conservative value for the purpose of comparing options.

- ***Impact of Water Metering***
  The West Bench experienced a reduction in demands from the 1900s to the early 2000s and these reductions are reflected in the above calculations. The upgrade project will include installation of flow meters on all properties which will probably further reduce annual demands. For the purpose of this report we have not reduced the maximum day demands as it is unclear what impact metering will have on peak demands.

- ***West Bench Design Demand*:** For the purpose of comparing options, we recommend the use of the following MDD.

  Residential Demand – 4.5 ML/d
  Agricultural Demand – 2.5 ML/d

When the project proceeds into preliminary and detailed design, we would recommend that this design basis be reviewed as there would appear to be an opportunity to reduce the design demands with the implementation of flow metering.

## 4.2 Sage Mesa

- ***Residential Demand*:** The Sage Mesa area consists of 265 connections of which 175 are metered in the Upper Pressure Zone and 90 are unmetered in the Lower Pressure Zone. The TRUE report recorded a maximum day demand of 9.2 $m^3$ /day/lot for the upper pressure zone and 6.4 $m^3$ /lot/day for the lower pressure zone. This equates to the following:

  Upper Zone MDD 197 x 9.2 $m^3$ /day = 1.81 ML/d
  Lower Zone MDD 68 x 6.4 $m^3$ /day = 435 $m^3$ /day = .44 ML/d
  Total MDD – 265 lots – 2.25 ML/d

- ***Agricultural/Commercial Demand*:** The Sage Mesa area has limited agricultural land usage; however, it includes two golf courses. The TRUE report indicated a golf course MDD of 550 $m^3$ /day = 0.55 ML/d

- ***Total Combined Demand*:** Based on the above criteria the combined MDD would total 2.8 ML/d.

- ***Impact of Water Metering*:** To be consistent in comparing options it should be assumed that the Sage Mesa area will be fully metered if it is integrated into the West Bench project. This would involve providing meters on properties in the lower pressure zone. For the purpose of this report we have not reduced the maximum day demands as it is unclear what impact metering will have on peak demands.

- ***Sage Mesa Design Demand*:** The above calculations were based on the review of two years demand records by the consultant. For the purpose of comparing options we recommend the use of the following criteria:

  Residential Demand – 2.5 ML/d
  Golf Course Demand – 0.5 ML/d

# 5 Water Treatment

## 5.1 Raw Water Quality

The West Bench's water supply is drawn from Okanagan Lake. The water quality from Okanagan Lake is considered to be very good. Raw water quality characterization presented in **Table 1-2** is based on a review of data from the City of Kelowna and the City of Penticton. Water quality in the lake is relatively consistent and not subject to rapid significant changes. This is due to the size and volume of the lake. By withdrawing water from depths greater than 25 metres the seasonal water quality is very consistent thereby optimizing its treatability. Table 1-1 below provides an indicator of the raw water quality since 1990.

**Table 1-2**
**Raw Water Quality**

| Parameters | Units | Min. | Max. | Normal |
|---|---|---|---|---|
| Alkalinity | mg/l | 101 | 122 | 109 |
| Colour | TCU | 0 | 5 | 2 |
| Hardness | mg/l | 105 | 130 | 117 |
| pH | pH | 7.5 | 9.1 | 8.0 |
| Turbidity | NTU | 0.1 | 4 | 0.5 |
| Calcium | mg/l | 30 | 38 | 34 |
| Iron | mg/l | .01 | .11 | .02 |
| UV Transmittance | % | 83 | 94 | 87 |

## 5.2 Water Quality Objectives

In 2006 Interior Health Authority established the 4.3.2.1.0 Drinking Water Objective. Under this objective the following criteria were established:

- 4 log virus removal
- 3 log Giardia and Cryptosporidium removal or inactivation
- 2 stages of treatment – see below
- 1 NTU turbidity maximum
- 0 bacterial indicators

Under the new objective a minimum of 2 stages of treatment is required for water that is at risk of containing pathogens. Filtration and disinfection should be considered on most water supplies to ensure a safe supply of water. UV light and chlorination can be considered for source water that meets the criteria for the exclusion of filtration as outlined in the Guidelines for Canadian Drinking Water Quality.

Interior Health now requires purveyors to issue a water quality advisory when turbidity values exceed 1.0 NTU and a boil water advisory if turbidity exceeds 5.0 NTU. Ultimately, all surface waters are to be filtered and this is to be taken into account in the planning of water treatment improvements by each water purveyor.

### 5.3 Water Treatment Strategy

For the purpose of this study it is important to be able to compare options based on a common water treatment approach. The raw water source for all options under consideration is Lake Okanagan. As outlined in 5.1, Lake Okanagan is considered to be a good quality raw water source.

One strategy which has been used on other systems supplied from Lake Okanagan has been to use two stage treatment consisting of UV followed by chlorination. Depending on the depth of intake and local lake limnology this strategy can be capable of meeting 4 of the 5 criteria set out in IHA's new guidelines, with turbidity being the one exception.

The writer contacted a local representative of Interior Health who indicated that to assure compliance with IHA's new Drinking Water Objective, multi-stage treatment incorporating filtration would be required. Depending on the quality of the source water, there are numerous ways of achieving filtered water including direct filtration, clarification and filtration, and membrane filtration.

The IHA has also developed a draft "Filtration Deferral Strategy" and policy document. This document is attached to this report under Enclosure 1C. The District may be able to defer costly filtration to a later date. To meet IHA requirements, however, certain conditions need to be met, and an ultra-violet (UV) disinfection system must be added.

Direct filtration involves chemical coagulation and mixing, flocculation, filtration, and chlorination. Clarification and filtration involves the same process steps as direct filtration with the addition of clarification prior to filtration. Membrane filtration involves the use of semi-permeable membranes to remove particulate mater from the water. Depending on source water quality and membrane technology, pre-treatment may be required for removal of organic carbon and colour.

All of these treatment processes produce liquid and solid wastes that require treatment and/or disposal. A common practice is to discharge water treatment wastes to sanitary sewer, however, at the present time, this option is not available for the West Bench. Therefore, treatment options

should include provisions for residual treatment. The selected treatment strategy for West Bench should take into consideration local lake limnology, depth of intake, and residuals handling.

The City of Penticton water treatment plant is designed to treat water from Lake Okanagan and Penticton Creek. The plant is a conventional filtration plant involving clarification and filtration. It was designed with the capability to treat lake water in the direct filtration mode, however, is not operated in this mode. A portion of the residuals from the plant is directed into the sanitary sewer system.

For the purpose of comparing options for the West Bench, the general filtration component includes clarification and filtration. This is a proven treatment process currently used by the City of Penticton for treating lake water. It should be noted that there is a strong possibility that both membrane filtration and direct filtration would be suitable treatment processes, however, residuals treatment would be more challenging and the direct filtration process would require the provision of UV to meet Giardia and Cryptosporidium removal requirements. Using the clarification and filtration strategy allows all alternatives to be compared on a consistent basis.

# 6 Distribution System Upgrades

Previous studies have identified the need for distribution system upgrades required to the West Bench system. These upgrades include the following works:

| | |
|---|---|
| Newton Drive - | 650 lin. m 200 mm pipe |
| Sparton Drive - | 470 lin. m 150 mm pipe |
| Veteran Drive - | 240 lin. m 150 mm pipe |
| Moorpark/Sunglo Drive - | 490 lin. m 150 mm pipe |
| Vedette Drive - | 240 lin. m 150 mm pipe |

The above noted replacement pipes are required to replace existing 75 mm and 100 mm steel mains that have created the largest number of leaks due to corrosion. These upgrades are considered common to all options and therefore are included in the cost estimates for all options.

As noted in Section 3, an earlier report identified a capacity shortage in the treated water reservoir. The most recent report, however, does not include any allowances for increasing storage capacity. The reservoir's existing capacity needs to be confirmed and the requirement for additional storage clarified.

In addition to the above upgrades, this project will include installation of flowmeters on all properties. This is also common to all options and therefore included in the cost estimates for all options.

# 7 Servicing Options

Six options have been developed for comparison purposes. Each option has been developed at a conceptual design level including capital and operating costs. Options 2, 3, 5 and 6 are potential options for filtration deferral. These additional options are denoted with a UV suffix. Each option is described herein.

## 7.1 Option 1 – City of Penticton Supply

- ***City of Penticton Proposal:*** In response to a request by Associated Engineering, the City of Penticton (COP) provided a proposal re: West Bench Water Supply under letter dated July 20, 2007. A copy of the City proposal is included in **Enclosure 1B**. The essence of the City Resolution 455/2007 was that the City would have no problem with the West Bench Irrigation District (WBID) considering the use of the City water supply as one of the options, subject to the following conditions:

    - Transfer of WBID water licences to the City.
    - COP must amend their water licences to include the West Bench boundaries.
    - All properties within West Bench must be metered.
    - The option of the City providing metering and billing services at a cost of $13.00 per reading (2 readings per year).
    - Connection point to be in the vicinity of Riverside Drive and Highway 97.
    - WBID responsible for constructing a booster pump station (including tie-in, emergency generator and land acquisition) to pump water from the City system to the West Bench.
    - Pump station and supply line must be sized to accommodate both WBID and Sage Mesa.
    - Operating charges for water would have a 50% fixed component and a 50% variable component.
    - Operating charges would be increased annually by the same amount as COP water rates.
    - Should the City change its allocation between fixed and variable costs for operating costs the same would apply to WBID.
    - Capital depreciation charges would be fixed and calculated as 7.3% of the annual depreciation value of the water utility per year.
    - A capital contribution in the amount of 20% of the capital costs related to the running of the water utility, on City charges, passed through to customers.
    - The City would only sell water to the WBID during non peak times (January – June, September – December) until the upgrades to the COP water treatment plant are completed, estimated 2010. Once the upgrades are complete the City would sell water throughout the year.
    - Late-comer fees for over-sizing are part of any agreement discussions.

- Any final decision would require Council approval and the development and execution of a contract.

- ***Concept*:** Option 1 therefore involves making a connection to the City of Penticton treated water distribution system in the northwest part of the City and providing a booster pumping station and supply pipeline to deliver water to the WBID. Refer to **Plan 1-1**.

- ***Raw Water Source*:** The raw water source for this option is a combination of Okanagan Lake and Penticton Creek, which are used by the City of Penticton as sources for their water treatment plant on the east side of the City. To supply water to the RDOS the City will have to arrange for transfer of the WBID's existing license for Okanagan Lake water to the City of Penticton.

- ***Water Treatment*:** The City currently operates a filtration plant that utilizes the following treatment processes – chemical coagulation and mixing, flocculation, clarification (plate settlers), filtration, and chlorination. The plant obtains its raw water supply from two sources, Lake Okanagan and Penticton Creek. It has two trains, one which can operate in direct Filtration mode and the other in conventional Filtration mode. The plant is currently operating near its maximum design capacity of 60 ML/d and a water treatment expansion project is being planned for 2009. We therefore believe that this expansion would have to be completed before water could be supplied to the WBID. It is our understanding that this plant meets IHA's new guidelines.

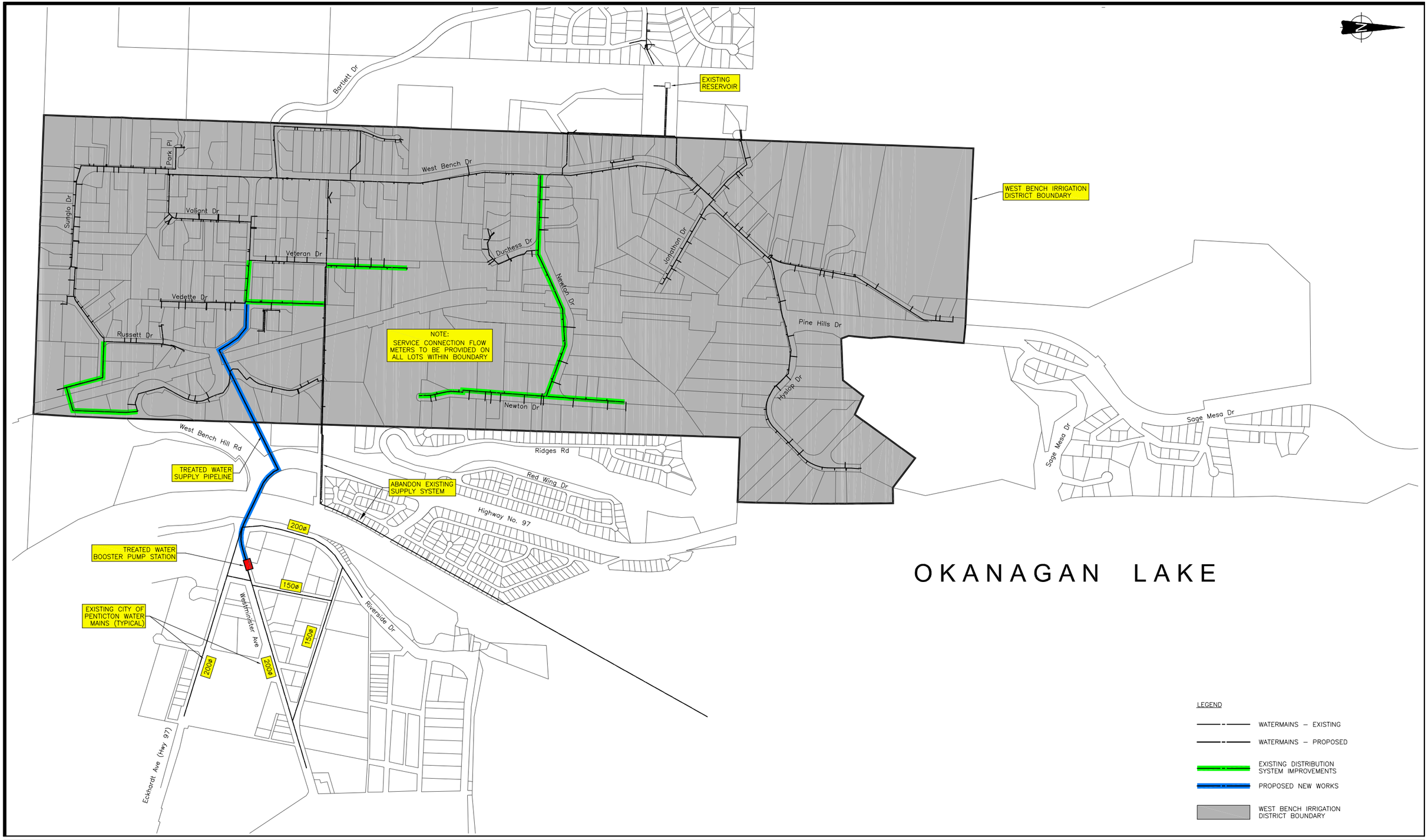
- ***Water Supply System*:** The water supply system would include the following components:

  - Connection to City of Penticton System: A connection would be made to the City of Penticton system in the vicinity of the intersection of Westminster Avenue and Eckhardt Avenue. Previous modelling has confirmed that the City system is capable of delivering the required demands for the WBID at this location once the COP treatment plant updates are completed.

  - Booster Treated Water Pump Station: A booster pump station sized to deliver 7 ML/d MDD would be installed in an open area on the Westminster Avenue right of way near the connection point. The pump station would consist of 2 duty and 1 standby pumps and would incorporate standby power (or drive) for 50% of the delivery capacity.

  - Treated Water Supply Pipeline: A 250 mm diameter supply pipeline would supply water from the connection point to a connection to the existing West Bench distribution system on Bartlett Drive.

This Drawing Is For The Use Of The Client And Project Indicated
No Representations Of Any Kind Are Made To Other Parties




| NO. | DATE | ENG. | BY | SUBJECT |
|---|---|---|---|---|
| | | | | |

REVISIONS

VERIFY SCALES

BAR IS 20mm ON ORIGINAL DRAWING

0 20mm

IF NOT 20mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PRELIMINARY
NOT FOR CONSTRUCTION

Associated Engineering



| | | | |
|---|---|---|---|
| PROJECT No. | 20062941 | | |
| SCALE | 1:5000 | | |
| DRAWN | J. BARTA | | |
| DESIGNED | B. HARVEY | | |
| CHECKED | | | |
| APPROVED | | | |
| DATE | | INITIAL | |

REGIONAL DISTRICT OF OKANAGAN-SIMILKAMEEN

KEY PLAN

WEST BENCH WATER SUPPLY IMPROVEMENTS OPTION 1

| DRAWING NUMBER | REV. NO. | SHEET |
|---|---|---|
| PL-AN01-01 | | |

FILE: 20062941-2025-45 AE Aug

- Existing Supply Components: The existing Okanagan Lake Intake, pumping station (including chlorination systems), and supply pipeline would be abandoned when the new system is operational.

- ***Potential Issues:***

  - By transferring its water licenses to the City of Penticton, the WBID users would lose its right to access the lake waters in the future. WBID would cease to be an entity, and users will lose the controls it has over finances and operations.

  - The West Bench users would have limited control of future operating costs which would be reviewed and updated on an annual basis by the City.

  - The City indicated that the design of the pump station and supply line should include oversizing for Sage Mesa. Due to uncertainties about the future connection of Sage Mesa, this has not been included in the costing to date.

  - The West Bench would be responsible for acquiring a site for the proposed booster station. While we have included an allowance for land acquisition, the cost and availability of land in this area is uncertain at this time.

  - We have assumed that the West Bench cannot apply any provincial funding to City of Penticton capital upgrades. This should be confirmed in writing.

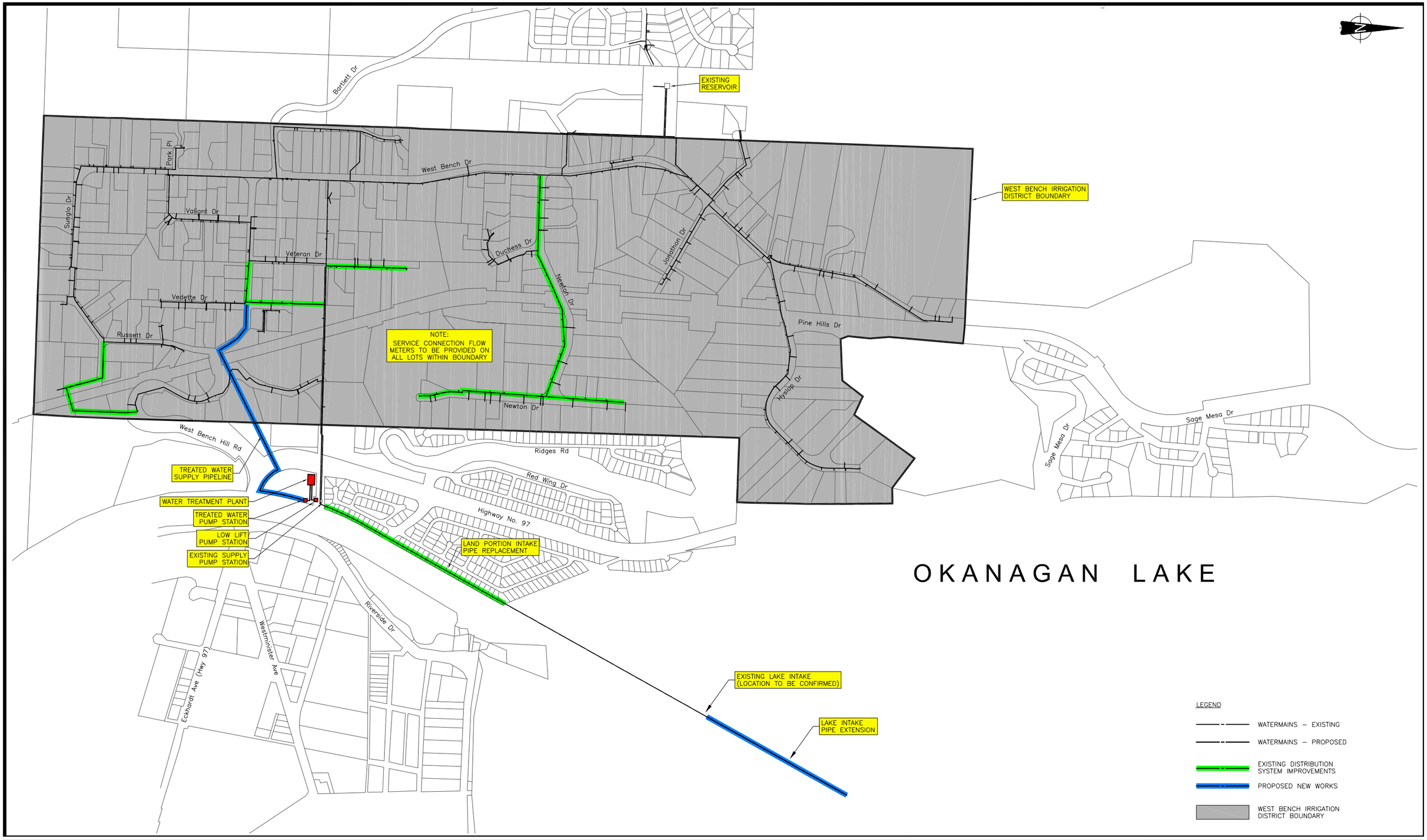
## 7.2 Option 2 – Upgrade Existing West Bench System

- ***Concept:*** Option 2 involves upgrading the existing Lake Okanagan Intake, converting the existing pump station to a low lift pumping facility, adding a new water treatment plant and a new high lift pumping facility, and a supply line to deliver water to the West Bench. Refer to **Plan 1-2**.

- ***Raw Water Intake:*** The raw water source would continue to be Lake Okanagan. To provide more consistent raw water quality the existing 670 metre long corroding land portion of the intake pipe would be replaced and a 450 lin. extension added to the lake portion to a depth of 30 m. For the purpose of this assessment we have assumed a 750 mm diameter extension due to concerns about head losses in the existing 600 mm CMP lake intake pipe.

- ***Water Treatment:*** A new water treatment plant would be required in the vicinity of the existing pump station. The intent is to convert the existing pump station to a low lift facility to lift water into the water treatment plant. For the purpose of this evaluation we have assumed conventional filtration. If filtration is deemed to be unaffordable at this point, an interim step may be to provide UV disinfection.

This Drawing Is For The Use Of The Client And Project Indicated
No Representations Of Any Kind Are Made To Other Parties




| NO. | DATE | ENG. | BY | SUBJECT |
|---|---|---|---|---|
| | | | | |

REVISIONS

VERIFY SCALES

BAR IS 20mm ON ORIGINAL DRAWING

0 20mm

IF NOT 20mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PRELIMINARY
NOT FOR CONSTRUCTION

Associated Engineering

| | | | |
|---|---|---|---|
| PROJECT No. | 20062941 | | |
| SCALE | 1:5000 | | |
| DRAWN | J. BARTA | | |
| DESIGNED | B. HARVEY | | |
| CHECKED | | | |
| APPROVED | | | |
| DATE | | INITIAL | |

REGIONAL DISTRICT OF OKANAGAN-SIMILKAMEEN

KEY PLAN

WEST BENCH WATER SUPPLY IMPROVEMENTS OPTION 2

| DRAWING NUMBER | REV. NO. | SHEET |
|---|---|---|
| PL-AN01-2 | | |


Rec'd 2025-45 AE Aug

- ***Water Supply System:*** The water supply system would include the following components:

  - High Lift Treated Water Pump Station: The treated water pump station would be sized to deliver 7 ML/d from a clearwell on the discharge side of the water treatment plant. The pump station would consist of 2 duty and 1 standby pumps and would incorporate standby power (or drive) for 50% of delivery capacity.

  - Supply Pipeline: A 250 mm diameter supply pipeline would supply water from the pump station to a connection to the existing distribution system on Bartlett Drive.

  - Existing Supply Components: A significant portion of the existing Okanagan Lake intake would be replaced and the existing pump station converted to a low lift pump station. The existing supply pipelines would be abandoned.

- ***Potential Issues:***

  - The operation and maintenance costs for the filtration plant will have a significant impact on future annual taxes.

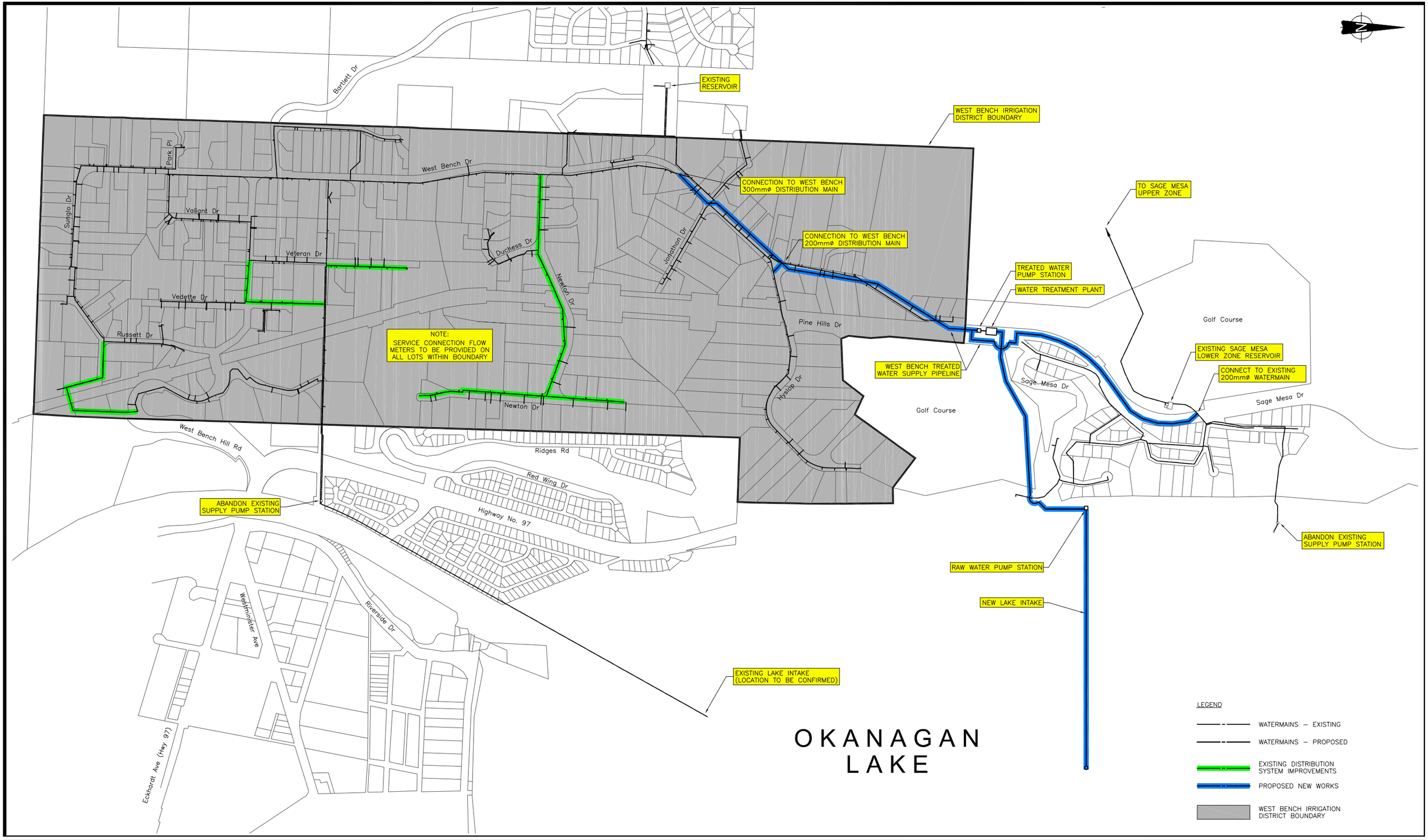
  - The WBID would be responsible for acquiring a site for the proposed water treatment plant. While we have included an allowance for land acquisition, the cost and availability of land in this area is uncertain at this time.

  - By using the conventional filtration treatment strategy it probably would not be necessary to extend the intake pipe to a deeper lake depth, even though it has been costed on that basis.

### 7.3 Option 3 –Joint West Bench / Sage Mesa System

- ***Concept:*** Option 3 involves combining the West Bench and Sage Mesa water systems into a single water supply system. This alternative would involve dissolving both utilities and creating one water system owned and operated by the RDOS. There are already some political, governance and asset transfer issues that may have to be resolved in order to proceed with this option. The two systems operate at different HGLs with Sage Mesa having two pressure zones (lower zone 454 m and upper zone 620 m) and West Bench having one pressure zone between the two Sage Mesa zones. The new supply system would therefore consist of a new lake intake, raw water pump station and supply line to a treatment plant; a high lift treated water pump station in the vicinity of the KVR; and new treated water supply pipelines, supplying West Bench via a connection to an existing main on West Bench Drive, and supplying Sage Mesa via a new supply main to a tie-in near the lower Sage Mesa Reservoir. Refer to **Plan 1-3**.

This Drawing Is For The Use Of The Client And Project Indicated
No Representations Of Any Kind Are Made To Other Parties




| NO. | DATE | ENG. | BY | SUBJECT |
|---|---|---|---|---|
| | | | | |

REVISIONS

VERIFY SCALES

BAR IS 20mm ON ORIGINAL DRAWING

0 20mm

IF NOT 20mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PRELIMINARY
NOT FOR CONSTRUCTION

Associated Engineering

| | | | |
|---|---|---|---|
| PROJECT No. | 20062941 | | |
| SCALE | 1:5000 | | |
| DRAWN | J. BARTA | | |
| DESIGNED | B. HARVEY | | |
| CHECKED | | | |
| APPROVED | | | |
| DATE | | INITIAL | |

REGIONAL DISTRICT OF OKANAGAN-SIMILKAMEEN

KEY PLAN

WEST BENCH WATER SUPPLY IMPROVEMENTS OPTION 3

| DRAWING NUMBER | REV. NO. | SHEET |
|---|---|---|
| PLAN 1-3 | | |


Rpt AN0123 2025-45 AE Aug

- ***Raw Water Supply System:*** The raw water supply system would consist of a 600 mm diameter HDPE pipe extended approximately 700 lin. m to a lake depth of approximately 30 m, a raw water pump station on the west side of the highway right-of-way and a supply pipeline through the Pine Hills golf course.

- ***Water Treatment:*** Water from the new intake would be pumped through a supply pipeline to the water treatment plant on the KVR near the Sage Mesa golf course. This site is adjacent to the existing golf course access road, and would require more detailed engineering services to address site grading issues, etc. Approval would be required to locate it on the KVR. If not this location, the other options would be to site the plant adjacent to the Sage Mesa lower zone reservoir, east of Sage Mesa Drive, or possibly adjacent to the West Bench Reservoir. This would increase the capital costs. For the purpose of this evaluation we have assumed a conventional filtration plant on the KVR right-of-way near the Sage Mesa golf course access.

- ***Water Supply System:*** The water supply system would include the following components:

    - <u>High Lift Treated Water Pump Station</u>: The treated water pump station would be sized to deliver 10 ML/d from a clearwell on the discharge side of the water treatment plant. The pump station would consist of 3 duty pumps (one of which would be dedic0ated to supplying Sage Mesa at lower zone HGL 454 m) and 1 standby pump and would incorporate standby power (or drives) for 50% of delivery capacity.

    - <u>Supply Pipeline</u>: A new 300 mm supply pipeline would supply water from the treated water pump station along West Bench Drive to connections in the West Bench and to Sage Mesa via a new 250 mm water main to the Sage Mesa Lower Reservoir.

    - <u>Existing Supply Components</u>: All of the existing West Bench and Sage Mesa intake and pump station supply components would be abandoned under this option.

- ***Potential Issues:***

    - This alternative would involve dissolving both utilities to create one water system owned and operated by the RDOS. These issues will need to be addressed and resolved at an early stage to allow the project to proceed.

    - The operation and maintenance costs for the filtration plant will have a significant impact on future annual taxes.

- This alternative involves securing a site for the proposed water treatment plant adjacent to the existing golf course access road on the KVR. While we have included an allowance for land acquisition, the cost and availability of land in this area is uncertain at this time.

- By supplying both systems, the capital costs increase significantly thereby increasing the reliance on senior government funding. There is no indication at this time whether the additional required funding would be available.

## 7.4 Option 4 – City of Penticton Domestic Supply and Separate Irrigation System

- ***Concept***: Option 4 involves making a connection to the City of Penticton treated water distribution system in the northwest part of the City and providing a booster pumping station and supply pipeline to deliver residential water to the West Bench. Irrigation water would be supplied from the existing supply system, and upgraded to address corrosion and maintenance issues. An irrigation distribution pipeline would be constructed along the CPR right of way to serve irrigated parcels along this corridor. Refer to **Plan 1-4**.

- ***Raw Water Source***: Residential water would be sourced from the City of Penticton system. Irrigation water would be sourced from the existing Lake Okanagan intake. The land portion of the existing intake pipe would have to be replaced to address existing corrosion issues. Prior to proceeding with this, the legal status of the right of way should be confirmed.

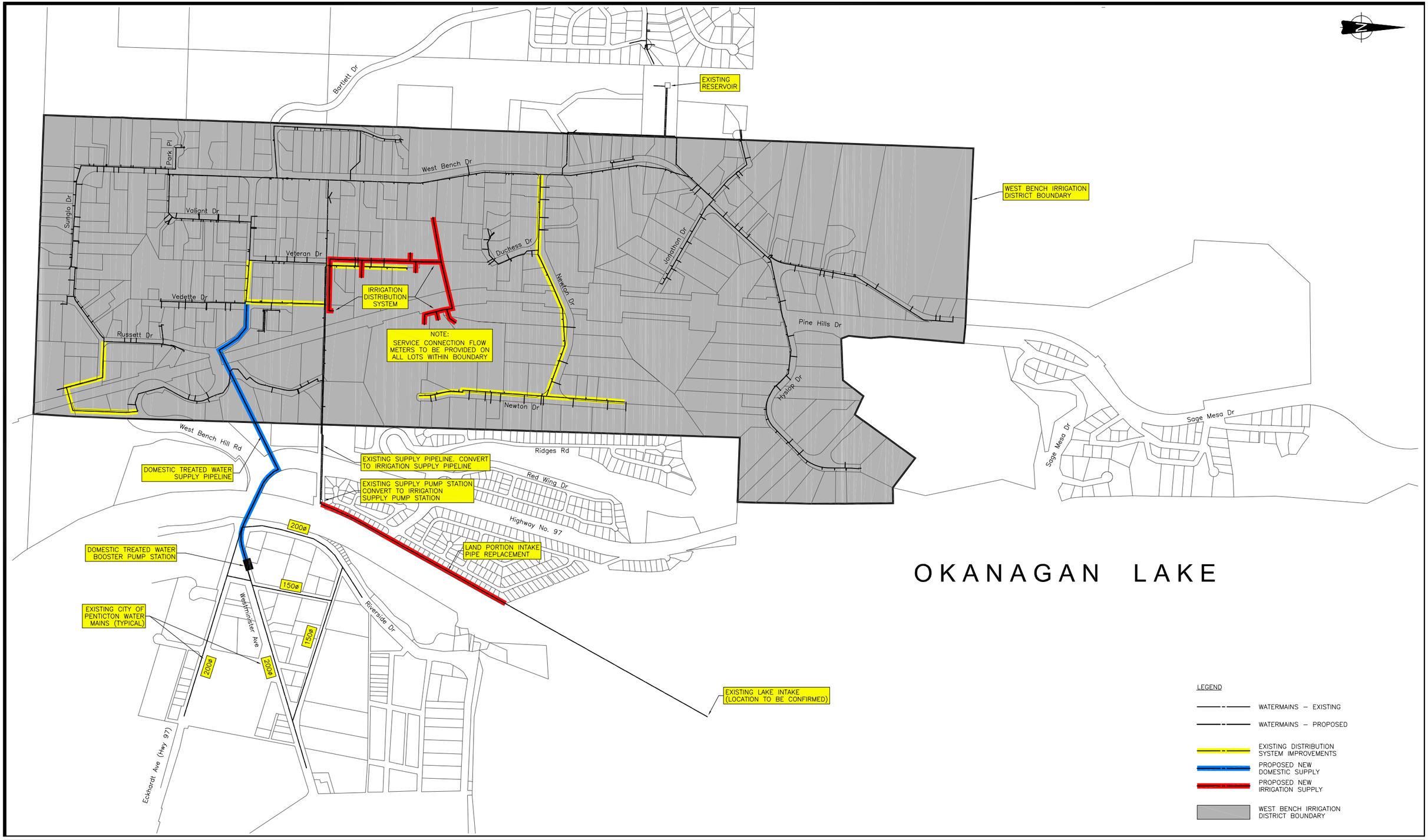
- ***Water Treatment***:: The upgraded City filtration plant would provide supply to the residential distribution system. As noted under Option 1, the City is currently planning an expansion of the plant and this would have to be completed before water could be supplied to the West Bench. This plant expansion is currently planned for 2008/2009.

- ***Water Supply System***:

  - Connection to City of Penticton System: A connection would be made to the City of Penticton system in the vicinity of the intersection of Westminster Avenue and Eckhardt Avenue as per Option 1.

  - Booster Treated Water Pump Station: A booster pump station sized to deliver 4.5 ML/d would be installed in the open area on the Wesminster Avenue right of way near the connection point. The pump station would consist of 2 duty and 1 standby pump and would incorporate standby power (or drive) for 50% of the delivery capacity.

This Drawing Is For The Use Of The Client And Project Indicated
No Representations Of Any Kind Are Made To Other Parties




| NO. | DATE | ENG. | BY | SUBJECT |
|---|---|---|---|---|
| | | | | |

REVISIONS

VERIFY SCALES

BAR IS 20mm ON ORIGINAL DRAWING

0 ——— 20mm

IF NOT 20mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PRELIMINARY
NOT FOR CONSTRUCTION

Associated Engineering



| | | | |
|---|---|---|---|
| PROJECT No. | 20062941 | | |
| SCALE | 1:5000 | | |
| DRAWN | J. BARTA | | |
| DESIGNED | B. HARVEY | | |
| CHECKED | | | |
| APPROVED | | | |
| DATE | | INITIAL | |

REGIONAL DISTRICT OF OKANAGAN-SIMILKAMEEN

KEY PLAN

WEST BENCH WATER SUPPLY IMPROVEMENTS OPTION 4

| DRAWING NUMBER | REV. NO. | SHEET |
|---|---|---|
| PL-AN01247 | | |

FILE: 20062941-2025-45 AE Aug

- Treated Water Supply Pipeline: A 200 mm diameter supply pipeline would supply water from the connection point to a connection to the existing distribution system on Bartlett Drive.

- Agricultural Supply Pump Station: The existing pump station would be partially demolished (after the new treated water supply system is operational). A new structure complete with two new pumps and associated piping and valving would be installed to supply the agricultural system. Prior to proceeding with this, the legal status of the right of way should be confirmed.

- Irrigation Supply Main: The existing supply pipeline would be converted to an irrigation supply main (assuming that it is still in operable condition) which would operate at a lower distribution pressure than the treated water system. A 200 mm diameter irrigation supply main would be extended along the CPR right of way to supply untreated water to large agricultural tracts along this corridor.

- Existing Supply Components: All existing supply components would be refurbished and re-used under this option.

- ***Potential Issues:***

  - There is some uncertainty regarding the domestic water demand reductions that would be achieved under this option and this will need to be confirmed during the preliminary design stage.

  - Statutory rights of way will need to be acquired for the proposed irrigation system. The availability of these rights of way is uncertain at this time.

  - By transferring the domestic portion of its water license capacity to the City of Penticton, the West Bench would lose its right to access this portion of its lake water supply in the future.

  - The West Bench would have limited control of future operating costs for its domestic water supply which would be reviewed and updated on an annual basis by the City.

  - No allowance has been included for oversizing the pump station and supply line to serve Sage Mesa, which was identified by the City as a condition of the City supplying water.

  - The West Bench would be responsible for acquiring a site for the proposed booster station. While we have included an allowance for land acquisition, the cost and availability of land in this area is uncertain at this time.

## 7.5 Option 5 – Upgrade Existing System and Separate Irrigation System

- ***Concept:*** Option 5 involves upgrading the existing Lake Okanagan intake, converting the existing pump station to an irrigation pumping facility, adding a new water treatment plant, a new high lift pumping facility and a treated water supply line to deliver treated water to the West Bench. A new irrigation supply main would be installed along the CPR right of way to serve agricultural parcels along this corridor. Refer to **Plan 1-5**.

- ***Raw Water Source:*** Residential and irrigation water would be sourced from the existing Lake Okanagan intake system. The land portion of this intake pipeline would be replaced and the lake portion of intake would be extended approximately 450 lin. m (750 mm diameter) into the lake to a depth of 30 m.

- ***Water Treatment:*** A new water treatment plant would be constructed in the vicinity of the existing pump station to treat the residential component. For the purpose of this evaluation, we have assumed a conventional filtration plant. The irrigation supply system would be supplied with untreated water.

- ***Water Supply System:***

    - High Lift Treated Water Pump Station: The treated water pump station would be sized to deliver 4.5 ML/d from the water treatment plant to the West Bench. The pump station would consist of 2 duty and 1 standby pumps and would incorporate standby power (or drive) for 50% of delivery capacity.

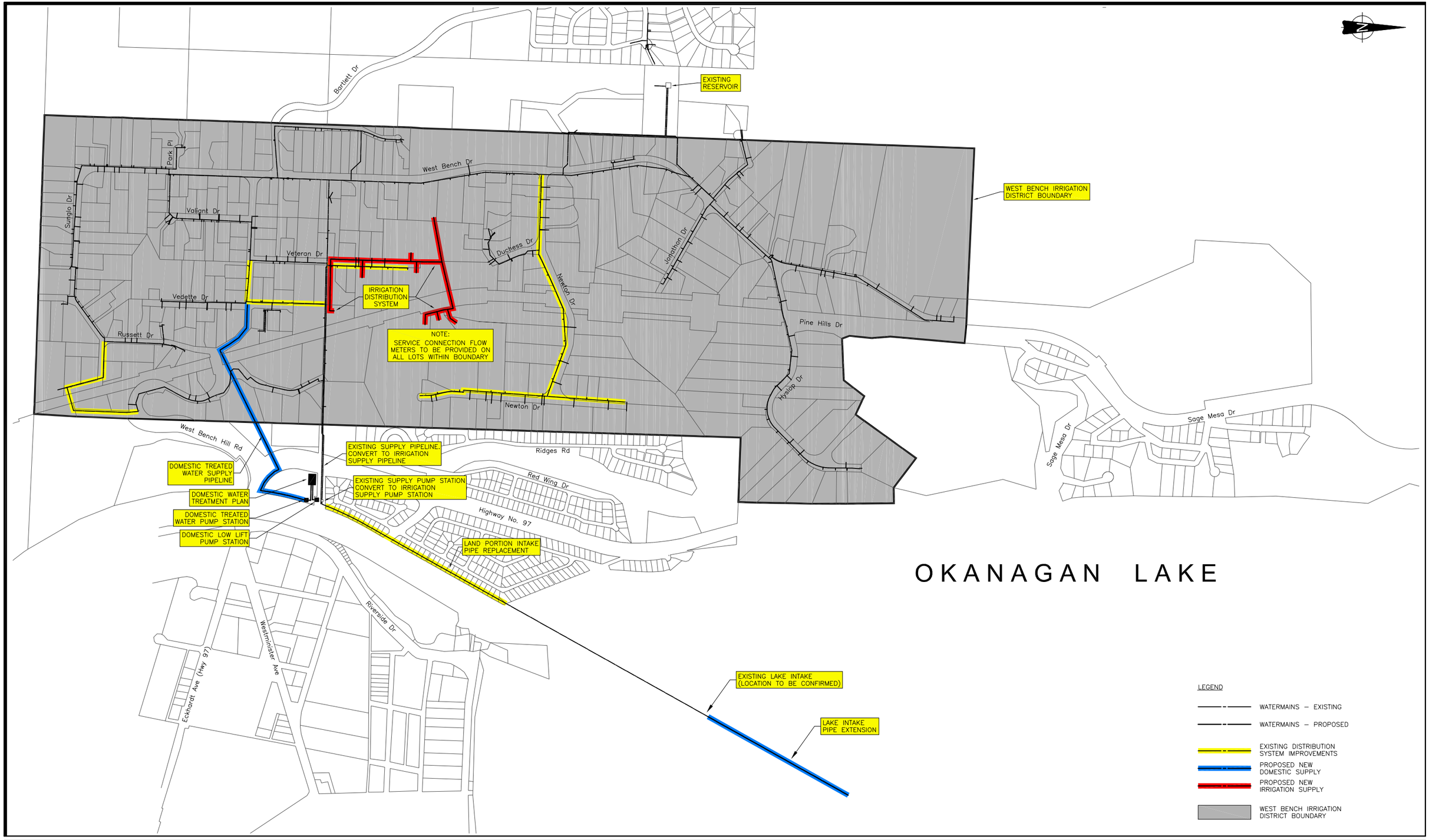
    - Treated Water Supply Pipeline: A 200 mm diameter supply pipeline would supply treated water from the pump station to a connection to the existing distribution system on Bartlett Drive.

    - Agricultural Supply Pump Station: The existing pump station would be partially demolished (after the new treated water supply system is operational). Two new pumps and associated piping and valving would be installed inside a new superstructure to supply the agricultural system.

    - Irrigation Supply Main: The existing supply pipeline would be converted to an irrigation supply main (assuming that it is still in operable condition) which would operate at a lower distribution pressure than the treated water system. A 200 mm diameter irrigation supply main would be extended along the CPR right of way to supply untreated water to large agricultural tracks along this corridor.

    - Existing Supply Components: All existing supply components would be refurbished and re-used under this option.

This Drawing Is For The Use Of The Client And Project Indicated
No Representations Of Any Kind Are Made To Other Parties




| NO. | DATE | ENG. | BY | SUBJECT |
|---|---|---|---|---|
| | | | | |

REVISIONS

VERIFY SCALES

BAR IS 20mm ON ORIGINAL DRAWING

0 ——— 20mm

IF NOT 20mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PRELIMINARY
NOT FOR CONSTRUCTION

Associated Engineering



| | | | |
|---|---|---|---|
| PROJECT No. | 20062941 | | |
| SCALE | 1:5000 | | |
| DRAWN | J. BARTA | | |
| DESIGNED | B. HARVEY | | |
| CHECKED | | | |
| APPROVED | | | |
| DATE | | INITIAL | |

REGIONAL DISTRICT OF OKANAGAN-SIMILKAMEEN

KEY PLAN

WEST BENCH WATER SUPPLY IMPROVEMENTS OPTION 5

| DRAWING NUMBER | REV. NO. | SHEET |
|---|---|---|
| PL-AN01-5 | | |

File: AN01-5 2025-45 AE Aug

- ***Potential Issues:***

  - There is some uncertainty regarding the domestic water demand reduction that would be achieved under this option and this will need to be confirmed during the preliminary design stage.

  - Statutory rights of way will need to be acquired for the proposed irrigation system. The availability of these rights of way is uncertain at this time.

  - The West Bench would be responsible for acquiring a .3 hectare site for the proposed water treatment plant beside the existing pump station. While we have included an allowance for land acquisition, the cost and availability of land in this area is uncertain at this time.

  - By using the conventional filtration treatment strategy, it probably would not be necessary to extend the intake pipe to a deeper lake depth, even though it has been costed on that basis.

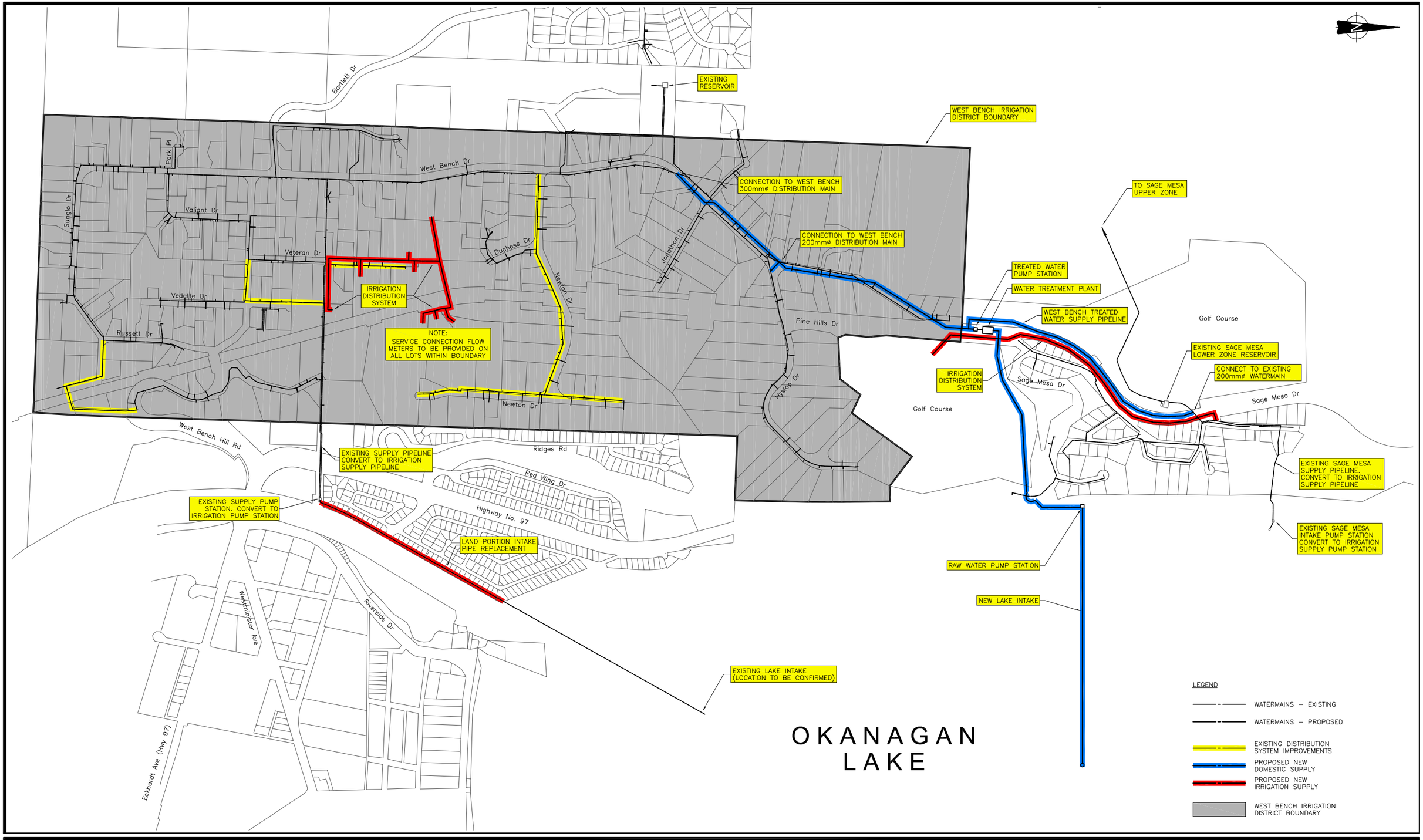
## 7.6 Option 6 – Joint West Bench/ Sage Mesa System and Separate Irrigation System

- ***Concept*:** Option 6 involves combining the West Bench and Sage Mesa domestic water systems and converting the existing intakes and supply pump stations to irrigation supply facilities. This alternative would involve dissolving both utilities and creating one water system owned and operated by the RDOS. The new domestic supply system would consist of:
  - a new lake intake,
  - raw water pump station and supply line to a treatment plant in the vicinity of the KVR
  - new treated water supply pipelines supplying West Bench via connections to the existing mains in West Bench Drive and
  - supplying Safe Mesa via a new supply main to a tie-in near the Lower Sage Mesa Reservoir.

  The existing West Bench and Sage Mesa intake pump stations and supply lines would be converted to irrigation supply facilities by replacing pumps and doing upgrades to the existing pump station structures. Refer to **Plan 1-6**.

- ***Raw Water Supply System:*** The raw water supply system (servicing the domestic demands) would consist of a 600 mm diameter HDPE pipe extended approximately 700 m to a lake depth of approximately 30 m, a raw water pup station on the west side of the highway and a supply line through the Pine Hills golf course to the water treatment plant. This system would be sized for a domestic demand of 7 ML/d.

This Drawing Is For The Use Of The Client And Project Indicated
No Representations Of Any Kind Are Made To Other Parties




| NO. | DATE | ENG. | BY | SUBJECT |
|---|---|---|---|---|
| | | | | |

REVISIONS

VERIFY SCALES

BAR IS 20mm ON ORIGINAL DRAWING

0 ——— 20mm

IF NOT 20mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PRELIMINARY
NOT FOR CONSTRUCTION

Associated Engineering

| | | | |
|---|---|---|---|
| PROJECT No. | 20062941 | | |
| SCALE | 1:5000 | | |
| DRAWN | J. BARTA | | |
| DESIGNED | B. HARVEY | | |
| CHECKED | | | |
| APPROVED | | | |
| DATE | | INITIAL | |

REGIONAL DISTRICT OF OKANAGAN-SIMILKAMEEN

KEY PLAN

WEST BENCH WATER SUPPLY IMPROVEMENTS OPTION 6

| DRAWING NUMBER | REV. NO. | SHEET |
|---|---|---|
| PLAN 1 of 6 | | |



Rpt. AN0146 2025-45 AE Aug

To serve the irrigation demands, the existing West Bench and Sage Mesa intake pump stations would be refitted with new smaller pumps and piping and the structures upgraded to serve the irrigation demands. The West Bench irrigation pump station would be sized to serve a demand of 2.5 ML/d and the Sage Mesa pump station sized to serve a demand of 0.5 ML/d to meet golf course irrigation needs.

- ***Water Treatment:*** A new water treatment plant sized to treat the domestic demand of 7 ML/d would be located on the KVR near the Sage Mesa golf course access. The site is adjacent to the existing golf course access road and would require more detailed engineering to address site grading issues etc. Approval would be required to locate the plant on the KVR. As with Option 3, there are other siting options for the plant; however, for the purpose of this evaluation we have assumed this location.

- ***Water Supply System:*** The domestic water supply system would include the following components:

  - Treated Water Pump Station: The treated water pump station would be sized to delivery 4.5 ML/d to the West Bench and 2.5 ML/d to Sage Mesa from a clearwell on the discharge side of the water treatment plant. The pump station would consist of three duty pumps (one of which would be dedicated to supplying Sage Mesa at lower zone HGL 454 m) and one standby pump, and would incorporate standby power or drives for 50% of delivery capacity.

  - Treated Water Supply Pipelines: A new 250 mm supply pipeline would supply water from the treated water pump station along West Bench Drive to connections on the West Bench and to Sage Mesa via a new 200 mm supply pipeline to the Sage Mesa Lower Reservoir.

  - Existing Supply Components: All of the existing West Bench and Sage Mesa intake and pump station supply components would be downsized and refurbished to serve the irrigation demands.

- ***Potential Issues:***

  - There is some uncertainty regarding the domestic water demand reductions that would be achieved under this option and this will need to be confirmed during the preliminary design stage.

  - Statutory rights of way will need to be acquired for the proposed irrigation system. The availability of these rights of way is uncertain at this time.

- This alternative would involve dissolving both utilities to create one water system owned and operated by the RDOS. These issues will need to be addressed and resolved at an early stage to allow the project to proceed.

- This alternative involves securing a site for the proposed water treatment plant adjacent to the existing golf course access road on the KVR. While we have included an allowance for land acquisition, the cost and availability of land in this area is uncertain at this time.

- This alternative has a significant reliance on senior government funding due to the capital costs. There is no indication at this time whether the additional required funding would be available.

## 7.7 Option 7 – Joint West Bench/Sage Mesa System Combined with City of Penticton

- ***City of Penticton:*** Consistent with Options 1 and 4, this option assumes that the necessary permits and requirements are met to join both the WBID and Sage Mesa water (WBSM) users to the City of Penticton water supply. Consistent with the requirements established by the City of Penticton for the WBID, we have assumed the same parameters for the combined system.

  Consistent with the COP letter dated July 20, 2007, as found in Technical Memorandum No. 1, the essence of a City Resolution would be that the City would have no problem with the WBSM using the City water supply as one of the options, subject to the following conditions:

  - Transfer of WBSM water licences to the City.
  - COP must amend their water licences to include the WBSM boundaries.
  - All properties within WBSM must be metered.
  - The option of the City providing metering and billing services at a cost of $13.00 per reading (2 readings per year).
  - Connection point to be in the vicinity of Riverside Drive and Highway 97. WBID responsible for constructing a booster pump station (including tie-in, emergency generator and land acquisition) to pump water from the City system to the West Bench.
  - Pump station and supply line must be sized to accommodate all users.
  - Operating charges for water would have a 50% fixed component and a 50% variable component.
  - Operating charges would be increased annually by the same amount as COP water rates.
  - Should the City change its allocation between fixed and variable costs for operating costs the same would apply to WBSM.

- Capital depreciation charges would be fixed and calculated as 7.3% of the annual depreciation value of the water utility per year.
- A capital contribution in the amount of 20% of the capital costs related to the running of the water utility, on City charges, passed through to customers.
- The City would only sell water to the WBSM during non peak times (January – June, September – December) until the upgrades to the COP water treatment plant are completed, estimated 2010. Once the upgrades are complete the City would sell water throughout the year.
- Late-comer fees for over-sizing are part of any agreement discussions.

Any final decision would require Council approval and the development and execution of a contract.

- ***Concept:*** Options 7 involves combining both West Bench and Sage Mesa water systems, then connecting them to the City of Penticton treated water supply with a booster pump station and supply pipeline. This alternative would involve dissolving both utilities and creating one water system owned and operated by the COP. There are already some political, governance and asset transfer issues that may have to be resolved in order to proceed with this option.

  The two systems operate at different HGLs with Sage Mesa having two pressure zones (lower zone 454 m and upper zone 620 m) and West Bench having one pressure zone between the two Sage Mesa zones. New treated water supply pipelines supplying West Bench via a connection to an existing main on West Bench Drive, and supplying Sage Mesa via a new supply main along Highway 97, tying into the existing intake pipeline. Refer to **Plan 1-7.**

- ***Raw Water Source:*** The raw water source for this option is a combination of Okanagan Lake and Penticton Creek, which are used by the City of Penticton as sources for their water treatment plant on the east side of the City. To supply water to the RDOS the City will have to arrange for transfer of both District's existing licenses for Okanagan Lake water to the City of Penticton.

- ***Water Treatment:*** The City currently operates a filtration plant that uses the following treatment processes – chemical coagulation and mixing, flocculation, clarification (plate settlers), filtration, and chlorination. The plant obtains its raw water supply from two sources, Lake Okanagan and Penticton Creek. It has two trains, one which can operate in direct Filtration mode and the other in conventional Filtration mode. The plant is currently operating near its maximum design capacity of 60 ML/d and a water treatment expansion project is being planned for 2009. We therefore believe that this expansion would have to be completed before water could be supplied to the Combined system t is our understanding that this plant meets IHA's new guidelines.

- ***Water Supply System:*** The water supply system would include the following components:

  - Connection to City of Penticton System: A connection would be made to the City of Penticton system in the vicinity of the intersection of Westminster Avenue and Eckhardt Avenue. Previous modeling has confirmed that the City system is capable of delivering the required demands for the WBID at this location once the COP treatment plant updates are completed. Further analysis would be required to determine if the existing COP system can feed a new combined area with an additional requirement of 10 ML/day.

  - Booster Treated Water Pump Station: A booster pump station sized to deliver 10 ML/d MDD would be installed on the highway on the west side of the River. The pump station would consist of 3 duty pumps (one of which would be dedicated to supplying Sage Mesa at lower zone HGL 454 m) and 1 standby pump and would incorporate standby power (or drives) for 50% of delivery capacity.

  - Treated Water Supply Pipeline: A 300 mm diameter supply pipeline would supply water from the connection point to a connection to the existing West Bench distribution system on Bartlett Drive.

  - Supply Pipeline: A new 250 mm supply pipeline would be installed along Highway 97 to service the existing Sage Mesa system.

  - Existing Supply Components: All of the existing West Bench and Sage Mesa intake and pump station supply components would be abandoned under this option.

- ***Potential Issues:***

  - Use of the highway right of way would need to be accepted by the Ministry of Transportation.

  - This alternative would involve dissolving both utilities to create one water system owned and operated by the COP. These issues will need to be addressed and resolved at an early stage to allow the project to proceed.

  - The operation and maintenance costs for the COP filtration plant will have a significant impact on future annual taxes.

  - While we have included an allowance for land acquisition, the cost and availability of land in this area is uncertain at this time.

- By supplying both systems, the capital costs increase significantly thereby increasing the reliance on senior government funding. There is no indication at this time whether the additional required funding would be available.

# 8 Cost Estimates

## 8.1 Cost Estimating Basis for on-Site Facilities

The capital cost estimates used for the comparison of the options have been developed using unit pricing for all components. The unit pricing is based on 2007 dollars and includes a 30% allowance for engineering and contingencies. Unit pricing used for developing the cost estimates is included in the appendices. Breakdowns for the costs are also provided in the appendices.

The operation and maintenance costs have been determined by separating out energy costs from other O&M costs and basing the other O&M costs on percentage of capital costs, depending on the type of facility or construction. For the City of Penticton supply options the annual O&M costs have been based on information provided by the City. Option 1 was based on the City data. Option 4 was based on prorating the City annual O&M costs based on the reduced demands. This assumption should be reviewed with the City.

## 8.2 Cost Estimates

**Table 8-1** summarizes capital and operating costs for each option:

**Table 8-1**
**Treatment – Clarification and Filtration**
**Capital and Operational Cost Summary**

| Option | Name | Supply and Distribution System Capital Cost | Water Treatment Capital Cost | Capital Cost | Initial Annual O&M Cost |
|---|---|---|---|---|---|
| 1 | City of Penticton Supply | $3,346,000 | $1,217,000 | $4,563,000 | $456,000 |
| 2 | Upgrade Existing System | $4,397,000 | $4,186,000 | $8,583,000 | $341,000 |
| 3 | West Bench/Sage Mesa | $5,657,000 | $5,980,000 | $11,637,000 | $446,000 |
| 4 | City of Penticton Domestic Supply and Separate Irrigation System | $3,926,000 | $783,000 | $4,709,000 | $322,000 |
| 5 | Upgrade and Separate Existing System | $4,785,000 | $2,691,000 | $7,476,000 | $250,000 |
| 6 | Upgrade and Separate Joint West Bench/ Sage Mesa System | $5,968,000 | $4,186,000 | $10,154.00 | $330,000 |
| 7 | City of Penticton to West Bench and Sage Mesa | $5,433,000 | $1,739,000 | $7,172,000 | $654,000 |

## 8.3 Life Cycle Cost Estimates

### 8.3.1 Life Cycle Costing Basis

Capital costs were applied in the life cycle costing on a one time basis at the front end of the life cycle. It was assumed that there would be no phasing of the capital works.

Operation and maintenance costs were projected over a 20 year life. It was assumed that demands would remain constant over the 20 year period and therefore operation and maintenance costs were also constant except for inflation. An inflation factor of 2.1% per annum was applied to future operating costs. This is the same inflation factor used by the City of Penticton for calculating its future costs.

### 8.3.2 Provincial Funding Assumptions

The RDOS was successful in obtaining provincial funding for the West Bench project under the BC Water Improvement Program. The RDOS has applied for additional funding due to concerns about escalating construction costs and the cost impacts of providing filtered water. It is our understanding that this funding could not be applied to off-site facilities or land acquisition. The costing included herein shows the impact of the RDOS obtaining 2/3 funding assistance on all capital costs within its direct control.

### 8.3.3 Life Cycle Cost Per Connection

In order to compare options on an equitable basis the life cycle costs were calculated on a cost per connection basis. This is useful in comparing options which include Sage Mesa to those that don't.
The costs per connection were calculated using the net capital cost assuming a government contribution of ⅔ of the onsite costs.

### 8.3.4 Life Cycle Cost Estimates

For each option the calculated increase in annual taxes per connection has been shown in **Table 8-2**. This cost represents the increased annual cost for debt retirement and operation and maintenance that will have to be covered by the West Bench ratepayers if the improvements are implemented. These costs are over and above the existing taxes of $1,000 per connection.

**Table 8-2**
**Treatment – Clarification and Filtration**
**Life Cycle Cost Summary**

| Option | Name | Capital Cost | Capital Cost Based on Gov't Grant of ⅔ of Capital Costs | Inflated O&M Life Cycle Cost – 20 year | No. of Connections | Net Life Cycle Cost Per Connection | Increase in Annual Taxes Per Connection |
|---|---|---|---|---|---|---|---|
| 1 | City of Penticton Supply | $4,563,000 | $1,521,000 | $11,084,000 | 351 | $38,911 | $1,690 |
| 2 | Upgrade Existing System | $8,583,000 | $2,861,000 | $8,372,000 | 351 | $37,045 | $1,626 |
| 3 | West Bench/Sage Mesa | $11,637,000 | $3,879,000 | $10,951,000 | 616 | $28,430 | $1,165 |
| 4 | City of Penticton Domestic Supply and Separate Irrigation | $4,709,000 | $1,570,000 | $7,701,000 | 351 | $29,507 | $1,219 |
| 5 | Upgrade and Separate Existing System | $7,476,000 | $2,492,000 | $6,141,000 | 351 | $29,505 | $1,219 |
| 6 | Upgrade and Separate Joint West Bench/ Sage Mesa System | $10,154,000 | $3,385,000 | $8,095,000 | 616 | $22,436 | $866 |
| 7 | City of Penticton to West Bench and Sage Mesa | $7,172,000 | $2,391,000 | $16,047,000 | 616 | $32,616 | $1,375 |

# 9 Impact of Filtration Deferral from IHA

If IHA's requirement for filtration can be deferred to a later date, as noted in Section 6, then the new treatment system must also include UV disinfection and Chlorination. This process does not have the capability of reducing water turbidity. UV treatment requires a smaller building footprint, is simpler to operate, and eliminates the requirement for residuals management. It therefore has a significant impact on the life cycle costs. This impacts options 2, 3, 5 and 6.

Similar to Section 8.1, Table 2 (Enclosure 1A) was developed on the assumption that the filtration component was not immediately required, but an additional cost estimate for UV disinfection was included.

**Table 9-1**
**Treatment – Chlorination and Ultraviolet (No Filtration)**
**Capital and Operational Cost Summary**

| Option | Name | Supply and Distribution System Capital Cost | Water Treatment Capital Cost | Capital Cost | Initial Annual O&M Cost |
|---|---|---|---|---|---|
| 2-UV | Upgrade Existing System | $4,397,000 | $1,183,000 | $5,580,000 | $186,000 |
| 3-UV | West Bench/Sage Mesa | $5,657,000 | $1,690,000 | $7,397,000 | $224,000 |
| 5-UV | Upgrade and Separate Existing System | $4,785,000 | $761,000 | $5,545,000 | $150,000 |
| 6-UV | Upgrade and Separate Joint West Bench/ Sage Mesa System | $5,968,000 | $1,183,000 | $7,151,000 | $174,000 |

**Table 9-2**
**Treatment – Chlorination and Ultraviolet (No Filtration)**
**Life Cycle Cost Summary**

| Option | Name | Capital Cost | Capital Cost Based on Gov't Grant of ⅔ of Capital Costs | Inflated O&M Life Cycle Cost – 20 year | No. of Connections | Net Life Cycle Cost Per Connection | Increase in Annual Taxes Per Connection |
|---|---|---|---|---|---|---|---|
| 2-UV | Upgrade Existing System | $5,580,000 | $1,860,000 | $4,552,000 | 351 | $21,935 | $841 |
| 3-UV | West Bench/Sage Mesa | $7,347,000 | $2,449,000 | $5,494,000 | 616 | $15,645 | $526 |
| 5-UV | Upgrade and Separate Existing System | $5,545,000 | $1,848,000 | $3,685,000 | 351 | $19,410 | $715 |
| 6-UV | Upgrade and Separate Joint West Bench/ Sage Mesa System | $7,151,000 | $2,384,000 | $4,275,000 | 616 | $13,486 | $418 |

Prepared by:

W.J. (Bill) Harvey, P.Eng.
Project Manager

WJH/cb

Enclosures - 1A and 1B

# ENCLOSURE 1A – COST ESTIMATING DATA

# Regional District of Okanagan-Similkameen
# West Bench Water Supply Improvements
# Options Review Study

## Table 1
## System Options Costs

| OPTION | NAME | TREATMENT | Supply and Distribution System Capital Cost | Water Treatment Capital Cost | Capital Cost | Net Capital Cost Based on Gov't Grant of 2/3 of Onsite Costs | Annual Debt Serving Cost (Notes 1 and 2) | 20 Year Debt Servicing Cost | Initial Annual Operating Cost | Total Inflated 20 Year O&M Cost - 2007-2026 (Note 3) | Total 20 Year Debt Servicing and O&M Cost | No. of Connections | Total Cost Per Lot | Total Annual Cost per Lot | Increase in Annual Taxes Per Connection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | City of Penticton Supply | Clarification/Filtration | $3,346,000 | $1,217,400 | $4,563,400 | $1,521,000 | $128,649 | $2,572,977 | $455,989 | $11,084,695 | $13,657,672 | 351 | $38,911 | $1,946 | $1,690 |
| 2 | Upgrade Existing System | Clarification/Filtration | $4,397,000 | $4,186,000 | $8,583,000 | $2,861,000 | $241,988 | $4,839,768 | $341,159 | $8,372,311 | $13,212,079 | 351 | $37,641 | $1,882 | $1,626 |
| 3 | Upgrade Joint West Bench/Sage Mesa System | Clarification/Filtration | $5,657,000 | $5,980,000 | $11,637,000 | $3,879,000 | $328,093 | $6,561,852 | $446,230 | $10,950,829 | $17,512,681 | 616 | $28,430 | $1,421 | $1,165 |
| 4 | City of Penticton Domestic Supply & Separate Irrigation | Clarification/Filtration | $3,926,000 | $782,614 | $4,708,614 | $1,570,000 | $132,793 | $2,655,867 | $321,905 | $7,701,263 | $10,357,130 | 351 | $29,507 | $1,475 | $1,219 |
| 5 | Upgrade and Separate Existing System | Clarification/Filtration | $4,785,000 | $2,691,000 | $7,476,000 | $2,492,000 | $210,778 | $4,215,554 | $250,253 | $6,141,398 | $10,356,952 | 351 | $29,507 | $1,475 | $1,219 |
| 6 | Upgrade and Separate Joint West Bench/Sage Mesa System | Clarification/Filtration | $5,968,000 | $4,186,000 | $10,154,000 | $3,385,000 | $286,309 | $5,726,184 | $329,847 | $8,094,697 | $13,820,881 | 616 | $22,436 | $1,122 | $866 |
| 7 | City of Penticton Supply to West Bench/Sage Mesa | Clarification/Filtration | $5,433,000 | $1,739,143 | $7,172,143 | $2,391,000 | $202,235 | $4,044,699 | $653,886 | $16,046,888 | $20,091,587 | 616 | $32,616 | $1,631 | $1,375 |

Notes:
1) Assumed Interest Rate 5.10%
2) Assumes that all 2/3 capital cost grant is approved. To date, only $2.35M grant has been approved.
3) Assumed Inflation Rate 2.10%

# Regional District of Okanagan-Similkameen
# West Bench Water Supply Improvements
# Options Review Study

## Table 2
## System Options Costs - UV

| OPTION | NAME | TREATMENT | Supply System Capital Cost | Water Treatment Capital Cost | Capital Cost | Net Capital Cost Based on Gov't Grant of 2/3 of Onsite Costs | Annual Debt Serving Cost (Notes 1 and 2) | 20 Year Debt Servicing Cost | Initial Annual Operating Cost | Total Inflated 20 Year O&M Cost - 2007-2026 (Note 2) | Total 20 Year Debt Servicing and O&M Cost | No. of Connections | Total Cost Per Lot | Total Annual Cost per Lot | Increase in Annual Taxes Per Connection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | City of Penticton Supply | Clarification/Filtration | $3,346,000 | $1,217,400 | $4,563,400 | $1,521,133 | $128,660 | $2,573,202 | $455,989 | $11,084,695 | $13,657,897 | 351 | $38,911 | $1,946 | $1,690 |
| 2UV | Upgrade Existing System | UV/Chlorination | $4,397,000 | $1,183,000 | $5,580,000 | $1,860,000 | $157,322 | $3,146,441 | $185,519 | $4,552,783 | $7,699,224 | 351 | $21,935 | $1,097 | $841 |
| 3UV | West Bench/Sage Mesa | UV/Chlorination | $5,657,000 | $1,690,000 | $7,347,000 | $2,449,000 | $207,141 | $4,142,814 | $223,887 | $5,494,359 | $9,637,174 | 616 | $15,645 | $782 | $526 |
| 4 | City of Penticton Domestic | Clarification/Filtration | $3,926,000 | $782,614 | $4,708,614 | $1,569,538 | $132,754 | $2,655,086 | $321,905 | $7,701,263 | $10,356,348 | 351 | $29,505 | $1,475 | $1,219 |
| 5UV | Partially Separated | UV/Chlorination | $4,785,000 | $760,500 | $5,545,500 | $1,848,500 | $156,349 | $3,126,987 | $150,198 | $3,685,986 | $6,812,974 | 351 | $19,410 | $971 | $715 |
| 6UV | Upgrade and Separate Joint West Bench/Sage Mesa System | UV/Chlorination | $5,968,000 | $1,183,000 | $7,151,000 | $2,383,667 | $201,615 | $4,032,294 | $174,207 | $4,275,168 | $8,307,462 | 616 | $13,486 | $674 | $418 |

Notes:
1) Assumed Interest Rate 5.10%
2) Assumes that all 2/3 capital cost grant is approved. To date, only $2.35M grant has been approved.
3) Assumed Inflation Rate 2.10%

0

Table 3a
OPTION 1
City of Penticton Supply

| Component | Capacity (ML/d) | Size | Units | Length (m) | Capital Cost | Initial Annual O&M Cost |
|---|---|---|---|---|---|---|
| **Supply System** | | | | | | |
| West Bench Distribution Improvements (See Table 9) | | | | | $1,821,000 | $9,105 |
| Additional Water Meter Chambers | | 351 | @ $500 | | $175,500 | |
| PS Land Acquisition | | 1 | ha | | $300,000 | |
| Booster Pump Station | 7 | 135 | kw | | $783,250 | $37,398 |
| Piping Connections | 7 | 300 | mm | 250 | $136,500 | $683 |
| River Crossing | 7 | 300 | mm | 100 | $130,000 | $650 |
| **Subtotal** | | | | | **$3,346,000** | **$48,000** |
| **Water Treatment Plant** | | | | | | |
| Chemical Coagulation and Mixing | 7 | | | | $0 | |
| Flocculation | 7 | | | | $0 | |
| Clarification | 7 | | | | $0 | |
| Filtration | 7 | | | | $0 | |
| Primary Disinfection | 7 | | | | $0 | |
| Secondary Disinfection | 7 | | | | $0 | |
| Residuals Management | 7 | | | | $0 | |
| COP Fixed Capital Charge | | | | | $1,217,400 | |
| **Subtotal** | | | | | **$1,217,400** | **$397,863** |
| **TOTAL** | | | | | **$4,563,400** | **$445,863** |

Table 3b
OPTION 2
Upgrade Existing System

| Component | Capacity (ML/d) | Size | Units | Length (m) | Capital Cost | Initial Annual O&M Cost |
|---|---|---|---|---|---|---|
| **Supply System** | | | | | | |
| West Bench Distribution Improvements (See Table 9) | | | | | $1,820,000 | $9,100 |
| WTP Land Acquisition | | 1 | ha | | $300,000 | |
| Treated Water Pumpstation | 7 | 394 | kw | | $1,288,300 | $99,169 |
| LLPS (in exist structure) | 7 | 20 | kw | | $169,000 | $6,070 |
| Lake Intake Replacement | 7 | 600 | mm | 600 | $468,000 | $2,340 |
| Lake Intake Deepening | 7 | 600 | mm | 450 | $351,000 | $1,755 |
| **Subtotal** | | | | | **$4,396,000** | **$118,434** |
| **Water Treatment** | | | | | | |
| Chemical Coagulation and Mixing | 7 | | | | $182,000 | |
| Flocculation | 7 | | | | $546,000 | |
| Clarification | 7 | | | | $0 | |
| Filtration | 7 | | | | $2,912,000 | |
| Primary Disinfection | 7 | | | | $273,000 | |
| Secondary Disinfection | 7 | | | | $0 | |
| Residuals Management | 7 | | | | $364,000 | |
| **Subtotal** | | | | | **$4,277,000** | **$323,117** |
| **TOTAL** | | | | | **$8,673,000** | **$441,551** |

Table 3c
OPTION 3
Upgraded Joint West Bench/Sage Mesa System

| Component | Capacity (ML/d) | Size | Units | Length (m) | Capital Cost | Initial Annual O&M Cost |
|---|---|---|---|---|---|---|
| **Supply System** | | | | | | |
| West Bench Distribution Improvements (See Table 9) | | | | | $1,360,000 | $6,800 |
| Additional Water Meters for Sage Mesa | | 265 | @ $1000 | | $265,000 | $1,325 |
| New Deep Intake Pipe | 10 | 600 | mm | 700 | $546,000 | $2,730 |
| Highway Crossing | 10 | 600 | mm | 70 | $109,200 | $546 |
| WTP Land Acquisition | | 1 | ha | | $300,000 | $0 |
| Lake Intake Pumpstation | 10 | 299 | kw | | $1,103,050 | $76,512 |
| Raw Wtr Supply Main | 10 | 400 | mm | 700 | $414,050 | $2,070 |
| Treated Water Pumpstation | 10 | 121 | kw | | $755,950 | $34,059 |
| Wtr Supply Mn - Sage Mesa | 3 | 250 | mm | 600 | $284,700 | $1,424 |
| Wtr Supply Mn - West Bench | 7 | 300 | mm | 950 | $518,700 | $2,594 |
| **Subtotal** | | | | | **$5,657,000** | **$128,058** |
| **Water Treatment** | | | | | | |
| Chemical Coagulation and Mixing | 10 | | | | $260,000 | |
| Flocculation | 10 | | | | $780,000 | |
| Clarification | 10 | | | | $0 | |
| Filtration | 10 | | | | $4,160,000 | |
| Primary Disinfection | 10 | | | | $390,000 | |
| Secondary Disinfection | 10 | | | | $0 | |
| Residuals Management | 10 | | | | $520,000 | |
| **Subtotal** | | | | | **$6,110,000** | **$461,595** |
| **TOTAL** | | | | | **$11,767,000** | **$589,653** |

Table 3d
OPTION 4
City of Penticton Domestic Supply and Separate Irrigation System

| Component | Capacity (ML/d) | Size | Units | Length (m) | Capital Cost | Initial Annual O&M Cost |
|---|---|---|---|---|---|---|
| **Supply System** | | | | | | |
| West Bench Distribution Improvements (See Table 9) | | | | | $1,821,000 | $9,105 |
| Additional Water Meter Chambers | | 351 | @ $500 | | $175,500 | |
| PS Land Acquisition | | 1 | ha | | $300,000 | |
| Irrigation Supply System | 2.5 | 250 | mm | 1000 | $377,000 | $1,885 |
| Irrigation Pump Station (in exist Structure) | 2.5 | 80 | kw | | $286,000 | $20,380 |
| Dom. Booster Pump Station | 4.5 | 90 | kw | | $695,500 | $26,665 |
| Piping Connections | 4.5 | 250 | mm | 250 | $154,375 | $772 |
| River Crossing | 4.5 | 250 | mm | 100 | $117,000 | $585 |
| **Subtotal** | | | | | **$3,926,000** | **$59,392** |
| **Water Treatment** | | | | | | |
| Chemical Coagulation and Mixing | 4.5 | | | | $0 | |
| Flocculation | 4.5 | | | | $0 | |
| Clarification | 4.5 | | | | $0 | |
| Filtration | 4.5 | | | | $0 | |
| Primary Disinfection | 4.5 | | | | $0 | |
| Secondary Disinfection | 4.5 | | | | $0 | |
| Residuals Management | 4.5 | | | | $0 | |
| COP WTP Capital Charge (Prorated) | | | | | $782,614 | $255,769 |
| **Subtotal** | | | | | **$782,614** | **$255,769** |
| **TOTAL** | | | | | **$4,708,614** | **$315,161** |

Table 3e
OPTION 5
Upgrade and Separate Existing West Bench System

| Component | Capacity (ML/d) | Size | Units | Length (m) | Capital Cost | Initial Annual O&M Cost |
|---|---|---|---|---|---|---|
| **Supply System** | | | | | | |
| West Bench Distribution Improvements (See Table 9) | | | | | $1,821,000 | $9,105 |
| Irrigation Supply System | 2.5 | 250 | mm | 1000 | $377,000 | $1,885 |
| WTP Land Acquisition | 4.5 | 1 | ha | | $300,000 | |
| Raw Water Pump Station (in exist structure) | 7 | 20 | kw | | $169,000 | $6,070 |
| Domestic Water Pumpstation | 4.5 | 253 | kw | | $1,013,350 | $65,541 |
| Irrigation Pump Station | 2.5 | 80 | kw | | $286,000 | $20,380 |
| Lake Intake Replacement | 7 | 600 | mm | 600 | $468,000 | $2,340 |
| Lake Intake Deepening | 7 | 600 | mm | 450 | $351,000 | $1,755 |
| **Subtotal** | | | | | **$4,785,000** | **$107,076** |
| **Water Treatment** | | | | | | |
| Chemical Coagulation and Mixing | 4.5 | | | | $117,000 | |
| Flocculation | 4.5 | | | | $351,000 | |
| Clarification | 4.5 | | | | $0 | |
| Filtration | 4.5 | | | | $1,872,000 | |
| Primary Disinfection | 4.5 | | | | $175,500 | |
| Secondary Disinfection | 4.5 | | | | $0 | |
| Residuals Management | 4.5 | | | | $234,000 | |
| **Subtotal** | | | | | **$2,749,500** | **$207,718** |
| **TOTAL** | | | | | **$7,534,500** | **$314,793** |

Table 3f
OPTION 6
Upgraded and Separate Joint West Bench/Sage Mesa System

| Component | Capacity (ML/d) | Size | Units | Length (m) | Capital Cost | Initial Annual O&M Cost |
|---|---|---|---|---|---|---|
| **Supply System** | | | | | | |
| West Bench Distribution Improvements (See Table 9) | | | | | $1,360,000 | $6,800 |
| Additional Water Meters for Sage Mesa | | 265 | @ $1000 | | $265,000 | $1,325 |
| WB Irrigation Supply System | 2.5 | 250 | mm | 1000 | $325,000 | $1,625 |
| SM Irrigation Supply System | 0.5 | 100 | mm | 600 | $140,400 | $702 |
| WB Irrigation Pump Station (in exist structure) | 2.5 | 80 | kW | | $286,000 | $20,380 |
| SM Irrigation Pump Station (in exist structure) | 0.5 | 15 | kW | | $159,250 | $4,878 |
| New Deep Intake Pipe | 7 | 600 | mm | 700 | $546,000 | $2,730 |
| Highway Crossing | 7 | 600 | mm | 70 | $109,200 | $546 |
| WTP Land Acquisition | | 1 | ha | | $300,000 | |
| Lake Intake Pumpstation | 7 | 157 | kW | | $826,150 | $42,645 |
| Raw Wtr Supply Main | 7 | 300 | mm | 700 | $313,950 | $1,570 |
| Treated Water Pumpstation | 7 | 64 | kW | | $644,800 | $20,464 |
| Wtr Supply Mn - Sage Mesa | 2.5 | 200 | mm | 600 | $241,800 | $1,209 |
| Wtr Suppy Mn - West Bench | 4.5 | 250 | mm | 950 | $450,775 | $2,254 |
| **Subtotal** | | | | | **$5,968,000** | **$107,127** |
| **Water Treatment Plant** | | | | | | |
| Chemical Coagulation and Mixing | 7 | | | | $182,000 | |
| Flocculation | 7 | | | | $546,000 | |
| Clarification | 7 | | | | $0 | |
| Filtration | 7 | | | | $2,912,000 | |
| Primary Disinfection | 7 | | | | $273,000 | |
| Secondary Disinfection | 7 | | | | $0 | |
| Residuals Management | 7 | | | | $364,000 | |
| **Subtotal** | | | | | **$4,277,000** | **$323,117** |
| **TOTAL** | | | | | **$10,245,000** | **$430,243** |

Table 3g
OPTION 7
City of Penticton Supply to West Bench and Sage Mesa

| Component | Capacity (ML/d) | Size | Units | Length (m) | Capital Cost | Initial Annual O&M Cost |
|---|---|---|---|---|---|---|
| **Supply System** | | | | | | |
| West Bench Distribution Improvements (See Table 9) | | | | | $1,360,000 | $6,800 |
| Additional Water Meters for Sage Mesa | | 265 | @ $1000 | | $265,000 | $1,325 |
| Additional Water Meter Chambers | | 616 | @ $500 | | $308,000 | |
| Highway Crossing | 10 | 600 | mm | 70 | $109,200 | $546 |
| River Crossing | 10 | 400 | mm | 100 | $156,000 | $780 |
| PS Land Acquisition | | 1 | ha | | $300,000 | |
| Booster Pump Station | 10 | 200 | kw | | $910,000 | $52,900 |
| Piping Connections | 10 | 400 | mm | 250 | $177,125 | $886 |
| Wtr Supply Mn - Sage Mesa | 3 | 250 | mm | 2800 | $1,328,600 | $6,643 |
| Wtr Supply Mn - West Bench | 7 | 300 | mm | 950 | $518,700 | $2,594 |
| **Subtotal** | | | | | **$5,433,000** | **$72,473** |
| **Water Treatment** | | | | | | |
| Chemical Coagulation and Mixing | 10 | | | | | |
| Flocculation | 10 | | | | | |
| Clarification | 10 | | | | | |
| Filtration | 10 | | | | | |
| Primary Disinfection | 10 | | | | | |
| Secondary Disinfection | 10 | | | | | |
| Residuals Management | 10 | | | | | |
| COP Fixed Capital Charge (Pro-Rated) | 10 | | | | $1,739,143 | |
| **Subtotal** | | | | | **$1,739,143** | **$581,413** |
| **TOTAL** | | | | | **$7,172,143** | **$653,886** |

**Regional District of Okanagan-Similkameen**
**West Bench Water Supply Improvements Options Review**

**Table 4**
**Water Treatment Cost Estimates**

| | West Bench Combined | West Bench Domestic | Sage Mesa Combined | Sage Mesa Domestic | Total Combined | Total Domestic |
|---|---|---|---|---|---|---|
| Plant Capacity (ML/d): | 7.0 | 4.5 | 3.0 | 2.5 | 10.0 | 7.0 |
| Ave. Ann. Demand (ML) | 610 | 392 | 261 | 218 | 871 | 610 |

| | ESTIMATED COST (See Note 1) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TREATMENT OPTION | Chemical Coagulation and Mixing | Flocculation | Clarification | Filtration | Primary Disinfection | Secondary Disinfection | Residuals Treatment | TOTAL CAPITAL COST | ANNUAL O&M COST | 20 YEAR O&M COST | PRESENT VALUE O&M |
| WEST BENCH - 7 ML/d | | | | | | | | | | | 3.00% |
| DISINFECTION (WITHOUT FILTRATION) | | | | | | | | | | | |
| Chlorination | | | | | $273,000 | | | $273,000 | $14,626 | $ 292,520 | $217,598 |
| Ozone/Chlorination | | | | | $1,820,000 | $273,000 | | $2,093,000 | $116,850 | $ 2,337,000 | $1,738,433 |
| UV/Chlorination | | | | | $910,000 | $273,000 | | $1,183,000 | $67,080 | $ 1,341,600 | $997,981 |
| FILTRATION | | | | | | | | | | | |
| Direct Filtration/UV | $182,000 | $546,000 | | $1,911,000 | $910,000 | $273,000 | $364,000 | $4,186,000 | $222,720 | $ 4,454,400 | $3,313,511 |
| Conventional Filtration | $182,000 | $546,000 | $1,274,000 | $1,547,000 | $273,000 | | $364,000 | $4,186,000 | $222,720 | $ 4,454,400 | $3,313,511 |
| Membrane Filtration | $182,000 | $546,000 | | $2,912,000 | $273,000 | | $364,000 | $4,277,000 | $323,117 | $ 6,462,333 | $4,807,160 |
| WEST BENCH & SAGE MESA - 10 ML/d | | | | | | | | | | | |
| DISINFECTION (WITHOUT FILTRATION) | | | | | | | | | | | |
| Chlorination | | | | | $390,000 | | | $390,000 | $20,894 | $ 417,886 | $310,854 |
| Ozone/Chlorination | | | | | $2,600,000 | $390,000 | | $2,990,000 | $166,929 | $ 3,338,571 | $2,483,476 |
| UV/Chlorination | | | | | $1,300,000 | $390,000 | | $1,690,000 | $95,829 | $ 1,916,571 | $1,425,687 |
| FILTRATION | | | | | | | | | | | |
| Direct Filtration/UV | $260,000 | $780,000 | | $2,730,000 | $1,300,000 | $390,000 | $520,000 | $5,980,000 | $318,171 | $ 6,363,429 | $4,733,587 |
| Conventional Filtration | $260,000 | $780,000 | $1,820,000 | $2,210,000 | $390,000 | | $520,000 | $5,980,000 | $318,171 | $ 6,363,429 | $4,733,587 |
| Membrane Filtration | $260,000 | $780,000 | | $4,160,000 | $390,000 | | $520,000 | $6,110,000 | $461,595 | $ 9,231,905 | $6,867,372 |
| WEST BENCH DOMESTIC - 4.5 ML/d | | | | | | | | | | | |
| DISINFECTION (WITHOUT FILTRATION) | | | | | | | | | | | |
| Chlorination | | | | | $175,500 | | | $175,500 | $9,402 | $ 188,049 | $139,884 |
| Ozone/Chlorination | | | | | $1,170,000 | $175,500 | | $1,345,500 | $75,118 | $ 1,502,357 | $1,117,564 |
| UV/Chlorination | | | | | $585,000 | $175,500 | | $760,500 | $43,123 | $ 862,457 | $641,559 |
| FILTRATION | | | | | | | | | | | |
| Direct Filtration/UV | $117,000 | $351,000 | | $1,228,500 | $585,000 | $175,500 | $234,000 | $2,691,000 | $143,177 | $ 3,579,429 | $2,130,114 |
| Conventional Filtration | $117,000 | $351,000 | $819,000 | $994,500 | $175,500 | | $234,000 | $2,691,000 | $143,177 | $ 3,579,429 | $2,130,114 |
| Membrane Filtration | $117,000 | $351,000 | | $1,872,000 | $175,500 | | $234,000 | $2,749,500 | $207,718 | $ 5,192,946 | $3,090,317 |
| PENTICTON PLANT COST CONTRIBUTION | | | | | | | | | | | |
| 7 ML/d | | | | | | | | $1,217,400 | $406,989 | $ 10,104,695 | $6,054,972 |
| 10 ML/d | | | | | | | | $1,739,143 | $581,413 | $ 14,435,279 | $8,649,961 |
| 4.5 ML/d | | | | | | | | $782,614 | $261,636 | $ 6,495,875 | $3,892,482 |

Note 1: Cost estimates for each treatment process include process equipment, all associated ancillary equipment, electrical & instrumentation, associated structures and siteworks, and associated residuals handling plus 30% allowance for engineering and contingencies.

**Regional District of Okanagan-Similkameen**
**West Bench Water Supply Options Review**

## Table 5
## Supply System Cost Estimates

| OPTION | NAME | Component | Capacity (ML/d) | Size | Units | Length (m) | Capital Cost | Initial Annual O&M Cost | 20 Year O&M Cost | PRESENT VALUE O&M |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 3.00% |
| 1 | **City of Penticton Supply** | West Bench Dist. Impr. | | | | | $1,821,000 | $9,105 | | |
| | | Additional Water Meter chambers | 351 | 500 | | | $175,500 | $878 | | |
| | | PS Land Acquisition | | 1 | ha | | $300,000 | | | |
| | | Booster Pump Station | 7 | 135 | kW | | $783,250 | $37,398 | | |
| | | Piping Connections | 7 | 300 | mm | 250 | $136,500 | $683 | | |
| | | River Crossing | 7 | 300 | mm | 100 | $130,000 | $650 | | |
| | **Subtotal** | | | | | | **$3,346,000** | **$49,000** | $ 980,000 | $ 728,996 |
| 2 | **Upgrade Existing System** | West Bench Dist. Impr. | | | | | $1,821,000 | $9,105 | | |
| | | WTP Land Acquisition | | 1 | ha | | $300,000 | | | |
| | | Treated Water Pumpstation | 7 | 394 | kW | | $1,288,300 | $99,169 | | |
| | | LLPS (in existing structure) | 7 | 20 | kW | | $169,000 | $6,070 | | |
| | | Lake Intake Replacement | 7 | 600 | mm | 600 | $468,000 | $2,340 | | |
| | | Lake Intake Deepening | 7 | 600 | mm | 450 | $351,000 | $1,755 | | |
| | **Subtotal** | | | | | | **$4,397,000** | **$118,439** | $ 2,368,780 | $ 1,762,073 |
| 3 | **Upgraded Joint West Bench/Sage Mesa System** | West Bench Dist. Impr. | | | | | $1,360,000 | $6,800 | | |
| | | Additional Water Meters for Sage Mesa | 265 | @ $1000 | | | $265,000 | $1,325 | | |
| | | New Deep Intake Pipe | 10 | 600 | mm | 700 | $546,000 | $2,730 | | |
| | | Highway Crossing | 10 | 600 | mm | 70 | $109,200 | $546 | | |
| | | WTP Land Acquisition | | 1 | ha | | $300,000 | $0 | | |
| | | Lake Intake Pumpstation | 10 | 299 | kW | | $1,103,050 | $76,512 | | |
| | | Raw Wtr Supply Main | 10 | 400 | mm | 700 | $414,050 | $2,070 | | |
| | | Treated Water Pumpstation | 10 | 121 | kW | | $755,950 | $34,059 | | |
| | | Wtr Supply Mn - Sage Mesa | 3 | 250 | mm | 600 | $284,700 | $1,424 | | |
| | | Wtr Supply Mn - West Bench | 7 | 300 | mm | 950 | $518,700 | $2,594 | | |
| | **Subtotal** | | | | | | **$5,657,000** | **$128,058** | $ 2,561,165 | $ 1,905,183 |
| 4 | **City of Penticton Domestic Supply and Separate Irrigation System** | West Bench Dist. Impr. | | | | | $1,821,000 | $9,105 | | |
| | | Additional Water Meter chambers | 351 | 500 | | | $175,500 | $878 | | |
| | | PS Land Acquisition | | 1 | ha | | $300,000 | | | |
| | | Irrigation Supply System | 2.5 | 250 | mm | 1000 | $377,000 | $1,885 | | |
| | | Irrigation Pump Station (in exist Structure) | 2.5 | 80 | kW | | $286,000 | $20,380 | | |
| | | Dom. Booster Pump Station | 4.5 | 90 | kW | | $695,500 | $26,665 | | |
| | | Piping Connections | 4.5 | 250 | mm | 250 | $154,375 | $772 | | |
| | | River Crossing | 4.5 | 250 | mm | 100 | $117,000 | $585 | | |
| | **Subtotal** | | | | | | **$3,926,000** | **$60,269** | $ 1,205,388 | $ 896,656 |
| 5 | **Upgrade and Separate Existing West Bench System** | West Bench Dist. Impr. | | | | | $1,821,000 | $9,105 | | |
| | | Irrigation Supply System | 2.5 | 250 | mm | 1000 | $377,000 | $1,885 | | |
| | | WTP Land Acquisition | 4.5 | 1 | ha | | $300,000 | | | |
| | | Raw Water Pump Station (in exist structure) | 7 | 20 | kW | | $169,000 | $6,070 | | |
| | | Domestic Water Pumpstation | 4.5 | 253 | kW | | $1,013,350 | $65,541 | | |
| | | Irrigation Pump Station | 2.5 | 80 | kW | | $286,000 | $20,380 | | |
| | | Lake Intake Replacement | 7 | 600 | mm | 600 | $468,000 | $2,340 | | |
| | | Lake Intake Deepening | 7 | 600 | mm | 450 | $351,000 | $1,755 | | |
| | **Subtotal** | | | | | | **$4,785,000** | **$107,076** | $ 2,141,510 | $ 1,593,013 |
| 6 | **Upgraded and Separate Joint West Bench/Sage Mesa System** | West Bench Dist. Impr. | | | | | $1,360,000 | $6,800 | | |
| | | Additional Water Meters for Sage Mesa | 265 | @ $1000 | | | $265,000 | $1,325 | | |
| | | WB Irrigation Supply System | 2.5 | 250 | mm | 1000 | $325,000 | $1,625 | | |
| | | SM Irrigation Supply System | 0.5 | 100 | mm | 600 | $140,400 | $702 | | |
| | | WB Irrigation Pump Station (in exist structure) | 2.5 | 80 | kW | | $286,000 | $20,380 | | |
| | | SM Irrigation Pump Station (in exist structure) | 0.5 | 15 | kW | | $159,250 | $4,878 | | |
| | | New Deep Intake Pipe | 7 | 600 | mm | 700 | $546,000 | $2,730 | | |
| | | Highway Crossing | 7 | 600 | mm | 70 | $109,200 | $546 | | |
| | | WTP Land Acquisition | | 1 | ha | | $300,000 | | | |
| | | Lake Intake Pumpstation | 7 | 157 | kW | | $826,150 | $42,645 | | |
| | | Raw Wtr Supply Main | 7 | 300 | mm | 700 | $313,950 | $1,570 | | |
| | | Treated Water Pumpstation | 7 | 64 | kW | | $644,800 | $20,464 | | |
| | | Wtr Supply Mn - Sage Mesa | 2.5 | 200 | mm | 600 | $241,800 | $1,209 | | |
| | | Wtr Suppy Mn - West Bench | 4.5 | 250 | mm | 950 | $450,775 | $2,254 | | |
| | **Subtotal** | | | | | | **$5,968,000** | **$107,127** | $ 2,142,533 | $ 1,593,774 |
| 7 | **City of Penticton to West Bench and Sage Mesa** | West Bench Distribution Improvements (See Table 9) | | | | | $1,360,000 | $6,800 | | |
| | | Additional Water Meters for Sage Mesa | | 265 | @ $1000 | | $265,000 | $1,325 | | |
| | | Additional Water Meter Chambers | | 616 | @ $500 | | $308,000 | $0 | | |
| | | Highway Crossing | 10 | 600 | mm | 70 | $109,200 | $546 | | |
| | | River Crossing | 10 | 400 | mm | 100 | $156,000 | $780 | | |
| | | PS Land Acquisition | | 1 | ha | | $300,000 | $0 | | |
| | | Booster Pump Station | 10 | 200 | kw | | $910,000 | $52,900 | | |
| | | Piping Connections | 10 | 400 | mm | 250 | $177,125 | $886 | | |
| | | Wtr Supply Mn - Sage Mesa | 3 | 250 | mm | 2800 | $1,328,600 | $6,643 | | |
| | | Wtr Supply Mn - West Bench | 7 | 300 | mm | 950 | $518,700 | $2,594 | | |
| | **Subtotal** | | | | | | **$5,433,000** | **$72,473** | $ 1,449,463 | $ 1,078,217 |

Notes:
1) Intake pump station installed KW assumes 2 duty, 1 spare, and 1 engine drive
2) Treated water pump station installed KW assumes 2 duty, 1 spare, and 1 engine drive
3) Irrigation water pump station installed KW assumes 2 duty and 1 spare, no engine drive

Table 6
Calculation of City of Penticton Fees

| Year | COP Capital Depreciation | | COP Operating Service Fee | | | | Total Capital & Operating Cost |
|---|---|---|---|---|---|---|---|
| | Annual Depreciation (See Note 1) | City Depreciation Fee (7.3%) | Fixed | Variable | Add $26 per connection annually for readings | Total | |
| 2007 | $1,306,346 | $95,363 | $150,000 | $152,500 | $9,126 | $311,626 | $406,989 |
| 2008 | $1,342,458 | $97,999 | $153,150 | $155,703 | $9,318 | $318,170 | $416,170 |
| 2009 | $1,640,019 | $119,721 | $156,366 | $158,972 | $9,513 | $324,852 | $444,573 |
| 2010 | $1,689,487 | $123,333 | $159,650 | $162,311 | $9,713 | $331,674 | $455,006 |
| 2011 | $1,669,038 | $121,840 | $163,002 | $165,719 | $9,917 | $338,639 | $460,479 |
| 2012 | $1,657,694 | $121,012 | $166,426 | $169,199 | $10,125 | $345,750 | $466,762 |
| 2013 | $1,631,866 | $119,126 | $169,920 | $172,752 | $10,338 | $353,011 | $472,137 |
| 2014 | $1,618,107 | $118,122 | $173,489 | $176,380 | $10,555 | $360,424 | $478,546 |
| 2015 | $1,589,386 | $116,025 | $177,132 | $180,084 | $10,777 | $367,993 | $484,018 |
| 2016 | $1,686,258 | $123,097 | $180,852 | $183,866 | $11,003 | $375,721 | $498,818 |
| 2017 | $1,796,716 | $131,160 | $184,650 | $187,727 | $11,234 | $383,611 | $514,771 |
| 2018 | $1,836,826 | $134,088 | $188,527 | $191,669 | $11,470 | $391,667 | $525,755 |
| 2019 | $1,780,598 | $129,984 | $192,486 | $195,695 | $11,711 | $399,892 | $529,876 |
| 2020 | $1,726,245 | $126,016 | $196,529 | $199,804 | $11,957 | $408,290 | $534,305 |
| 2021 | $1,835,370 | $133,982 | $200,656 | $204,000 | $12,208 | $416,864 | $550,846 |
| 2022 | $1,780,191 | $129,954 | $204,870 | $208,284 | $12,464 | $425,618 | $555,572 |
| 2023 | $1,726,851 | $126,060 | $209,172 | $212,658 | $12,726 | $434,556 | $560,616 |
| 2024 | $1,835,956 | $134,025 | $213,564 | $217,124 | $12,993 | $443,681 | $577,706 |
| 2025 | $1,781,424 | $130,044 | $218,049 | $221,683 | $13,266 | $452,999 | $583,043 |
| 2026 | $1,728,710 | $126,196 | $222,628 | $226,339 | $13,545 | $462,512 | $588,708 |
| 2027 | $1,837,753 | $134,156 | $227,303 | $231,092 | $13,829 | $472,225 | $606,380 |
| 2028 | $1,783,828 | $130,219 | $232,077 | $235,945 | $14,120 | $482,141 | $612,361 |
| 2029 | $1,731,700 | $126,414 | $236,950 | $240,900 | $14,416 | $492,266 | $618,680 |
| 2030 | $1,840,644 | $134,367 | $241,926 | $245,959 | $14,719 | $502,604 | $636,971 |
| TOTAL - 2007 to 2026 | | $2,457,147 | | | | $7,647,548 | $10,104,695 |
| TOTAL - 2007 to 2026 [3] | | | | | | | $6,495,875 |

Notes:
1. From City of Penticton, July 20, 2007 - spreadsheet in Enclosure 1B
2. Inflation factor = 2.1%, as assumed by City
3. Cost prorated based on flow.

Table 7.
Water Treatment Unit Costs

| Process | Larger System Base Cost Per ML/d (1) | Smaller System Base Cost Per ML/d (2) |
|---|---|---|
| Chemical Coagulation and Mixing | $26,000 | $31,200 |
| Flocculation | $78,000 | $93,600 |
| Clarification | | |
| -Conventional Tube or Plate Settler | $182,000 | $218,400 |
| Filtration | | |
| -High Rate (12 m/hr) | $273,000 | $327,600 |
| -High Rate (18 m/hr) | $221,000 | $265,200 |
| -Membrane | $416,000 | $499,200 |
| Primary Disinfection | | |
| -Chlorine | $39,000 | $46,800 |
| -Ultraviolet | $130,000 | $156,000 |
| -Ozone | $260,000 | $312,000 |
| Residuals Treatment | | |
| -Plate Settler/Thickener Centrifuge | $52,000 | $62,400 |
| Add this when no san sewer available | | |

Notes
(1) Based on 5 ML/d plant size and larger
(2) Based on 4 ML/d plant size and smaller
(3) All costs include a 30% allowance for engineering & contingencies

Table 8
Unit Costs - Buried Pipe

| Diameter | Pipe Supply & Install (1) | Hydrants & Valves (2) | Pavement Restoration | Total Excl Pavement | Total Incl Pavement |
|---|---|---|---|---|---|
| 150 | $140 | $40 | $75 | $180 | $255 |
| 200 | $190 | $45 | $75 | $235 | $310 |
| 250 | $240 | $50 | $75 | $290 | $365 |
| 300 | $290 | $55 | $75 | $345 | $420 |
| 350 | $340 | $60 | $90 | $400 | $490 |
| 400 | $390 | $65 | $90 | $455 | $545 |
| 450 | $440 | $70 | $90 | $510 | $600 |
| 600 | $590 | $75 | $100 | $665 | $765 |
| 750 | $740 | $80 | $100 | $820 | $920 |
| 900 | $890 | $90 | $100 | $980 | $1,080 |

Notes:

(1) PVC or DI Pipe

(2) Assumes buried line valves, one hydrant per 100m, one air valve assembly per 500m

(3) Costs do not include engineering and contingencies

**Table 9**
**West Bench Distribution System Improvements**

| Section | Diameter (mm) | Length (lin m) | Unit Cost | Cost | |
|---|---|---|---|---|---|
| Newton Drive | 200 | 650 | $ 310 | $ 201,500 | |
| Sparton Drive | 150 | 470 | $ 255 | $ 119,850 | |
| Veteran Drive | 150 | 240 | $ 255 | $ 61,200 | |
| Moorpark/Sunglo Drive | 150 | 490 | $ 255 | $ 124,950 | |
| Vedette Drive | 150 | 240 | $ 255 | $ 61,200 | |
| Service Connections | | 63 | $ 2,000 | $ 126,000 | |
| West Bench Flow Meters | | 351 | $ 1,000 | $ 351,000 | |
| **SUBTOTAL** | | | | **$ 1,045,700** | |
| **ENG'G & CONTINGENCIES** | | | **@ 30%** | **$ 313,710** | |
| **TOTAL** | | | | **$ 1,359,410** | **$ 1,360,000** |

**West Bench Supply System Improvements**

| Section | Diameter (mm) | Length (lin m) | Unit Cost | Cost | |
|---|---|---|---|---|---|
| Supply Line to Moorpark | 300 | 690 | $ 345 | $ 238,050 | |
| Bridge Crossing | 300 | 50 | $ 400 | $ 20,000 | |
| Bartlett Drive | 300 | 230 | $ 420 | $ 96,600 | |
| **SUBTOTAL** | | | | **$ 354,650** | |
| **ENG'G & CONTINGENCIES** | | | **@ 30%** | **$ 106,395** | |
| **TOTAL** | | | | **$ 461,045** | **$ 461,000** |

**Total Supply and Distribution** **$ 1,821,000**

**Regional District of Okanagan-Similkameen**
**West Bench Water Supply Improvements**
**Options Review Study**
**Technical Memorandum No. 1**
**Table 10**
**System Options Costs**
**Assume only $2.35M in Grant Funding Available**

| OPTION | NAME | TREATMENT | Supply and Distribution System Capital Cost | Water Treatment Capital Cost | Capital Cost | Net Capital Cost Based on Gov't Grant of $2.35M only | Annual Debt Serving Cost (Notes 1 and 2) | 20 Year Debt Servicing Cost | Initial Annual Operating Cost | Total Inflated 20 Year O&M Cost - 2007-2026 (Note 2) | Total 20 Year Debt Servicing and O&M Cost | No. of Connections | Total Cost Per Lot | Total Annual Cost per Lot | Increase in Annual Taxes Per Connection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | City of Penticton Supply | Clarification/Filtration | $3,346,000 | $1,217,400 | $4,563,400 | $2,213,400 | $187,213 | $3,744,265 | $455,989 | $11,084,695 | $14,828,960 | 351 | $42,248 | $2,112 | $1,856 |
| 2 | Upgrade Existing System | Clarification/Filtration | $4,397,000 | $4,186,000 | $8,583,000 | $6,233,000 | $527,198 | $10,543,961 | $341,159 | $8,372,311 | $18,916,272 | 351 | $53,893 | $2,695 | $2,439 |
| 3 | Upgrade Joint West Bench/Sage Mesa System | Clarification/Filtration | $5,657,000 | $5,980,000 | $11,637,000 | $9,287,000 | $785,511 | $15,710,214 | $446,230 | $10,950,829 | $26,661,043 | 616 | $43,281 | $2,164 | $1,908 |
| 4 | City of Penticton Domestic Supply & Separate Irrigation | Clarification/Filtration | $3,926,000 | $782,614 | $4,708,614 | $2,358,614 | $199,496 | $3,989,914 | $321,905 | $7,701,263 | $11,691,177 | 351 | $33,308 | $1,665 | $1,409 |
| 5 | Upgrade and Separate Existing System | Clarification/Filtration | $4,785,000 | $2,691,000 | $7,476,000 | $5,126,000 | $433,566 | $8,671,321 | $250,253 | $6,141,398 | $14,812,719 | 351 | $42,201 | $2,110 | $1,854 |
| 6 | Upgrade and Separate Joint West Bench/Sage Mesa System | Clarification/Filtration | $5,968,000 | $4,186,000 | $10,154,000 | $7,804,000 | $660,076 | $13,201,520 | $329,847 | $8,094,697 | $21,296,216 | 616 | $34,572 | $1,729 | $1,473 |
| 7 | City of Penticton Supply to West Bench/Sage Mesa | Clarification/Filtration | $5,433,000 | $1,739,143 | $7,172,143 | $4,822,143 | $407,865 | $8,157,306 | $653,886 | $16,046,888 | $24,204,193 | 616 | $39,293 | $1,965 | $1,709 |

Notes:
1) Assumed Interest Rate 5.10%
2) To date, only $2.35M grant has been approved.
3) Assumed Inflation Rate 2.10%

**Regional District of Okanagan-Similkameen**
**West Bench Water Supply Improvements**
**Options Review Study**
**Technical Memorandum No. 1**
**Table 11**
**System Options Costs - UV**
**Assume only $2.35M in Grant Funding Available**

| OPTION | NAME | TREATMENT | Supply System Capital Cost | Water Treatment Capital Cost | Capital Cost | Net Capital Cost Based on Gov't Grant of $2.35M only | Annual Debt Serving Cost (Notes 1 and 2) | 20 Year Debt Servicing Cost | Initial Annual Operating Cost | Total Inflated 20 Year O&M Cost - 2007-2026 (Note 2) | Total 20 Year Debt Servicing and O&M Cost | No. of Connections | Total Cost Per Lot | Total Annual Cost per Lot | Increase in Annual Taxes Per Connection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | City of Penticton Supply | Clarification/Filtration | $3,346,000 | $1,217,400 | $4,563,400 | $2,213,400 | $187,213 | $3,744,265 | $455,989 | $11,084,695 | $14,828,960 | 351 | $42,248 | $2,112 | $1,856 |
| 2UV | Upgrade Existing System | UV/Chlorination | $4,397,000 | $1,183,000 | $5,580,000 | $3,230,000 | $273,199 | $5,463,981 | $185,519 | $4,552,783 | $10,016,764 | 351 | $28,538 | $1,427 | $1,171 |
| 3UV | West Bench/Sage Mesa | UV/Chlorination | $5,657,000 | $1,690,000 | $7,347,000 | $4,997,000 | $422,655 | $8,453,100 | $223,887 | $5,494,359 | $13,947,460 | 616 | $22,642 | $1,132 | $876 |
| 4 | City of Penticton Domestic | Clarification/Filtration | $3,926,000 | $782,614 | $4,708,614 | $2,358,614 | $199,496 | $3,989,914 | $321,905 | $7,701,263 | $11,691,177 | 351 | $33,308 | $1,665 | $1,409 |
| 5UV | Partially Separated | UV/Chlorination | $4,785,000 | $760,500 | $5,545,500 | $3,195,500 | $270,281 | $5,405,620 | $150,198 | $3,685,986 | $9,091,606 | 351 | $25,902 | $1,295 | $1,039 |
| 6UV | Upgrade and Separate Joint West Bench/Sage Mesa System | UV/Chlorination | $5,968,000 | $1,183,000 | $7,151,000 | $4,801,000 | $406,077 | $8,121,540 | $174,207 | $4,275,168 | $12,396,708 | 616 | $20,125 | $1,006 | $750 |

Notes:
1) Assumed Interest Rate 5.10%
2) To date, only $2.35M grant has been approved.
3) Assumed Inflation Rate 2.10%

# ENCLOSURE 1B – CITY OF PENTICTON JULY 20, 2007 LETTER

ORJ → File

THE CITY OF Penticton

cc MW

Penticton CELEBRATING A CENTURY 1908 -2008

July 20, 2007

Regional District of Okanagan-Similkameen
101 Martin Street
Penticton, B.C. V2A 5J9

*Attention:* *Andrew Reeder*
*Engineering Services Manager*

Dear Mr. Reeder:

**RE: Supply of Water to the Westbench Irrigation District**

Please be advised that Council at their Regular meeting held on Monday, July 16, 2007 passed the following Resolution:

LEGAL: Supply of Water to the Westbench I.D.
Moved/Seconded

455/2007 THAT the staff memorandum dated July 16, 2007 regarding the Supply of Water to the Westbench Irrigation District be received;

AND THAT staff be directed to inform the RDOS that the WBID must transfer their water licenses to the City of Penticton should they purchase water from the City;

AND THAT staff be directed to inform the RDOS that an amendment to the City water license is required should the City provide water outside of their municipal boundaries;

AND THAT staff be directed to inform the RDOS that it will be a requirement that WBID install RF water meters and a meter chamber to each property receiving irrigation and domestic water;

AND THAT staff be directed to inform the RDOS that the City is prepared to read WBID water meters twice a year, generate a bill

N:\city\RMS\5200-5799 ENGINEERING AND PUBLIC WORKS\5600 Water Supply and Distribution\5600-96 - Water West Bench Supply of Domestic Service\2007-07-20-Letter RDOS-Supply of Water-Westbench ID.doc



171 MAIN STREET, PENTICTON, BRITISH COLUMBIA, CANADA V2A 5A9 TELEPHONE (250) 490-2400 FAX (250) 490-2402

and mail it out for a cost of $13.00 per read $2007 incremented yearly by increase in costs to the City of Penticton;

AND THAT staff be directed to inform the RDOS that the City of Penticton is prepared to allow a hook up in the vicinity of Riverside Drive and Highway 97;

AND THAT staff be directed to inform the RDOS that the WBID pump station is required to have an emergency generator and the pump station and transmission main will require the ability to address future expansion to service Sage Mesa. WBID will be responsible for 100% of the capital and operating costs, including but not limited to design, construction, tie in and land acquisition;

AND THAT staff be directed to inform the RDOS that:

1. Operating charges for water will have a 50% fixed component and a 50% variable component;
2. Operating charges will be increased annually by the same amount as City of Penticton water rates;
3. Should the City change its allocation between fixed and variable costs for operating costs the same would apply to WBID;
4. Capital depreciation charges will be fixed and calculated as 7.3% of the annual depreciation value of the water utility per year;
5. A capital contribution in the amount of 20.0% of the capital expansion cost of the water treatment plant will be required;
6. WBID will be limited to a mark up of 18%, for administration costs related to the running of the water utility, on City charges, passed through to customers, unless they can demonstrate to the satisfaction of the City that the mark up should be higher;
7. The City will only be willing to sell water to the WBID during non peak times (January – June, September – December) until the upgrades to the city of Penticton water treatment plant are completed, estimated 2010. Once the upgrades are complete the City will be willing to sell water through out the year;

AND THAT staff be directed to inform the RDOS that the changes to the billing rates included in Appendix D should address their concerns regarding the reasonableness of the proposed rates;

AND THAT staff be directed to inform the RDOS that Appendix D

provides the information required to determine the impacts of separating the agricultural and domestic water systems;

AND FURTHER THAT staff be directed to inform the RDOS that the City can only commit that the collection of later comer fees for over sizing will be discussed as part of any agreement discussions that occur with Sage Mesa regarding the supply of water.

CARRIED, Councillor Grimaldi against.

I would kindly ask that you contact our Director of Development and Engineering Services, Mr. Mitch Moroziuk, for further details at (250) 490-2515.

Yours truly,

**THE CORPORATION OF THE CITY OF PENTICTON**

*Cathy Ingram*

Cathy Ingram
City Clerk

:cw
Cc: Mitch Moroziuk, Dir. Of Eng. & Dev. Services

Water Cost Calcualations
12-Feb-07

Assumptions:
1. - 2003, 2004, 2005 Water Use from 2005 EarthTech Water Study 2006 Water Use for City Records.
2. - Penticton Water Flows 2007- 2230 calculated based on 2006 actual increased by 1.5% per year from 2005 EarthTech Water Study.
3. - Westbench Water Flows based on January 29, 2007 E-mail from Bill Harvey of Associated Engineering.
4. - Inflation of 2.1%
5. - Capital Additions 2003, 2004, 2005 based on actual costs.
6. - Capital Additions 2006 based on 2006 Capital Plan. 2007 - 2016 based on 2007 Capital Plan.
7. - Capital Additions 2017 - 2030 based on keeping Asset value around $52,000,000
8. - 2003 - 2005 Operating Cost Actuals, see TOTAL FROM WATER UTILITY OPERATING COSTS go to Cell AD87
9. - 2006 Operating Cost based on 2006 budget, see TOTAL FROM WATER UTILITY OPERATING COSTS go to Cell AB121
10. - 2007 - 2011 Operating Cost based on 2007 budget go to Cell AB 121
11. - 2012 - 2030 Operating Costs - Previous year Operating costs x 1.021 (Inflation)
12. - 2005 Water Utility Capital Asset Values provided by the Finance Departement
13. - 2006 - 2016 Water Utility Capital Asset Additions from 2006 and 2007 - 2016 Capital Budget go to cell AE139
14. - 2017 - 2030 Water Utility Capital Asset Additions set to keep the asset value at around $52,000,000 go to cell AE139

| (A) | (B) | (D) | (E) | (G1) | (H) | (I) | (J) | (K) | (M) | (N) | (O) | (U) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | City of Penticton Average Annual Water Use | Westbench Average Annual Water Use | Total Estimated Average Annual Water Use | Annual Full Cost Operating from TOTAL row WATER UTILITY OPERATING EXPENDITURES SPREADSHEET | Annual Full Cost Operating Charge per ML | Estimated Annual Operating Service Fee to Westbench | Starting Value of the Capital Asset from 2005 Financial Statements or notes to then calculated | Capital Additions from TOTAL row WATER UTILITY CAPTIAL COSTS | Capital Depreciation | Ending Value of the Capital Asset | Estimated Annual Capital Service Fee to Westbench | ESTIMATED ANNUAL OPERATING AND CAPITAL SERVICE FEES TO WESTBENCH |
| | | | ((B)+(D)) | | ((G1)/(B)) | ((D)x(H)) | | | (((J)+(K))/30) | ((J)+(K)-(M)) | ((M)x(E)/(G)) | ((I)+(O)) |
| (#) | (ML/Year) | (ML/Year) | (ML/Year) | ($) | ($/ML) | ($) | ($) | ($) | ($) | ($) | ($) | ($) |
| 2003 | 8,483.00 | 610.00 | 9,093.00 | 3,104,758.89 | $366.00 | $223,258.63 | | $0.00 | $0.00 | $0.00 | $0.00 | **$223,258.63** |
| 2004 | 7,748.00 | 610.00 | 8,358.00 | 3,183,575.01 | $410.89 | $250,642.84 | | $0.00 | $0.00 | $0.00 | $0.00 | **$250,642.84** |
| 2005 | 8,240.00 | 610.00 | 8,850.00 | 3,304,111.70 | $400.98 | $244,600.50 | $37,244,370.68 | $0.00 | $1,241,479.02 | $36,002,891.66 | $85,570.87 | **$330,171.37** |
| 2006 | 7,762.00 | 610.00 | 8,372.00 | 3,775,107.93 | $486.36 | $296,678.15 | $36,002,891.66 | $1,777,691.30 | $1,259,352.77 | $36,521,230.19 | $91,758.86 | **$388,437.02** |
| 2007 | 7,878.43 | 610.00 | 8,488.43 | 3,878,062.32 | $492.24 | $300,265.16 | $36,521,230.19 | $2,669,150.00 | $1,306,346.01 | $37,884,034.19 | $93,877.32 | **$394,142.48** |
| 2008 | 7,996.61 | 610.00 | 8,606.61 | 4,034,073.09 | $504.47 | $307,728.61 | $37,884,034.19 | $2,389,719.92 | $1,342,458.47 | $38,931,295.63 | $95,147.80 | **$402,876.41** |
| 2009 | 8,116.56 | 610.00 | 8,726.56 | 4,161,216.43 | $512.68 | $312,736.36 | $38,931,295.63 | $10,269,282.77 | $1,640,019.28 | $47,560,559.12 | $114,639.94 | **$427,376.29** |
| 2010 | 8,238.30 | 610.00 | 8,848.30 | 4,331,805.13 | $525.81 | $320,745.77 | $47,560,559.12 | $3,124,059.19 | $1,689,487.28 | $48,995,131.04 | $116,472.86 | **$437,218.63** |
| 2011 | 8,361.88 | 610.00 | 8,971.88 | 4,428,906.79 | $529.65 | $323,089.26 | $48,995,131.04 | $1,076,014.12 | $1,669,038.17 | $48,402,106.98 | $113,478.27 | **$436,567.54** |
| 2012 | 8,487.31 | 610.00 | 9,097.31 | 4,521,913.84 | $532.79 | $324,999.15 | $48,402,106.98 | $1,328,735.49 | $1,657,694.75 | $48,073,147.72 | $111,153.10 | **$436,152.25** |
| 2013 | 8,614.62 | 610.00 | 9,224.62 | 4,616,874.03 | $535.93 | $326,920.33 | $48,073,147.72 | $882,854.83 | $1,631,866.75 | $47,324,135.79 | $107,911.13 | **$434,831.45** |
| 2014 | 8,743.84 | 610.00 | 9,353.84 | 4,713,828.38 | $539.10 | $328,852.86 | $47,324,135.79 | $1,219,074.45 | $1,618,107.01 | $46,925,103.24 | $105,523.05 | **$434,375.91** |
| 2015 | 8,874.99 | 610.00 | 9,484.99 | 4,812,818.78 | $542.29 | $330,796.82 | $46,925,103.24 | $756,494.15 | $1,589,386.58 | $46,092,210.80 | $102,216.82 | **$433,013.64** |
| 2016 | 9,008.12 | 610.00 | 9,618.12 | 4,913,887.97 | $545.50 | $332,752.27 | $46,092,210.80 | $4,495,545.78 | $1,686,258.55 | $48,901,498.03 | $106,945.84 | **$439,698.11** |
| 2017 | 9,143.24 | 610.00 | 9,753.24 | 5,017,079.62 | $548.72 | $334,719.28 | $48,901,498.03 | $5,000,000.00 | $1,796,716.60 | $52,104,781.43 | $112,372.62 | **$447,091.90** |
| 2018 | 9,280.39 | 610.00 | 9,890.39 | 5,122,438.29 | $551.96 | $336,697.91 | $52,104,781.43 | $3,000,000.00 | $1,836,826.05 | $53,267,955.38 | $113,288.16 | **$449,986.07** |
| 2019 | 9,419.59 | 610.00 | 10,029.59 | 5,230,009.50 | $555.23 | $338,688.25 | $53,267,955.38 | $150,000.00 | $1,780,598.51 | $51,637,356.87 | $108,296.02 | **$446,984.26** |
| 2020 | 9,560.89 | 610.00 | 10,170.89 | 5,339,839.70 | $558.51 | $340,690.34 | $51,637,356.87 | $150,000.00 | $1,726,245.23 | $50,061,111.64 | $103,531.73 | **$444,222.07** |
| 2021 | 9,704.30 | 610.00 | 10,314.30 | 5,451,976.33 | $561.81 | $342,704.28 | $50,061,111.64 | $5,000,000.00 | $1,835,370.39 | $53,225,741.25 | $108,545.98 | **$451,250.26** |
| 2022 | 9,849.87 | 610.00 | 10,459.87 | 5,566,467.83 | $565.13 | $344,730.12 | $53,225,741.25 | $180,000.00 | $1,780,191.38 | $51,625,549.88 | $103,817.46 | **$448,547.58** |
| 2023 | 9,997.61 | 610.00 | 10,607.61 | 5,683,363.66 | $568.47 | $346,767.93 | $51,625,549.88 | $180,000.00 | $1,726,851.66 | $50,078,698.21 | $99,304.10 | **$446,072.03** |
| 2024 | 10,147.58 | 610.00 | 10,757.58 | 5,802,714.29 | $571.83 | $348,817.79 | $50,078,698.21 | $5,000,000.00 | $1,835,956.61 | $53,242,741.61 | $104,106.48 | **$452,924.26** |
| 2025 | 10,299.79 | 610.00 | 10,909.79 | 5,924,571.29 | $575.21 | $350,879.77 | $53,242,741.61 | $200,000.00 | $1,781,424.72 | $51,661,316.89 | $99,604.93 | **$450,484.70** |
| 2026 | 10,454.29 | 610.00 | 11,064.29 | 6,048,987.29 | $578.61 | $352,953.93 | $51,661,316.89 | $200,000.00 | $1,728,710.56 | $50,132,606.32 | $95,307.84 | **$448,261.77** |
| 2027 | 10,611.10 | 610.00 | 11,221.10 | 6,176,016.02 | $582.03 | $355,040.36 | $50,132,606.32 | $5,000,000.00 | $1,837,753.54 | $53,294,852.78 | $99,903.70 | **$454,944.06** |
| 2028 | 10,770.27 | 610.00 | 11,380.27 | 6,305,712.36 | $585.47 | $357,139.12 | $53,294,852.78 | $220,000.00 | $1,783,828.43 | $51,731,024.35 | $95,615.96 | **$452,755.08** |
| 2029 | 10,931.82 | 610.00 | 11,541.82 | 6,438,132.32 | $588.93 | $359,250.29 | $51,731,024.35 | $220,000.00 | $1,731,700.81 | $50,219,323.54 | $91,522.58 | **$450,772.87** |
| 2030 | 11,095.80 | 610.00 | 11,705.80 | 6,573,333.10 | $592.42 | $361,373.93 | $50,219,323.54 | $5,000,000.00 | $1,840,644.12 | $53,378,679.42 | $95,917.65 | **$457,291.58** |

**WATER UTILITY**
**OPERATING EXPENDITURES**

| | Actual | Actual | Actual | Amended | Budget | Budget | Budget | Budget | Budget |
|---|---|---|---|---|---|---|---|---|---|
| Classification | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
| Supervision Salaries | 94,663 | 218,010 | 211,706 | 246,063 | 255,747 | 255,000 | 260,000 | 265,000 | 265000 |
| Vehicles | 17,942 | 18,087 | 20,579 | 25,170 | 25,508 | 25,200 | 25,200 | 25,200 | 25200 |
| Administration Charge | 231,231 | 196,739 | 226,495 | 229,370 | 332,700 | 340,000 | 350,000 | 360,000 | 370000 |
| Consulting | 4,285 | 45,760 | 67,000 | 76,910 | 20,000 | 15,000 | 15,000 | 15,000 | 15000 |
| Distribution System Operation & Mtce | 548,432 | 379,530 | 477,950 | 447,610 | 476,800 | 445,000 | 450,000 | 455,000 | 455000 |
| Water Licence | - | 16,856 | 18,750 | 22,000 | 15,000 | 23,000 | 23,000 | 24,000 | 24000 |
| Reservoir & Intakes - General | - | 77,879 | 61,489 | 112,000 | 89,000 | 110,000 | 112,000 | 115,000 | 115000 |
| Irrigation System | - | 40,852 | 54,240 | 55,500 | 57,500 | 57,000 | 58,000 | 59,000 | 59000 |
| Standby Wages | - | 6,178 | 20,916 | 9,000 | 9,300 | 10,000 | 10,000 | 10,000 | 10000 |
| Customer Billing & Meter Maintenance | 113,880 | 152,857 | 154,751 | 323,500 | 329,000 | 200,000 | 200,000 | 200,000 | 200000 |
| Tools | 15,434 | 4,331 | 3,325 | 6,500 | 8,000 | 7,300 | 7,300 | 7,500 | 7500 |
| Recoverable | - | 5,386 | 8,839 | 13,500 | 13,500 | 14,300 | 14,300 | 14,500 | 14500 |
| Recoverable - Service Contract | - | - | | 52,131 | 40,700 | - | - | - | 0 |
| Vandalism | - | 4,019 | 6,855 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5000 |
| Treatment Plant Operation | 633,598 | 632,698 | 614,659 | 762,200 | 764,700 | 830,000 | 850,000 | 875,000 | 875000 |
| Pump Station Operations/Reservoirs | 291,021 | 269,209 | 255,103 | 289,700 | 264,000 | 305,000 | 310,000 | 315,000 | 315000 |
| Outstanding Debt-Accrued Interest | 44,520 | 439 | (18,915) | - | - | - | - | - | 0 |
| Debenture - Interest | 441,470 | 443,010 | 423,202 | 369,375 | 411,328 | 518,708 | 568,938 | 644,979 | 709180 |
| - Principal | 167,846 | 167,846 | 167,846 | 167,847 | 314,089 | 363,649 | 386,832 | 421,928 | 451559 |
| Tsf to Reserve-Future Expenditures | 292,300 | 550,386 | 210,007 | - | - | - | - | - | 0 |
| Transfer to Surplus | 250,173 | - | 87,436 | - | 48,264 | - | - | - | 0 |
| Transfer to Water Capital | 1,711,842 | 1,352,378 | 1,101,163 | 6,109,628 | 2,556,500 | 1,654,800 | 2,292,150 | 2,174,000 | 2019000 |
| Transfer to Water Capital Reserve | - | - | - | - | - | - | - | - | 0 |
| Transfer to DCC Reserves | 249,762 | 204,369 | 224,190 | 160,000 | 200,000 | 125,000 | 125,000 | 125,000 | 125000 |
| Transfer to General Revenue Fund | | - | - | 11,837 | 47,569 | - | - | - | 0 |
| TOTAL EXPENDITURES | 5,108,399 | 4,786,819 | 4,397,586 | 9,494,841 | 6,284,205 | 5,303,957 | 6,062,720 | 6,111,107 | 6,059,939 |
| Domestic Water Direct Costs | 1,586,931 | 1,539,226 | 1,610,473 | 1,971,010 | 1,952,800 | 1,928,000 | 1,960,000 | 1,999,000 | 1,999,000 |
| TOTAL Indirect Costs | 363,555 | 482,927 | 529,105 | 584,013 | 641,955 | 642,500 | 657,500 | 672,700 | 682,700 |
| WTP Indirect Cost Allocation | 100% | 97% | 97% | 97% | 97% | 97% | 97% | 97% | 97% |
| WTP Indirect Costs | 363,555 | 470,441 | 511,866 | 568,019 | 623,593 | 624,050 | 638,603 | 653,415 | 663,128 |
| WTP interest Costs | 441,470 | 443,010 | 423,202 | 369,375 | 411,328 | 518,708 | 568,938 | 644,979 | 709,180 |
| WTP Direct, Indirect and Interest Costs | 2,391,956 | 2,452,677 | 2,545,541 | 2,908,404 | 2,987,721 | 3,070,758 | 3,167,541 | 3,297,394 | 3,371,308 |
| 18% Admin Overhead | 430,552 | 441,482 | 458,197 | 523,513 | 537,790 | 552,737 | 570,157 | 593,531 | 606,835 |
| **SUBTOTAL** | 2,822,508 | 2,894,159 | 3,003,738 | 3,431,916 | 3,525,511 | 3,623,495 | 3,737,698 | 3,890,924 | 3,978,143 |
| **Profit at 10%** | 282,251 | 289,416 | 300,374 | 343,192 | 352,551 | 362,349 | 373,770 | 389,092 | 397,814 |
| Inflation Correction | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 1.21% | 1.21% | 1.21% | 1.21% |
| Currency Year | $2003 | $2004 | $2,005 | $2,006 | $2,007 | $2,008 | $2,009 | $2010 | $2011 |
| **TOTAL** | **3,104,759** | **3,183,575** | **3,304,112** | **3,775,108** | **3,878,062** | **4,034,073** | **4,161,216** | **4,331,805** | **4,428,907** |

| WATER UTILITY<br>CAPITAL EXPENDITURE | Actual<br>2003 | Actual<br>2004 | Actual<br>2005 | Amended<br>2006 | Budget<br>2007 | Budget<br>2008 | Budget<br>2009 | Budget<br>2010 | Budget<br>2011 | Budget<br>2012 | Budget<br>2013 | Budget<br>2014 | Budget<br>2015 | Budget<br>2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Water Filtration Capital Cost | | | 20,365,791 | 1,563,083 | 45,000 | 656,000 | 5,633,000 | 1,258,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 1,308,000 |
| Capital Costs Lakeshore pump | | | 3,033,176 | 53,000 | 25,000 | 30,000 | 30,000 | 30,000 | 35,000 | 35,000 | 40,000 | 40,000 | 40,000 | 40,000 |
| Capital Costs Water Mains | | | 11,197,664 | | 1,368,000 | 1,345,000 | 3,289,600 | 1,348,600 | 795,000 | 997,000 | 701,500 | 996,500 | 548,000 | 2,051,500 |
| Dams,Intakes,Reservoirs | | | 2,511,638 | | 988,500 | 115,500 | 271,500 | 169,500 | 86,500 | 111,500 | 1,500 | 8,500 | 41,500 | 638,500 |
| Pipelines | | | 136,102 | | | | | | | | | | | |
| **SUBTOTAL** | - | - | 37,244,371 | 1,616,083 | 2,426,500 | 2,146,500 | 9,224,100 | 2,806,100 | 966,500 | 1,193,500 | 793,000 | 1,095,000 | 679,500 | 4,038,000 |
| **Profit at 10%** | - | - | - | 161,608 | 242,650 | 214,650 | 922,410 | 280,610 | 96,650 | 119,350 | 79,300 | 109,500 | 67,950 | 403,800 |
| Inflation Correction | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 1.21% | 1.21% | 1.21% | 1.21% | 1.21% | 1.21% | 1.21% | 1.21% | 1.21% |
| Currency Year | $2003 | $2004 | $2,005 | $2,006 | $2,007 | $2,008 | $2,009 | $2010 | $2011 | $2012 | $2013 | $2014 | $2015 | $2016 |
| **TOTAL** | **-** | **-** | **37,244,371** | **1,777,691** | **2,669,150** | **2,389,720** | **10,269,283** | **3,124,059** | **1,076,014** | **1,328,735** | **882,855** | **1,219,074** | **756,494** | **4,495,546** |

# ENCLOSURE 1C – IHA FILTRATION DEFERRAL LETTER AND DRAFT POLICY JULY 20, 2007

# ISSUE PAPER: FILTRATION DEFERRAL

**Name of Issue: Criteria for the Deferral of Filtration**

**Background and Issue Analysis:**

Interior Health expects Water Suppliers to provide filtration for all water supply systems using surface water sources or ground water under the direct influence of surface water. Water suppliers wishing to apply for deferral of filtration as per the *Guidelines for Canadian Drinking Water Quality* (GCDWQ) exclusion criteria must make a proposal to Interior Health that defines their watershed control program, dual treatment technologies and is supported by suitable source monitoring data trended over a minimum of one year and preferably several years. Source water monitoring data may also provide information to indicate the need to initiate filtration.

Interior Health's direction on drinking water quality and treatment standards is based on the GCDWQ and other regulatory documents.

The *GCDWQ* provide "Criteria for the Exclusion of Filtration in Waterworks Systems". Water Supply systems that currently meet the exclusion criteria cannot guarantee they will do so indefinitely. Therefore, the focus of this document is filtration "deferral" criteria not "exclusion" criteria.

Long term improvement plans that propose to "defer" filtration will be reviewed on a case-by-case basis.

The IH Water Excellence Team (WET) agreed that the following questions be discussed at the Senior Water Excellence Team (SWET) meeting setting the strategic direction for WET:

a. *Should we define "watershed control program" under the 4th exclusion criteria?*
b. *Recommend that we develop criteria & expectations for long term planning*
c. *Recommend that IH takes direction from the Guidelines for Canadian DW Quality for filtration.*

The outcome of SWET was:

- Agreement that there was potential for deferral of requirement for filtration;
- Take direction from the GCDWQ and the exclusion criteria for deferral. IHA would need to develop our understanding of the exclusion criteria;
- There is a need to identify factors that we would consider in the potential for deferral of the requirement for filtration;
- IHA and the Water Supplier can never guarantee that the deferral of filtration would be permanent;

DRAFT

- Criteria to be developed by WET for deferral monitoring and triggers for filtration.
- Interior Health has a primary program objective to provide clear expectations of water suppliers.
- Water Suppliers have requested clear expectations from Interior Health to assist them in long term planning for filtration and UV treatment to meet 43210 Treatment Objectives.
- Medical Health Officers are not prepared to accept differing water treatment standards that may correlate to inequitable distribution of health outcomes.
- Water Suppliers have requested from Interior Health:
    - acknowledgement of the positive health impacts of UV treatment; and
    - support for UV treatment (dependant on suitable source water characteristics) as an interim measure towards full implementation of 43210 treatment infrastructure.

**Options:**

1. Deal with each proposal on a case-by-case basis (in the absence of filtration deferral policy)

   The disadvantage to this approach is the hesitation of water suppliers to make long term plans because of the uncertainty of their requirements. They are unable to accurately identify costs of their infrastructure options.

2. Provide guidance on expectations for general source water situations, including triggers that would remove the deferral for filtration

   The advantage is to provide water suppliers with some guidelines that they can use for planning. The risk is that they will not plan for filtration because they hope to avoid it, rather than planning to accomplish filtration in a reasonable timeframe.

3. Same as 2 with expectations of timelines for installation

   The risk of this would be the use of timelines without due consideration of the individual water supply system's unique characteristics.

**Recommendations:**

Choose Option 3 with clarification that the guidance of timelines for installation is *for consideration only.* A decision tree format could be included as an appendix to the Drinking Water Quality Improvement Program Booklet.

It is worth noting that not all water systems will be able to apply for a "Deferral of Filtration", and the following implementation plan should be considered in that

DRAFT

context. Water suppliers that have any of the following concerns should be excluded from consideration for a Deferral of Filtration:

- poor source water quality (as determined by the Drinking Water Officer)
- uncontrolled watershed
- plan for only a single disinfection process

**Implementation Plan for Establishing Criteria for the Deferral of Filtration:**

1. Development of policy regarding filtration and the potential for deferral. Refer to Appendix A.

2. Identify a method for water suppliers to determine whether or not they could qualify for deferral. Develop reasonable timelines for their use in planning to achieve the 43210 objectives with or without filtration deferral. Refer to Appendix B "Factors For Water Suppliers To Determine Filtration Or Filtration Deferral Planning Requirments".

   Water suppliers using a surface water source, or a groundwater source under the direct influence of surface water, need to have a system assessment completed by a qualified Professional Engineer and develop an implementation plan to achieve 43210 Treatment Objectives, including filtration
   - The system assessment should identify infrastructure and life cycle costs, including rate structures and development cost charges.
   - The implementation plan should include a selected technology and identify staged and continuous benchmarks with clear target dates.
   - The implementation plan should allow future filtration, i.e. ensure land footprint available in conceptual layout and a treatment train that can accommodate filtration at a later date as required.

3. Develop the criteria that a water supplier could use to demonstrate clear achievement of the GCDWQ exclusion criteria for proposals of filtration deferral. Refer to Appendix C "Criteria To Demonstrate That A Water Supplier Can Achieve The GCDWQ Filtration Exclusion Criteria".

   Water Supply systems that may currently meet the exclusion criteria cannot guarantee they will do so indefinitely. Water suppliers wishing to apply for deferral of filtration as per the GCDWQ exclusion criteria must make a proposal to Interior Health that defines their watershed control program, dual treatment technologies and is supported by suitable source monitoring data trended over a minimum of one year and preferably several years. Source water monitoring data may also provide information to indicate the need to initiate filtration.

   The following information could be included in future revisions of the Conditions on Operating Permits booklet:

DRAFT

- Watershed control programs expressly intended to minimize fecal contamination can be accomplished by completing appropriate modules of the comprehensive source to tap assessment guide developed by MOE and MOH. Modules appropriate to the water supply system will be identified by the DWO and may be included in conditions of the operating permit.
- Water suppliers must provide progress reports with implementation of treatment infrastructure upgrades.
- Water suppliers must provide water monitoring data to show continued achievement of deferral criteria.

4. Develop strategy of IH responses to proposals for deferral

   Implementation of filtration deferral decisions will be accomplished through Typical "Deferral" Conditions on Operating Permit.

   - Prior to a decision to defer treatment the Drinking Water Official must undertake internal consultation that includes but is not limited to the following people: Senior Public Health Inspector, Public Health Engineer, Senior Drinking Water Officer, and Medical Health Officer.
   - Water supply system file information must document these discussions and decision regarding deferral.

**Desired Outcomes:**

- Drinking Water Quality Improvement Program COP booklet should have factors to consider for deferral of filtration. Appendix D provides information for consideration of site-specific monitoring programs.
- Communications directed towards water suppliers should identify Interior Health's expectations regarding filtration and/or deferral.

Prepared by: Dale Thomas, Mike Adams, Elizabeth Sigalet
Reviewed by: WET Date: May 28, 2007
Revised by: WET Date: June 13, 2007
Submitted to: IH Material Development Date: July 12, 2007

DRAFT

## APPENDIX A

Interior Health
DRAFT FILTRATION POLICY

NUMBER & NAME OF POLICY
Month, Year

### 1.0 PURPOSE

To provide clarity of Interior Health's position in relationship to the filtration of surface water or ground water under the direct influence of surface water.

### 2.0 DEFINITIONS

Filtration: a physical and/or biological process used to treat water by removing contaminants by passing water through media or membranes.

### 3.0 POLICY

Interior Health expects existing Water Suppliers to provide filtration for all water supply systems using surface water sources or ground water under the direct influence of surface water. Water suppliers wishing to apply for deferral of filtration as per the GCDWQ exclusion criteria must make a proposal to Interior Health.

### 4.0 PROCEDURE

Drinking Water Officials must consider the provincial *Drinking Water Officers' Guide* in the exercise of their duties and discretion. They are, however, able to depart from the guide in any case where sound reason exists to do so. In the performance of their duties, Drinking Water Officers will look in order to:

- provincial and other legislation,
- the Provincial Drinking Water Officer's Guide and other provincial directives,
- the Canadian Drinking Water Quality Guidelines or other federal – provincial guidelines
- resources prepared by other organizations.

Interior Health's direction on drinking water quality and treatment standards is based on the *Guidelines for Canadian Drinking Water Quality (GCDWQ)* and policy developed by other organizations.

The *GCDWQ* provide "Criteria for the Exclusion of Filtration in Waterworks Systems". Water Supply systems that currently meet the exclusion criteria cannot guarantee they will do so indefinitely; therefore, the focus of this document is filtration "deferral" criteria not "exclusion" criteria.

Drinking Water Officials, under the guidance provided in the *Guidelines for Canadian Drinking Water Quality (GCDWQ),* Interior Health's' Drinking Water Quality Improvement Program (DWQIP) and Small Water System Strategy (SWSS) programs, will direct water supply systems that use a surface water source or a groundwater source under the direct influence of surface water to provide filtration prior to public consumption.

New water supply systems will be expected to meet *43210 Drinking Water Objective* and provide filtration as part of a satisfactory application for a construction permit. The issuing official should consider whether the proposed treatment is adequate as part of their decision-making process whether to issue the construction permit.

Existing water systems need to develop long term plans and have an acceptable implementation strategy to adequately address public health risks in relation to their source(s). Drinking Water Officials, through the application of Conditions on Operating Permits (DWQIP) or Multiple Barriers of Protection (SWSS), should engage the water supplier to ensure there is an adequate plan in place to the provision of drinking water that meets the *Guidelines for Canadian Drinking Water Quality* and the *43210 Drinking Water Objective*.

Water suppliers wishing to apply for deferral of filtration must make a proposal to Interior Health that defines their watershed control program, dual treatment technologies and is supported by suitable source monitoring data trended over a minimum of one year and preferably several years.

## 5.0 REFERENCES


- BC Drinking Water Protection Act [SBC 2001] Chapter 9
- BC Drinking Water Protection Regulation [inc. amendments up to B.C. Reg. 352/2005, December 9, 2005]
- BC Drinking Water Officer's Guide [Version 7]
- Guidelines for Canadian Drinking Water Quality [Modified 2005-01-13]
- Drinking Water Quality Improvement Program COP Booklet
- Issue Paper: Filtration Deferral


DRAFT

## APPENDIX B

FACTORS FOR WATER SUPPLIERS TO DETERMINE FILTRATION OR FILTRATION DEFERRAL PLANNING REQUIRMENTS

All water supply systems in Interior Health's Drinking Water Quality Improvement Program are required to assess source water quality and provide long term plans to achieve 43210 as a condition on their operating permits.

For systems that have source water that is surface water or under the direct influence of surface water, the plans will include filtration.

For plans including filtration without deferral – refer to timelines and milestones in Appendix B-1.

For plans proposing deferral of filtration – refer to timelines, milestones and proposal requirements in Appendix B-2.

Plans including the deferral of filtration are less capital intensive and should not be delayed. It is reasonable for the public to expect that if filtration deferral is proposed, that the additional required disinfection would be installed as quickly as possible

DRAFT

## Appendix B-1: Plans Including Filtration

If a water supply system using surface water as a water source cannot meet the Canadian Drinking Water Quality Guidelines for exclusion of filtration, they are required to plan for filtration.

Milestones (which may be applied as conditions on operating permits) include:

- assessment and planning for financing
- completion of a (long term) plan to achieve 43210 objectives
- design
- construction

IH expects water suppliers to reduce risk to public health by achieving the shortest possible timelines on the implementation plan. Experience has indicated that it is reasonable to achieve filtration within 7 years:

- 2 years for assessment and planning to achieve 43210
- 3 years for design and planning for financing
- 2 years for construction and implementation

The water supplier, in collaboration with IH, will establish timelines specific to their individual systems. Factors such as outbreaks may shorten timelines. Drinking Water Officers may set milestone targets on operating permits.

It is reasonable and achievable for water supply systems serving more than 500 people per day to have filtration operational by 2015. It is reasonable for the public to expect that:

- 50% of water supply systems will have filtration in place by 2012
- 90% of water supply systems will have filtration in place by 2015

Emphasis is placed on the health risk reduction with the shortest timelines possible to achieve filtration.

DRAFT

## Appendix B-2: Plans Including Deferral of Filtration

If a water supply system using surface water as a water source cannot meet the Canadian Drinking Water Quality Guidelines for exclusion of filtration they are required to plan for filtration.

The water supplier, in collaboration with IH, will establish timelines and milestones specific to individual systems.

1. Water supplier submits a plan for achieving the long term objectives of 43210.

2. Water supplier submits proposal (with at least one year of data) for deferral of filtration, including:
    a. Demonstration of meeting the Canadian Drinking Water Quality Guidelines for exclusion from filtration
        i. E.coli and coliform monitoring
        ii. on-line continuous turbidity monitoring to provide daily average
        iii. performance monitoring of disinfection processes to achieve credit for 4-log removal of viruses and 3-log removal of Cryptosporidium and Giardia
        iv. annual update or review of changes to the watershed and control program (e.g. sewage outfalls, mining, forestry, agriculture)

    b. site-specific monitoring identified by DWO concerns which might include:
        i. monitoring the presence of Giardia or Cryptosporidium and establishing baseline data
        ii. constituents identified by the EPA guidelines (e.g. algae, dissolved organics, conductivity)
        iii. process concerns (e.g. coagulant breakthrough)

3. Water suppliers must be prepared to install filtration if any of the following occur:
    a. waterborne illness outbreak
    b. exceedence of avoidable disinfection byproducts
    c. failure to provide or meet the exclusion criteria monitoring requirements
    d. significant degradation of raw water quality identified by the DWO
    e. health threats

The water supplier must be prepared to meet the expectation of construction and implementation of filtration within 2 years of being unable to meet the deferral criteria.

DRAFT

It is reasonable and achievable for water supply systems serving more than 500 people per day to have two methods of disinfection operational by 2013. It is reasonable for the public to expect that if filtration deferral is proposed, that the additional required disinfection would be installed as quickly as possible.

Emphasis is placed on the health risk reduction with the shortest timelines possible to achieve disinfection objectives. Some systems may be further ahead than others and will, therefore, be required to move ahead more quickly.

DRAFT

## APPENDIX C

CRITERIA TO DEMONSTRATE THAT A WATER SUPPLIER CAN ACHIEVE THE GCDWQ FILTRATION EXCLUSION CRITERIA

Systems may qualify for deferral of filtration if they demonstrate the following :

- 4 log removal or inactivation of viruses and 3 log inactivation of protozoa is achieved using a minimum of 2 disinfection processes.
- Background baseline levels of Cryptosporidium and Giardia, adequate to establish trends, have been established.
- A watershed control program designed with the express purpose of minimizing fecal contamination in the source water is being implemented.
- No more than 10% of source/raw water E.coli samples exceed 20/100 ml in any 6-month period.
- No more than 10% of source/raw water total coliform samples exceed 100/100 ml in any 6-month period.
- Turbidity in source immediately before disinfection does not exceed 1NTU 95% of the time in any 30-day period.*
- Peak turbidity readings do not exceed 5NTU for more than 2 days in a 1-year period.
- Expected average annual total Trihalomethanes at locations farthest from treatment will not exceed 100 mg/L.

* This is intended to clarify “average daily turbidity around 1 NTU”. For planning purposes it is important to recognize that some systems will clearly achieve the criteria. Systems that might not always meet the criteria must recognize that they may be required to implement filtration if they do not meet the criteria identified. This interpretation is drawn as a parallel to the treatment requirements for “slow sand or diatomaceous earth filtration” in the Turbidity Guideline that identifies turbidity levels “shall be less than or equal to 1.0 NTU in at least 95% of the measurements made, or at least 95% of the time each calendar month”

DRAFT

## APPENDIX D

CONSIDERATIONS FOR ONGOING MONITORING PROGRAMS FOR SYSTEMS WITH FILTRATION DEFERRAL

Water quality in BC can fluctuate daily, weekly and over long periods of time. Drinking water systems that have raw water quality that currently meets the *GCDWQ Filtration Exclusion Criteria* need to ensure they monitor their raw water to ensure they can detect changes that will effect treatment efficiency.

The following is a list of raw water monitoring parameters that need to be incorporated into a Water System Monitoring Program to help ensure watershed problems can be detected on systems that have deferred filtration:

**Turbidity:**
Turbidity should be monitored continuously as it will have a direct relationship to disinfection efficiency. Disinfection will be compromised when turbidity rises above 1 NTU.

**Pathogen Loading:**
Deferral of filtration is based on the premise that there are minimal microbiological hazards in the raw water. To ensure this, the raw water must be measured for microbiological indicators that can be used to gauge pathogen loading. Total coliform and E.coli should be minimal in the raw water with low risk of pathogens. The frequency of monitoring should be proportional to level of bacteria detected. As bacterial levels increase, so should the frequency of testing.

**Trihalomethanes:**
Unfiltered water often contains organic material which, when combined with chlorine disinfectant, can produce Trihalomethanes (THM). THM samples should be taken in the distribution system farthest from treatment. The frequency of THM sampling should be proportional to the levels of THM detected. As the THM levels increase, so should the sampling. The Guidelines for Canadian Drinking Water Quality currently indicate that no samples should exceed 0.016 mg/L Bromodichloromethane (BDCM), and the annual running average of Trihalo-methanes-total (THMs) should not exceed 0.100 mg/L.

**UV Transmittance:**
Unfiltered water often contains organic material. Organic material can stop UV light from reaching and inactivating pathogens, allowing them to pass through the disinfection process. UV transmittance should be part of the continuous on-line treatment monitoring and may be built into the treatment device. Typically, treatment devices are not validated for raw water transmittance below 85%.

DRAFT

# Technical Memorandum No. 2

Associated Engineering

GLOBAL PERSPECTIVE. LOCAL FOCUS.

## Regional District of Okanagan-Similkameen

### West Bench Water Supply Improvements Options Review Study

### Evaluation and Comparison of System Options

**August 2007**



File: 0580-20/2025-45 AE Aug

# TECHNICAL MEMORANDUM NO. 2

**West Bench Water Supply Improvements**
**Options Review Study**
**Evaluation and Comparison of System Options**

***Issued:*** August 31, 2007
***Previous:*** April 5, 2007

## 1 Objective

The objective of this Technical Memorandum is to evaluate and compare shortlist supply and treatment options from Technical Memorandum No. 1 leading to a recommended option.

## 2 Evaluation Criteria

The following is a summary of criteria used for evaluating the various options:

### 2.1 Cost and Cost Risks

- ***Capital Cost*****:** The options were ranked based on their total capital costs. The capital costs will impact the RDOS' ability to finance the proposed capital works and is therefore considered separate of life-cycle costs.

- ***Life-Cycle Costs*****:** The options were ranked in terms of their total life-cycle costs per lot. Life-Cycle costs have been estimated on the basis of financing based on a 20 year amortization at 5% interest rate plus the operation and maintenance costs projected for the 20 year period 2007 to 2026. Options with lower life-cycle costs are ranked higher than those with higher life-cycle costs. Future operation and maintenance costs were inflated at 2.1% per annum.

- ***Government Funding Dependency*****:** Options were ranked on terms of their dependence on outside government funding. Options that require significant government funding were ranked lower due to the probability that the RDOS would be unsuccessful in obtaining the funding.

- ***Constructability*****:** Options were ranked in terms of their potential for constructability problems and cost overruns. Options with site constraints or potentially difficult geotechnical conditions were ranked lowest.

- ***Potential Political Implementation Risks*****:** Options were ranked in terms of their dependence on cooperation of beneficiaries. Options that were considered to be at risk due to political cooperation issues were ranked the lowest.

- ***Direct Ability to Control Future Costs*:** Options were ranked based on their vulnerability to or lack of control of future costs. Options that involved significant costs beyond the direct control of the RDOS were ranked lowest.

- ***Water Treatment Plant Site and Pump Station Site Availability*:** The options were ranked based on their vulnerability to problems in acquiring land for facilities. Options where the availability of lands at the proposed plant site is unknown were therefore ranked lower than those not requiring land acquisition.

## 2.2 Source Capacity and Water Quality

- ***Available Source Capacity to Meet Projected Demands*:** The options were ranked in terms of the supply source ability to meet the projected demands. Those sources considered to have more spare or excess capacity were ranked higher than those with limited capacity.

- ***Raw Water Quality*:** The options were ranked in terms of the general source water quality relative to parameters of importance to public health. Included in this ranking was consideration of the variability of water quality including frequency and amplitude of spikes of parameters such as turbidity and colour.

- ***Source Resilience to Water Quality Deterioration*:** Each option was ranked in terms of resilience to future water quality deterioration. Sources having minimal existing and future potential development within their watersheds were ranked higher than those with significant existing or potential future development.

## 2.3 Treated Water Quality

- ***Treatment Conformance with IHA Requirements*:** Each option was ranked in terms of its ability to meet IHA's water quality requirements, thereby addressing public health protection. Options having higher quality source water and/or multi-barrier treatment were ranked the highest.

- ***Risk of Human Consumption of Lower Quality Water from System*:** The options were ranked in terms of the potential risk of human consumption of lower quality water from the RDOS system. Options having components carrying lower quality water such as separated systems were ranked lower than systems containing only potable water conforming to IHA's water quality requirements.

- ***Flexibility for Phasing Filtration*:** The options were ranked in terms of their feasibility for phasing filtration. For example, options that include multiple unit treatment processes, thereby allowing the potential for phased treatment implementation and thus reduced initial capital cost, were ranked higher than options involving fewer process steps.

### 2.4 Operation and Security

- ***Operational Robustness*:** The options were ranked in terms of their operational complexity and robustness. Supply options having reduced mechanical and electrical components were ranked higher than those having high complexity. Treatment options having proven robust treatment components and more robust treatment processes were ranked higher than those with more complex or finicky treatment components.

- ***Operations and Maintenance Accessibility*:** The options were ranked in terms of their operations and maintenance accessibility. Those that have mechanical/electrical components at multiple locations or at long distance from the base of operations were ranked low.

- ***Operational Flexibility*:** Options were ranked in terms of their flexibility relative to potential failure of individual components. Options having more than one source of supply therefore were ranked higher than those with single sources and single pipelines.

- ***Security*:** Options were ranked in terms of their exposure to potential vandalism or security breaches. Options having treatment plants at remote locations away from the view of general public were ranked low. Options having treatment plants in developed areas with high public visibility were ranked highest.

### 2.5 Environmental/Urban Impact

- ***Construction - Environmental Impacts*:** Options were ranked in terms of the impact of their construction on the natural environment.

- ***Operation – Environmental Impacts*:** Options were ranked in terms of the impact of their operation on the natural and urban environment. For instance, options involving significant water treatment residuals management requirements, high noise generation, etc., were ranked the lowest.

## 3 Importance of Evaluation Criteria

In order to assist in the evaluation process, a numerical weighting was identified for each of the evaluation criteria. Numerical scoring of options is a highly subjective exercise and therefore was not used in evaluating options. It should not be used as the sole basis for selecting one option over the others. However, it was felt that understanding the importance of each criteria was important in the evaluation process.

The Criteria Importance was established in consultation with RDOS staff relative to each of the evaluation criteria. Criteria which were considered to have higher importance to the RDOS were therefore given higher weighting applied for each of the criteria:

| Criteria | Importance |
|---|---|
| **Cost and Cost Risks** | |
| Capital Cost | High |
| Life-Cycle Cost per Lot | Highest |
| Government Funding Dependency | High |
| Constructability | Medium |
| Potential Political Implementation Risk | Medium |
| Direct Ability to Control Future Costs | Medium |
| Water Treatment Plant Site Availability | Medium |
| **Source Capacity/Quality** | |
| Available Source Capacity | Medium |
| Raw Water Quality | Medium |
| Source Resilience to Water Quality Deterioration | Medium |
| **Treated Water Quality** | |
| Treatment Conformance with IHA Requirements | High |
| Risk of Human Consumption of Lower Quality Water | Medium |
| Flexibility for Phasing Filtration | Low |
| **Operation and Security** | |
| Operational Robustness | Medium |
| Operational Flexibility | Medium |
| Security | Low |
| **Environmental/Urban Impacts** | |
| Construction - Environmental Impacts | Medium |
| Operation – Environmental Impacts | Medium |

# 4 Assessment

The following summarizes our findings relative to the qualitative assessment of each option under each of the major assessment criteria.

## 4.1 Capital Costs

The option having the lowest net capital cost was Option 1 which involved tying in to the City of Penticton supply. It should be noted that this option has higher operation and maintenance costs than some other options due to the fact that the City proposes to incorporate capital depreciation into its rate structure. Option 4, City of Penticton Domestic Supply and Separate Irrigation, was the second highest ranked option based on net capital cost.

## 4.2 Life Cycle Cost per Lot

The option having the lowest Life Cycle Cost per Lot is Option 6-UV, Upgrade and Separate Joint West Bench/Sage Mesa System. It should be noted however that this option assumes that the RDOS would be successful in obtaining approximately $4.67 million in government funding, implying that Sage Mesa would become a utility under the RDOS. Option 3-UV was the second highest ranked option under this criteria.

## 4.3 Government Funding Dependency

Options 1 and 4 have the least dependence on outside government funding and therefore were ranked the best in this category. Options 3 and 6 have the highest dependence on outside government funding and therefore were ranked lowest.

## 4.4 Constructability

The constructability of any option is highly impacted by geotechnical conditions, site constraints and any other factor which may impact the ability to construct the required facilities. Options 1 and 4, which involve the City of Penticton supply, were ranked higher that the other options because the plant already exists and its expansion will probably not involve additional excavation and foundation works.

## 4.5 Potential Political Implementation Risks

Options 2 and 5 involve the standalone involvement of the West Bench and were therefore ranked the best in this category. Options 3 and 6 would involve the cooperation of Sage Mesa and it is unclear at the present time as to their cooperation. Options 3 and 6 were therefore ranked lowest. Options 1 and 4 were ranked as average under this criteria.

### 4.6 Direct Ability to Control Future Costs

Options 1 and 4 include City controlled life cycle cost components that account for over 80% of the total life cycle costs. The West Bench would therefore be at some risk of costs beyond its control. Options 1 and 4 were therefore ranked lowest under this criteria. This is particularly true if the costs of the new upgrades to the COP Water Treatment Plant surpass the $6 M cost estimate suggested by the City.

### 4.7 WTP and Pump Station Site Availability

Options 2, 3, 5 and 6 involve acquiring lands to construct the water treatment facilities. The ability of the RDOS to be able to purchase these lands is unclear at this time. Options 1 and 4 require acquisition of land within the City boundary to construct the booster pump station. The ability of the RDOS to be able to purchase lands within the City is probably going to be more challenging than for the other options. Options 1 and 4 were therefore ranked lowest in this category.

### 4.8 Available Source Capacity

All options involve drawing the raw water supply from Lake Okanagan. The existing water licences allow withdrawal quantities exceeding the projected water demands. Options 1 and 4 have the added benefit of having a second source of supply, Penticton Creek, however the added benefit to the West Bench is marginal due to the fact that at present the West Bench already has adequate licence capacity to meet its demand requirements from the lake. All options were therefore considered equal under this criteria.

### 4.9 Raw Water Quality

All options involve diverting water from Lake Okanagan and were given the same rank.

### 4.10 Source Resilience to Water Quality Deterioration

Because all options involve drawing water from Lake Okanagan they are considered equal under this category.

### 4.11 Treatment Conformance with IHA Requirements

All filtered options covered under this technical memorandum were developed on the basis of treatment conformance with IHA's requirements therefore, they have been considered to be equal under this criteria. Options that don't include filtration, but meeting the filtration deferral requirements, are ranked lower.

### 4.12 Risk of Human Consumption of Non-Potable Water

Options involving separation of the domestic and irrigation systems will involve the potential risk of ingestion of non-potable water. In this analysis we have assumed that the irrigation systems will be delivering untreated water. This does create the risk that humans could unknowingly ingest non-potable water. Options 1, 2, and 3 were therefore considered to have a higher ranking under this criteria than Options 4, 5 and 6.

### 4.13 Flexibility for Phasing Filtration

All options that include filtration, have been ranked equally under this criteria. The UV options were ranked higher under this criteria.

### 4.14 Operational Robustness

Options 2, 3, 5, and 6 are based on conventional filtration treatment technology. Options 1 and 4 provide the flexibility of treating the water using either direct filtration technology or conventional filtration (clarification and filtration) technology. The City of Penticton water treatment plant includes a clarifier. While the plant has the ability to treat water in the direct filtration mode, the City's current operating strategy involves directing all water through the clarifier and thus operating it in conventional filtration mode. Having a clarifier in the treatment process adds robustness to the process. Because all options are based on the same treatment process, all options were ranked equally. UV options were rated lower.

### 4.15 Operational Flexibility

The City of Penticton water treatment plant is supplied from two different sources and includes capabilities to treat those source waters individually or through blending. The plant includes two trains of flocculators, one clarifier, and six filters. Having increased numbers of treatment units significantly improves the ability to deal with source water quality issues, treatment process upsets, equipment malfunction and other operational issues in comparison to a plant incorporating fewer treatment units. The single clarifier could create a potential constraint during a process upset. For Options 2, 3, and 6 the treatment process would include two clarifiers, therefore these options were ranked highest under this criteria.

### 4.16 Security

All options would include plants located in visible urban environments. No single option was perceived to have increased security in comparison to the other options. They were therefore considered to be equal under this criteria.

### 4.17 Construction - Environmental Impacts

The construction of water supply systems involves considerable disturbance to the environment during the construction process. Options 2, 3, 5, and 6 would involve more excavation and

handling of water during construction than Option 1 and 4 and were therefore ranked slightly lower. The UV options require a smaller initial building footprint, and were ranked higher.

### 4.18 Operation – Environmental Impacts

The most significant environmental impact created by the operation of water supply and treatment facilities involves the handling of liquid and solid residuals from the treatment process. Options 4, 5, and 6 involve the requirement to treat less water than Options 1, 2, and 3 and would therefore involve less residuals handling and disposal on a per capita basis. Options 4, 5, and 6 were therefore ranked higher than the other options. The UV options had the least environmental impact, and were therefore ranked the highest.

## 5 Conclusions

This brief analysis was performed to assess the various risks associated with the construction of any of these options. Criteria for assessing the weighting of importance were based on discussions with RDOS Board and staff members.

It is immediately evident that Options 1 and 4 provide the required treatment at the least initial capital cost. Upon further examination however, high operational costs, as well as inability for West Bench users to control their future water costs, increase the risks of these options substantially.

The highest ranked options are Options 2-UV and 5-UV, where initial capital costs are higher, however long-term operational costs are significantly lower. The greatest risk with these options are that they rely on the IHA Filtration Deferral Policy, which permits the delay of filter installation to a later date. If filters become a requirement in the future, the capital costs of these options increase significantly.

Prepared by:

W.J (Bill) Harvey, P.Eng.
Project Manager

WJH/cb

Enclosure - 2A

# ENCLOSURE 2A - QUALITATIVE ASSESSMENT OF OPTIONS

**Regional District of Okanagan-Similkameen**
**West Bench Water Supply Improvements**
**Options Review Study**
**Technical Memorandum No. 2**
**Table 2-1**
**System Options Qualitative Evaluation**

| | | | COST AND PROJECT RISK | | | | | | | SOURCE CAPACITY/QUALITY | | | TREATED WATER QUALITY | | | OPERATION & SECURITY | | | ENVIRONMENTAL IMPACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OPTION | NAME | TREATMENT | Net Capital Cost Based on Gov't Grant of 2/3 of Onsite Costs | Total Annual Cost per Lot[1] | Government Funding Dependancy | Constructability | Potential Political Implementation Risks | Direct Ability to Control Future Costs | WTP and Pumpstation Site Availability | Available Source Capacity to Meet Projected Demands | Raw Water Quality | Source Resilience to Water Quality Deterioration | Treatment Conformance With IHA Requirements | Risk of Human Consumption of Non-Potable Water From System | Flexibility For Phasing Filtration | Operational Robustness | Operational Flexibility | Security | Construction - Environmental Impact | Operation - Environmental Impact | Overall Assessment |
| CRITERIA IMPORTANCE | | | High | Highest | High | Medium | Medium | Medium | Medium | Medium | Medium | Medium | High | Medium | Low | Medium | Medium | Low | Medium | Medium | |
| 1 | City of Penticton Supply | Clarification/ Filtration | $1,521,000 | $1,946 | Good | Good | Average | Poor | Poor | Average | Good | Good | Good | Good | Average | Good | Average | Average | Good | Average | ***Average*** |
| 2 | Upgrade Existing System | Clarification/ Filtration | $2,861,000 | $1,882 | Average | Average | Good | Good | Average | Average | Good | Good | Good | Good | Average | Good | Good | Average | Average | Average | ***Below average*** |
| 3 | Joint West Bench/Sage Mesa System | Clarification/ Filtration | $3,879,000 | $1,421 | Poor | Average | Poor | Good | Average | Average | Good | Good | Good | Good | Average | Good | Good | Average | Average | Average | ***Lowest*** |
| 4 | City of Penticton Domestic Supply & Separate Irrigation | Clarification/ Filtration | $1,570,000 | $1,475 | Good | Good | Average | Poor | Poor | Average | Good | Good | Good | Poor | Average | Good | Average | Average | Good | Good | ***Above average*** |
| 5 | Upgrade Existing System & Separate Irrigation | Clarification/ Filtration | $2,492,000 | $1,475 | Average | Average | Good | Good | Average | Average | Good | Good | Good | Poor | Average | Good | Poor | Average | Average | Good | ***Average*** |
| 6 | Joint West Bench/Sage Mesa System & Separate Irrigation | Clarification/ Filtration | $3,385,000 | $1,122 | Poor | Average | Poor | Good | Average | Average | Good | Good | Good | Poor | Average | Good | Good | Average | Average | Good | ***Below average*** |
| 7 | City of Penticton Supply to West Bench/Sage Mesa | Clarification/ Filtration | $2,391,000 | $1,631 | Average | Good | Poor | Poor | Poor | Good | Good | Good | Good | Average | Average | Good | Average | Average | Good | Good | ***Below Average*** |
| ***UV Options*** | | | | | | | | | | | | | | | | | | | | | |
| 2UV | Upgrade Existing System | UV/Chlorination | $1,860,000 | $1,097 | Average | Average | Good | Good | Average | Average | Average | Good | Average | Good | Good | Average | Average | Average | Good | Good | ***Highest*** |
| 3UV | West Bench/Sage Mesa | UV/Chlorination | $2,449,000 | $782 | Poor | Average | Poor | Good | Average | Average | Average | Good | Average | Good | Good | Average | Average | Average | Good | Good | ***Above average*** |
| 5UV | Partially Separated | UV/Chlorination | $1,848,500 | $971 | Average | Average | Good | Good | Average | Average | Average | Good | Average | Poor | Good | Average | Average | Average | Good | Good | ***Above average*** |
| 6UV | West Bench/Sage Mesa Domestic | UV/Chlorination | $2,383,667 | $674 | Poor | Average | Poor | Good | Average | Average | Average | Good | Average | Poor | Good | Average | Average | Average | Good | Good | ***Average*** |

Note:
1. The cost per lots are based on a full grant being obtained for each option.

# Technical Memorandum No. 1

## Regional District of Okanagan-Similkameen

### West Bench Water Supply Improvements Options Review Study

### System Options Development

**February 2007**

**CONFIDENTIALITY AND © COPYRIGHT**

This document is for the sole use of the addressee and Associated Engineering (B.C.) Ltd. The document contains proprietary and confidential information that shall not be reproduced in any manner or disclosed to or discussed with any other parties without the express written permission of Associated Engineering (B.C.) Ltd. Information in this document is to be considered the intellectual property of Associated Engineering (B.C.) Ltd. in accordance with Canadian copyright law.

This report was prepared by Associated Engineering (B.C.) Ltd. for the account of Regional District of Okanagan-Similkameen. The material in it reflects Associated Engineering (B.C.) Ltd.'s best judgement, in light of the information available to it, at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Associated Engineering (B.C.) Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

# Table of Contents

# TECHNICAL MEMORANDUM NO. 1

**West Bench Water Supply Improvements**
**Options Review Study**
**System Options Development**

***Issued:*** February 20, 2007
***Previous:*** January 22, 2006

## 1 OBJECTIVE

The objective of this Technical Memorandum is to identify and develop water supply options for the West Bench water system.

## 2 PREVIOUS REPORTS

In preparing this Technical Memorandum Associated Engineering obtained copies of and reviewed the following reports:

1. West Bench Irrigation District Assessment Study prepared for Regional District of Okanagan-Similkameen, Stantec Consulting Ltd., December 2001.

2. West Bench Irrigation District Water Supply Options prepared for West Bench Irrigation District, Stantec Consulting Ltd., April 2006.

3. Sage Mesa Water and Public Service Company Assessment Report prepared for Regional District of Okanagan Similkameen, True Consulting Group, January 2000.

Some information contained in the above reports has been re-used in the preparation of this Technical Memorandum.

## 3 EXISTING SYSTEM

The existing West Bench water system has been historically managed by the West Bench Irrigation District (WBID). Over the past 15 years the WBID has undertaken a program of distribution system improvements. The system includes the following existing components.

- ***Lake Intake*****:** The existing Lake Okanagan intake consists of 500 metres of 600 mm corrugated steel pipe in the lake and 670 metres of 500 mm steel pipe on shore. Sections of the land portion of the existing intake pipe are apparently corroding. The lake portion includes an intake screen at an appropriate depth of 13.5 metres. Based on previous inspection the lake portion appears to be in good condition, however the screen does not meet current standards.

- ***Supply Pump Station*:** The existing pump station consists of three 150 HP pumps and one 75 HP pump, a chlorine feed system and associated mechanical and electrical equipment. The proven capacity of the pump station utilizing two 150 HP pumps and the 75 HP pump is reported to be approximately 105 l/sec. A need has been identified to upgrade/replace the existing facility due to its poor structural condition and extensive mechanical wear and tear.

- ***Water Reservoir:*** The existing water reservoir has a capacity of 1,020 $m^3$. The 2001 report indicated that it has a capacity shortfall of approximately 700 $m^3$ to provide balancing and fire storage to the system. The 2006 report doesn't include any allowance for reservoir upgrading. The need for additional storage capacity has not been included in this study but should be addressed during predeisgn.

- ***Distribution System*:** The existing distribution system consists of pipes ranging in diameter from 75 mm to 300 mm diameter of varying material. The system serves approximately 351 domestic and irrigation connections, including 145 acres of irrigated lands at pressures ranging from 275 to 690 kPa.

- ***Supply Pipelines*:** The existing supply pipelines are 400 mm and 300 mm diameter ductile iron pipe installed in 1979. They are assumed to be in reasonable condition.

It is our understanding that the West Bench water supply and distribution system is currently being operated by the City of Penticton under contract to the West Bench Irrigation District.

The previous reports have noted some questions regarding the legal status of the rights of way that the land portion of the lake intake pipe and the Supply Pump Station are located on. They also indicate similar issues with some of the existing distribution mains.

Based on our review of existing reports, we have assumed, for the purposes of this study that the existing land portion of the lake intake and the existing supply pump station require complete replacement if they are to be integrated into the system upgrading. Certain distribution system upgrades should also be undertaken and these are identified in a subsequent section of this Technical Memorandum.

# 4 WATER DEMAND DESIGN CRITERIA

Previous studies have been undertaken by others which have included reviews of water demands. These studies have included reviews of historical demands and projection of current estimated demands for the purposes of establishing water demand criteria. As part of this study we have not undertaken a detailed review of previous demand projections.

The water supply and treatment components should be designed to meet maximum day demand. The following therefore confirms the water demand design criteria used in this report for the purposes of comparing options.

## 4.1 West Bench

- ***Historical Water Demands:*** Historical maximum day demands for the period between 2000 and 2005 are summarized as follows:

  2000 – 6.36 ML/d
  2001 – 6.50 ML/d
  2002 – 6.94 ML/d
  2003 – 6.23 ML/d
  2004 – 5.62 ML/d
  2005 – 5.60 ML/d

- ***Residential Demand*****:** The West Bench area consists of 351 connections. For the purposes of this report, residential demand is defined as the combined indoor and outdoor water demand for a typical (non-agricultural) lot in the West Bench. Previous reports have utilized a residential demand of 2 usgpm (0.126 L/s) per lot. This equates to a demand as follows:

  MDD = 351 x 0.126 L/sec = 44.2 L/sec = 3.82 ML/d

- ***Agricultural Demand*****:** According to previous reports, the agricultural land usage presently totals approximately 29 Ha (72 acres). Using a design criteria of 6 usgpm (0.378 L/s) per acre, this equates to the following demand:

  MDD = 72 x 0.378 L/sec = 27.2 L/sec = 2.35 ML/d

- ***Total Combined Demand*****:** Based on the above, the total combined demand would equate to 6,172 $m^3$ /day. The previous reports have suggested that this calculation may underestimate the actual demands due to orchards that have been converted to irrigated lawns that could be returned to agricultural use in the future. Based on a review of historical maximum day demand records, an MDD of 7,000 $m^3$ /day was recommended. This would appear to be a reasonably conservative value for the purpose of comparing options.

- ***Impact of Water Metering***
  The West Bench experienced a reduction in demands from the 1900s to the early 2000s and these reductions are reflected in the above calculations. This project will include installation of flow meters on all properties which will probably further reduce annual

demands. For the purpose of this report we have not reduced the maximum day demands as it is unclear what impact metering will have on peak demands.

- ***West Bench Design Demand*:** For the purpose of comparing options, we recommend the use of the following MDD.

  Residential Demand – 4.5 ML/d
  Agricultural Demand – 2.5 ML/d

When the project proceeds into preliminary and detailed design, we would recommend that this design basis be reviewed as there would appear to be an opportunity to reduce the design demands with the implementation of flow metering.

## 4.2 Sage Mesa

- ***Residential Demand*:** The Sage Mesa area consists of 265 connections of which 175 are metered in the Upper Pressure Zone and 90 are unmetered in the Lower Pressure Zone. The TRUE report recorded a maximum day demand of 9.2 $m^3$ /day/lot for the upper pressure zone and 6.4 $m^3$ /lot/day for the lower pressure zone. This equates to the following:

  Upper Zone MDD 197 x 9.2 $m^3$ /day = 1.81 ML/d
  Lower Zone MDD 68 x 6.4 $m^3$ /day = 435 $m^3$ /day = .44 ML/d
  Total MDD – 265 lots – 2.25 ML/d

- ***Agricultural/Commercial Demand*:** The Sage Mesa area has limited agricultural land usage; however, it includes two golf courses. The TRUE report indicated a golf course MDD of 550 $m^3$ /day = 0.55 ML/d

- ***Total Combined Demand*:** Based on the above criteria the combined MDD would total 2.8 ML/d.

- ***Impact of Water Metering*:** To be consistent in comparing options it should be assumed that the Sage Mesa area will be fully metered if it is integrated into the West Bench project. This would involve providing meters on properties in the lower pressure zone. For the purpose of this report we have not reduced the maximum day demands as it is unclear what impact metering will have on peak demands.

- ***Sage Mesa Design Demand*:** The above calculations were based on the review of two years demand records by the consultant. For the purpose of comparing options we recommend the use of the following criteria:

  Residential Demand – 2.5 ML/d
  Golf Course Demand – 0.5 ML/d

# 5 WATER TREATMENT

In 2006 Interior Health Authority established the following new guidelines:

- 4 log virus removal
- 3 log Giardia and Cryptosporidium removal
- 2 stages of treatment
- 1 NTU turbidity maximum
- 0 coliforms

Interior Health now requires purveyors to issue a water quality advisory when turbidity values exceed 1.0 NTU and a boil water advisory if turbidity exceeds 5.0 NTU. Ultimately, all surface waters are to be filtered and this is to be taken into account in the planning of water treatment improvements by each water purveyor.

For the purpose of this study it is important to be able to compare options based on a common water treatment approach. The raw water source for all options under consideration is Lake Okanagan. Lake Okanagan is considered to be a good quality raw water source.

One strategy which has been used on other systems supplied from Lake Okanagan has been to use two stage treatment consisting of UV followed by chlorination. Depending on the depth of intake and local lake limnology this strategy can be capable of meeting 4 of the 5 criteria set out in IHA's new guidelines, with turbidity being the one exception.

The writer contacted a local representative of Interior Health who indicated that to assure compliance with IHA's new guidelines, multi-stage treatment incorporating filtration would be required. Depending on the quality of the source water, there are numerous ways of achieving filtered water including direct filtration, conventional filtration (clarification and filtration), and membrane filtration. The selected strategy for West Bench will depend on the depth of intake and local lake limnology. Using the existing shallow intake, the most appropriate strategies would be clarification and filtration or membrane filtration. By deepening the intake, thereby providing more consistent raw water quality, an appropriate strategy would be direct filtration.

For the purpose of comparing options we have selected direct filtration. This is one treatment process currently used by the City of Penticton for treating lake water and is therefore a proven treatment technology for Lake Okanagan water. To meet the Giardia and Cryptosporidium

inactivation requirements we have assumed that the treatment process would incorporate UV. Using the direct filtration treatment strategy also allows all alternatives to be compared on a consistent basis.

# 6 DISTRIBUTION SYSTEM UPGRADES

Previous studies have identified the need for distribution system upgrades required to the West Bench system. These upgrades include the following works:

Newton Drive – 650 lin. m 200 mm pipe
Sparton Drive – 470 lin. m 150 mm pipe
Veteran Drive – 240 lin. m 150 mm pipe
Moorpark/Sunglo Drive – 490 lin. m 150 mm pipe
Vedette Drive – 240 lin. m 150 mm pipe

The above noted replacement pipes are required to replace existing 75 mm and 100 mm steel mains that have created the largest number of leaks due to corrosion. These upgrades are considered common to all options and therefore are included in the cost estimates for all options.

As noted in Section 3, an earlier report identified a capacity shortage in the treated water reservoir. The most recent report, however, does not include any allowances for increasing storage capacity. The reservoir's existing capacity needs to be confirmed and the requirement for additional storage clarified.

In addition to the above upgrades, this project will include installation of flowmeters on all properties. This is also common to all options and therefore included in the cost estimates for all options.

# 7 SERVICING OPTIONS

Five options have been developed for comparison purposes. Each option has been developed at a conceptual design level including capital and operating costs. Each option is described herein.

## 7.1 Option 1 – City Of Penticton Connection

- ***City of Penticton Proposal:*** In response to a request by Associated Engineering, the City of Penticton provided a proposal re: West Bench Water Supply under letter dated February 12, 2007. A copy of the City proposal is included in Enclosure 1B. The essence of the City proposal was that the City would have no problem with the West Bench Irrigation District considering the use of the City water supply as one of the options, subject to the following conditions:
  - Transfer of WID water licences to the City.

- Amendment of water licences to state that water can be used within City and West Bench boundaries.
- All properties within West Bench to be metered.
- The option of the City providing metering and billing services at a cost of $13.00 per reading.
- Connection point to be in the vicinity of Riverside Drive and Highway 97.
- West Bench responsible for constructing a booster pump station (including tie-in and land acquisition) to pump water from the City system to the West Bench.
- Design of the pump station and supply line to accommodate both West Bench and Sage Mesa.
- The City would charge the West Bench for the cost of supplying water and the West Bench's portion of the capital depreciation charges. The costs are confirmed in an attached spreadsheet and subject to review and adjustment annually.
- The City optionally offered to consider taking complete operational and management for the entire system subject to evaluation of the existing water infrastructure and upgrades.
- Any final decision would require Council approval and the development and execution of a contract.

- ***Concept*:** Option 1 therefore involves making a connection to the City of Penticton treated water distribution system in the northwest part of the City and providing a booster pumping station and supply pipeline to deliver water to the West Bench. Refer to **Plan 1-1**.

- ***Raw Water Source*:** The raw water source for this option is a combination of Okanagan Lake and Penticton Creek, which are used by the City of Penticton as sources for their water treatment plant on the east side of the City. To supply water to the RDOS the City would probably have to arrange for transfer of the West Bench Irrigation District's existing license for Okanagan Lake water to the City of Penticton.

- ***Water Treatment*:** The City currently operates a filtration plant that utilizes the following treatment processes – chemical coagulation and mixing, flocculation, clarification (plate settlers), filtration, and chlorination. The plant obtains its raw water supply from two sources, Lake Okanagan and Penticton Creek. It has two trains, one which can operate in direct Filtration mode and the other in conventional Filtration mode. The plant is currently operating near its maximum design capacity of 60 ML/d and a water treatment expansion project is therefore in the planning stages. We therefore believe that this expansion would have to be completed before water could be supplied to the West Bench. Currently, this expansion is being planning for 2009. It is our understanding that this plant meets IHA's new guidelines.

- ***Water Supply System*:** The water supply system would include the following components:

  - Connection to City of Penticton System: A connection would be made to the City of Penticton system in the vicinity of the intersection of Westminster Avenue and Eckhardt Avenue. Previous modelling has confirmed that the City system is capable of delivering the required demands for the West Bench system at this location.

  - Booster Treated Water Pump Station: A booster pump station sized to deliver 7 ML/d MDD would be installed in an open area on the Westminster Avenue right of way near the connection point. The pump station would consist of 2 duty and 1 standby pumps and would incorporate standby power (or drive) for 50% of the delivery capacity.

  - Treated Water Supply Pipeline: A 250 mm diameter supply pipeline would supply water from the connection point to a connection to the existing West Bench distribution system on Bartlett Drive.

  - Existing Supply Components: The existing Okanagan Lake Intake, pumping station (including chlorination systems), and supply pipeline would be abandoned when the new system is operational.

## 7.2 Option 2 – Upgrade Existing West Bench System

- ***Concept:*** Option 2 involves upgrading the existing Lake Okanagan Intake, converting the existing pump station to a low lift pumping facility, adding a new water treatment plant and a new high lift pumping facility, and a supply line to deliver water to the West Bench. Refer to **Plan 1-2**.

- ***Raw Water Intake:*** The raw water source would continue to be Lake Okanagan. To provide more consistent raw water quality the existing 670 metre long corroding land portion of the intake pipe would be replaced and a 450 lin. extension added to the lake portion to a depth of 30 m. For the purpose of this assessment we have assumed a 750 mm diameter extension due to concerns about head losses in the existing 600 mm CMP lake intake pipe.

- ***Water Treatment:*** A new water treatment plant would be required in the vicinity of the existing pump station. The intent is to convert the existing pump station to a low lift facility to lift water into the water treatment plant. For the purpose of this evaluation we have assumed direct filtration. If filtration is deemed to be unaffordable at this point, an interim step may be to provide UV disinfection.

- ***Water Supply System:*** The water supply system would include the following components:

  - High Lift Treated Water Pump Station: The treated water pump station would be sized to deliver 7 ML/d from a clearwell on the discharge side of the water treatment plant. The pump station would consist of 2 duty and 1 standby pumps and would incorporate standby power (or drive) for 50% of delivery capacity.

  - Supply Pipeline: A 250 mm diameter supply pipeline would supply water from the pump station to a connection to the existing distribution system on Bartlett Drive.

  - Existing Supply Components: A significant portion of the existing Okanagan Lake intake would be replaced and the existing pump station converted to a low lift pump station. The existing supply pipelines would be abandoned.

## 7.3 Option 3 – Upgraded Joint West Bench - Sage Mesa System

- ***Concept:*** Option 3 involves combining the West Bench and Sage Mesa water systems into a single water supply system. This alternative would involve dissolving both utilities and creating one water system owned and operated by the RDOS. There are already some political, governance and asset transfer issues that may have to be resolved in order to proceed with this option. The two systems operate at different HGLs with Sage Mesa having two pressure zones (lower zone 454 m and upper zone 620 m) and West Bench having one pressure zone between the two Sage Mesa zones. The new supply system would therefore consist of a new lake intake, raw water pump station and supply line to a treatment plant; a high lift treated water pump station in the vicinity of the KVR; and new treated water supply pipelines, supplying West Bench via a connection to an existing main on West Bench Drive, and supplying Sage Mesa via a new supply main to a tie-in near the lower Sage Mesa Reservoir. Refer to **Plan 1-3**.

- ***Raw Water Supply System:*** The raw water supply system would consist of a 600 mm diameter HDPE pipe extended approximately 700 lin. m to a lake depth of approximately 30 m, a raw water pump station on the west side of the highway right-of-way and a supply pipeline through the Pine Hills golf course.

- ***Water Treatment:*** Water from the new intake would be pumped through a supply pipeline to the water treatment plant on the KVR near the Sage Mesa golf course. This site is adjacent to the existing golf course access road, and would require more detailed engineering services to address site grading issues, etc. Approval would be required to locate it on the KVR. If not this location, the other options would be to site the plant adjacent to the Sage Mesa lower zone reservoir, east of Sage Mesa Drive, or possibly adjacent to the West Bench Reservoir. This would increase the capital costs. For the purpose of this evaluation we have assumed a direct filtration plant on the KVR right-of-way near the Sage Mesa golf course access.

- ***Water Supply System:*** The water supply system would include the following components:

  - High Lift Treated Water Pump Station: The treated water pump station would be sized to deliver 10 ML/d from a clearwell on the discharge side of the water treatment plant. The pump station would consist of 3 duty pumps (one of which would be dedicated to supplying Sage Mesa at lower zone HGL 454 m) and 1 standby pump and would incorporate standby power (or drives) for 50% of delivery capacity.

  - Supply Pipeline: A new 300 mm supply pipeline would supply water from the treated water pump station along West Bench Drive to connections in the West Bench and to Sage Mesa via a new 250 mm water main to the Sage Mesa Lower Reservoir.

  - Existing Supply Components: All of the existing West Bench and Sage Mesa intake and pump station supply components would be abandoned under this option.

## 7.4 Option 4 – City Of Penticton Domestic Supply And Separate Irrigation System

- ***Concept***: Option 4 involves making a connection to the City of Penticton treated water distribution system in the northwest part of the City and providing a booster pumping station and supply pipeline to deliver residential water to the West Bench. Irrigation water would be supplied from the existing supply system which would have to be upgraded to address corrosion and maintenance issues. An irrigation distribution pipeline would be constructed along the CPR right of way to serve irrigated parcels along this corridor. Refer to **Plan 1-4**.

- ***Raw Water Source***: Residential water would be sourced from the City of Penticton system. Irrigation water would be sourced from the existing Lake Okanagan intake. The land portion of the existing intake pipe would have to be replaced to address existing corrosion issues. Prior to proceeding with this, the legal status of the right of way should be confirmed.

- ***Water Treatment***: The City filtration plant would provide supply to the residential distribution system. As noted under Option 1, the City is currently planning an expansion of the plant and this would have to be completed before water could be supplied to the West Bench. This plant expansion is currently planned for 2008/2009.

- ***Water Supply System***:

  - Connection to City of Penticton System: A connection would be made to the City of Penticton system in the vicinity of the intersection of Westminster Avenue and Eckhardt Avenue as per Option 1.

  - Booster Treated Water Pump Station: A booster pump station sized to deliver 4.5 ML/d would be installed in the open area on the Wesminster Avenue right of way near the connection point. The pump station would consist of 2 duty and 1 standby pump and would incorporate standby power (or drive) for 50% of the delivery capacity.

  - Treated Water Supply Pipeline: A 200 mm diameter supply pipeline would supply water from the connection point to a connection to the existing distribution system on Bartlett Drive.

  - Agricultural Supply Pump Station: The existing pump station would be partially demolished (after the new treated water supply system is operational). A new structure complete with two new pumps and associated piping and valving would be installed to supply the agricultural system. Prior to proceeding with this, the legal status of the right of way should be confirmed.

  - Irrigation Supply Main: The existing supply pipeline would be converted to an irrigation supply main (assuming that it is still in operable condition) which would operate at a lower distribution pressure than the treated water system. A 200 mm diameter irrigation supply main would be extended along the CPR right of way to supply untreated water to large agricultural tracts along this corridor.

  - Existing Supply Components: All existing supply components would be refurbished and re-used under this option.

## 7.5 Option 5 – Upgrade And Separate Existing West Bench System

- ***Concept:*** Option 5 involves upgrading the existing Lake Okanagan intake, converting the existing pump station to an irrigation pumping facility, adding a new water treatment plant, a new high lift pumping facility and a treated water supply line to deliver treated water to the West Bench. A new irrigation supply main would be installed along the CPR right of way to serve agricultural parcels along this corridor. Refer to **Plan 1-5**.

- ***Raw Water Source:*** Residential and irrigation water would be sourced from the existing Lake Okanagan intake system. The land portion of this intake pipeline would be replaced and the lake portion of intake would be extended approximately 450 lin. m (750 mm diameter) into the lake to a depth of 30 m.

- ***Water Treatment:*** A new water treatment plant would be constructed in the vicinity of the existing pump station to treat the residential component. For the purpose of this evaluation, we have assumed a direct filtration plant. The irrigation supply system would be supplied with untreated water.

- ***Water Supply System:***

  - High Lift Treated Water Pump Station: The treated water pump station would be sized to deliver 4.5 ML/d from the water treatment plant to the West Bench. The pump station would consist of 2 duty and 1 standby pumps and would incorporate standby power (or drive) for 50% of delivery capacity.

  - Treated Water Supply Pipeline: A 200 mm diameter supply pipeline would supply treated water from the pump station to a connection to the existing distribution system on Bartlett Drive.

  - Agricultural Supply Pump Station: The existing pump station would be partially demolished (after the new treated water supply system is operational). Two new pumps and associated piping and valving would be installed inside a new superstructure to supply the agricultural system.

  - Irrigation Supply Main: The existing supply pipeline would be converted to an irrigation supply main (assuming that it is still in operable condition) which would operate at a lower distribution pressure than the treated water system. A 200 mm diameter irrigation supply main would be extended along the CPR right of way to supply untreated water to large agricultural tracks along this corridor.

  - Existing Supply Components: All existing supply components would be refurbished and re-used under this option.

## 7.6 Option 6 – Upgraded And Separate Joint West Bench/ Sage Mesa System

- ***Concept*:** Option 6 involves combining the West Bench and Sage Mesa domestic water systems and converting the existing intakes and supply pump stations to irrigation supply facilities. This alternative would involve dissolving both utilities and creating one water system owned and operated by the RDOS. The new domestic supply system would consist of:
  - a new lake intake,
  - raw water pump station and supply line to a treatment plant in the vicinity of the KVR
  - new treated water supply pipelines supplying West Bench via connections to the existing mains in West Bench Drive and

- supplying Safe Mesa via a new supply main to a tie-in near the Lower Sage Mesa Reservoir.

The existing West Bench and Sage Mesa intake pump stations and supply lines would be converted to irrigation supply facilities by replacing pumps and doing upgrades to the existing pump station structures. Refer to **Plan 1-6**.

- ***Raw Water Supply System:*** The raw water supply system (servicing the domestic demands) would consist of a 600 mm diameter HDPE pipe extended approximately 700 m to a lake depth of approximately 30 m, a raw water pup station on the west side of the highway and a supply line through the Pine Hills golf course to the water treatment plant. This system would be sized for a domestic demand of 7 ML/d.

  To serve the irrigation demands, the existing West Bench and Sage Mesa intake pump stations would be refitted with new smaller pumps and piping and the structures upgraded to serve the irrigation demands. The West Bench irrigation pump station would be sized to serve a demand of 2.5 ML/d and the Sage Mesa pump station sized to serve a demand of 0.5 ML/d to meet golf course irrigation needs.

- ***Water Treatment:*** A new water treatment plant sized to treat the domestic demand of 7 ML/d would be located on the KVR near the Sage Mesa golf course access. The site is adjacent to the existing golf course access road and would require more detailed engineering to address site grading issues etc. Approval would be required to locate the plant on the KVR. As with Option 3, there are other siting options for the plant; however, for the purpose of this evaluation we have assumed this location.

- ***Water Supply System:*** The domestic water supply system would include the following components:
  - Treated water pump station: The treated water pump station would be sized to delivery 4.5 ML/d to the West Bench and 2.5 ML/d to Sage Mesa from a clearwell on the discharge side of the water treatment plant. The pump station would consist of three duty pumps (one of which would be dedicated to supplying Sage Mesa at lower zone HGL 454 m) and one standby pump, and would incorporate standby power or drives for 50% of delivery capacity.

  - Treated Water Supply Pipelines: A new 250 mm supply pipeline would supply water from the treated water pump station along West Bench Drive to connections on the West Bench and to Sage Mesa via a new 200 mm supply pipeline to the Sage Mesa Lower Reservoir.

  - Existing Supply Components: All of the existing West Bench and Sage Mesa intake and pump station supply components would be downsized and refurbished to serve the irrigation demands.

# 8 COST ESTIMATES

## 8.1 Cost Estimating Basis For On-Site Facilities

The capital cost estimates used for the comparison of the options have been developed using unit pricing for all components. The unit pricing is based on 2006 dollars and includes a 30% allowance for engineering and contingencies. Unit pricing used for developing the cost estimates is included in the appendices. Breakdowns for the costs are also provided in the appendices.

The operation and maintenance costs have been determined by separating out energy costs from other O&M costs and basing the other O&M costs on percentage of capital costs, depending on the type of facility or construction. For the City of Penticton supply options the costs have been based on information provided by the City. Option 1 was based on the City data. Option 2 was based on prorating the City costs based on the reduced demands. This assumption should be reviewed within the City.

## 8.2 Cost Estimates

The following table summarizes capital and operating costs for each option:

| Option | Name | Treatment | Supply and Distribution System Capital Cost | Water Treatment Capital Cost | Capital Cost | Initial Annual O&M Cost |
|---|---|---|---|---|---|---|
| 1 | City of Penticton Supply | Clarification/Filtration | $2,900,000 | $0 | $2,900,000 | $442,142 |
| 2 | Upgrade Existing System | Direct Filtration | $4,396,000 | $4,186,000 | $8,582,000 | $341,154 |
| 3 | West Bench/Sage Mesa | Direct Filtration | $5,391,000 | $5,980,000 | $11,371,000 | $444,900 |
| 4 | City of Penticton Domestic Supply and Separate Irrigation System | Clarification/Filtration | $3,480,000 | $0 | $3,480,000 | $301,377 |
| 5 | Upgrade and Separate Existing System | Direct Filtration | $4,784,000 | $2,691,000 | $7,475,000 | $250,248 |
| 6 | Upgrade and Separate Joint West Bench/ Sage Mesa System | Direct Filtration | $5,702,000 | $4,186,000 | $9,888,000 | $328,517 |

# 9 LIFE CYCLE COST ESTIMATES

## 9.1 Life Cycle Costing Basis

Capital costs were applied in the life cycle costing one time basis at the front end of the life cycle. It was assumed that there would be no phasing of the capital works.

Operation and maintenance costs were projected over a 20 year life. It was assumed that demands would remain constant over the 20 year period and therefore operation and maintenance costs were also constant except for inflation. An inflation factor of 2.1% per annum was applied to future operating costs. This is the same inflation factor used by the City of Penticton for its future costs.

## 9.2 Provincial Funding Assumptions

The RDOS was successful in obtaining provincial funding for the West Bench project under the BC Water Improvement Program. The RDOS intends to apply for additional funding due to concerns about escalating construction costs and the cost impacts of providing filtered water. It is our understanding that this funding could not be applied to off-site facilities or land acquisition. The costing included herein shows the impact of the RDOS obtaining 2/3 funding assistance on all capital costs.

## 9.3 Life Cycle Cost Per Connection

In order to compare options on an equitable basis the life cycle costs were calculated on a cost per connection basis. This is useful in comparing options which include Sage Mesa to those that don't.

The costs per connection were calculated in two ways as follows:

1) Net life cycle cost per connection using the net capital cost assuming a government contribution of ⅔ of the onsite costs.
2) Gross life cycle cost per connection using the gross capital assuming no government contribution.

## 9.4 Life Cycle Cost Estimates

The following table summarizes life cycle capital and operating costs for each option:

| Option | Name | Treatment | Net Capital Cost Based on Gov't Grant of ⅔ of Capital Costs | Inflated O&M Life Cycle Cost – 20 year | Total Debt Servicing O&M Life Cycle Cost - 20 year | No. of Connections | Net Life Cycle Cost Per Connection | Annual Cost Per Connection |
|---|---|---|---|---|---|---|---|---|
| 1 | City of Penticton Supply | Clarification/Filtration | $3,279,000 | $9,722,078 | $11,273,969 | 351 | $32,120 | $1,606 |
| 2 | Upgrade Existing System | Direct Filtration | $2,861,000 | $8,372,189 | $12,963,669 | 351 | $36,934 | $1,847 |
| 3 | West Bench/Sage Mesa | Direct Filtration | $3,900,000 | $10,918,190 | $17,000,578 | 616 | $27,598 | $1,380 |
| 4 | City of Penticton Domestic Supply and Separate Irrigation | Clarification/Filtration | $2,841,000 | $6,592,764 | $8,454,392 | 351 | $24,087 | $1,204 |
| 5 | Upgrade and Separate Existing System | Direct Filtration | $2,488,000 | $6,141,275 | $10,140,565 | 351 | $28,890 | $1,445 |
| 6 | Upgrade and Separate Joint West Bench/ Sage Mesa System | Direct Filtration | $3,296,000 | $8,062,057 | $13,351,649 | 616 | $21,675 | $1,084 |

Prepared by:

W.J. (Bill) Harvey, P.Eng.
Project Manager

WJH/sb

Enclosures - 1A and 1B

# ENCLOSURE 1A - COST ESTIMATING DATA

# ENCLOSURE 1B – CITY OF PENTICTON FEBRUARY 12, 2007 LETTER

# Technical Memorandum No. 2

## Regional District of Okanagan-Similkameen

### West Bench Water Supply Improvements Options Review Study

**February 2007**

**CONFIDENTIALITY AND © COPYRIGHT**

This document is for the sole use of the addressee and Associated Engineering (B.C.) Ltd. The document contains proprietary and confidential information that shall not be reproduced in any manner or disclosed to or discussed with any other parties without the express written permission of Associated Engineering (B.C.) Ltd. Information in this document is to be considered the intellectual property of Associated Engineering (B.C.) Ltd. in accordance with Canadian copyright law.

This report was prepared by Associated Engineering (B.C.) Ltd. for the account of Regional District of Okanagan-Similkameen. The material in it reflects Associated Engineering (B.C.) Ltd.'s best judgement, in light of the information available to it, at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Associated Engineering (B.C.) Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

# Table of Contents

# TECHNICAL MEMORANDUM NO. 2

**West Bench Water Supply Improvements**
**Options Review Study**
**Evaluation and Comparison of System Options**

***Issued:*** February 21, 2007
***Previous:*** February 9, 2007

## 1 OBJECTIVE

The objective of this Technical memorandum is to evaluate and compare shortlist supply and treatment options from Technical Memorandum No. 1 leading to a recommended option.

## 2 EVALUATION CRITERIA

The following is a summary of criteria used for evaluating the various options:

### 2.1 Cost and Cost Risks

- ***Capital Cost*****:** The options were ranked based on their total capital costs. The capital costs will impact the RDOS' ability to finance the proposed capital works and is therefore considered separate of life-cycle costs.

- ***Life-Cycle Cost*****:** The options were ranked in terms of their total life-cycle costs per lot. Life-Cycle costs have been estimated on the basis of financing based on a 20 year amortization at 5% interest rate plus the operation and maintenance costs projected for the 20 year period 2007 to 2026. Options with lower life-cycle costs are ranked higher than those with higher life-cycle costs. Future operation and maintenance costs were inflated at 2.1% per annum.

- ***Government Funding Dependency*****:** Options were ranked on terms of their dependence on outside government funding. Options that require significant government funding were ranked lover and due to the probability that the RDOS would be unsuccessful in obtaining the funding.

- ***Constructability*****:** Options were ranked in terms of their potential for constructability problems and cost overruns. Options with high site constraints or potentially difficult geotechnical conditions were ranked lowest.

- ***Potential Political Implementation Risks*****:** Options were ranked on terms of their dependence on cooperation of beneficiaries. Options that were considered to be at risk due to political cooperation issues were ranked the lowest.

- ***Direct Ability to Control Future Costs*:** Options were ranked based on their vulnerability to or lack of control of future costs. Options that involved significant costs beyond the direct control of the RDOS were ranked lowest.

- ***Water Treatment Plant Site and Pumpstation Site Availability*:** The options were ranked based on their vulnerability to problems in acquiring land for facilities. Options where the availability of lands at the proposed plant site is unknown were therefore ranked lower than these not requiring land acquisition.

## 2.2 Source Capacity and Water Quality

- ***Available Source Capacity to Meet Projected Demands*:** The options were ranked in terms of their ability to meet the projected demands. Those sources considered to have more spare or excess capacity were ranked higher than those with limited capacity.

- ***Raw Water Quality*:** The options were ranked in terms of the general source water quality relative to parameters of importance to public health. Included in this ranking was consideration of the variability of water quality including frequency and amplitude of spikes of parameters such as turbidity and colour.

- ***Source Resilience to Water Quality Deterioration*:** Each option was ranked in terms of resilience to future water quality deterioration. Sources having minimal existing and future potential development within their watersheds were ranked higher than those with significant existing or potential future development.

## 2.3 Treated Water Quality

- ***Treatment Conformance with IHA Requirements*:** Each option was ranked in terms of its ability to meet IHA's water quality requirements, thereby addressing public health protection. Options having higher quality source water and/or multi-barrier treatment were ranked the highest.

- ***Risk of Human Consumption of Lower Quality Water from System*:** The options were ranked in terms of the potential risk of human consumption of lower quality water from the RDOS system. Options having components carrying lower quality water such as separated systems were ranked lower than systems containing only potable water conforming to IHA's water quality requirements.

- ***Flexibility for Phasing Filtration*:** The options were ranked in terms of their feasibility for phasing filtration. For example, options that include multiple unit treatment processed, thereby allowing the potential for phased treatment implementation and this reduced initial capital cost were ranked higher than options involving fewer process steps.

## 2.4 Operation and Security

- ***Operational Robustness*:** The options were ranked in terms of their operational complexity and robustness. Supply options having reduced mechanical and electrical components were ranked higher than those having high complexity. Treatment options having proven robust treatment components and more robust treatment processes were ranked higher than those with more complex or finicky treatment components.

- ***Operations and Maintenance Accessibility*:** The options were ranked in terms of their operations and maintenance accessibility. Those that have mechanical/electrical components at multiple locations or at long distance from the base of operations were ranked low.

- ***Operational Flexibility*:** Options were ranked in terms of their flexibility relative to potential failure of individual components. Options having more than one source of supply therefore were ranked higher than those with single sources and single pipelines.

- ***Security*:** Options were ranked in terms of their exposure to potential vandalism or security breaches. Options having treatment plants at remote locations away from the view of general public were ranked low. Options having treatment plants in developed areas with high public visibility were ranked highest.

## 2.5 Environmental/Urban Impact

- ***Construction Environmental Impacts*:** Options were ranked in terms of the impact of their construction on the natural environment.

- ***Operation – Environmental Impacts*:** Options were ranked in terms of the impact of their operation on the natural and urban environment. For instance, options involving significant water treatment residuals management requirements, high noise generation, etc., were ranked the lowest.

The qualitative assessment of each option under the above criteria is shown on Table 2-1 in Enclosure 2A.

# 3 ASSESSMENT

The following summarizes our finding relative to the qualitative assessment of each option under each of the major assessment criteria.

## 3.1 Capital Costs

The option having the lowest net capital cost was Option 1 which involved tying in to the City of Penticton supply. It should be noted that this option has higher operation and maintenance costs than some other options due to the fact that the City was incorporating capital depreciation into its rate structure. Option 4 City of Penticton Domestic Supply and Separate Irrigation was that the second highest ranked option based on net capital cost.

## 3.2 Life Cycle Cost per Lot

The option having the lowest Life Cycle Cost per Lot is Option 6 Upgrade and Separate Joint West Bench/Sage Mesa System. It should be noted however that this option assumes that the RDOS would be successful in obtaining approximately $6.6 million in government funding. Option 4 was again the second highest ranked option.

## 3.3 Government Funding Dependency

Options 1 and 4 have the least dependence on outside government funding and therefore were ranked the best in this category. Options 3 and 6 have the highest dependence on outside government finding and therefore were ranked lowest.

## 3.4 Constructability

The constructability of any option is highly impacted by geotechnical conditions, site constraints and any other factor which may impact the ability to construct the required facilities. Options 1 and 4 which involve the City of Penticton supply were ranked higher that the other options because the plant already exists and its expansion will probably not involve additional excavation and foundation works.

## 3.5 Potential Political Implementation Risks

Options 2 and 5 involve the standalone involvement of the West Bench and were therefore ranked the best in this category. Options 3 and 6 would involve the cooperation of Sage Mesa and it is unclear at the present time as to their cooperation. Options 3 and 6 were therefore ranked lowest. Options 1 and 4 would involve the approval of the City of Penticton. The City appears to be interested in supplying water to the West Bench therefore Options 1 and 4 were ranked as average under this criteria.

### 3.6 Direct Ability to Control Future Costs

Options 1 and 4 include City controlled life cycle cost components that account for over 80% of the total life cycle costs. The West Bench would therefore be at some risk of costs beyond its control. Options 1 and 4 were therefore ranked lowest in this category.

### 3.7 WTP Site Availability

Options 2, 3, 5 and 6 involve acquiring lands to construct the water treatment facilities. The ability of the RDOS to be able to purchase these lands is unclear at this time. Options 1 and 4 which don't require water plant land acquisition have therefore, been ranked the highest under this criteria.

### 3.8 Available Source Capacity

All options involve drawing the raw water supply from Lake Okanagan. The existing water licences allow withdrawal quantities exceeding the projected water demands. Options 1 and 4 have the added benefit of having a second source of supply, Penticton Creek, however the added benefit to the West Bench is marginal due to the fact that at present there is adequate licence capacity in the later. All options were therefore considered equal under this criteria.

### 3.9 Raw Water Quality

Because all options involve diverting water from Lake Okanagan they are considered equal under this category. The fact that Options 1 and 4 can also be supplied from Pentiction Creek was not considered to be either a benefit (due to an alternative source) or a detriment (due to its lower raw water quality).

### 3.10 Source Resilience to Water Quality Deterioration

Because all options involve drawing water from Lake Okanagan they are considered equal under this category.

### 3.11 Treatment Conformance with IHA Requirements

All options covered under this technical memorandum were developed on the basis of treatment conformance with IHA's requirements therefore, they have been considered to be equal under this criteria. Should consideration be given to options that don't include filtration, thus not assuring conformance with IHA's requirements, they would be ranked lower.

### 3.12 Risk of Human Consumption of Non-Potable Water

Options involving separation of the domestic and irrigation systems will involve the potential risk of ingestion of non-potable water. In this analysis we have assumed that the irrigation systems will be delivering untreated water. This does create the risk that humans could unknowingly ingest non-

potable water. Options 1, 2, and 3 were therefore considered to have a higher ranking under this criteria than Options 4, 5 and 6.

### 3.13 Flexibility for Phasing Filtration

Because all options considered have involve filtration they have been ranked equally under this criteria. Should consideration be given to options that don't include filtration they would be ranked lower under this criteria.

### 3.14 Operational Robustness

Options 2, 3, 5, and 6 are based on direct filtration treatment technology. Options 1 and 4 provide the flexibility of treating the water using direct filtration technology or conventional filtration (clarification and filtration) technology. The City of Penticton water treatment plant includes a clarifier. While the plant has the ability to treat water in the direct filtration mode, the City's current operating strategy involves directing all water through the clarifier and thus operating in conventional filtration mode. Having a clarifier in the treatment process adds robustness to the process. For this reason Options 1 and 4 were ranked higher than Options 2, 3, 5, and 6.

### 3.15 Operational Flexibility

The City of Penticton water treatment plant is supplied from two different sources and includes capabilities to treat those source waters individually or through blending. The plant includes two trains of flocculators, one clarifier, and six filters. Having increased numbers of treatment units significantly improves the ability to deal with source water quality issues, treatment process upsets, equipment malfunction and other operational issues in comparison to a plant incorporating fewer treatment units. For those reasons, Options 1 and 4 were ranked higher than Options 2, 3, and 5.

### 3.16 Security

All options would include plants located in visible urban environments. No single option was perceived to have increased security in comparison to the other options. They were therefore considered to be equal under this criteria.

### 3.17 Construction Environmental Impacts

The construction of water supply systems involves considerable disturbance to the environment during the construction process. Options 2, 3, and 5 would involve more excavation and handling of water during construction than Option 1 and 2 and were therefore ranked slightly lower.

### 3.18 Operation – Environmental Impacts

The most significant environmental impact created by the operation of water supply and treatment facilities involves the handling of liquid and solid residuals from the treatment process. Options 4, 5, and 6 involve the requirement to treat less water than Options 1, 2, and 3 and would therefore involve less residuals handling and disposal. Options 4 and 5 were therefore ranked higher than the other options.

## 4 IMPORTANCE OF EVALUATION CRITERIA

In order to assist in the evaluation process, a numerical weighting was identified for each of the evaluation criteria. Numerical scoring of options is a highly subjective exercise and therefore was not used in evaluating options. It should not be used as the sole basis for selecting one option over the others. However it was felt that understanding the importance of each criteria was important in the evaluation process.

The weighting system was established in consultation with RDOS staff relative to each of the evaluation criteria. Criteria which were considered to have higher importance to the RDOS were therefore given higher weighting applied for each of the criteria:

| Criteria | Weighting |
|---|---|
| **Cost and Cost Risks** | |
| Capital Cost | 10 |
| Life-Cycle Cost per Lot | 10 |
| Constructability | 5 |
| Water Treatment Plant Site Availability | 5 |
| **Source Capacity/Quality** | |
| Available Source Capacity | 2 |
| Raw Water Quality | 2 |
| Source Resilience to Water Quality Deterioration | 2 |
| **Treated Water Quality** | |
| Treatment Conformance with IHA Requirements | 5 |
| Risk of Human Consumption of Lower Quality Water | 3 |
| Flexibility for Phasing Filtration | 2 |
| **Operation and Security** | |
| Operational Robustness | 3 |
| Operational Flexibility | 5 |
| Security | 2 |

**Environmental/Impacts**

| | |
|---|---|
| Construction Environmental Impacts | 2 |
| Operation – Environmental Impacts | 2 |

In all of the criteria which have been given a higher weighting of importance, Options 1, 3, 4, and 6 consistently rank higher than Options 2 and 5. Options 2 and 5 involve upgrading the existing West Bench System.

Options 1 and 4, which involve the City of Penticton supply rank higher than Options 3 and 6 in the areas of Operation and Security and Environmental Impact.

Options 3 and 6, which involve joining the West Bench and Sage Mesa systems, have the lowest annual cost per lot; however this assumes significant government funding.

# 5 CONCLUSIONS

The City of Penticton options 1 and 4 consistently rank better than the other options and involve fewer risks relative to project implementation. The only downside to the City of Pentiction options is the uncertainties relative to future costs. This would necessitate having a clear contractual agreement between the parties.

Prepared by:

W.J (Bill) Harvey, P.Eng.
Project Manager

WJH/cm

Enclosure - 2A

# ENCLOSURE 2A - QUALITATIVE ASSESSMENT OF OPTIONS

File
F 5330.20
Sage Mesa

# Report

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS

# Regional District of Okanagan-Similkameen

## West Bench Water Supply Improvements Options Review Study

## Sage Mesa Stand Alone Option

**September 2007**



File: 0580-20/2025-45 AE Sept

**CONFIDENTIALITY AND © COPYRIGHT**

This document is for the sole use of the addressee and Associated Engineering (B.C.) Ltd. The document contains proprietary and confidential information that shall not be reproduced in any manner or disclosed to or discussed with any other parties without the express written permission of Associated Engineering (B.C.) Ltd. Information in this document is to be considered the intellectual property of Associated Engineering (B.C.) Ltd. in accordance with Canadian copyright law.

This report was prepared by Associated Engineering (B.C.) Ltd. for the account of Regional District of Okanagan-Similkameen. The material in it reflects Associated Engineering (B.C.) Ltd.'s best judgement, in light of the information available to it, at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Associated Engineering (B.C.) Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

# Table of Contents

# REPORT

**West Bench Water Supply Improvements**
**Options Review Study**
**Sage Mesa Stand Alone Option**

***Issued:*** September 24, 2007
***Previous:*** September 12, 2007

## 1 Objective

The objective of this study is to identify and develop an 8th option to the West Bench water system study - Technical Memorandum 1. This option conceptually examines the proposed requirements and costs associated with providing the Sage Mesa Development with Treated water from Okanagan Lake that meets the requirements of the Canadian Drinking Water Guidelines and a policy to meet these guidelines from the Interior Health Authority (IHA).

## 2 Previous Reports

In preparing this report Associated Engineering obtained copies of and reviewed the following studies:

1. Sage Mesa Water and Public Service Company Assessment Report prepared for Regional District of Okanagan-Similkameen, True Consulting Group, January 2000.

2. West Bench Water Supply Improvements - Options Review Study – Technical Memorandum No. 1. Associated Engineering Ltd. August 2007.

Some information contained in the above reports has been re-used in the preparation of this study.

## 3 Existing System

### 3.1 Existing Infrastructure

The Sage Mesa Water and Public Service Company water system is located approximately 2 km north-west of the City of Penticton, servicing 250 residential connections and two golf courses in the West Bench area. Since 1990, the water system has been managed and operated by the Water Management Branch of the BC Ministry of Environment. The system includes the following existing components:

- ***Lake Intake*:** The existing Lake Okanagan intake consists of 120 metres of 300 mm and 32 meters of 600 mm corrugated steel pipe in the lake to a depth of 13.7 m below average lake level. The intake was replaced in 2005, and remains in good condition. The screen meets the current MOE standards for screen size.

- ***Supply Pump Station*:** The existing pump station consists of a 75 HP and 25 HP pump, a chlorine feed system and associated mechanical and electrical equipment.

- ***Lower Zone and Water Reservoir:*** The lower pressure zone is based on a 454 m hydraulic grade line. The Lower zone is pressurized from the main supply pump station, and balanced using an existing water reservoir having a capacity of 272 $m^3$. The cast-in-place reservoir is on the west end of the old KVR railway ROW. The reservoir is undersized, and should be 672 $m^3$ to meet current standards (this cost is not included in this study).

- ***Upper Zone and Reservoir*:** Water is boosted from the Lower Pressure zone to a 450 $m^3$ reservoir in the Upper Zone near Forsythe Place. The existing booster pump station consists of two 75 HP pumps, a chlorine feed system and associated mechanical and electrical equipment. The proven capacity of the pump station is reported to be approximately 24 l/sec. The reservoir, also undersized, should be 1,020 $m^3$ to meet current standards (the cost of reservoir replacement is not included in this study).

- ***Distribution System*:** Both Lower and Upper pressure zones in the existing distribution system consist of pipes ranging in diameter from 75 mm to 300 mm diameter of varying material. The system serves approximately 250 domestic connections and two golf courses.

- ***Supply Pipelines*:** The existing supply pipeline from the Lake station is 200 mm diameter ductile iron pipe installed in 1979. A second 1,250 m supply pipeline from the booster station to the Upper Zone reservoir consists of 200 mm and 150 mm diameter ductile iron pipe. They are assumed to be in reasonable condition.

- ***Water Treatment:*** The current water treatment consists of Sodium Hypochlorite injection at the intake pump station. Apparently minimum chlorine contact times are not adequate (less than 5 minutes).

- **Future Works:** The True Report (2000) outlines works required basic upgrades to the system, as well as a new main line installation along Highway 97 to increase chlorine contact times. There is no mention in this report of water treatment to the minimum levels in the Canadian Drinking Water Guidelines.

Based on our review of existing reports, we have assumed, for the purposes of this study that the existing land portion of the lake intake and the existing supply pump station require complete replacement to current standards, including pump redundancy, if they are to be integrated into the system upgrading. Certain distribution system upgrades should also be undertaken and these are identified in a subsequent section of this report.

# 4 Water Demand Design Criteria

Previous studies have been undertaken by others which have included reviews of water demands. These studies have included reviews of historical demands and projection of current estimated demands for the purposes of establishing water demand criteria. As part of this study we have not undertaken a detailed review of previous demand projections.

The water supply and treatment components should be designed to meet maximum day demand. The following therefore confirms the water demand design criteria used in this report for the purposes of comparing options.

## 4.1 Sage Mesa

- ***Residential Demand***: The Sage Mesa area consists of 265 services, of which 175 are metered in the Upper Pressure Zone and 90 are unmetered in the Lower Pressure Zone. The TRUE report recorded a maximum day demand of 9.2 $m^3$ /day/lot for the upper pressure zone and 6.4 $m^3$ /lot/day for the lower pressure zone. This equates to the following:

  Upper Zone - MDD 197 x 9.2 $m^3$ /day = 1.81 ML/d
  Lower Zone - MDD 68 x 6.4 $m^3$ /day = 435 $m^3$ /day = 0.44 ML/d
  Total MDD – 265 lots – 2.25 ML/d

- ***Agricultural/Commercial Demand***: The Sage Mesa area has limited agricultural land usage; however, it includes two golf courses. The TRUE report indicated a golf course MDD of 550 $m^3$ /day = 0.55 ML/d

- ***Total Combined Demand***: Based on the above criteria the combined MDD would total 2.8 ML/d.

- ***Impact of Water Metering***: To be consistent in comparing options it should be assumed that the Sage Mesa area will be fully metered. New meters would need to be installed in the Lower Pressure Zone. For the purpose of this report we have not reduced the maximum day demands as it is unclear what impact metering will have on peak demands.

- ***Sage Mesa Design Demand***: The above calculations were based on the review of two years demand records by the consultant. For the purpose of comparing options we recommend the use of the following criteria:

  Residential Demand – 2.5 ML/d
  Golf Course Demand – 0.5 ML/d

# 5 Water Treatment

## 5.1 Raw Water Quality

The Sage Mesa water supply is drawn from Okanagan Lake. The water quality from Okanagan Lake is considered to be very good. Raw water quality characterization presented in Table 5-1 is based on a review of data from the City of Kelowna and the City of Penticton, and provides an indicator of the raw water quality since 1990. Water quality in the lake is relatively consistent and not subject to rapid significant changes. This is due to the size and volume of the lake. By withdrawing water from depths greater than 25 metres the seasonal water quality is very consistent, thereby optimizing its treatability.

**Table 5-1**
**Raw Water Quality**

| Parameters | Units | Min. | Max. | Normal |
|---|---|---|---|---|
| Alkalinity | mg/l | 101 | 122 | 109 |
| Colour | TCU | 0 | 5 | 2 |
| Hardness | mg/l | 105 | 130 | 117 |
| pH | pH | 7.5 | 9.1 | 8.0 |
| Turbidity | NTU | 0.1 | 4 | 0.5 |
| Calcium | mg/l | 30 | 38 | 34 |
| Iron | mg/l | .01 | .11 | .02 |
| UV Transmittance | % | 83 | 94 | 87 |

## 5.2 Water Quality Objectives

In 2006 Interior Health Authority established the 4.3.2.1.0 Drinking Water Objective. Under this objective the following criteria were established:

- 4 log virus removal
- 3 log Giardia and Cryptosporidium removal or inactivation
- 2 stages of treatment – see below
- 1 NTU turbidity maximum
- 0 bacterial indicators

Under the new objective a minimum of 2 stages of treatment is required for water that is at risk of containing pathogens. Filtration and disinfection should be considered on most water supplies to ensure a safe supply of water. UV light and chlorination can be considered for source water that meets the criteria for the exclusion of filtration as outlined in the Guidelines for Canadian Drinking Water Quality.

Interior Health now requires purveyors to issue a water quality advisory when turbidity values exceed 1.0 NTU and a boil water advisory if turbidity exceeds 5.0 NTU. Ultimately, all surface waters are to be filtered and this is to be taken into account in the planning of water treatment improvements by each water purveyor.

### 5.3 Water Treatment Strategy

For the purpose of comparison to Technical Memorandum No. 1, the only raw water source under consideration is Lake Okanagan.

One strategy which has been used on other systems supplied from Lake Okanagan has been to use two stage treatment consisting of UV followed by chlorination. Depending on the depth of intake and local lake limnology this strategy can be capable of meeting 4 of the 5 criteria set out in IHA's new guidelines, with turbidity being the one exception.

The IHA has also developed a draft "Filtration Deferral Strategy" and policy document. The District may be able to defer costly filtration to a later date. To meet IHA requirements, however, certain conditions need to be met, and an ultra-violet (UV) disinfection system must be added.

Direct filtration involves chemical coagulation and mixing, flocculation, filtration, and chlorination. Clarification and filtration involves the same process steps as direct filtration with the addition of clarification prior to filtration. Membrane filtration involves the use of semi-permeable membranes to remove particulate mater from the water. Depending on source water quality and membrane technology, pre-treatment may be required for removal of organic carbon and colour.

All of these treatment processes produce liquid and solid wastes that require treatment and/or disposal. A common practice is to discharge water treatment wastes to sanitary sewer, however, at the present time, this option is not available at Sage Mesa. Therefore, treatment options should include provisions for residual treatment. The selected treatment strategy for the Sage Mesa system should take into consideration local lake limnology, depth of intake, and residuals handling.

For the purpose of comparing options with results from the West Bench study (Technical Memorandum No. 1), we have selected clarification and filtration. This is a proven treatment process currently used by the City of Penticton for treating lake water. It should be noted that there is a strong possibility that both membrane filtration and direct filtration would be suitable treatment processes, however, residuals treatment would be more challenging and the direct filtration process would require the provision of UV to meet Giardia and Cryptosporidium removal requirements.

Using the clarification and filtration strategy allows for this alternative to be compared with those covered by Technical Memorandum No. 1 on a consistent basis.

# 6 Distribution System Upgrades

Previous studies have identified the need for distribution system upgrades required to the Sage Mesa System. These upgrades are crucial to increase the chlorine contact time required to the first connection. These upgrades include the following works:

The water treatment facility would have to be integrated into the pump station. The methodology of construction and the safety issues involved with a treatment facility at this lakeside pump station are beyond the scope of this study, and should be examined. We have assumed, in this instance, that the water treatment facility is combined with the current pump station at its existing location.

The pipeline replacement options found in the True Engineering Report (2000) are used here for reference. Unit costs consistent with Technical Memorandum No. 1 were used in the cost estimates to upgrade this system.

In addition to the above upgrades, this project will include installation of flowmeters on all properties. This is also common to all options and therefore included in the cost estimates for all options.

# 7 Servicing Options

Seven options were developed for comparison purposes in Technical Memorandum No.1. Four of those options were further analyzed for potential UV systems. The following additional option has been studied here:

## 7.1 Option 8 and 8-UV – Sage Mesa Stand Alone System

- ***Concept:*** This option involves performing all works required to meet current Canadian Drinking Water Guidelines, consistent with the methodology in Technical Memorandum No. 1, which examined 6 other water supply and treatment options in this area of the Regional District. Sage Mesa operates two pressure zones (lower zone 454 m and upper zone 620 m). A new pump station, intake and pipeline, consistent with the True Engineering Report (2000) would be constructed to replace an aging infrastructure. A new lake intake is required to reach the 25 meter depth necessary to avoid excess filtration requirement, and meet the required transmissivity levels to operate an Ultra-Violet disinfection system. The lake water quality is assumed to be better and more consistent at this depth than at shallower levels. Further limnological review is required to confirm this. A new main line would supply Sage Mesa from the intake to a tie-in near the lower Sage Mesa Reservoir. Refer to Plan 1- 8.

- ***Lake Intake and Pump Station:*** The raw water supply system would consist of a 300 mm diameter HDPE pipe extended approximately 700 lin. m to a lake depth of approximately 25 m and a new pumping unit on the current site.

- ***Water Treatment:*** The water treatment facility would be included in the construction of the new pump station on the lake. This, coupled with the new supply pipeline, would solve the chlorine contact time issue.

- ***Water Supply System:*** The water supply system would include the following components:

  - High Lift Treated Water Pump Station: The treated water pump station would be sized to deliver 3 ML/d from a clearwell on the discharge side of the water treatment plant. The pump station would consist of 2 duty pumps dedicated to supplying Sage Mesa at lower zone HGL 454 m.

  - Supply Pipeline: A new 300 mm supply pipeline would supply water from the treated water pump station along Highway 97 to connections in Sage Mesa via a new 250 mm water main to the Sage Mesa Lower Reservoir.

  - Existing Supply Components: Some components, such as the existing intake and pump station supply components would need to be replaced. Much of the pipeline distribution system can remain as is, depending on condition.

- ***Potential Issues:***

  - The new water treatment plan site would require Ministry of Environment approval.

  - The intake location and depth would require further limnological review and water quality data.

  - The water treatment plant would have to be laid out and constructed to allow the existing intake pump station to continue operating during the construction period (or otherwise the water treatment plant would have to be relocated to the lower zone reservoir site.

  - The operation and maintenance costs for the filtration plant will have a significant impact on future annual taxes.

# 8 Cost Estimates

## 8.1 Cost Estimating Basis for On-Site Facilities – Conventional Filtration

The capital cost estimates used for the comparison of the options have been developed using unit pricing for all components. The unit pricing is based on 2007 dollars and includes a 30% allowance for engineering and contingencies. Unit pricing used for developing the cost estimates is included in the appendices. Breakdowns for the costs are also provided in the appendices.

The operation and maintenance costs have been determined by separating out energy costs from other O&M costs and basing the other O&M costs on percentage of capital costs, depending on the type of facility or construction.

Table 8-1 summarizes capital and operating costs for each option:

**Table 8-1**
**Conventional Filtration**
**Capital and Operational Cost Summary**

| Option | Name | Supply and Distribution System Capital Cost | Water Treatment Capital Cost | Capital Cost | Initial Annual O&M Cost |
|---|---|---|---|---|---|
| 8 | Sage Mesa – Stand Alone System | $2,925,000 | $2,153,000 | $5,078,000 | $153,000 |

## 8.2 Life Cycle Costing Basis – Conventional Filtration

Capital costs were applied in the life cycle costing on a one time basis at the front end of the life cycle. It was assumed that there would be no phasing of the capital works.

Operation and maintenance costs were projected over a 20 year life. It was assumed that demands would remain constant over the 20 year period and therefore operation and maintenance costs were also constant except for inflation. An inflation factor of 2.1% per annum was applied to future operating costs. This is the same inflation factor used by the City of Penticton for calculating its future costs.

### 8.3 Provincial Funding Assumptions

The RDOS was successful in obtaining provincial funding for the West Bench project alone under the BC Water Improvement Program. The RDOS has applied for additional funding due to concerns about escalating construction costs and the cost impacts of providing filtered water. It is our understanding that this funding could not be applied to off-site facilities or land acquisition and does not apply, at this time, to Sage Mesa. The costing included herein shows the impact of the RDOS obtaining 2/3 funding assistance on all capital costs within its direct control.

### 8.4 Life Cycle Cost Per Connection

In order to compare options on an equitable basis the life cycle costs were calculated on a cost per connection basis. The costs per connection were calculated using the net capital cost assuming a government contribution of ⅔ of the onsite costs.

### 8.5 Life Cycle Cost Estimates

For this option, the calculated increase in annual taxes per connection is shown in Table 8-2. This cost represents the increased annual cost for debt retirement and operation and maintenance that will have to be covered by the Sage Mesa ratepayers if the improvements were implemented. These costs are over and above the existing rates.

**Table 8-2**
**Conventional Filtration**
**Life Cycle Cost Summary**

| Option | Name | Net Capital Cost Based on Gov't Grant of ⅔ of Capital Costs | Inflated O&M Life Cycle Cost – 20 year | Total Debt Servicing O&M Life Cycle Cost - 20 year | No. of Connections | Net Life Cycle Cost Per Connection | Total Annual Cost Per Lot |
|---|---|---|---|---|---|---|---|
| 8 | Sage Mesa Stand Alone System | $1,693,000 | $3,766,000 | $6,506,000 | 265 | $24,550 | $1,228 |

# 9 Assuming Filtration Deferral From IHA – UV and Chlorination Costs

Similar to Tables 8-1 and 8-2, costs were developed assuming that Sage Mesa applies and is granted a filtration deferral for their new water treatment system. The water treatment would then consist of Chlorination and UV disinfection, with allowances for future filtration. The capital costs are thus revised, with Table 8-3 providing results for Capital and O&M Costs, and Table 8-4 providing life cycle costs.

**Table 8-3**
**Filtration Deferral – Ultra-Violet and Chlorination Disinfection**
**Capital and Operational Cost Summary**

| Option | Name | Supply and Distribution System Capital Cost | Water Treatment Capital Cost | Capital Cost | Initial Annual O&M Cost |
|---|---|---|---|---|---|
| 8 | Sage Mesa Stand Alone System | $2,925,000 | $608,000 | $3,533,000 | $74,000 |

**Table 8-4**
**Filtration Deferral – Ultra-Violet and Chlorination Disinfection**
**Life Cycle Cost Summary**

| Option | Name | Net Capital Cost Based on Gov't Grant of ⅔ of Capital Costs | Inflated O&M Life Cycle Cost – 20 year | Total Debt Servicing O&M Life Cycle Cost - 20 year | No. of Connections | Net Life Cycle Cost Per Connection | Total Annual Cost Per Lot |
|---|---|---|---|---|---|---|---|
| 8 | Sage Mesa Stand Alone System | $1,178,000 | $1,813,000 | $3,805,000 | 265 | $14,360 | $718 |

## 10 Recommendations

1. The Regional District review this report with the Community-at-large to receive feedback on this and other options presented and impact on taxes.

2. Based on successful UV treatment of Okanagan Lake water by other local communities in the area, a treatment option that includes filtration deferral (UV and chlorination) should be chosen.

3. Limnological studies on Okanagan Lake near the intake should proceed immediately to obtain the necessary data for obtaining the IHA Construction Approvals and filtration deferral, as well as proceed with design.

4. Obtain written clarification from IHA regarding acceptable treatment strategies for Sage Mesa.

Prepared by:

W.J. (Bill) Harvey, P.Eng.
Project Manager

WJH/cb

Enclosure 3 – Cost Estimating Data

# ENCLOSURE 3 - COST ESTIMATING DATA

# Regional District of Okanagan-Similkameen
# West Bench Water Supply Improvements
# Options Review Study

## Table 1
## System Options Costs

| OPTION | NAME | TREATMENT | Supply and Distribution System Capital Cost | Water Treatment Capital Cost | Capital Cost | Net Capital Cost Based on Gov't Grant of 2/3 of Onsite Costs | Annual Debt Serving Cost (Note 1) | 20 Year Debt Servicing Cost | Initial Annual Operating Cost | Total Inflated 20 Year O&M Cost - 2007-2026 (Note 2) | Total 20 Year Debt Servicing and O&M Cost | No. of Connections | Total Cost Per Lot | Total Annual Cost per Lot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | Sage Mesa / Stand Alone | Clarification/Filtration | $2,925,000 | $2,152,800 | $5,077,800 | $1,693,000 | $137,005 | $2,740,099 | $153,446 | $3,765,690 | $6,505,789 | 265 | $24,550 | $1,228 |

Notes:
1) Assumed Interest Rate 5.10%
2) To date, only $2.35M grant has been approved.
3) Assumed Inflation Rate 2.10%

# Regional District of Okanagan-Similkameen
# West Bench Water Supply Improvements
# Options Review Study

## Table 2
## System Options Costs - UV

| OPTION | NAME | TREATMENT | Supply System Capital Cost | Water Treatment Capital Cost | Capital Cost | Net Capital Cost Based on Gov't Grant of 2/3 of Onsite Costs | Annual Debt Serving Cost (Note 1) | 20 Year Debt Servicing Cost | Initial Annual Operating Cost | Total Inflated 20 Year O&M Cost - 2007-2026 (Note 2) | Total 20 Year Debt Servicing and O&M Cost | No. of Connections | Total Cost Per Lot | Total Annual Cost per Lot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8-UV | Sage Mesa Stand Alone | UV/Chlorination | $2,925,000 | $608,400 | $3,533,400 | $1,177,800 | $99,620 | $1,992,408 | $73,873 | $1,812,909 | $3,805,317 | 265 | $14,360 | $718 |

Notes:
1) Assumed Interest Rate 5.10%
2) Assumes that all 2/3 capital cost grant is approved. To date, only $2.35M grant has been approved for West Bench.
3) Assumed Inflation Rate 2.10%

Table 3h
OPTION 8
Sage Mesa Stand Alone System

| Component | Capacity (ML/d) | Size | Units | Length (m) | Capital Cost | Initial Annual O&M Cost |
|---|---|---|---|---|---|---|
| **Supply System** | | | | | | |
| New Deep Intake Pipe | 3 | 300 | mm | 700 | $546,000 | $2,730 |
| Additional Water Meters for Sage Mesa | | 265 | @ $1000 | | $265,000 | $1,325 |
| Highway Crossing | 3 | 250 | mm | 70 | $109,200 | $546 |
| WTP Land Acquisition | | 1 | ha | | $300,000 | $0 |
| Lake Intake Pumpstation | 3 | 75 | kw | | $666,250 | $23,088 |
| Treated Water Pumpstation | 3 | 20 | kw | | $559,000 | $9,970 |
| Wtr Supply Mn - Sage Mesa | 3 | 250 | mm | 1010 | $479,245 | $2,396 |
| **Subtotal** | | | | | **$2,925,000** | **$40,055** |
| **Water Treatment** | | | | | | |
| Chemical Coagulation and Mixing | 3 | | | | $93,600 | |
| Flocculation | 3 | | | | $280,800 | |
| Clarification | 3 | | | | $655,200 | |
| Filtration | 3 | | | | $795,600 | |
| Primary Disinfection | 3 | | | | $140,400 | |
| Secondary Disinfection | 3 | | | | $0 | |
| Residuals Management | 3 | | | | $187,200 | |
| **Subtotal** | | | | | **$2,152,800** | **$113,391** |
| **TOTAL** | | | | | **$5,077,800** | **$153,446** |

**Regional District of Okanagan-Similkameen**
**West Bench Water Supply Improvements Options Review**
**Sage Mesa Stand Alone Option**
**Table 4**
**Water Treatment Cost Estimates**

| TREATMENT OPTION | ESTIMATED COST (See Note 1) | | | | | | | TOTAL CAPITAL COST | ANNUAL O&M COST | 20 YEAR O&M COST | PRESENT VALUE O&M |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Chemical Coagulation and Mixing | Flocculation | Clarification | Filtration | Primary Disinfection | Secondary Disinfection | Residuals Treatment | | | | |
| SAGE MESA (STANDALONE) - 3 ML/d | | | | | | | | | | | 3.00% |
| DISINFECTION (WITHOUT FILTRATION) | | | | | | | | | | | |
| Chlorination | | | | | $140,400 | | | $140,400 | $7,438 | $ 148,766 | $110,663 |
| Ozone/Chlorination | | | | | $936,000 | $140,400 | | $1,076,400 | $59,049 | $ 1,180,971 | $878,494 |
| UV/Chlorination | | | | | $468,000 | $140,400 | | $608,400 | $33,819 | $ 676,371 | $503,135 |
| FILTRATION | | | | | | | | | | | |
| Direct Filtration/UV | $93,600 | $280,800 | | $982,800 | $468,000 | $140,400 | $187,200 | $2,152,800 | $113,391 | $ 2,267,829 | $1,686,978 |
| Conventional Filtration | $93,600 | $280,800 | $655,200 | $795,600 | $140,400 | | $187,200 | $2,152,800 | $113,391 | $ 2,267,829 | $1,686,978 |
| Membrane Filtration | $93,600 | $280,800 | | $1,497,600 | $140,400 | | $187,200 | $2,199,600 | $165,129 | $ 3,302,571 | $2,456,696 |

Note 1: Cost estimates for each treatment process include process equipment, all associated ancillary equipment, electrical & instrumentation, associated structures and siteworks, and associated residuals handling plus 30% allowance for engineering and contingencies.

**Regional District of Okanagan-Similkameen**
**West Bench Water Supply Options Review**

## Table 5
## Supply System Cost Estimates

| OPTION | NAME | Component | Capacity (ML/d) | Size | Units | Length (m) | Capital Cost | Initial Annual O&M Cost | 20 Year O&M Cost | PRESENT VALUE O&M |
|---|---|---|---|---|---|---|---|---|---|---|
| 8 | Sage Mesa System (Standalone) | New Deep Intake Pipe | 3 | 300 | mm | 700 | $546,000 | $2,730 | | |
| | | Additional Water Meters for Sage Mesa | 265 | @ $1000 | | | $265,000 | $1,325 | | |
| | | Highway Crossing | 3 | 250 | mm | 70 | $109,200 | $546 | | |
| | | WTP Land Acquisition | | 1 | ha | | $300,000 | $0 | | |
| | | Lake Intake Pumpstation | 3 | 20 | kW | | $559,000 | $9,970 | | |
| | | Treated Water Pumpstation | 3 | 75 | kW | | $666,250 | $23,088 | | |
| | | Wtr Supply Mn - Sage Mesa | 3 | 250 | mm | 1010 | $479,245 | $2,396 | | |
| | Subtotal | | | | | | $2,925,000 | $40,055 | $ 801,095 | $ 595,913 |

1) Intake pump station installed KW assumes 2 duty, 1 spare, and 1 engine drive
2) Treated water pump station installed KW assumes 2 duty, 1 spare, and 1 engine drive
3) Irrigation water pump station installed KW assumes 2 duty and 1 spare, no engine drive

Table 7.
Water Treatment Unit Costs

| Process | Larger System Base Cost Per ML/d (1) | Smaller System Base Cost Per ML/d (2) |
|---|---|---|
| Chemical Coagulation and Mixing | $26,000 | $31,200 |
| Flocculation | $78,000 | $93,600 |
| Clarification | | |
| -Conventional Tube or Plate Settler | $182,000 | $218,400 |
| Filtration | | |
| -High Rate (12 m/hr) | $273,000 | $327,600 |
| -High Rate (18 m/hr) | $221,000 | $265,200 |
| -Membrane | $416,000 | $499,200 |
| Primary Disinfection | | |
| -Chlorine | $39,000 | $46,800 |
| -Ultraviolet | $130,000 | $156,000 |
| -Ozone | $260,000 | $312,000 |
| Residuals Treatment | | |
| -Plate Settler/Thickener Centrifuge Add this when no san sewer available | $52,000 | $62,400 |

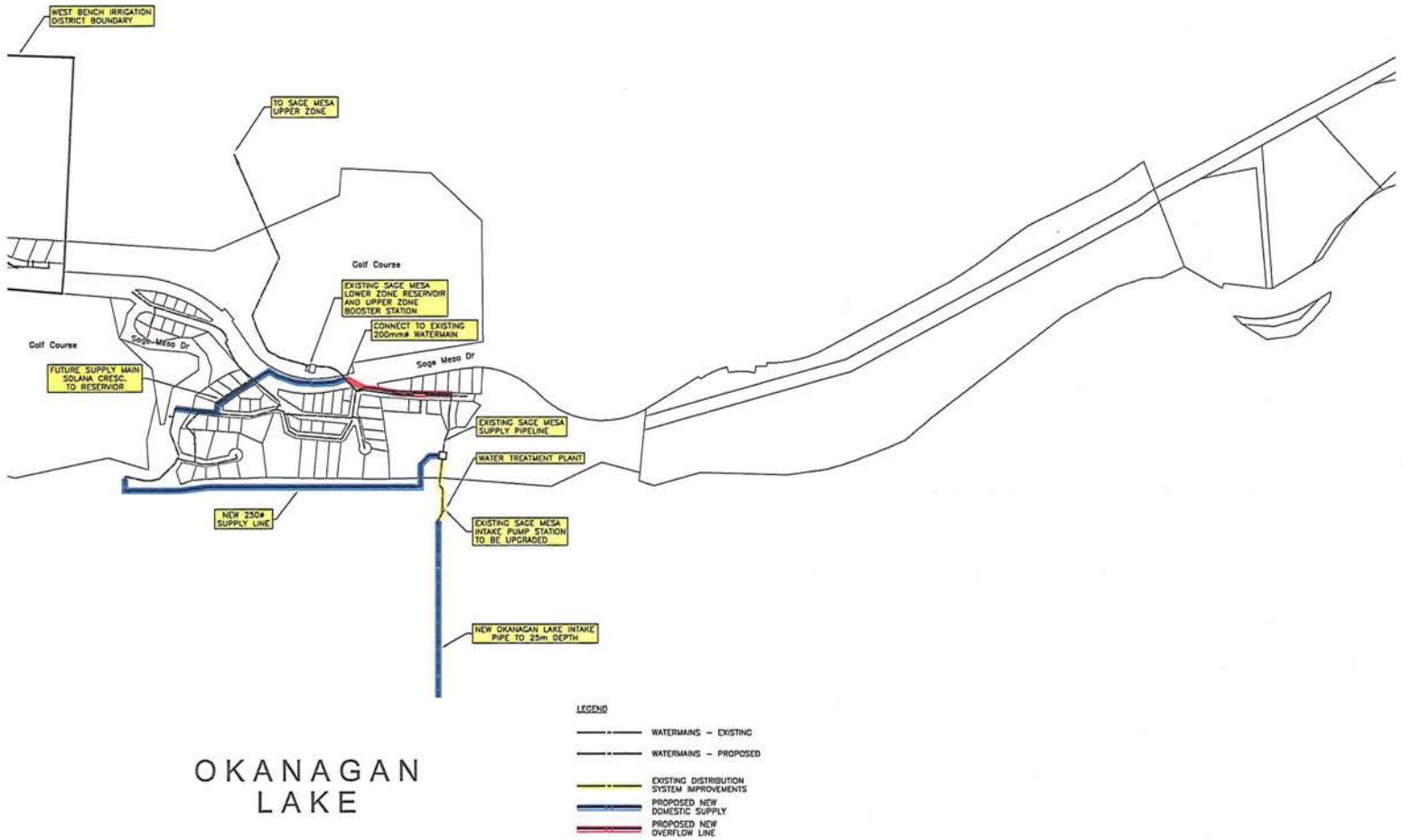
Notes
(1) Based on 5 ML/d plant size and larger
(2) Based on 4 ML/d plant size and smaller
(3) All costs include a 30% allowance for engineering & contingencies

Table 8
Unit Costs - Buried Pipe

| Diameter | Pipe Supply & Install (1) | Hydrants & Valves (2) | Pavement Restoration | Total Excl Pavement | Total Incl Pavement |
|---|---|---|---|---|---|
| 150 | $140 | $40 | $75 | $180 | $255 |
| 200 | $190 | $45 | $75 | $235 | $310 |
| 250 | $240 | $50 | $75 | $290 | $365 |
| 300 | $290 | $55 | $75 | $345 | $420 |
| 350 | $340 | $60 | $90 | $400 | $490 |
| 400 | $390 | $65 | $90 | $455 | $545 |
| 450 | $440 | $70 | $90 | $510 | $600 |
| 600 | $590 | $75 | $100 | $665 | $765 |
| 750 | $740 | $80 | $100 | $820 | $920 |
| 900 | $890 | $90 | $100 | $980 | $1,080 |

Notes:
(1) PVC or DI Pipe
(2) Assumes buried line valves, one hydrant per 100m, one air valve assembly per 500m
(3) Costs do not include engineering and contingencies

This Drawing Is For The Use Of The Client And Project Indicated
No Representations Of Any Kind Are Made To Other Parties




| NO. | DATE | ENG. | BY | SUBJECT |
|---|---|---|---|---|
| REVISIONS | | | | |

VERIFY SCALES

BAR IS 20mm ON ORIGINAL DRAWING

0 —— 20mm

IF NOT 20mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PRELIMINARY
NOT FOR CONSTRUCTION

Associated Engineering

| | | |
|---|---|---|
| PROJECT No. | 20062941 | |
| SCALE | 1:5000 | |
| DRAWN | A. PLONIDIN | |
| DESIGNED | R. MACLEAN | |
| CHECKED | | |
| APPROVED | | |
| DATE | | INITIAL |

REGIONAL DISTRICT OF OKANAGAN-SIMILKAMEEN

KEY PLAN

SAGE-MESA
STAND ALONE
OPTION 8

| DRAWING NUMBER | REV. NO. | SHEET |
|---|---|---|
| PLAN 1-8 | | |

# WEST BENCH IRRIGATION DISTRICT

# WATER SUPPLY OPTIONS

*Prepared for:*

*West Bench Irrigation District*

*Prepared by:*
*Stantec Consulting Ltd.*
*300 - 1708 Dolphin Avenue*
*Kelowna, British Columbia V1Y 9S4*

*APRIL 2006*

# West Bench Irrigation District: Water Supply Options

## Table of Contents



### List of Figures



### List of Tables



### Appendices

# 1.0 Introduction

In the last 15 years, West Bench Irrigation District (WBID) has undertaken a program of replacing steel watermains and upgrading the supply system. This work was done without the benefit of receiving grants from senior levels of government. Applications for funding under the Canada BC Infrastructure Program were prepared by the Regional District of Okanagan Similkameen (RDOS) and resubmitted in 2005 under the new BC Water Improvement Program (BCWIP). RDOS has been awarded an Infrastructure Grant for upgrading the WBID water supply system. This upgrade included replacement of water mains, installation of water meters, and upgrades of the water supply system including ultraviolet (UV) disinfection. The grant application was based on a conceptual design and cost estimate prepared by Stantec Consulting Ltd. for RDOS on February 21, 2005 for RDOS. Since completion of this conceptual report, further discussions have occurred with the City of Penticton regarding the potential for a connection to the City's water system and there have been further construction cost increases. The Provincial Government is in support of WBID studying all options and has agreed to allow RDOS to transfer the grant funding from the BCWIP to the City of Penticton if necessary.

WBID retained Stantec Consulting to look into various water supply options for the District and update our opinion of probable costs for these options based on a more detailed analysis of the requirements for each project and updating of prices for construction and materials. WBID requested Stantec investigate three options:

**Option 1** Obtain fully-treated water supply from the City of Penticton and abandon the existing supply from Okanagan Lake

**Option 2** Upgrade WBID supply system to provide ultraviolet disinfection

**Option 3** Examine the potential for a new water supply system that will feed both Sage Mesa and West Bench

Within each of these options there are a number of common projects in the West Bench distribution system. This includes the installation of meters on all connections and replacement of watermains in certain areas.

The following sections of this report will provide information on the system components that will require upgrading and our opinion of probable costs for these works. It should be noted that much more detailed engineering work will be required to confirm the sizing of each component and cost of the system. Final costs will only be known when tendering is received and construction is complete. It is the intent of this report to provide the District with sufficient information to select a preferred option, and then move into preliminary design for that option.

# 2.0 Design Criteria

Design criteria used in determining sizes of system components are outlined in this section. These criteria were previously established in water studies completed for the District as well as an assessment of the West Bench water supply system completed for RDOS in 2001.

## 2.1 SYSTEM COMPONENTS

The adequacy of water system components to meet the demands of the users is evaluated using the following criteria. These criteria are based on previous studies, typical criteria for water systems in the Okanagan and subdivision bylaws for RDOS and the City of Penticton.

- **Water Treatment**

  The Interior Health Authority (IHA) has set guidelines for all purveyors to meet. These guidelines suggest that the "4,3,2,1,0" rule be obtained by water suppliers. The 4,3,2,1,0 rule means:

  - 4 log reduction for viruses
  - 3 log reduction for Giardia
  - 2 log reduction for Cryptosporidium
  - less than 1 NTU *
  - zero coliforms

  * Medical Health Officer stated a long-term objective of 0.1 NTU, CDWG state 1.0 NTU as the standard

  Recent discussions with Ron Johnston, P.Eng. at IHA indicated that standards for the interior will now require purveyors to issue a water quality advisory when turbidity values exceed 1.0 NTU and a boil water advisory if turbidity exceeds 5.0 NTU. He also stated that ultimately **all** surface water sources are to be filtered. Although the requirement for filtering existing surface water sources is a long-term objective, it should be taken into account in the planning of water treatment improvements by each water purveyor.

- **Pumping Capacity and Supply System**

  The supply pumps must be capable of pumping the maximum day demand with the largest pump out of service. The lake intake (where applicable) must be capable of conveying water from the lake to the pump station at a rate equal to the pumping rate and maintain water level sufficient for pump operation. The source must be capable of supplying the total District demands.

Maximum Day Demands for West Bench are estimated to be:

| | |
|---|---|
| Residential connection | 0.126 l/s/connection (2.0 USgpm) |
| Irrigation | 0.378 l/s/acre (6 USgpm) |

- **Balancing Storage**

  A storage volume of 25 percent of the total maximum day domestic demand plus fire flow is typically recommended for a municipal system. Where balancing storage is not provided, pumping systems with standby power may be acceptable.

- **Fire Demand**

  A minimum residential fire flow of 60 l/s (950 USgpm) for 1.5 hours duration and 85 l/s for 2 hours for the school has been utilized in previous studies. The RDOS Subdivision Servicing Bylaw does require minimum fire flows of 75 l/s for new residential development and that Fire Underwriters Survey requirements be met.

- **Pressures**

  Typical pressures are to be maintained between 275 and 690 kpa with a minimum of 135 kpa at a fire site during a maximum day.

- **Distribution System**

  The distribution system must be capable of conveying the maximum day demand plus fire flow or peak hour demand. Velocities of the water in pipelines should be kept less than 2.0 m/s except near a fire where 4.0 m/s is permitted. Mains should be looped wherever possible.

## 2.2 WATER DEMANDS

The following analysis was completed for determining expected demands for the District. The demands determine sizing of each component of the water system so it is important to arrive at figures that accurately reflect water use in the community. The following sources of information were reviewed.

- **Previous Water Studies**

  Stantec completed a water study in 1999 that reviewed West Bench's water system. An analysis of demands indicated flows were at a peak during July of 1998. On July 27, 1998, 10,000$m^3$ of water was utilized in the District. This value was compared to expected demands based on bylaws and typical water use. The calculated theoretical maximum day demand (MDD) for the District was estimated to be 8580$m^3$/day based on 353 domestic connections and 145 acres of irrigated lands. The 145 acres of irrigated land was based on a study completed in 1983 by Stantec. At that time there was a total

of 295 acres of Grade A land (irrigated). Within the 295 acres there were 300 homes. Using an average lot size of 0.5 acres for each home, we established an area that was irrigated of approximately 145 acres (295 acres – (300 x 0.5) = 145). This calculation was done as most lots in West Bench at the time were large and had small orchards. As noted the water use on July 27/98 exceeded estimated demands by approximately 15%. As a result, the 1999 study set the MDD for the District at 10,000$m^3$/day.

- **Current Estimated Demands**

Utilizing the same criteria for unit demands (2.0 USgpm per lot, 6 USgpm per acres of irrigation) we have recalculated demands based on current conditions. Since the completion of the 1999 study, the District has implemented water conservation programs including odd/even day watering, no lawn watering between 9:00am and 6:00pm, and public education programs. In addition, a number of orchards have been removed and more efficient watering systems have been installed. WBID provided a letter dated February 19, 2006 that indicated the remaining large parcels with irrigation totaled 72 acres and the total number of connections to be 351 (previous reports used 353). The estimated demands using this value are:

| | | |
|---|---|---|
| 351 connections x 0.126 l/s x 60 x 1.440 = | | 3821 $m^3$/day |
| 72 acres x 0.378 l/s x 60 x 1.440 = | | 2351 $m^3$/day |
| | **TOTAL** | **6172 $m^3$/day** |

This demand calculation may under estimate the actual demands as a number of the irrigated areas that may have had orchards removed may still be irrigated (lawns) or they could be returned to agricultural use in the future.

- **Flow Record Review**

Flow records were provided by the District for 2000 to 2005. The following maximum day demands were noted:

| | |
|---|---|
| 2000 | 6360$m^3$/day |
| 2001 | 6500$m^3$/day |
| 2002 | 6940$m^3$/day |
| 2003 | 6230$m^3$/day |
| 2004 | 5620$m^3$/day |
| 2005 | 5600$m^3$/day |

Flows have been dropping since 2002, possibly as a result in water conservation efforts. However, as the demand in 2002 is recent, we would estimate MDD's to be approximately 7000$m^3$/day based on this data.

- **Summary of Calculations**

  Based on the various analyses presented above we estimate the maximum day demand to be 7000 $m^3$/day. This value will be utilized in determining component size for the various options analyzed for system upgrading as follows:

  - Tie in to City of Penticton
    MDD - 7000$m^3$/day (1280 usgpm)
    Pump Rate – 2 @ 650 usgpm plus one standby.
  - Upgrade existing system
    MDD - 7000$m^3$/day (1280 usgpm)
    Pump Rate – 2 @ 800 usgpm (existing pumps) plus one standby.
  - Sage Mesa/ West Bench
    MDD - 7000$m^3$/day – West Bench
    MDD - 3000$m^3$/day – Sage Mesa*
    Pump Rate – 2 @ 950 usgpm plus one standby.

    *Sage Mesa Report January 2000 estimates MDD @ 2660$m^3$. Use 3000$m^3$/day to provide for growth since 2000. This value includes golf course water which could possibly be separated from the domestic supply – ie. Use old pump station for golf course.

It should be noted that these calculations do not include an allowance for growth. At this stage for the purpose of comparison of options, we have utilized existing demands only. When a preferred option is selected, potential growth and expansion of service area should be examined. With the implementation of water metering, there should be some reduction in demands that could service new development.

# 3.0 SERVICING OPTION

The following section outlines the various servicing options, provides conceptual designs of each, and provides our opinion of probable costs for each option. There are certain components of the project that are common to all options. They are identified in Section 3.1.

## 3.1 WEST BENCH SYSTEM UPGRADE

In the last 15 years, WBID has undertaken a program of replacing the old steel watermains in the distribution system. Previous studies had identified additional mains that were considered to be a high priority for replacement. These mains were identified in our letter of February 21, 2005 and consist of the following:

- Newton Drive from West Bench Drive to Spartan
- Spartan Drive
- Veteran Drive – North end
- Vedette Drive – North end
- Moorpark Drive – South end including Sunglo Drive to Russett
- Pumphouse supply mains

*Figure 3.1* provides a layout of these mains.

The above-noted mains generally consist of 75 and 100 mm steel mains that have in the past created the largest number of leaks due to corrosion. Vedette Drive is 150 mm, the supply mains are 400 mm and 300 mm. The supply mains were replaced in 1979 with ductile iron. There has only been one leak on this line so we anticipate they are still in reasonable shape. Further investigation of their condition should be done before any replacement of these sections is planned.

On previous projects mains were generally replaced with 150 mm pvc. Where mains are dead end, a 150 mm pvc pipe can generally meet fire demands of 60 l/s at MDD. However flows of 75 l/s (RDOS bylaw minimum) plus MDD can not be achieved within the velocity requirements of 4.0 m/sec. Hydraulic modeling of the system would be required to determine if pressures are maintained at fire flows. For this study we have used replacement sizes identified in previous studies – these should be confirmed at the preliminary design stage.

Some main replacements will require obtaining easements from property owners. Costs for obtaining these, or additional costs for rerouting mains around these easements are not included. For the supply mains from the pump house (either West Bench or City of Penticton option) a new alignment is proposed. This alignment avoids rear yard installation where currently no easements are in place. It does however require easements to be obtained.

A summary of our opinion of probable costs for these mains is provided in the following *Table 3.1*. A breakdown of each cost is provided in Appendix A. The costs include a contingency allowance as noted in the breakdown.

**Table 3.1**
**Watermain Replacement Costs**

| Location | Length/Size | Cost |
|---|---|---|
| Newton Drive | 650m – 200mm | $299,000 |
| Sparton Drive | 470m – 150mm | $182,000 |
| Veteran Drive | 240m – 150mm | $101,000 |
| Moorpark/ Sunglo Drive | 490m – 150mm | $161,000 |
| Vedette Drive | 240m – 150mm | $66,000 |
| Pump House Supply Mains | 970m – 300mm | $419,000 |
| | **Subtotal** | **$1,228,000** |
| | **Engineering (10%)** | **$122,800** |
| | **TOTAL** | **$1,350,800** |

There are a number of other components of the West Bench Supply System that will need to be upgraded or replaced in the future. Items identified by WBID include:

- Existing lake intake section
- Two 150 hp pumps
- MCC and PLC
- Building repairs and chlorination system upgrade

An order of magnitude estimate to replaced items associated with supply system is:

| | |
|---|---|
| • Lake intake (600 m long) | $500,000 |
| • Two 150 hp pumps | $100,000 |
| • MCC and PLC | $220,000 |
| • Building repairs and chlorination system upgrade | $70,000 |
| SUBTOTAL | $890,000 |
| 25% contingency & engineering | $223,000 |
| **TOTAL** | **$1,113,000** |

In addition to these items there would be approximately 1.5 km of distribution system upgrades that have a lower priority than ones identified above.

The other major system component upgrade would be the installation of meters. The original grant application included for meter installation inside the homes. As many of the services have irrigation connections between the property line and the home, installation of meters should be done at the property line. These meters are however more expensive than the interior meters both for installation and purchase. Our opinion of probable costs for meter installation based on pricing received from Terasen Gas are as follows. It should be noted that some of the meters would be installed at the time of the watermain replacements so these installation costs would be reduced.

**Table 3.2**
**Metering Costs**

| Item | Number | Unit Cost | Total |
|---|---|---|---|
| Exterior meters install as part of waterline project | 63 | $800 | $50,400 |
| Exterior meter on existing connection | 288 | $1,200 | $345,600 |
| | | **Subtotal** | **$396,000** |
| | | **Contingency & Engineering (15%)** | **$60,000** |
| | | **TOTAL** | **$456,000** |

## 3.2 OPTION 1 – CITY OF PENTICTON TIE-IN

Stantec Consulting Ltd., on behalf of WBID, approached the City of Penticton with a request that the City consider supplying water to West Bench. Currently the City of Penticton operates and maintains the WBID water supply system. The City of Penticton responded with a letter dated February 1, 2006, copy in Appendix B. The letter stated that the City would support Stantec Consulting reviewing the City tie-in as an option to investigate but would not commit to whether they would supply WBID with treated water.

One concern from City staff was the amount of water used for irrigation. They felt that treated water should not be used for irrigation of orchards/vineyards on the West Bench. While it would be desirable to have a separate irrigation supply for some of the larger agriculture users, generally located between Bartlett Drive and Newton Drive, this would require maintaining a separate water supply system and installing dual distribution pipeline for the agricultural areas.

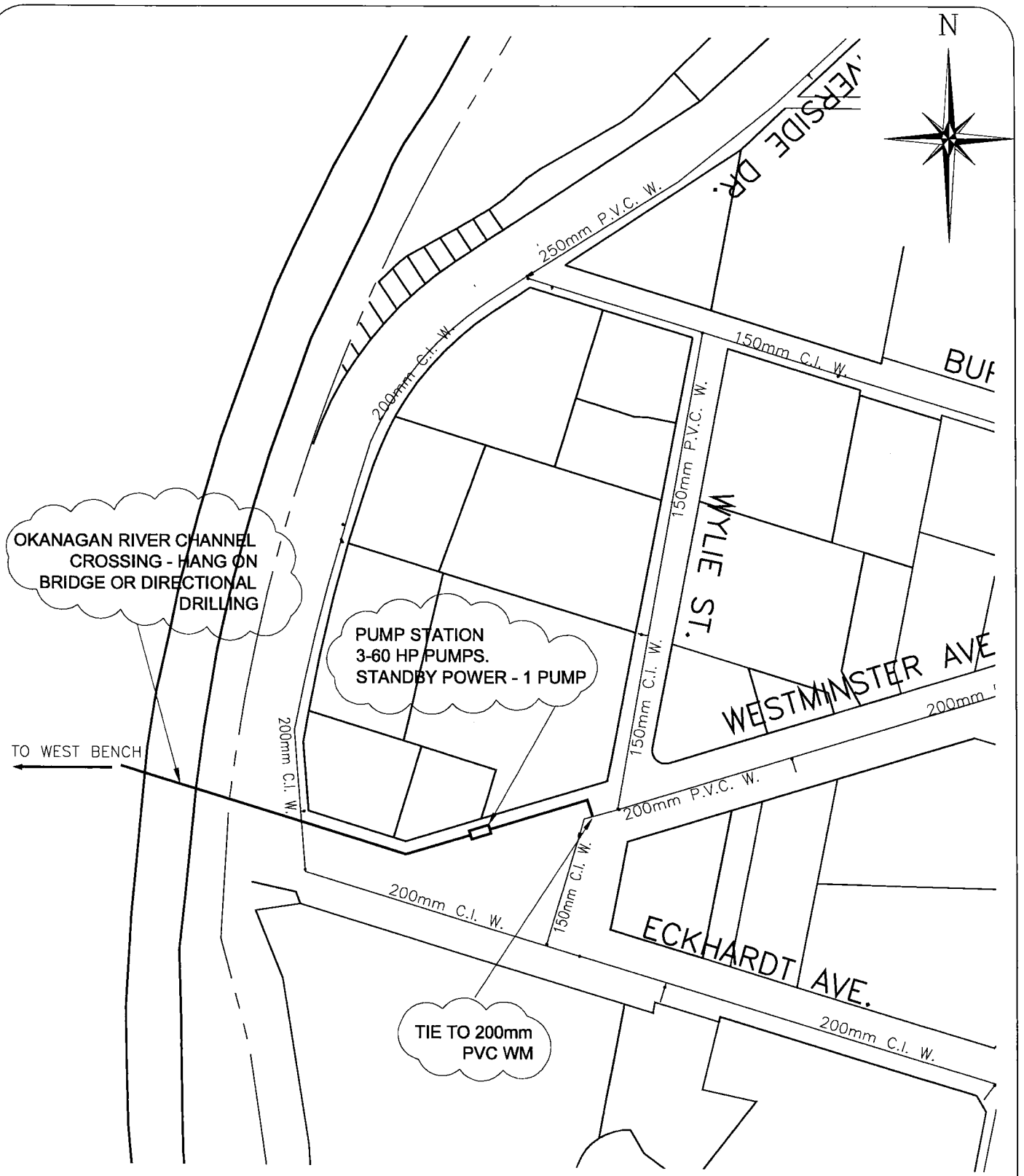
The existing intake, pump house, and supply main could be utilized to provide irrigation water to the central area of the district if it became a requirement to separate some of the irrigation supply from domestic. This would however require installation of some additional supply mains, connection to existing services, and maintaining the existing WBID supply system which, over time, will require upgrading/replacement of existing supply line, intake, and pump house. Given the cost of this, both capital and operating, it is unlikely that the benefit received would justify the cost. As noted in Section 2, the lands that have primarily agricultural uses are approximately 72 acres. These are intermixed with the domestic users.

At this stage we have assumed all supply will come directly from the City. Further study would be required to determine the cost/benefit of providing a separate irrigation supply (untreated lake water or river channel, or effluent from the Advanced Wastewater Treatment Plant).

In order to supply WBID with water from Penticton, the capacity of the city's distribution system in the area of a tie-in location was investigated. The City recently updated its water model through an overall study Earth Tech completed. Stantec retained AF Consulting, the subconsultant Earth Tech had retained to complete the water model, to run a computer simulation of the City's distribution system. With a demand of 82 l/s (2 pumps @ 41 l/s – 650 USgpm) taken from the distribution system at the intersection of Westminister and Eckhart Avenues, the distribution system can still provide fire flows of at least 150 l/s in the general area (see AF Consulting Report in Appendix C). Therefore, the existing distribution system is capable of supplying West Bench without any upgrades.

In order to pump water to the West Bench Reservoir, a pump station would be constructed in the area of the "Welcome to Penticton" sign.

The pump station would have 3-60 hp horizontal split case pumps installed in a block building. Standby power would be provided for one pump to make up for shortfalls in fire storage at the reservoir and provide emergency back up. A 300 mm supply line would be installed from the pump station across the Okanagan River Channel to intercept with the new supply line that would have been installed for the West Bench Option 2 – see Figure 3.1. The main across the river channel would either be hung on the bridge or directional drilled under the channel. One issue with directional drilling is the wall thickness and diameter of the HDPE pipe required for 215 psi discharge pressure at the pump station. A steel casing pipe could be drilled with ductile or class 200 pvc main installed in the casing pipe as another option. Figure 3.2 provides a schematic of the pump station and piping systems.




Stantec

WEST BENCH IRRIGATION DISTRICT
OPTION 1 - TIE TO CITY OF PENTICTON
SCALE 1:2500
FIGURE 3.2

The estimated cost for the pump station, supply mains and river crossing are as follows:

- **Pump Station**

| | |
|---|---|
| Site works/ general requirements | $150,000 |
| Building | $125,000 |
| Mechanical | $145,000 |
| Electrical including genset | $150,000 |
| Landscape | $10,000 |
| Power supply | $20,000 |
| Subtotal | $600,000 |
| 25% contingencies and Engineering | $150,000 |
| **TOTAL** | **$750,000** |

- **Piping Systems**

| | |
|---|---|
| 300 mm pvc suction 50 m x $300 | $15,000 |
| 300 mm DI discharge 200 m x $400 | $80,000 |
| River crossing | $100,000 |
| Road rehab | $10,000 |
| Tie to existing | $5,000 |
| Subtotal | $210,000 |
| 25% contingency and engineering | $53,000 |
| **TOTAL** | **$263,000** |

- **A summary of the cost of this option is therefore:**

| | | |
|---|---|---|
| West Bench Main Replacement | $1,300,000 | * |
| Water meters | $456,000 | |
| Pump Station | $750,000 | |
| Piping Systems | $263,000 | |
| **TOTAL** | **$2,769,000** | (GST not included) |

* length adjusted for supply mains deleted.

The cost noted above does not include any costs or contribution by West Bench for upgrading the Water Treatment Plant in Penticton. Currently we understand the plant is nearing capacity (MDD of 54 to 55 Ml/day, plant capacity is 60 Ml/day). Upgrading will therefore be required before WBID can be serviced. Cost sharing arrangements for this must be negotiated with the City of Penticton.

## 3.3 OPTION 2 – UPGRADE WEST BENCH SYSTEM

This option consists of upgrading the supply and disinfection system for West Bench. The components of work associated with this option are as follows:

- **Intake Extension**

  The existing intake is in relatively shallow water. The intake has been subject to changes in water quality over the years. In order to reduce the number of times that water quality issues arise, we would recommend the intake be extended to approximately 30 metres depth. It is expected this will provide the District with water quality equal to the City of Penticton's intake and similar to the City of Kelowna's intakes. The City of Kelowna has recently installed UV treatment on each of its intakes. The intake extension would consist of a 750 mm (30 inch) HDPE pipe extension from the end of the existing 600 mm (24 inch) cmp. The larger size intake is required to keep head loss to a minimum due to the depth of the pump station wet well. A new screen structure would also be required.

  It appears the intake extension would be approximately 450 meters. The information available of the location of the existing intake is not clear on the actual length or depth of the existing pipeline.

  The estimated cost for the lake intake extension is as follows:

| | |
|---|---|
| Intake Pipe | |
| 450 m of 750 mm HDPE @ $450 | $202,000 |
| Anchors | |
| 90@ $700 | $63,000 |
| Tie to existing | $10,000 |
| Intake Screen | $25,000 |
| Subtotal | $300,000 |
| 25% contingency & Engineering | $75,000 |
| **TOTAL** | **$375,000** |

  A number of years ago there were at least two leaks in the land portion of the intake pipe. When these were repaired it was noted there was corrosion on sections of the pipe. It may therefore be necessary to replace all or sections of this pipeline from the valve chamber adjacent the dam to the pump station. Prior to proceeding with this we do however recommend further investigations be done to determine the condition of the existing pipe. An estimated cost for this work is:

| | |
|---|---|
| Intake Pipe (Land Portion) | |
| 685 m of 600 mm HDPE @ $550/m | $377,000 |
| Tie Ins (2) | $30,000 |
| Air Valves | $30,000 |
| Subtotal | $437,000 |
| 25% contingency & Engineering | $110,000 |
| **TOTAL** | **$547,000** |

The total estimated cost for intake extension and repairs is **$922,000**.

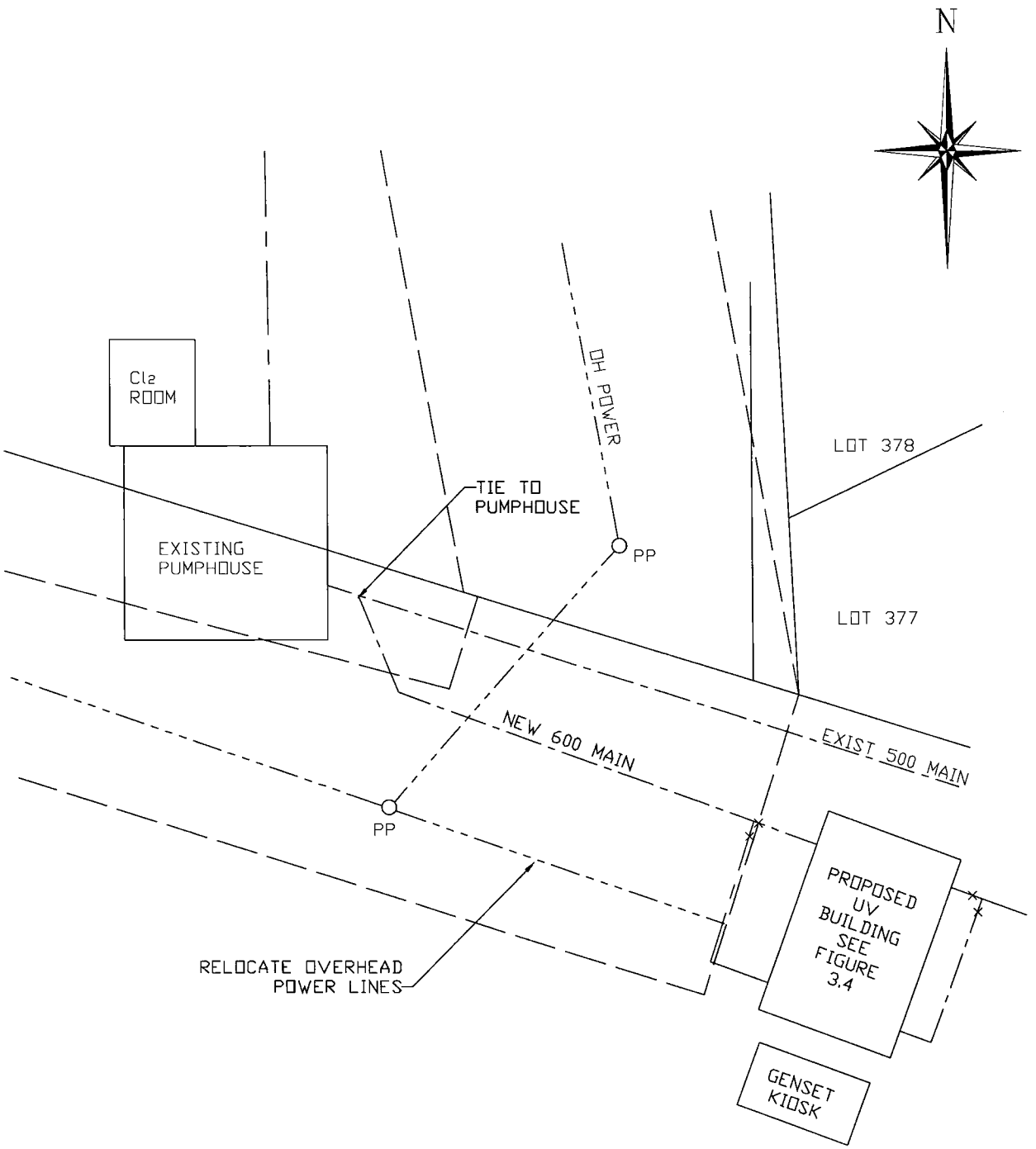
- **Disinfection Upgrade**

In order to meet the current objectives of IHA for water treatment, it is proposed to install ultraviolet (UV) light disinfection on the West Bench supply. There are two options for installing UV disinfection – on suction (intake) side of the pump station, or on the discharge (high pressure) side of the pump station. As the pressures on the discharge side of the pump station exceed 200 psi, the suction side appears to be the most feasible option. At the preliminary design stage, both options should be reviewed as the discharge side may be more economical if the issues associated with high pressures/transients can be resolved. Locating the UV facility at Moorpark Drive would reduce pressures to below 150 psi. At this stage we have maintained the original option of installing the UV on the suction side of the pump station.

Figures 3.3 and 3.4 provide a conceptual layout of the facility. The UV reactors would be installed in the new intake line north of the existing pump house. In order to keep the impact on the channel walkway to a minimum we have located the new UV building as close to the west property line as practical. This will however require relocation of a section of overhead power lines as the building would be directly underneath them. Alternately the building could be moved east however this will have a greater impact on the channel.

The UV chamber would be approximately 6 meters by 4 meters with 2 – 600 mm (24 inch) UV reactors. Each reactor would be capable of disinfecting 100 l/s (1600 USgpm), the capacity of two 150 hp pumps in the pump station. This provides a redundant unit – it may be possible to install one unit at the initial stage subject to IHA approvals if budgets become an issue. On top of the chamber, a building would be constructed to house the UV control panels and electrical service. A new electrical service would be installed to this building with the existing pump house service being abandoned. The pump house would be fed from the UV building.

Standby power capable of running one pump and one UV unit would be provided. This would be a 250 kw genset located in a kiosk adjacent the UV building. At this stage we have not included for any costs for upgrading electrical equipment or controls in the pump station.

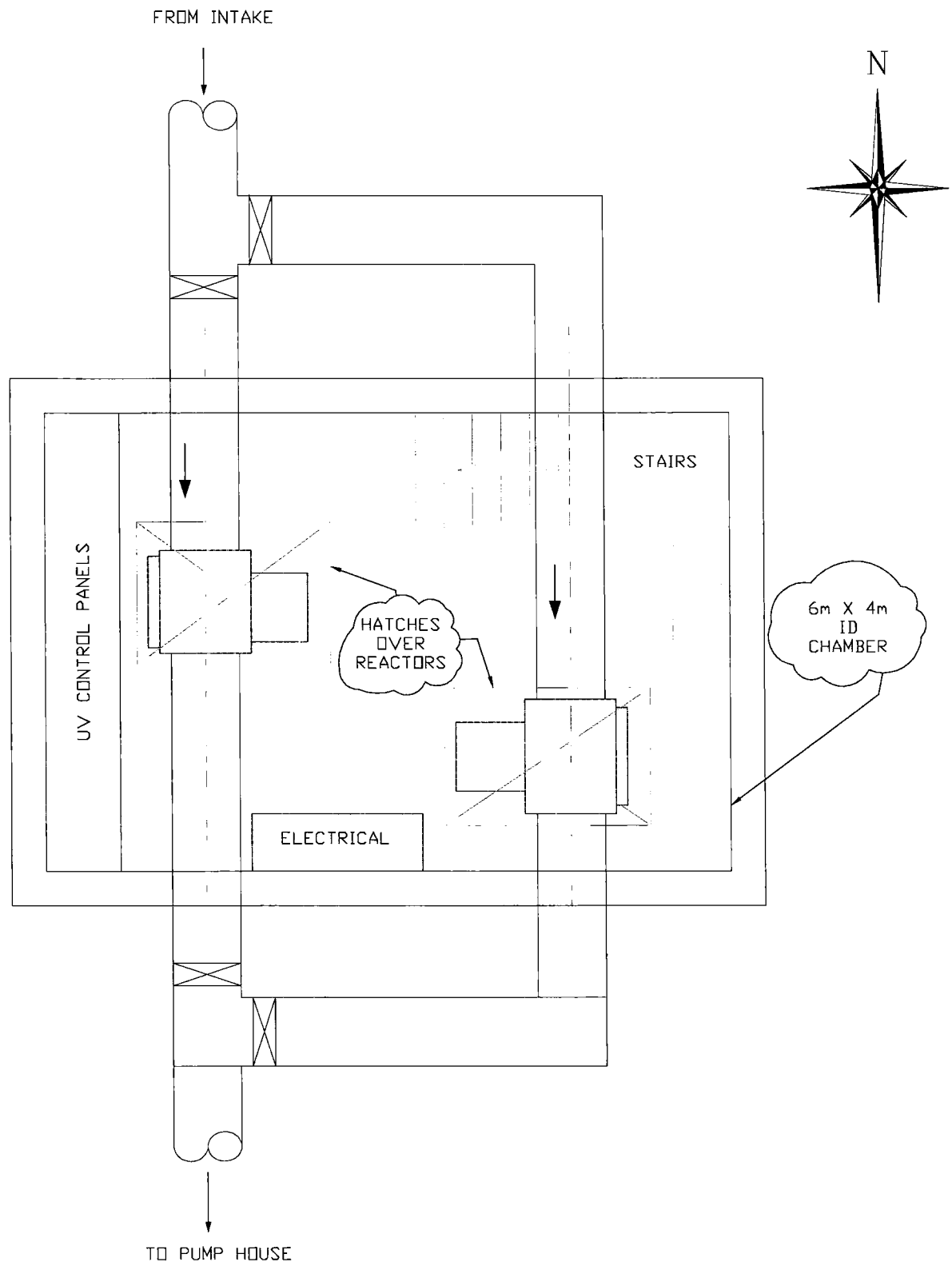



Stantec

WEST BENCH IRRIGATION DISTRICT
OPTION 2 - LOCATION PLAN

SCALE 1:250 (±)

**FIGURE 3.3**




Stantec

WEST BENCH IRRIGATION DISTRICT
OPTION 2 - UV REACTOR CHAMBER
SCALE 1:500
**FIGURE 3.4**

The estimated cost for the UV disinfection facility is as follows:

| | |
|---|---|
| UV Equipment – Trojan 2 – 4L24 units | $380,000 |
| UV Building | |
| ▪ site works and miscellaneous | $75,000 |
| ▪ building | $120,000 |
| ▪ mechanical | $150,000 |
| ▪ electrical including genset | $225,000 |
| **Subtotal** | **$570,000** |

| | |
|---|---|
| Summary UV Facility | |
| UV Equipment | $380,000 |
| UV Building | 570,000 |
| Contingencies & Engineering | 225,000 |
| **TOTAL** | **$1,175,000** |

- **Summary of Option 2**

A summary of the various costs for Option 2 are as follows:

| | | |
|---|---|---|
| Lake Intake Extension | $375,000 | |
| Lake Intake Replacement (Land Section) | 547,000 | |
| Disinfection Upgrade | 1,175,000 | |
| Pipeline Replacement | 1,350,000 | |
| Meter Installation | 456,000 | |
| **TOTAL** | **$3,903,000** | **(GST not included)** |

This cost is approximately 11% higher than estimates prepared in February 2005. This is due to increases in construction and material costs as well as the change in type of meter installation. In addition to the costs noted above, there are the items noted in Section 3.1 that will need upgrading or replacement in the future. The cost of these items was estimated to be approximately $1,113,000 so the actual cost of Option 2 is approximately **$5,000,000** ($1,113,000 + $3,903,000 = $5,016,000).

A key consideration for this Option (and Option 3) is that ultimately filtration may be required. There is the potential to construct a treatment plant on PIB Lands adjacent the pump station if agreements for the land can be negotiated.

## 3.4 OPTION 3 - WEST BENCH/ SAGE MESA SYSTEM

The third option for consideration is a combined West Bench/ Sage Mesa Water Supply System. This alternative would combine the water supply for both districts and provide UV disinfection. The cost of the project would be shared by both utilities which would be dissolved and become one water system operated by RDOS or the City of Penticton. There are a number of political considerations and decisions that would have to occur before this could happen. At this stage we have only considered the technical aspects.

The two water systems have different pressure zones so one supply system will have various hydraulic considerations. One way to overcome the differences in hydraulics between the two systems would be to have the new lake pump station capable of pumping to West Bench reservoir, which has the highest demand and highest elevation, and pressure reduce for the lower Sage Mesa reservoir. Although this is not the most energy efficient method, it would be the least cost from a capital perspective. A present worth analysis would need to be done to compare costs of two different pumping systems in the lake pump station versus the additional energy costs of the single system. The upper zone of Sage Mesa would still be supplied from the lower Sage Mesa reservoir and booster station.

The new supply system would consist of the following components – see Figure 3.5.

- Lake intake opposite current pullout on Highway 97
- Low head pump station in wet well on the lake side of Highway 97
- Forcemain under highway to pump station and UV disinfection facility in Highway pullout
- New supply main from pump station to West Bench via golf course and to Sage Mesa tying to existing watermain on Sage Mesa Drive (prv station required). New supply main to Sage Mesa lower reservoir (as per True Consulting report).

There will be a number of easements required for pipeline alignments as well as specific environmental approvals and permits to obtain for the intake and pumping stations. Approval to construct the UV facility and high head pump station in the pullout will be required from Ministry of Transportation.

Our opinion of probable costs for this system based on the conceptual design would be as follows:

- **Lake Intake**

| | |
|---|---|
| 750 mm HDPE pipe | |
| 250 m @ $1,300/m | $325,000 |
| 450 m @ $450/m | $202,000 |
| Concrete anchors | |
| 140 m @ $700/m | $98,000 |
| Intake Screen | $25,000 |
| Environmental Works | $50,000 |
| **Subtotal Intake** | **$700,000** |

- **Low Head Pump Station – 3-10 hp submersible pumps**

| | |
|---|---|
| Site Works | $50,000 |
| Concrete Caisson | $150,000 |
| Mechanical | $100,000 |
| Electrical (supply from UV) | $80,000 |
| Intake Tie In | $15,000 |
| Environmental | $25,000 |
| **Subtotal Low Head Pump Station** | **$420,000** |

- **UV Facility and High Head Pump Station – 3-150 hp pumps**

| | |
|---|---|
| Site Works | $75,000 |
| Building (15 m x 8 m) | $240,000 |
| Mechanical UV | $150,000 |
| Mechanical Pumps | $200,000 |
| UV Supply | $485,000 |
| Electrical including genset | $325,000 |
| Power Supply | $50,000 |
| **Subtotal** | **$1,525,000** |

- **Water Supply Mains**

| | |
|---|---|
| 400 mm | |
| 410 m @ $450 | $184,500 |
| 50 m @ $1,050 | $52,500 |
| 300 mm | |
| 1420 m @ $425 | $603,500 |
| 250 mm | |
| 150 m @ $350 | $52,500 |
| 470 m @ $425 | $200,000 |
| PRV Station | $75,000 |
| **Total Watermains** | **$1,168,000** |

A summary of the supply system costs is:

| | |
|---|---|
| Lake Intake | $700,000 |
| Low Head Pump Station | $420,000 |
| High Head Pump Station and UV | $1,525,000 |
| Water Supply Mains | $1,168,000 |
| Subtotal | $3,813,000 |
| 25% Contingency & Engineering | $953,000 |
| **TOTAL (no GST included)** | **$4,766,000** |

In additional to these costs there will be the watermain replacement costs for West Bench plus metering for Sage Mesa and West Bench. Sage Mesa has approximately 265 connections.

| | |
|---|---|
| West Bench Water Mains * | $1,050,000 |
| West Bench Metering | $456,000 |
| Sage Mesa Metering | $366,000 |
| **TOTAL** | **$1,872,000** |

*Pump house supply mains not replaced however some additional looping required.

Total project costs would be in the order of **$6,638,000** (4,766,000 + 1,872,000). As with Option 2, costs do not include adding filtration in the future (if necessary). There is very limited space for filtration in this option.

# 4.0 Conclusions and Recommendations

## 4.1 CONCLUSIONS

Based on the work completed to date on the conceptual designs and the potential costs of each option, the following conclusions can be made:

- The estimated cost of each option for comparison is:

| Option | Cost | |
|---|---|---|
| 1 – Tie to Penticton | $2,769,000 | (1) |
| 2 – Upgrade West Bench | $3,903,000 | (2) |
| 3 – West Bench Sage Mesa | $6,638,000 | |

(1) Cost does not include upgrades to the water treatment plant. Note for recent study Stantec did for tying sanitary sewer systems to the City from West Bench, the estimated cost for upgrading the Waste Water Treatment Plant was factored into a yearly capital/operating cost to be paid by each homeowner. This may be the case for upgrades to the Water Treatment Plant. Negotiations for cost sharing with the City would be required.

(2) Does not include the cost of upgrades required at the pump house or existing lake intake as they were not part of the original project definition. These costs are estimated to be $1,113,000 for a total of $5,000,000.

- The advantages/ disadvantages of each option are as follows:

| Option | Advantages | Disadvantages |
|---|---|---|
| 1<br>Tie to City of Penticton | • Provides long-term supply of treated water meeting all IHA requirements<br>• Operation and maintenance will be secure by trained staff responsible for large utility<br>• Eliminates a number of infrastructure components that will eventually need replacement (pump house, lake intake)<br>• Least capital cost when treatment plant upgrades not included<br>• Lower operating cost than other options<br>• Removes requirement to handle chlorine | • Requires City to agree to servicing West Bench which is outside its boundaries<br>• Cost for upgrading treatment plant may be high – to be negotiated with City<br>• costs to RDOS for Admin.<br>• Infrastructure areas not necessarily transfered (RDOS Board to approve) |
| 2<br>Upgrade Existing | • Will provide high quality water meeting all current health guidelines<br>• Potential area adjacent to site for addition of filtration plant if land can be obtained from Penticton Indian Band<br>• Qualified staff | • Okanagan Lake water may ultimately require filtration<br>• A number of major system components will require upgrading or replacement as time goes on (pump station, lake intake – cost over $1,000,000)<br>• Land tenure issues with pump station and intake need to be resolved<br>• Royalty/patent cost for UV disinfection to be resolved |

| Option | Advantages | Disadvantages |
|---|---|---|
| 3<br>West Bench Sage Mesa | • Will provide high quality water meeting all current health guidelines<br>• Provides one new supply system for two utilities – aging infrastructure for each system can be abandoned<br>• Combines two utilities into one system | • Okanagan Lake water may ultimately require filtration<br>• Very limited space for future treatment systems<br>• High capital costs<br>• Will require extensive approval process with environment, MoT, DFO, etc.<br>• Requires agreement from existing Sage Mesa utility owner and residents<br>• Royalty/patent cost for UV disinfection to be resolved |

## 4.2 RECOMMENDATIONS

The following recommendations are offered based on the results of this study.

1) Initial further discussions with the City of Penticton for tie in of their water supply system. In order to reduce demands investigate methods of separating irrigation and domestic uses in specific areas of the District. Prepare preliminary design and cost estimates for various components.

   Note – from a long term supply perspective a connection to the City of Penticton's water supply system will be the most viable option

2) If discussions fail with the City of Penticton undertake the following:

   - Have discussions with Sage Mesa utility owner regarding possible combined system. Investigate potential for additional grants. If potential for combined system exits, complete further preliminary engineering to review options/costs.

   - If Option 3 not possible, undertake preliminary design and costing for Option 2 water system upgrades

   - Apply for additional funding to cover cost increases as well as the items not included in the original grant application that will need upgrading in the future.

   - Resolve all land tenure issues including potential site for future water filtration plant

# APPENDIX A

## Watermain Cost Estimates

# WESTBENCH IRRIGATION DISTRICT
# WATERMAIN REPLACEMENT

| Item No. | Item Description | Unit | Unit Cost | Quantity | Extension | Cont'gcy | Cont'gcy Total | Total Cost |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| 1 | **NEWTON DRIVE** | | | | | | | |
| 1.1 | WATERMAINS CL 150 C900 PVC | | | | | | | |
| 1.1.1 | 150mm | lm | $ 125.00 | 0 | $ - | 15.0% | $ - | $ - |
| 1.1.2 | 200mm | lm | $ 145.00 | 650 | $ 94,250.00 | 15.0% | $ 14,137.50 | $ 108,387.50 |
| 1.1.3 | Casing pipe | lm | $ 150.00 | 20 | $ 3,000.00 | 15.0% | $ 450.00 | $ 3,450.00 |
| 1.2 | GATE VALVES | | | | | | | |
| | 150mm | ea. | $ 650.00 | 3 | $ 1,950.00 | 15.0% | $ 292.50 | $ 2,242.50 |
| | 200mm | ea. | $ 1,000.00 | 2 | $ 2,000.00 | 15.0% | $ 300.00 | $ 2,300.00 |
| | 250mm | ea. | $ 1,600.00 | 0 | $ - | 15.0% | $ - | $ - |
| 1.3 | TEE'S c/w T.B. | | | | | | | |
| 1.3.1 | 150mm | ea. | $ 400.00 | | $ - | 15.0% | $ - | $ - |
| 1.3.2 | 200mm | ea. | $ 500.00 | 3 | $ 1,500.00 | 15.0% | $ 225.00 | $ 1,725.00 |
| 1.3.3 | 250mm | ea. | $ 900.00 | | $ - | 15.0% | $ - | $ - |
| 1.4 | BENDS | | | | | | | |
| 1.4.1 | 150mm | ea. | $ 300.00 | | $ - | 15.0% | $ - | $ - |
| 1.4.2 | 200mm | ea. | $ 400.00 | 3 | $ 1,200.00 | 15.0% | $ 180.00 | $ 1,380.00 |
| 1.4.3 | 250mm | ea. | $ 500.00 | | $ - | 15.0% | $ - | $ - |
| 1.5 | END CAPS C/W T.B. | | | | | | | |
| 1.5.1 | 150mm | ea. | $ 250.00 | | $ - | 15.0% | $ - | $ - |
| 1.5.2 | 200mm | ea. | $ 300.00 | | $ - | 15.0% | $ - | $ - |
| 1.5.3 | 250mm | ea. | $ 350.00 | | $ - | 15.0% | $ - | $ - |
| 1.6 | BLOW OFF | | | | | | | |
| 1.6.1 | 100mm | ea. | $ 1,500.00 | | $ - | 15.0% | $ - | $ - |
| 1.7 | HYDRANTS | | | | | | | |
| 1.7.1 | HYDRANTS ASSEMBLY | ea. | $ 2,900.00 | 3 | $ 8,700.00 | 15.0% | $ 1,305.00 | $ 10,005.00 |
| 1.7.2 | CL 150 C900 PVC LEADS | l.m. | $ 125.00 | 15 | $ 1,875.00 | 15.0% | $ 281.25 | $ 2,156.25 |
| 1.8 | TIE TO EXIST. | ea. | $ 2,500.00 | 1 | $ 2,500.00 | 15.0% | $ 375.00 | $ 2,875.00 |
| 1.9 | WATER SERVICES | | | | | | | |
| 1.9.1 | 25mm SERVICE SET | ea. | $ 1,000.00 | 22 | $ 22,000.00 | 15.0% | $ 3,300.00 | $ 25,300.00 |
| 1.9.2 | 25mm SERVICE PIPE | l.m. | $ 70.00 | 220 | $ 15,400.00 | 15.0% | $ 2,310.00 | $ 17,710.00 |
| 1.10 | AIR RELEASE VALVE | ea. | $ 3,800.00 | 1 | $ 3,800.00 | 15.0% | $ 570.00 | $ 4,370.00 |
| 1.11 | GRANULAR MATERIALS | | | | | | | |
| 1.11.1 | SELECT GRANULAR SUB-BASE ( 300mm SGSB ) | sq. m | $ 6.00 | 2,500 | $ 15,000.00 | 15.0% | $ 2,250.00 | $ 17,250.00 |
| 1.11.2 | CRUSHED GRANULAR BASE COURSE ( 150mm - 25mm CBC ) | sq. m | $ 7.00 | 2,500 | $ 17,500.00 | 15.0% | $ 2,625.00 | $ 20,125.00 |
| 1.12 | HOT MIX PAVING (50mm DEPTH)- remove replace | sq.m | $ 13.00 | 3,600 | $ 46,800.00 | 15.0% | $ 7,020.00 | $ 53,820.00 |
| 1.13 | HOT MIX PAVING -driveways etc, remove replace | sq. m | $ 22.00 | 200 | $ 4,400.00 | 15.0% | $ 660.00 | $ 5,060.00 |
| | | | | | | | | |
| | **TOTAL SECTION 1** | | | | | | | **$ 278,156.25** |

# WESTBENCH IRRIGATION DISTRICT
# WATERMAIN REPLACEMENT

| Item No. | Item Description | Unit | Unit Cost | Quantity | Extension | Cont'gcy | Cont'gcy Total | Total Cost |
|---|---|---|---|---|---|---|---|---|
| **2** | **SPARTON DRIVE** | | | | | | | |
| 2.1 | WATERMAINS CL 150 C900 PVC | | | | | | | |
| 2.1.1 | 150mm | lm | $ 125.00 | 470 | $ 58,750.00 | 15.0% | $ 8,812.50 | $ 67,562.50 |
| 2.1.2 | 200mm | lm | $ 145.00 | | $ - | 15.0% | $ - | $ - |
| 2.1.3 | 250mm | lm | $ 160.00 | | $ - | 15.0% | $ - | $ - |
| 2.2 | GATE VALVES | | | | | | | |
| | 150mm | ea. | $ 650.00 | 6 | $ 3,900.00 | 15.0% | $ 585.00 | $ 4,485.00 |
| | 200mm | ea. | $ 1,000.00 | | $ - | 15.0% | $ - | $ - |
| | 250mm | ea. | $ 1,600.00 | | $ - | 15.0% | $ - | $ - |
| 2.3 | TEE'S c/w T.B. | | | | | | | |
| 2.3.1 | 150mm | ea. | $ 400.00 | 5 | $ 2,000.00 | 15.0% | $ 300.00 | $ 2,300.00 |
| 2.3.2 | 200mm | ea. | $ 500.00 | | $ - | 15.0% | $ - | $ - |
| 2.3.3 | 250mm | ea. | $ 900.00 | | $ - | 15.0% | $ - | $ - |
| 2.4 | BENDS | | | | | | | |
| 2.4.1 | 150mm | ea. | $ 300.00 | 2 | $ 600.00 | 15.0% | $ 90.00 | $ 690.00 |
| 2.4.2 | 200mm | ea. | $ 400.00 | | $ - | 15.0% | $ - | $ - |
| 2.4.3 | 250mm | ea. | $ 500.00 | | $ - | 15.0% | $ - | $ - |
| 2.5 | END CAPS C/W T.B. | | | | | | | |
| 2.5.1 | 150mm | ea. | $ 250.00 | 1 | $ 250.00 | 15.0% | $ 37.50 | $ 287.50 |
| 2.5.2 | 200mm | ea. | $ 300.00 | | $ - | 15.0% | $ - | $ - |
| 2.5.3 | 250mm | ea. | $ 350.00 | | $ - | 15.0% | $ - | $ - |
| 2.6 | BLOW OFF | | | | | | | |
| 2.6.1 | 100mm | ea. | $ 1,500.00 | 1 | $ 1,500.00 | 15.0% | $ 225.00 | $ 1,725.00 |
| 2.7 | HYDRANTS | | | | | | | |
| 2.7.1 | HYDRANTS ASSEMBLY | ea. | $ 2,900.00 | 4 | $ 11,600.00 | 15.0% | $ 1,740.00 | $ 13,340.00 |
| 2.7.2 | CL 150 C900 PVC LEADS | l.m. | $ 125.00 | 25 | $ 3,125.00 | 15.0% | $ 468.75 | $ 3,593.75 |
| 2.8 | TIE TO EXIST. | ea. | $ 2,500.00 | 1 | $ 2,500.00 | 15.0% | $ 375.00 | $ 2,875.00 |
| 2.9 | WATER SERVICES | | | | | | | |
| 2.9.1 | 25mm SERVICE SET | ea. | $ 1,000.00 | 15 | $ 15,000.00 | 15.0% | $ 2,250.00 | $ 17,250.00 |
| 2.9.2 | 25mm SERVICE PIPE | l.m. | $ 70.00 | 200 | $ 14,000.00 | 15.0% | $ 2,100.00 | $ 16,100.00 |
| 2.10 | AIR RELEASE VALVE | ea. | $ 3,800.00 | 1 | $ 3,800.00 | 15.0% | $ 570.00 | $ 4,370.00 |
| 2.11 | GRANULAR MATERIALS | | | | | | | |
| 2.11.1 | SELECT GRANULAR SUB-BASE ( 300mm SGSB ) | sq. m | $ 6.00 | 900 | $ 5,400.00 | 15.0% | $ 810.00 | $ 6,210.00 |
| 2.11.2 | CRUSHED GRANULAR BASE COURSE ( 150mm - 25mm CBC ) | sq. m | $ 7.00 | 1,500 | $ 10,500.00 | 15.0% | $ 1,575.00 | $ 12,075.00 |
| 2.12 | HOT MIX PAVING (50mm DEPTH)- remove replace | sq.m | $ 13.00 | 800 | $ 10,400.00 | 15.0% | $ 1,560.00 | $ 11,960.00 |
| 2.13 | HOT MIX PAVING -driveways etc, remove replace | sq. m | $ 22.00 | 150 | $ 3,300.00 | 15.0% | $ 495.00 | $ 3,795.00 |
| | | | | | | | | |
| | **TOTAL SECTION 2** | | | | | | | **$ 168,618.75** |

# WESTBENCH IRRIGATION DISTRICT
# WATERMAIN REPLACEMENT

| Item No. | Item Description | Unit | Unit Cost | Quantity | Extension | Cont'gcy | Cont'gcy Total | Total Cost |
|---|---|---|---|---|---|---|---|---|
| 3 | **VETERAN DRIVE** | | | | | | | |
| 3.1 | WATERMAINS CL 150 C900 PVC | | | | | | | |
| 3.1.1 | 150mm | lm | $ 125.00 | 240 | $ 30,000.00 | 15.0% | $ 4,500.00 | $ 34,500.00 |
| 3.1.2 | 200mm | lm | $ 145.00 | | $ - | 15.0% | $ - | $ - |
| 3.1.3 | 250mm | lm | $ 160.00 | | $ - | 15.0% | $ - | $ - |
| 3.2 | GATE VALVES | | | | | | | |
| | 150mm | ea. | $ 650.00 | 3 | $ 1,950.00 | 15.0% | $ 292.50 | $ 2,242.50 |
| | 200mm | ea. | $ 1,000.00 | | $ - | 15.0% | $ - | $ - |
| | 250mm | ea. | $ 1,600.00 | | $ - | 15.0% | $ - | $ - |
| 3.3 | TEE'S c/w T.B. | | | | | | | |
| 3.3.1 | 150mm | ea. | $ 400.00 | 2 | $ 800.00 | 15.0% | $ 120.00 | $ 920.00 |
| 3.3.2 | 200mm | ea. | $ 500.00 | | $ - | 15.0% | $ - | $ - |
| 3.3.3 | 250mm | ea. | $ 900.00 | | $ - | 15.0% | $ - | $ - |
| 3.4 | BENDS | | | | | | | |
| 3.4.1 | 150mm | ea. | $ 300.00 | 2 | $ 600.00 | 15.0% | $ 90.00 | $ 690.00 |
| 3.4.2 | 200mm | ea. | $ 400.00 | | $ - | 15.0% | $ - | $ - |
| 3.4.3 | 250mm | ea. | $ 500.00 | | $ - | 15.0% | $ - | $ - |
| 3.5 | END CAPS C/W T.B. | | | | | | | |
| 3.5.1 | 150mm | ea. | $ 250.00 | 1 | $ 250.00 | 15.0% | $ 37.50 | $ 287.50 |
| 3.5.2 | 200mm | ea. | $ 300.00 | | $ - | 15.0% | $ - | $ - |
| 3.5.3 | 250mm | ea. | $ 350.00 | | $ - | 15.0% | $ - | $ - |
| 3.6 | BLOW OFF | | | | | | | |
| 3.6.1 | 100mm | ea. | $ 1,500.00 | 1 | $ 1,500.00 | 15.0% | $ 225.00 | $ 1,725.00 |
| 3.7 | HYDRANTS | | | | | | | |
| 3.7.1 | HYDRANTS ASSEMBLY | ea. | $ 2,900.00 | 2 | $ 5,800.00 | 15.0% | $ 870.00 | $ 6,670.00 |
| 3.7.2 | CL 150 C900 PVC LEADS | l.m. | $ 125.00 | 12 | $ 1,500.00 | 15.0% | $ 225.00 | $ 1,725.00 |
| 3.8 | TIE TO EXIST. | ea. | $ 2,500.00 | 1 | $ 2,500.00 | 15.0% | $ 375.00 | $ 2,875.00 |
| 3.9 | WATER SERVICES | | | | | | | |
| 3.9.1 | 25mm SERVICE SET | ea. | $ 1,000.00 | 11 | $ 11,000.00 | 15.0% | $ 1,650.00 | $ 12,650.00 |
| 3.9.2 | 25mm SERVICE PIPE | l.m. | $ 70.00 | 120 | $ 8,400.00 | 15.0% | $ 1,260.00 | $ 9,660.00 |
| 3.10 | AIR RELEASE VALVE | ea. | $ 3,800.00 | 1 | $ 3,800.00 | 15.0% | $ 570.00 | $ 4,370.00 |
| 3.11 | GRANULAR MATERIALS | | | | | | | |
| 3.11.1 | SELECT GRANULAR SUB-BASE ( 300mm SGSB ) | sq. m | $ 6.00 | 350 | $ 2,100.00 | 15.0% | $ 315.00 | $ 2,415.00 |
| 3.11.2 | CRUSHED GRANULAR BASE COURSE ( 150mm - 25mm CBC ) | sq. m | $ 7.00 | 700 | $ 4,900.00 | 15.0% | $ 735.00 | $ 5,635.00 |
| 3.12 | HOT MIX PAVING (50mm DEPTH)- remove replace | sq.m | $ 13.00 | 100 | $ 1,300.00 | 15.0% | $ 195.00 | $ 1,495.00 |
| 3.13 | HOT MIX PAVING -driveways etc, remove replace | sq. m | $ 22.00 | 250 | $ 5,500.00 | 15.0% | $ 825.00 | $ 6,325.00 |
| | | | | | | | | |
| | **TOTAL SECTION 3** | | | | | | | **$ 94,185.00** |

# WESTBENCH IRRIGATION DISTRICT
# WATERMAIN REPLACEMENT

| Item No. | Item Description | Unit | Unit Cost | Quantity | Extension | Cont'gcy | Cont'gcy Total | Total Cost |
|---|---|---|---|---|---|---|---|---|
| **4** | **MOORPARK/SUNGLO DRIVE** | | | | | | | |
| 4.1 | WATERMAINS CL 150 C900 PVC | | | | | | | |
| 4.1.1 | 150mm | lm | $ 125.00 | 490 | $ 61,250.00 | 15.0% | $ 9,187.50 | $ 70,437.50 |
| 4.1.2 | 200mm | lm | $ 145.00 | | $ - | 15.0% | $ - | $ - |
| 4.1.3 | Casing pipe | lm | $ 150.00 | 20 | $ 3,000.00 | 15.0% | $ 450.00 | $ 3,450.00 |
| 4.2 | GATE VALVES | | | | | | | |
| | 150mm | ea. | $ 650.00 | 4 | $ 2,600.00 | 15.0% | $ 390.00 | $ 2,990.00 |
| | 200mm | ea. | $ 1,000.00 | | $ - | 15.0% | $ - | $ - |
| | 250mm | ea. | $ 1,600.00 | | $ - | 15.0% | $ - | $ - |
| 4.3 | TEE'S c/w T.B. | | | | | | | |
| 4.3.1 | 150mm | ea. | $ 400.00 | 3 | $ 1,200.00 | 15.0% | $ 180.00 | $ 1,380.00 |
| 4.3.2 | 200mm | ea. | $ 500.00 | | $ - | 15.0% | $ - | $ - |
| 4.3.3 | 250mm | ea. | $ 900.00 | | $ - | 15.0% | $ - | $ - |
| 4.4 | BENDS | | | | | | | |
| 4.4.1 | 150mm | ea. | $ 300.00 | 7 | $ 2,100.00 | 15.0% | $ 315.00 | $ 2,415.00 |
| 4.4.2 | 200mm | ea. | $ 400.00 | | $ - | 15.0% | $ - | $ - |
| 4.4.3 | 250mm | ea. | $ 500.00 | | $ - | 15.0% | $ - | $ - |
| 4.5 | END CAPS C/W T.B. | | | | | | | |
| 4.5.1 | 150mm | ea. | $ 250.00 | | $ - | 15.0% | $ - | $ - |
| 4.5.2 | 200mm | ea. | $ 300.00 | | $ - | 15.0% | $ - | $ - |
| 4.5.3 | 250mm | ea. | $ 350.00 | | $ - | 15.0% | $ - | $ - |
| 4.6 | BLOW OFF | | | | | | | |
| 4.6.1 | 100mm | ea. | $ 1,500.00 | | $ - | 15.0% | $ - | $ - |
| 4.7 | HYDRANTS | | | | | | | |
| 4.7.1 | HYDRANTS ASSEMBLY | ea. | $ 2,900.00 | 2 | $ 5,800.00 | 15.0% | $ 870.00 | $ 6,670.00 |
| 4.7.2 | CL 150 C900 PVC LEADS | l.m. | $ 125.00 | | $ - | 15.0% | $ - | $ - |
| 4.8 | TIE TO EXIST. | ea. | $ 2,500.00 | 3 | $ 7,500.00 | 15.0% | $ 1,125.00 | $ 8,625.00 |
| 4.9 | WATER SERVICES | | | | | | | |
| 4.9.1 | 25mm SERVICE SET | ea. | $ 1,000.00 | 7 | $ 7,000.00 | 15.0% | $ 1,050.00 | $ 8,050.00 |
| 4.9.2 | 25mm SERVICE PIPE | l.m. | $ 70.00 | 100 | $ 7,000.00 | 15.0% | $ 1,050.00 | $ 8,050.00 |
| 4.10 | AIR RELEASE VALVE | ea. | $ 3,800.00 | 1 | $ 3,800.00 | 15.0% | $ 570.00 | $ 4,370.00 |
| 4.11 | GRANULAR MATERIALS | | | | | | | |
| 4.11.1 | SELECT GRANULAR SUB-BASE ( 300mm SGSB ) | sq. m | $ 6.00 | 800 | $ 4,800.00 | 15.0% | $ 720.00 | $ 5,520.00 |
| 4.11.2 | CRUSHED GRANULAR BASE COURSE ( 150mm - 25mm CBC ) | sq. m | $ 7.00 | 1,400 | $ 9,800.00 | 15.0% | $ 1,470.00 | $ 11,270.00 |
| 4.12 | HOT MIX PAVING (50mm DEPTH)- remove replace | sq.m | $ 13.00 | 500 | $ 6,500.00 | 15.0% | $ 975.00 | $ 7,475.00 |
| 4.13 | HOT MIX PAVING -driveways etc, remove replace | sq. m | $ 22.00 | 300 | $ 6,600.00 | 15.0% | $ 990.00 | $ 7,590.00 |
| | | | | | | | | |
| | **TOTAL SECTION 4** | | | | | | | **$ 148,292.50** |

# WESTBENCH IRRIGATION DISTRICT
# WATERMAIN REPLACEMENT

| Item No. | Item Description | Unit | Unit Cost | Quantity | Extension | Cont'gcy | Cont'gcy Total | Total Cost |
|---|---|---|---|---|---|---|---|---|
| **5** | **VEDETTE DRIVE - to end of road, not to supply mains** | | | | | | | |
| 5.1 | WATERMAINS CL 150 C900 PVC | | | | | | | |
| 5.1.1 | 150mm | lm | $ 125.00 | 150 | $ 18,750.00 | 15.0% | $ 2,812.50 | $ 21,562.50 |
| 5.1.2 | 200mm | lm | $ 145.00 | | $ - | 15.0% | $ - | $ - |
| 5.1.3 | 250mm | lm | $ 160.00 | | $ - | 15.0% | $ - | $ - |
| 5.2 | GATE VALVES | | | | | | | |
| | 150mm | ea. | $ 650.00 | 2 | $ 1,300.00 | 15.0% | $ 195.00 | $ 1,495.00 |
| | 200mm | ea. | $ 1,000.00 | | $ - | 15.0% | $ - | $ - |
| | 250mm | ea. | $ 1,600.00 | | $ - | 15.0% | $ - | $ - |
| 5.3 | TEE'S c/w T.B. | | | | | | | |
| 5.3.1 | 150mm | ea. | $ 400.00 | 2 | $ 800.00 | 15.0% | $ 120.00 | $ 920.00 |
| 5.3.2 | 200mm | ea. | $ 500.00 | | $ - | 15.0% | $ - | $ - |
| 5.3.3 | 250mm | ea. | $ 900.00 | | $ - | 15.0% | $ - | $ - |
| 5.4 | BENDS | | | | | | | |
| 5.4.1 | 150mm | ea. | $ 300.00 | 2 | $ 600.00 | 15.0% | $ 90.00 | $ 690.00 |
| 5.4.2 | 200mm | ea. | $ 400.00 | | $ - | 15.0% | $ - | $ - |
| 5.4.3 | 250mm | ea. | $ 500.00 | | $ - | 15.0% | $ - | $ - |
| 5.5 | END CAPS C/W T.B. | | | | | | | |
| 5.5.1 | 150mm | ea. | $ 250.00 | 1 | $ 250.00 | 15.0% | $ 37.50 | $ 287.50 |
| 5.5.2 | 200mm | ea. | $ 300.00 | | $ - | 15.0% | $ - | $ - |
| 5.5.3 | 250mm | ea. | $ 350.00 | | $ - | 15.0% | $ - | $ - |
| 5.6 | BLOW OFF | | | | | | | |
| 5.6.1 | 100mm | ea. | $ 1,500.00 | 1 | $ 1,500.00 | 15.0% | $ 225.00 | $ 1,725.00 |
| 5.7 | HYDRANTS | | | | | | | |
| 5.7.1 | HYDRANTS ASSEMBLY | ea. | $ 2,900.00 | 1 | $ 2,900.00 | 15.0% | $ 435.00 | $ 3,335.00 |
| 5.7.2 | CL 150 C900 PVC LEADS | l.m. | $ 125.00 | 8 | $ 1,000.00 | 15.0% | $ 150.00 | $ 1,150.00 |
| 5.8 | TIE TO EXIST. | ea. | $ 2,500.00 | 1 | $ 2,500.00 | 15.0% | $ 375.00 | $ 2,875.00 |
| 5.9 | WATER SERVICES | | | | | | | |
| 5.9.1 | 25mm SERVICE SET | ea. | $ 1,000.00 | 8 | $ 8,000.00 | 15.0% | $ 1,200.00 | $ 9,200.00 |
| 5.9.2 | 25mm SERVICE PIPE | l.m. | $ 70.00 | 100 | $ 7,000.00 | 15.0% | $ 1,050.00 | $ 8,050.00 |
| 5.10 | AIR RELEASE VALVE | ea. | $ 3,800.00 | 0 | $ - | 15.0% | $ - | $ - |
| 5.11 | GRANULAR MATERIALS | | | | | | | |
| 5.11.1 | SELECT GRANULAR SUB-BASE ( 300mm SGSB ) | sq. m | $ 6.00 | 200 | $ 1,200.00 | 15.0% | $ 180.00 | $ 1,380.00 |
| 5.11.2 | CRUSHED GRANULAR BASE COURSE ( 150mm - 25mm CBC ) | sq. m | $ 7.00 | 425 | $ 2,975.00 | 15.0% | $ 446.25 | $ 3,421.25 |
| 5.12 | HOT MIX PAVING (50mm DEPTH)- remove replace | sq.m | $ 13.00 | 0 | $ - | 15.0% | $ - | $ - |
| 5.13 | HOT MIX PAVING -driveways etc, remove replace | sq. m | $ 22.00 | 200 | $ 4,400.00 | 15.0% | $ 660.00 | $ 5,060.00 |
| | | | | | | | | |
| | **TOTAL SECTION 5** | | | | | | | **$ 61,151.25** |

# WESTBENCH IRRIGATION DISTRICT
# WATERMAIN REPLACEMENT

| Item No. | Item Description | Unit | Unit Cost | Quantity | Extension | Cont'gcy | Cont'gcy Total | Total Cost |
|---|---|---|---|---|---|---|---|---|
| **6** | **PUMP HOUSE SUPPLY MAINS** | | | | | | | |
| 6.1 | WATERMAINS CL 150 C900 PVC | | | | | | | |
| 6.1.1 | 300mm | lm | $ 220.00 | 970 | $ 213,400.00 | 15.0% | $ 32,010.00 | $ 245,410.00 |
| 6.1.2 | Highway crossing | lm | $ 1,000.00 | 30 | $ 30,000.00 | 15.0% | $ 4,500.00 | $ 34,500.00 |
| 6.1.3 | Rail crossing | lm | $ 160.00 | 20 | $ 3,200.00 | 15.0% | $ 480.00 | $ 3,680.00 |
| 6.2 | GATE VALVES | | | | | | | |
| | 150mm | ea. | $ 650.00 | 5 | $ 3,250.00 | 15.0% | $ 487.50 | $ 3,737.50 |
| | 200mm | ea. | $ 1,000.00 | | $ - | 15.0% | $ - | $ - |
| | 300mm | ea. | $ 3,000.00 | 4 | $ 12,000.00 | 15.0% | $ 1,800.00 | $ 13,800.00 |
| 6.3 | TEE'S / CROSSES c/w T.B. | | | | | | | |
| 6.3.1 | 150mm | ea. | $ 400.00 | | $ - | 15.0% | $ - | $ - |
| 6.3.2 | 200mm | ea. | $ 500.00 | | $ - | 15.0% | $ - | $ - |
| 6.3.3 | 300mm | ea. | $ 1,800.00 | 3 | $ 5,400.00 | 15.0% | $ 810.00 | $ 6,210.00 |
| 6.4 | BENDS | | | | | | | |
| 6.4.1 | 150mm | ea. | $ 300.00 | | $ - | 15.0% | $ - | $ - |
| 6.4.2 | 200mm | ea. | $ 400.00 | | $ - | 15.0% | $ - | $ - |
| 6.4.3 | 300mm | ea. | $ 1,000.00 | 6 | $ 6,000.00 | 15.0% | $ 900.00 | $ 6,900.00 |
| 6.5 | END CAPS C/W T.B. | | | | | | | |
| 6.5.1 | 150mm | ea. | $ 250.00 | | $ - | 15.0% | $ - | $ - |
| 6.5.2 | 200mm | ea. | $ 300.00 | | $ - | 15.0% | $ - | $ - |
| 6.5.3 | 300mm | ea. | $ 350.00 | | $ - | 15.0% | $ - | $ - |
| 6.6 | BLOW OFF | | | | | | | |
| 6.6.1 | 100mm | ea. | $ 1,500.00 | | $ - | 15.0% | $ - | $ - |
| 6.7 | HYDRANTS | | | | | | | |
| 6.7.1 | HYDRANTS ASSEMBLY | ea. | $ 2,900.00 | 1 | $ 2,900.00 | 15.0% | $ 435.00 | $ 3,335.00 |
| 6.7.2 | CL 150 C900 PVC LEADS | l.m. | $ 125.00 | 5 | $ 625.00 | 15.0% | $ 93.75 | $ 718.75 |
| 6.8 | TIE TO EXIST. | ea. | $ 2,500.00 | 4 | $ 10,000.00 | 15.0% | $ 1,500.00 | $ 11,500.00 |
| 6.9 | WATER SERVICES | | | | | | | |
| 6.9.1 | 25mm SERVICE SET | ea. | $ 1,000.00 | | $ - | 15.0% | $ - | $ - |
| 6.9.2 | 25mm SERVICE PIPE | l.m. | $ 70.00 | | $ - | 15.0% | $ - | $ - |
| 6.10 | AIR RELEASE VALVE | ea. | $ 3,800.00 | 1 | $ 3,800.00 | 15.0% | $ 570.00 | $ 4,370.00 |
| 6.11 | GRANULAR MATERIALS | | | | | | | |
| 6.11.1 | SELECT GRANULAR SUB-BASE ( 300mm SGSB ) | sq. m | $ 6.00 | 1,400 | $ 8,400.00 | 15.0% | $ 1,260.00 | $ 9,660.00 |
| 6.11.2 | CRUSHED GRANULAR BASE COURSE ( 150mm - 25mm CBC ) | sq. m | $ 7.00 | 2,500 | $ 17,500.00 | 15.0% | $ 2,625.00 | $ 20,125.00 |
| 6.12 | HOT MIX PAVING (50mm DEPTH)- remove replace | sq.m | $ 13.00 | 1,200 | $ 15,600.00 | 15.0% | $ 2,340.00 | $ 17,940.00 |
| 6.13 | HOT MIX PAVING -driveways etc, remove replace | sq. m | $ 22.00 | 200 | $ 4,400.00 | 15.0% | $ 660.00 | $ 5,060.00 |
| | **TOTAL SECTION 6** | | | | | | | **$ 386,946.25** |

# WESTBENCH IRRIGATION DISTRICT
# WATERMAIN REPLACEMENT

| Item No. | Item Description | Unit | Unit Cost | Quantity | Extension | Cont'gcy | Cont'gcy Total | Total Cost |
|---|---|---|---|---|---|---|---|---|
| 7 | **MISCELLANEOUS ITEMS** | | | | | | | |
| 7.1 | SURVEYS AND LAYOUT (CONSTRUCTION) | ls | $ 15,000.00 | 1 | $ 15,000.00 | 10.0% | $ 1,500.00 | $ 16,500.00 |
| 7.2 | BONDING & INSURANCE | ls | $ 25,000.00 | 1 | $ 25,000.00 | 10.0% | $ 2,500.00 | $ 27,500.00 |
| 7.3 | MOB/DEMOB and GENERAL REQUIREMENTS | ls | $ 40,000.00 | 1 | $ 40,000.00 | 10.0% | $ 4,000.00 | $ 44,000.00 |
| | **TOTAL SECTION 7** | | | | | | | **$ 88,000.00** |

| | | | |
|---|---|---|---|
| SUBTOTAL FOR ALL SECTIONS | $ 1,069,000.00 | $ 156,350.00 | $ 1,225,350.00 |
| 10 % ENGINEERING | | | $ 122,535.00 |
| SUBTOTAL WORK, ENGINEERING, CONTINGENCY | | | $ 1,347,885.00 |
| 0% G.S.T. | | | $ - |
| **TOTAL** | | | **$ 1,347,885.00** |
| | AVERAGE CONTINGENCY | 14.6% | |

# APPENDIX B

Letter from City of Penticton

File:

February 1, 2006

Charlie Higgins P.Eng.
Branch Manager
Stantec Consulting
300 1708 Dolphin Avenue
Kelowna, B.C.
V1Y 9S4

Dear Sir:

**RE: WESTBENCH WATER SUPPLY PRE-DESIGN**

Further to your E-mail of January 4, 2005 regarding having the West Bench Irrigation District examine the possibility of City of Penticton supplied treated water as one of the options for consideration under their Provincial Infrastructure Grant I advise as follows:

1. The matter was brought before the Special Closed meeting of Council on January 16, 2006.
2. The City has no problem with Stantec considering the use of City of Penticton Water as one of the options to be considered during the pre-design phase.
3. The City is however not in a position to say whether it would agree to provide treated water to the West Bench Irrigation District at this time. This is something that will require evaluation by City staff and further consideration by Council.
4. From a capital cost perspective Stantec is advised that the City would expect Westbench to pay all costs for improvements to their infrastructure as well as any improvements to City of Penticton infrastructure necessary to bring the required water to the Westbench system.
5. From an operating perspective Stantec is advised that the City would expect Westbench to pay 100 % of the operating costs plus applicable overheads and profit plus make a contribution to the depreciation of capital asset base for the water system based on use.

Please refer any further correspondence on this matter to Mr. M. Moroziuk, Director of Development and Engineering Services at (250) 490-2515.

Respectfully yours,
THE CORPORATION OF THE CITY OF PENTICTON

Cathy Ingram
City Clerk

C: L. den Boer, Administrator
M. Moroziuk, Director of Development and Engineering Services
L. Robson, Manager of Public Works
B. Edge, Water Plant Supervisor

# APPENDIX C

AF Consulting Report

AF CONSULTING LTD.

AFC file: 0606-02

March 28, 2006

Charlie Higgins, P.Eng.
Stantec Inc.
1708 Dolphin Avenue, Suite 300
Kelowna, BC V1Y 9S4

Dear Mr. Higgins:

**RE: West Bench Irrigation District – Penticton BC**
**Water System Modeling Findings**

## 1.0 INTRODUCTION

As requested in your email dated March 21, 2006 we have completed some modeling tasks to explore the effects of connecting the West Bench Irrigation District to the City of Penticton water distribution system.

This letter-report summarizes the results obtained from the current City of Penticton water model when adding a constant demand of 82 L/s at the corner of Riverside Dr. and Eckhardt Ave.

We understand that the construction of a pump station to service the West Bench Irrigation District pumping a Maximum Day Demand (MDD) of 82 L/s is being considered.

In preparation of this letter report, the City of Penticton Subdivision and Development Bylaw No. 2004 81, was reviewed to provide background information and criteria for the engineering analysis. The objective of this letter is to establish the required upgrades to the existing water distribution system to meet the Subdivision Bylaw criteria when adding the West Bench Irrigation District (WBID) demands to the system.

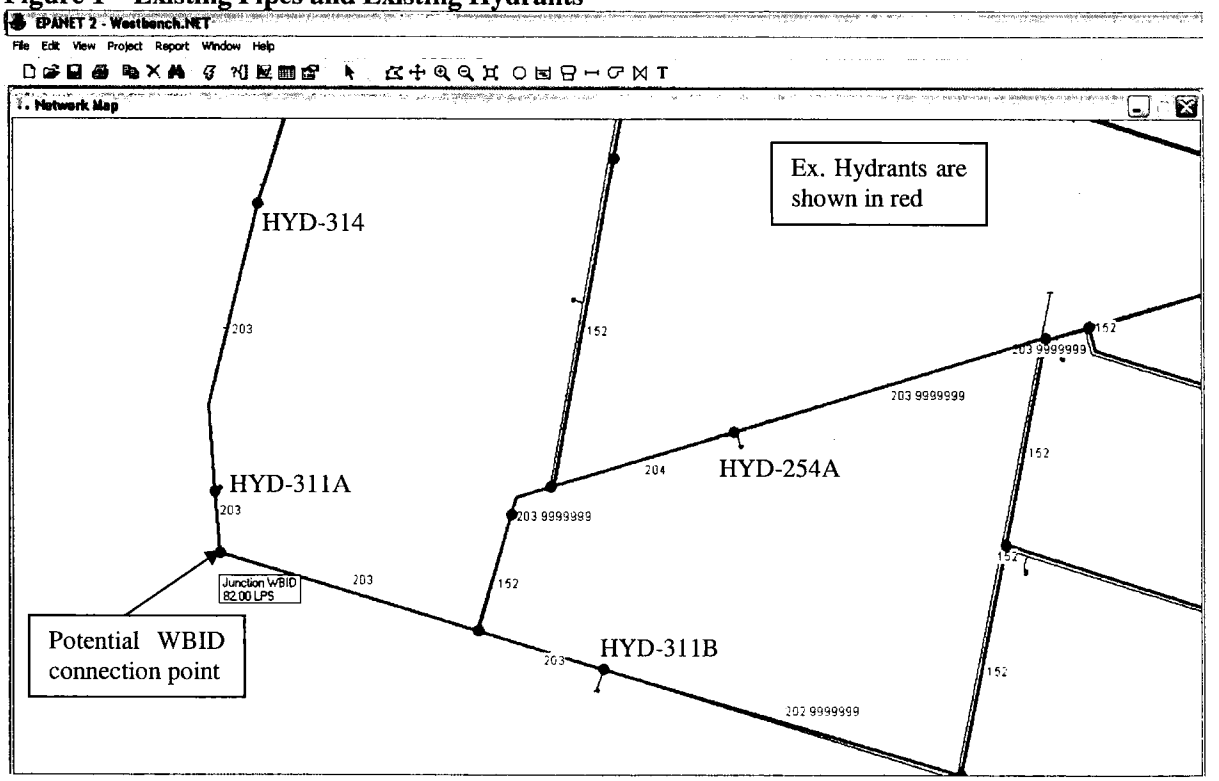
## 2.0 DESIGN CRITERIA

Criteria for design of water facilities are consistent with the City of Penticton Subdivision and Development Bylaw No. 2004 81. Criteria used for the engineering analysis is as follows:

| | |
|---|---|
| Fire Flow Demand (Commercial Areas) | 150 L/s |
| | |
| Maximum Static Pressure | 1034 kPa (150 psi) |
| Minimum System Pressure at ADD | 275 kPa (40 psi) |
| Minimum System Pressure at PHD | 250 kPa (36 psi) |
| Minimum System Pressure at MDD + Fire Flow | 140 kPa (20 psi) |
| | |
| Maximum Allowable Water Velocities | |
| Under PHD | 2.0 m/s |
| Under MDD + Fire Flow | 4.0 m/s |

The current City of Penticton Epanet model was utilized to carry out this task. Nodes at the actual location of the hydrant were added in the vicinity of the proposed connection point. Figure 1 illustrates the existing pipe diameters in the area and the nodes at each hydrant location.

**Figure 1 – Existing Pipes and Existing Hydrants**



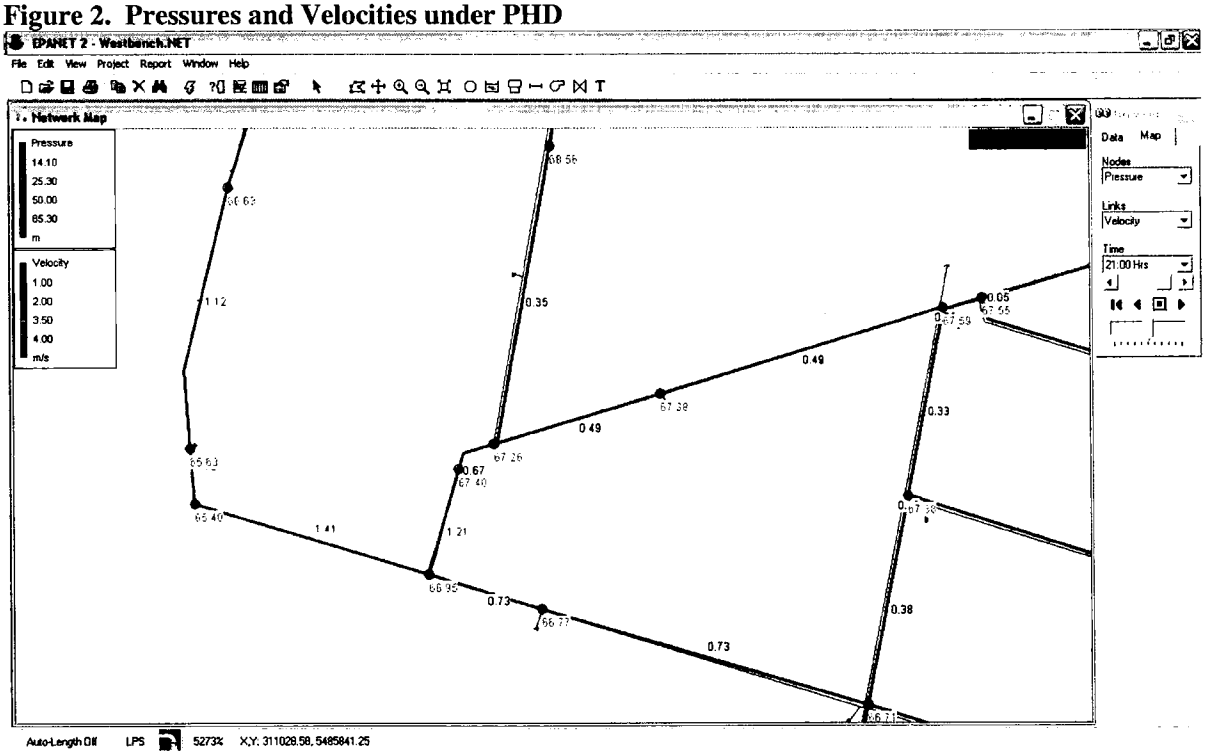
## 3.0 ENGINEERING ANALYSIS

The model has been modified adding a constant demand of 82 L/s at the WBID node. WBID node is located at the intended connection point of the WBID to the City of Penticton water system.

### Peak Hour Demand Condition

The lowest pressure during PHD and after adding the WBID demand takes place at the intended connection point. It has been calculated at 65.4m of head (92.4 psi). This figure is much higher than the minimum requirement of 25.3m (36 psi) by the Subdivision Bylaw. Velocities in the pipe network feeding the area are below the 2.0 m/s requirement. Figure 2 shows the pressures and velocities for the PHD condition.

**Figure 2. Pressures and Velocities under PHD**




### Maximum Day Demand Condition

The lowest pressure during MDD and after adding the WBID demand takes place at the intended connection point. It has been calculated at 77.9m of head (110.7 psi). This figure is much higher than the minimum requirement of 28.2m (40 psi) for ADD. Residual pressures in the area are not being anticipated to be of concern when adding the WBID demands to the system.

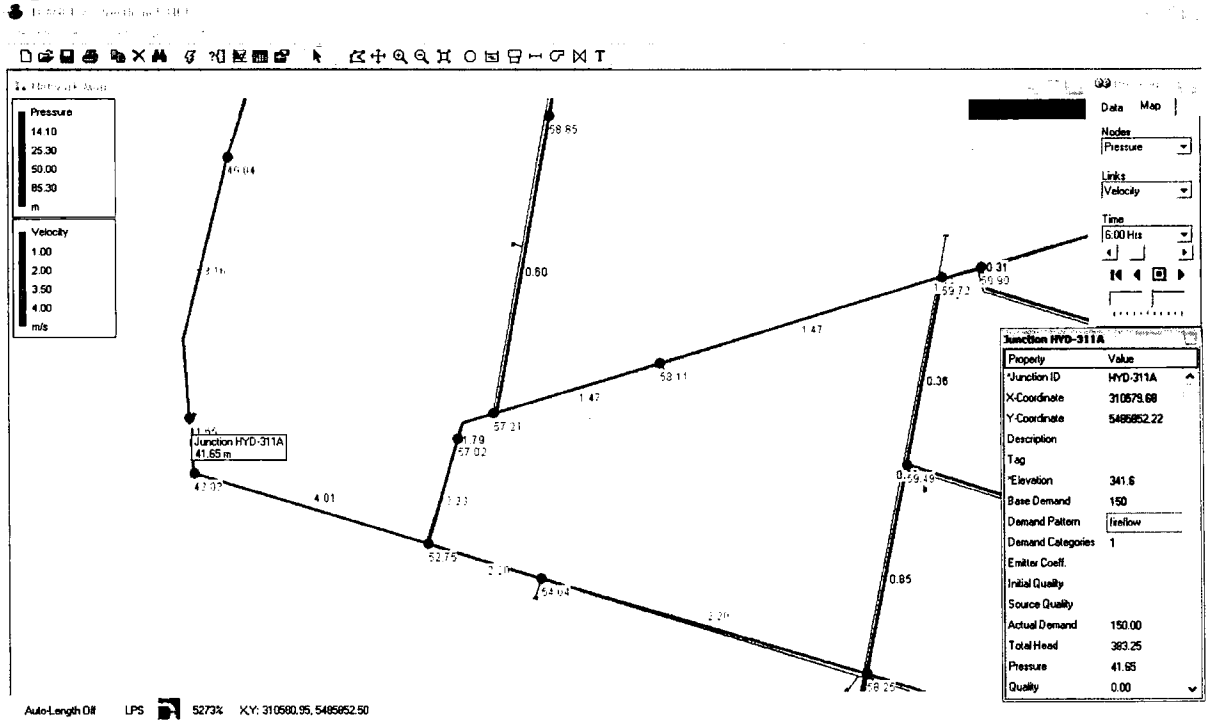
### Maximum Day Demand plus Fire Flow Scenario

Several simulations were carried out adding a fire flow demand of 150 L/s at each one of the existing hydrants or the nearest node. Residual pressures in the area drop to the 41.7m – 51.6m (59.2 psi – 73.3 psi). The residual pressure for all fire flows simulated was higher than the minimum requirement of 14.1m (20 psi) through the entire system.

The most critical results are obtained when modeling a 150 L/s fire flow at hydrant 311A. The residual pressure is 41.7m (59.2 psi) and the maximum velocity in pipe P-436-79A of 4.01 m/s. The residual

pressure is much higher than the minimum required of 14.1m (20 psi) while the maximum calculated velocity of 4.01 m/s is practically equal to the maximum recommended of 4.0 m/s. Figure 3 shows the fire flow plus MDD results when the fire demand is located at hydrant 311A.

**Figure 3. Residual Pressures and Velocities for FF + MDD at HYD-311A**



## 4.0 SUMMARY

The summary of the findings during the modeling tasks is as follows:

- The existing water distribution system has capacity to supply a continuous demand of 82 L/s at the corner of Riverside Dr. and Eckhardt Ave. while meeting with the City of Penticton Subdivision Bylaw requirements for the water system. No upgrades are required to service the West Bench Irrigation District.
- The analysis carried out included simulation of Peak Hour Demand, Maximum Day Demand and Maximum Day Demand plus fire flow of 150 L/s at several locations in the vicinity of the proposed connection point of the two utilities. In order to get maximum accuracy in the results, nodes were added at the actual hydrant locations.
- The lowest pressure for a non fire scenario takes place at the proposed connection point during PHD. The estimated residual pressure is 65.4m (92.4 psi).
- Velocities for the PHD are lower than the maximum acceptable of 2.0 m/s. Velocities under MDD plus fire flow are typically lower than 4.0. When simulating a 150 L/s fire flow at Hydrant 311A there is one pipe with velocity of 4.01 m/s which could be considered equal to the maximum acceptable velocity for the fire flow condition.
- Although the figures included in the report show the area close to the proposed connection point, the residual pressures and water velocities were reviewed for the entire system. The results from the model are satisfactory and meet with City of Penticton requirements.

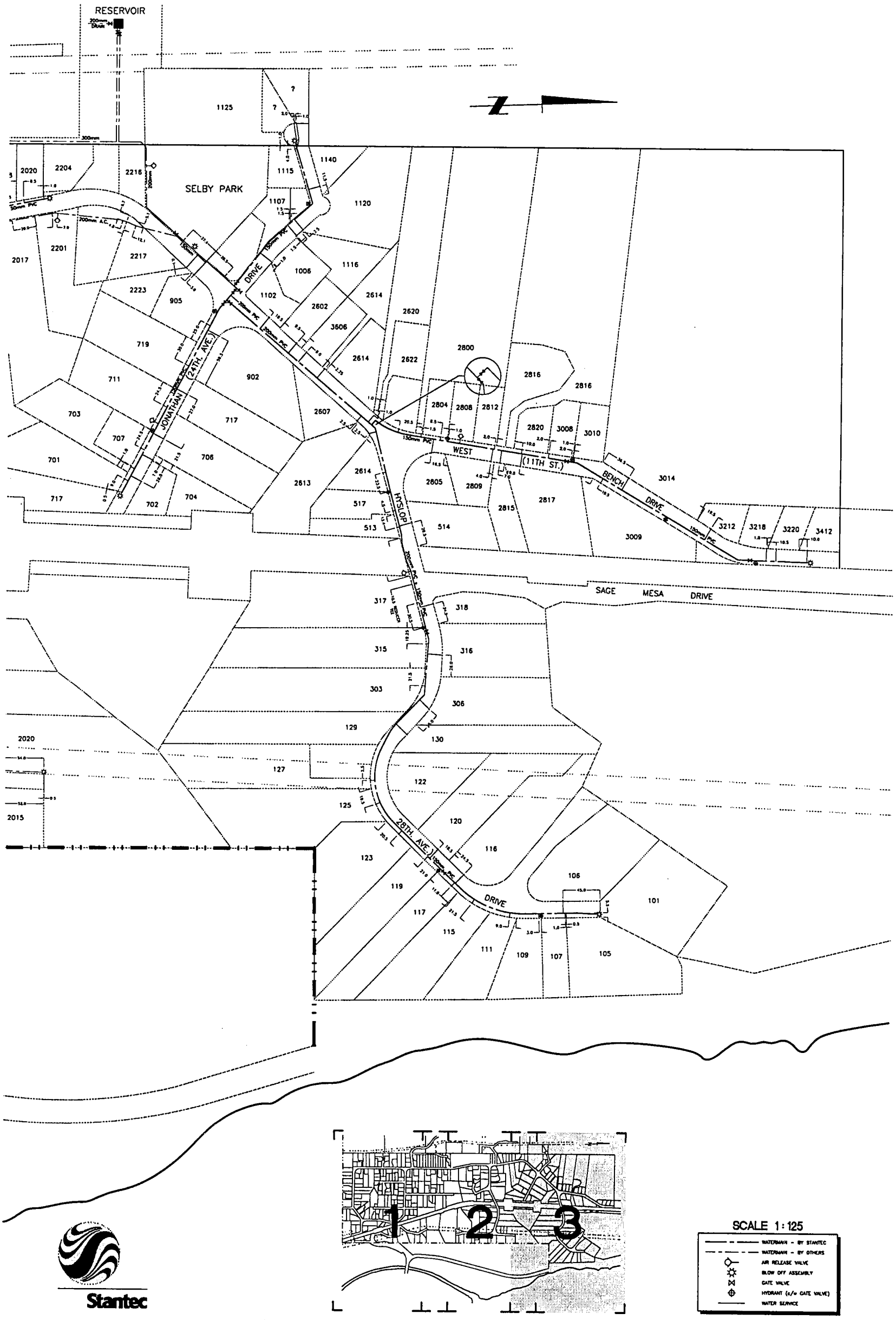
Please review this report and don't hesitate to contact me with your comments.

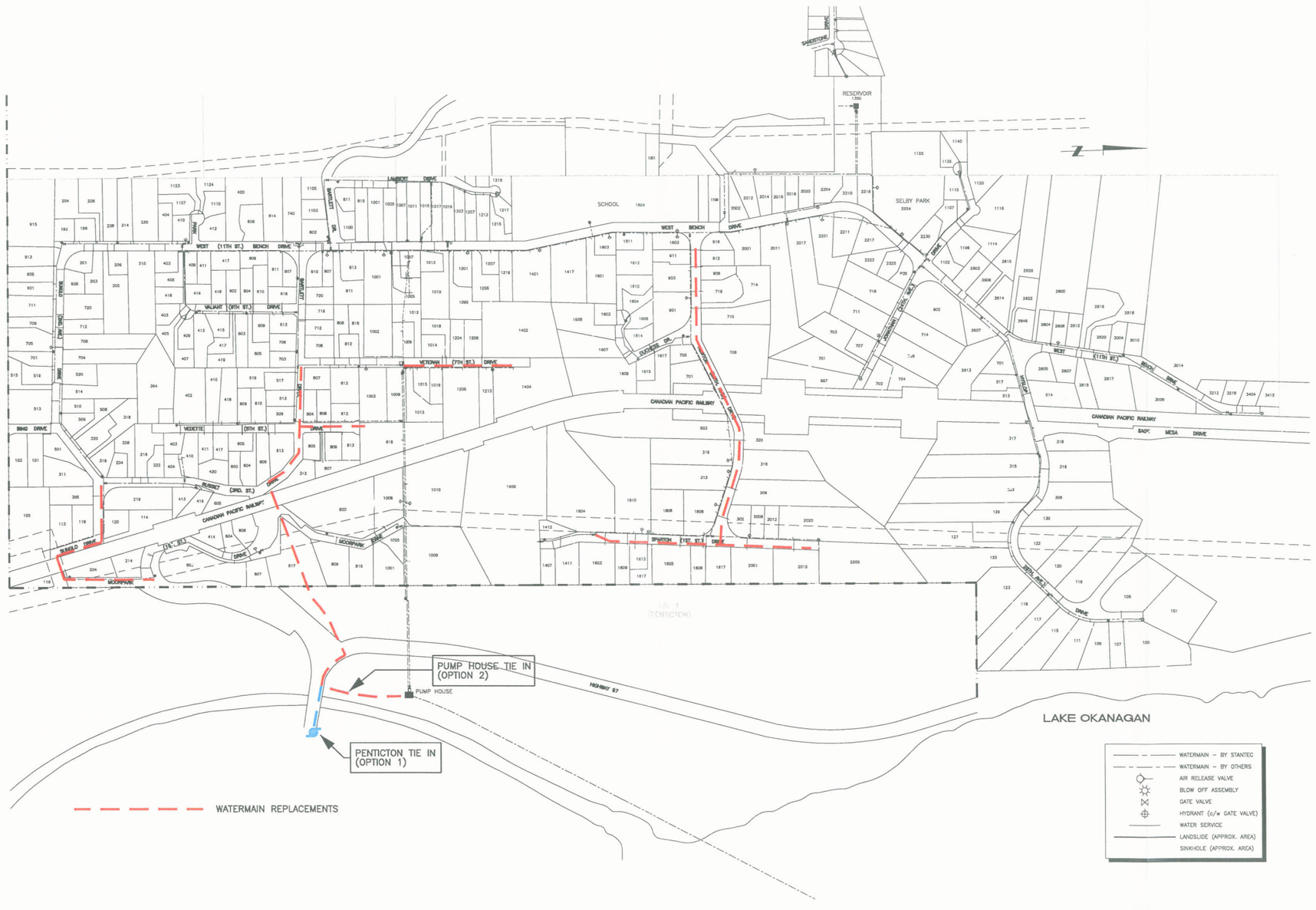
Yours truly,
**AF CONSULTING LTD.**

Sec. 22(1) personal information

Antonio Faccini, BASc
Principal

AF/af


RESERVOIR
200mm DRAIN
300mm
1125
?
1140
1115
1120
SELBY PARK
1107
2020
2204
2216
2201
2217
2017
2223
905
1006
1116
1102
2614
2602
2620
3606
2622
2800
2816
2804
2808
2812
2820
3008
3010
3014
719
711
902
703
717
2607
707
706
701
704
702
2613
2614
2605
2809
2815
2817
3009
3212
3218
3220
3412
513
514
517
HYSLOP
DRIVE
JONATHAN (24TH. AVE.)
WEST (11TH ST.)
BENCH DRIVE
SAGE MESA DRIVE
317
318
315
316
303
306
129
130
127
122
125
120
116
123
119
117
115
111
109
107
105
106
101
28TH. AVE.
2015
1
2
3
SCALE 1:125
WATERMAIN - BY STANTEC
WATERMAIN - BY OTHERS
AIR RELEASE VALVE
BLOW OFF ASSEMBLY
GATE VALVE
HYDRANT (c/w GATE VALVE)
WATER SERVICE
Stantec




| NO. | DATE | DESCRIPTION | BY | APPROVED |
|---|---|---|---|---|
| 6 | | | | |
| 5 | | | | |
| 4 | | | | |
| 3 | | | | |
| 2 | | | | |
| 1 | | | | |

REVISIONS

| NO. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| 5 | PLAN OF RECORD | | |
| 4 | APPROVAL FOR CONSTRUCTION | | |
| 3 | FOR TENDER | | |
| 2 | FOR APPROVAL | | |
| 1 | PRELIMINARY | | |

DRAWING STATUS

LEGEND

| | | | |
|---|---|---|---|
| WATER | | MANHOLE | M.H. |
| SAN. SEWER | | POWER POLE | P.P. |
| STORM SEWER | | LAMP STANDARD | L.S. |
| GAS | | CATCH BASIN | C.B. |
| U/G TELEPHONE | | HYDRANT | |
| U/G ELECTRICAL | | TREES | |

SEAL

Stantec

| | |
|---|---|
| DESIGNED BY | C.W.H |
| DRAWN BY | DPG |
| SCALE | 1 : 8500 |
| APPROVED BY | C.W.H |
| CHECKED BY | J.T.G |
| DATE | APRIL 2006 |

CLIENT: WESTBENCH IRRIGATION DISTRICT

TITLE: WATER SYSTEM UPGRADE
MAIN REPLACEMENTS

| | |
|---|---|
| FILE NAME: | 207-Overall |
| SHEET | 1 of 1 |
| JOB NO. | 22-207-14 |
| REVISION / STATUS NO. | |
| DRAWING NO. | 3.1 |