

To: Chief Administrative Officer **Date:** June 17, 2024
From: Kyle D'Appolonia, Environmental Coordinator
Subject: **Stave Falls Aquifer Hydrogeologic Review**

Recommendation(s)

This report is provided for information. No staff recommendation accompanies this report and Council action is not required.

Purpose

The purpose of this report is to summarize the findings of the Stave Falls Aquifer Hydrogeologic Review which was completed by AECOM Canada Ltd. in December 2023. The consultant will present the findings on June 17, 2024.

Background

Due to recent development interest in the Stave Falls Neighborhood (SFN), some existing residents have expressed apprehension regarding the capacity and potential depletion of the underlying aquifers. As such, staff were directed by Council to engage the services of a qualified professional to address these concerns. A Request for Proposal (RFP 2023-006) was issued for consulting services to conduct a preliminary review of the aquifers underlying the SFN. AECOM was awarded the contract which was executed on June 23, 2023. The preliminary review was based on publicly available data and information provided by municipal staff. The scope of work included review of the following:

- local area geology and topography;
- existing groundwater supply investigation reports and other published data including water well logs, observation well records, and aquifer mapping reports;
- the current municipal private well policy; and
- the location of known private septic systems.

Upon review, a technical report was prepared which included the following components:

- summary of the number of current licensed allowances;
- estimation of the capacity of the underlying aquifers, maximum safe extraction capacity, and associated number of users;
- recommended changes to the municipal private well policy; and
- recommended further assessment and monitoring programs to ensure best management of the aquifers.

AECOM presented these findings to staff during an internal meeting on October 31, 2023, and the final technical report was issued on December 12, 2023 (Attachment A).

Discussion and Analysis

As indicated, this review was intended to be preliminary and consisted of a desktop exercise. Information utilized to conduct this analysis was limited to publicly available data and technical

information provided by municipal staff. Consultant reports provided by municipal staff were limited to specific areas, while more broadly the SFN was not characterized. Publicly available information was generally limited to the provincial well databases, associated aquifer mapping reports, and fact sheets. AECOM concluded that these sources had limitations in terms of accuracy and completeness; however, deemed them to be sufficient for the purposes of a preliminary assessment. Further, it was acknowledged that there was significant information lacking to confirm many of the assumptions inferred during the evaluation which would be required to produce an adequate conceptual model of the aquifers and reliable water balance. AECOM reiterated the value of further characterization to confirm connectivity with surface water features, aquifer properties, seasonal water level fluctuations, and water quality.

Mapped Aquifers

The technical report identified five mapped aquifers which underly the SFN as summarized in the table below.

Aquifer ID #	884	26	971	154	19
Type	Surficial	Surficial	Surficial	Bedrock	Bedrock
Confinement	Confined	Confined	Unconfined	Confined	Confined
Minimum Depth (m)	0.3	0.3	1.5	Artesian	0.9
Maximum Depth (m)	97.5	95.4	24.4	88.1	182.9
Median Depth (m)	9.1	9.1	7.0	20.7	19.8
Licensed Wells	98	2	2	31	0

AECOM identified Aquifer 884 as the primary domestic water supply source for the SFN. An additional 85 groundwater wells did not specify aquifer association (omitted from the table above) but were assumed to be correlated to Aquifer 884. Many of the aquifers appeared to be partially to fully confined by a surficial unit consisting of fine-grained glacially derived sediments, providing meaningful quantities of water to groundwater well users.

Scoping Level Water Balance

From the preliminary review, the scoping level water balance indicated that there was an overall surplus of water on an annual basis. However, a deficit was identified for two summer months (July and August), coinciding with the period when groundwater use is typically highest. Potential evaporation in summer exceeds incoming precipitation, resulting in no groundwater recharge to the aquifers during these months. Surplus water in June and September is low compared to the winter months (December through February) which would suggest that these months may also experience a deficit in years with a hot and dry summer.

Vulnerability to Surface Contamination

Vulnerability to groundwater contamination was determined to be highest in the southern portion of the SFN along Wilson Street south of the Ruskin Dam where Aquifer 971 is exposed at the surface. This is due to the interpreted outcropping of the aquifer that is collocated with agricultural

land or septic systems. Other vulnerabilities occur along Dewdney Trunk Road where residences and agricultural lands are concentrated, and along the northern part of Wilson Street where Aquifer 884 is anticipated to outcrop at ground surface. Vulnerability due to interconnection between aquifers and surface water features, notably Stave Lake and Hayward Lake, is unknown.

Review of Well Policy

AECOM concluded that the municipal private well policy is generally suitable for the SFN as it aims to collect important information for a rural groundwater dependent area that is not otherwise required for provincial government agencies for domestic well users. However, the policy documents contain a significant volume of information that is duplicated or inconsistent with provincial technical guidance documents. AECOM recommended enhancing these policy documents by specifically referencing the technical requirements established by the provincial government.

Recommendations

The technical report identified seven recommendations to improve the overall hydrogeologic understanding of the SFN to inform future policy decisions and ensure a sustainable use of groundwater resources for the community. These recommendations are summarized in table format below.

Recommendation	Rationale
Establish a digital database.	For housing hydrogeologic data including well locations, water usage, pumping data, groundwater level measurements, well evaluation reports, and septic system locations. A digital database would be more useful for record keeping purposes.
Characterize aquifer properties and connectivity to surface water features.	To determine the sustainable yield of the unconsolidated aquifers underlying the SFN. Completing pump tests in targeted locations near Hayward Lake and Stave Lake would allow for quantification of groundwater and surface water interactions along the eastern boundary of the SFN. This information is ultimately critical for determining the quantity of groundwater that is available for consumption.
Implement a groundwater monitoring program.	To monitor the current state of the aquifers and how they respond to meteoric inputs and outputs, groundwater use, and fluctuations in the elevation of Hayward Lake and Stave Lake. AECOM indicated that monitoring should include a series of observation wells in upland and lowland environments that are initially focused on Aquifer 884.
Improve the hydrogeological conceptual model.	To understand where the aquifer outcrops, characterize the extent and continuity of confining units, and determine the connection between aquifers and surface water features. Drilling is required to

	fill data gaps in targeted locations. A detailed geologic model is critical for all future hydrogeologic investigations.
Establish a local meteorological station.	To monitor precipitation, temperature, relative humidity, net radiation, wind speed, and wind direction within the SFN. This is important information for the establishment of inputs and outputs from the water balance and is known to be highly variable in the mountainous environment of the SFN.
Consider the impacts of climate change.	For future water balance evaluations to ensure the long-term sustainable aquifer yield is climate resilient. The Lower Mainland is expected to experience longer and drier summers in conjunction with more intense fall and winter precipitation events.
Update the private well policy.	To minimize duplicity and contradictions with established technical guidance documents and focus on information that is important to the municipality.

Financial Implications

There are no current financial implications associated with this report. This report is for information purposes only; however, additional investigation has been recommended by the consultant.

Communication

No communication action is required.

Summary and Conclusion

This technical report consisted of a desktop exercise and was intended to be a preliminary review, identifying data gaps to direct further investigation. AECOM inferred conclusions based on the data which was available and outlined recommendations to improve the overall hydrogeologic understanding of the SFN. The SFN is one of several rural neighborhoods which relies on groundwater sources. Further investigation should also consider surrounding neighborhoods which are also subject to similar development pressures and lack data to adequately model hydrogeologic systems and quantify aquifer capacities.

- Report Prepared by:** Kyle D'Appolonia, Environmental Coordinator
- Reviewed by:** Erin Blaney, Manager of Environmental Services
- Approved for Inclusion:** Mike Younie, Chief Administrative Officer

Attachment(s)

Attachment A: Stave Falls Aquifer Hydrogeologic Review