ROBINSON NOBLE

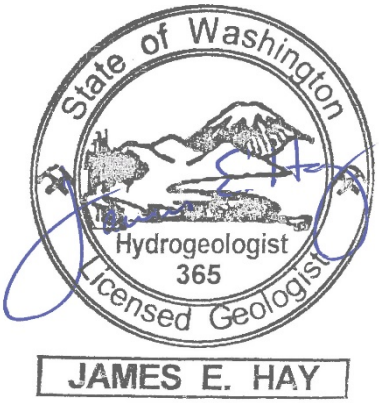
Technical Memorandum

To: Henry Chen, Engineering and Capital Projects Director
Cascade Water Alliance

From: James E. Hay, LHG, CPG

Date: July 1, 2022

Subject: Independent Water Supply Audit
Skyway Water & Sewer District
(Robinson Noble project no.: 3400-001A)



1 – Audit Purpose

Cascade Water Alliance (Cascade) is a municipal corporation formed by its Member agencies under RWC 39.106, the Joint Municipal Utility Services Act. The seven Member agencies entered into the Cascade Joint Municipal Utilities Services Agreement, dated March 28, 2012 (the "Joint Agreement"). Cascade serves as a regional wholesale water supplier to its Members, some of which own independent water systems.

As a part of the water supply relationship under the Joint Agreement, Members with independent supply are responsible for maintaining that supply capacity and availability, with Cascade's supply obligation incremental to that independent supply. As a part of Cascade's original formation, each Member's water supplies were "audited" to determine both regulatory and physical capacity. These water supply audits formed part of the basis for, and terms of, membership and remain the basis for Members' independent supply obligations. Cascade is now conducting new and updated water supply audits of the four Members with independent supply, including the Skyway Water and Sewer District.

The results of these audits are only for Cascade's purposes of implementation of the Joint Agreement. The focus of these audits is to quantify the Members' available water supply capacity, both in terms of regulatory and infrastructure capacity, and their ability to meet established production requirements. The results will be used to update the inventory of Members' independent supplies, establish Members' independent supply capacity, and determine our Member's individual and collective ability to meet their related production requirements. Like prior audits, this evaluation primarily considers system characteristics and production data for a three-year period, in this case the 2017 – 2019 calendar years.

2 – Introduction

Skyway Water & Sewer District (District) is a special purpose district that owns and operates a Group A community water system. Table 1 summarizes data for the system as presented in the Washington State Department of Health (Health) Water Facilities Inventory (WFI) form, accessed on July 21, 2021. Their water service area is shown in Figure 1.

Table 1: Skyway Water & Sewer District Water System

Water System Name:	Skyway Water & Sewer
WSDOH System ID Number:	38800
Address:	6723 S 124th Street, Seattle, WA 98178
Manager:	Cynthia Lamothe
Total Service Connections:	4,169 [a]
Source Wells In Service:	Wells 8, 9, and 10

[a] The total service connections indicated by Health on the WFI form (4,169) is the number of residential units that receive water from the water system. In contrast, purveyors typically count the physical number of service connections (3,395). This value is lower because a single, physical connection to a multi-family building serves multiple residential units.

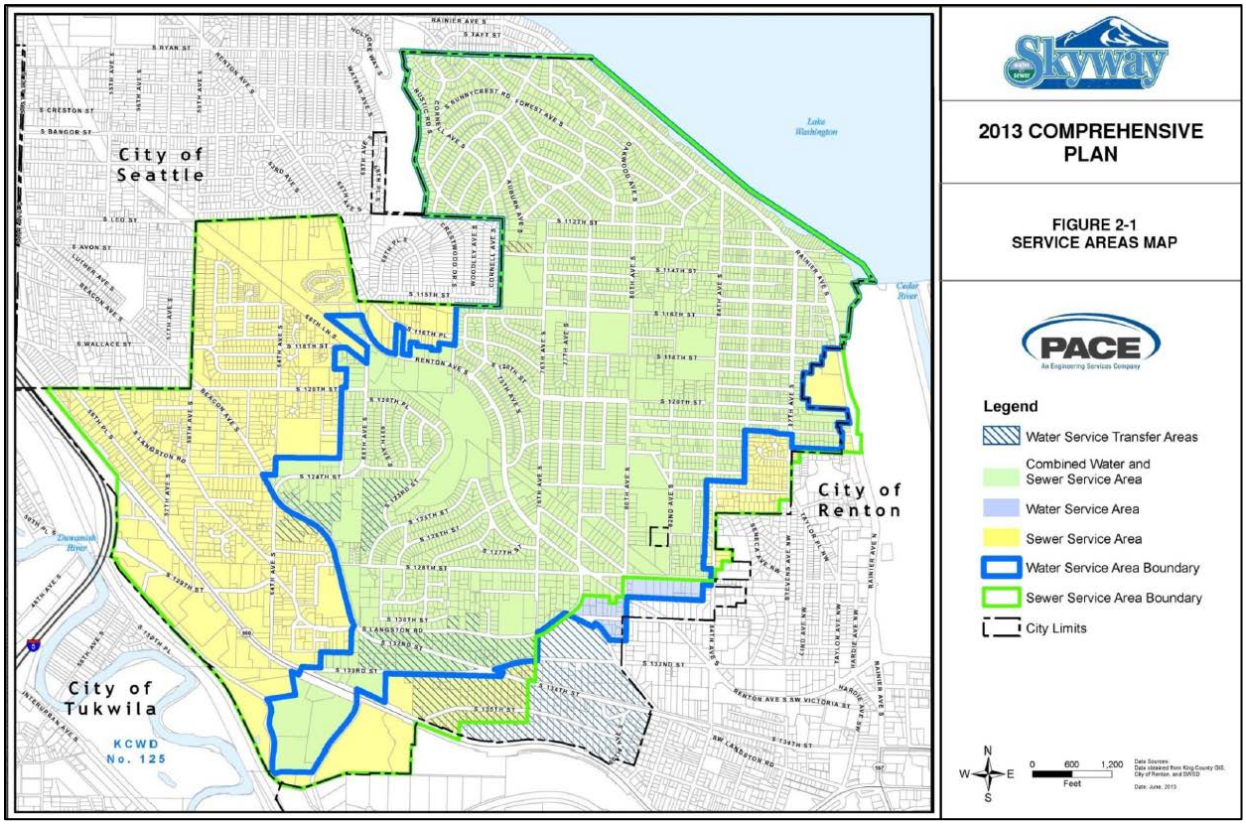


Figure 1: Skyway Water and Sewer System service area
(excerpted from the District's 2013 Comprehensive Plan)

3 – Independent Sources of Supply

The District currently has three source wells in service, summarized in Table 2, and two wells for emergency use only (Wells 5 and 6). The District also has a backup independent source of supply through a wholesale water contract with the City of Renton that allows for the purchase of up to 0.546 million gallons per day (MGD), equivalent to a maximum continuous flow rate of 379.2 gpm.

Table 2: Summary of Source Wells in Service

Well No.	Unique Well ID	Source No.	Year Drilled	Depth (ft bgs) [a]	Casing Diameter (in) [a]	Screen Diameter (in)	Screen Interval (ft bgs)	Test Rate (gpm) / year / SC (gpm/ft) [a,b]	Pump Capacity (gpm)
8	AFT-340	07	2009	117	12	8P [c]	70 – 90	89 / 2009 / 5.3	70
9	AFT-341	06	2009	260	12	10P	230 – 250	395 / 2009 / 17.2	320
10	AFT-342	08	2009	298	12	8P	271.5 – 292	268 / 2009 / 6.4	100

[a] ft bgs, feet below ground surface; in, inches; gpm, gallons per minute; SC, specific capacity; gpm/ft, gallons per minute per foot of drawdown

[b] Specific capacity, a measure of well efficiency calculated by dividing the production rate by the drawdown incurred, is technically only directly comparable for equivalent production rates and durations. Test durations for all three wells were 24 hours.

[c] "P" denotes pipe-size screen.

4 – Regulatory Status of Sources

4.1 – Water System

The regulatory requirements for Group A water systems are specified in Chapter 246-290 WAC, governed by the Washington State Department of Health (Health). The fundamental planning and engineering document for water and sewer districts is their Comprehensive Plan (CP). The District's CP, last approved in October 2014, has detailed information about all aspects of the District's system, including infrastructure and service area, source approval, demand projections, production capacity, water rights, and overall regulatory compliance. The District's wellhead protection plan, a primary source water protection requirement (WAC 246-290-135), is included in the CP appendices. The wellhead protection areas (WHPAs),[1] which are also shown on Health's Source Water Assessment Program (SWAP) GIS Mapping Tool (GMT),[2] were delineated with a combination of analytical modeling and hydrogeologic mapping for all four required TOT durations.

[1] A WHPA reflects a portion of the zone of contribution of water to a well, including both horizontal and vertical flow; however, WHPAs present a "flat" birds-eye view of the area contributing water to a well without respect to depth. Historically, WHPAs have consisted of three time-of-travel (TOT) boundaries: 1-year (Zone 1), 5-years (Zone 2), and 10-years (Zone 3). As of April 9, 1999, WAC 246-290-135(3)(c)(ii) requires that a six-month TOT boundary also be delineated as part of Zone 1.

[2] https://www.doh.wa.gov/CommunityandEnvironment/DrinkingWater/SourceWater/GISMappingTool, accessed June 22, 2021.

Health also summarizes the current status of key aspects of the water system via reports accessible from Sentry Internet.[3] The Water Facilities Inventory Report, last updated on January 4, 2021, shows that Wells 8, 9, and 10 have the approved source numbers and pump capacities shown in Table 2. As of July 21, 2021, Health's Pre-Adequacy Data Summary Report shows the District has a current and valid operating permit, a permit category color of green,[4] no current water quality violations or compliance actions, and the total approved connections are unspecified (not limited).

4.1.1 – Water Treatment

Source approval also indicates that water provided by the District's wells meets potable water standards after any necessary treatment and blending. As discussed in the CP, water from all three wells is treated with sodium hypochlorite and processed through a greensand filtration system. Although current protocol is to pump 160 gpm from either the combination of Wells 8 and 10 or from Well 9, the treatment plant has expansion capacity to treat higher production rates.

4.2 – Water Rights

Water rights consist of an instantaneous quantity (gallons per minute, gpm) referred to as "Qi," and an annual quantity (acre-feet per year, afy), referred to as "Qa." These quantities may be additive or non-additive. Additive quantities define the full allocation of water that may be produced, while non-additive quantities provide flexibility in which sources produce the water. For the purposes of the current audit, it is the additive quantities that are most relevant.

Table 3: Skyway Water & Sewer District Groundwater Rights

		Instantaneous Quantity (Qi)		Annual Quantity (Qa)	
	Document No.	Additive	Non-additive	Additive	Non-additive
Active Wells					
Well 8	G1-21931CWRIS	100 gpm		160 afy	
	G1-*00950CWRIS	125 gpm		200 afy	
Wells 9 & 10	G1-21930CWRIS	300 gpm		480 afy	
	G1-24664CWRIS	122 gpm [a]			136 afy
		647 gpm		840 afy	

[a] The WRTS entry shows both Qi and Qa quantities are supplemental (non-additive), but the Report of Examination, permit, and certificate only annotate the Qa quantity as supplemental (non-additive). Values above are consistent with the District's CP (Water Rights Self-Assessment; Appendix W-6), which also includes the G1-24664CWRIS Qi as an additive quantity.

As reflected in the Washington State Department of Ecology's (Ecology's) Water Right Tracking System (WRTS), the District maintains four groundwater rights authorizing an additive Qi of 647 gpm and an additive Qa of 840 afy, as summarized in Table 3. This data is consistent with that presented in the District's CP.

[3] https://fortress.wa.gov/doh/eh/portal/odw/si/Intro.aspx, accessed July 21, 2021.

[4] Per Health, "Systems in this category are considered adequate for existing uses and new service connections up to the number of approved service connections."

5 – Physical Status of Sources

Site visits to the District's wells were conducted on February 5th, 2020. Based on the information reviewed, all three active wells appear substantially compliant with Chapter 18.104 RCW (Water Well Construction) and the subsequent WAC 173-160 (Minimum Standards for Construction and Maintenance of Wells). The physical capacity of the District's wells to produce water is summarized below. For Wells 8 and 10, this capacity is indicated by both historical pump test data and the capacity of the installed pump. In the case of Well 9, this data also includes the results of a step-rate pump test conducted by District personnel as part of the audit process. Note that actual production capacities may be constrained by a variety of factors that are not evaluated here, including: short- and long-term variations in water level, groundwater recharge, and water quality; and both operations and resource management decisions.

5.1 – Well 8

According to the well's construction and testing report, Well 8 was originally tested at a constant rate of 89 gpm for 24 hours. At the end of the test, the drawdown was 16.8 feet (76% of available drawdown), indicating a 24-hour specific capacity of 5.3 gpm/ft. The installed well pump has a rated capacity of 70 gpm, slightly higher than the well's capacity of 60 gpm. The discharge pipe, valves, and flow meter are 3-inch diameter.

5.2 – Well 9

According to the well's construction and testing report, Well 9 was tested at a constant rate of 395 gpm for 24 hours. At the end of the test, the drawdown was 23.0 feet (74% of the available drawdown), indicating a 24-hour specific capacity of 17.2 gpm/ft. Although the well was originally rated at 350 gpm based on short-term testing, long-term water level declines, particularly in Well 9, indicated this is higher than the Intermediate Aquifer can support. In 2014, the District's consultant estimated that the safe instantaneous production limit for the Intermediate Aquifer (from either Well 9 or 10) might be in the range of 100 – 150 gpm; through trial-and-error, the District has determined that 160 gpm is achievable. The installed well pump has a rated capacity of 320 gpm. The discharge pipe, valves, and flow meter are 6-inch diameter.

On March 2nd, 2021, District personnel conducted an 8-hour step-rate test of Well 9. Prior to the test, the well was offline for at least 8 hours and the static water level was steady at 216.1 feet below the top of the casing. The well was pumped at 50 and 100 gpm for 1 hour each; the last step, 160 gpm, was run for 6 hours. The 1-hour specific capacity values were 21.7, 21.5, and 21.9 gpm/ft,[5] respectively, similar to the specific capacities from step-rate testing at construction. The 6-hour specific capacity at 160 gpm was 21.6 gpm. The well is estimated to use 7.6 feet of drawdown (55% of the available drawdown) and have a specific capacity of 21.0 gpm/ft after 24 hours of continuous production of 160 gpm.

5.3 – Well 10

According to the well's construction and testing report, Well 10 was originally tested at a constant rate of 268 gpm for 24 hours. At the end of the test, the drawdown was 42 feet (91% of available drawdown), indicating a 24-hour specific capacity of 6.4 gpm/ft. Well 10, which is completed in the

[5] Specific capacity rates generally either remain the same or decline as production rates and pumping duration increase. The apparent (minimal) rise in specific capacity at 160 gpm may be due to production rate variability.

same Intermediate Aquifer as Well 9, was originally rated at 240 gpm, but production is limited by aquifer characteristics. The installed well pump has a rated capacity of 100 gpm, slightly higher than the well's capacity of 90 gpm. The discharge pipe, valves, and flow meter are 4-inch diameter.

5.4 – Interties

In addition to their three interties with Cascade, the District has one, bi-directional intertie and one, unidirectional intertie with the City of Renton. The bi-directional intertie is used for both the wholesale purchase and sale of treated water between parties and to provide an emergency standby source of water. The intertie is located at Skyway's Dimmitt Booster Station, 12603 82nd Avenue South, near the intersection of 82nd Avenue South and South 126th Street. The District owns and operates a 10-inch diameter flow meter to measure water flowing through the intertie, which is 12-inch diameter ductile iron. The unidirectional intertie is used as an emergency standby source of water and is located at 8016 South 116th Street, near the intersection of 80th Avenue South and South 116th Street. The District owns and operates a 10-inch diameter flow meter to measure water flowing through the intertie, which is 12-inch diameter ductile iron. The wholesale contract is for the purchase of up to 0.546 MGD of water at rates up to 379.2 gpm; the emergency agreement is for the purchase and sale of up to 1.8 MGD of water at flow rates up to 1,250 gpm.

6 – CWA Production Requirements

Combined production, in millions of gallons, from these three wells for 2017 through 2019 calendar years is presented in Table 4 (peak month and year **underlined and in bold**; peak season shaded).[6]

Table 4: 2017 - 2019 Production (millions of gallons)

	J	F	M	A	M	J	J	A	S	O	N	D	Total
2017	1.72	1.86	**2.13**	1.83	1.48	1.92	1.82	2.04	1.84	1.89	1.84	1.62	21.98
2018	**1.90**	1.71	1.83	1.79	1.70	1.54	1.82	1.52	1.87	1.34	1.82	1.75	20.59
2019	1.49	1.75	1.82	1.84	2.88	3.16	**3.85**	3.48	2.77	2.59	2.60	3.35	**31.56**
Average	1.70	1.77	1.93	1.82	2.02	2.21	**2.50**	2.35	2.16	1.94	2.09	2.24	24.71

As a Member of CWA, the District agreed to maximum production requirements from their independent supply sources, based on three-year production averages (2001 – 2003).[7] Though there is a general waiver of production requirements currently in effect, Table 5 summarizes the District's recent average and peak-season day production, based on the data from Table 4, and peak-day values based on both well pump capacity[8] (Table 2) and additive instantaneous (Qi) water rights (Table 3).[9,10,11]

---

[6] This audit only considers production data from 2017 – 2019; it was not finalized until 2022 due to delays caused by the COVID-19 pandemic.

[7] As defined in the Member Water Audit prepared by CWA, dated March 19, 2012.

[8] Note that this simple sum of pump capacities may be an overestimate of actual production capacity as it makes no allowance for drawdown interference between wells.

[9] Average Day production calculated by dividing the three-year average annual production by 365 days. Peak-season Day production calculated by dividing the three-year average peak season production (June through

Table 5: Independent Source Production Summary

Production Metric	Production Requirement	2017 – 2019 Values	Peak Year (2019) Values	Peak Year Difference
Average Day	0.30 MGD	0.07 MGD	0.09 MGD	(0.21 MGD)
Peak-season Day	0.50 MGD	0.08 MGD	0.11 MGD	(0.39 MGD)
Production Metric	**Production Requirement**	**Peak-day Values**		**Peak-day Difference**
Peak-day Capacity	0.63 MGD	0.37 MGD (pump capacity) [a,b] 0.78 MGD (additive water rights)		(0.26 MGD) [a,b] 0.15 MGD

[a] The District pumps their wells at a reduced capacity as a consequence of aquifer limitations and as a strategy to maintain long-term well efficiency. This does not hinder the District's ability to meet their Peak-day Capacity since it can meet the indicated difference with its backup independent source of supply, wholesale water from the City of Renton, as envisioned in the 2012 Member Water Audit.

[b] As used in this table, pump capacity reflects the lower well capacities (discussed in Sections 5.1-5.3) and not the rated pump capacities shown in Table 2. Even with 24-hour production, this capacity does not meet the Peak-day Capacity requirement on its own (without wholesale water from the City of Renton).

7 – Recommendations

None.

8 – Conclusion

The purpose of this audit has been to summarize current production status and alert members to potential risks, now and in the future. It is intended to be used by Members to help ensure that they remain able to comply with their contractual obligations to Cascade.

All Cascade Members, including Skyway Water & Sewer District, have complied with their contractual production requirements to-date, particularly given the production waivers for all three metrics (Average Day, Peak-season Day, and Peak-day Capacity) discussed above. At some point, should such waivers expire and not be further extended, this audit and the production history indicate an ability to substantively meet the independent production requirements. While production from the District's own wells has been limited and less than the overall production requirements, the availability of the Renton wholesale contract provides an ongoing means to supplement well production and meet contractual obligations.

September) by 122 days. Peak-day capacity calculated by multiplying instantaneous capacity (either pump capacity or additive Qi water rights) multiplied by 20 hours of production (83.3% of maximum production).

[10] The March 19, 2012, Member Water Audit provides conflicting interpretations of the additive/non-additive nature of the 122 gpm Qi from G1-24664CWRIS. By its inclusion in the "Instantaneous Flow Capacity" total in Table 3 of that document, the Qi is considered an additive quantity that could readily contribute to a peak-day quantity; however, this Qi was explicitly not included in the 2012 peak-day capacity analysis (Section 4.3.1 of that document) on the stated grounds that the "…capacity of Well 7 is assumed to be supplemental."

[11] Members must manage their resources to meet a wide variety of physical and regulatory constraints, so production history may not be indicative of the ability or intent to produce a maximum volume of water in any given year.