COMMITTEE OF THE WHOLE

Thursday, January 11, 2024
TO BE HELD
IN THE BOARDROOM OF THE
SUNSHINE COAST REGIONAL DISTRICT OFFICES
AT 1975 FIELD ROAD, SECHELT, B.C.

AGENDA

CALL TO ORDER 9:30 a.m.

AGENDA

1. Adoption of Agenda — Pages 1 - 2

PRESENTATIONS AND DELEGATIONS

2. Langdale Wellfield Development - Project Update (Groundwater Investigation Round 2 - Phase 3)

(i) Presentation: Ineke M. Kalwij, Ph.D., P.Eng., Senior Hydrogeologist and Principal Engineer, Kalwij Water Dynamics Inc., and Joel McAllister, P.Eng., Onsite Engineering Ltd. — Annex A pp. 3-29

(ii) Staff Report: Results Groundwater Investigation Phase 3 - Round 2 - Langdale Wellfield Well Development — Annex B pp. 30-92
Acting Manager, Capital Projects
(Voting – A, B, D, E, F and Sechelt)

REPORTS

3. Water System Fire Flow Update — Report to Follow
General Manager, Infrastructure Services
General Manager, Planning and Development
Manager, Utility Services
(Voting – A, B, D, E, F and Sechelt)

4. 2023 Drought Response Plan Summary — Annex C pp. 93-110
Manager, Utility Services
Water Sustainability Coordinator
(Voting – A, B, D, E, F and Sechelt)

5. Association of Vancouver Island and Coastal Communities (AVICC) Resolutions — Annex D, pp. 111-114
Executive Coordinator
(Voting All Directors)

6. Community Emergency Preparedness Fund Grant Application – Emergency Support Services Equipment and Training – Program Improvements — Annex E, pp. 115-116
Emergency Management Coordinator
(Voting – All Directors)

7. Request for Proposal 2361312 Recreation Management Software – Contract Award — Annex F, pp. 117-118
Manager, Recreation Services
(Voting – B, D, E, F, Sechelt, sNGD and Gibsons)

8. SCRD/School District No. 46 Joint Use Steering Committee Minutes of September 7, 2023 — Annex G, pp. 119-121
(Voting – A, B, D, E, F, Sechelt and Gibsons)

9. Solid Waste Management Plan Public and Technical Advisory Committee (PTAC) Minutes of November 21, 2023 — Annex H, pp. 122-124
(Voting – All Directors)

COMMUNICATIONS

NEW BUSINESS

IN CAMERA

That the public be excluded from attendance at the meeting in accordance with Section 90 (1) (g) (i) and (k) of the *Community Charter* – "litigation or potential litigation affecting the municipality"; "the receipt of advice that is subject to solicitor-client privilege, including communications necessary for that purpose"; and "negotiations and related discussion respecting the proposed provision of a municipal service that are at their preliminary stages and that, in the view of the council, could reasonably be expected to harm the interests of the municipality if they were held in public".

ADJOURNMENT

Sunshine Coast Regional District

ANNEX A

Groundwater Investigation Round 2 Phase 3 – Langdale Well

Summary of Findings and Next Steps

Prepared for the Committee of the Whole Meeting on January 11, 2024

Ineke Kalwij, Ph.D., P.Eng.

Project Manager, Senior Hydrogeological Engineer

Kalwij Water Dynamics Inc.

Groundwater Investigation Round 2, Phase 3 – Langdale Well

- The drilling and construction of two production-sized test wells at the Langdale well site, near test well TW-2(20) which was constructed & tested under *Groundwater Investigation Phase 2, Part 2 and Phase 3 – Gray Creek*.

- To expand SCRD's access to groundwater to meet current water supply deficit in the Chapman Water System and to diversify water supply sources.

Project Scope and Purpose

1| Construction of two Production-Sized Test Wells.

2| Pumping Tests.

3| Technical Assessment & Reporting.

4| Water Licence Application & Other Requirements.

5| Conceptual Design – Wellfield & Water Treatment Plant.

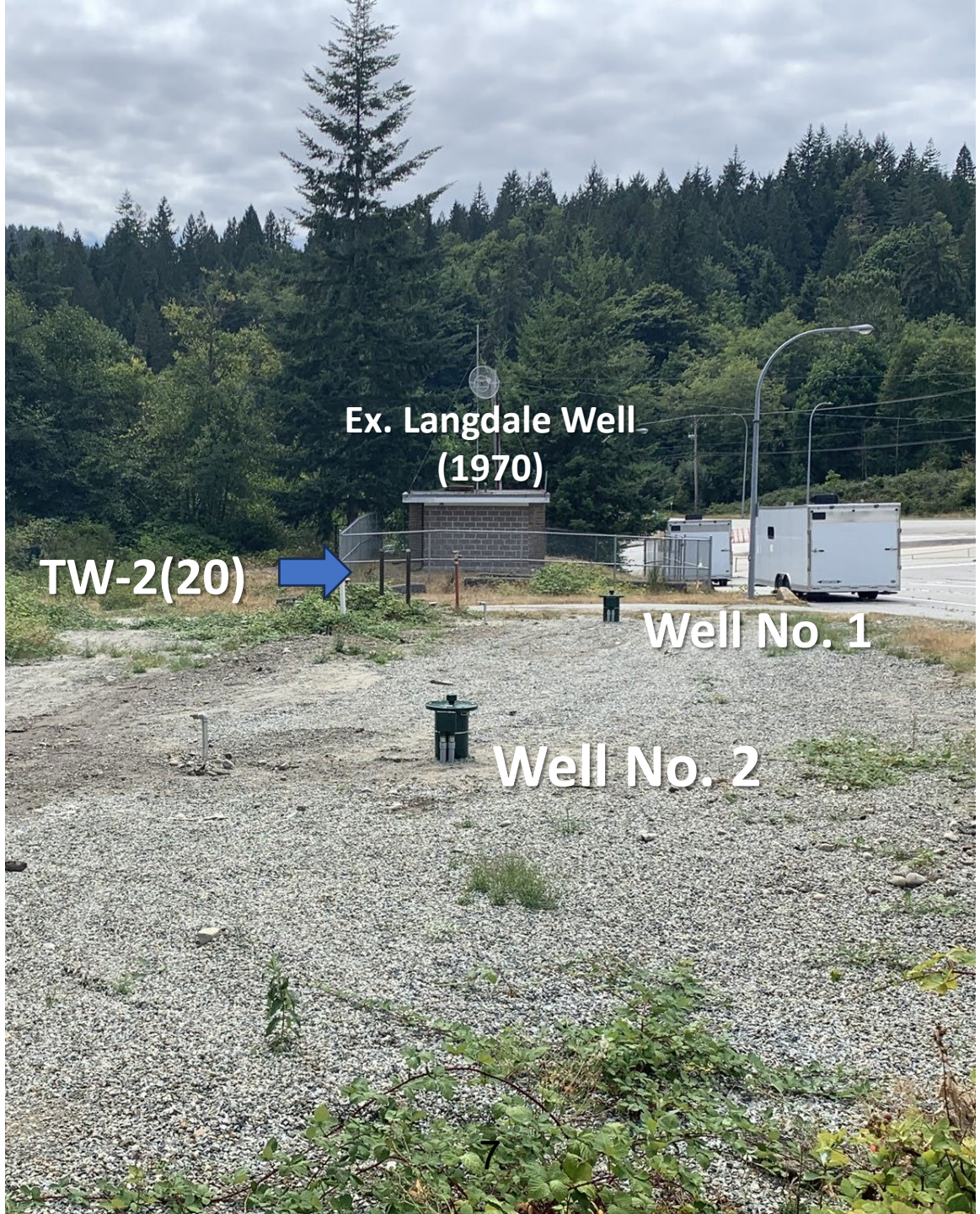
6| Preliminary Construction Cost Estimate.

Project Site

(New Wells)

Well No. 1

Well ID No.
63382

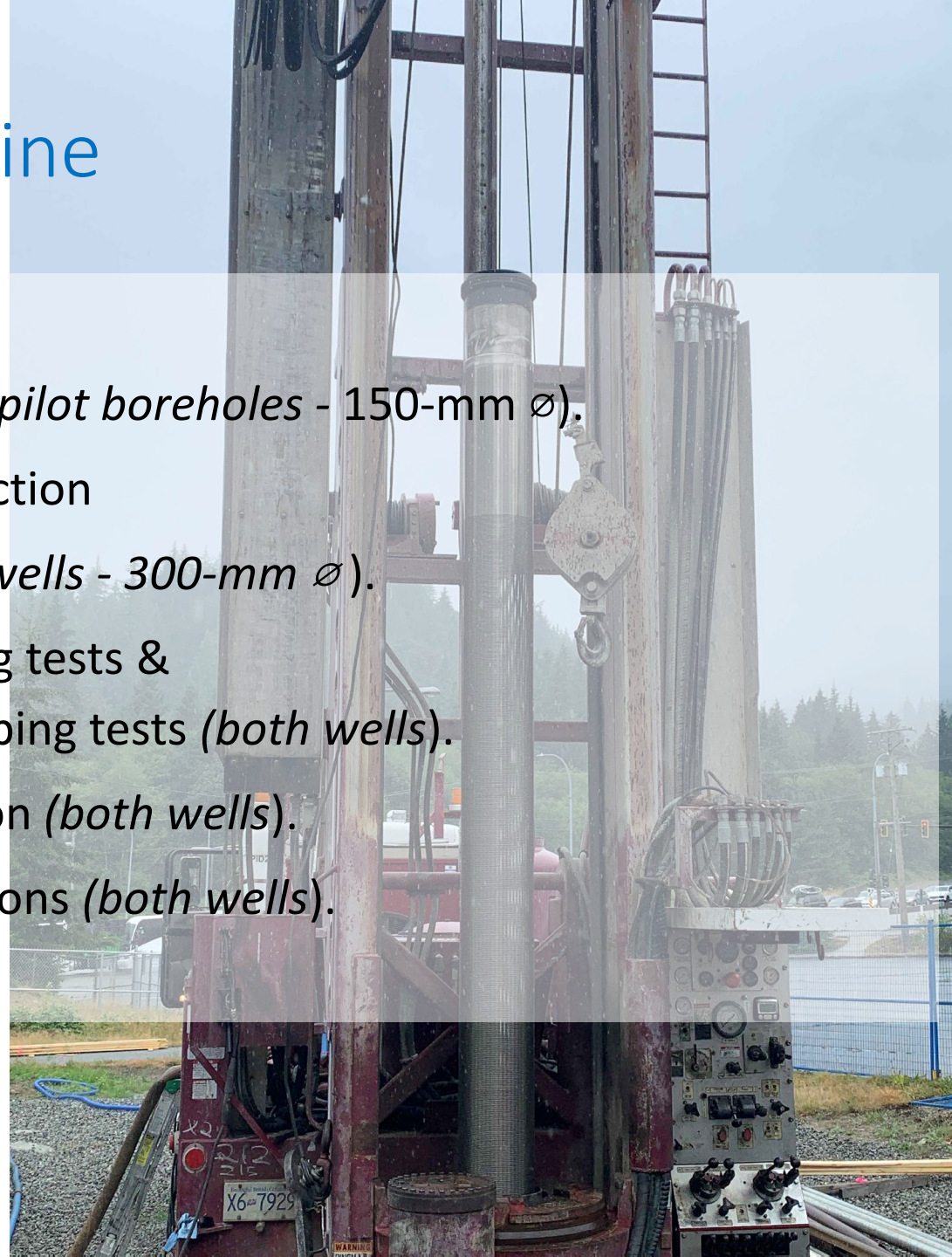


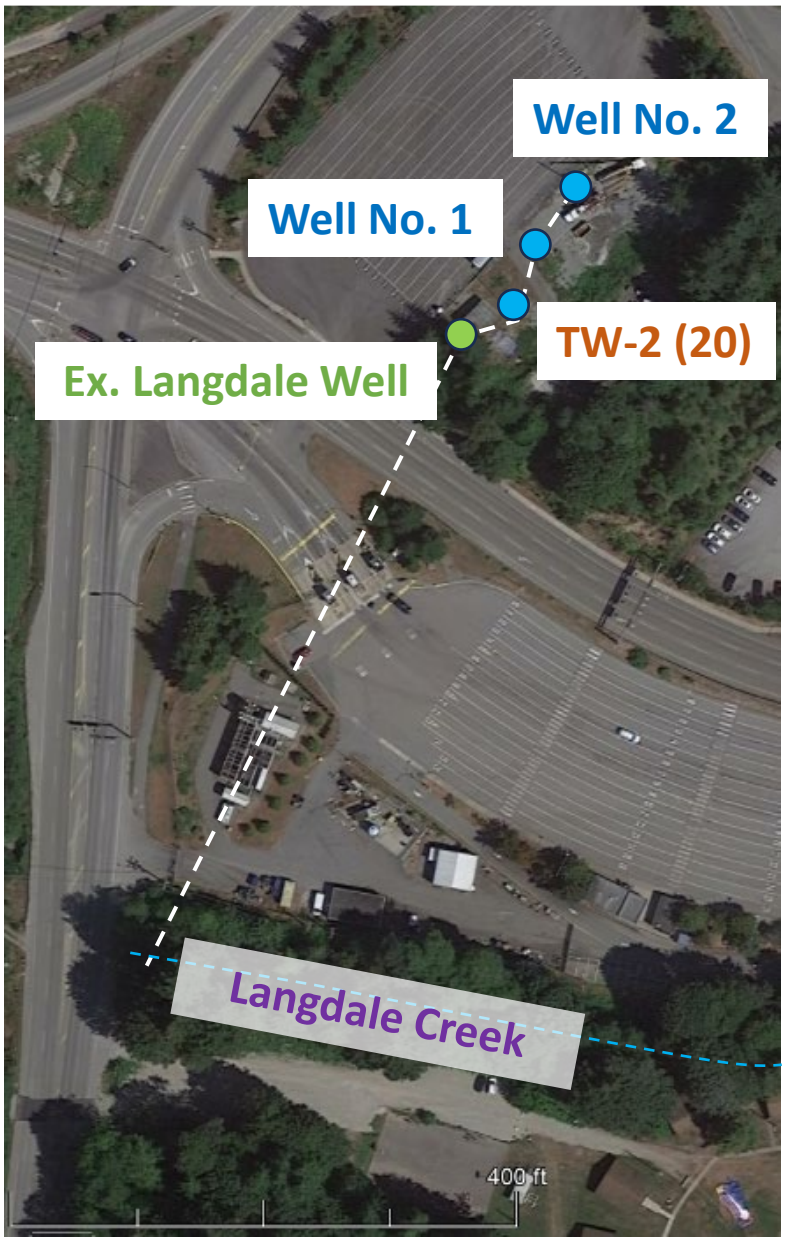
Well No. 2

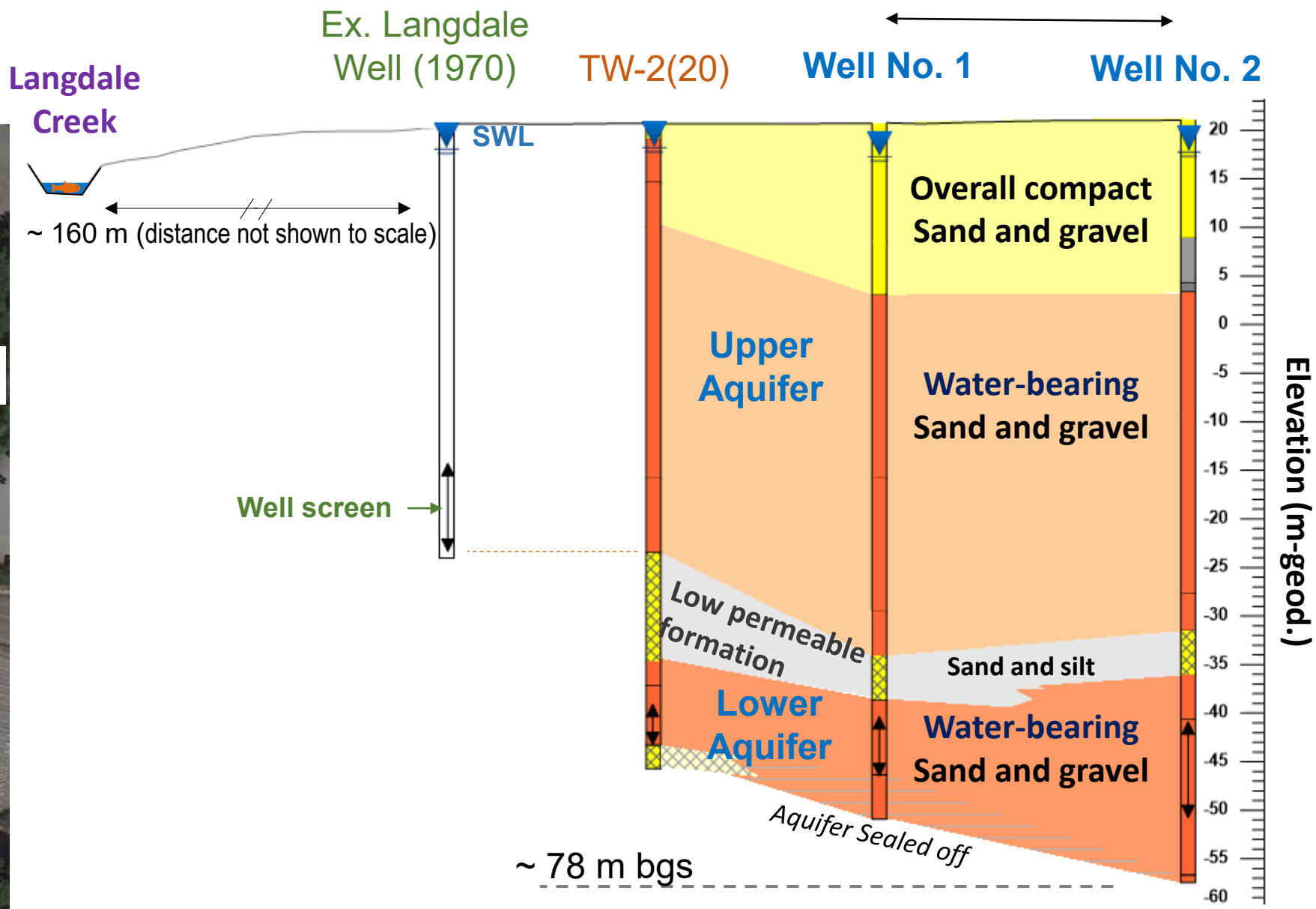
Well ID No.
63383

Fieldwork Timeline

- May 25 - June 2, 2022: Pilot borehole drilling (*2 pilot boreholes* - 150-mm ⌀).
- July 6 - October 5, 2022: Well drilling and construction
  (2 *production-sized test wells - 300-mm* ⌀).
- February 13 - March 3, 2023: Step-drawdown pumping tests &
  72-hr constant rate pumping tests *(both wells*).
- May 17 - May 18, 2023: Pitless adapter installation *(both wells*).
- May 25, 2023: Downhole video inspections *(both wells*).







Hydrogeology (Cross-Section - Schematic)

Production-Sized Test Well Drilling & Construction

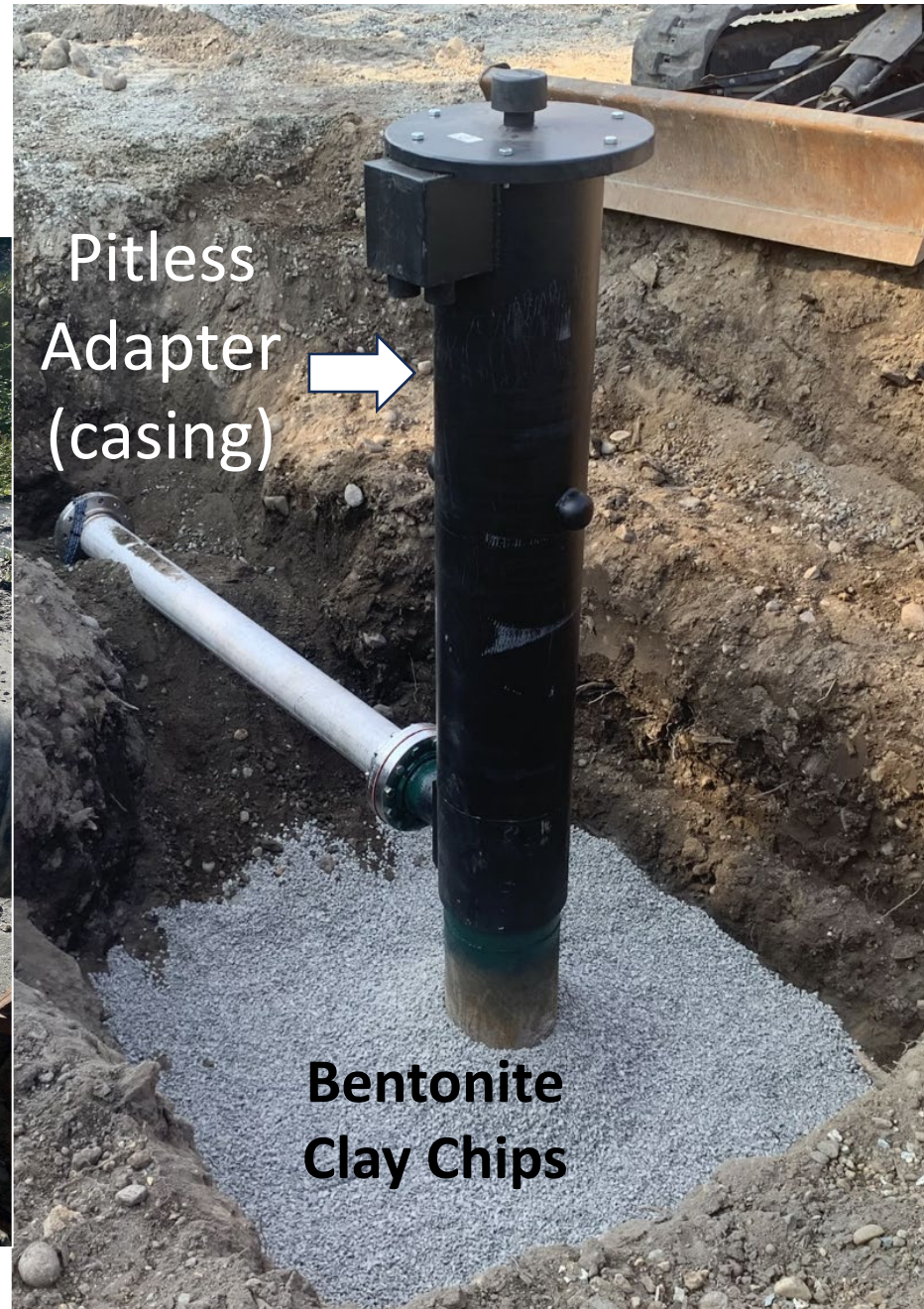
- Casing diameter: 300 mm
- Completed well depth:
  - Well No. 1: 68.6 m (222 ft)
  - Well No. 2: 72.9 m (236 ft)

Well Screen Assembly Installation

- Well No. 1: 5.8 m (screen)
- Well No. 2: 9.1 m (screen)

Well Development

Pitless Adapter Installation



Aquifer Testing & Analysis

- Step-drawdown tests
- 72-hr constant rate pumping tests

- Well No. 1: **19.6 L/s** (311 gpm)
- Well No. 2: **56.8 L/s** (900 gpm)

  - Observation wells.
  - Langdale Creek.
  - Water sampling / analysis.
  - Electrical conductivity, pH monitoring.

Long Term Yield of the Production Wells

- **Well No. 1: 13.1 L/s**
  - *Certified yield: 13.1 L/s*
- **Well No. : 92.8 L/s**
  - *Certified yield: 56.8 L/s*

Water Quality Analysis Results

The water quality of the analyzed constituents meets Canadian Drinking Water Guidelines for maximum acceptable concentrations (MAC) and aesthetic objectives (AO), except the AO for iron and manganese:

Analyte	Well No. 1	Well No. 2	Guideline Limit
Dissolved Iron (mg/L)	0.54	0.67	0.3 AO
Dissolved Manganese (mg/L)	0.047	0.031	0.02 AO; 0.12 MAC

Current levels are not a human health concern but may cause staining and discolouration.

Analyte	Well No. 1	Well No. 2	Guideline Limit
Hardness (mg/L)	38	36	
pH (-)	7.21	7.3	7.0 – 10.5
EC (µSiemens/cm)	114	115	
TDS (mg/L)	61	60	500 AO

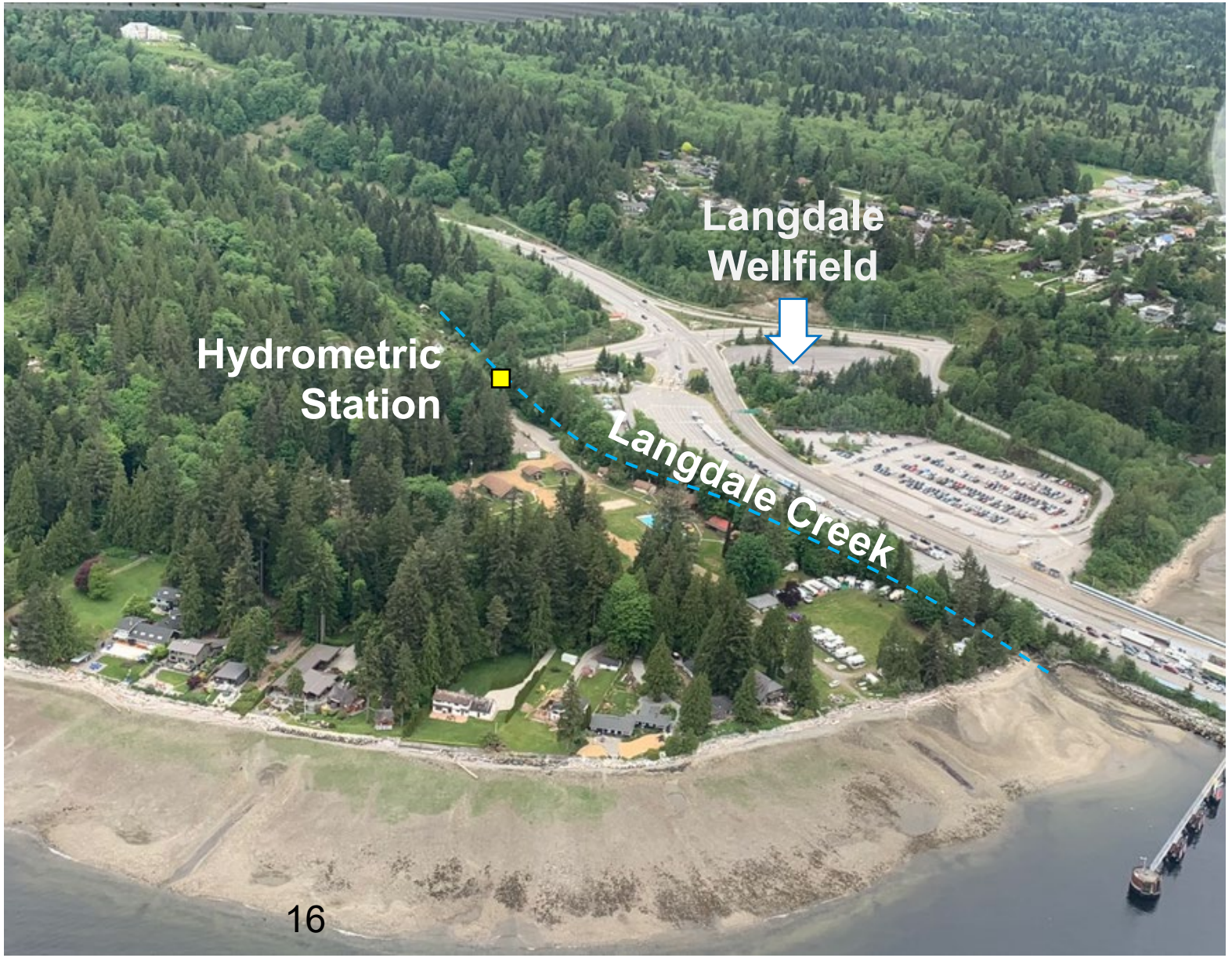
Organic Carbon <= NDL (0.5 mg/L); no concerns for water under the influence of surface water.

Langdale Creek Monitoring

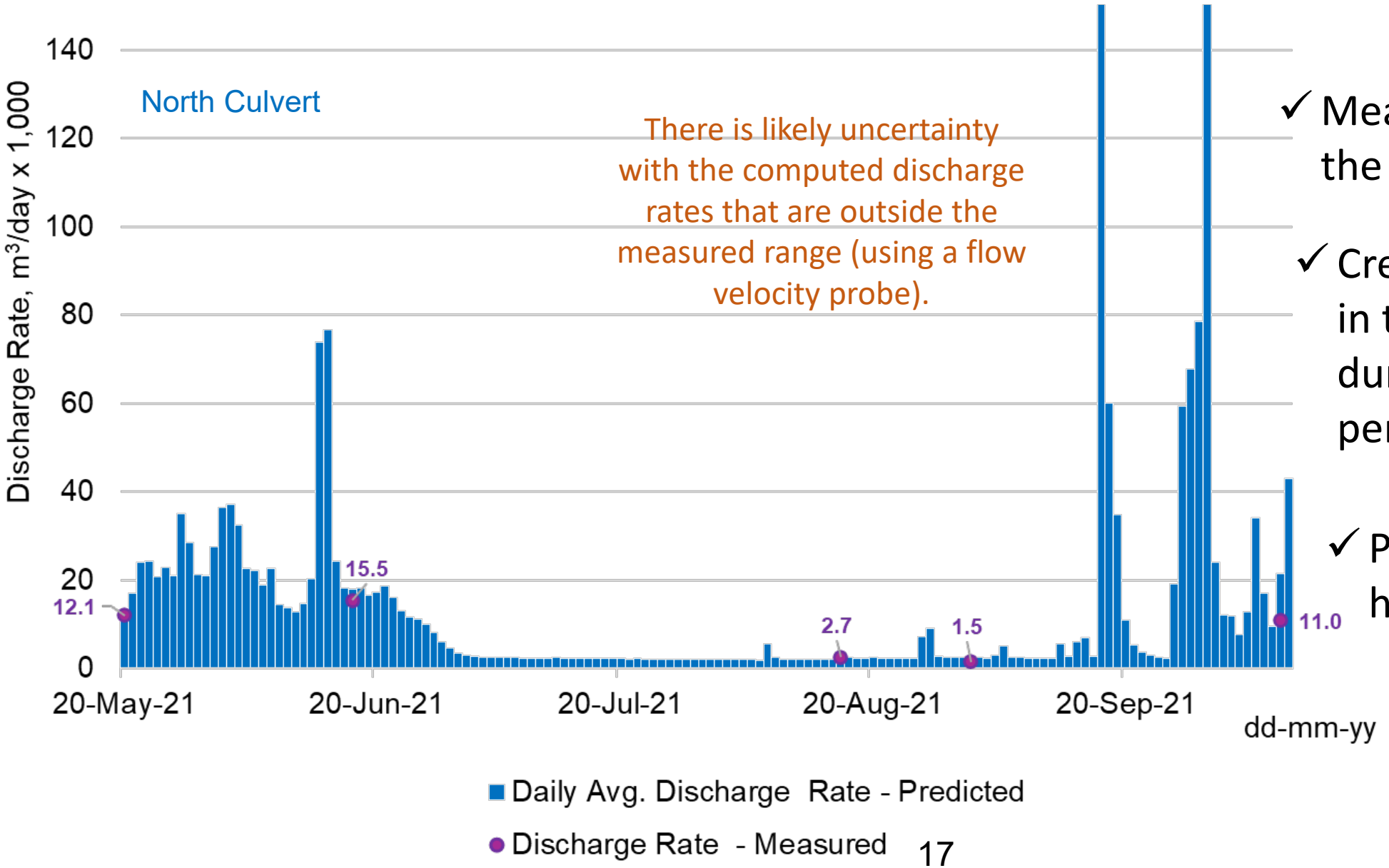
- ✓ May 20, 2021, to Sep 28, 2022:
  - Recording of water levels (levelogger).
  - Periodical flow measurements (flow velocity probe).
  - Establish stream - discharge curve.

- ✓ During the constant rate pumping tests Feb 13 – Mar 3, 2023:
  - Recording of water levels (levelogger).

Langdale Creek Monitoring



Langdale Creek Monitoring - Results



- ✓ Measured <u>low flow</u> in the creek: 1500 m^3/day.
- ✓ Creek did not dry up in this lower reach during the monitored period.
- ✓ Peak flow within 24 hrs of a storm event

Results

- ✓ There was no measurable impact observed on the creek water levels during the **pumping test** window for each well (**New Wells**), with pumping at an average discharge rate of 19.6 L/s and 56.8 L/s for **Well No. 1** (**Test 1**) and **Well No. 2** (**Test 2**), respectively.

- ✓ This rules out direct hydraulic connectivity between the New Wells and Langdale Creek, which might otherwise be observed if the cone of depression from well pumping had intercepted the base of the creek.

Results

- ✓ Given the shallow (unconfined) aquifer inferred to underlie the Langdale Creek Delta, the creek is likely in direct hydraulic connection with that shallow aquifer.

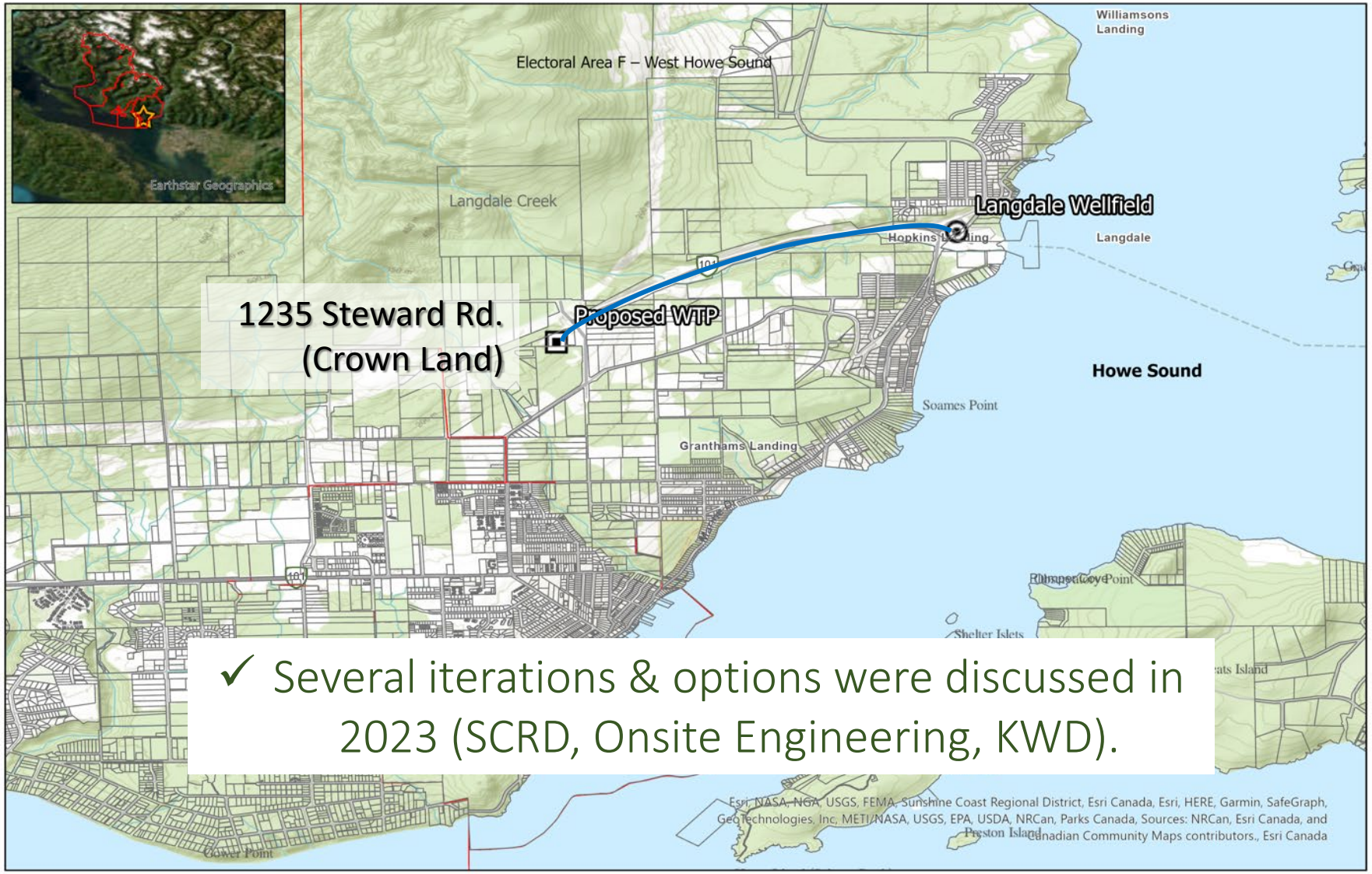
- ✓ The New Wells have been constructed in a lower (leaky) confined aquifer system (*below low permeable formation with likely vertical leakage from the upper aquifer*).

Other Considerations

- ✓ No concerns of saltwater intrusion – based on water quality data collected during the pumping tests.
- ✓ No concerns with respect of well interference (third party wells) – main (other) groundwater user within 1 km radius is Hopkins Water System.

Conceptual Design –

Wellfield, Alignment & Water Treatment Plant (WTP)



✓ Several iterations & options were discussed in 2023 (SCRD, Onsite Engineering, KWD).

Proposed at the wellfield:

- ✓ New building (electrical, controls).
- ✓ Gated access (wellhead protection).
- ✓ Submersible pump-motor assembly (production wells).
- ✓ Backup generator.

Approximately 3 km of 400 mm ø raw watermain along the Sunshine Coast Hwy.

Conceptual Design –

Wellfield, Alignment & Water Treatment Plant (WTP)

✓ Reservoir sizes and other required sizing are all design aspects that need to be confirmed.

WTP:

- ✓ 250 m^3 raw water reservoir.
- ✓ Booster station.
- ✓ Pre-packaged greensand filtration water treatment plant.
- ✓ 2 x 2,500 m^3 treated water reservoir.
- ✓ Waste residual handling and management area.
- ✓ Backup generator.

Treated water transmission main to connect to existing 300 mm ø w/m (intersection N. Road and Reed Road)

N

Class D Cost Estimate

Item	Cost
Langdale Wellfield Completion	$ 1,400,000
Raw Water Transmission Main	$ 4,215,000
Water Treatment Plant	$ 8,200,000
Treated Water Transmission Main and Connections	$ 1,525,000
Total Construction Costs	**$ 15,340,000**
Engineering and Contingency	$ 6,700,000
Project Sub-Total	**$ 22,040,000**

Source: Onsite Engineering – Technical Memorandum #5

Water Licence Application & Other Requirements

- Groundwater licence application (Ministry of Water, Land and Resource Stewardship - MWLRS)
  - Requested amount: 60 L/s (1,892,160 m^3 per year).
  - Application to be submitted in January 2024.
- Crownland Tenure Application (MWLRS) -
  - 1235 Steward Rd. – Proposed WTP.
  - Application to be submitted in January 2024.
- Project Notification: News Wells & Ex. Langdale Well(1970)
  - Application to be submitted in January 2024.

Next Steps

Key Next Steps

- Secure funds for the Infrastructure needed to connect the New Wells to Chapman Water System (Wellfield, Alignments & WTP).
- Finalize Infrastructure design.
- Continuing communications with the Ministry of Water, Land and Resource Stewardship regarding the Water Licence Application and Crown Land Tenure Applications.

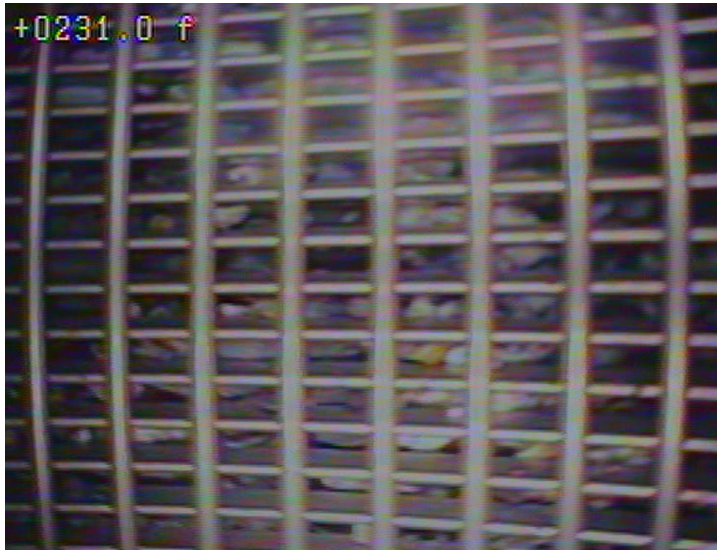
Key Next Steps

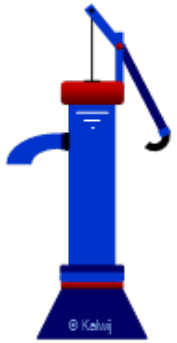
- Organize an information session / consultation meeting with the First Nations – *Communications / scheduling in progress*.

- Ministry of Transportation & Finance (MOTF) & BC Ferries Terminal (BCF) – Langdale Wellfield Land Use / Land Swop: land falls within area leased by BCF from MOTF – *Communications in progress*.

- Ministry of Transportation & Infrastructure (MOTI): permission for trenchless crossings, raw water transmission main construction along Sunshine Coast Hwy, access road to WTP, tie-in to Chapman Water System.

Downhole Video: view through the well screen towards the geological formation (aquifer).





Thank you for your Attention.

Any Questions?

SUNSHINE COAST REGIONAL DISTRICT STAFF REPORT

TO: Committee of the Whole – January 11, 2024

AUTHOR: Jesse Waldorf, Acting Manager, Capital Projects

SUBJECT: **RESULTS GROUNDWATER INVESTIGATION PHASE 3 – ROUND 2 – LANGDALE WELLFIELD DEVELOPMENT**

RECOMMENDATION(S)

1) **THAT the report titled Results Groundwater Investigation Phase 3 – Round 2 – Langdale Wellfield Development be received for information;**

2) **AND THAT the SCRD proceed with the final design and engineering to support construction of the Langdale Wellfield;**

3) **AND THAT the 2024 Budget Proposal for the Langdale Wellfield Development be amended to reflect the revised project costs and proposed funding sources;**

4) **AND FURTHER that staff provide a report as part of the 2024 Round 2 deliberations on the financial and electoral process implications of long-term borrowing in support of the construction phase of the Langdale Wellfield Development project.**

BACKGROUND

The Comprehensive Regional Water Plan, approved in June 2013, identified several projects to increase the water supply for the Chapman Creek water supply system. One of those projects is the Groundwater Investigation project, which explores the potential development of production wells as an additional water supply source.

Phase 1 of the Groundwater Investigation project was concluded in spring 2017 and included a desktop feasibility study of the sites to develop production wells. The results of Phase 2 of the Groundwater Investigation project were presented to the Board in January 2019. During that phase, small diameter test wells were drilled at four sites selected during Phase 1. Subsequently, test pumps were temporarily installed to test productivity of the well, potential for impacts to the environment and other nearby wells, and to determine water quality. Based on the findings of that phase, the Board approved to advance the development of the Church Road Wellfield.

In 2020 the Board provided direction to staff to initiate a second round of drilling and testing of potential sites for production wells. Based on the results of the testing and analysis undertaken as part of Groundwater Investigation Phase 2, Part 2, further development of a wellfield at the Langdale location was recommended.

In November 2021, the Sunshine Coast Regional District (SCRD) contracted Kalwij Water Dynamics (KWD) to complete Round 2, Phase 3, of the Groundwater Investigation. The scope of the project included siting, designing, drilling, developing, testing, and analyzing two production sized wells in the vicinity of the Langdale Ferry Terminal, and connecting the Langdale System to the Chapman Water System.

The purpose of this report is to present the findings of the Groundwater Investigation Round 2 – Phase 3, Langdale Wellfield Well Development project and to seek direction on proceeding with Phase 4.

DISCUSSION

The results of Phase 3 of the development of a wellfield at Langdale are summarized in a technical memorandum that is attached as Attachment A. As part of this Committee meeting's agenda there is also a presentation by the consultant on these results.

Site selection of wellfield

The SCRD owns and operates an existing Langdale well located near the BC Ferries terminal. This well has been providing water to the Langdale community since 1971. The Langdale Water System is a stand-alone water system supplying potable water to approximately 223 properties.

In a previous project phase, adjacent to the existing Langdale well located at the BC Ferries terminal was determined to be the best location for the drilling and construction of the two new production-sized test wells. This site is managed by BC Ferries Corporation and owned by the BC Transportation Financing Authority.

Drilling of two new test wells and results of pump testing

Two 250 mm production-sized test wells were drilled as part of this project phase. Well 1 was drilled to a depth of 68.6 meters and Well 2 was drilled to a depth of 72.9 meters. Both wells access a deeper aquifer than the current Langdale well is diverting water from. It is likely that these two aquifers are not connected.

From the pump testing results, it was determined that the combined long-term sustainable yield of the two new wells is 70 L/s. The long-term sustainable yield is the amount of water that can be drawn from a well without having any long-term negative impacts on the aquifer.

The preliminary water quality testing from the two new production wells indicates that the raw water meets the Guidelines for Canadian Drinking Water Quality standards for maximum acceptable concentrations and aesthetic objectives, except the for iron and manganese. The raw water has elevated concentrations of dissolved iron and manganese that are not a human health concern but will need to undergo treatment to remove.

As time is of the essence, it is recommended to keep the total withdrawal capacity under 75 L/s. If that threshold is exceeded a full Environmental Assessment under the *BC Environmental Assessment Act* is required which would take several years to complete. Taking into consideration the capacity of the existing well and keeping total withdrawal under 75 L/s, the additional capacity from the new wells would be 60 L/s.

There may be opportunities to investigate increasing this volume in future should the SCRD seek to increase the volume of the licence. At that time the drilling of a third well as a back-up well, or to create additional withdrawal capacity, could be considered.

Potential impact to Langdale Creek

The Langdale Wellfield is approximately 175 m north of Langdale Creek, which is a confirmed fish bearing creek and categorized as having a sensitive ecosystem.

Based on the data collected during the Langdale Creek monitoring program, which was carried out between May 20, 2021, and September 28, 2022, KWD confirmed that there is no measurable impact on the creek water levels. It is therefore unlikely that a future Water Licence for this wellfield will contain a requirement to augment creek flows to maintain Environmental Flow Needs.

Impact on Chapman Water System

The additional 60 L/s or 5184 m3/day from the new wells will contribute to the Chapman Water System.

The Church Road Wellfield can provide 4,800 cubic metres per day (m3/day) and up to 700 m3/day to maintain the Environmental Flow Needs for Soames Creek.

To put these volumes in the context of the actual current water demand the peak daily average demands during each of the Water Conservation Stages for 2022 and 2023 m3/day for the Chapman water system are presented in the table below.

	2022	**2023**
Stage 1	21,321	20,687
Stage 2	19,337	19,970
Stage 3	17,762	15,810
Stage 4	13,268	12,601

Proposed infrastructure to connect new wells to Chapman Water System

The infrastructure associated with new wells will only supply the Chapman Water System and the existing Langdale Water pump and treatment infrastructure will remain a separately operated water system serving the existing Langdale community.

As part of the Wellfield development and connection to the Chapman Water System, the proposed infrastructure upgrades required to utilize the new Wellfield include the following:

- Drilled wells and pumps
- Electrical and control equipment building
- Backup generators
- 3 km of 400 mm watermains
- Raw water reservoir
- Water Treatment Plant
- Treated water reservoirs
- Residual handling and management area

A water modelling assessment will be completed to confirm other water transmission infrastructure upgrades required to assist transmission of water to the Roberts Creek/Sechelt area.

Regulatory Requirements, Permits and Approvals

In addition to a groundwater licence application (Ministry of Water, Lands, and Resource Stewardship) that will be submitted in January 2024, the following approvals will be required at various stages to bring the groundwater source online:

- Completion of a Crown Land Tenure Application (Ministry of Forests) for 1235 Stewart Road which will be submitted with the groundwater licence application in January 2024.
- Completion of the Project Notification, which will be submitted to the Environmental Assessment Office (in progress).
- Approval from *Sḵwx̱wú7mesh Nation*; an archaeological investigation will likely be part of the approval process.
- Land Use Approval from BC Ferries Corporation and BC Transportation Financing Authority.
- Approval from Ministry of Transportation and Infrastructure (MOTI) for watermain construction along Sunshine Coast Highway and trenchless crossings at Port Mellon Highway and Stewart Road.
- Construction Permit from Vancouver Coastal Health.
- Various utility applications (BC Hydro, Telecommunications).
- Source Approval / Water System Operation Permit from Vancouver Coastal Health.

Financial Implications

The following table presents an updated summary of project costs of Groundwater Investigation Round 2, Phase 3:

	Groundwater Round 2 – Phase 3 Budget
Approved Budget (2021)	$1,277,600
Contract with KWD for Langdale Wellfield Well Development (per RFP 2137013) *	$650,000
Remaining Budget	**$627,600**

The remaining budget is anticipated to be sufficient to support the design engineering work required to complete development of the tender package for construction. **Staff are requesting the Board affirm that they would like to proceed with the final design and engineering to support construction of the Langdale Wellfield, targeted for 2025**.

The revised estimate to construct all the associated infrastructure is currently $23.37 million, (Class D Cost Estimate).

The table below outlines the estimated costs for all components to develop the wellfield.

Description	Cost estimate
Langdale Wellfield Upgrades *New pump station, wellfield piping and other civil works*	$1.6 M
Raw Water Transmission Main *transmission main and two trenchless crossings*	$4.22 M
Water Treatment Plant *Land acquisition, archaeological, raw water reservoir, two treated water reservoirs, prepackaged chlorination treatment plant, civil works, administration and electrical building, equipment, and storage building*	$7.66 M
Treated Watermain Extension *Tie-in to existing water system, contingency*	$1.53M
Sub-Total Estimate	**$15.01 M**
Designs, Permit and Construction Management	$1.52 M
Total Engineering and Construction	**$16.53 M**
40% Contingency	$6.61M
SCRD Staff	$0.23M
Total Estimate	**$23.37 M**

Considering the approved remaining project budget of $627,600 would be put towards the design portion of the $1.52 million, the total required budget for the construction phase would be $22.75 million. The 40% contingency allowance is intended to cover any unforeseen expenditures and regular cost inflation.

Potential funding sources for the construction phase include reserves, parcel tax, Community Works Funds or the Growing Communities Funds, future grants, and a long-term loan. There are not sufficient reserves to fund this project and staff will continue to explore grant opportunities for this project.

The requested budget included in the 2024 Budget Proposal for the construction phase of this project will be updated based on the cost estimate listed above. **Staff will also provide a subsequent report detailing the financial and legislative implications** for the rate payers at the 2024 Round 2 Budget deliberations to support the inclusion of the project in the Financial Plan.

Organizational and Intergovernmental Implications

Additional staff time and annual operating budget to operate and maintain the Langdale Wellfield and associated infrastructure estimates have been calculated and will be included in the Round 2 2024 Budget Proposal. More accurate operating expenses can only be fully quantified once the design and operating regimes of the infrastructure are complete.

Timeline for next steps

Staff will proceed with issuing a Request for Proposal (RFP) for engineering services for the final design (utilizing the remaining funds) in Q1 2024.

Communications Strategy

Information on this project will be shared broadly via local media, corporate newsletters, social media and the SCRD website. Additional information will be provided to property owners in the vicinity of the proposed wellfield.

Staff recommend changing the name of the project to ch'kwelhp Wellfield Project with agreement from the Sḵwx̱wú7mesh Nation as this is the traditional name of the area.

Staff will reach out to the *shíshálh* Nation and Sḵwx̱wú7mesh Nation to share the general findings of this project. Consultation with Sḵwx̱wú7mesh should begin in early 2024.

STRATEGIC PLAN AND RELATED POLICIES

This project is directly related to the Service Delivery Focus Area of *Water Stewardship* in the Boards 2023-2027 Strategic Plan. It fits within the strategic action of *continuing to explore, enhance and develop ground water and surface water sources.*

CONCLUSION

Two 250 mm production-sized test wells were drilled as part of this project phase. From the pump testing results, it was determined that the combined long-term sustainable yield of the two new wells is 70 L/s.

The development of Langdale Wellfield would substantially increase the overall resilience of the Chapman Water System contributing 5184 m3/day of water to the Chapman Water System.

The remaining approved budget is anticipated to be sufficient to support the design engineering work required to complete development of the tender package for construction. Staff will proceed with issuing an RFP for engineering services for the final design (utilizing the remaining funds) in Q1 2024.

The construction phase of this project is expected to cost $22.75M and staff will provide additional information at the 2024 Round 2 Budget deliberations on the financial and legislative implications of the project.

Staff recommend changing the name of the project to ch'kwelhp Wellfield Project with agreement from the Sḵwx̱wú7mesh Nation as this is the traditional name of the area.

Attachments:

Attachment A – Proposed Chapman Water System Improvements Overview Technical Memorandum, dated December 11, 2023.

Reviewed by:			
Manager	X - S. Walkey	CFO/Finance	X - T. Perreault
GM	X - R. Rosenboom	Legislative	X - S. Reid
CAO	X - D. McKinley	Other	

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DRAFT

TECHNICAL MEMORANDUM #5 File 2053-2

DATE: January 4, 2024
TO: Sunshine Coast Regional District
ATTN: Stephen Misiurak, P.Eng., Manager Capital Projects
FROM: Joel McAllister, P.Eng., Stephen Bertulli, P.Eng.

RE: Proposed Chapman Water System Improvements Overview Technical Memorandum

1 Introduction

The Sunshine Coast Regional District (SCRD) is looking to improve the capacity of the Chapman Water System (CWS) by introducing new groundwater sources. Onsite Engineering (OEL) has worked with Kalwij Water Dynamics Ltd. (KWD) and the SCRD to review multiple configurations for connecting Langdale wellfield water to the CWS. The purpose of this memorandum is to summarize the options reviewed to date and the current preferred approach.

2 Background

The SCRD manages multiple independent water systems throughout the regional district. The CWS is the largest water system and extends from Wood Bay to Hopkins Landing, supplying about 85% of the SCRD's serviced population (approximately 25,000). Water is supplied by the Edwards Lake and Chapman Lake reservoirs, Chaster Wells, Grey Creek Intake, Soames Wells, and recently developed Church Road Wells. A water demand analysis indicated that the SCRD will require additional water supply to meet future demand. The SCRD plans to connect new wells located near the BC Ferries (BCF) terminal in Langdale (herein referred to as 'New Wells') to the CWS to help meet future demand.

3 Summary of Proposed System Improvements

The works required to connect New Wells to the CWS can be broken down into four separate projects:

1. **New Wells** – Construct pumping infrastructure to pump raw water to a new treatment plant (WTP).

2. **Raw Water Transmission Main** – Construct a new raw water watermain to convey New Well water to a new WTP.

3. **Water Treatment Plant** – Construct a new WTP to treat the water to Canadian Water Quality Guidelines (CWQG) standards.

4. **Treated Water Transmission Main** – Construct a new treated water transmission main to connect treated water to the CWS.

Figure 1 shows the extents of where these projects are in relation to the overall project.

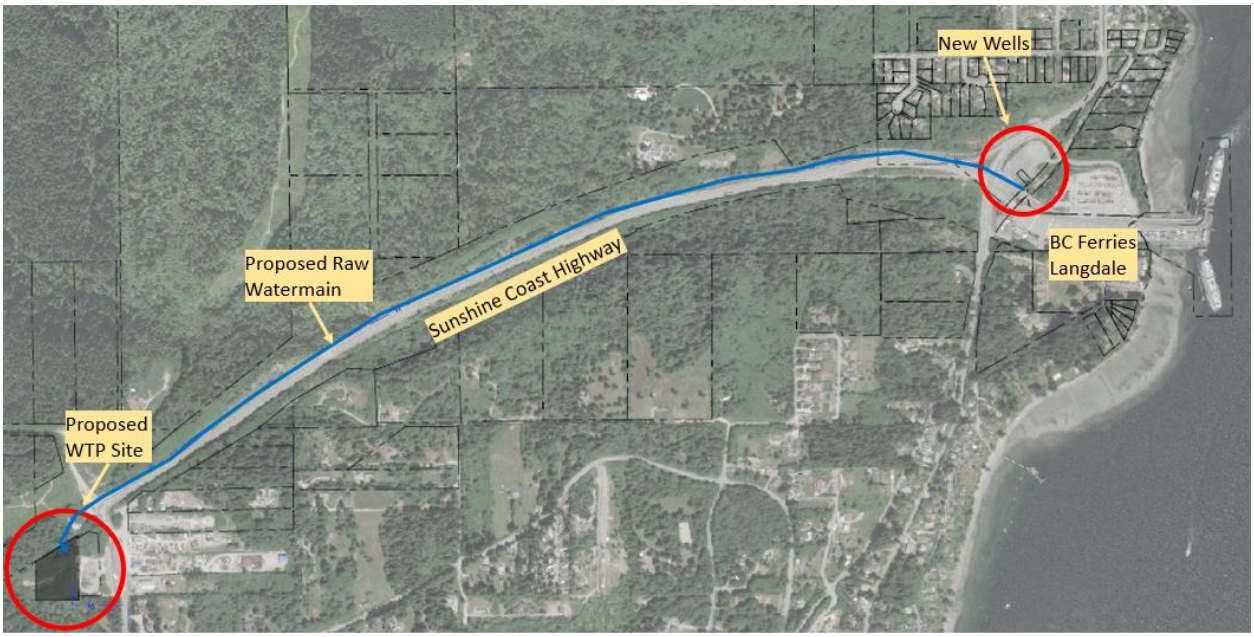

Figure 1: Water System Improvement Project Area

3.1 New Wells

The New Wells, located at the BCF terminal in Langdale, have recently been developed and are intended to supply the CWS with additional water. The water must be pumped to a separate lot for treatment; thus, the wells need to be sized for pumping at a high head or be connected to a booster pump station. It is anticipated that new well pumps will be able to pump directly to the proposed WTP.

The wells dedicated to a new CWS source would be limited to a flow of 60 L/s (951 GPM); the existing Langdale well, which serves the Langdale water system, operates at 14 L/s. The SCRD is aware that well operation above 75 L/s may trigger an environmental assessment.

The infrastructure upgrades for the New Wells include:

- Two (2) 300 mm diameter production wells with pitless units (drilled in 2022) and submersible multi-stage pumps/motors (motor underneath pump assembly).
- Gated access for wellhead protection and would include space for parking and maintenance equipment/vehicles.
- New building to house electrical and control equipment. This may also include an equipment storage and maintenance working area.
- Backup generator capable of allowing pumping to the proposed WTP for a 24-hour period.

- Well flushing station with environmental controls and discharge to the existing stormwater system.
- Provision for future well.

The wellfield site is located within the BCF terminal staging area, and the expansion will need to occupy part of the adjacent Ministry of Transportation of Infrastructure (MOTI) right-of-way. Design will require coordination and approvals from both the BCF and MOTI stakeholders.

3.2 Raw Water Transmission

A new raw water transmission main will be required to convey water pumped from the New Wells to the new WTP. Three potential alignments were considered, and were discussed in TM#3, appended to this memo. The three options included:

1. Adjacent to the Sunshine Coast Highway (north side)
2. Along Marine Drive to Parker Road
3. Along Marine Drive to North Road

Option 1 is the preferred alignment; it is the shortest and most direct route. Options 2 and 3 required obtaining new property easements and extensive road restorations, respectively.

At this time, it is envisioned that Option 1 will be within the MOTI Right-of-Way (ROW), where there are also existing BC Hydro power poles for the east half of the alignment. The alignment will require review by a Qualified Environmental Professional (QEP) to determine the environmental requirements.

The current scope of work for Option 1 includes:

- Approximately 3 km of 400 mm ø (16”) watermain (anticipated to be ductile iron), running adjacent to the Sunshine Coast Highway (north side), capable of handling a maximum pressure of 2,413 kPa (350 psi).
- Pigging stations at the terminus of the alignment and possibly one mid-alignment.
- Two trenchlessly installed and cased crossings – one at Port Mellon Highway and one at Stewart Road.

3.3 Water Treatment Plant

The groundwater quality has been tested and has been shown to have elevated dissolved iron and manganese concentrations, both of which exceed the aesthetic objective (AO) set out in the Canadian Water Quality Guidelines (CWQG). The high iron and manganese concentrations in the groundwater can precipitate out of solution when oxidized which becomes an operational risk to the water system, so it is important to reduce the concentrations before connecting to the CWS. The precipitate can cause scaling within the water system and plugging issues in equipment and service connections. Additionally, it is a nuisance to the users because it can cause staining of food/appliances and can give the water an unpleasant metallic taste.

Two treatment options were considered, and were discussed in TM#4, appended to this memo:

1. Pre-packaged greensand filtration plant – Removing iron and manganese via chemical treatment and filtration.
2. Blending with CWS – Blending raw water with treated CWS water to bring iron and manganese concentrations to below AO through dilution.

Option 1 is the preferred approach. Option 2 (blending) is not feasible as it would require 2.5 parts CWS water to 1 part New Well water. With the desired capacity of the WTP being 60 L/s, this would require 150 L/s CWS water and would put excessive strain on the existing water system (for context 150 L/s is minimum fire flow for an institutional development).

Further, there is no redundancy with Option 2 as it is dependent on CWS water being available for blending. In scenarios where less than 150 L/s is available (such as during high demand), this new source would need to be throttled and would have a negative impact to water supply when it is needed the most.

The SCRD has identified a potential site for the proposed WTP, located southwest of the intersection at the Sunshine Coast Highway and Stewart Road, west of the Visitor Information Park. The civic address for the site is 1235 Stewart Road (Folio 746.04145.250). This lot is bisected by a ROW; the WTP would be sited in south half of the parcel.

Treatment technology for dissolved iron and manganese is well established and is a relatively simple process. A combination of oxidation and filtration will be sufficient to reduce the dissolved metals to below AO. A technical discussion of iron and manganese treatment was provided in TM#2 and is appended to this memo.

It is important to note that the WTP has a waste stream, which is comprised of a considerable volume of flushing water with the filtered precipitate out of the raw water. The filters flush on a routine basis, and there needs to be provision to either store the waste on site or to convey the waste to a wastewater treatment plant (WWTP). At this time, it is envisioned that there will be a waste lagoon on site to accept and store waste. The nearest WWTP in the Town of Gibsons and the ability of this plant to accept WTP waste requires an independent study.

3.3.1 Water Treatment Plant Infrastructure

The anticipated requirements for a proposed WTP include:

- 250 m^3 (67,000 USgal) raw water reservoir with provisions for routine cleaning/flushing.
- Booster station to pump water through the treatment plant.
- Pre-packaged greensand filtration water treatment plant.
- Two (2) 2,500 m^3 (660,500 USgal) treated water reservoirs.
- Waste residual handling and management area.
- Backup generator capable of powering the treatment plant and booster station for 24 hours.

3.3.2 Operations & Maintenance

Water treatment plant operation requirements are relatively low. The process is automated, so as long as the system is connected to a SCADA system the WTP can be monitored and controlled remotely. Daily visits by an operator are ideal for visual checks on the equipment and to verify the system is operating as observed on SCADA.

The chemical requirements are limited to hypochlorite, which is used both as an oxidizer and as a disinfectant. Hypochlorite usage is anticipated to be around 10 kg/day.

The filtration media requires replacement every 10 years on average. The media is a manufactured product and the treatment building would be designed to accommodate replacement. While the replacement is a large lump sum cost when it occurs, the annualized cost for the media is minor when considered from a day-to-day perspective. Based on a preliminary assessment, operations and maintenance for the plant (considering power, chemicals, and media replacement) is about $50,000 - $75,000 per year. This does not consider managing the waste residual and operator costs.

3.3.3 Waste Residual

It is anticipated that waste residuals will be stored in a lagoon on site. Waste is generated by backwashing the treatment tanks, and it is estimated that the backwash will generate 25 m^3 of waste per cycle, with a cycle every 10 days. This equates to about 915 m^3 of waste annually. The design basis of a lagoon would be based on the British Columbia Sewerage System Standard Practice Manual V3.

Routine lagoon maintenance will be required to make sure there is always capacity to discharge waste. In the warm/dry months evaporation can help rid water from the lagoon, but in cold/wet months vactor trucks may be required to service the lagoon to maintain capacity. The requirements for the lagoon to be lined would be determined during design and is dictated by the composition of the waste residual.

The nearest wastewater treatment plant (WWTP) is located in the Town of Gibsons. It may be possible to connect the WTP waste discharge to the Gibsons sanitary system; however, a separate study would be required to confirm if the WWTP has the capacity and capability to treat the waste.

3.3.4 Provision for Future Water Sources

In future groundwater investigation programs, new viable groundwater sources may be identified with favourable water quality (i.e, meeting MAC and AO guideline limits). The new WTP could be designed to accommodate new raw water sources. If there are any provisions to modify the routing through the treatment stream, they would be subject to review and approval by the MoH, as there would be potential for cross contamination.

If new raw sources are found which have lower dissolved iron and manganese than is found in the New Wells, but still exceeds the AO (assuming all other constituents meet AO and MAC), blending could be done in the raw reservoir which would reduce iron/manganese loading on the greensand filters, reducing operational costs and waste residuals.

If new raw sources are found to have dissolved iron and manganese below the AO, filter bypasses can be included in the design to route this 'cleaner' water into the treated water reservoir after it is chlorinated.

3.4 Treated Water Transmission Main

From the proposed WTP site, there are two possible connection points to the CWS: at the intersection of North Road and Stewart Road, or at the intersection of North Road and Reed Road.

The connection at North Road and Stewart Road is the nearest connection point, which is 600 m away and is a 150 mm ø pipe. If the connecting pipe is similarly sized at 150 mm ø the velocity would be 3.4 m/s at 60 L/s (the WTP capacity). This is greater than the MMCD design guidelines of 2.0 m/s during peak hour demand, thus this connection is not recommended.

The connection at the intersection of North Road and Reed Road would be to the recently completed watermain that was part of the Church Road project. This connection point is 1.5 km away and it is assumed this watermain size is 300 mm ø. The proposed WTP could connect with a 300 mm ø, which would limit pipe velocity to 0.85 m/s at 60 L/s, which would allow for additional wells to be brought on line in the future. The ideal connecting pipe size would be determined via water model assessment.

It is envisioned that the new WTP reservoirs will be set to have the same top water level (TWL) as the reservoirs on Henry Road, which is 210.3 m above sea level. This would allow connection to the CWS without any pressure regulation or boosting.

3.5 Stakeholders

There will be multiple stakeholders involved throughout the project to ensure all regulatory requirements are being met and proper consultation is done. The following stakeholders will include, but may not be limited to:

- Sunshine Coast Regional District
- Squamish First Nations
- Ministry of Transportation and Infrastructure (MOTI)
- BC Ferries (BCF)
- Ministry of Health (MOH)
- BC Hydro
- Ministry providing Grant (if applicable)
- Ministry of Water, Land, and Resource Stewardship

4 Preliminary Technical Assessment

A preliminary technical assessment was performed to determine if an intermediate booster station would be needed between the New Wells and the proposed WTP. This assessment was modelled in EPANET 2.2 with the following parameters:

- Well #1 – Certified Yield = 13.1 L/s
- Well #1 – Drawdown pumping level = -14.01 m (geodetic)
- Well #2 – Certified Yield = 56.8 L/s
- Well #2 – Drawdown pumping level = 0.58 m (geodetic)
- Raw Water Transmission Main – 400 mm ø 2,600 m long, C-Factor 120
- Raw Water Storage Tank – Top Water Level 207 m (approx. 7 m above grade)

With the above assumptions, EPANET model yielded the following flow and pressure parameters:

Table 1: Pump Assessment Criteria

Parameter	Well #1	Well #2	Both Well #1 & 2	Well #1 & 2 Plus a Future Well at 50 L/s
Certified Yield (L/s)	13.10	56.80	69.90	119.90
Specific Capacity (L/s/m)	0.37	2.69		
Top of Casing Flange (m)	21.40	21.70		
Drawdown Elevation	-14.01	0.58		
Pressure at Well Site (m)	185.62	187.32	188.18	192.77
Pressure at Well Site (psi)	264.14	266.56	267.78	274.31
Head at Pump Elevation (m)	207.30	209.00	209.85	214.50

Based on the above, submersible multi-stage pumps and motors were evaluated to determine if pumping directly from the New Wells to the proposed WTP without an intermediate booster station would be feasible given the flow and head necessary. With Franklin's FE Select Software, it was determined that there are available Franklin pump/motor combinations for this project. It is assumed that other pump manufacturers would also have suitable pump/motors.

The Franklin preliminary pump selection is appended to this memo.

It is noted that a raw water booster pump station will be required at the WTP to pump water from the raw water tank through the treatment plant at 100 psi (as required by the treatment plant supplier). From the treatment tanks, water would discharge into treated water reservoir which will have a TWL equivalent to the Henry Road reservoir (210.3 m).

5 Class D Cost Estimate

A 'Class D' cost estimate has been prepared to capture the major project components and their anticipated costs based on the current level of project definition. As the project advances, cost estimates will be revised and updated accordingly to ensure that all costs are being captured, and to identify potential cost efficiencies during design.

Table 2 shows the estimated costs for the CWS improvements, broken down by project. A Class D breakdown is appended to this memo.

Table 2: CWS Improvement Class D Cost Estimate

Project Area	Cost
Langdale Wellfield Upgrades	$1,400,000
Raw Water Transmission Main	$4,215,000
Water Treatment Plant	$8,200,000
Treated Water Transmission Main and Connections	$1,525,000
Total Construction Costs	**$15,340,000**
Engineering and Contingency	$6,700,000
Project Sub-Total	**$22,040,000**

6 Closure

This Report (the "Report") has been prepared by Onsite Engineering Ltd. ("Onsite") for the benefit of the Sunshine Coast Regional District ("Client"). The information, data, recommendations and conclusions contained in the Report:

- are subject to the scope, schedule, and other constraints and limitations and qualifications contained in the Report (the "Limitations");
- represent Onsite's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to Onsite which has not been independently verified;
- have not been updated since the date of issuance of the Report and their accuracy is limited to the time period and circumstances in which they were collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- were prepared for the specific purposes described in the Report;
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

Unless expressly stated to the contrary in the Report, Onsite:

- shall not be responsible for any events or circumstances that may have occurred since the date on which the Report was prepared or for any inaccuracies contained in information that was provided to Onsite;
- agrees that the Report represents its professional judgement as described above for the specific purpose described in the Report, but Onsite makes no other representations with respect to the Report or any part thereof;
- in the case of subsurface, environmental or geotechnical conditions, is not responsible for variability in such conditions geographically or over time.

The Report is to be treated as confidential and may not be used or relied upon by third parties, except:

- as agreed by Onsite and the Client;
- as required by law;
- for use by governmental reviewing agencies.

Any use of this Report is subject to these Qualifications. Any damages arising from improper use of the Report or parts thereof shall be borne by the party making such use.

Onsite Engineering Ltd.

Prepared by:	Reviewed by:
Stephen Bertulli, P.Eng.	Joel McAllister, P.Eng.

Item	Description	Unit	Qty	Unit Price	Amount
Langdale Wellfield Upgrades					
1	Wellfield Control Building (incl. elec/control/back up generator)	LS	1	$1,000,000	$1,000,000
2	New Well pumps	LS	1	$200,000	$200,000
3	Site Finishing (fencing/asphalt, etc.)	LS	1	$100,000	$100,000
4	Wellfield Piping and Civil Works	LS	1	$100,000	$100,000
Raw Water Transmission Main					
5	400 mm diameter DI raw water transmission main	LM	2925	$1,200	$3,510,000
6	Port Mellon Hwy Crossing (trenchless)	LM	75	$2,000	$150,000
7	Stewart Rd Crossing (trenchless)	LM	60	$2,000	$120,000
8	Pigging Station	Ea	3	$75,000	$225,000
9	Environmental and Hydro allowance	%	5		$210,000
Water Treatment Plant					
10	Raw Water Reservoir (250 m3)	m3	250	$1,000	$250,000
11	Treatment Plant Booster Station	LS	1	$500,000	$500,000
12	Pre-Package Fe/Mn Treatment Plant incl. chlorination	LS	1	$3,000,000	$3,000,000
13	Treated Water Reservoir (2x 2,500 m3)	m3	5000	$540	$2,700,000
14	Site Civil, Groundworks, Piping	LS	1	$750,000	$750,000
15	Electrical and SCADA and Backup Generator Building	LS	1	$1,000,000	$1,000,000
Treated Water Transmission Main and Connections					
16	300 mm diameter DI treated water transmission main	LM	1500	$1,000	$1,500,000
17	Tie-in and Valving	LS	1	$25,000	$25,000
	Total Construction cost				**$15,340,000**
	Design, Permits and Construction Management 10%	%	10		$1,600,000
	Total Engineering and Construction				**$16,940,000**
	Contingency	%	30		$5,100,000
	Grand Total				**$22,040,000**

Technical Memorandum #2

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DRAFT

TECHNICAL MEMORANDUM #2

DATE: July 10, 2023
TO: Sunshine Coast Regional District
ATTN: Ineke Kalwij, Ph.D., P.Eng.
CC: Sachindra Wijayabandara
FROM: Joel McAllister, P.Eng., Stephen Bertulli, P.Eng.

Re: Water Treatment Technology Review for Elevated Dissolved Iron and Manganese

The following memo is developed for the Sunshine Coast Regional District (SCRD) to provide a high-level overview of available treatment methods for iron and manganese removal from groundwater.

1 Introduction

1.1 Purpose

The SCRD has begun to develop additional water sources with the goal to increase the capacity of the Chapman water system. In 2022, two new wells were developed into production-sized test wells at the Langdale wellfield, located at the Langdale BC Ferries terminal, and are potential sources.

A water quality test has been collected from one of the wells, which shows that dissolved iron and manganese are higher than the Canadian Water Quality Guidelines aesthetic objectives. This memo provides information on available treatment technologies capable of removing dissolved iron and manganese from raw water.

1.2 Canadian Water Quality Guidelines

The Canadian Water Quality Guidelines (CWQG) provides recommended treatment objectives for water providers. The CWQG considers health effects, aesthetic effects, and operations when listing recommended concentrations of the various constituents. Acceptable levels are based on Maximum Allowable Concentrations (MAC) and Aesthetic Objectives (AO).

1.3 Well No. 1 Water Quality

A water quality sample was collected in February 2023 from Well No. 1, the results are appended to the memo. The results show that there are elevated levels of dissolved iron (0.54 mg/L) and dissolved manganese (0.047 mg/L). Both elements exceed the CWQG AO, dissolved manganese is below the MAC. To note, there is no MAC for dissolved iron. Additionally, hardness is reported at 38 mg/L equivalent $CaCO_3$, which is considered soft water, summarized in Table 1.

Table 1 – Water Quality Results for Iron and Manganese in Well No. 1

Element	Well No. 1 (mg/L)	MAC (mg/L)	AO (mg/L)
Dissolved Iron	0.54	n/a	0.3
Dissolved Manganese	0.047	0.12	0.02
Hardness	38 (equivalent $CaCO_3$)	n/a	n/a

The consequence of having elevated levels of dissolved iron and manganese is staining and discolouration. If levels are above AO, staining of household fixtures, laundry, and food can be significant, which is a primary concern when it comes to consumer confidence in the quality of water.

Hardness is a measure of the level of dissolved polyvalent metals present in the water and is expressed in mg/L equivalent $CaCO_3$. With increasing concentrations of equivalent $CaCO_3$, the water hardness will also increase. If water hardness is high (hard water is > 120 mg/L $CaCO_3$ equiv.), then the water can deposit scale, which is unsightly, but also can pose operational problems due to deposits clogging pipes and fixtures. If water hardness is low (soft water is < 60 mg/L $CaCO_3$ equiv.), it can create corrosion issues through leeching of elements into the water, thereby degrading pipes.

Based on the test result, the water needs to be treated for dissolved iron and manganese to meet the AO, which will also provide benefit to operations over the long-term. Following treatment, the hardness of the water may need to be adjusted to be suitable for distribution.

2 Overview of Typical Treatment Processes

Removal of dissolved iron and manganese is a common requirement for groundwater sources. There are multiple methods for treatment, but in general, they incorporate the following:

- **Oxidation** – An oxidant is added to the raw water which will combine with the dissolved metals and bring them out of solution, creating a precipitate.

  There are multiple types of oxidants, including, but not limited to, aeration, chlorine (such as from hypochlorite), permanganates (such as potassium permanganate), and ozone. The preferred oxidant depends on the raw water properties, how quickly the oxidant needs to react, and the type of treatment used by downstream processes.

- **Clarification** – If the raw water contains a high combined concentration of dissolved iron and manganese then clarification is likely required. Typically, this threshold is 5 mg/L, and is required in order to prevent excessive sediment loading on downstream processes.

  Clarification uses gravity settling to remove solids, which can be done through several methods including conventional sedimentation, high rate settling, ballasted flocculation, or solids contact.

- **Filtration** – The raw water is filtered through specific media to capture particulate and to remove remaining dissolved iron and manganese that may not have been oxidized or removed in prior processes.

The three main types of filtration are gravity filtration, membranes, and pressure filtration. Typically, groundwater is filtered in pressure vessels unless it is under the influence of surface water, in which case there are bacterial and virus considerations at this step.

There is a wide range of filtration media available which is specified to meet treatment targets based on the specific treatment processes and raw water quality. The filtration media in pressure vessels can be inorganic or organic granular media, biological media, or ionized media.

2.1 Residuals

Residuals are the waste product leftover from the treatment processes. For iron and manganese removal, the main byproduct is an iron and manganese oxide sludge, but other constituents in the source water and treatment chemicals also impact the composition of residuals.

These residuals typically have a high-water content, which impacts how they are disposed. If there is centralized sewerage treatment available (i.e. local wastewater treatment plant), the discharge to the local sewer system is the ideal approach to residual management. However, if centralized treatment is not available, then a dedicated residual management system needs to be included in the water treatment system design. In general, a residual management system includes:

- A dewatering method to reduce the water content of the waste, thereby increasing solids content. This can be done passively (e.g. settling) or mechanically (e.g. centrifuge). The water can be discharged to the environment if it meets regulations, or in some situations recycled back into the treatment process.
- A method to deal with the dewatered solids. Dewatered solids can be stockpiled and/or shipped off site. It is important to understand the composition of the solids, as there may be restrictions for ultimate disposal.

3 Available Treatment Options

The following section describes provides a brief overview of the oxidation, chlorination, and residuals management and the difference options within these treatment steps. Since the SCRD water quality shows that the combined dissolved iron and manganese concentration is ~0.6 mg/L, it is assumed clarification is not required, and is not discussed.

3.1 Oxidation Options

Oxidation, also referred to as pre-treatment, involves dosing the raw water with an oxidant to remove the undesired dissolved metals from solution. There are numerous types of oxidizers available which all act on the same premise of electron exchange to take dissolved iron and manganese out of solution. However, not all oxidizers are equal, and which type of oxidant to use needs to consider the quality of the source water as well as the different steps in the treatment process.

The main consideration when assessing the quality of the source water is how much organics are present. Organics oxidize as well, meaning that source water with a higher organics content will require a higher dose of oxidant to remove dissolved metals. Some oxidizers, such as chlorine, will react with organics to create disinfection by-products which are undesirable. Additionally, organics can combine with dissolved metals to create complexed forms which behave differently then more basic forms and can complicate the treatment process.

The other factor that affects oxidation is the pH of the water, which impacts the rate of reactions (temperature also plays a role in reaction rates, but much less than pH). Oxidants with slower reaction times will require more time upstream of other treatment processes in order to fully react. In general, dissolved manganese requires longer reaction times compared to dissolved iron and may impact the preferred oxidizer. Below is a summary of the typical oxidants available.

3.1.1 Aeration (O_2)

Aeration involves adding air into the raw water which allows atmospheric oxygen to dissolve into solution. This can be done by injecting air into the piping/tanks or can be done by creating turbulent conditions, such as with cascading towers.

Aeration is effective in removing dissolved iron out of solution but is much less effective for manganese due to the long reaction time. If manganese removal is required, it would typically be done following aeration either with a chemical oxidant or through the filtration process.

Generally, aeration is most suitable when there is a very high dissolved iron and manganese concentration (> 5mg/L). It is a cost-effective step to remove a large amount of dissolved iron, which helps limit the amount of chemical oxidant needed to complete the oxidation process. Aeration also benefits raw water which has organics that may cause disinfection by-products if chlorine is a part of the process.

3.1.2 Chlorine (Cl_2)

Chlorine can be added to raw water either by injection of chlorine gas or addition of a chlorine solution, such as sodium hypochlorite. Chlorine is effective at oxidizing dissolved iron above a pH of 8.0; however, it is not effective at oxidizing dissolved manganese due to the long reaction time. If dissolved manganese also needs to be treated, the chlorine cannot be relied upon and is a factor in designing the treatment process.

Chlorine as an oxidant is suitable for groundwater that has low organic matter, to avoid disinfection by-products, and in systems where breaking head is undesirable. Chlorine has the additional benefit of being able to provide a chlorine residual through the treatment process which helps with achieving required chlorine contact times.

3.1.3 Permanganate (MnO_4)

Permanganate is available in two forms, as a solid potassium permanganate and as a liquid sodium permanganate. Permanganate is highly reactive and is very effective at oxidizing both dissolved iron and

manganese very quickly. Due to the high reactivity, it is also more hazardous relative to other options, increasing safety requirements for storage and handling.

Permanganate is suitable when dissolved manganese is the primary issue in the raw water, when there is limited detention time for reaction, or to pre-treat raw water when disinfection by-products are a concern.

3.1.4 Chlorine Dioxide (ClO_2)

Chlorine dioxide is a highly reactive oxidizer and is effective at oxidizing both iron and manganese. It is a gas which is injected into the treatment process, and it is usually generated on site. Chlorine dioxide may create disinfection by-products that include chlorites and chlorates, both of which have a MAC of 1 mg/L in the CWQG; this is generally not an issue for chlorine (Cl_2) or permanganate. The use of chlorine dioxide as an oxidizer requires very strict control to minimize these by-products.

Chlorine dioxide is most suitable when a high reaction rate is required (i.e. when there is not enough detention time for chlorine or permanganate to react), when there is a high concentration of organics in the raw water preventing the use of chlorine, or when complex forms of iron and manganese are present.

3.1.5 Ozone (O_3)

Ozone is similar to chlorine dioxide in that it is highly reactive and is effective at oxidizing both iron and manganese, and is also effective at oxidizing organic material without creating chlorinated disinfection by-products. If bromides are present ozonation can produce bromates, which are undesirable and have a MAC 0f 0.01 mg/L in the CWQG. The cost of producing ozone is generally prohibitive for smaller plants, and due to the high reactivity, dosing is more complicated compared to alternatives.

Ozone is most suitable when a high reaction rate is required (i.e. when there is not enough detention time for chlorine or permanganate to react), when there is a high concentration of organics in the raw water preventing the use of chlorine, when complex forms of iron and manganese are present, and when there is low bromide concentrations in the raw water.

3.2 Filtration Media Options

3.2.1 Manganese Sand Media

Manganese sand media refers to media that has the ability to both filter out particulate (iron and manganese oxides) and to adsorb the dissolved iron and manganese that has not been oxidized (i.e. is still in solution). Adsorption refers to the dissolved elements attaching to the media surface as the method of removal.

The most common type of manganese sand media are Manganese Greensand, Manganese Dioxide-Coated Sand, and Manganese Dioxide Ore (Pyrolusite). Depending on the design of the treatment process, additional layers of anthracite/coal above the manganese sand media may be included to assist with filtration by reducing the sediment load on the manganese media, thereby extending run times.

Each type of media requires regeneration and backwashing. Regeneration refers to regenerating the adsorbing capacity of the media, which is consumed over time during treatment, and requires an oxidant to be washed over the media. Backwashing refers to running the filter in reverse to flush out the filtered material to maintain the hydraulic capacity of the filter. The details of backwashing and regeneration depend on the raw water quality as well as the type of media used.

Typically, backwashing and regeneration occur simultaneously, where the backwash water contains a regeneration agent, and so the backwash both cleans the media and restores the adsorbing capacity. However, regeneration can also be done while the filter is active during the treatment process, if the source water quality allows. When regeneration is done as part of the backwash process the operation mode is referred to as 'intermittent regeneration', and when the regeneration is done as part of the treatment process it is referred to as 'continuous regeneration'.

Intermittent regeneration is where iron is oxidized prior to filtration and manganese removal is done through adsorption to the media. Once the adsorption capacity of the media is consumed, the media is regenerated during the backwash process only; thus, regeneration of media is intermittent. Regeneration can be done through either chlorine or permanganate. Generally, this approach is used when dissolved iron levels are below 0.5 mg/L.

Continuous regeneration (i.e. catalytic oxidation) is where both iron and manganese are oxidized prior to filtration. Enough oxidizer is dosed so that it remains in the treatment stream and through the filter. Any dissolved metals that were not removed via oxidation will be removed via adsorption, and the capacity of the filter is continuously regenerated due to the remaining oxidizer. Backwash is only required once the filter is no longer able to effectively remove particulate.

3.2.1.1 Manganese Greensand

Manganese greensand is a glauconite ore that is coated with manganese dioxide. Glauconite ore is a granular media that has a greenish colour and appears sand-like; once coated with manganese dioxide it turns to a dark purple. The term 'manganese greensand' is generally used to refer to media that uses naturally occurring glauconite ore, which is becoming limited in supply; traditional manganese greensand not specified in new treatment plant designs due to this issue.

Manganese greensand typically utilizes a coal (anthracite) top layer in the filter increases the efficiency of the greensand media. The coal layer generally has a higher porosity (higher void area), which allows for the particulate to flocculate and settle before the greensand layer. This reduces the sediment loading on the greensand layer which has many benefits: backwashing is simplified, manganese removal is more efficient, and filter run times can be extended.

3.2.1.2 Manganese Dioxide-Coated Sand

Manganese dioxide-coated sand differs from greensand in that the sand media is not glauconite ore; however, it is coated with the same manganese dioxide as greensand, giving it very similar properties and is a suitable, cost-effective alternative for manganese greensand. Functionally, it works on the same

principles, but the operating parameters, such as hydraulic loading rate and adsorption capacity, may differ.

Manganese dioxide-coated sand is a manufactured product, and as such, the operating parameters are dependent on the specific media product. Typically, it operates through continuous regeneration with chlorine as an oxidizer. A separate regeneration process is usually not required, reducing the need for permanganate in the treatment process.

3.2.1.3 Manganese Dioxide Ore (Pyrolusite)

Pyrolusite is a naturally occurring manganese dioxide ore, and can be used instead of a coated sand. The primary benefit of pyrolusite is that there is no coating that can wear, so any removal of the ore surface (i.e. through abrasion or other methods) exposes a fresh surface of manganese dioxide.

Pyrolusite can be used in a continuous or intermittent regeneration process with chlorine as an oxidizer. Which regeneration process is typically determined based on the source water quality and the potential for chlorinated disinfection by-products. If by-products are a concern, chlorine regeneration is used intermittently.

The primary drawback for pyrolusite is that it requires more energy for backwash and cleaning, as it is about 1.6 times as heavy compared to sand media.

3.2.2 Biological Filtration Media

Biological filtration media operates by having bacteria growth inside the pressure vessel which is able to oxidize the iron and manganese. Over the course of operation, dense precipitates build up within the filter; these precipitates are denser compared to those that are formed with pre-treatment oxidation. As a result, biological filters have a higher retention capacity. Also, biological media does not require oxidation beforehand, as it is done within the media.

In order to remain effective, biological filters require specific environmental conditions so that the oxidizing bacteria can remain alive and active; this requires a high degree of control for the treatment process. Backwashing is required, similar to the manganese media, to maintain the effectiveness of the filters by removing precipitate as it builds up.

Biological media filters generally have longer run times before backwash is required; however, this benefit is offset by the fact that separate filters are required for iron and manganese removal, as the environmental conditions required to oxidize the elements are different. This effectively doubles the number of vessels required for treatment.

3.2.3 Ion Exchange Media

Ion exchange operates by swapping charged particles from the raw water with similarly charged particles on the media filter. For iron and manganese, sodium is typically used as the exchange ion. The primary difference between ion exchange and traditional filtration media is that the iron and

manganese are not oxidized prior to the ion exchange filter. Rather, the iron and manganese are kept in solution to allow the elements to adsorb to the exchange media.

Since the elements are kept in solution, there is no risk to filter plugging; however, once the exchange capacity of the media is depleted breakthrough occurs. Breakthrough refers to when iron and manganese are able to pass through the filter without being removed. To maintain the filter, and prevent breakthrough, the exchange media is backwashed with a regenerating solution to restore the exchange capacity, well before breakthrough can occur. The waste from ion exchange is a brine solution with a high concentration of iron and manganese.

Ion exchange is typically used in point-of-use situations and where hardness removal is also desired. For larger systems, it is less efficient compared to traditional filtration as there is a high volume of backwash produced and the process generally requires more control to provide effective treatment.

3.2.4 Membrane Filtration

Membrane filtration involves filtering water through membranes that have specific pore sizing to remove constituents from the water. Typically, membrane filtration is used where treatment for pathogen removal is required, such as for groundwater under direct influence of surface water (GUDI).

Membranes are capable of treating water with high levels of dissolved metals, but it is important to understand the type of dissolved metals in the source water. If organics are present, the organically complexed versions of manganese may not be sufficiently removed.

Aside from the pathogen aspect, membranes are beneficial when there is limited footprint available, but have the operation drawbacks of being more complex systems and requiring special knowledge for operation and maintenance.

3.3 Residual Options

For typical sand filtration, the residuals are an iron and manganese oxide sludge, but also contains constituents present in the source water. Technically, off-gas from the treatment is considered a residual as well, if aeration is used, but for the purpose of this memo it is not considered.

The amount of dry residual produced on a per day basis can be determined based on the treatment system flow rate and the total concentration of contaminants. However, the actual volume of residuals depends on the water content, which can be significant depending on the level of treatment the residuals go through. Methods of residual treatment are similar to water treatment, but instead of meeting drinking water requirements, they need to meet disposal requirements. Thus, it is important to understand the disposal regulations, composition of the residual (both chemical composition and water content), available disposal locations and land use area, and the ability of the environment to accept liquids from the treatment process.

Generally, if there is no centralized sewer system available to dispose of the residuals, then dewatering is required to concentrate the solids to a suitable level. Typical methods of dewatering include thickening/clarification, non-mechanical dewatering, and mechanical dewatering.

3.3.1 Thickening/Clarification

Thickening/clarification consists of settling the sludge out of suspension to increase the solids content of the sludge and decanted water can be recycled back into the treatment process or released to the environment.

The ability to recycle the water back into the treatment process is dependent on the process and the quality of the decanted water. For example, the pH of the decanted water may need to be adjusted prior to reintroducing to the treatment stream to avoid upsetting any pre-treatment oxidation. Likewise, the ability to discharge decanted water to the environment requires an understanding of water quality regulations and the receiving environment.

The thickened sludge can be transported off-site to an appropriate disposal area, such as a nearby wastewater treatment plant. Disposal costs may depend on the final destination but would factor in disposal volume and quality. These processes can generate a waste sludge that has a solids concentration between 2% and 4%; the level of thickening is usually determined during design in conjunction with disposal costs.

3.3.2 Non-Mechanical Dewatering

Dewatering resulting a high solids content sludge, typically 12% or higher, and contains no free liquid. The resulting product is referred to as a 'cake' and is not free flowing. The presence of free liquid is based on a 'paint filter test;' simply put, if the cake drips when placed on a wire mesh then it is said to contain free liquid.

The premise of non-mechanical dewatering involves allowing the sludge to passively dry through evaporation or infiltration, where water is slowly removed until it reaches the necessary solids content. Typical non-mechanical methods of dewatering include lagoons and sand drying beds. A lagoon is a large basin where water can evaporate or infiltrate (if permitted) over time. Sand drying beds are where the sludge is spread out over a large porous layer and is able to dewater via gravity; an underdrain to collects the leachate so it can be disposed of as required.

The ability to use these methods depend on the available land and the climate, where substantial areas are generally needed as well as a warmer (and sometimes drier) climate. Structures can be installed overtop of lagoons and sand beds in wetter regions if it determined to be economically feasible. Generally, the leachate cannot be recycled back into the water treatment process if the source water is groundwater.

3.3.3 Mechanical Dewatering

Mechanical dewatering uses equipment to physically remove water to produce the cake. Polymers may be required to help form and generate the cake. There are multiple types of equipment which can

dewater sludge including, but not limited to, belt press, plate press, frame press, centrifuge, and screw press.

Mechanical dewatering equipment generally has a small footprint and is an efficient way to collect the solid residuals. Since most machines require the use of a polymer, the water can not be recycled back into the treatment process as the polymer may have adverse effects on the water treatment systems, but it may be able to be recycled back into the dewatering process. Also, discharge of the water to the environment may be possible but is determined once the polymers to be used are known.

4 Conclusion

The above discussion has provided a high-level introduction to the oxidation, filtration, and residuals management treatment steps required to remove elevated dissolved iron and manganese from raw water. The goal of providing this information is to assist the SCRD in understanding the treatment process and help develop questions that will guide the decision making for treatment system selection.

4.1 Treatment Process Selection

The raw water sample indicates that treatment requirements are not complicated, as there is only elevated iron and manganese are present above the AO of the CWQG. The sample also indicates very low (possibly none) organic carbon or and no coliforms. This indicates the water source is not under the influence of surface water, simplifying the treatment process.

Pre-packaged water treatment systems are available for removal of iron and manganese, which are convenient and reliable as they can be purchased, constructed, and tested by the vendor before being shipped to site. These are an economical solution to provide simple treatment and can be integrated into the full WTP. Discussions with the vendor will allow for all technology options to be reviewed in detail so the capital and operational costs for the different configurations can be understood.

4.2 Next Steps

It is noted that these pre-packaged systems only form one piece of the overall WTP plant. A prudent next step for the SCRD would be to develop a Project Definition Report, which would review and consolidate all the different aspects needed to understand how best to design, build and integrate a new WTP into the Chapman water system. This will allow for an accurate preliminary project budget and schedule, which will be able to be improved at the project develops.

The Project Definition Report may include, but would not be limited to, identifying stakeholders and consultation requirements, funding availability and requirements, review of permits and approvals, power supply requirements, operational requirements, preliminary water treatment plant design, integration into the Chapman water system, waste management, environmental requirements, schedule and critical path review, and procurement and delivery option analysis.

5 Closure

This Report (the "Report") has been prepared by Onsite Engineering Ltd. ("Onsite") for the benefit of the Sunshine Coast Regional District ("Client"). The information, data, recommendations and conclusions contained in the Report:

- are subject to the scope, schedule, and other constraints and limitations and qualifications contained in the Report (the "Limitations");
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- must be read as a whole and sections thereof should not be read out of such context;
- were prepared for the specific purposes described in the Report;
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

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Onsite Engineering Ltd.

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Project Name: SCRD Langdale Wellfield
Project Location: Well No. 1(63382)
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1633519**
Control Number:
Date Received: Feb 21, 2023
Date Reported: Mar 6, 2023
Report Number: 2849871

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Delivery	Format	Deliverables
Email	PDF	COC / Test Report
Email	Standard Crosstab Without Tabs	Test Report
Email - Merge	PDF	COA
Email - Merge	PDF	COA / COC
Email - Merge	PDF	COC / Invoice

Notes To Clients:

- Mar 06, 2023 - Report was issued to include addition of Health Canada Drinking Water Quality Guideline interpretations requested by Ineke Kalwij of Kalwij Water Dynamics Inc. on March 6, 2023.
  Previous report 2845623.

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Reference Number	1633519-1
Sample Date	February 20, 2023
Sample Time	08:36
Sample Location	
Sample Description	Well No. 1(63382) / 5.3 °C
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Aggregate Organic Constituents						
UV Transmittance		%/cm	95.0	0.1		
Inorganic Nonmetallic Parameters						
Ammonium - N		mg/L	<0.025	0.025		
Kjeldahl Nitrogen	Total	mg/L	<0.10	0.1		
Sulfide	Total	mg/L	<0.002	0.002	0.05	Below AO
Organic Carbon	Total Nonpurgeable	mg/L	0.5	0.5		
Metals Extractable						
Aluminum	Extractable	mg/L	<0.002	0.002	0.1 OG; 2.9 MAC	Below OG
Antimony	Extractable	mg/L	<0.0002	0.0002	0.006	Below MAC
Arsenic	Extractable	mg/L	0.0039	0.0002	0.01	Below MAC
Barium	Extractable	mg/L	0.003	0.001	2.0	Below MAC
Boron	Extractable	mg/L	0.010	0.002	5	Below MAC
Cadmium	Extractable	mg/L	<0.00001	0.00001	0.007	Below MAC
Chromium	Extractable	mg/L	<0.0005	0.0005	0.05	Below MAC
Copper	Extractable	mg/L	<0.001	0.001	1 AO; 2 MAC	Below AO
Lead	Extractable	mg/L	<0.0001	0.0001	0.005	Below MAC
Molybdenum	Extractable	mg/L	0.003	0.001		
Nickel	Extractable	mg/L	<0.0005	0.0005		
Selenium	Extractable	mg/L	<0.0002	0.0002	0.05	Below MAC
Silver	Extractable	mg/L	<0.00001	0.00001		
Uranium	Extractable	mg/L	<0.0005	0.0005	0.02	Below MAC
Zinc	Extractable	mg/L	0.011	0.001	5	Below AO
Trace Metals Dissolved						
Digestion	Dissolved		Field filtered and Pres Dissol			
Titanium	Dissolved	mg/L	<0.002	0.002		
Aluminum	Dissolved	mg/L	0.001	0.001	0.1 OG; 2.9 MAC	Below OG
Antimony	Dissolved	mg/L	<0.00002	0.00002	0.006	Below MAC
Arsenic	Dissolved	mg/L	0.0035	0.0001	0.010	Below MAC
Barium	Dissolved	mg/L	0.0034	0.0001	2.0	Below MAC
Beryllium	Dissolved	mg/L	<0.00005	0.00005		
Bismuth	Dissolved	mg/L	<0.0001	0.0001		
Boron	Dissolved	mg/L	0.012	0.002	5	Below MAC
Cadmium	Dissolved	mg/L	<0.00001	0.00001	0.007	Below MAC
Chromium	Dissolved	mg/L	<0.00005	0.00005	0.05	Below MAC
Cobalt	Dissolved	mg/L	<0.00002	0.00002		
Copper	Dissolved	mg/L	<0.0005	0.0005	1 AO; 2 MAC	Below AO
Iron	Dissolved	mg/L	0.54	0.002	0.3	Above AO

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Company:

Project ID:
Project Name: SCRD Langdale Wellfield
Project Location: Well No. 1(63382)
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1633519**
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Reference Number	1633519-1
Sample Date	February 20, 2023
Sample Time	08:36
Sample Location	
Sample Description	Well No. 1(63382) / 5.3 °C
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Trace Metals Dissolved - Continued						
Lead	Dissolved	mg/L	0.00003	0.00001	0.005	Below MAC
Lithium	Dissolved	mg/L	0.0012	0.0005		
Manganese	Dissolved	mg/L	0.047	0.001	0.02 AO; 0.12 MAC	Above AO
Molybdenum	Dissolved	mg/L	0.0033	0.00002		
Nickel	Dissolved	mg/L	<0.0002	0.0002		
Selenium	Dissolved	mg/L	<0.0002	0.0002	0.05	Below MAC
Silver	Dissolved	mg/L	<0.00001	0.00001		
Strontium	Dissolved	mg/L	0.030	0.0001	7.0	Below MAC
Tellurium	Dissolved	mg/L	<0.00005	0.00005		
Thallium	Dissolved	mg/L	<0.00001	0.00001		
Thorium	Dissolved	mg/L	<0.00005	0.00005		
Tin	Dissolved	mg/L	<0.0001	0.0001		
Uranium	Dissolved	mg/L	0.00001	0.00001	0.02	Below MAC
Vanadium	Dissolved	mg/L	<0.00005	0.00005		
Zinc	Dissolved	mg/L	0.018	0.0005	5.0	Below AO
Zirconium	Dissolved	mg/L	<0.0001	0.0001		
Metals Total						
Mercury	Total	mg/L	<0.000005	0.000005	0.001	Below MAC
Calcium	Total	mg/L	7.4	0.01		
Magnesium	Total	mg/L	4.6	0.02		
Potassium	Total	mg/L	2.4	0.04		
Silicon	Total	mg/L	17	0.005		
Sulfur	Total	mg/L	4.5	0.02		
Sodium	Total	mg/L	6.4	0.1	200	Below AO
Titanium	Total	mg/L	<0.002	0.002		
Physical and Aggregate Properties						
Colour	Apparent, Potable	Colour units	5	5	15	Below AO
Turbidity		NTU	0.9	0.1	0.1/0.3/1.0 OG	
Routine Water						
pH			7.21	1	7.0-10.5	Within OG Range
Electrical Conductivity	at 25 °C	µS/cm	114	1		
Calcium	Extractable	mg/L	7.4	0.2		
Magnesium	Extractable	mg/L	4.8	0.2		
Sodium	Extractable	mg/L	6.2	0.4	200	Below AO
Potassium	Extractable	mg/L	2.4	0.4		
Iron	Extractable	mg/L	0.53	0.01	0.3	Above AO
Manganese	Extractable	mg/L	0.049	0.005	0.02 AO; 0.12 MAC	Above AO

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Reference Number	1633519-1
Sample Date	February 20, 2023
Sample Time	08:36
Sample Location	
Sample Description	Well No. 1(63382) / 5.3 °C
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Routine Water - Continued						
Chloride	Dissolved	mg/L	2.3	0.4	250	Below AO
Fluoride		mg/L	<0.05	0.05	1.5	Below MAC
Nitrate - N		mg/L	<0.01	0.01	10	Below MAC
Nitrite - N		mg/L	<0.005	0.005	1	Below MAC
Sulfate (SO4)	Extractable	mg/L	14	0.9	500	Below AO
T-Alkalinity	as CaCO3	mg/L	41	5		
Total Dissolved Solids		mg/L	61	1	500	Below AO
Hardness	as CaCO3	mg/L	38			
Langelier Index	Extractable		-1.6			
Saturation pH	Extractable	pH	8.8			
Calcium	Dissolved	mg/L	7.4	0.01		
Magnesium	Dissolved	mg/L	4.6	0.02		
Potassium	Dissolved	mg/L	2.6	0.04		
Silicon	Dissolved	mg/L	17	0.005		
Sodium	Dissolved	mg/L	6.2	0.1	200	Below AO
Sulfur	Dissolved	mg/L	4.3	0.02		
Hardness	as CaCO3 (dissolved)	mg/L	38	5		
Trace Metals Total						
Aluminum	Total	mg/L	0.001	0.001	0.1 OG; 2.9 MAC	Below OG
Antimony	Total	mg/L	<0.00002	0.00002	0.006	Below MAC
Arsenic	Total	mg/L	0.0034	0.0001	0.010	Below MAC
Barium	Total	mg/L	0.0030	0.0001	2.0	Below MAC
Beryllium	Total	mg/L	<0.00005	0.00005		
Bismuth	Total	mg/L	<0.0001	0.0001		
Boron	Total	mg/L	0.012	0.002	5	Below MAC
Cadmium	Total	mg/L	<0.00001	0.00001	0.007	Below MAC
Chromium	Total	mg/L	0.00010	0.00005	0.05	Below MAC
Cobalt	Total	mg/L	<0.00002	0.00002		
Copper	Total	mg/L	<0.0002	0.0002	1 AO; 2 MAC	Below AO
Iron	Total	mg/L	0.53	0.002	0.3	Above AO
Lead	Total	mg/L	0.00003	0.00001	0.005	Below MAC
Lithium	Total	mg/L	0.0013	0.0005		
Manganese	Total	mg/L	0.046	0.001	0.02 AO; 0.12 MAC	Above AO
Molybdenum	Total	mg/L	0.0033	0.00002		
Nickel	Total	mg/L	<0.0002	0.0002		
Selenium	Total	mg/L	<0.0002	0.0002	0.05	Below MAC
Silver	Total	mg/L	<0.00001	0.00001		

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Project Location: Well No. 1(63382)
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Reference Number	1633519-1
Sample Date	February 20, 2023
Sample Time	08:36
Sample Location	
Sample Description	Well No. 1(63382) / 5.3 °C
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Trace Metals Total - Continued						
Strontium	Total	mg/L	0.029	0.0001	7.0	Below MAC
Tellurium	Total	mg/L	<0.00005	0.00005		
Thallium	Total	mg/L	<0.00001	0.00001		
Thorium	Total	mg/L	<0.00005	0.00005		
Tin	Total	mg/L	<0.0001	0.0001		
Uranium	Total	mg/L	0.00001	0.00001	0.02	Below MAC
Vanadium	Total	mg/L	0.00013	0.00005		
Zinc	Total	mg/L	0.0099	0.0005	5.0	Below AO
Zirconium	Total	mg/L	<0.0001	0.0001		

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Lot ID: **1633519**
Control Number:
Date Received: Feb 21, 2023
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Reference Number	1633519-2
Sample Date	February 20, 2023
Sample Time	09:35
Sample Location	
Sample Description	Well No. 1(63382) / 5.3 °C
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Microbiological Analysis						
Total Coliforms	Enzyme Substrate Test	MPN/100 mL	<1.0	1.0	0 per 100 mL	Below MAC
Fecal Coliforms	Enzyme Substrate Test	MPN/100 mL	<1.0	1		
Escherichia coli	Enzyme Substrate Test	MPN/100 mL	<1.0	1.0	0 per 100 mL	Below MAC
Heterotrophic Count - Aerobic	SimPlate	MPN/mL	156	2		
Approximate Iron Related Bacteria Population	BART Kit	CFU/mL	9000			
Approximate Sulfate Reducing Bacteria Population	BART Kit	CFU/mL	<1			

Approved by:

Max Hewitt
Operations Manager

Data have been validated by Analytical Quality Control and Element's Integrated Data Validation System (IDVS).
Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.

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Methodology and Notes

Bill To: Kalwij Water Dynamics Inc
P.O. Box 684 Station Main
Port Coquitlam, BC, Canada
V3B 6H9
Attn: Ineke Kalwij
Sampled By:
Company:

Project ID:
Project Name: SCRD Langdale Wellfield
Project Location: Well No. 1(63382)
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1633519**
Control Number:
Date Received: Feb 21, 2023
Date Reported: Mar 6, 2023
Report Number: 2849871

Method of Analysis

Method Name	Reference		Method	Date Analysis Started	Location
Alkalinity, pH, and EC in water	APHA	*	Alkalinity - Titration Method, 2320 B	Feb 22, 2023	Element Edmonton - Roper Road
Alkalinity, pH, and EC in water	APHA	*	Conductivity, 2510 B	Feb 22, 2023	Element Edmonton - Roper Road
Alkalinity, pH, and EC in water	APHA	*	pH - Electrometric Method, 4500-H+ B	Feb 22, 2023	Element Edmonton - Roper Road
Ammonium-N in Water	APHA	*	Automated Phenate Method, 4500-NH3 G	Feb 24, 2023	Element Edmonton - Roper Road
Anions (Routine) by Ion Chromatography	APHA	*	Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B	Feb 23, 2023	Element Edmonton - Roper Road
Approval-Edmonton	APHA		Checking Correctness of Analyses, 1030 E	Feb 24, 2023	Element Edmonton - Roper Road
Carbon Organic (Total) in water (TOC)	APHA		High-Temperature Combustion Method, 5310 B	Feb 22, 2023	Element Edmonton - Roper Road
Chloride in Water	APHA	*	Automated Ferricyanide Method, 4500-Cl- E	Feb 22, 2023	Element Edmonton - Roper Road
Colour (Apparent) in water	APHA	*	Visual Comparison Method, 2120 B	Feb 27, 2023	Element Edmonton - Roper Road
Fecal Coliforms- Colilert (VAN)	APHA		Enzyme Substrate Test, APHA 9223 B	Feb 21, 2023	Element Vancouver
Heterotrophic (Standard) Plate Count (Aerobic SP) - VAN	APHA		Enzyme Substrate Method, 9215 E	Feb 21, 2023	Element Vancouver
Iron Reducing and Oxidizing Bacteria	IRB-BART		Iron Related Bacteria - BART Method, IRB-BART	Feb 21, 2023	Element Vancouver
Mercury (Total) in water	EPA	*	Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry, 245.7	Feb 23, 2023	Element Edmonton - Roper Road
Metals ICP-MS (Extractable) in water	APHA/USEPA	*	Metals By Inductively Coupled Plasma/Mass Spectrometry, APHA 3125 B / USEPA 200.2, 200.8	Feb 23, 2023	Element Edmonton - Roper Road
Metals ICP-MS (Extractable) in water	US EPA	*	Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Feb 23, 2023	Element Edmonton - Roper Road
Metals SemiTrace (Dissolved) in water (VAN)	US EPA	*	Metals & Trace Elements by ICP-AES, 6010C	Feb 23, 2023	Element Vancouver
Metals SemiTrace (Total) in Water (VAN)	US EPA	*	Metals & Trace Elements by ICP-AES, 6010C	Feb 23, 2023	Element Vancouver
Metals Trace (Extractable) in water	APHA		Hardness by Calculation, 2340 B	Feb 23, 2023	Element Edmonton - Roper Road
Metals Trace (Extractable) in water	APHA	*	Inductively Coupled Plasma (ICP) Method, 3120 B	Feb 23, 2023	Element Edmonton - Roper Road
Sulfate Reducing Bacteria - BART	SRB-BART		Sulfate Reducing Bacteria - BART Method, SRB-BART	Feb 21, 2023	Element Vancouver
Sulfide in water	APHA	*	Gas Dialysis, Automated Methylene Blue Method, 4500-S2- E	Feb 23, 2023	Element Edmonton - Roper Road
Total and E-Coli - Colilert - DW (VAN)	APHA		Enzyme Substrate Test, APHA 9223 B	Feb 21, 2023	Element Vancouver
Total and Kjeldahl Nitrogen (Total) in Water	ISO	*	Water Quality - Determination of nitrogen, ISO/TR 11905-2	Feb 22, 2023	Element Edmonton - Roper Road

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Methodology and Notes

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Attn: Ineke Kalwij
Sampled By:
Company:

Project ID:
Project Name: SCRD Langdale Wellfield
Project Location: Well No. 1(63382)
LSD:
P.O.:
Proj. Acct. code:

Lot ID: **1633519**
Control Number:
Date Received: Feb 21, 2023
Date Reported: Mar 6, 2023
Report Number: 2849871

Method Name	Reference		Method	Date Analysis Started	Location
Trace Metals (dissolved) in Water (VAN)	US EPA	*	Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Feb 23, 2023	Element Vancouver
Trace Metals (Total) in Water (VAN)	US EPA	*	Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Feb 24, 2023	Element Vancouver
Turbidity in Water	APHA	*	Turbidity - Nephelometric Method, 2130 B	Feb 27, 2023	Element Edmonton - Roper Road
Ultraviolet Transmittance in Water	APHA	*	Ultraviolet Absorption Method, 5910 B	Feb 23, 2023	Element Vancouver

** Reference Method Modified*

References

APHA	Standard Methods for the Examination of Water and Wastewater
APHA/USEPA	Standard Methods For Water/ Environmental Protection Agency
EPA	Environmental Protection Agency Test Methods - US
IRB-BART	IRB-BART. Std Methods for the App. of BART Testers, DBI
ISO	International Organization for Standardization
SRB-BART	SRB-BART. Std Methods for the App. of BART Testers, DBI
US EPA	US Environmental Protection Agency Test Methods

Guidelines

Guideline Description	Health Canada GCDWQ
Guideline Source	Guidelines for Canadian Drinking Water Quality, Health Canada, Sept 2020
Guideline Comments	MAC = Maximum Acceptable Concentration AO = Aesthetic Objective OG = Operational Guideline for Water Treatment Plants (does not apply to private groundwater wells). Refer to Health Canada for complete guidelines at www.hc-sc.gc.ca

Comments:

- Mar 06, 2023 - Report was issued to include addition of Health Canada Drinking Water Quality Guideline interpretations requested by Ineke Kalwij of Kalwij Water Dynamics Inc. on March 6, 2023.
  Previous report 2845623.

Technical Memorandum #3

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DRAFT

TECHNICAL MEMORANDUM #3

DATE: September 27, 2023
TO: Sunshine Coast Regional District
ATTN: Stephen Misiurak, P.Eng., Manager Capital Projects
FROM: Joel McAllister, P.Eng., Stephen Bertulli, P.Eng.

RE: Alternative Options for Raw Water Transmission Main Alignment Technical Memorandum

1 Introduction

This memorandum has been prepared for the Sunshine Coast Regional District (SCRD) to provide high level options for a raw water transmission main alignment that does not parallel the Sunshine Coast Highway.

2 Background

The SCRD is looking to incorporate two new groundwater wells, located at the Langdale Wellfield, into the Chapman Water System (CWS). The initial assessment considered routing the raw water transmission main along the Sunshine Coast Highway, which is a Ministry of Transportation and Infrastructure Right-of-Way (MOTI ROW) to connect the wells to the Water Treatment Plant (WTP), shown in Figure 1. There are many technical challenges with this alignment, as there are multiple gullies and creek crossings. Additionally, it will be subject to a rigorous approval process as it is along the main highway within the Sunshine Coast. Thus, the SCRD would like to review alternative options for the raw water transmission main alignment.

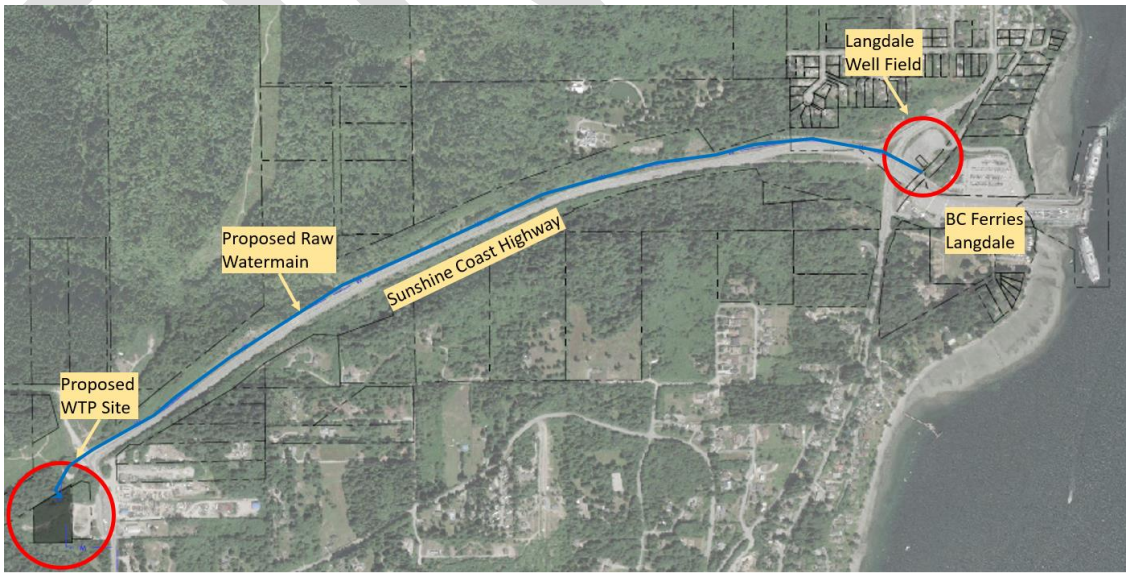

Figure 1: Initial Raw Watermain Alignment

3 Alternative Option 1 – Parker Drive

The most direct route between the Langdale wellfield and proposed WTP, while avoiding the Sunshine Coast Highway, is along Parker Drive, shown in Figure 2. The alignment is approximately 3 km. This road ROW is also MOTI controlled; however, it is assumed that the requirements for building along this alignment will be less stringent.

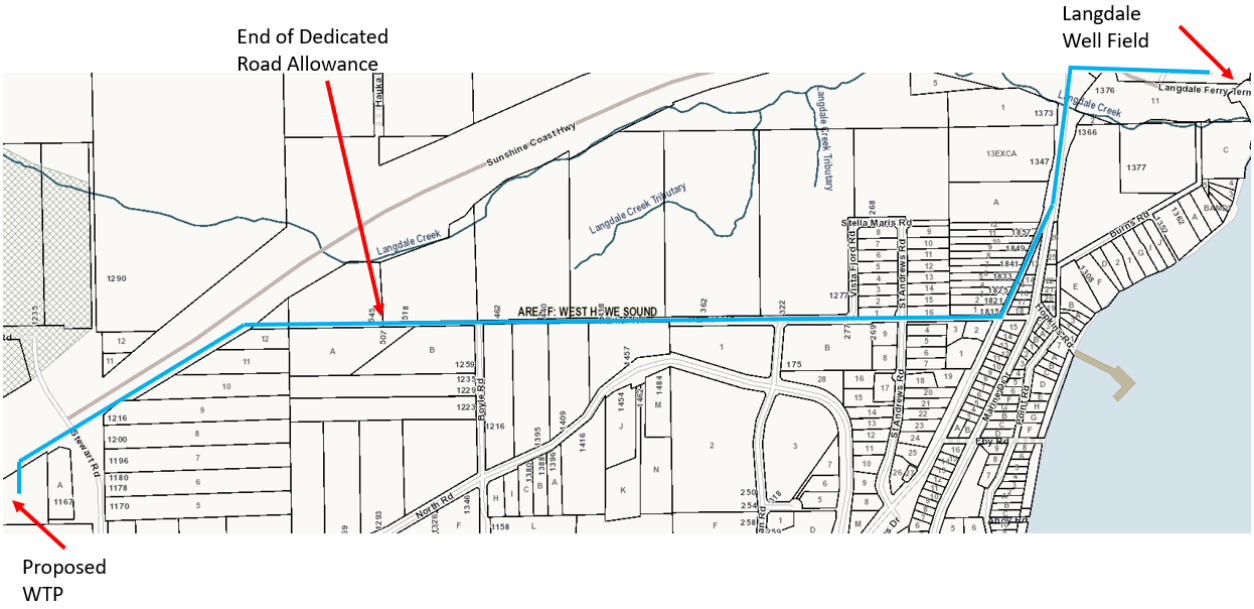

Figure 2: Alternative Raw Watermain Alignment Along Parker Road

There is a dedicated ROW extending from Marine Drive westward that connects to Parker Drive (Figure 3). This dedicated ROW terminates at the boundary between properties 516 and 545. In order to minimize the raw watermain alignment, an additional ROW through the 545 property and adjacent lot (unidentified in the SCRD Cadastre) is required. This would allow the forcemain to follow the south side of the Sunshine Coast Highway for approximately 500 m.

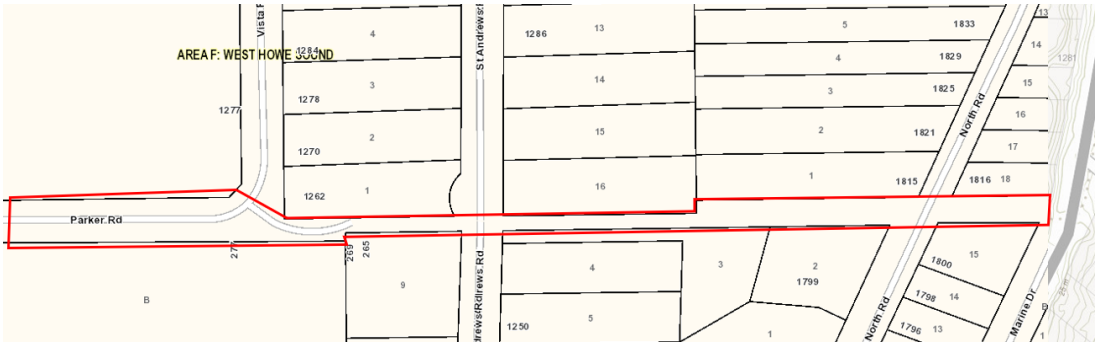

Figure 3: ROW from Marine Drive to Parker Road

The road ROW connecting Marine Drive to Parker Road is currently not developed for road works. There are multiple properties built up, and it appears there are dwellings within the ROW. It may be

possible to trenchlessly install a transmission main through this ROW. This would need to be reviewed during the design phase.

The west boundary of the Parker Road ROW appears to provide access to 545 Parker Road (Figure 4). The small triangular property adjacent belongs to 1290 Stewart Road, majority of which is adjacent to the north side of the highway. The Parker Road ROW will need to be extended through both properties to the highway, or a dedicated ROW for the watermain be obtained.

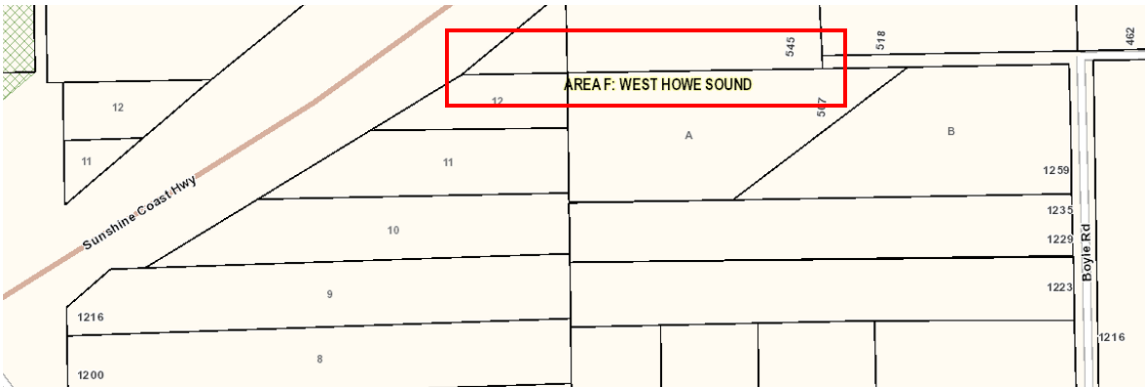

Figure 4: Area requiring new ROW for 545 Parker Road

4 Alternative Option 2 – North Road

An alternative route which could keep the transmission main within an existing road way /ROWwould be to route along North Road (Figure 5). This alignment is approximately 4 km.

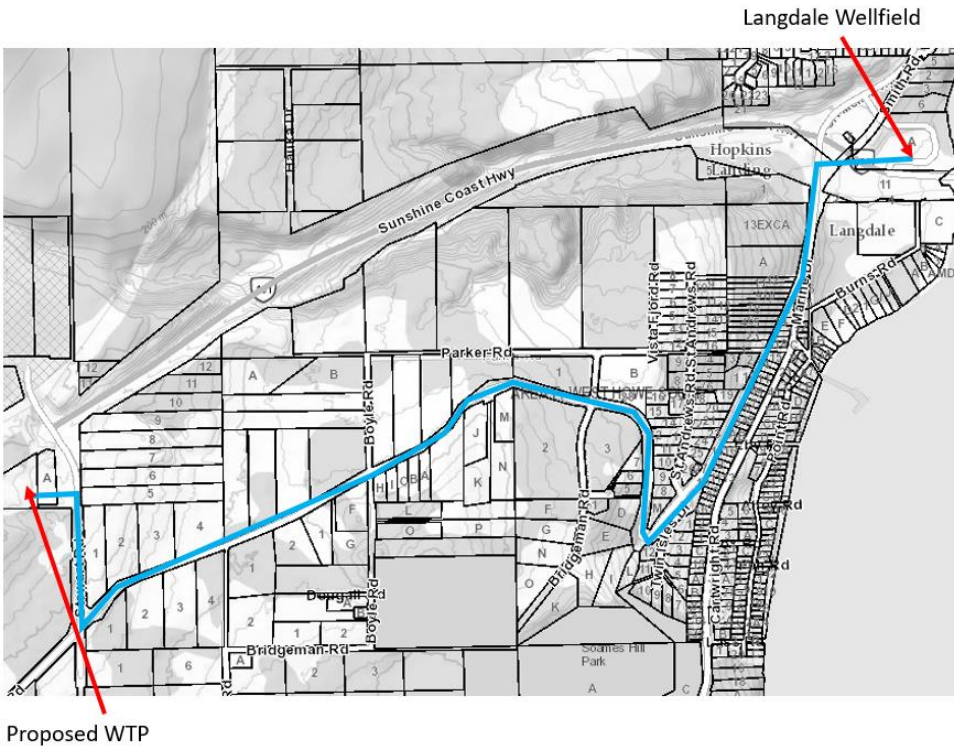

Figure 5: Alignment Along North Road

The SCRD already has a watermain along North Road, which is part of the CWS. This option would remove the need to obtain new road ROW dedication and avoids dealing with the stretch of ROW connecting Marine Drive to Parker Road. However, the alignment is about 35% longer. Additionally, North Road is a paved road (unlike much of Parker Road), so any work along North Road will have increased restoration requirements.

5 Cost Comparison Estimate

A 'Class D' cost estimate has been prepared to compare the cost between the three options. Based on construction cost comparisons, the route along Parker Drive is the most economical option. However, there are subjective requirements that may factor into the decision making for which is the best option. This may include factors such as MOTI coordination efforts, ROW negotiations, trenchless feasibility, and construction impacts.

	Unit	Quantity	Unit Rate	Total Cost
Original Alignment (Along Sunshine Coast Highway)				
400 mm diameter DI raw water transmission main	LM	2,700	$ 1,200	$ 3,240,000
Port Mellon Hwy Crossing (trenchless)	LM	230	$ 2,000	$ 460,000
Stewart Rd Crossing (trenchless)	LM	60	$ 2,000	$ 120,000
		Sub-Total		**$ 3,820,000**
Alternative Option 1 - Parker Drive				
400 mm diameter DI raw water transmission main along Marine Dr	LM	1,000	$ 1,000	$ 1,000,000
Trenchless connection Marine Drive to Parker Road	LM	400	$ 2,000	$ 800,000
400 mm diameter DI raw water transmission main along Parker Road	LM	1,300	$ 800	$ 1,040,000
400 mm diameter DI raw water transmission main along Highway	LM	500	$ 1,200	$ 600,000
Stewart Rd Crossing (trenchless)	LM	60	$ 2,000	$ 120,000
		Sub-Total		**$ 3,560,000**
Alternative Option 2 - North Road				
400 mm diameter DI raw water transmission main along Marine Dr	LM	4,000	$ 1,000	$ 4,000,000
Stewart Rd Crossing (trenchless)	LM	60	$ 2,000	$ 120,000
		Sub-Total		**$ 4,120,000**

6 Closure

This Report (the "Report") has been prepared by Onsite Engineering Ltd. ("Onsite") for the benefit of the Sunshine Coast Regional District ("Client"). The information, data, recommendations and conclusions contained in the Report:

- are subject to the scope, schedule, and other constraints and limitations and qualifications contained in the Report (the "Limitations");
- represent Onsite's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;

- may be based on information provided to Onsite which has not been independently verified;
- have not been updated since the date of issuance of the Report and their accuracy is limited to the time period and circumstances in which they were collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- were prepared for the specific purposes described in the Report;
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

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- shall not be responsible for any events or circumstances that may have occurred since the date on which the Report was prepared or for any inaccuracies contained in information that was provided to Onsite;
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- as required by law;
- for use by governmental reviewing agencies.

Any use of this Report is subject to these Qualifications. Any damages arising from improper use of the Report or parts thereof shall be borne by the party making such use.

Onsite Engineering Ltd.

Prepared by:	Reviewed by:
Stephen Bertulli, P.Eng.	Joel McAllister, P.Eng.

Technical Memorandum #4

ONSITE Engineering Ltd.

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DRAFT

TECHNICAL MEMORANDUM #4

DATE: September 28, 2023
TO: Sunshine Coast Regional District
ATTN: Stephen Misiurak, P.Eng., Manager Capital Projects
FROM: Joel McAllister, P.Eng., Stephen Bertulli, P.Eng.

RE: Alternative Options for Raw Water Transmission Main Alignment Technical Memorandum

1 Introduction

This memorandum has been prepared for the Sunshine Coast Regional District (SCRD) to provide potential alternative configurations to treat water from the Langdale wellfield before connecting to the Chapman Water System (CWS).

2 Background

The SCRD is looking to incorporate two new groundwater wells, located at the Langdale Wellfield, into the (CWS). The SCRD has identified a suitable location for water treatment infrastructure at 1235 Stewart Road. TM #1 discussed a conceptual water treatment plant (WTP), and considered full treatment and storage, as well as other amenities such as an operator's building and general equipment storage. As the anticipated cost for this type of WTP is large the SCRD would like to explore options to lower the capital costs for the WTP.

This Langdale water source would connect to the existing CWS, and as such will need to meet Canadian Water Quality Guidelines (CWQG), avoid upsetting existing treatment practices, or unintentionally create unwanted byproducts when combining different sources of water. It is noted that the CWS is currently served by a surface water source, where as the Langdale water is a ground water source.

3 Approval Requirements

The following provides the minimum requirements for connecting Langdale wellfield water into the CWS:

- Ministry of Health approvals – The construction of new drinking water infrastructure will require a permit from the Ministry of Health (MoH). Through this process, the MoH will review the level of treatment, source water quality, and existing water system to be connected to, among other items. Any options discussed in this memo have not been discussed with the MoH, thus, are subject to comment and approvals.
- Water to Meet CWQG – The Langdale water has been shown to have elevated dissolved iron and manganese, above the aesthetic objective (AO) of the CWQG. Treatment to reduce the

dissolved metals to below AO is readily available; however, as the water is being combined with water of different quality there may be some additional processes involved (after treatment) before combining waters.

4 Alternative WTP Options

The following present two options for discussion on how to reduce capital costs for a new WTP.

4.1 Reduced Scope WTP

The following are the requirements for a reduced scope WTP, assuming use of a pre-packaged treatment plant as discussed in TM#1. Note that a separate sizing exercise is required to confirm that new infrastructure is appropriately sized for the intended purpose, but not larger than necessary.

- Raw Water Reservoir – A raw water reservoir would be required to provide a buffering volume upstream of the treatment process. The size of this tank can be relatively small, as the purpose is to break hydraulic head between the groundwater well pumps and the treatment process. For the purpose of this exercise, a 250 m^3 tank is assumed.
- Treatment Booster Station – A small booster station would be required to pressurize water from the raw water tank through the treatment process.
- Pre-Packaged Treatment Plant – A pre-packaged treatment plant would provide removal of the dissolved iron and manganese to below CWQG. This plant is also able to provide chlorination prior to discharge. This plant generates residual waste that needs to be managed. This building would include chemical storage and monitoring equipment.
- Treated Water Reservoir – A reservoir downstream of the treatment will provide contact time for chlorine. The water level of the reservoir would be designed to match the hydraulic grade line (HGL) of the CWS, allowing it to passively feed the CWS on demand. Typically, reservoirs are sized to meet MMCD design standards; however, if the purpose of the reservoir is not to contribute to fire flow capacity in the CWS, then the sizing can be reduced to provide contact time only. For the purpose of this exercise a single 500 m^3 tank is assumed.
- Residual Management Plan – The pre-packaged treatment plant has a waste stream that requires a discharge point. A waste lagoon is likely the most economical solution for storage, but a plan is required to maintain the sustainability of the lagoon.

4.2 Blending Treatment Option

In lieu of a pre-packaged water treatment plant, a blended water approach may be a viable option. Blending aims to reduce the level of dissolved metals by mixing with a separate source water that has lower concentrations. Once the dissolved metals are below the CDQG threshold level, the water can be combined with the CWS.

- Raw Water/Settling Reservoir – A reservoir would be required to allow for precipitation and settling of dissolved metals. An oxidant is required to assist in the precipitation; chlorine dosing is likely the simplest and most effective method and would primarily remove iron, leaving the

majority of dissolved manganese in solution. The chlorine will also provide the necessary disinfection residual. This reservoir would need to be large to provide adequate retention time.

- Blending Reservoir – A blending reservoir would be used to blend CWS water with the 'treated' Langdale water. This approach aims to reduce the dissolved manganese concentration below the AO (0.02 mg/L) through dilution. The Langdale water has a dissolved manganese concentration of 0.047 mg/L. The ratio of blending is dependent on the relative concentrations of dissolved manganese in the two water sources. Assuming a concentration of 0 mg/L in the CWS water, a blending ration of 2.5 parts of CWS water to 1 part Langdale water is required. The water level of the reservoir would be designed to match the HGL of the CWS, allowing it to passively feed the CWS on demand.
- Residual Management – The settling and blending reservoirs would accumulate residuals over time, and they would need to be designed such that they can be cleaned reliably and routinely. A plan is required to prevent excessive build-up of residuals in the tanks.
- General Purpose Building – A building will be required to house necessary equipment for the plant such as chemical storage, monitoring equipment, and other items required by the process.

As noted above, in order to achieve sufficient blending to reduce the iron and manganese concentrations below the AO, a ratio of 1 part Langdale water to 2.5 parts CWS water is required. To fully utilize the capacity of the new Langdale wells (60 L/s), a flow rate of 150 L/s from the CWS is required.

5 Cost Comparison Estimate

A 'Class D' cost estimate has been prepared to compare the cost between the three options. Based on construction cost comparisons, a blended treatment approach may be more economical from a capital cost perspective. However, the actual cost is highly dependent on three factors: MoH requirements actual tanks sizes required for the settling and blending, and ability of the CWS to provide enough water for blending on top of providing typical usage. Costs that would be common to both options, such as land acquisition, are not included.

Reduced WTP Option	Unit	Qty	Unit Price	Amount
Raw Water Reservoir (300 m3)	m3	250	$600	$150,000
Treatment Plant Booster Station	LS	1	$500,000	$500,000
Pre-Package Fe/Mn Treatment Plant incl. chlorination	LS	1	$2,000,000	$2,000,000
Treated Water Reservoir (500 m3)	m3	500	$600	$300,000
Site Civil, Groundworks, Piping, Electrical, SCADA	LS	1	$2,000,000	$2,000,000
Boosting Pump Station	LS	1	$500,000	$500,000
Residuals Management	LS	1	$250,000	$250,000
			Sub-Total (Construction)	**$5,700,000**
Design, Permits, and Construction Management	LS	10%		$570,000
Contingency	LS	40%		$2,280,000
	Sub-Total (Eng., Construct, Contingency)			**$8,550,000**

Blending Option	Unit	Qty	Unit Price	Amount
Settling Reservoir (1000 m3)	m3	1000	$600	$600,000
Blending Reservoir (1000 m3)	m3	1000	$600	$600,000
General Purpose Building	LS	1	$1,000,000	$1,000,000
Site Civil, Groundworks, Piping, Electrical, SCADA	LS	1	$1,000,000	$1,000,000
Boosting Pump Station	LS	1	$500,000	$500,000
Incoming CWS piping	LS	1	$200,000	$200,000
Residuals Management	LS	1	$250,000	$250,000
			Sub-Total (Construction)	**$4,150,000**
Design, Permits, and Construction Management	LS	10%		$415,000
Contingency	LS	40%		$1,660,000
	Sub-Total (Eng., Construct, Contingency)			**$6,225,000**

6 Closure

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Onsite Engineering Ltd.

Prepared by:	Reviewed by:
Stephen Bertulli, P.Eng.	Joel McAllister, P.Eng.

Franklin Pump Selection (Example)

Pump Performance Datasheet

Company Name	
Company contact number	
Quote Number	1986491
Project name	Default

Model/Order No.	FST-9FHC Enclosed Impeller
Stages	4
Quantity of pumps in parallel	1
Based on curve number	9FHC(2POLE)
Saved Date	15 Dec 2023 2:31 PM

Operating Conditions

Flow, rated	: 56.80 l/s
Head, rated (requested)	: 215.5 m
Head, rated (actual)	: 218.2 m
Suction pressure, rated / max	: 0.82 / 0.82 psi.g
NPSH available	: 35.07 ft
Site Supply Frequency	: 60 Hz

Performance

Speed criteria	: Synchronous
Speed	: 3450 rpm
Impeller dia.	: 7.19 in
Impeller diameter, maximum	: 7.42 in
Impeller diameter, minimum	: 6.94 in
Efficiency (bowl / pump)	: 84.54 / - %
NPSH required / margin required	: 24.03 / 0.00 ft
Ns (imp. eye flow) / Nss (imp. eye flow)	: 2,313 / 8,846 US Units
MCSF	: 38.43 l/s
Head max.	: 238.8 m
Head rise to shutoff (bowl / pump)	: 10.43 / - %
Flow, best eff. point (bowl / pump)	: 64.56 / - l/s
Flow ratio, rated / BEP (bowl / pump)	: 87.98 / - %
Diameter ratio (rated / max)	: 96.93 %
Head ratio (rated dia / max dia)	: 92.19 %
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Selection status	: Acceptable

Liquid

Liquid type	: Water
Additional liquid description	:
Solids diameter, max	: 0.00 in
Solids concentration, by volume	: 0.00 %
Temperature	: 68.00 deg F
Fluid density	: 1.000 / 1.000 SG
Viscosity	: 1.00 cP
Vapor pressure, rated	: 0.34 psi.a

Material

Material selected	: Cast Iron

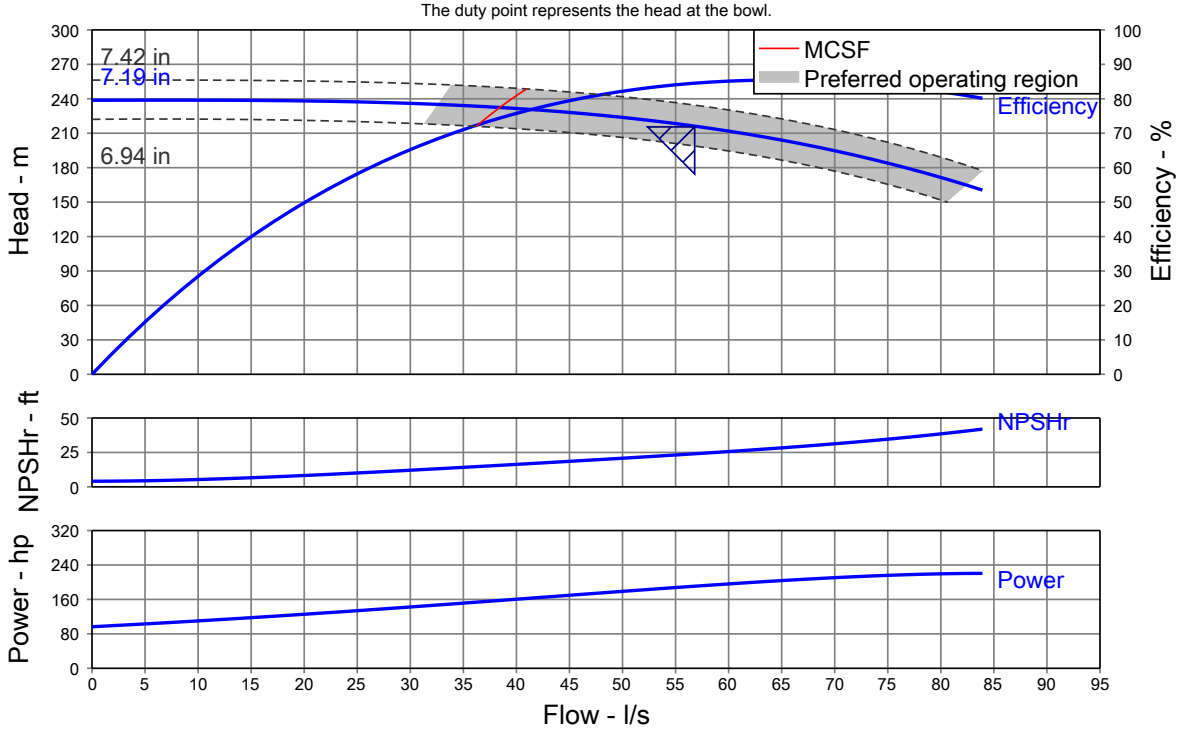
Pressure Data

Shut off pressure	: See the Additional Data page
Maximum allowable working pressure	: See the Additional Data page
Maximum allowable suction pressure	: N/A
Hydrostatic test pressure	: See the Additional Data page

Driver & Power Data (@Max density)

Driver sizing specification	: Maximum power
Margin over specification	: 0.00 %
Service factor	: 1.15 (used)
Power, hydraulic	: 161 hp
Power (bowl / pump)	: 191 / - hp
Power, maximum	: 221 hp
Motor rating	: 200 hp / 149 kW

Pump performance. Adjusted for construction, viscosity, static lift to discharge nozzle centerline, friction and power losses of lineshaft and thrust bearings.
The duty point represents the head at the bowl.

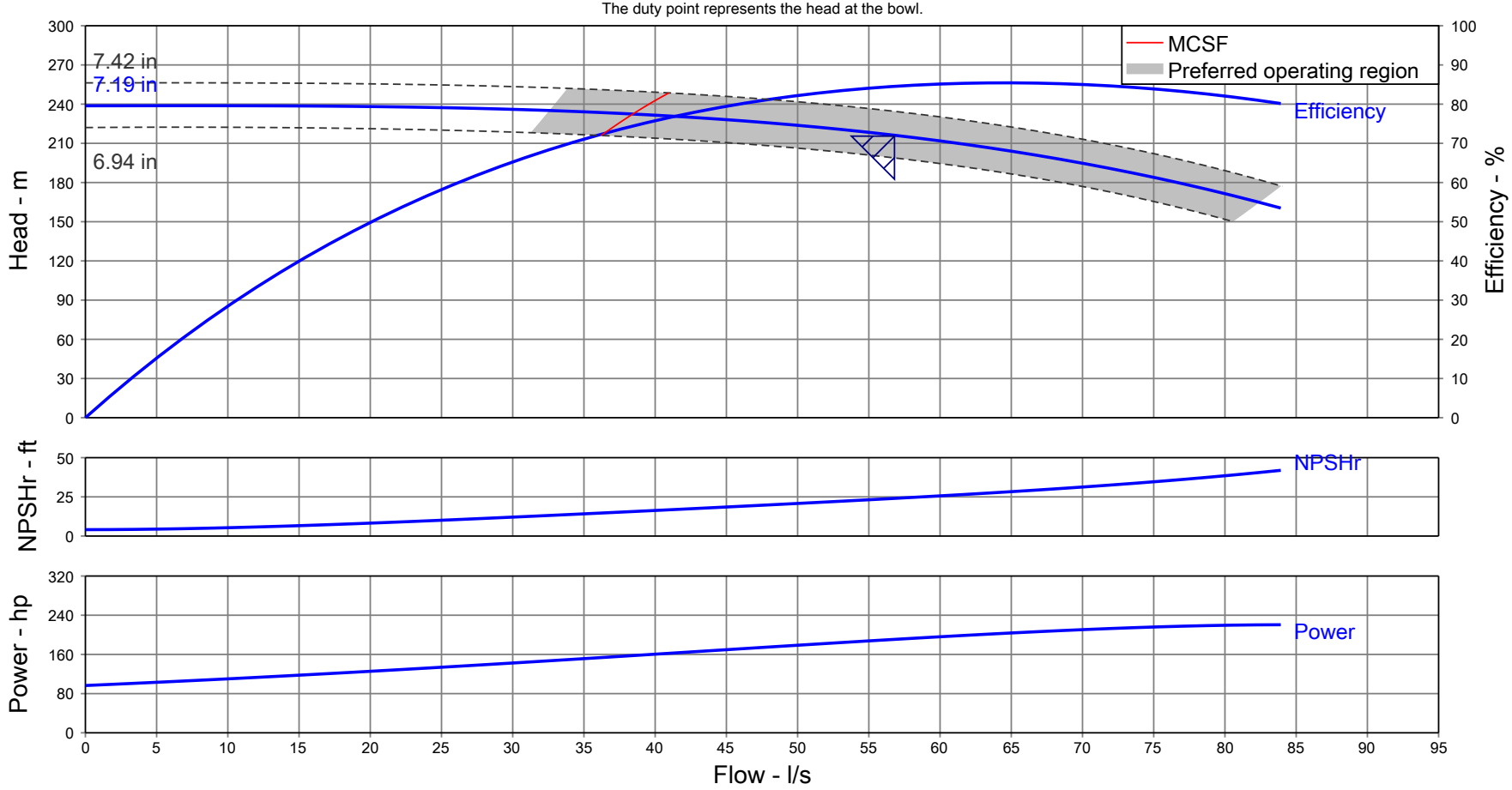


Pump Performance Curve

Company Name	
Company contact number	

Quote Number	1986491
Quote Date	15 Dec 2023
Project name	Default

Pump performance. Adjusted for construction, viscosity, static lift to discharge nozzle centerline, friction and power losses of lineshaft and thrust bearings.
The duty point represents the head at the bowl.



Description	: FST-9FHC Enclosed Impeller
Stages	: 4
Flow, rated	: 56.80 l/s
Head, rated	: 215.5 m

Speed	: 3450 rpm
Based on curve number	: 9FHC(2POLE)
Efficiency (bowl / pump)	: 84.54 %
Power (bowl / pump)	: 191 / - hp

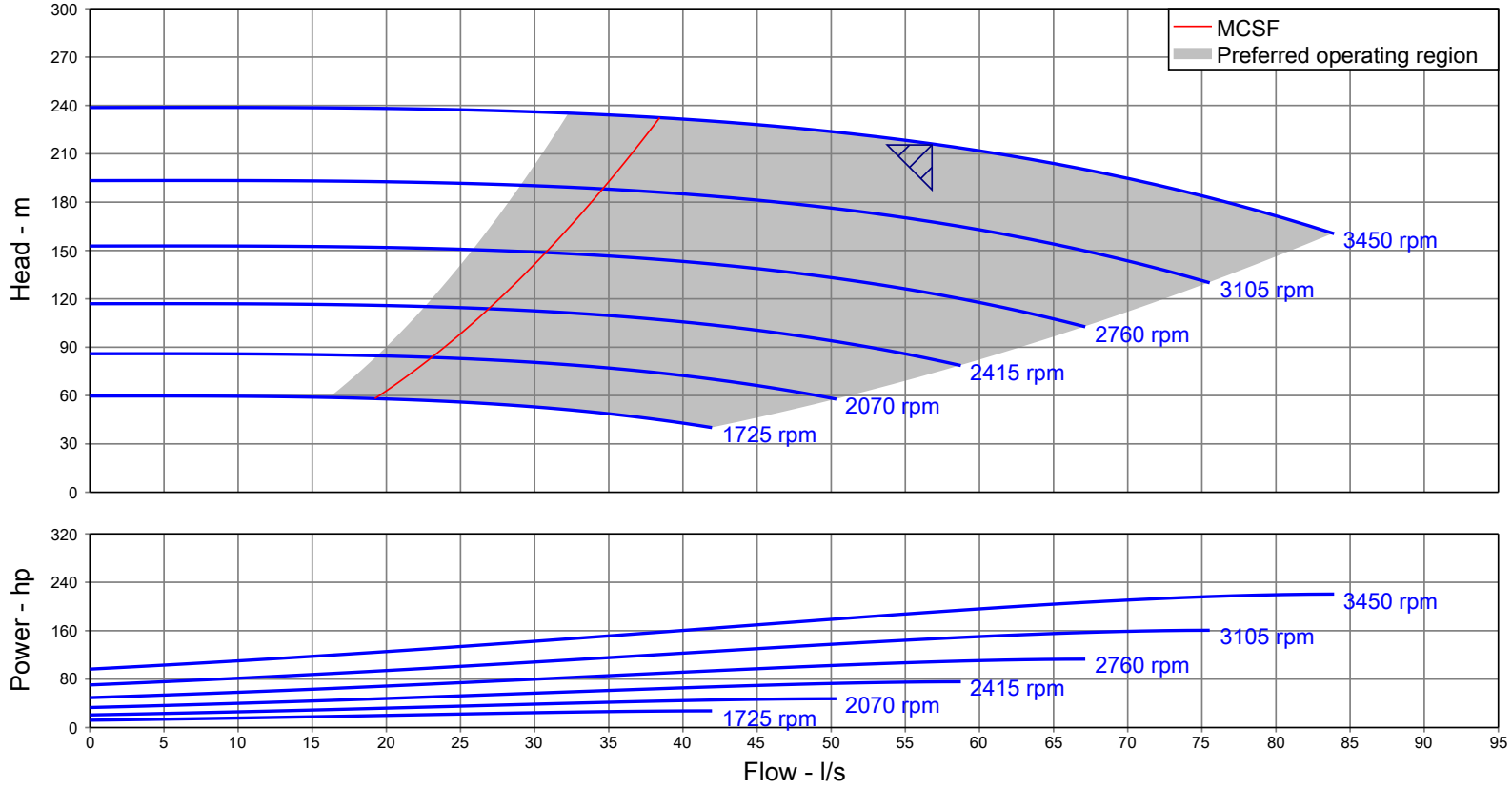
NPSH required	: 24.03 ft
Fluid density	: 1.000 / 1.000 SG
Viscosity	: 1.00 cP
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Saved Date	: 15 Dec 2023 2:31 PM

Multi-Speed Performance Curve

Company Name	
Company contact number	

Quote Number	1986491
Quote Date	15 Dec 2023
Project name	Default

Pump performance. Adjusted for construction, viscosity, static lift to discharge nozzle centerline, friction and power losses of lineshaft and thrust bearings.
The duty point represents the head at the bowl.



Description	: FST-9FHC Enclosed Impeller
Stages	: 4
Flow, rated	: 56.80 l/s
Head, rated	: 215.5 m

Speed	: 3450 rpm
Based on curve number	: 9FHC(2POLE)
Efficiency (bowl / pump)	: 84.54 %
Power (bowl / pump)	: 191 / - hp
Impeller dia.	: 7.19 in

NPSH required	: 24.03 ft
Fluid density	: 1.000 / 1.000 SG
Viscosity	: 1.00 cP
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Saved Date	: 15 Dec 2023 2:31 PM

Pump Performance - Additional Data

Company Name	
Company contact number	
Quote Number	1986491
Project name	Default

Model/Order No.	FST-9FHC Enclosed Impeller
Stages	4
Quantity of pumps in parallel	1
Based on curve number	9FHC(2POLE)
Saved Date	15 Dec 2023 2:31 PM

Performance Data	
Head, maximum diameter, rated flow	: 234.5 m
Head, minimum diameter, rated flow	: 198.8 m
Head max.	: 238.8 m
Efficiency adjustment factor, total	: 1.00
Power adjustment, total	: 0.00 hp
Head adjustment factor, total	: 1.00
Flow adjustment factor, total	: 1.00
Flow adjustment factor, efficiency only (shift BEP)	: 1.00
Flow adjustment factor, end-of-curve only, total	: 1.00
MCSF adjustment factor	: 1.00
NPSHR adjustment factor, total	: 1.00
User applied performance adjustment comments	:
NPSH margin dictated by pump supplier	: 0.00 ft
NPSH margin dictated by user	: 0.00 ft
NPSH margin used (added to 'required' values)	: 0.00 ft

Stage, Speed and Solids Limits	
Stages, maximum	: 9
Stages, minimum	: 1
Pump speed limit, maximum	: 3600 rpm
Pump speed limit, minimum	: 1200 rpm
Curve speed limit, maximum	: 3600 rpm
Curve speed limit, minimum	: 1801 rpm
Variable speed limit, maximum	: -
Variable speed limit, minimum	: 5 rpm
Solids size limit	: 0.75 in
Typical Driver Data	
Driver speed, full load	: 3570 rpm
Driver speed, rated load	: 3571 rpm
Driver efficiency, 100% load	: N/A
Driver efficiency, 75% load	: N/A
Driver efficiency, 50% load	: N/A

Mechanical Limits	
Torque, rated power, rated speed	: 5.53 hp/100 rpm
Torque, maximum power, rated speed	: 6.39 hp/100 rpm
Torque, driver power, full load speed	: 5.60 hp/100 rpm
Torque, driver power, rated speed	: 5.60 hp/100 rpm
Torque, pump shaft limit	: 15.62 hp/100 rpm
Radial load, worst case	: -
Radial load limit	: -
Impeller peripheral speed, rated	: -
Impeller peripheral speed limit	: -

Various Performance Data	**Flow (l/s)**	**Head (m)**	**Efficiency (%)**	**NPSHr (ft)**	**Power (hp)**
Shutoff, rated	0.00	238.7	-	-	96.53
Shutoff, maximum	0.00	256.3	-	-	115
MCSF	38.43	232.4	74.41	15.64	158
Rated flow, minimum	56.80	198.8	84.25	-	176
Rated flow, maximum	56.80	234.5	83.31	-	210
BEP flow, rated	64.56	204.8	85.43	28.07	203
120% rated flow, rated	68.16	198.3	85.25	30.15	208
End of curve, rated	83.92	160.5	80.15	41.92	221
End of curve, minimum	80.65	149.9	80.02	39.01	198
End of curve, maximum	84.04	177.1	79.93	42.04	244
Maximum value, rated	-	238.8	85.43	-	221
Maximum value, maximum	-	-	85.44	-	244

System differential pressure	**@ Density, rated**	**@ Density, max**
Differential pressure, rated flow, rated (psi)	307.0	307.0
Differential pressure, shutoff, rated (psi)	339.0	339.0
Differential pressure, shutoff, maximum (psi)	363.9	363.9

Discharge pressure	**@ Suction pressure, rated**	**@ Suction pressure, max**	**@ Suction pressure, rated**	**@ Suction pressure, max**
Discharge pressure, rated flow, rated (psi.g)	307.8	307.8	307.8	307.8
Discharge pressure, shutoff, rated (psi.g)	339.8	339.8	339.8	339.8
Discharge pressure, shutoff, maximum (psi.g)	364.7	364.7	364.7	364.7

Ratios			
Maximum flow / rated flow, rated	: 147.75 %	Head rated diameter / head minimum diameter, rated flow	: 108.72 %

Pump Performance - Additional Data

Head and Power Losses	
Friction loss rate, column	: -
Friction loss, column	: -
Friction loss, discharge head	: -
Friction loss, can/barrel	: -
Friction loss, suction bell and strainer	: 0.00 m
Friction loss, bowl/column adaptor	: -
Friction loss, total	: -
Power loss, lineshaft bearings	: -
Power loss, thrust bearing	: -
Power loss, total	: -
Bowl vs. Pump Performance	
Head (bowl / pump)	: 215.5 m / -
Efficiency (bowl / pump)	: 84.54 % / -
Power (bowl / pump)	: 191 hp / -
NPSH required at first stage impeller eye	: 24.03 ft
Weights and Down Thrust	
Weight, lineshaft	: -
Weight, bowl assembly rotating element	: 295.0 lb
Thrust factor	: 3.11 lb/ft
Thrust, hydraulic (rated / max)	: 2,194.9 / 2,432.2 lbf
Thrust, bowl shaft end (rated / max)	: -1.45 / -1.45 lbf
Thrust, shaft step (rated / max)	: - / -
Thrust, stuffing box sleeve (rated / max)	: - / -
Thrust, total (rated / max)	: 2,488.5 / 2,725.8 lbf
Thrust Limit	: -

* Rated thrust @ rated head, density, and suction pressure where applicable
* Max thrust @ max head, density, and suction pressure where applicable

Pressure Data	Shut off pressure (psi.g)	Maximum allowable working pressure (psi.g)	Hydrostatic test pressure (psi.g)
Bowl	339.9	500.0	750.0
Column	-	-	-
Discharge head	-	-	-
Can/Barrel	-	-	-

Torque Limits	
Torque, lineshaft limit	: -

Dimensions	
Minimum clearance below suction bell lip/case	: 10.00 in
Minimum well diameter	: 9.69 in
Suction nozzle centerline height	: -
Suction to first stage impeller centerline	: -
Bowl assembly length, first stage	: 0.00 in
Bowl assembly length, upper stage	: 8.50 in
Bowl assembly length, total	: 25.50 in
Suction bearing hub length	: 0.00 in
Strainer length	: 0.00 in
Bowl to column adaptor length	: -
Discharge head stick-down	: -
Submersible motor adaptor length	: -
Submersible motor length	: -
Column length	: -
Total pump length	: -
Can / barrel length	: -
Stuffing box sleeve diameter	: -
Suction bell diameter	: -
Minimum submergence to prevent vortexing	: 30.00 in
Minimum submergence for start-up	: 30.00 in
Discharge head height	: -
Discharge nozzle centerline height	: -
Min distance discharge nozzle centerline to suction bell	: 0.00
Lineshaft length	: -
Bowl shaft diameter	: 1.50 in
Bowl diameter, outside	: 9.25 in
Bowl diameter, exit	: 8.19 in
Column diameter, inside	: -
Column internal obstruction diameter	: -
Can/barrel diameter, inside	: -
Can/barrel obstruction diameter	
NPSH	
NPSH at bowl (available / required)	: 35.07 ft / 24.03 ft
NPSH at low liquid level (available / required)	: - / -
NPSH at suction flange (available / required)	: - / -
Liquid Velocities	
Column liquid velocity	: -
Discharge head liquid velocity	: -
Can liquid velocity	: -
Suction nozzle liquid velocity	: -

INTERNAL PRICE SHEET			
Company name		Size / Stages	FST-9FHC Enclosed Impeller / 4
		Pump speed	3450 rpm
Line item number	001	Quote No.	1986491
Project name	Default	Date Last Saved	15 Dec 2023

Totals			
Total Extended Net	$ 109,259.36	Estimated Lead Time	8 weeks
Pump Total	$ 24,796.36		

Pump

Qty	Description	Order No.	List Price	Multiplier	Net Price	Margin	Unit Sell Price	Extended Sell Price
	9FHC-1CJ2BS-08-04-C04-S							
1	Model: 9FHC		$ 7,934.00	1.000	$ 7,934.00	0.00 %	$ 7,934.00	$ 7,934.00
	Impeller Type: Enclosed							
	Bowl shaft diameter: 1-1/2"							
	NSF/ANSI 61 Certification: NSF – Certified							
4	Bowl Material: Cast Iron ASTM A48 Class 30 (default)	179-9FLHC-030WR	Included		Included		Included	Included
4	Bowl Wear Ring Material: 316 SS		$ 674.00	1.000	$ 674.00	0.00 %	$ 674.00	$ 2,696.00
1	Bowl Bearing Material: Bronze (Alloy C89835)		$ 482.00	1.000	$ 482.00	0.00 %	$ 482.00	$ 482.00
	Bolting options: Standard Bolting							
	Bolting material: 18-8ss Bowl Bolting		Included		Included		Included	Included
4	Impeller Material: 304SS Standard (AISI Type 304)	444-9FHCA-304	Included		Included		Included	Included
4	Impeller Collets: AISI Type 416 SS	225-0016-416	$ 124.00	1.000	$ 124.00	0.00 %	$ 124.00	$ 496.00
	Impeller Dynamic Balance: Standard (ISO Grade 6.3)		Included		Included		Included	Included
1	Bowl Shaft Material: 416 SS (ASTM A582, Type 416)	760-510071-416	Included		Included		Included	Included
1	Bowl Shaft Cplg Material: 416 SS (ASTM A582, Type 416)	256-0099-416	Included		Included		Included	Included
	Bowl Discharge Type: Threaded							
1	Bowl Discharge Bearings Material: Bronze (AlloyC89835)	136-0018-835						
1	Bowl Discharge Size: 8"	302-0404-065						
	Discharge Head Selection: Customer Supplied							
1	Motor Bracket Size: 8 in	816-0179-065						
	Coating Name: Induron PE-70 Epoxy (NSF)							
	Coating Thickness: 3-6 Mils DFT (per coat)							
	Number of Coats: One Coat							
	Coating Color: Gray							
1	Bowl Surfaces to be Coated: OD of Bowl (Special Coated)		$ 1,482.00	1.000	$ 1,482.00	0.00 %	$ 1,482.00	$ 1,482.00
	Bowl Performance Test: No							
	Hydrostatic Test - Bowl: No							
	Material Certifications: None							
	Field Service/Start-up: No							
1	Warranty: Extended (5 year)		$ 11,706.36	1.000	$ 11,706.36	0.00 %	$ 11,706.36	$ 11,706.36

INTERNAL PRICE SHEET			
Project name	Default	Quote No.	1986491
Line item number	001	Date Last Saved	15 Dec 2023

Pump

Qty	Description	Order No.	List Price	Multiplier	Net Price	Margin	Unit Sell Price	Extended Sell Price
	Expedite Order Delivery: No							

Motor

Qty	Description	Order No.	List Price	Multiplier	Net Price	Margin	Unit Sell Price	Extended Sell Price
1	Motor: 8" Three-Phase, 200 HP, 316 SS, 460/380V, 60/50Hz, 1.15/1.0 SF , DOL (3), 2391086204	2391086204	$ 84,463.00	1.000	$ 84,463.00	0.00 %	$ 84,463.00	$ 84,463.00

Assembly	Qty	Code
	1	Smart Part number=9FHC-1CJ2BS-08-04-C04-S
SCREW SandCap		
SCREW DischCase	1	
SCREW BowlSuct		
SUCTION CASE	1	
COUPLING	1	
BowlShaft Barstock		
SAND CAP	1	
BEARING SuctionCase	1	
BEARING Bowl		
CASING BOWL		
COLLET		
DISCHARGE CASE	1	
ORING		
IMPELLER	1	
PLUG DischargeCase		
PLUG SuctionCase	1	

QUOTATION

Quote Information	
Quote No.	1986491
Quote Date	15 Dec 2023
Project name	Default
Est. Leadtime ARO	8 weeks

/ / /

McAllister, Joel (jmcallister@onsite-eng.ca-franklin)

Customer Information	
To	
Street Address	
City/State/Zip	/ /
Phone No.	

Totals	
Total Extended Net	$ 109,259.36
Pump Total	$ 24,796.36
Motor Total	$ 84,463.00

Pump

Order No.	Qty	Description	Unit Price	Extended Sell Price
	1	*9FHC-1CJ2BS-08-04-C04-S*		
		Bowl		
		Configuration		
	1	Model: 9FHC	$ 7,934.00	$ 7,934.00
		Impeller Type: Enclosed		
		Bowl shaft diameter: 1-1/2"		
		NSF/ANSI 61 Certification: NSF – Certified		
		Material options		
179-9FLHC-030WR	4	Bowl Material: Cast Iron ASTM A48 Class 30 (default)	Included	Included
	4	Bowl Wear Ring Material: 316 SS	$ 674.00	$ 2,696.00
	1	Bowl Bearing Material: Bronze (Alloy C89835)	$ 482.00	$ 482.00
		Bolting material: 18-8ss Bowl Bolting	Included	Included
		Impeller options		
444-9FHCA-304	4	Impeller Material: 304SS Standard (AISI Type 304)	Included	Included
225-0016-416	4	Impeller Collets: AISI Type 416 SS	$ 124.00	$ 496.00
		Impeller Dynamic Balance: Standard (ISO Grade 6.3)	Included	Included
		Bowl shaft options		
760-510071-416	1	Bowl Shaft Material: 416 SS (ASTM A582, Type 416)	Included	Included
256-0099-416	1	Bowl Shaft Cplg Material: 416 SS (ASTM A582, Type 416)	Included	Included
		Discharge options		
		Bowl Discharge Type: Threaded		
136-0018-835	1	Bowl Discharge Bearings Material: Bronze (AlloyC89835)		
302-0404-065	1	Bowl Discharge Size: 8"		
		Submersible Motor		
		Configuration		
816-0179-065	1	Motor Bracket Size: 8 in		
		Coating		
		Configuration		
		Bowl Assembly Coating		
		Coating Name: Induron PE-70 Epoxy (NSF)		
		Coating Thickness: 3-6 Mils DFT (per coat)		
		Number of Coats: One Coat		

QUOTATION

Quote Information	
Quote No.	1986491
Quote Date	15 Dec 2023
Project name	Default
Est. Leadtime ARO	8 weeks

Totals	
Total Extended Net	$ 109,259.36
Pump Total	$ 24,796.36
Motor Total	$ 84,463.00

Pump

Order No.	Qty	Description	Unit Price	Extended Sell Price
		Coating Color: Gray		
	1	Bowl Surfaces to be Coated: OD of Bowl (Special Coated)	$ 1,482.00	$ 1,482.00
		Other Optional Features or Requirements		
		Special Services / Warranty Options		
	1	Warranty: Extended (5 year)	$ 11,706.36	$ 11,706.36
Pump Total				$ 24,796.36

Motor

Order No.	Qty	Description	Unit Price	Extended Sell Price
		Submersible Motor		
		Configuration		
2391086204	1	Motor: 8" Three-Phase, 200 HP, 316 SS, 460/380V, 60/50Hz, 1.15/1.0 SF , DOL (3), 2391086204	$ 84,463.00	$ 84,463.00
Motor Total				$ 84,463.00

QUOTATION

Quote Information	
Quote No.	1986491
Quote Date	15 Dec 2023
Project name	Default
Est. Leadtime ARO	8 weeks

/ / /

McAllister, Joel (jmcallister@onsite-eng.ca-franklin)

Customer Information	
To	
Street Address	
City/State/Zip	/ /
Phone No.	

Pump		
Order No.	Qty	Description
	1	*9FHC-1CJ2BS-08-04-C04-S*
		Bowl
		Configuration
		Model: 9FHC
		Impeller Type: Enclosed
		Bowl shaft diameter: 1-1/2"
		NSF/ANSI 61 Certification: NSF – Certified
		Material options
179-9FLHC-030WR	4	Bowl Material: Cast Iron ASTM A48 Class 30 (default)
		Bowl Wear Ring Material: 316 SS
		Bowl Bearing Material: Bronze (Alloy C89835)
		Bolting material: 18-8ss Bowl Bolting
		Impeller options
444-9FHCA-304	4	Impeller Material: 304SS Standard (AISI Type 304)
225-0016-416	4	Impeller Collets: AISI Type 416 SS
		Impeller Dynamic Balance: Standard (ISO Grade 6.3)
		Bowl shaft options
760-510071-416	1	Bowl Shaft Material: 416 SS (ASTM A582, Type 416)
256-0099-416	1	Bowl Shaft Cplg Material: 416 SS (ASTM A582, Type 416)
		Discharge options
		Bowl Discharge Type: Threaded
136-0018-835	1	Bowl Discharge Bearings Material: Bronze (AlloyC89835)
302-0404-065	1	Bowl Discharge Size: 8"
		Submersible Motor
		Configuration
816-0179-065	1	Motor Bracket Size: 8 in
		Coating
		Configuration
		Bowl Assembly Coating
		Coating Name: Induron PE-70 Epoxy (NSF)
		Coating Thickness: 3-6 Mils DFT (per coat)
		Number of Coats: One Coat

QUOTATION

Quote Information	
Quote No.	1986491
Quote Date	15 Dec 2023
Project name	Default
Est. Leadtime ARO	8 weeks

Pump		
Order No.	Qty	Description
		Coating Color: Gray
		Bowl Surfaces to be Coated: OD of Bowl (Special Coated)
		Other Optional Features or Requirements
		Special Services / Warranty Options
		Warranty: Extended (5 year)

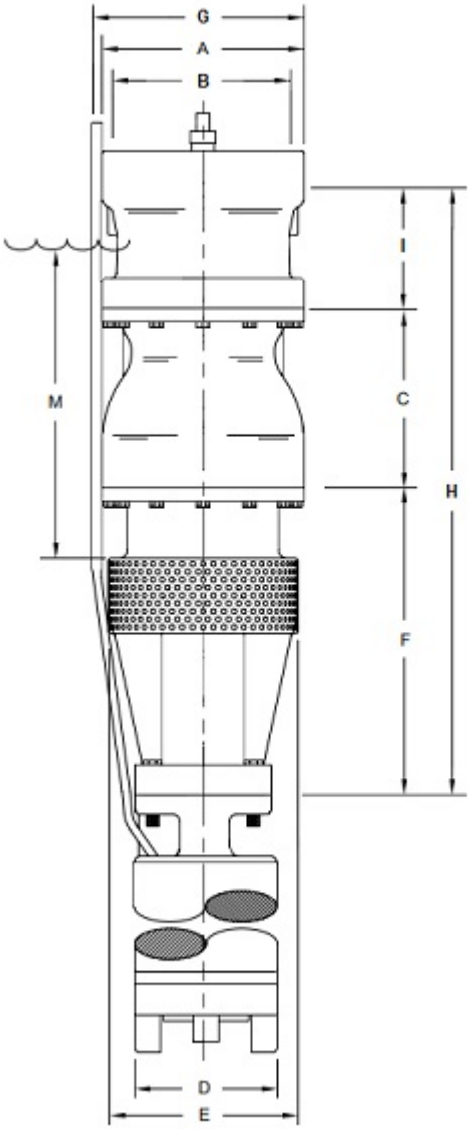
Motor		
Order No.	Qty	Description
1		**Submersible Motor**
		Configuration
2391086204	1	Motor: 8" Three-Phase, 200 HP, 316 SS, 460/380V, 60/50Hz, 1.15/1.0 SF , DOL (3), 2391086204

FPS

FE SELECT

Quote Number	1986491
Quote Date	15 Jun 2023
Revision	

Dimensional Information (9FHC-1CJ2BS-08-04-C04-S)



Dim	Value
A	9.44
B	8.00
C	8.5
D	8.00
E	9.25
F	13.00
G	10.19
H	54.50
I	5.62
J	-
K	-
L	-
M	30.00

Disch Head Side View

NOTES:
1. ALL DIMENSIONS ARE IN INCHES +/- 0.375
2. NOT FOR CONSTRUCTION UNLESS CERTIFIED BY ENGINEERING

Project Name:	Default	Certified For:	
PO/REF ID:		Certified By:	
Date:	15 Dec 2023 2:31 PM	Customer:	
Quoted By:	Joel McAllister	Customer Contact:	
Quoted By Phone:		Customer Phone:	

Franklin Electric

FST Vertical Turbine
Dimensional Information
(Bowl Assembly)

Drawing Number:	Rev:

FPS

FE SELECT

Quote Number 1986491
Quote Date 15 Jun 2023
Revision

Product Datasheet (9FHC-1CJ2BS-08-04-C04-S)

Item Number: 001	Lube Type:	Pump Speed: 3450 rpm
Pump Model: FST9FHC	Number of Stages: 4	

General Data		
Flow: 56.80 l/s	Head: 215.5 m	NPSHR: 24.03 ft
Liquid: Water	SG: 0.9983	Efficiency: 84.54 %
Liquid Temp.: 68.00 deg F	Viscosity: 1.00 cP	MCSF: 38.43 l/s

Pump Data		
Bowl Model: 9FHC	Column Conn. Size: 8.00 in	DH Model: -
Stages: 04	Column Conn. Type: Threaded	Flange Size: -
Bowl Shaft Diameter: 1-1/2"	LS Coupling Size: -	DH Construction: -
Impeller Type: Enclosed	Lineshaft Diameter: -	Column Size:
Impeller Dia.: 7.19 in	Total Rated Thrust: 2,488.5 lbf	Col Pipe Wall Thickness:
Impeller Conn. Type: Collet	Power Rated: 200 hp	Strainer Type: -

Material Data		
Bowl: Cast Iron ASTM A48 Class 30 (default)	Impeller: 304SS Standard (AISI Type 304)	Motor Coupling: -
Bowl WR: 316 SS	Impeller WR: None	Col Pipe:
Bowl Shaft: 416 SS (ASTM A582, Type 416)	Lineshaft: -	Motor Bracket: -
Collet: AISI Type 416 SS	Bowl Bearing: Bronze (Alloy C89835)	Suction Screen: Stainless Steel

Motor Data		
MFG: Franklin Electric	HP: 200 hp	Motor Size: 8 in
Type: 316 SS	RPM: 3450 rpm	Phase: 3
Frame: -	Volts: 460/380V	Frequency: 60 Hz
Catalog: 2391086204		

Weights	Mechanical Seal Data	
Est. Pump Wt.: 295.0 lb	Mfg:	Type:
Est. Motor Wt.: 1,040.0 lb	Size:	API Code:

Coatings	
Bowl ID: Vitreous Enamel	Bowl OD: Induron PE-70 Epoxy (NSF)
Column ID: -	Column OD: -
Head ID: Induron PE-70 Epoxy (NSF)	Head OD: Franklin Blue
Tube OD: -	

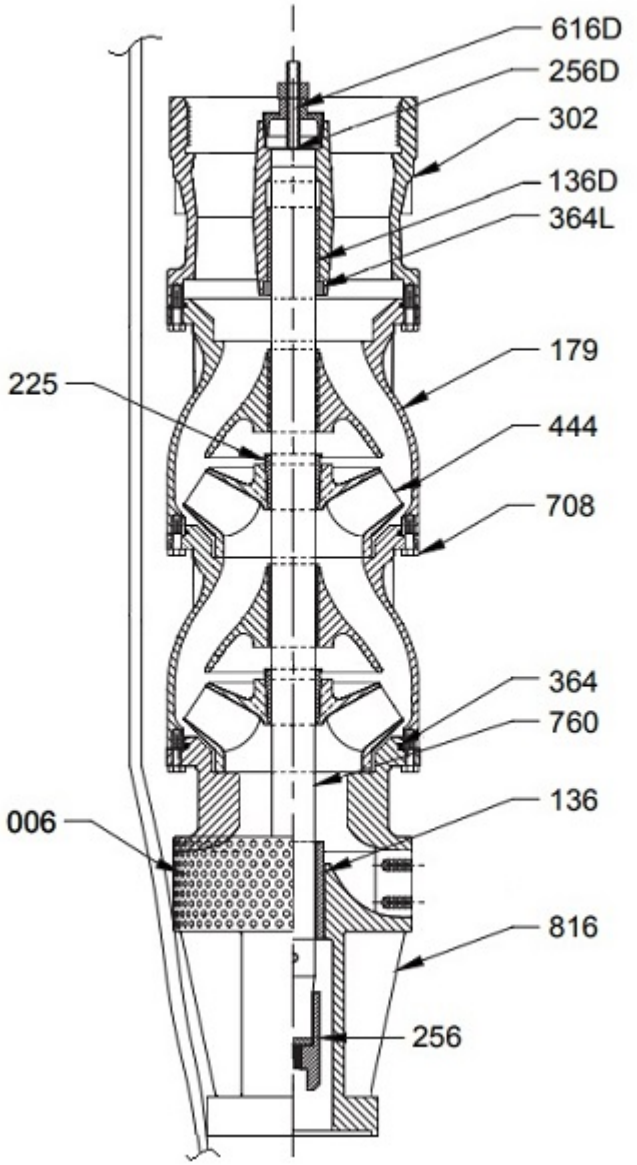
Project Name:	Default	Certified For:	
PO/REF ID:		Certified By:	
Date:	15 Dec 2023 2:31 PM	Customer:	
Quoted By:	Joel McAllister	Customer Contact:	
Quoted By Phone:		Customer Phone:	
Franklin Electric		**FST Vertical Turbine Product Datasheet (Bowl Assembly)**	
		Drawing Number:	Rev:

FPS

FE SELECT

Quote Number 1986491
Quote Date 15 Jun 2023
Revision

Bill of Materials (9FHC-1CJ2BS-08-04-C04-S)



ITEM	DESCRIPTION	QTY	PART NUMBER
816	MOTOR BRACKET	1	816-0179-065
136D	DISCHARGE CASE BEARING	1	136-0018-835
179	BOWL ASSEMBLY	4	179-9FLHC-030WR
225	IMPELLER COLLET	4	225-0016-416
256	LINESHAFT COUPLING	1	256-0099-416
302	DISCHARGE CASE	1	302-0404-065
364	BOWL O-RING	5	364-0167-BN
444	IMPELLER	4	444-9FHCA-304
616D	DISCHARGE CASE PLUG	2	616-0003-STL
364L	LIP SEAL	1	364-0047-LS
708	ASSEMBLY HEX SCREWS	60	708-0012-188
760	BOWL SHAFT	61.25	760-510071-416
006	SUCTION SCREEN	0	-
-		0	-
-		0	-
-			
-			-
-			-
-			-

IMPELLER TRIM: 7.19 in

NOTES:
1. ALL DIMENSIONS ARE IN INCHES +/- 0.375
2. NOT FOR CONSTRUCTION UNLESS CERTIFIED BY ENGINEERING

Project Name:	Default	Certified For:	
PO/REF ID:		Certified By:	
Date:	15 Dec 2023 2:31 PM	Customer:	
Quoted By:	Joel McAllister	Customer Contact:	
Quoted By Phone:		Customer Phone:	

Franklin Electric

FST Vertical Turbine
Bill of Materials
(Bowl Assembly)

Drawing Number: Rev:

SUNSHINE COAST REGIONAL DISTRICT STAFF REPORT

TO: Committee of the Whole – January 11, 2024

AUTHOR: Shane Walkey, Manager, Utility Services
Graham Starsage, Water Sustainability Coordinator

SUBJECT: **2023 DROUGHT RESPONSE PLAN SUMMARY**

RECOMMENDATION(S)

THAT the report titled 2023 Drought Response Plan Summary be received for information.

BACKGROUND

The Sunshine Coast Regional District's (SCRD) Drought Response Plan (DRP) is the primary tool for ensuring water systems can support demand and maintain operational confidence in water supply capacity. The DRP prioritizes water supply for human health, fire protection, and Environmental Flow Needs. Water Conservation Regulations are in effect annually from May 1 to September 30 as per *SCRD Water Rates and Regulation Bylaw No. 422, 1995* (Bylaw No. 422). Water Conservation Regulations Stages are implemented based on factors such as water supply conditions, weather forecasts, and community water use trends. In years with prolonged drought, regulations can extend beyond September 30.

The purpose of this report is to provide an overview of DRP implementation in 2023.

DISCUSSION

Province Wide Drought

A severe province wide drought dramatically affected BC in 2023. Environment and Climate Change Canada's (ECCC) summer Integrated Seasonal Climate (ISC) bulletin stated, "prolonged drought effects from fall and winter [2022-2023] were still evident in baseflows and groundwater levels." More than 80% of BC's water basins experienced Level 4 or 5 drought conditions. Level 5 is the highest level assessed by the British Columbia Drought and Water Scarcity Response Plan. The British Columbia Drought Information Portal describes a Level 5 drought as having 'almost certain adverse socioeconomic effects'; the Sunshine Coast reached Level 5 in mid-August of 2023.

To manage the provincial-wide drought, the Province of BC issued letters to water purveyors, urging a 50% reduction in water use. The SCRD was in a unique position, having endured serious droughts in the last decade, and was able to draw on previous experience to mitigate impacts. However, drought impacts are likely to continue into 2024. ECCC's winter ISC bulletin, stated "after a prolonged, widespread drought, fall storms have brought hydrological recharge to several regions of the province, but long-term deficits remain, and drought effects may linger."

All Water Systems

SCRD Water Conservation Regulation stages implemented in 2023 are summarized below.

Table 1: 2023 Drought Response Plan Stage Implementation: All Water Systems

Water System	Source	Implemented Water Conservation Regulations
Langdale	Groundwater: Langdale Well	Stage 1
Soames	Groundwater: Soames Well	Stage 1
Granthams	Groundwater: Soames Well	Stage 1
Chapman	Surface water: Chapman Creek, Chapman Lake, Edwards Lake, Gray Creek Groundwater: Chaster Well, Church Road Wellfield	Stage 1, 2, 3, 4
South Pender Harbour	Surface water: McNeill & Harris Lakes	Stage 1, 2, 3
North Pender Harbour	Surface water: Garden Bay Lake	Stage 1
Cove Cay	Surface water: Ruby Lake	Stage 1
Egmont	Surface water: Waugh Lake	Stage 1
Eastbourne	4 Groundwater Wells	Stage 1, 2, 3, 4

Table 2: 2023 Drought Response Plan Stage Implementation Dates

Water System	Stage 1	Stage 2	Stage 3	Stage 4	Stage 1	End of Regulations
Chapman	May 1	July 7	August 11	September 8	September 27	October 4
South Pender Harbour	May 1	June 8	July 14	N/A	N/A	October 24
Eastbourne	May 1	July 7	July 21	July 31	October 11	October 24

Chapman Water System

Stage 1 Water Conservation Regulations came into effect on May 1 and Stage 2 regulations began on July 7, coinciding with the end of snow melt watershed contributions. The Chapman Water Distribution System reached peak demand on July 5, during Stage 1 at 20,687 cubic metres (m^3) per day. After implementing Stage 2 regulations, water demand on the Chapman Water System decreased (Figure 1).

In response to weather conditions, lake levels, and community demand, the SCRD further implemented Stage 3 regulations on August 11, and Stage 4 regulations on September 8. Stage 4 prohibited all non-essential outdoor water use to preserve remaining water storage until significant rainfall. The implementation of Stage 4 regulations saw a further reduction in average daily demand.

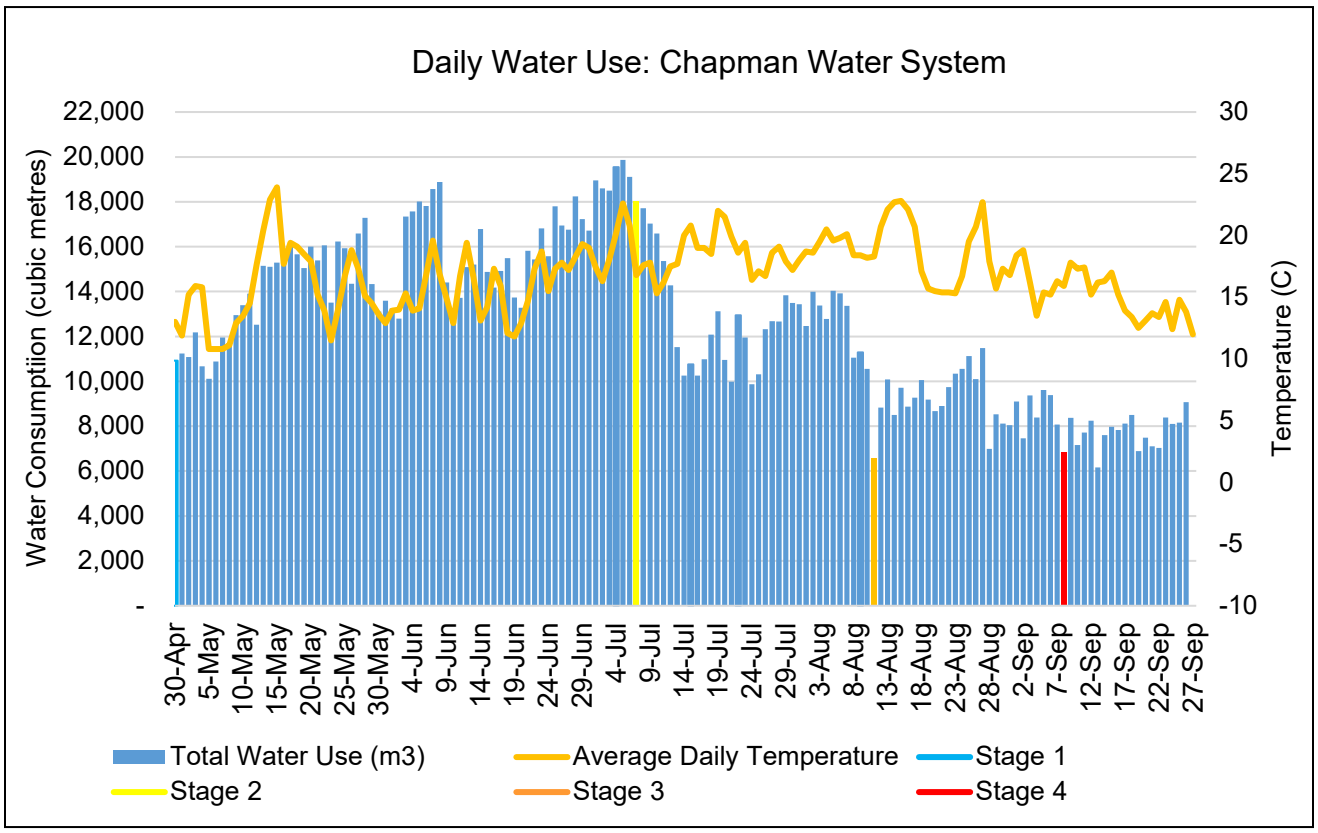
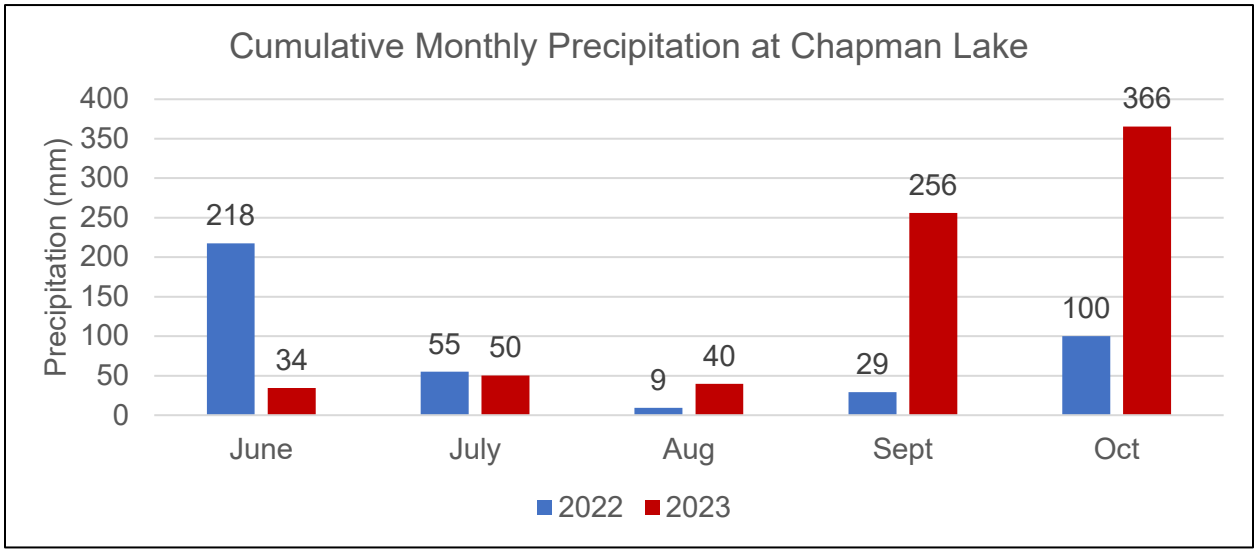


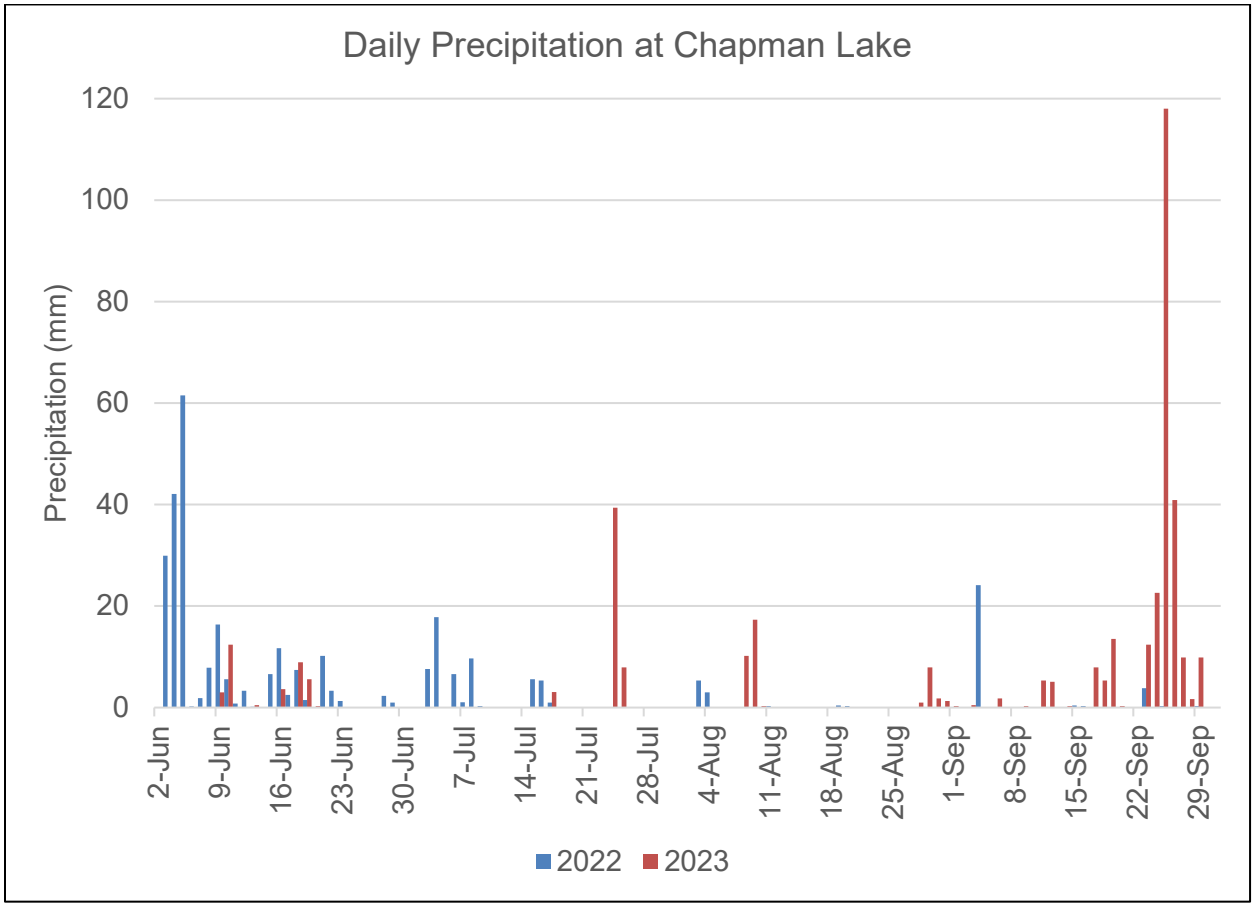
Figure 1: Daily water consumption: Chapman Water System (all sources)

In May 2023, the Tetrahedron snowpack was above average, however, it melted rapidly starting in mid-June and by early July snow melt contributions to Chapman Lake stopped.

Overall, precipitation at Chapman Lake from May 1 to September 30 in 2023 was even lower than 2022, a year with serious and prolonged drought. Significantly, rainfall was lower in early Summer 2023 with June precipitation approximately seven times lower than 2022. However, August precipitation was four times higher in 2023 compared to 2022.

In late September, heavy rains filled Chapman Lake and Edwards Lake, and Water Conservation Regulations moved from Stage 4 to Stage 1. Stage 1 remained in place until October 4 when long-term forecasts showed adequate precipitation to rescind all regulations (Figures 2 and 3).





Figures 2 and 3: Cumulative and Daily Precipitation Data

In addition to environmental conditions, operating capacities and limitations of water treatment plants and distribution systems must be considered in water supply management. These factors, in conjunction with weather, temperature, precipitation, lake levels, and community demand are all relevant when making decisions about Water Conservation Regulation stages.

The historical number of days at each Water Conservation Regulation stage is shown in Table 3.

Table 3: Chapman Water System: Number of days in each stage (2018 - 2023)

Year	Stage 1	Stage 2	Stage 3	Stage 4	Total Days
2018	79	39	21	14	153
2019	52	40	61	0	153
2020	108	29	16	0	153
2021	76	18	18	41	153
2022	111	26	8	104	249
2023	74	35	28	19	156

Note: Water Conservation Regulations are in effect May 1 to September 30 at minimum, which equals 153 days.

Operations

Chapman Lake, Edwards Lake, Gray Creek, Chaster Well, and Church Road Wellfield contributed to the Chapman Water System in 2023. Optimizing the system is complex as there are many dynamic variables. In addition to considering current water supply and demand conditions, staff operate multiple water sources in one collective system.

During the winter months, under typical operating conditions, the Chapman Water System is sourced from Chapman Creek which is naturally fed by Chapman Lake and Edwards Lake. After the snow melts and the lakes stop overflowing, it is necessary to release water from Chapman Lake and Edwards Lake via their dam outlet valves to ensure adequate water for Environmental Flow Needs and community demand. Valve adjustments are based on calculations which consider environmental conditions, community demand, and the rate of loss in Chapman Creek. In recent years, late summer watershed contributions have trended to lower and sometimes negative levels, impacting operational forecasting and lowering the risk threshold for decision making.

During summer drought conditions, other water sources in the Chapman Water System are used to supplement community demand. In addition to Chapman Lake, the following sources were used in 2023.

- Chaster Well was activated before July 7 for operational reasons and began contributing to supply once the water stopped overflowing from Chapman Lake dam on July 7 and continued to do so until September 29.

- Church Road Wellfield began contributing to supply on July 11. Integrating the new supply source included operational adjustments to mechanical components, treatment processes, and distribution system adjustments to increase efficiency. Supply contributions from Church Road delayed the Chapman Water System supply from reaching Stage 4 by approximately two weeks.

- Gray Creek is a surface water source with an independent water disinfection facility feeding the Chapman Water System. Gray Creek source was activated earlier this year (July 12) compared to previous years. Early use of this water source aided in the overall increase in water supply.

- Edwards Lake is an additional source for the Chapman Water System. Edwards Lake began contributing to the supply September 6 before implementation of Stage 4 Water Conservation Regulations. This was an earlier start than in previous years. Edwards Lake water supply is typically held in reserve to ensure supply through a dry fall.

- Siphons at Chapman Lake were online for 10 days from September 12 to 22. Siphons at Chapman and Edwards Lake are critical components to ensure resiliency in supply during drought. Siphons provide access to supply more than 1.5 million m^3 of water during Stage 4 conditions.

Table 4: Chapman Water System: Activation of source comparison 2022 to 2023

System	Contribution Start Date and Volume			
	2022		2023	
Chaster Well	July 20	113,790 m^3	July 7	53,080 m^3
Chapman Lake Valve	July 28	764,600 m^3	July 7	711,808 m^3
Church Road	N/A	0 m^3	July 11	133,598 m^3
Gray Creek	Aug 10	152,962 m^3	July 12	155,137 m^3
Edwards Lake	Aug 24	885,800 m^3	Sept 6	64,400 m^3
Chapman Lake emergency siphons	Aug 29	651,058 m^3	Sept 12	101,204 m^3
Edwards Lake emergency siphons	Oct 6	429,181 m^3	N/A	0 m^3
Town of Gibsons	Sept 27	22,156 m^3	N/A	0 m^3

Environmental Flow Needs (EFN) reduction was approved for September 11 to 30, 2023, with the minimum flow requirement reduced to 160 liters per second. However, this reduction was dependent on the condition that no Pink Salmon were observed in Chapman Creek. Since Pink Salmon migration in Chapman Creek was at a peak during this period, flow reduction was not used.

The early introduction of Gray Creek and Chaster Well water sources to the Chapman Water System, combined with contributions from Church Road Wellfield and periodic rain events in the upper watershed, resulted in a more resilient water supply compared to 2022.

South Pender Water System

South Pender Harbour Water System's source is McNeill Lake and Harris Lake. McNeill Lake watershed is primarily dependent on precipitation, with limited recharge from snowfall. Combined with a hot, sunny, and dry early spring, demand levels in May and June were well above seasonal norms and the daily withdrawal limit for McNeill Lake was exceeded multiple times.

- Stage 2 was implemented June 8, in response to rapidly decreasing lake levels and high demand.

- Stage 3 was implemented July 14 as lake levels continued to drop and community demand remained high. Moving to Stage 3 was required due to a combination of limited precipitation, dropping lake levels, and the need to stay in compliance with provincial licences.

On July 31, the channel connecting Harris to McNeill Lake was cleared to increase flow into McNeill Lake. By the end of the summer Harris Lake level had dropped approximately one (1) metre while supplementing McNeill Lake.

A combination of periodic rainfall events in late July and August, releasing water from Harris Lake, reducing demand through Water Conservation Regulations, and repairs to major leaks, slowed the drawdown of McNeill Lake ensuring a sustainable supply. Heavy rains in late October replenished the lakes and ended Water Conservation Regulations for South Pender Harbour on October 24.

Due to prolonged drought in 2022, minimal fall and winter precipitation may have impacted watershed recharge, possibly affecting 2023 lake levels. Should environmental conditions be similar in upcoming years, the same approach to demand management ensuring sustainable supply and licence compliance can be anticipated.

The existing infrastructure at Harris Lake is unable to support the maximum allowable drawdown specified by the licence for the lake. The present channel and infrastructure limitations restrict access to 20% of the allowable limit. To address this shortfall, the SCRD aims to implement improvements to discharge infrastructure at Harris Lake. A 2024 Budget Proposal is being considered by the Board to assess the current diversion infrastructure and regulatory requirements and complete engineering design for any recommended infrastructure upgrades.

Eastbourne Water System

The Eastbourne Water System is a groundwater system that is heavily tied to precipitation for recharge. Eastbourne has a history of drought impacting water supply and residents are experienced with Water Conservation Regulations. The community regularly experiences Stage 4 restrictions in the summer. The Eastbourne Water System increased severity in Water Conservation Regulations from Stage 1 to Stage 4 as the dry summer progressed. Eastbourne wells reached a concerningly low production in mid-October. As the community demand was not significantly different compared to prior years, the prolonged drought this summer, the limited recharging impact of the few rain showers on the aquifer in combination with an insufficient recharged aquifer after the 2022 drought could all be contributing factors.

Bulk Water Supply

A bulk water filling station accessing the Langdale Water System was available to support business continuity for projects impacted in Stages 3 and 4, such as farm irrigation and civic works. Contractors, farmers, and other commercial water users were contacted by direct mail and electronic communications. Users included construction companies and a nursery.

Leak Resolution

The SCRD sent a total of 1,098 letters to properties with suspected leaks in Q1 though Q3. The Monthly Water Use Update program has increased by nearly 50% to 925 subscribers as of November 2023. This is up from 625 in 2022. Approximately 14% of SCRD metered properties receive their Monthly Water Use data. The Monthly Water Use Updates increase water literacy by providing residents with their water consumption data and indicating if potential leaks (continuous flow) are detected.

Other Conservation Efforts

- In 2023, the SCRD's Rainwater Harvesting Rebate program funding for the Regional Water Service ($35,000) was fully claimed. The funding supported a total volume of over 367,000 liters of storage in the community. No rebates were claimed for North ($1,500) or South Pender Harbour ($2,000) Water Service Areas. However, increasing rebate levels for the two service areas, supported by increased communication, could be considered to support demand management requirements for both service areas.

- Conservation measures for public sports fields managed by the SCRD, District of Sechelt, and shíshálh Nation Government District were increased in 2023. Irrigation restrictions were set at 50% of Stage 1 limits, instead of 40% restrictions previously applied. Watering of public sports fields was prohibited in Stage 3 and 4.

Drought Response Plan Communications

The SCRD used multiple communication channels to share Water Conservation Regulations updates with residents, businesses, and visitors.

- Notification for each change between Stages included:
    - Media releases
    - Website
    - Radio
    - Facebook
    - Coast Reporter Homepage Digital Ad (began in June)
    - Posted at the SCRD office
    - Mail drop to 11,200 properties before Stage 1 – Get Ready for Summer (April 11)
    - Direct mail to all residents in Stage 4 (September)
    - Announcements on Langdale and Earls Cove BC Ferries routes in Stage 4
    - Both permanent and temporary stage signs on highway in Areas B, D and F

Additional Communication Initiatives 2023

- New webpage *Water Updates*
  - Launched a one-stop shop for information on water supply updates, regulations, water systems, conservation tips, water projects and reporting violations (July).
  - A Lake Level graph was created to display the remaining percentage of water in Chapman Lake, providing the Board and community members with a simple representation of supply levels.
- Water Supply Updates
  - Provided 11 Water Supply Update presentations to SCRD Committee of the Whole meetings (June 8 to October 12).
  - Presentation slides and recordings made available on Water Updates webpage.
- Community Engagement
  - Co-hosted with Sunshine Coast Regional Economic Development Organization (SCREDO) and Sunshine Coast Tourism, two Water Updates for Local Businesses online events (July 12 and August 16). Provided updates on regulations and changes to Bylaw No. 422.
  - Announcements shared through Sunshine Coast Tourism to visitors.
  - Information booths at Madeira Park IGA for beginning of Stage 3 (July 12), at Roberts Creek Farmers Market (July 26), and Pender Harbour Days (August 5).
  - SCRD responded to enquiries from media including CoastFM, Coast Reporter, Harbour Spiel, Global News, CBC News, and CTV News (July to September).
- Direct Communications (by mail or email)
  - Top 500 residential water users on Chapman Water System (based on August 2022 data) as part of a Spring High Use Mailout (March 20).
  - Top 25 residential water user on South Pender Harbour Water System, as water licence daily maximum was being exceeded (June 7).
  - High use commercial accounts, in addition to the Province's request for all water purveyors to reduce their use by 50% (June 7).
  - 52 Class 9 properties (commercial farms) providing information about the two (2)-week limit to Stage 4 exemptions, and Langdale bulk filling station (September 7).
  - Direct email to contractors whose work uses potable water, such as landscapers and gardening businesses (Stages 2 to 4).

SCRD staff supported public inquiries about Water Conservation Regulations by phone, email, in-person, and social media channels. Additional staff resources were available for follow-up with property owners with ongoing leaks.

Compliance and Enforcement

The DRP and corresponding Water Conservation Regulations are outlined in Bylaw No. 422 and the *SCRD Bylaw Notice Enforcement Bylaw No. 638, 2011*.

To enforce Bylaw No. 422, the SCRD has a compliance approach of 1) Education, 2) Warning, 3) Fine. The fine for each infraction of Water Conservation Regulations in 2023 remained at:

Stage 1: $200 Stage 2: $300 Stage 3: $400 Stage 4: $500

SCRD Bylaw staff interacted with 61 properties about compliance with Water Conservation Regulations (Table 4). A total of 64 interactions occurred in response to complaints received by the public, 32 of these interactions were site visits. Patrols were conducted to ensure compliance with sprinkling hours and to investigate high users as determined through meter data. Staff left a door hanger notification at properties in violation, provided verbal warnings, or issued a mailed notification with a warning citing the specific bylaw provision.

The level of staff interaction and Bylaw Enforcement Notices (BEN) was less than in 2022 when there was an extended drought into late Fall. In 2023, a total of two tickets were issued resulting in fines amounting to $1,000. This was the first year where the Bylaw Enforcement division received water regulation complaints directly. Previously, the first point of contact had been Infrastructure Services staff.

Table 5: Water Conservation Regulations Compliance Interactions (May 1 to October 24, 2023)

Number of properties SCRD staff interacted with about water conservation compliance	
Number of Bylaw Enforcement files created/opened	61
Number of files requiring enforcement/follow-up	48

Number of interactions that were in response to complaints received from the public	
Information letters – water conservation regulations/alleged violations	32
Site visits made by Bylaw Enforcement staff	32
Total of above interactions	**64**
Number of Bylaw Enforcement Notices (BEN)	
Total number of BEN tickets issued	2
Dollar amount of fines issued	
Total amount of BEN tickets issued	$1,000

Table 6: Water Conservation Regulations compliance interactions (May 1 to Oct 24, 2023)

Water System	Number of Properties
Chapman	45
Granthams	1
Soames	0
Langdale	1
North Pender Harbour	0
South Pender Harbour	13
Egmont, Cove Cay	0
Eastbourne	0

Table 7: Category of Water Conservation Regulations violations reported.

Method	% Violations Reported
Phone complaint	0%
Bylaw form submission (website)	93%
Staff patrol	5%
Email complaint	2%
In-person complaints (administration office)	0%

Table 8: Category of Water Conservation Regulations violations reported.

Category	% Violations Reported
Stage 1	20%
Stage 2	34%
Stage 3	39%
Stage 4	7%

Strategic Plan and Related Policies

Water Stewardship is a focus area of the SCRD's Strategic Plan 2023-2027. The DRP's demand management tools support the objective of efficient water use while fostering responsible stewardship of this critical resource.

Organizational Implications

As the changing climate continues to affect SCRD water systems, continued investment in resources is required for drought management. Specific areas for resource improvement include Bylaw Services, communications, environmental monitoring, and operations.

- 2023 was the first year Bylaw Enforcement managed water conservation complaints directly. The increased file volume impacted Bylaw's ability for a timely response. It is necessary to continue supporting Bylaw Enforcement for effective regulation compliance across SCRD services.

- 2023 saw an increase in public and Board interest for water conservation information including watershed conditions, lake levels, and water data. Significant staff resources were required to maintain frequent communications regarding SCRD projects and current drought conditions, outlined above in this report, in addition to raising community water literacy and advancing behavior change.

- 2023 required an increase in operational and environmental staff resources for Environmental Flow Needs management of Chapman and Soames.

Timeline and next steps

Drought response continues to be a SCRD priority. As such the following policy and planning is scheduled to take place.

- In 2024, the Water Strategy will be presented to the Board in Q1, which will bring forward an associated Water Efficiency Plan.

- Staff is preparing an implementation plan to pilot volumetric billing in the South and North Pender Harbour Water Service Areas in 2024.

Staff continue to work on projects at various stages of budget consideration, feasibility studies, infrastructure upgrades, or capital project management to increase water security, resilience, and efficiency.

Strategic Plan and related Policies

The 2023-2027 Strategic Plan includes actions listed in support of the Drought Response Plan that are relevant. These strategic actions are:

- Continually improve the operations of all the Regional Districts aging water systems.

- Work with the shíshálh Nation and the Province of BC to ensure the SCRD is able to utilize effective drought response approaches.

CONCLUSION

In 2023 the province of BC experienced a continuation of 2022's severe drought. By August, more than 80% of BC's water basins reached Level 4 or 5 conditions; the Sunshine Coast reached Level 5 midmonth. A hot, dry, spring and summer coupled with high community demand significantly impacted SCRD water systems. On the Chapman Water system, the additional supply of Church Road, Gray Creek, and Chaster Well, in combination with operations maximizing distribution efficiencies and the use of siphons, mitigated drought impacts by delaying and reducing Stage 4. For the first time, South Pender Harbour required the implementation of Stage 3 to manage demand, ensure supply, and stay within water licence limits. Additionally, increased discharge from Harris Lake helped stabilize the drawdown of McNeill Lake. On Eastbourne, Stage 4 was required, and wells reached their lowest production late October. In late September, three days of heavy rains replenished Chapman Lake and regulations were rescinded. By late October, South Pender Harbour and Eastbourne water supply had been significantly recharged and regulations rescinded. All other water systems remained at Stage 1 from May 1 to September 30.

ATTACHMENTS

Attachment A – 2023 Drought Response Plan Summary

Reviewed by:			
Manager	X – M. Edbrooke	Finance	
GM	X – R. Rosenboom	Legislative	
CAO	X – D. McKinley	Other	

2023 Drought Response Plan Summary

Water Supply and Forecasts: Chapman Water System

Spring

The Chapman Water System relies on watershed creek flow from rainfall and snow melt for most of the year, and on water stored in the Chapman and Edward Lake reservoir during times of drought.

In May 2023, the Chapman snow water equivalent (SWE), the amount of water contained in the Chapman Creek Watershed snowpack, was slightly above average compared to previous years (Figure 1).

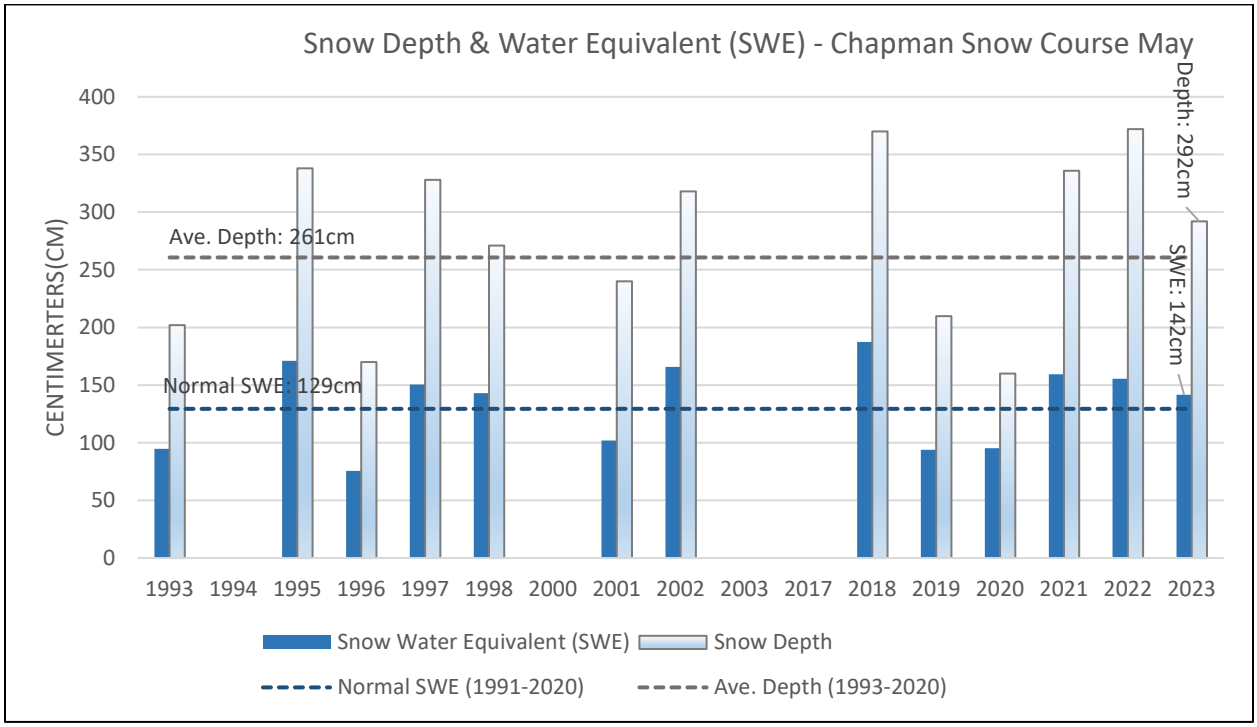


Figure 1: Snow water equivalent in the Chapman snow course

In June the snowpack melt rate was higher than previous years and contributions of snow melt to Chapman Lake were observed until early July. In comparison, 2022 snowpack contributions to Chapman Laked were observed until early August.

Total precipitation in spring 2023 was less than historical normals (30-year averages) and generally below average values from the previous 13 years (Figure 2).

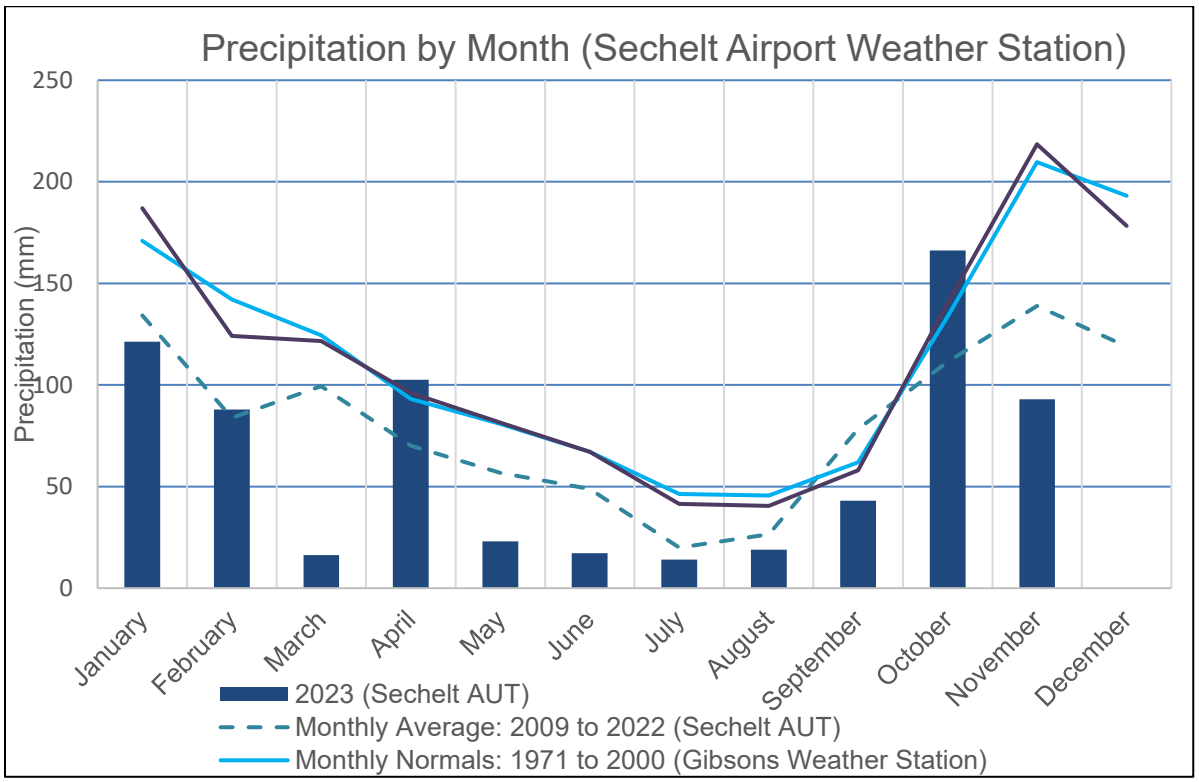


*Figure 2: Precipitation by month (Sechelt Airport Weather Station). ** data up to Nov 14, 2023*

Summer

Summer temperatures were generally consistent with the average monthly mean temperatures from the last decade, except for May which was hotter (Figure 3).

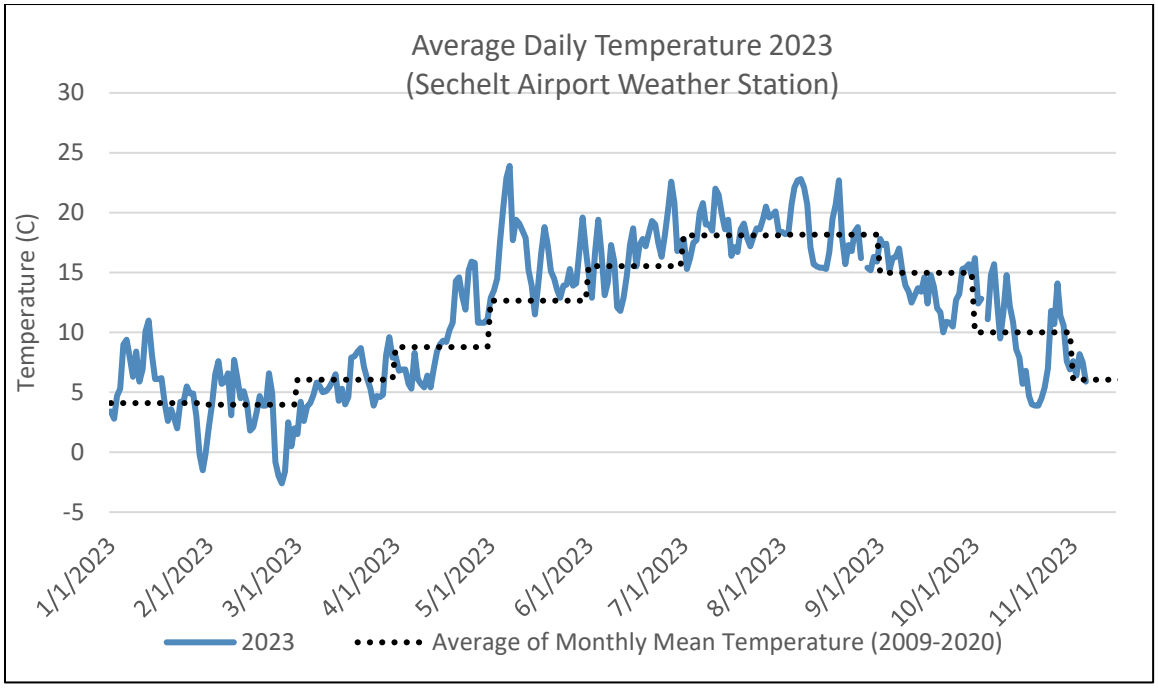


*Figure 3: Average daily temperatures at Sechelt Airport Weather Station in 2023. ** data up to Nov 14, 2023*

Precipitation from January to October 2023 was lower than in 2022. Scattered rain events from July to September extended the water supply in the lakes. Heavy rainfall of 194mm from September 24 to 26 filled Chapman Lake (Figure 4). The siphons were taken offline at this time.

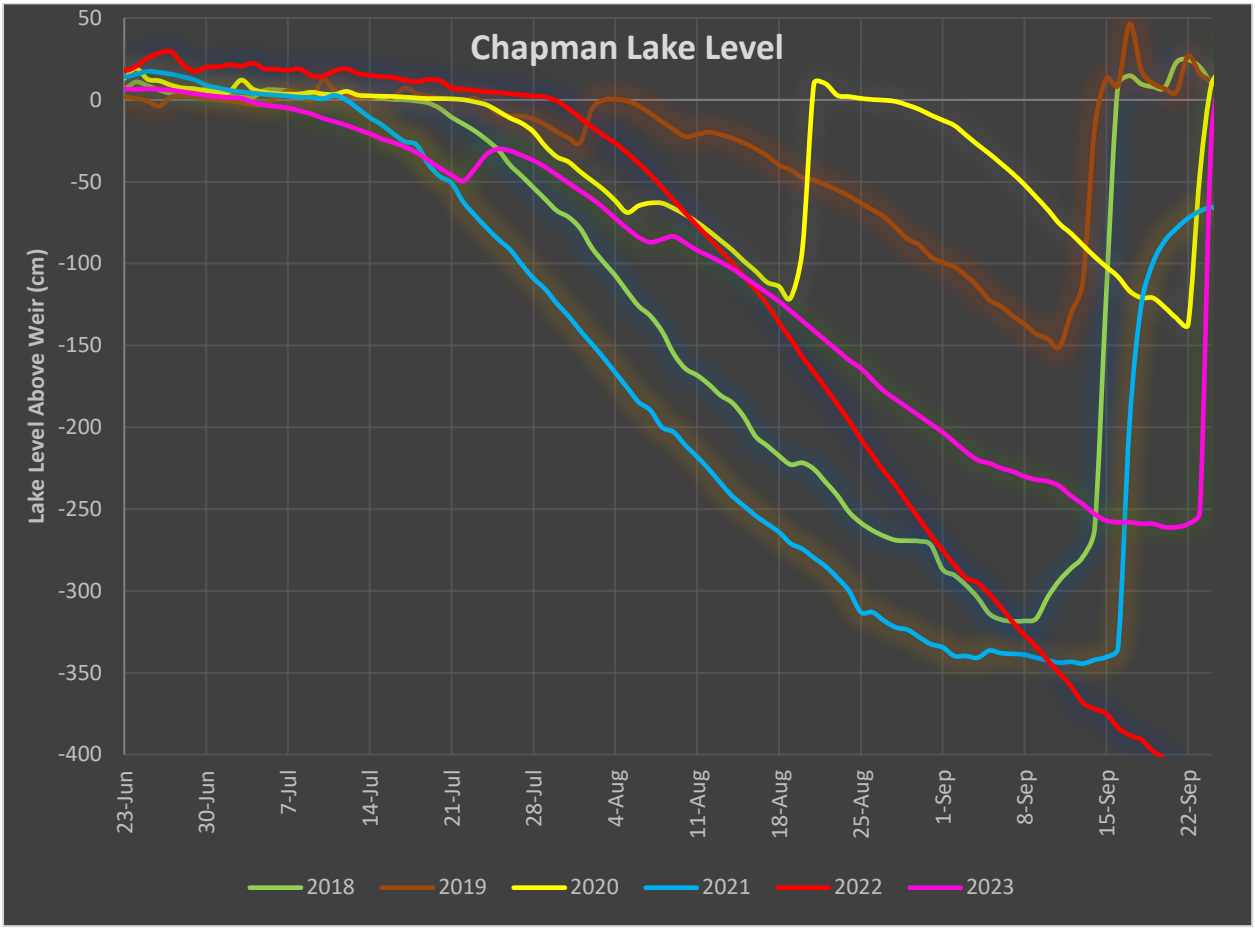


Figure 4: Historic Chapman Lake Level Graph

As water supply decreased, several sources contributed to the Chapman Water System (Table 1) including an emergency siphon system on Chapman Lake to gain access to additional water in Stage 4. Staff also released water from Edwards Lake to sustain flows in Chapman Creek and meet demand and Environmental Flow Needs. Church Road Wellfield became fully operational in July. Staff also operated Chaster Well and Gray Creek during the summer months to supplement the Chapman Water system. Figure 5 shows the total source contribution percentages in the Chapman system between May 12 and September 26.

Table 1: Contributing Sources to the Chapman Water System Supply (Stage 2 - Stage 4)

System	Contribution Dates	Volume
Chapman Lake	Jul 7 to Sept 12	711,808 m^3
Gray Creek	July 12 to Sept 25	155,137 m^3
Church Road	July 11 to Sept 26	133, 598 m^3
Chapman Lake emergency siphons	Sept 12 to Sept 22	101,204 m^3
*Chaster Well	Jul 7 to Sept 26	50,646 m^3
Edwards Lake	Sept 6 to Sept 25	64,400 m^3
Edwards Lake emergency siphons	N/A	0 m^3
Town of Gibsons	N/A	0 m^3

**Note: Chaster Well started contributing to the water supply on May 12, before Stage 2.*

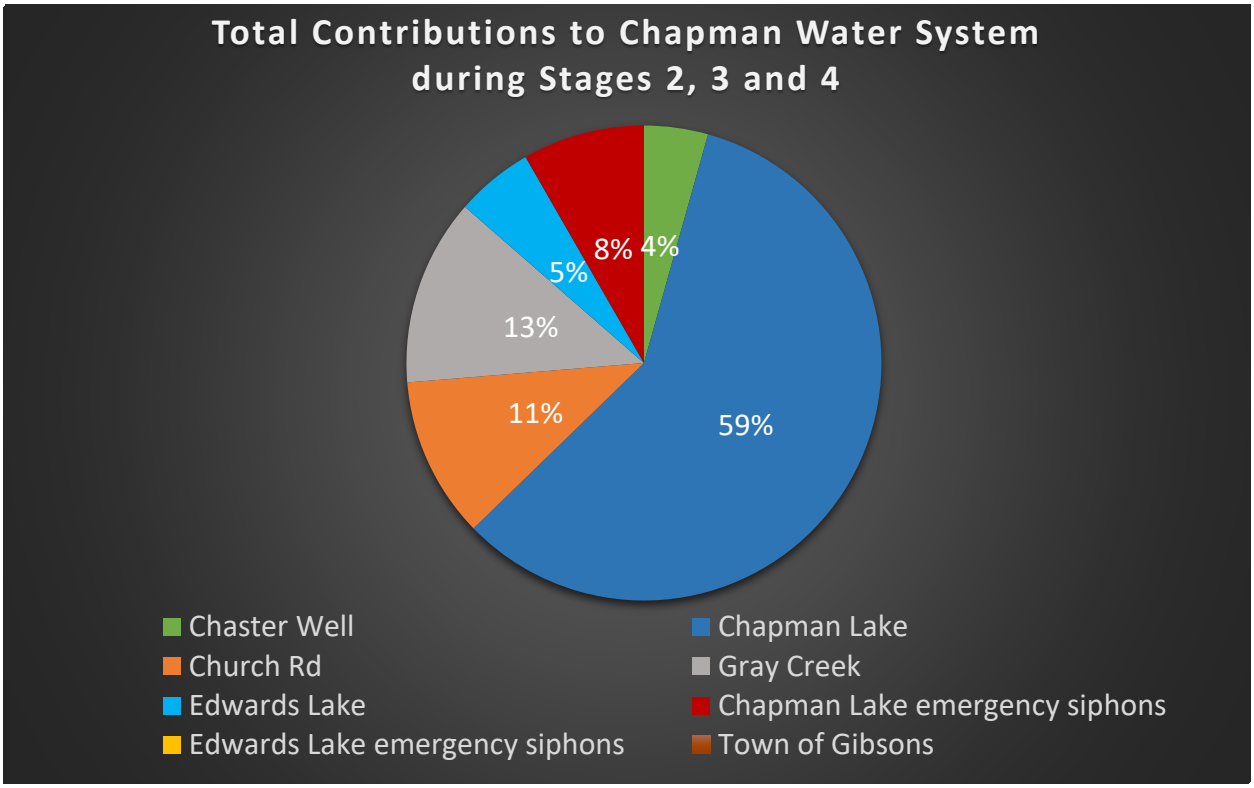


Figure 5: Chapman Water System source contribution for Summer 2023

Water Supply and Forecasts: South Pender Harbour and Eastbourne Water Systems

The drought conditions described for the Chapman Water System above also significantly impacted the South Pender Harbour and Eastbourne Water System.

In particular:

- South Pender Harbour Water System uses McNeill and Harris Lakes for water storage and supply in the summer months. Stage 2 was called June 8, Stage 3 started July 14 and ended October 24. Due to the prolonged drought of 2022, the watershed for South Pender Harbour felt the effects into 2023. McNeill Lake level decreased rapidly from May to June. In October rains began to refill the lakes.
- Harris Lake is the secondary water source for the South Pender Harbour system. On July 31, 2023, the channel out of Harris Lake was dug out by operations to feed additional water into McNeill Lake. Harris Lake was dropped over 1.0m to supplement McNeill Lake.
- A combination of periodic rainfall events, releasing water from Harris Lake, and reducing demand through Stage 2 and Stage 3 Water Conservation Regulations, slowed the drawdown of McNeill Lake. Heavy rains in late October replenished the lakes and ended water conservation regulations for South Pender Harbour (Figure 6).

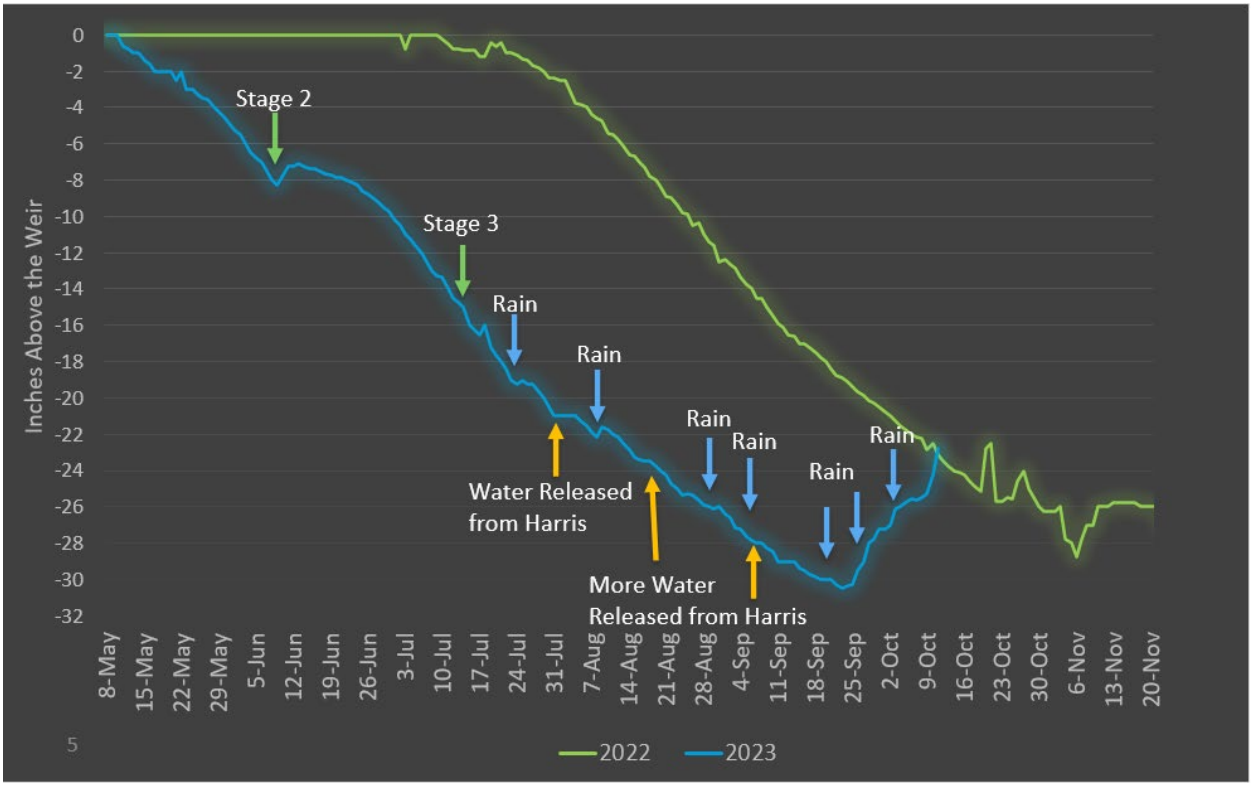


Figure 6: McNeill Lake level 2023 and 2022

- Eastbourne Water System is a groundwater system that relies on precipitation. The Eastbourne Water System was under Stage 2 Water Conservation Regulations on July 7, followed by Stage 3 on July 21, and Stage 4 on July 31. Well levels reached historic lows mid-October. Water Conservation Regulations ended October 24 after heavy rainfall.

Water Demand: Chapman Water System

The Chapman system reached peak demand during Stage 1 on July 5, producing 20,687 cubic metres (m3) per day.

The Environmental Flow Needs (EFN) requirement for Chapman Creek is 200 litres per second.

Water Demand: South Pender Harbour

The South Pender Harbour Water System services Madeira Park residents and businesses. In 2023, community water demand peaked during Stage 1 on Tuesday, May 21 with the water treatment plant producing 1,739 m^3. In response to high community demand during Stage 1 and 2, raw water intake from McNeill Lake exceeded the daily maximum permitted by the water license of 1,818 m^3 multiple times.

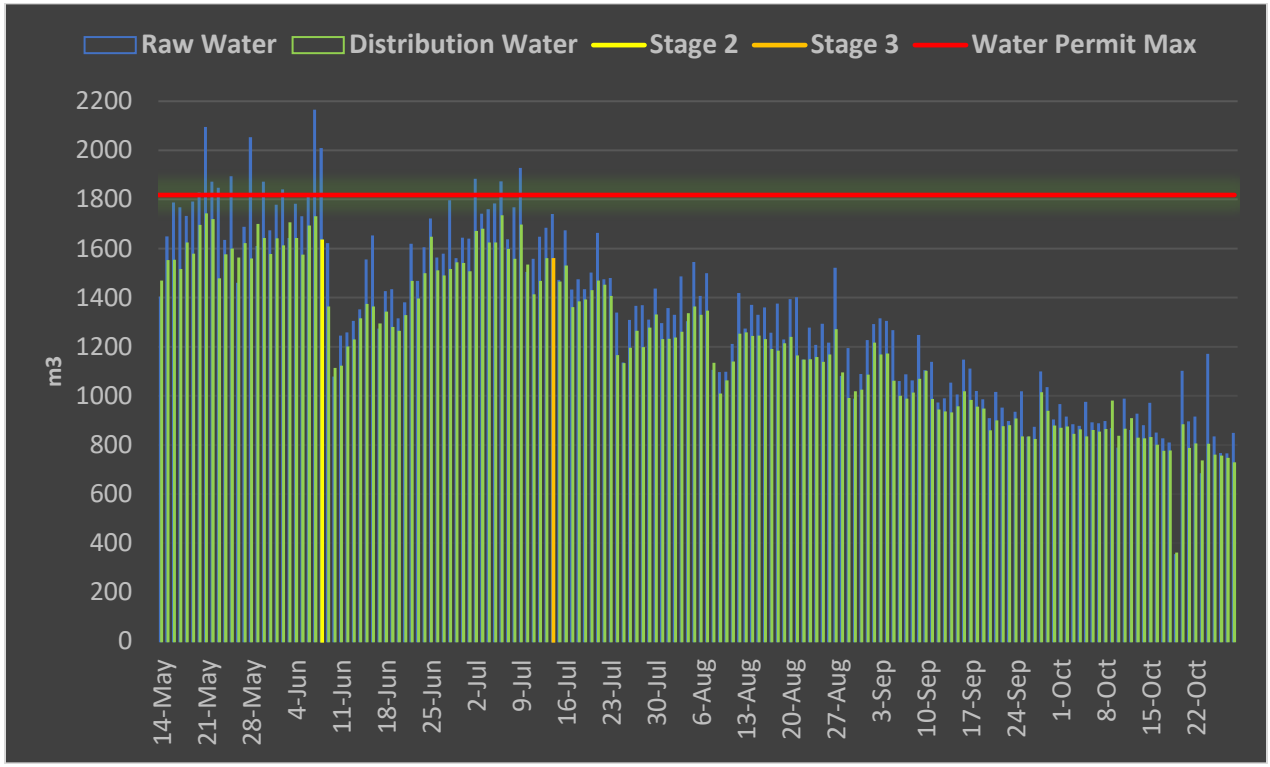


Figure 7: South Pender Harbour Demand Raw Water and Distributed Water

SUNSHINE COAST REGIONAL DISTRICT STAFF REPORT

TO: Committee of the Whole – January 11, 2023

AUTHOR: Christine Armitage, Executive Coordinator

SUBJECT: **ASSOCIATION OF VANCOUVER ISLAND AND COASTAL COMMUNITIES (AVICC) RESOLUTIONS**

RECOMMENDATION(S)

(1) THAT the report titled Association of Vancouver Island and Coastal Communities (AVICC) Resolutions be received for information;

(2) AND THAT the draft resolutions be approved and submitted to AVICC prior to the February 7, 2024, deadline.

BACKGROUND

The following motion was put forward at the December 14, 2023, Committee of the Whole meeting:

Recommendation No. 3 *2024 Call for Resolutions to the Association of Vancouver Island and Coastal Communities (AVICC)*

The Committee of the Whole recommended that the report titled 2024 Call for Resolutions to the Association of Vancouver Island and Coastal Communities (AVICC) be received for information;

AND THAT resolutions on the following topics be drafted and presented to the January 11, 2024, Committee of the Whole meeting:

- Ports prioritization and capital maintenance
- Increased funding for engagement with local governments with respect to roads
- Increased maintenance funding for rural road improvements
- Improved road design for increased safety for vulnerable road users
- BC Transit regarding free transit for students

DISCUSSION

In response to discussion at the December 14, 2023, Committee of the Whole meeting, staff have drafted the following resolutions to be approved and submitted to AVICC prior to the February 7, 2024, deadline.

1. Ports Prioritization and Maintenance

WHEREAS public wharves and docks are critical transportation links for people, supplies, and emergency services in coastal communities, and there is a lack of coordinated

provincial and federal priority setting and funding to support and maintain critical connectivity along BC's 25,000 kilometres of coastline;

AND WHEREAS the federal government divested government wharves, and the responsibility for maintenance and management of public ports has fallen entirely on local taxpayers and nonprofit groups, and the provincial government does not have a ministry responsible for dealing with for the complex issues involving public ports, especially in unincorporated areas;

AND WHEREAS the Ministry of Transportation and Infrastructure is responsible for maintaining the roads leading to public ports and continues to approve subdivision applications for water-only access residential developments; and evolving transportation technology and climate change requires a complete reconsideration of the design of small ports to meet future needs:

THEREFORE BE IT RESOLVED that the province, and the federal government, review BC's marine network as a whole and identify which ports should have the highest priority for public support to maintain critical connectivity along BC's 25,000 kilometres of coastline to meet the long term economic, social, and emergency needs of coastal residents.

AND BE IT FURTHER RESOLVED that the province funds the creation of engineering best practices for building ports to meet future transportation needs and climate resilience and provide financial support for the operation and maintenance of key ports, especially those used by public ferry services.

2. <u>Engagement with Local Governments with Respect to Road Network Planning</u>

WHEREAS the Ministry of Transportation and Infrastructure lacks the funding, staffing and mandate to plan overall road networks in unincorporated areas and to proactively deal with transportation and development planning issues in the "fringe" interface areas of municipalities and regional districts;

AND WHEREAS problems with runoff from roads and development are increasingly severe across the province, and are significantly impacted by the Ministry of Transportation and Infrastructure decisions around subdivision approvals and road infrastructure;

AND WHEREAS the Ministry of Transportation and Infrastructure does not proactively engage with local governments on future planning and maintenance of numbered routes that run through municipalities and often through downtown cores:

THEREFORE BE IT RESOLVED that the province direct and fund the Ministry of Transportation and Infrastructure to engage with local governments on overall road network planning and subdivision planning in order to improve decision-making to reduce cumulative negative impacts on communities.

3. <u>Funding for Rural Road Maintenance</u>

WHEREAS secondary roads in unincorporated areas of BC are typically maintained on a break/fix basis despite deteriorating conditions and increasing traffic;

AND WHEREAS there is no publicly available plan for the upgrade and replacement of rural roads, culverts, and bridges:

THEREFORE BE IT RESOLVED that the province direct and fund the Ministry of Transportation and Infrastructure to establish a capital asset management plan for secondary road networks across the province.

4. Improved Road Design for Vulnerable Road Users

WHEREAS the Ministry of Transportation and Infrastructure road design standards prioritize the efficient movement of motor vehicles over the safety of vulnerable road users, including pedestrians, transit users, and cyclists;

AND WHEREAS narrow road rights-of-way and topographic challenges in rural areas often make it impossible for active transportation infrastructure to be built to the Ministry of Transportation and Infrastructure's Active Transportation Design Guide of separated paths along road corridors;

AND WHEREAS the Ministry of Transportation and Infrastructure will not approve, fund, or maintain any road improvements that don't meet their Active Transportation Design Guide:

THEREFORE BE IT RESOLVED that the province instruct the Ministry of Transportation and Infrastructure to prioritize the safety of vulnerable road users in their road design standards.

AND BE IT FURTHER RESOLVED that the Ministry of Transportation and Infrastructure recognize the practical challenges of active transportation in rural areas and approve, fund and maintain minor road improvements that increase safety for vulnerable road users, such as paved shoulders and crosswalks.

5. Free Transit for Students

At the 2020 UBCM Convention, New Westminster put forward the following resolution, which was not endorsed by UBCM:

> *Whereas youth across British Columbia and all people living in poverty deserve safe, easy, and affordable commutes; And whereas a lack of affordable transportation is a significant barrier to social connection, access to services and labour market inclusion for low income adults and youth; And whereas direct harm can be brought to low income adults and youth due to punitive fare evasion ticketing, which can impact credit ratings and further entrench poverty; And whereas the AllOnBoard campaign has been endorsed by business, labour, and advocacy organizations across British Columbia in their call to remove the barriers to public transit for youth and those experiencing poverty; Therefore be it resolved that the provincial government work to make transit access more equitable by supporting free public transit across BC for youth under 19 years of age; And be it further resolved that the provincial government support a sliding scale monthly pass system based on income; And be it further resolved that BC Transit and TransLink proactively end the practice of fare evasion ticketing of minors, and*

introduce community service and restorative justice options for adults as an alternative to fare evasion tickets.

At the 2022 UBCM Convention, Central Saanich put forward the following resolution, which was endorsed by AVICC but not endorsed by UBCM:

Whereas the BC Governments fare-free transit program for youth aged 12 and under grade 6 saves families money while offering youth low-carbon transportation that helps the province and municipalities reach carbon neutrality targets; And whereas expanding eligibility to those aged 13 and under grade 7 would reduce the current disparity between the have fare-free and those who have not within middle schools: Therefore be it resolved that the UBCM endorse a request that the Province of BC expands the fare-free transit program for youth aged 13 and under grade 7.

Based on the above resolutions previously brought forward to UBCM, staff are recommending the following be put forward to AVICC:

WHEREAS the BC Government's fare-free transit program for youth aged 12 and under grade 6 saves families money while offering youth low-carbon transportation that helps the province and municipalities reach carbon neutrality targets;

AND WHEREAS expanding eligibility to those in grade 12 and under would reduce the current disparity between the have fare-free and those who have not within BC schools:

THEREFORE BE IT RESOLVED that UBCM request the province to expand the fare-free transit program for youth in grade 12 and under.

STRATEGIC PLAN AND RELATED POLICIES

CONCLUSION

Resolutions must be adopted by the Board no later than the January 25, 2024, Regular Board meeting to meet the submission deadline. Resolutions must be submitted to AVICC by February 7, 2024.

Reviewed by:			
Manager		Finance	
GM		Legislative	X – S. Reid
CAO	X – D. McKinley	Other	

SUNSHINE COAST REGIONAL DISTRICT STAFF REPORT

TO: Committee of the Whole – January 11, 2024

AUTHOR: Nancy Hughes, Emergency Management Coordinator

SUBJECT: **COMMUNITY EMERGENCY PREPAREDNESS FUND GRANT APPLICATION – EMERGENCY SUPPORT SERVICES EQUIPMENT AND TRAINING – PROGRAM IMPROVEMENTS**

RECOMMENDATION(S)

(1) THAT the report titled Community Emergency Preparedness Fund Grant Application – Emergency Support Services (ESS) Equipment and Training – Program Improvements be received;

(2) AND THAT the grant application of up to $30,000 for the Training, ESS equipment and program improvements be submitted to the Union of British Columbia Municipalities on behalf of the Sunshine Coast Regional District;

(3) AND FURTHER THAT the Sunshine Coast Regional District supports the current proposed activities identified in the application and is willing to provide overall grant management.

BACKGROUND

The Community Emergency Preparedness Fund (CEPF) is a suite of funding streams intended to enhance the resiliency of local governments, First Nations and communities in responding to emergencies. Funding is provided by the Province of BC and is administered by UBCM.

Staff are preparing a grant application for the Emergency Support Services (ESS) Equipment and Training funding stream to carry out ESS Program Improvements. The application deadline is January 26, 2024.

DISCUSSION

The Sunshine Coast Emergency Program (SCEP) continues to improve the capacity and ability of our Emergency Support Services Program (ESS) to respond and aid all our communities if emergency shelter, food and clothing are required after a disaster. Group lodging equipment, on-going training and supplies for our volunteers are paramount for a successful response. During 2023 we focused on building our ESS Team and providing training and exercising for our volunteers primarily on emergency management in general and on Level 1 Response (individual to 2 family sized fires) calls. We seek funding to enhance the capacity to provide emergency support services through new equipment for group lodging, responding to calls and reception centre training.

Financial Implications

This grant is expected to cover 100% of the eligible costs of the proposed project to a maximum amount of $30,000. If the application is successful, a future Financial Plan Bylaw amendment will be required to accept the grant.

Timeline for next steps or estimated completion date

Upon approval of the SCRD Board direction to apply for the grant, staff will apply and supporting documentation. If approved, the project will be carried out and completed between the months of April – November 2024.

STRATEGIC PLAN AND RELATED POLICIES

This request aligns with the SCRD's Emergency Preparedness Plan.

CONCLUSION

An application to the Community Emergency Preparedness Fund is being prepared by staff. The deadline to submit an application is January 26, 2024. A resolution of support from the Board is required for the application to be considered.

Reviewed by:			
Manager	X - M. Treit	CFO/Finance	X - T. Perreault
GM		Legislative	
CAO	X – D. McKinley	Other	

SUNSHINE COAST REGIONAL DISTRICT STAFF REPORT

TO: Committee of the Whole – January 11, 2024

AUTHOR: Graeme Donn, Manager, Recreation Services

SUBJECT: **RFP 2361312 RECREATION MANAGEMENT SOFTWARE - CONTRACT AWARD**

RECOMMENDATION(S)

(1) THAT the report titled RFP 2361312 Recreation Management Software - Contract Award be received for information;

(2) AND THAT subject to the approval of the 2024 Budget Proposal titled "Recreation Software Change Implementation" a contract to provide recreation management software be awarded to Perfect Mind Inc dba Xplor Recreation for the amount up to $120,000.00 (excluding GST);

(3) AND FURTHER THAT the delegated authorities be authorized to execute the contract.

BACKGROUND

The purpose of Request for Proposals RFP 2361312 is to seek a service provider for the software system that manages recreation business transactions including: customer database, facility rentals, admission/pass sales, point of sales, program registration and reporting/analysis/financial accounting. Parks Services and Dakota Ridge also utilize this software for facility rentals and pass sales. The scope of services for the RFP was developed to align with business needs and to address known gaps in functionality, reporting, data analysis, etc.

DISCUSSION

Request for Proposal (RFP) Process and Results

Request for proposal RFP 2361312 Recreation Management Software was issued on August 30, 2023 and closed on September 29, 2023.

Three compliant proposals were received for RPF 2361312. Led by Purchasing, the evaluation team consisted of three team members. The evaluation committee reviewed and scored the proposal against the criteria set out in section 7. Based on the best overall score and value offered, staff have recommended that a contract be awarded to Perfect Mind Inc. dba Xplor Recreation as they met the specifications as outlined and are the best value for the above-mentioned contract.

Summary of Bids Received

Name	**Value of Contract (excluding GST)**
Intelligenz Limited	$87,546.61
Univerus Software Inc	$73,650.24
Perfect Mind Inc dba Xplor Recreation	$109,696.00

It is recommended that the awarded contract be in the amount not to exceed $120,000 for the duration of the 3-year contact (March 2024-March 2027), which also includes a contingency for one-time implementation costs.

Financial Implications

The current operating base budget allocation for recreation management software is sufficient for the ongoing annual fees, however a one-time base budget lift will be required cover the cost of the vendor support for implementation.

Further, migration to a new software system is a significant undertaking that will also require staff project implementation support, development of operational policies and procedures for new software, staff training and change management, new hardware and public promotion. The project implementation team will include representatives from Recreation, Parks, Finance and Information Systems.

It is anticipated that the one-time implementation costs will be approximately $150,000 and consideration for these costs are included in the 2024 Budget Proposal titled “Recreation Software Change Implementation” that will be deliberated at Round 2 of the 2024-2028 Financial Planning process**.**

Timeline for next steps or estimated completion date

Following the approval of the Round 2 budget proposal “Recreation Software Change Implementation”, the contract award will be made.

Preparing the organization for a migration to new software is anticipated to occur over the next year with the new software going live in early 2025.

STRATEGIC PLAN AND RELATED POLICIES

This project has been considered through the Service Delivery Excellence lens and aligns with the SCRD Board’s Procurement Policy.

CONCLUSION

In accordance with the SCRD’s Procurement Policy, RFP 2361312 was issued for Recreation Management Software. Three compliant bids were received.

Based on the best overall score and value offered, staff recommend that the SCRD enter into a contract agreement with Perfect Mind Inc dba Xplor Recreation with a value of up to $120,000.

Reviewed by:			
Manager		CFO/Finance	X - T. Perreault
GM	X - S. Gagnon	Legislative	
CAO	X - D. McKinley	Other	X - V. Cropp

SCRD/SCHOOL DISTRICT NO. 46

JOINT USE STEERING COMMITTEE MINUTES

Thursday, September 7, 2023 at 9:30 AM
School Board Office - 494 South Fletcher Road – Gibsons BC

Attended:	SD46 Trustee	Maria Hampvent
	SD46 Trustee	Stacia Leech
	SD46 Trustee	Pammila Ruth
	SD46 Trustee (Observer)	Ann Skelcher
	SD46 Trustee (Observer)	Sue Girard
	SCRD Director	Silas White
	SCRD Director	Alton Toth
	SD46 Secretary-Treasurer	Nicholas Weswick
	SCRD GM, Community Services	Shelley Gagnon
	SD46, Executive Assistant / Recorder	Shelley Herrling
Regrets:	SCRD Director	Kelly Backs

CALL TO ORDER 9:34 a.m.

WELCOME AND INTRODUCTIONS

Welcome remarks and introductions of those present were conducted.

AGENDA

The agenda was adopted as presented.

MINUTES

Joint Use meeting minutes of September 21, 2022 were accepted as presented.

Follow up discussion from meeting minutes included:

Expanding the Joint Use Agreement to include other parties was discussed at last meeting and explored by staff.

- Town of Gibsons and District of Sechelt have advised they will not currently consider participating in the Joint Use agreement. Participation may be explored in the future.

Joint Sports Field Strategy

- Sunshine Coast Regional District, School District 46, District of Sechelt and SIGD received funding approval from their Board/Council to participate in Sunshine Coast Joint Sports Field Strategy.
- Town of Gibsons did not receive funding approval.
- SCRD confirmed they are responsible to coordinate group, scope of work and move forward with strategy.
- SCRD is exploring possibility of Sunshine Coast Regional Economic Development Organization (SCREDO) involvement to help guide strategy planning.
- First meeting with all organizations anticipated for late September or early October.

NEW BUSINESS

Review of Joint Use Steering Committee Terms of Reference

Discussion included the following points:

- Frequency of committee meetings was discussed and it was suggested by staff that Committee meetings once per year is adequate, unless meeting to address specific changes to the agreement.
- It was noted that SD46 and SCRD staff meet more frequently throughout year at operational level.

Review of Master Joint Use Agreement

Discussion included the following points:

- A question arose about Emergency Preparedness and overlap with the Joint Use Agreement.
- It was noted that the SCRD is responsible for emergency preparedness for the Sunshine Coast, which is a separate function and committee.

Key Performance Measures

Discussion included the following points:

Discussion at the last JUS Committee meeting included producing an annual report and identifying key performance measures of the successes of the Joint Use Agreement to include in this report.

- SD46 staff noted that community access to school district facilities is free or deeply discounted and below cost of running facility, which is not strictly linked to JUS, but should be referenced in reporting to show the significant community and recreation benefits to the Joint Use Agreement and the community as a whole.
- Metrics will be reported to JUS Committee and formal reporting to respective organizations.
- KPI's could include SD46 and SCRD land planning and construction contributions in the development of facilities.
- Important that the report be made public to ensure the community understands there is mutual benefit and that both organizations are working together with existing and future facilities.
- It was noted that the SCRD subsidizes school district student use and JUS agreement is limited to SCRD bookings at school district facilities.
- SD46 Celebrating Community Use of Schools (2022-23 school year), highlighting community bookings and user fees savings, was presented to the committee and discussed.
- It was noted that it is a priority for the SCRD to inform the public on emergency preparedness and information will be reported at next SCRD public meeting.

Recommendation No. 1 *Joint Use Committee Annual Reporting*

The Joint Use Steering Committee recommended that staff produce an annual report on behalf of the JUS Committee to include the utilization by the community and by both parties related to the Joint Use Agreement, and that community access to school district facilities and long-range land use and facilities planning be components of the annual report.

SD46 and SCRD staff to meet and produce a draft annual report by end of March 2024, to present to the Joint Use Committee.

DISCUSSION

No further items were discussed.

NEXT MEETING

ADJOURNMENT 10:30 a.m.

SUNSHINE COAST REGIONAL DISTRICT
SOLID WASTE MANAGEMENT PLAN
PUBLIC AND TECHNICAL ADVISORY COMMITTEE

Tuesday, November 21, 2023

RECOMMENDATIONS FROM THE SOLID WASTE MANAGEMENT PLAN PUBLIC AND TECHNICAL ADVISORY COMMITTEE MEETING HELD IN THE CEDAR ROOM,1975 FIELD ROAD, SECHELT, BC

PRESENT:		
(Voting Members)	Chair	J. Sutherland
	Vice Chair	D. Reeve
	Members	J. Walton
		N. Brenchley
		P. Robson
		S. Selzer
		S. Van Poppelen
		M. Ernst
	Director, Electoral Area E	D. McMahon
ALSO PRESENT:		
(Non-Voting)	Manager, Solid Waste Services	M. Sole
	Solid Waste Operations Coordinator	A. Patrao
	Recorder	R. Newland
REGRETS:	Members	A. Joe
		E. Machado

CALL TO ORDER 3:40 p.m.

AGENDA The agenda was adopted as amended.

MINUTES The minutes of the October 24, 2023, Solid Waste Management Plan Public and Technical Advisory Committee meeting were accepted as circulated.

REPORTS *Waste Prevention and Diversion Strategies Memo 2: CDR and Non-Sector Specific Issues* was received as a supporting document for the presentation given on this topic.

PRESENTATIONS AND DELEGATIONS

Potential Waste Prevention and Diversion Strategies to Address Construction, Demolition and Renovation Waste and Other Issues

Veronica Bartlett, representative of Morrison Hershfield, provided a presentation on the

Potential Waste Prevention and Diversion Strategies to Address Construction, Demolition and Renovation Waste and Other Issues, which included the following:

- Reviewed the feedback from the last meeting.
    - The feedback survey was well received by the Solid Waste Management Plan Public and Technical Advisory Committee (PTAC).
    - The graphs provided by Morrison Hershfield are preferred over the graphs provided in the feedback included in agenda package (Annex C).
- Improve Construction, Demolition and Renovation (CDR) waste prevention and diversion.
    - Discussion included:
        - The high cost and burden on businesses to comply with some example bylaws.
- Improve circular economy opportunities for local businesses.
- Reduce tourist and event waste and increase waste diversion.
    - Discussion included:
        - Part-time residents' may be grouped with tourists, information is limited at this time.
        - Diversion potential should be "unknown" not "low".
        - Michael Ernst discussed findings provided in the agenda package (Annex D).
            - Michael will be reaching out to Sunshine Coast Tourism for an informational meeting.
- Prevent and address illegal dumping.
    - Discussion included:
        - Opportunity for education, especially for items that are free to recycle.
- Prevent and address marine debris.
    - Unable to discuss due to time constraints.
    - Actioned to Committee members to review the presentation on their own time before the next meeting.
- Improve wildlife management related to waste management.
    - Unable to discuss due to time constraints.
    - Actioned to Committee members to review the presentation on their own time before the next meeting.

NEW BUISNESS

PTAC Meeting updates - Amened agenda item

- The Town of Gibsons has a standing meeting on the third Tuesday of the month and is unable to attend the PTAC meetings when held on these dates.
- Meeting invites may be moved to Teams platform instead of Zoom.

PTAC Feedback from October Meeting

This feedback was discussed as part of the presentation given by Morrison Hershfield.

Bylaw Discussion

This topic is being referred to the next Committee due to time constraints.

Tourism Waste

This topic was discussed as part of the presentation given by Morrison Hershfield.

- Michael Ernst has volunteered to do some research on this topic by meeting with Sunshine Coast Tourism.

NEXT MEETING January 2024

ADJOURNMENT 5:35 p.m.