Report

Associated Engineering

GLOBAL PERSPECTIVE. LOCAL FOCUS.

Regional District of Okanagan-Similkameen

Osoyoos Irrigation District Water Supply and Treatment Cost/Benefit Review

August 2008

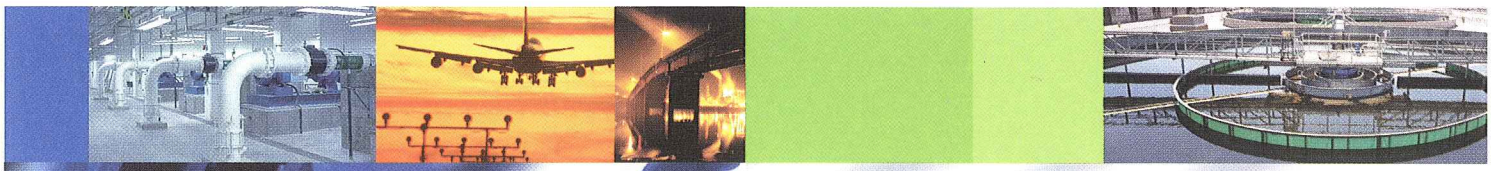


Table of Contents

EXECUTIVE SUMMARY

1 Overview

This report provides a summary of the findings and recommendations relative to options for developing alternative water supply sources and water treatment solutions for the Osoyoos Irrigation District (OID). The project includes a review of water demands, water quality objectives, water treatment requirements, and options for supply of water to the OID service area. More detailed information is available for 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 Acknowledgements

Associated Engineering would like to acknowledge the input of the following RDOS and OID personnel who have been actively involved in the development of this report:
Mr. Andrew Reeder, Engineering Services Manager, RDOS
Mark Pendergraft, Area Director, RDOS
Michael McWhinnie, Treasurer, Osoyoos Irrigation District

3 Existing System

The existing water system is managed by the Osoyoos Irrigation District on the east bench of Osoyoos Lake, just east of the town of Osoyoos. The system was constructed in 1967 and is currently on a Standing Boil Water Notification. The system consists of the following components:

- 140 Domestic Connections
- 40 agricultural connections
- 163 ha of agriculture
- Screen intake - 10.7 m deep - 300 m intake to pump house on 45th St.
- Four vertical turbine pumps in wet well
  - 158 Lps @ 110 TDH
- Gas chlorination system
- A 180,000 litre balancing reservoir,
- An aging distribution system consisting of pipes ranging in diameter from 75 mm to 300 mm diameter of varying material.

4 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:

- 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.

5 Potential Water Supply and Treatment Requirements

The following is a review of water supply sources to Osoyoos Lake.

5.1 Osoyoos Lake

OID water supply is currently drawn from Osoyoos Lake. The OID inlet is in the southern portion of the Lake, and can typically experience higher temperature and colour problems than in the lower portion. Earlier studies have shown that water quality parameters in the Okanagan River near Oliver typically read True and Apparent colours between 5 to 20 Colour units, hardness values between 100 to 150 mg/L and turbidity values well over 5 NTU, particularly during spring freshet. The turbidity values have generally remained around the 1 NTU level during the year, except where higher temperatures and nutrient levels increase the turbidity and colour levels in the water. We believe that this water can be consistently treated using conventional filtration methods.

We have assumed that water treatment systems off Osoyoos Lake are not candidates for Filtration Deferral by IHA, and therefore must include filtration.

5.2 Groundwater

A preliminary report on the assessment of groundwater availability was produced by Golder Associates Ltd. as part of this project. The report determined that there may be some areas to develop a domestic water supply for domestic indoor use only. There is inadequate capacity to provide irrigation to lawns or gardens from this supply.

Under current legislation, groundwater must be chlorinated to maintain minimum chlorine residuals in the distribution system and avoid bacterial contamination. Chlorination using free chlorine is proposed for disinfecting the groundwater extracted from the aquifer, assuming the well is not GUDI. This form of disinfection would provide a residual in the distribution system to control microbial re-growth.

5.3 Town of Osoyoos

The Town of Osoyoos supplies all urban development within its town limits with groundwater supplied from six deep wells. Generally, the drinking water is documented to meet or exceed Canada Drinking Water guidelines. Town water is not fluoridated or chlorinated. The Town is on the Conditions on Permit Program and will meet IHA's 4-3-2-1-0 treatment objective in the future.

Outside Town limits, water is supplied from Osoyoos Lake or from the Okanagan River through intakes and pump stations. This water is treated with a chlorination system.

5.4 Point of Entry Devices

Point of Entry (POE) devices are considered as a treatment process for those options where rural homes are supplied with irrigation water only. These POE's must meet the IHA 4-3-2-1-0 protocol. Ultrafiltration membrane filters, with GAC pre-filtration and post-membrane UV disinfection are proposed, and would provide turbidity removal, UV disinfection, and a dual barrier to pathogens. Chlorination would continue at the lake intake site, and raw water would be fed directly into the POE devices.

6 Water Demand Design Criteria.

Technical Memorandum No. 1 provides information on water demand design criteria. The water supply and treatment components must be designed to meet maximum day demand (MDD). The following confirms the breakdowns of demands used in the preparation of this report:

- Residential Demand MDD = 180 connections at 900 L/day = 0.175 ML/day.
- Agricultural Demand (163 ha) MDD = 13.1 ML/day.
- Total Combined Demand = 13.3 ML/day

7 Distribution System Upgrades

The existing distribution requires upgrades beyond the water quality upgrades identified in this report. Upgrades to address the following issues are common to all options and are included in all cost estimates:

- Looping the system where possible, allowing for less water stagnation, improving taste and odour and minimizing corrosion.

- Existing raw water connections to the households will be maintained for irrigation and fire flow protection where system separation is proposed. Any new pipeline connected to a residence will provide potable water for indoor use only.

- Fire flows will continue to be provided through the existing irrigation system.

- Service connections are presently unmetered. All options include the installation of flow meters at all service connections.

8 Proposed Servicing Options

We examined the following options:

8.1 Option 1 – Osoyoos Lake Treated Supply

This option assumed that all Osoyoos Lake water delivered through an updated OID infrastructure be treated to the minimum IHA requirements. Included in the upgrade of the system would be a new high lift pump station and water treatment facility. The existing pump station would be converted to a low lift facility to feed the treatment plant. The new water treatment plant would be placed in the vicinity of the existing pump station. The treatment plant would include conventional filtration to treat 13.3 ML/day, including flocculation, clarification, filtration, chlorination and residue management and a building.

8.2 Options 2 and 2a – Osoyoos Lake Treated Domestic Supply

By separating the residences from the current distribution system and connecting them to a new, smaller twinned domestic system, only that residential water would require treatment. We investigated two options with this type of arrangement:

- Option 2 assumed all residences in the OID would be supplied by separate domestic distribution system with treated water from a new filtration plant. Additional works would include a new domestic supply high lift pump station and treated water supply main to the new twinned distribution system. The existing intake and pump station would continue to operate for irrigation and fire flow.
- Option 2a assumed that POE devices could be used to supply the rural residences instead of twinning long distances with new distribution mains to each. Using POE's would require IHA approval.

8.3 Options 3 and 3a – Groundwater Domestic Supply

Golder Associates Ltd. examined the possibility of using groundwater from a contained aquifer to provide a separated pipeline system with water for residential use only. For the purposes of this report, we assumed that the water supply was for direct residential consumption only, and that the groundwater supply would only require chlorination (provided the wells are not GUDI - Groundwater Under Direct Influence). Only groundwater sources within the District boundaries were examined. There may be opportunities outside the boundaries, but are beyond the scope of this report.

- Option 3 assumed all residences in the OID were supplied by pipeline with groundwater. Additional works would include well installations, new water supply mains and new chlorination units. The existing intake and pump station would continue to operate for

irrigation and fire flow. Double backflow prevention devices would be required at potential cross connections.

- Option 3a assumed that POE devices could be used to supply some of the rural residences not directly connected to the groundwater pipeline instead of installing new distribution mains to each. Using POE's would require IHA approval.

8.4 Option 4 – Osoyoos Lake Supply with Point of Entry Treatment

Similar to Option 1, we assumed that the OID would continue to provide raw water from Osoyoos Lake to all clients through an upgraded pump station and distribution system, with residences using point of entry devices to treat their water. Pilot testing would be required to determine the optimal water treatment requirements.

8.5 Option 5 – Town of Osoyoos Supply

We examined connecting the OID to Town of Osoyoos water distribution system. The source of raw water source for this option is from the Town of Osoyoos, which relies on GUDI groundwater for its water supply, and therefore currently does not comply with all the conditions on its permit, nor does it meet the 4-3-2-1-0 objectives. This would require a connection to an existing City watermain which is in close proximity to the existing OID pump station, new pump station and twinned pipeline system to service residences similar to Option 2. The Town does not treat or disinfect water from its groundwater sources.

The key issue with this option is that the Town of Osoyoos will not provide water to the OID. The RDOS contacted the Town to pursue a connection to the Town system and to provide additional water necessary and cover these costs. The Town responded by letter that there is no willingness by the Town to provide water to the OID at this time. A copy of this letter is included in the Appendices of Technical Memorandum No. 1. We did not include Option 5 in the economic analysis since operating costs and fees were not available.

9 Cost Estimates

The capital cost estimates used for the comparison of the options have been developed using unit pricing for all components. Cost estimates are based on year 2000 pricing. The net capital cost was calculated on the assumption that the project would be eligible for 2/3 funding assistance for 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 percent per annum.

For each option the calculated increase in annual taxes per connection has been shown in Tables 1 and 2. This cost represents the increased annual cost for debt retirement and operation and maintenance that will have to be covered by OID ratepayers if the improvements are implemented. The following tables provide a summary of the financial impact for each option.

Table 1. Cost Comparison

Option	Name	Supply and Distribution System Capital Cost	Water Treatment Capital Cost	Capital Cost	Initial Annual O&M Cost
1	Osoyoos Lake Treated Supply	$2,283,000	$7,968,350	$10,251,350	$528,026
2	Osoyoos Lake Treated Domestic Supply	$3,420,000	$358,800	$3,778,800	$35,896
2a	Osoyoos Lake Treated Domestic Supply (POE in Rural Residences)	$2,125,000	$622,800	$2,747,800	$58,896
3	Groundwater Domestic Supply	$3,613,000	$23,400	$3,636,400	$20,466
3a	Groundwater Domestic Supply (POE in Rural Residences)	$2,211,000	$221,400	$2,432,400	$43,240
4	Osoyoos Lake Supply with POE Systems	$764,000	$1,188,000	$1,952,000	$138,820

Table 2. Life Cycle Cost Comparison

Option	Name	Capital Cost	Capital Cost Based on Gov't Grant of 2/3 of Capital Costs	Inflated O&M Life Cycle Cost – 20 year	No. of Connections	Net Life Cycle Cost Per Connection	Total Annual Cost per Lot
1	Osoyoos Lake Treated Supply	$10,251,350	$3,617,000	$12,829,640	180	$103,524	$5,176
2	Osoyoos Lake Treated Domestic Supply	$3,778,800	$1,460,000	$872,177	180	$17,863	$893
2a	Osoyoos Lake Treated Domestic Supply (POE in Rural Residences)	$2,747,800	$1,116,000	$1,431,017	180	$17,900	$895
3	Groundwater Domestic Supply	$3,636,400	$1,412,000	$497,270	180	$15,352	$768
3a	Groundwater Domestic Supply (POE in Rural Residences)	$2,432,400	$1,011,000	$1,050,607	180	$14,851	$743
4	Osoyoos Lake Supply with POE Systems	$1,952,000	$851,000	$3,372,972	180	$26,326	$1,316

Notes:
1) Assumed Interest Rate 5.00%
2) Assumed Inflation Rate 2.00%
3) Land Acquisition costs are not applicable for grant.

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 technical merits, the risks involved, operational costs and issues, as well as the environmental impacts. 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.

The assessment and evaluation 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 OID Board and RDOS staff.

Option 3 – Groundwater Domestic Supply had the highest overall rating. Further groundwater testing is still required however to confirm whether is adequate capacity in the aquifers to meet the OID domestic requirements.

Option 2 provides the next highest rating. The guarantee of long term water supply coupled with relatively lower life cycle costs make this a possible alternative to Option 3.

The lowest ranked option is Option 1, where the costs to treat all water in the District is prohibitive.

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. As a first step, water quality testing be completed for a full suite of parameters including metals, fertilizers, pesticides and microbiology to confirm the quality of groundwater and its suitability as a drinking water source.

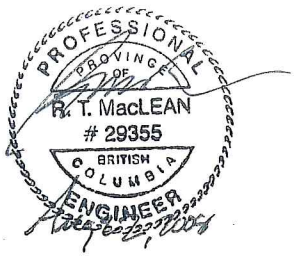
3. Confirm with the provincial government the potential for obtaining provincial government funding for the project.

4. Assuming water quality meets project requirements, a test well should be drilled to confirm long term production capacity.

5. Assuming that ground water quality and quantity meet project requirements, proceed on the basis of Option 3.

6. Before proceeding with final design, the OID should further investigate reducing the design residential domestic demands with the implementation of flow metering.

Prepared by:



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