



City of Tacoma, WA

TACOMA WATER
REQUEST FOR QUALIFICATIONS
WELLFIELD TREATMENT EVALUATION ENGINEERING
SERVICES
SPECIFICATION NO. TW23-0153F



City of Tacoma
Tacoma Water

REQUEST FOR QUALIFICATIONS TW23-0153F
Wellfield Treatment Evaluation Engineering Services

Submittal Deadline: 11:00 a.m., Pacific Time, Tuesday, September 12, 2023

Submittals must be received by the City's Procurement and Payables Division prior to 11:00 a.m. Pacific Time.

For electronic submittals, the City of Tacoma will designate the time of receipt recorded by our email, sendbid@cityoftacoma.org, as the official time of receipt. This clock will be used as the official time of receipt of all parts of electronic bid submittals. Late submittals will be returned unopened and rejected as non-responsive.

Submittal Delivery: Sealed submittals will be received as follows:

By Email:

sendbid@cityoftacoma.org

Maximum file size: 35 MB. Multiple emails may be sent for each submittal

Bid Opening: Submittals must be received by the City's Procurement and Payables Division prior to 11:00 a.m. Pacific Time. Sealed submittals in response to a RFB will be opened Tuesday's at 11:15 a.m. by a purchasing representative and read aloud during a public bid opening held at the Tacoma Public Utilities Administrative Building North, 3628 S. 35th Street, Tacoma, WA 98409, conference room M-1, located on the main floor. They will also be held virtually Tuesday's at 11:15 a.m. Attend [via this link](#) or call 1 (253) 215 8782. Submittals in response to an RFP, RFQ or RFI will be recorded as received. As soon as possible, after 1:00 PM, on the day of submittal deadline, preliminary results will be posted to www.TacomaPurchasing.org.

Solicitation Documents: An electronic copy of the complete solicitation documents may be viewed and obtained by accessing the City of Tacoma Purchasing website at www.TacomaPurchasing.org.

- [Register for the Bid Holders List](#) to receive notices of addenda, questions and answers and related updates.
- Click here to see a [list of vendors registered for this solicitation](#).

Pre-Proposal Meeting: A pre-proposal meeting will not be held.

Project Scope: Review existing Tacoma Water data, facility information, and operational needs to identify alternatives and their costs for managing PFAS in wellfield supplies. Support Tacoma Water in decision-making to identify a recommended strategy and implementation plan for PFAS management.

Estimate: \$200,000.00 (For budgetary purposes only)

Paid Sick Leave: The City of Tacoma requires all employers to provide paid sick leave as set forth in Title 18 of the Tacoma Municipal Code and in accordance with State of Washington law.

Americans with Disabilities Act (ADA Information): The City of Tacoma, in accordance with Section 504 of the Rehabilitation Act (Section 504) and the Americans with Disabilities Act (ADA), commits to nondiscrimination on the basis of disability, in all of its programs and activities. Specification materials can be made available in an alternate format by emailing the contact listed below in the *Additional Information* section.

Title VI Information: "The City of Tacoma" in accordance with provisions of Title VI of the Civil Rights Act of 1964, (78 Stat. 252, 42 U.S.C. sections 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, national origin in consideration of award.

Additional Information: Requests for information regarding the specifications may be obtained by contacting Brandon Snow, Senior Buyer by email to bsnow@cityoftacoma.org.

Protest Policy: City of Tacoma protest policy, located at www.tacomapurchasing.org, specifies procedures for protests submitted prior to and after submittal deadline.



Meeting sites are accessible to persons with disabilities. Reasonable accommodations for persons with disabilities can be arranged with 48 hours advance notice by calling 253-502-8468.

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SUBMITTAL CHECKLIST

This checklist identifies items to be included with your submittal. Any submittal received without these required items may be deemed non-responsive and not be considered for award.

Submittals must be received by the City of Tacoma Purchasing Division by the date and time specified in the Request for Qualifications page.

The following items make up your complete electronic submittal package (include all the items below):	
Signature Page (Appendix B)	
Statement of Qualifications (SOQs), including Content to be Submitted (Section 9)	
After award, the following documents will be executed:	
City of Tacoma Contract (See sample in Appendix C)	
Certificate of Insurance and related endorsements (Appendix C)	

1. BACKGROUND

The City of Tacoma (City), Department of Public Utilities, Water Division (Tacoma Water) has measured per - and poly-fluoroalkyl substances (PFAS) in some of its drinking water sources. In March 2023, the United States Environmental Protection Agency (USEPA) published the draft [PFAS National Primary Drinking Water Regulation Rulemaking](#) (PFAS Rule). The proposed rule requires drinking water systems to maintain levels for six PFAS below new Maximum Contaminant Levels (MCLs). At the low MCLs currently proposed within the draft PFAS Rule, Tacoma Water is expected to require PFAS treatment for all or part of its backup supply, the South Tacoma Wellfield sources. To date, there have been no PFAS detections over the reporting limits for Tacoma Water's primary source; the Green River supplies 95 percent or more of Tacoma Water's supply in most years.

Tacoma Water intends to award a contract for engineering consultant support in identifying a proposed strategy for treating PFAS in its drinking water sources, particularly the South Tacoma Wellfield supplies. The project will involve identification and systematic evaluation of alternatives that allow the South Tacoma Wellfield supply to be in compliance with the PFAS Rule and will result in a final recommendation that will serve as the baseline for future design.

Detailed background is provided in Appendix A.

To learn more about the City of Tacoma, visit www.cityoftacoma.org.

SOQs submitted and/or the selected Consultant(s) may be used for projects of similar type and scope at the sole discretion of the City for up to one year.

2. SUMMARY OF SCOPE OF SERVICES AND DELIVERABLES

It is the City's intent to select a consultant based on qualifications and abilities of the firm and key project individuals. The selected consultant will review existing Tacoma Water data, facility information, and operational needs to identify alternatives and their costs for managing PFAS in the South Tacoma Wellfield. The consultant will support Tacoma Water in decision-making to identify a recommended strategy for PFAS in the South Tacoma Wellfield. The resulting deliverables will provide Tacoma Water with a master plan, capital and operational budget costs, and next steps for managing PFAS in the South Tacoma Wellfield.

In addition, the project may also include high-level master planning for other Tacoma Water facilities should those sources require PFAS treatment in the future and bench-top or pilot-scale testing for treatment of South Tacoma Wellfield water.

A more detailed discussion of the anticipated scope of work is provided in Appendix A.

These services are budgeted at approximately \$200,000.00 and the anticipated completion date is approximately December 2024; however, the scope, budget, and schedule will be negotiated with the selected consultant.

3. ANTICIPATED CONTRACT TERM

The anticipated duration of the contract is for an approximately one-year period with the City's sole option to renew for additional periods as applicable.

4. CALENDAR OF EVENTS

The following schedule has been established for the submission and evaluation of the SOQs and selection of the Consultant. These are tentative dates only and the City reserves the right to adjust these dates at its sole discretion.

Contract may be issued after Public Utility Board and/or City Council approval.

The anticipated schedule of events concerning this Solicitation is as follows:

Publish and issue Solicitation:	8/14/2023
Pre-Submittal Questions:	8/30/2023
Response to Questions:	9/1/2023
Submittal Due Date:	9/12/2023
Submittal Evaluated, on or about:	9/26/2023
Interviews/presentations, on or about:	10/3/2023
Award Recommendation, on or about:	10/10/2023
Public Utility Board/City Council Approval, on or about:	NA

5. INQUIRIES

5.1 Questions should be submitted to Brandon Snow, Senior Buyer, via email to bsnow@cityoftacoma.org. Subject line to read:

TW23-0153F – Wellfield Treatment Evaluation Engineering Services – *VENDOR NAME*

5.2 Questions are due by 3 pm on the date included in the Calendar of Events section.

5.3 Questions marked confidential will not be answered or included.

5.4 The City reserves the discretion to group similar questions to provide a single answer or not to respond when the requested information is confidential.

5.5 The answers are not typically considered an addendum.

5.6 The City will not be responsible for unsuccessful submittal of questions.

5.7 Written answers to questions will be posted alongside the specifications at www.tacomapurchasing.org

6. DISCLAIMER

The City is not liable for any costs incurred by the Respondent for the preparation of materials, or a submittal submitted in response to this Solicitation, for conducting any presentations to the City, or any other activities related to responding to this Solicitation or related to the contract negotiation process.

7. EVALUATION CRITERIA

A Selection Advisory Committee (SAC) consisting of City staff and other stakeholders, as appropriate, shall independently evaluate the SOQs. The relative weight of each scoring criteria is indicated in the table below.

Criteria	Max Points
Team Structure and Qualifications (Section 9.1)	25
Experience and Related Projects (Section 9.2)	25
Project Approach and Understanding (Section 9.3)	45
Equity in Contracting (Section 9.4)	5
Client References (Section 9.5)	0
Total	100

After the evaluation, the SAC may conduct interviews of the most qualified Respondents before final selection.

- 7.1** The SAC may use references to clarify information in the submittals and/or interviews, if conducted, which may affect the final scoring. The City reserves the right to contact references other than those included in the submittal.
- 7.2** Part 1 of the evaluation process shall consist of the evaluation of the written SOQ package submitted by each Respondent and as a result, a short list of Respondents may be invited to interview with the SAC.
- 7.3** Part 2 of the evaluation process shall consist of the evaluation of interviews, if conducted, to produce a final scoring. The City reserves the right to select the Consultant team directly from the SOQs (Part 1 evaluation) without conducting an interview.

8. SOQ SUBMITTAL AND GENERAL GUIDELINES

The SOQ should be submitted in PDF format. Proposals should be formatted as 8 ½" x 11", except for specific exhibits where necessary. The City requires that the Respondent's SOQ submittals be limited to no more than 15 double-sided pages or 30 pages total (not including City required forms, front and back covers, and appendices specifically referenced in Sections 9.1 and 9.5).

9. CONTENT TO BE SUBMITTED

A full and complete response to each of the "CONTENT TO BE SUBMITTED" items is expected in a single location; do not cross reference to another section in your submittal.

Information that is confidential must be clearly marked and provide an index identifying the affected page number(s) and locations(s) of such identified materials. See Section 1.06 Public Disclosure: Proprietary or Confidential Information of the City Standard Terms and Conditions.

Respondents are to provide complete and detailed responses to all items below. Submittals that are incomplete or conditioned in any way that contain alternatives or items not called for in this RFQ, or not in conformity with law, may be rejected as being non-responsive.

The City will not accept any submittal containing a substantial deviation from the requirements outlined in this RFQ.

Submittals should present information in a straightforward and concise manner, while ensuring complete and detailed descriptions of the Respondent's/team's abilities to meet the requirements of this RFQ. Emphasis will be on completeness of content. The written submittals should be prepared in the sequential order as outlined below.

The City reserves the right to request clarification of any aspect of a firm's submittal or request additional information that might be required to properly evaluate the submittal. A firm's failure to respond to such a request may result in rejection of the firm's submittal. Firms are required to provide responses to any request clarification within two (2) business days.

Requests for clarification or additional information shall be made at the sole discretion of the City. The City's retention of this right shall in no way diminish a Respondent's responsibility to submit a submittal that is current, clear, complete, and accurate.

9.1 Team Structure and Qualifications – 25 points

Please describe the consulting team structure, including names of lead team members with titles, technical qualifications, and general project responsibilities. Include the following:

- Provide a summary of the background and experience of the Project Manager relevant to this project.
- Describe the Project Manager's experience with projects of similar type and size. Provide at least one example.
- Identify key team members, including any staff expected to make key contributions to the project. For each team member, describe their technical qualifications and general project responsibilities.
- Provide an org chart for the team including all subconsultants. Clearly delineate responsibilities of subconsultants.
- Identify which office(s) the project will be delivered from and the locations of key team members.
- Provide a statement that clearly conveys the firm's commitment to actively perform the proposed work and the ability of all proposed project personnel to accept responsibility for completing the project in view of the firm's current and projected workload.
- Include individual resumes for all team members as Appendix A (resumes will not count toward page count total).

9.2 Experience and Related Projects – 25 points

Please provide a summary of the experience of the firm relative to this project. For each example project identified, include the following:

- General description of the project

- Name and contact information of the client
- Project location
- Start and completion dates
- Any key similarities to Tacoma Water's Wellfield Treatment Evaluation project
- Involvement of the individuals proposed for this project team and their role on the example project

Provide at least five examples of related projects. At least two of the examples should involve PFAS treatment evaluation, planning, or design.

9.3 Project Approach and Understanding – 45 points

Summarize the project team's understanding of the project and primary issues that will need to be addressed to complete it. Describe the following:

- Respondent's suggested approach to accomplishing the proposed scope of work, including any proposed activities, methodologies, tools, or tasks that Respondent would like Tacoma Water to be aware of
- Respondent's understanding of key issues to be addressed in this project and potential approaches proposed to address them
- Respondent's understanding of the use of granular activated carbon versus ion exchange in Pacific Northwest groundwaters and some initial factors for Tacoma Water to consider.
- Respondent's process for Quality Assurance/Quality Control (QA/QC)
- Conceptual project schedule for completing the consultant services

9.4 Equity in Contracting – 5 points

Proposed teams with certified [Washington State Office of Minority & Women's Business Enterprises](#) will receive five points, these include the following categories:

- ☐ Disadvantaged Business Enterprise (DBE)
- ☐ Minority Business Enterprise (MBE)
- ☐ Minority/Women Business Enterprise (MWBE)
- ☐ Small Business Enterprise (SBE)
- ☐ Women Business Enterprise (WBE)

9.5 Client References – 0 points

References shall be used to verify the accuracy of the information provided by the Respondent, which may affect the rating of the Respondent.

The City reserves the right to contact references other than those submitted by the Respondent. Please provide a list of references in Appendix B (references will not count toward the total page count).

Provide five recent references who may be contacted concerning your firm's performance with regard to the qualifications listed in the SOQ. In listing the references, include the name of the client, contact person, contact person's position, contact person's role on the referenced project, telephone number, email address, and the specific work your firm did for the client.

10. INTERVIEWS / ORAL PRESENTATIONS

An invitation to interview may be extended to Respondents based on SAC review of the written submittals. The SAC reserves the right to adjust scoring based on additional information and/or clarifications provided during interviews. The SAC may determine additional scoring criteria for the interviews following evaluation of written submittals.

The City reserves all rights to begin contract negotiations without conducting interviews.

Respondents must be available to interview within five (5) business days' notice.

If interviews are conducted, the SAC will schedule the interviews using the email address for communications provided on the signature page. Additional interview information will be provided at the time of invitation. At this time, it is anticipated that the main objective of the interview will be for the SAC to meet the project manager and key personnel that will have direct involvement with the project and hear about their relevant experience and expertise. The City does not intend to meet with firm officials unless they are to be directly involved with the project.

11. RESPONSIVENESS

11.1 Respondents agree their submittal is valid until a contract(s) has been executed.

11.2 All submittals will be reviewed by the City to determine compliance with the requirements and instructions specified in this Solicitation. The Respondent is specifically notified that failure to comply with any part of this Solicitation may result in rejection of the submittal as non-responsive. The City reserves the right, in its sole discretion, to waive irregularities deemed immaterial.

11.3 The final selection, if any, will be that submittal which, after review of submissions and potential interviews, in the sole judgement of the City, best meets the requirements set forth in this Solicitation.

12. CONTRACT OBLIGATION

The selected Respondent(s) will be expected to execute a Contract with the City. At a minimum, any contract will incorporate the contents of this specification, including all stated services or deliverables and other requirements and the City of Tacoma Standard Terms and Conditions, together with the contents of Respondent's submittal. The submittal contents of the successful Respondent will become contractual obligations.

13. FORM OF CONTRACT

In event the City's Services Contract or other City Contract template is attached to this RFQ as a sample form of Contract, the City expects to utilize the Terms and Conditions contained in the sample form of Contract. Post award negotiation may occur at the discretion of the City. Respondents should clearly state exceptions to City's Standard Terms and Conditions as well as to the Terms and Conditions contained in any attached sample form of Contract and to any other portions of this RFQ, including the stated Insurance Requirements. Respondents may also propose to utilize their own form of Contract and, in such instances, Respondent must provide its form of Contract as part of its submittal. City, at its sole option, will decide whether to engage in negotiation on any or all proposed exceptions. City reserves sole discretion to determine the final form of Contract that will be used.

14. STANDARD TERMS AND CONDITIONS

City of Tacoma [Standard Terms and Conditions](#) apply.

15. INSURANCE REQUIREMENTS

Successful Respondent will provide proof of and maintain the insurance coverage in the amounts and in the manner specified in the City of Tacoma Insurance Requirements contained in Appendix C.

16. PARTNERSHIPS

The City will allow Respondents to partner in order to respond to this Solicitation. Respondents may team under a Prime Respondent's submittal in order to provide responses to all sections in a single submission; however, each Respondent's participation must be clearly delineated by section. The Prime Respondent will be considered the responding vendor and the responsible party at contract award. Any contract negotiations will be conducted only with the Prime Respondent. All contract payments will be made only to the Prime Respondent.

Any agreements between the Prime Respondent and other companies will not be a part of the agreement between the City and the Prime Respondent. The City reserves the right to select more than one Prime Respondent.

17. COMMITMENT OF FIRM KEY PERSONNEL

The Respondent agrees that key personnel identified in its submittal or during contract negotiations as committed to this project will, in fact, be the key personnel to perform during the life of this contract. Should key personnel become unavailable for any reason, the selected Respondent shall provide suitable replacement personnel, subject to the approval of the City. Substantial organizational or personnel changes within the agency are expected to be communicated immediately. Failure to do so could result in cancellation of the Contract.

18. AWARD

Awardee shall be required to comply with [2 CFR Part 25](#) and obtain a unique entity identifier and/or be registered in the System for Award Management as appropriate.

After the Respondent(s) is selected by the SAC and prior to award, all other Respondents will be notified via email by the Purchasing Division.

Once a finalist (or finalists) has been selected by the SAC, contract negotiations with that finalist will begin, and if a contract is successfully negotiated, it will, if required, be submitted for final approval by the Public Utility Board and/or City Council.

19. SCOPE, BUDGET, AND SCHEDULE

The selected Respondent will meet with the City to review the project scope and timeline. Based on the meeting, the selected Respondent shall submit a draft scope, budget, and project schedule to the City within five (5) business days or as directed by the City's Project Manager. The scope and budget shall include an itemized list of tasks and include estimated hours for the proposed work. The budget shall be supported by a list of hourly rates for personnel to be utilized under this contract.

20. ENVIRONMENTALLY PREFERABLE PROCUREMENT

In accordance with the City's Sustainable Procurement Policy and [Climate Action Plan](#), it is the policy of the City to encourage the use of products or services that help to minimize the environmental and human health impacts of City Operations. Respondents are encouraged to incorporate environmentally preferable products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose. This comparison may consider raw materials acquisition, products, manufacturing, packaging, distribution reuse, operation, maintenance or disposal of the product or service.

The City encourages the use of sustainability practices and desires any awarded contractor(s) to assist in efforts to address such factors when feasible for:

- Durability, reusability, or refillable;
- Pollutant releases, especially persistent bioaccumulative toxins (PBTs), low volatile organic compounds (VOCs), and air quality and stormwater impacts;
- Toxicity of products used;
- Greenhouse gas emissions, including transportation of products and services, and embodied carbon
- Recycled content;
- Energy and water resource efficiency;

21. PROPRIETARY OR CONFIDENTIAL INFORMATION

The Washington State Public Disclosure Act ([RCW 42.56 et seq.](#)) requires public agencies in Washington make public records available for inspection and copying unless they fall within the specified exemptions contained in the Act, or are otherwise privileged. Documents submitted under this RFP shall be considered public records and, with limited exceptions, will be made available for inspection and copying by the public.

Information that is confidential or proprietary must be clearly marked. Further, an index must be provided indicating the affected page number(s) and location(s) of all such identified material. Information not included in said index will not be reviewed for confidentiality or as proprietary before release.

22. ADDENDUMS

In the event it becomes necessary to revise any part of this RFQ, an addendum will be posted alongside specifications at www.tacomapurchasing.org. Failure to acknowledge addendum(s) on the required Signature Page in Appendix B may result in a submittal being deemed non-responsive by the City.

APPENDIX A

BACKGROUND AND ANTICIPATED SCOPE OF WORK

BACKGROUND AND ANTICIPATED SCOPE OF WORK

1. OBJECTIVE

The City of Tacoma (City), Department of Public Utilities, Water Division (Tacoma Water) has measured per- and poly-fluoroalkyl substances (PFAS) in some of its drinking water sources. In March 2023, the United States Environmental Protection Agency (USEPA) published the draft [PFAS National Primary Drinking Water Regulation Rulemaking](#) (PFAS Rule). The proposed rule requires drinking water systems to maintain levels for six PFAS below new Maximum Contaminant Levels (MCLs). At the low MCLs currently proposed within the draft PFAS Rule, Tacoma Water is expected to require PFAS treatment for all or part of its backup supply, the South Tacoma Wellfield sources. To date, there have been no PFAS detections over the reporting limits for Tacoma Water's primary source; the Green River supplies 95 percent or more of Tacoma Water's supply in most years.

Tacoma Water intends to award a contract for engineering consultant support in identifying a proposed strategy for treating PFAS in its drinking water sources, particularly the South Tacoma Wellfield supplies. The project will involve identification and systematic evaluation of alternatives that allow the South Tacoma Wellfield supply to be in compliance with the PFAS Rule and will result in a final recommendation that will serve as the baseline for future design.

2. BACKGROUND

2.1 TACOMA WATER SOURCES

Tacoma Water's primary source is the Green River supply. The Green River Watershed consists of approximately 230 square miles of protected land upstream of the diversion. Water from the North Fork Wellfield, located within the watershed, can replace Green River water at times of the year when the Green River is turbid and groundwater recharge levels allow. The Green River Filtration Facility (GRFF) has capacity to treat up to 150 million gallons per day (MGD) from the Green River or the North Fork Wellfield. Tacoma Water operates its Green River supply to maintain minimum stream flows in the Green River consistent with existing agreements.

Tacoma Water also owns and operates multiple wells in and around the city. Groundwater produced from these wells augments the Green River supply during summer months when peak demands and lower in-stream flows occur. Groundwater is also critical at times when high turbidity, storms, operational issues, or emergencies may limit the Green River supply. In a typical year, these groundwater wells supply approximately 5 percent of total annual water for the system. Figure 1 provides a map of all Tacoma Water's groundwater sources.

There are 24 active wells, one spring source, and several inactive or emergency wells.

Additional information may be found in Sections 4.1, 4.2, 4.5, 5.1, 5.2, and 7.5 of Tacoma Water's [Water System Plan](#).

2.2 SOUTH TACOMA GROUNDWATER FACILITIES

The South Tacoma Wellfield is Tacoma Water's primary groundwater source. The active wells in the wellfield generally extend from approximately 84th Street South to 35th Street South along South Tacoma Way and South Clement Avenue. Table 1 identifies the wells included in the South Tacoma Wellfield and Figure 2 shows the wells and the other South Tacoma Wellfield facilities.

Table 1 South Tacoma Wellfield Wells

Well	Nominal Capacity (MGD)	Address (Approximate)	Status	Aquifer	Entry Point to Distribution	Notes
1B	3.5	3102 S 63rd St	Active	Sea Level	Can feed either HSR or STPS	
2B	2.0	3452 S 35th St	Out of service	Shallow	HSR	Not equipped with pump/motor
2C	2.9	3452 S 35th St	Infrequent use	Deep	HSR	Contains ammonia; requires breakpoint chlorination
3A	4.1	7815 S Warner St	Active	Shallow & Sea Level	STPS when operating; HSR otherwise	
4A	1.3	3816 S Tacoma Way	Infrequent use	Shallow	HSR	Pump/motor purchased in 1931
5A	6.5	3251 S 56th St	Active	Shallow & Sea Level	HSR	
6B	3.9	4331 S Tacoma Way	Active	Shallow	HSR	
7B	1.2	7402 S Cedar St	Out of service	Sea Level	STPS when operating; HSR otherwise	Not currently used due to PFAS levels
8B	4.4	6700 S Clement St	Active	Sea Level	STPS when operating; HSR otherwise	
9A	4.5	3617 S Lawrence St	Active	Shallow	HSR	
10C	0.8	7440 S Cedar St	Out of service	Shallow	STPS when operating; HSR otherwise	Not currently used due to PFAS levels
11A	8.8	4315 S Tacoma Way	Active	Shallow	HSR	
12A	5.0	3542 S Pine St	Active	Shallow	HSR	Air stripping towers onsite
13A	1.1	7420 S Cedar St	Active	Deep	STPS when operating; HSR otherwise	

Wells in the South Tacoma Wellfield do not discharge directly into the distribution system. Each well discharges into the Wells Pipeline, a low-pressure pipeline constructed of concrete, steel, and ductile iron. The Wells Pipeline conveys water from the South Tacoma wells to South Tacoma Pump Station and Hood Street Reservoir; these locations are where the well water is treated and are considered the regulatory compliance points or entry points to distribution.

2.2.1 HOOD STREET RESERVOIR

Hood Street Reservoir is a 10-million-gallon reservoir and serves as the primary entry point for South Tacoma Wellfield water into the distribution system. The reservoir normally feeds the Low Service Zone with Green River water supplied through Pipeline 4; however, if South Tacoma wells are operating, the Wells Pipeline will also feed well water into the reservoir. The well water either blends with Green River water in the reservoir or completely replaces the Green River water, depending upon well production rates. Typically, the Low Service Zone (elevation 251 feet), which is also supplied Green River water from Portland Avenue Reservoir, requires approximately 12 to 15 MGD from Hood Street Reservoir to meet demands with the current industrial customer base. Additional well water (up to 15 MGD) may be pumped into Pipeline 4 and the Gravity Pressure Zone (elevation 581 feet) using Hood Street Pump Station. Well water (approximately 1 to 4 MGD depending on demand that varies seasonally) fed into the Low Service Zone may also be pumped into Northeast Tacoma (elevation 549 feet) using Marine View Pump Station.

Well water treatment at Hood Street Reservoir includes corrosion control with pH adjustment, fluoridation, and disinfection using onsite sodium hypochlorite generators. Before entering Hood Street Reservoir, the well water in the Wells Pipeline is injected with sodium hydroxide, fluorosilicic acid, and sodium hypochlorite. While the treatment systems were designed to treat 40 MGD, actual dosing requirements and system demands typically limit maximum Hood Street well flow rates to 30 to 35 MGD or less.

2.2.2 SOUTH TACOMA PUMP STATION

South Tacoma Pump Station is used during higher demand periods, or if Hood Street Reservoir is offline, to deliver South Tacoma well water to the Gravity Pressure Zone. When the pump station is operating, wells located south of the pump station (3A, 7B, 8B, 10C, and 13A) are automatically directed into the pump station's 0.5-million-gallon basin. Well 1B's discharge line has a modulating valve that sends Well 1B water to either South Tacoma Pump Station or Hood Street Reservoir depending on the level in the pump station basin. When South Tacoma Pump Station is offline, all wells are directed to Hood Street Reservoir. South Tacoma Pump Station has four vertical turbine pumps, which have a total design capacity of approximately 17 MGD to the Gravity Pressure Zone. At this time, not all pumps are functional and pump station capacity is limited. Tacoma Water has a project planned for the 2027/2028 biennium that will rehabilitate all pumps and motors and upgrade electrical equipment.

Well water treatment at South Tacoma Pump Station includes corrosion control with pH adjustment and disinfection using a large-capacity tablet chlorinator. As well water enters the basin beneath the pump station, air is bubbled into the water with diffusers to raise the pH. As the water is pumped out of the basin, calcium hypochlorite is injected.

2.2.3 ADDITIONAL SOUTH TACOMA WELL TREATMENT

Well 12A has five air-stripping towers onsite for removal of volatile organic compounds (VOCs). The towers were installed in the 1980s to remove contamination caused by the Time Oil Superfund site. The air stripping process also has the effect of raising the pH of the water from Well 12A before it flows to Hood Street Reservoir.

Well 2C is located in the Deep Aquifer and the water contains ammonia. Although the well has not been used aside from testing, temporary breakpoint chlorination facilities are in place if the well were to be required in emergency circumstances.

2.2.4 INTERMITTENT USE

While well use can be generally described as seasonal with the majority of production in the summer months, actual well use varies significantly year-to-year and month-to-month. South Tacoma groundwater facilities may be used continuously for four or five months in the summer and fall, as they were in 2015, or they may be used for a handful of days each month throughout the year. Figure 3 and Figure 4 show monthly production at Hood Street Reservoir and South Tacoma Pump Station, respectively, over the last several years.

As evidenced by the monthly production rates, any treatment systems installed for the South Tacoma wells must have the ability to be idled for several months at a time and the ability to be started up within a day or two's notice.

2.2.5 CHANGE IN SYSTEM DEMAND

At the time of advertisement for this Request for Qualifications, Tacoma Water's largest industrial customer suddenly announced closure of its facility in the Low Service Zone. Therefore, much of the historical demand from Hood Street Reservoir will no longer exist. Tacoma Water believes the South Tacoma wells remain critical to retaining system resiliency and reliability; however, some of the operational descriptions detailed in the previous sections may no longer be fully valid by the time this project begins. Tacoma Water will be reevaluating its operations and necessary well capacity going forward.

2.3 OTHER WELLS

In addition to the South Tacoma Wellfield, other wells are available within Tacoma Water's system, as shown in Table 2. At this time, the majority of the other wells do not have corrosion control treatment and, therefore, cannot be used.

Table 2 Other Outlying Wells

Well	Nominal Capacity (MGD)	Address (Approximate)	Entry Point to Distribution	Notes
GPL1 *†	4.6	11302 E Pipeline Rd, Puyallup	Pipeline 4	Design of improvements underway to put back in service
GPL2 *†	3.2	11423 86 th Ave E, Puyallup	Pipeline 4	Design of improvements underway to put back in service
UP1 *†	1.6	3516 Crestview Dr W, University Place	Direct to distribution	
UP10 *†	2.0	9409 48 th St W, University Place	Direct to distribution	Emergency use only
PA1 *†	1.7	3702 E "M" St, Tacoma	Portland Ave Reservoir	
SE2 ‡	0.6	1117 90 th St E, Tacoma	Direct to distribution	
SE6 ‡	0.6	1117 90 th St E, Tacoma	Direct to distribution	
SE8 *†	0.6	1614 99 th St E, Tacoma	Direct to distribution	
SE11 *	1.1	1190 103 rd St E, Tacoma	Direct to distribution	
SE11A *	0.6	1190 103 rd St E, Tacoma	Direct to distribution	
Prairie Ridge Springs *	0.8	13117 Spring Site Rd E, Orting	Pipeline 1	Spring source with horizontal collectors rather than a vertical well

* Does not have corrosion control.

† Out of service.

‡ Only potentially used in unusual circumstances due to operational complications.

A capital project is underway, however, at the Gravity Pipeline Wells in the Puyallup area. These wells, GPL1 and GPL2, pump approximately 9 MGD combined directly into Pipeline 4 to feed the Gravity Pressure Zone. As part of the current project, the pumps and motors for both wells will be replaced, the well buildings will be demolished and replaced, the electrical systems will be upgraded, and corrosion control treatment and onsite sodium hypochlorite generation will be installed. PFAS levels measured in the Gravity Pipeline Wells are just below USEPA's proposed MCLs. Granular Activated Carbon (GAC) treatment is being designed along with the other improvements, but Tacoma Water has not yet decided if or when GAC treatment will be constructed for the Gravity Pipeline Wells.

2.4 WELLS MASTER PLAN

Tacoma Water has developed an [Integrated Resource Plan](#) (IRP) to improve its ability to manage available water supplies, plan for new supplies as needed, and protect stream flow for fish in the Green River.

Based on the Resource Adequacy Standard (RAS), current demand forecast, and Water Yield, Supply, and Demand Model (WYSDM) developed as part of the IRP, Tacoma Water has a goal of approximately 40 MGD of reliable groundwater supply available at all times.

The Wells Master Plan and its Business Case Evaluation (Attachment 1) were developed to determine the most cost-effective alternative for improving groundwater supplies to reach the 40-MGD goal. The Wells Master Plan work included a reliability analysis for each component of each well in Tacoma Water's system and the life cycle costs to harden each well. It was determined that it was most cost-effective to harden – or make improvements to improve reliability for – a small number of wells rather than do the minimum to keep a large number of wells available. Various combinations of wells were considered. The recommended alternative includes making necessary improvements to Wells 1B, 3A, 5A, 6B, 8B, 11A, 12A, 13A, GPL1, and GPL2. In addition, the Hood Street Pump Station, South Tacoma Pump Station, and Marine View Pump Station will also be upgraded to ensure that well water can be distributed throughout multiple pressure zones. Other wells within the system will be mothballed once the recommended improvements are complete.

It is recognized that the PFAS Rule may affect the existing Wells Master Plan recommendation. For example, wells that have higher PFAS concentrations may result in higher life cycle costs that could make other wells more feasible for improvement, or planned upgrades to pump stations may be adjusted to allow for PFAS-related facilities. Improvements to Well 12A are largely complete, a contract hydrogeologist led initial pump testing of the selected wells, and work at Marine View Pump Station is already in progress. In 2023, additional Wells Master Plan work will kick off with cleanout and testing of Wells 6B and 5A, followed by pulling and reinstalling each well's pump, motor, and column pipe. Mechanical equipment will also be renewed or replaced as needed, and electrical gear will be updated. Additional wells are expected to follow in later years.

2.5 PFAS

In 2015, Tacoma Water sampled for six PFAS compounds as part of the Third Unregulated Contaminant Monitoring Rule (UCMR3). With the blended samples and high laboratory minimum reporting levels, no PFAS were detected.

In 2018, Tacoma Water proactively sampled all individual sources for 14 PFAS compounds at the lowest laboratory detection limits available at the time. PFAS were not detected in the Green River or North Fork Wellfield water but were detected in the majority of the backup sources at low levels. Of the wells, only the wells in the Deep Aquifer (Well 2C, 13A, and PA1) had no detections. Two South Tacoma wells (Well 7B and 10C) had PFAS concentrations that were near the EPA's 2016 Health Advisory Level and were voluntarily removed from service at that time.

In 2022, Wells GPL1 and GPL2 were both sampled for PFAS as part of the ongoing design project.

In June and July 2023, Tacoma Water performed another round of comprehensive PFAS source sampling. All sources were sampled individually.

Most active wells were run for approximately one week prior to sampling, while other wells were just run to blow-off or sampled with a portable pump.

Some preliminary results are available; the remainder are expected to be available in September. Results will be used to prepare for the compliance sampling required by Washington State Department of Health (DOH) and for UCMR5, as well as to inform this engineering evaluation.

It is important to note that the investigative samples have been collected from individual sources, but compliance monitoring is required at entry points to distribution. For the South Tacoma wells, any compliance samples will be blended samples collected at Hood Street Reservoir or South Tacoma Pump Station. Likewise, it is important to note that Tacoma Water customers mostly receive all Green River water throughout the year; when they do receive well water, it is typically only a few times a year and well water from multiple wells is typically blended together or with Green River water. Also, when groundwater production from the South Tacoma Wells is less than approximately 15 MGD, most of this water goes to the Low Service Zone in the Tacoma Tideflats, and is primarily used for industrial processes.

PFAS data, including preliminary results from some of the 2023 sampling, are available in Attachment 2.

Tacoma Water has not specifically identified the source(s) of PFAS contamination in its groundwater, although there are known military bases and firefighting training facilities within the vicinity of the wells. Given the industrial makeup of South Tacoma, the presence of a nearby military base with known PFAS contamination, and the ubiquitous nature of PFAS in the environment, finding the specific source of the contamination has not been prioritized and is not expected to be within the scope of this evaluation.

2.6 OTHER WATER QUALITY

A summary of other water quality data for Tacoma Water sources is provided in Attachment 3. As part of the 2023 investigative PFAS sampling, water quality parameters that could impact PFAS treatment were measured. Those data will be provided to the selected consultant, along with other relevant historical data.

3. ANTICIPATED SCOPE OF WORK

A detailed scope of work and budget will be negotiated with the selected Consultant. The scope of work is expected to include, but is not limited to, the following tasks:

- Data Review and Analysis
 - Review existing Tacoma Water PFAS data, source water quality data, and operations data.
 - Consider the effects of various facility operations (i.e., blending at Hood Street Reservoir) on PFAS concentrations at entry points.

- Alternatives Screening
 - Prepare a comprehensive list of potential solutions to meet the requirements of the PFAS Rule and to provide 40 MGD of reliable groundwater supply, focusing on the South Tacoma Wellfield. (*Actual amount of required supply may be adjusted.*)
 - Consider appropriate treatment methods for PFAS removal, to include, at a minimum, granular activated carbon and ion exchange.
 - Consider alternative configurations for PFAS treatment facilities within South Tacoma and potential locations for such facilities (both Tacoma Water property and other potential sites).
 - Consider operational solutions to remain in compliance without building treatment.
 - Document why specific alternatives were not considered further.
- Detailed Development of Top Alternatives
 - Further develop the most feasible alternatives to understand details such as the following:
 - Equipment sizing
 - Required footprints
 - Effects on operations, groundwater pump station needs, and system hydraulics
 - Required modifications to existing facilities
 - O&M requirements, including potential media change-out and disposal of backwash water
 - Means of maintaining PFAS treatment system under the infrequent use conditions of the South Tacoma Wells
 - Potential land acquisition, zoning, or permitting issues
 - Work with Tacoma Water to incorporate top alternatives into the Wells Master Plan and to inform one another.
 - Prepare life-cycle costs for the most feasible alternatives.
- Decision-making Support
 - Provide appropriate tools and/or facilitation to support Tacoma Water in evaluating costs and benefits and in selecting a preferred alternative.

- Media Selection
 - Support Tacoma Water in performing appropriate modeling, bench-scale testing (i.e., rapid small-scale column test), and/or pilot testing to (1) adequately select specific media for PFAS treatment and (2) obtain DOH regulatory approval for the selected alternative.
- Green River Filtration Facility Master Planning
 - Perform a high-level review of the GRFF source water, treatment processes, and facility layout and document the following:
 - If PFAS were to be detected in the Green River supply at levels that required treatment at some point in the future, what PFAS treatment method would most likely be installed?
 - Rough sizing and necessary footprint for the likely treatment process
 - Order-of-magnitude cost estimate for the likely treatment process
- Additional Support
 - Technical Communication Planning
 - Support Tacoma Water in potential public outreach or policymaker presentations by preparing understandable graphics and talking points about the project.
 - Funding
 - Support Tacoma Water in identifying grant and loan opportunities for funding this work and in understanding potential associated requirements.
- Final Report
 - Prepare a final report documenting the recommended alternative. The report should clearly lay out the following:
 - High-level strategy for managing PFAS in the South Tacoma Wells, which will serve as a baseline for the future design.
 - Budgetary cost estimate.
 - Implementation plan, including planning for the following:
 - Equipment and media procurement
 - Permitting issues
 - Property management, land acquisition, and zoning issues
 - Timeline and strategy for compliance with PFAS Rule

- Contingency strategy for supplementing recommended alternative if PFAS regulations become more stringent in future

4. ANTICIPATED IMPLEMENTATION SCHEDULE

The overall schedule for PFAS treatment implementation will depend on the scope of work negotiated with the selected consultant and the final compliance date and extension allowances set by USEPA and DOH; however, Tacoma Water expects to base capital budgeting on the rough schedule provided in Table 3.

Table 3 Anticipated Schedule of Activities

Time Period	Anticipated Activity
Remainder of 2023	Negotiate and execute consultant contract
<i>By end of 2023</i>	<i>PFAS Rule finalized by EPA</i>
2024	Complete work covered by this RFQ
Early 2025	Issue RFQ and hire engineering consultant to perform design and services during construction
2025 – 2027	Complete design, permitting, land acquisition
<i>Beginning of 2027</i>	<i>Compliance with PFAS Rule required</i>
2028 – 2029	Construct and start up new facilities
<i>Beginning of 2029</i>	<i>Compliance with PFAS Rule required, if 2-year extension allowed</i>

If new treatment facilities are required and are not in operation by the time compliance with the PFAS Rule is required (assumed to be 2029), Tacoma Water anticipates limiting well operations in the interim to maintain PFAS levels below the MCLs.

Figure 4-2. Tacoma Water Groundwater Sources

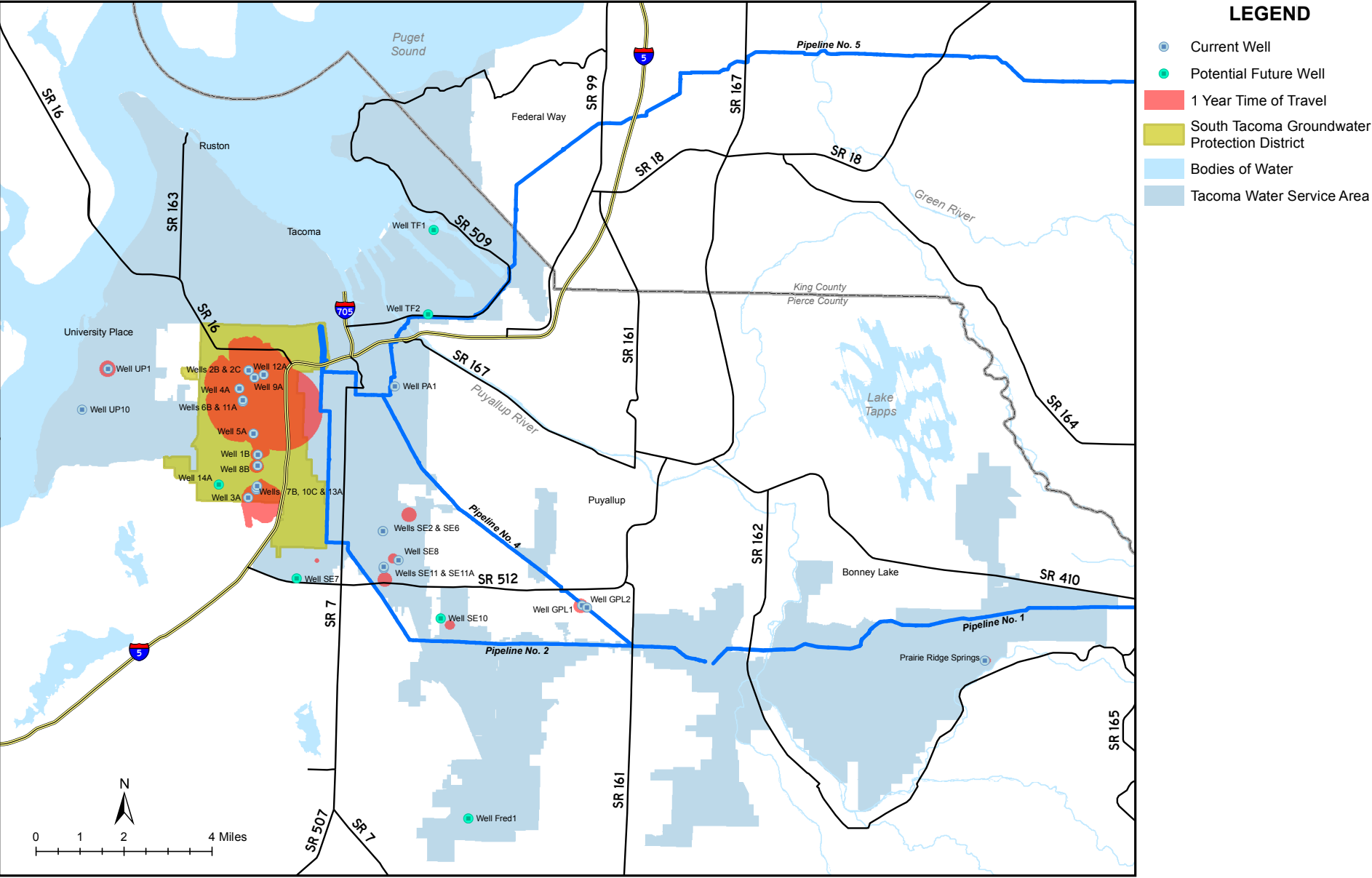
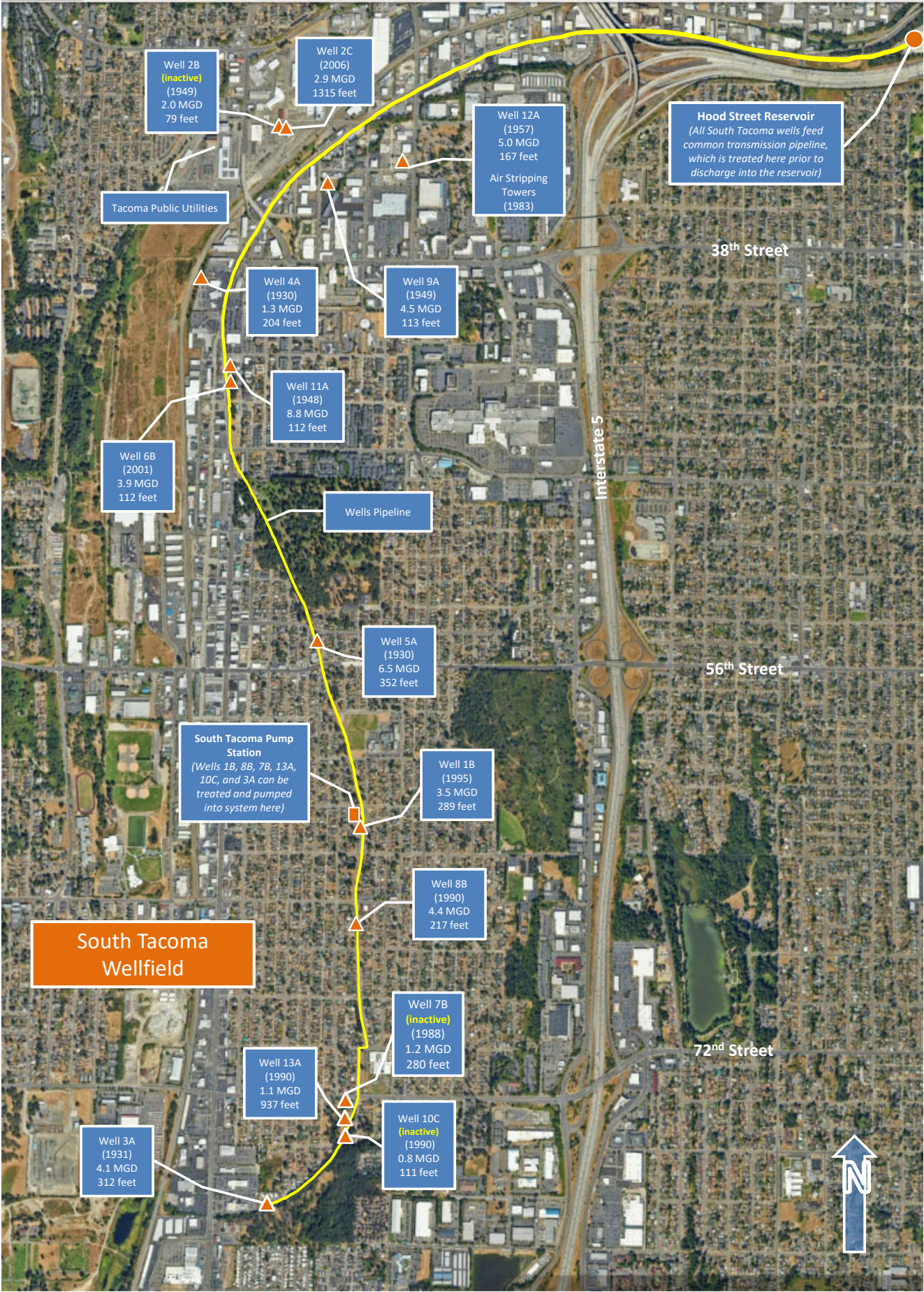
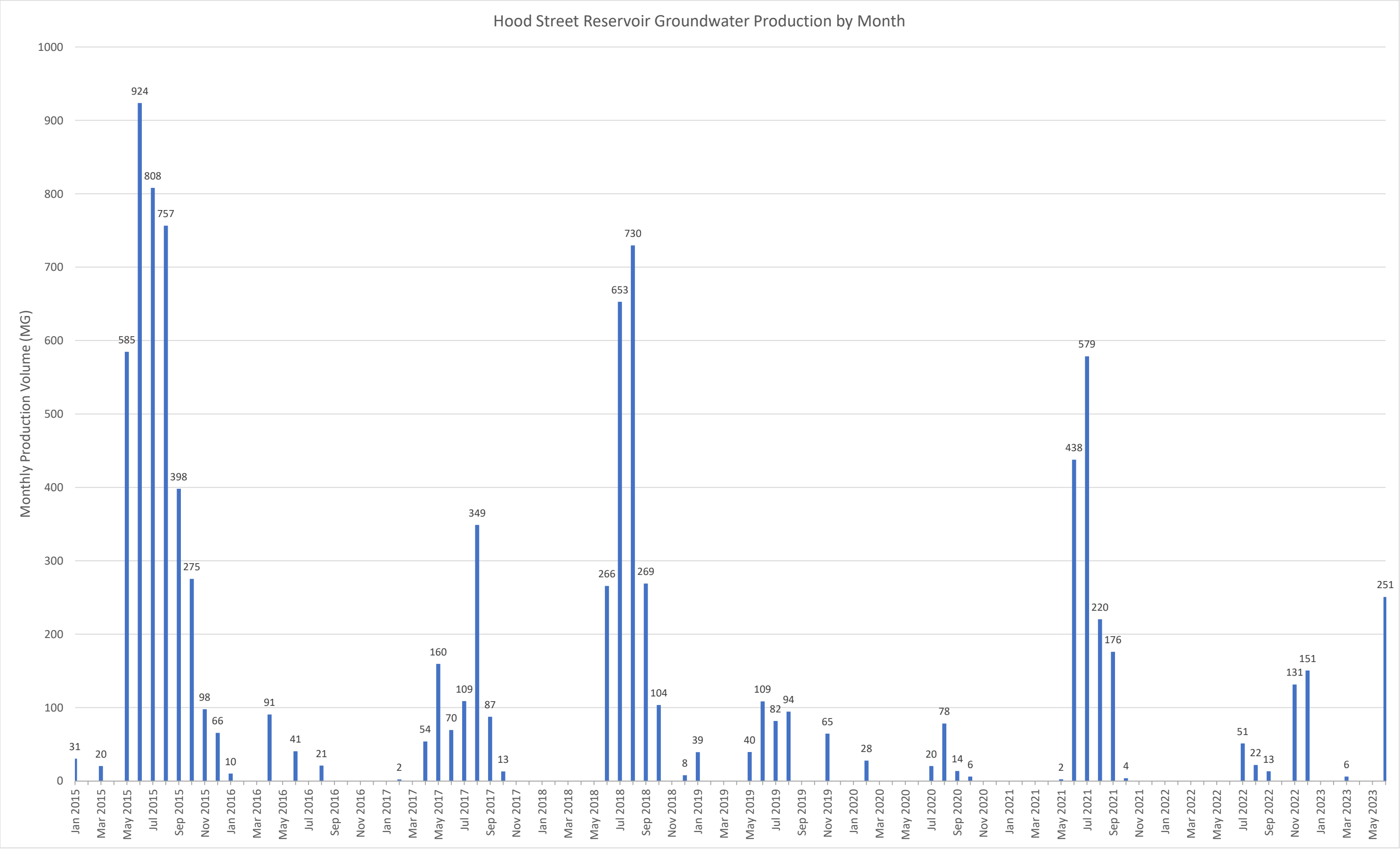
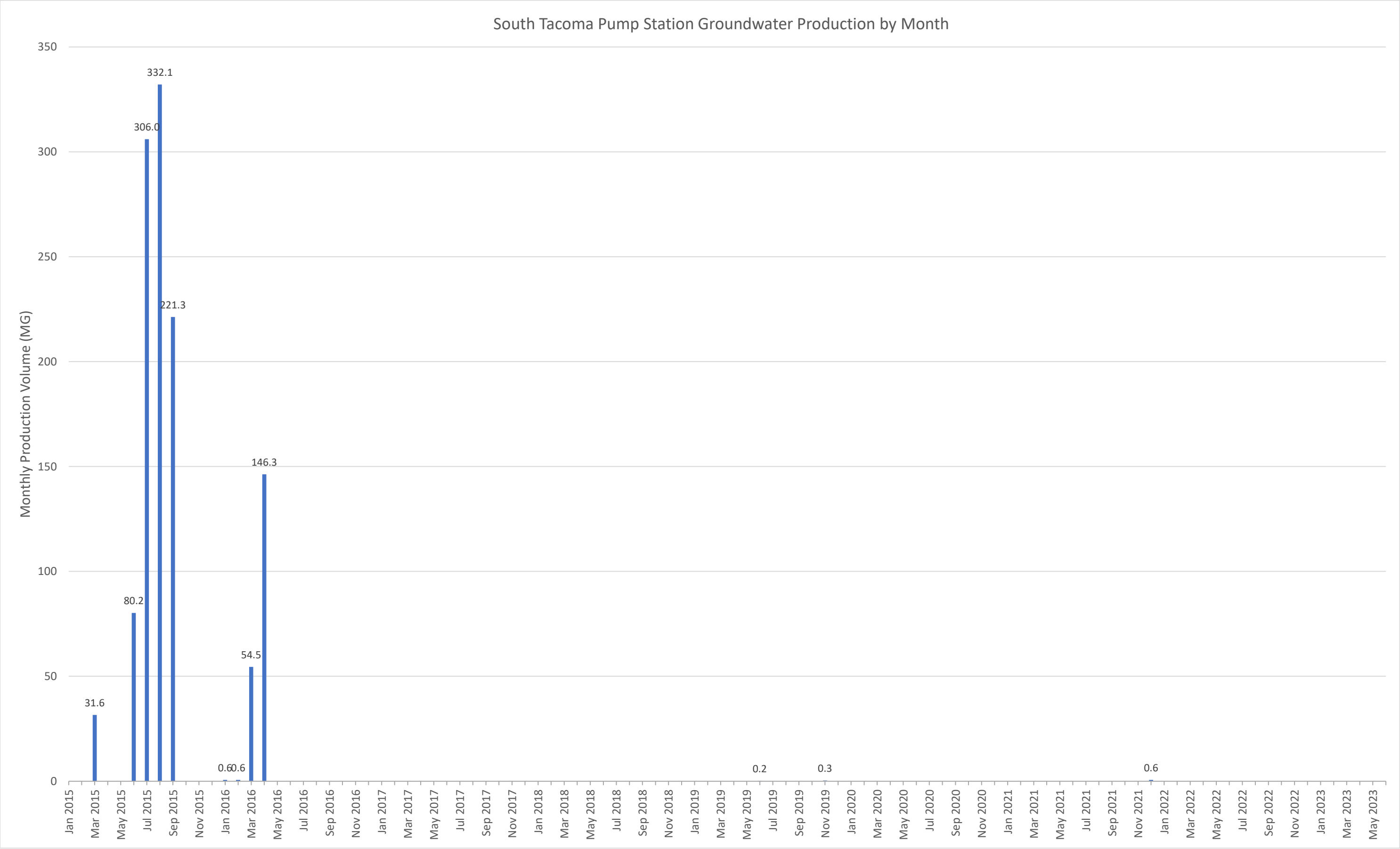


Figure 2







TO: Shannon Wall, Planning & Engineering Section Manager

FROM: Jason Moline, P&E / Water Resources Professional Engineer
Glen George, P&E / Water Resources Supervisor

SUBJECT: Wells Master Plan

DATE: April 10, 2020

1. INTRODUCTION

Changing conditions have decreased the frequency of needing groundwater, and also put more restrictions on use of wells. Changes include the following:

- Reduced demand since the 1980s,
- VOCs from the Time Oil Superfund Site (12A blowers installed 1983),
- Municipal storage behind Howard Hanson Dam (since 2005),
- Reduced finished water storage (McMillin covered 2012),
- Filtration allowing more use of turbid river water during storms (completed 2015),
- Corrosion control added at Hood Street and South Tacoma Pump Stations (2016),
- Minimum pH requirement from DOH prevents use of most outlying wells (2018), and
- PFAS sampling (10C taken out of service 2018).

This has inadvertently led to deferred investment, and to many facilities with equipment well past its expected design life. There is reluctance to add treatment to facilities that are rarely used and have substandard pumping equipment, as well as hesitation to replace non-functional equipment at wells that lack the treatment facilities to meet current water quality standards.

Nevertheless, groundwater is still needed to help Tacoma guarantee minimum flow in the Green River at Auburn, per the 1995 agreement with the Muckleshoot Tribe. Keeping wells available also helps maintain water rights, provide resilience, address reduced availability of surface water due to climate change, and accommodate growth.

In response to the above, as well as to concerns raised by field staff about the deteriorating conditions of the wells, a process was developed to quantify Tacoma Water's groundwater needs and meet these in the most cost-effective way.

2. DEMAND AND SUPPLY TRENDS

Demand has declined 30-35% since the peak in the 1980s, and is expected to be more or less flat in the foreseeable future. Despite increasing population, demand is projected to continue to trend slightly downward, until picking up again somewhat after a couple decades.

Before Pipeline 5, during the summer Tacoma Water would often flow as much Green River water as possible down Pipeline 1 under the First Diversion Water Right. Any additional demand would be met by running in-town wells. Since 2005, municipal storage behind Howard Hanson Dam (HHD) has been available during the dry season. This has led to less exercise of the wells recently.

Also, high river turbidity used to sometimes result in increased use of in-town groundwater wells. The first storms during the fall could bring high river turbidity, prior recharge of the North Fork aquifer by rain. This resulted in a temporary reduction in flow from Headworks and a shift to in-town groundwater wells. Today, the Green River Filtration Facility can remove excess turbidity from the diverted surface water, so it is no longer necessary to run wells during autumn.

3. GREEN RIVER INSTREAM FLOWS

Groundwater is used on a seasonal basis rather than continuously. Tacoma Water's wells typically supply approximately 5% of total annual water requirements, usually for summer peaking and to help maintain Green River minimum instream flows.

Wells are less affected by droughts than are river flows, so the wells add valuable diversity to the sources available to Tacoma. The wells provide a critical supplement and backup water supply to meet demands that cannot be met from the Green River system.

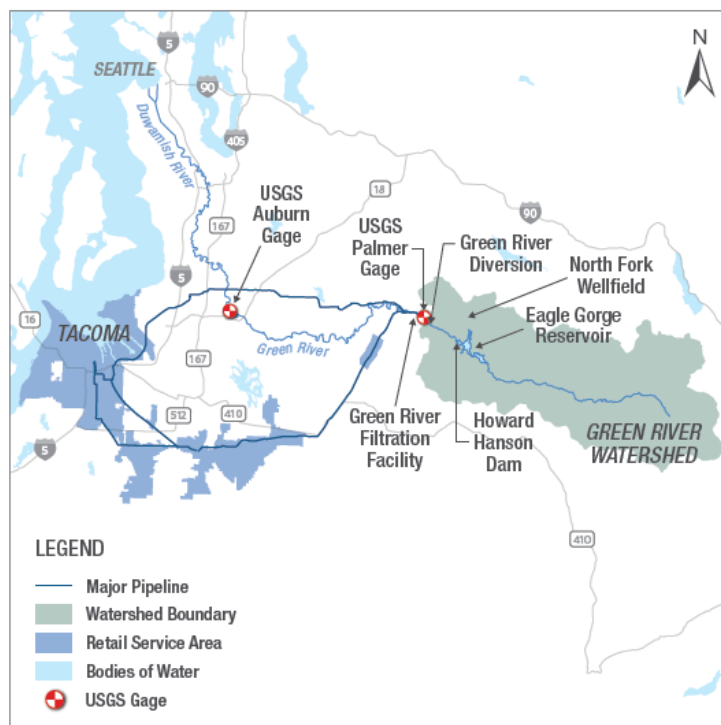
Historically, significant droughts have occurred in roughly 1 of every 25 years. The infrequent nature complicates the response, in part because the regulatory environment has changed and staff has turned over between events.

3.1. Low Probability but High Consequence Event

Groundwater is not required in non-drought years, and is used primarily during this time only to reduce flow changes at the river diversion. This is due to additional surface water supplies brought online 14 years ago from the Second Diversion Water Right (SDWR) and the Additional Water Storage Project (AWSP).

The Muckleshoot Agreement states, "TPU shall provide...guaranteed continuous instream flows...in the Green River as measured at the Auburn gage". Typically this is 250 cfs, but it may be reduced to 225 cfs 30 days after meeting with the resource agencies and, at a minimum, instituting water use restrictions.

The Army Corps of Engineers (Corps) releases water from their 24 kAF portion of the storage behind HHD (that is, in what is known as Eagle Gorge Reservoir) to maintain at least 110 cfs upstream at Palmer. The Corps has stated the operation of the dam is designed to protect against a drought that has a probability of occurrence of 1 in 50 years, or reliable in 98% of years on average.



Dry conditions in the middle and upper Green River result in Tacoma having to use its share of municipal storage (currently 4 kAF, excluding the Partners) from behind HHD, and/or reducing its diversion, to supplement augmentation for Auburn. In 2016, Tacoma used approximately 62% (2,563 AF) of its municipal storage to maintain the Auburn gage, in addition to what the Corps released for Palmer from a separate portion of the storage behind HHD. This could become a more serious problem if any issues prevented the Corps from storing a full summer pool, or caused them to evacuate the pool early.

Tacoma Water is different from many utilities (including Seattle, Everett, and Portland) that rely on surface water because the primary purpose of our raw water reservoir is for the Corps to provide seasonal flood control. It is completely emptied each fall in preparation for potential flooding typically starting in November and continuing into February, and refilled each spring after flood season has passed. Many utilities monitor reservoir level as an indicator of the severity of a drought, but this is not a viable option for Tacoma. The Corps typically tries to empty the pool by November 1, although Corps staff has indicated they would hold onto some storage longer if continued dry conditions were forecast. If dry weather continued or returned in the days or weeks after the reservoir was emptied, then Tacoma could potentially be left without a source of surface water.

The Green River Flow Management Committee (GRFMC) brings together multiple stakeholders (Corps, Muckleshoot, King County, Tacoma Water, Washington State Department of Ecology, NOAA Fisheries, U.S. Fish and Wildlife Service, and Washington State Department of Fish and Wildlife) to manage HHD. The Corps operates and regulates the dam, and makes decisions with input from the committee. The adaptive management approach offers flexibility to use water in ways that maximizes benefits for all. However, this complicates modeling because the parameters of river water usage could change over a short time frame.

Some extra water should be reserved during a drought as a safety factor to make sure both customer demand and instream flow obligations can be met given future uncertainty, although there is not necessarily a uniform standard in the utility industry for how to quantify this. Tacoma Water is using drought indicators, spreadsheets, and system yield modeling to manage risk.

Typically, to avoid customer confusion, any curtailment or other temporary demand reduction messaging is done in partnership with the major utilities in the area (including Seattle and Everett). There is more flexibility for individual utilities to acquire temporary additional supply sources as each deems necessary.

The unpredictability of severe drought events, the seasonal loss of reservoir storage, and the changeable obligations of instream flow commitments all combine to emphasize the importance of maintaining a readily available groundwater supply.

3.2. 2015 Drought

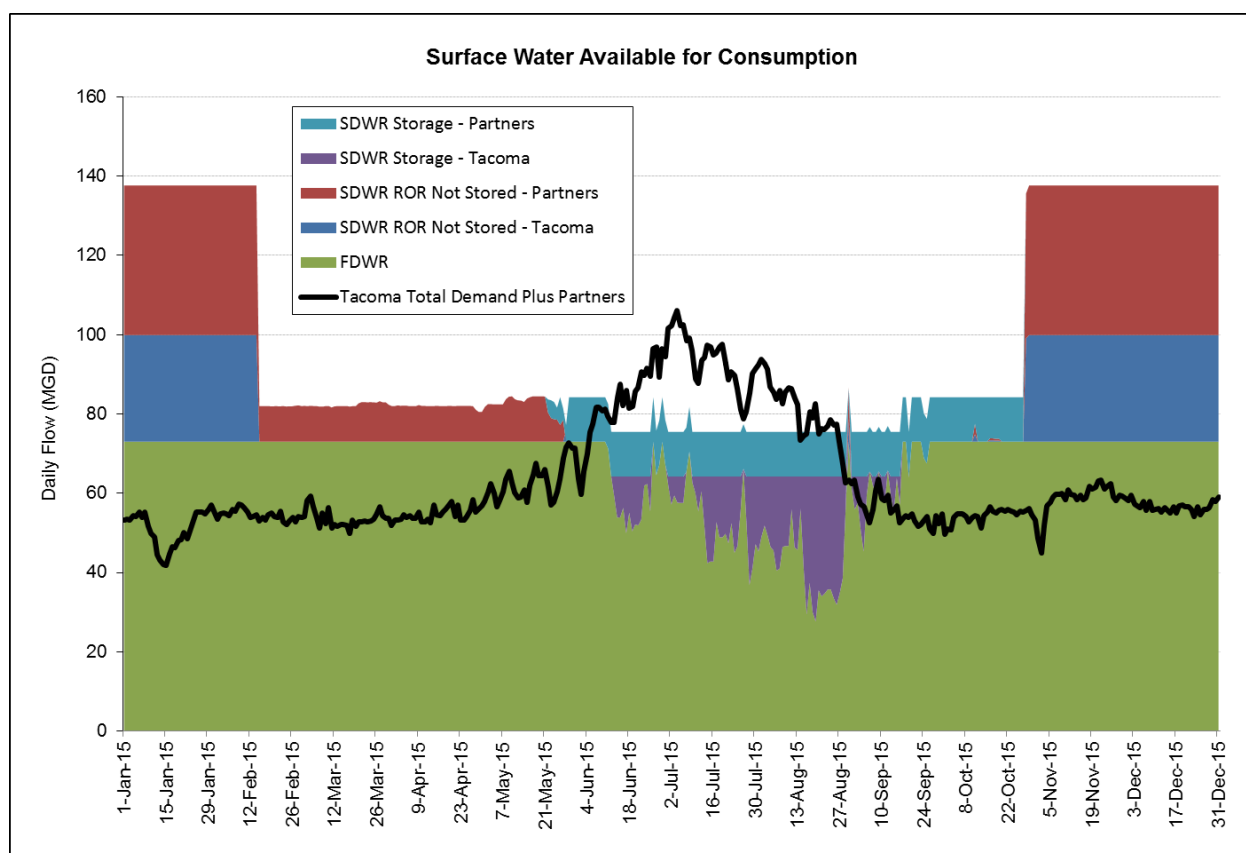
In 2015, Tacoma Water started running 20-30 MGD of groundwater in May. Even though the First Diversion Water Right was available, this was done to accelerate refill behind HHD during the spring, as well as to be a good neighbor for the other stakeholders. To minimize the diversion from the Green River, engineers and mechanics at Tacoma Water worked with outside vendors to get groundwater production up to a maximum daily average of approximately 45 MGD. Wells were turned off in October once the fall rains returned.

Due to the effort required to maintain sufficient well production in 2015, there are concerns about the availability and the reliability of the groundwater system to fully meet demand if surface water supply is limited. (Note that reliability is defined as the probability that a system is available – not failed or undergoing repair – to perform a required function under stated operating conditions when needed. For example, a system could be 80% available but still 100% reliable, because that 20% downtime was planned in advance to occur when the equipment was not needed.)

In addition, approximately 448 AF (146 MG) of groundwater from Lakehaven's wells was purchased for about \$367 thousand. Moving the groundwater into Tacoma's system required a partial shutdown of Pipeline 5, needed to be held essentially constant, and was limited by demand from 356th Pump Station (1 MGD to Northeast Tacoma / Indian Hill Reservoir in September) and Auburn (3 MGD wholesale). Additional piping was installed at 356th in 2017 so water from Lakehaven could now be obtained without operating valves on Pipeline 5.

Also in 2015, approximately 782 AF (255 MG) of Lakehaven's water stored behind HHD was purchased for just over \$170 thousand. A pump system was temporarily installed at Eagle Lake as well, which is estimated to have put an extra 1000 AF (28 cfs for 19 days in early fall) into the Green River.

The graph below shows actual demand (black line) in 2015. Available surface water (areas filled with color) is also shown; note this is different than the surface water actually used. The white area under the black line is the demand that needed to be met with in-town groundwater or other supplies. The total volume of water from in-town wells and purchased sources was significantly greater than this, in part because at the time we did not know when the fall rains would return and make more water available.



3.3. 1987 Drought

An extended dry fall occurred in 1987. Recurrence of this scenario is one of the highest risk situations that Tacoma Water has identified.

The drought of 1987 resulted in the following operational impacts:

- Reservoir behind HHD only refilled to 75% of normal due to dry spring weather
- Tacoma diversion reduced to 71 mgd (September 1)
- Tacoma diversion reduced to 61 mgd (September 25)
- Tacoma diversion reduced to 48 mgd (October 2)

- Tacoma imposed mandatory water use restrictions (October 15 to December 5)
- Tacoma diversion reduced to 29 mgd (October 18)
- Simpson (now WestRock) mill shutdown (October 20 to October 26)
- Simpson mill operated at reduced flow (October 27 to November 15)
- Water pumped from Eagle Lake into the Green River (October 16 to November 20)
- Tacoma purchased water from other utilities (November 4 to November 18)
- Tacoma diversion reduced to 24 mgd (November 13)
 - Net use of river by Tacoma as low as 4 mgd, including Eagle Lake
 - Instream flow at Palmer as low as 60 cfs (normally minimum 110 cfs)
- HHD returned to flood control operation (December 11)

3.4. Impacts from Others

The Green River continues to be valued for fish habitat; substantial efforts have been made to preserve and restore it. The Muckleshoot Tribe and King County Department of Natural Resources especially continue to be very interested in management of the river. There has been talk about possibly managing temperatures in the river for fisheries in the future. However, as documented in chapters 4 and 5 of the Habitat Conservation Plan, permanent changes have been made in the past by others to redirect and develop the drainage basin. This complicates replication of historic river conditions.

The combined diversions of the White and Black Rivers (see Appendix C) reduced summer flows to roughly 30 percent or less of their historical magnitude within the lower Green / Duwamish River basin. The diversion in 1906 of the White River (via what used to be known as the Stuck River near Game Farm Park in Auburn) into the Puyallup River, which improved flood control for King County, caused a loss of approximately 50 percent of the inflow to the Green/Duwamish estuary.

The Black River (near Fort Dent Park in Tukwila) used to connect the outlet of Lake Washington and the Cedar River to the Green River. This changed in 1916, by construction of the Ship Canal/Ballard Locks and associated lowering of the water level in Lake Washington. The Cedar River was also diverted into the lake to provide flows for the locks.

The current practice of donating half the municipal storage (for Tacoma and the 3 Partners) from behind HHD in lieu of downstream fish passage at this dam for instream flow augmentation helps counter these structural flow reductions now. Most of this water has typically been used when Chinook salmon return for spawning season, generally in mid-September to mid-October. Once the Corps completes fish passage, which is projected to occur in 2032, this “flexible” water used by the Muckleshoot and resource agencies could decrease from 15 kAF to 5 AF, if Tacoma and the Partners consumptively use all the water they can access.

Furthermore, the lower Green River basin has undergone extensive urbanization, and the former meandering channel has been extensively straightened. The Lower Duwamish was declared a Superfund site in 2001, and is undergoing a cleanup estimated to cost \$342 million. The middle basin is currently in the process of conversion from agricultural to urban land use, which could impact the local inflows downstream of Palmer that help Tacoma meet the instream flow obligation at Auburn. Over 97 percent of the lower Green/Duwamish estuary has been filled and developed.

Tacoma Water is not the only party diverting water from the Green River. There are more than 6,000 water rights and claims on file with Ecology for ground and surface water within the Green River basin, with a large number located within the Big Soos and Newaukum subbasins (that is, upstream of the Auburn gage). Although some groundwater is pumped from deep aquifers, other groundwater comes from shallow water tables that are connected directly to streams, and may be over-appropriated.

4. WATER QUALITY

Concerns over VOCs and PFAS, along with updated corrosion control requirements means Tacoma must revise the way it utilizes groundwater. Some well sources have become generally unusable unless additional treatment is added.

4.1. Contamination

For over 20 years, Tacoma Water has maintained a policy for the operation of six wells in South Tacoma. Well 12A must be operated during sustained usage of any of the five nearby large capacity wells (2B, 4A, 6B, 9A, and 11A). There is evidence of volatile organic compounds (VOCs including PCA, DCE, TCE, and PCE) from previous industrial activities in the area of Well 12A. Air stripping towers were added to Well 12A in 1983 to remove the VOCs from the water. This policy addresses the concern that the plume of VOCs could migrate toward the other wells (listed above) while they are in service. If 12A is not operating, the total capacity of all six wells is lost (up to 25 MGD).

The VOCs are primarily from the former Time Oil site (3011 S Fife St), which has been undergoing Superfund cleanup since 1983. This has achieved an 87.5% reduction of the 6 primary VOCs at the site. EPA is currently evaluating the success of the remedy, and plans to transfer the Site to the State of Washington for long-term operation and maintenance.

In addition, Well 10C has been removed from service due to elevated PFAS (perfluoroalkyl substances) levels. This is a relatively small and shallow well. However, future regulations to lower PFAS limits could affect the viability of other nearby wells, such as 7B. The contamination may have spread from past fire-fighting exercises at nearby Joint Base Lewis-McChord (JBLM) or other fire-fighting training facilities in the area.

4.2. Corrosion Control

Following a corrosion control study by HDR for Tacoma Water, the Washington State Department of Health implemented minimum pH requirements in September 2018. The specifics are listed below.

- GRFF
 - Minimum daily average pH > 8.2,
 - Minimum daily average alkalinity > 20 mg/L CaCO₃
- All In-town Wells – Minimum daily average pH > 7.4
- All Tap Samples – Minimum pH > 7.2

These rules are intended to address chemistry changes that impact service lines and household plumbing when switching between surface water and groundwater. The result is to further improve the utility's continued compliance with the Lead and Copper Rule, and reduce potential lead exposure to its customers.

These more stringent requirements normally prevent many wells from being utilized until corrosion control treatment is installed, although it has been suggested a temporary waiver might be granted by the state if there were exceptional circumstances. Such equipment was estimated to cost between \$170 thousand to \$1 million (approximately) per site.

4.3. Summer Peaking

Groundwater has historically been used to offset peak demand. Demand can vary by 15-20 MGD during a 7-day period, typically due to relatively dramatic shifts between hot/sunny and cool/wet weather. The availability of smart controllers for sprinkler systems has helped conserve water, but can make this variation even more abrupt. Daily demand is often difficult to predict, especially given the lack of a standardized tool, inaccuracies of weather forecasts, weather differences within the service area, and variable wholesale use.

Historically, large open reservoirs such as McMillin, Portland Avenue, North End, and Hood Street have helped buffer the changes. When all three open basins were online at McMillin (210 MG total), it was much easier to use reservoir storage to meet varying demand. The two new tanks (68 MG total) at McMillin (although these avoid rechlorination and are much better for protecting water quality) do not allow as much of this. Additionally, excess water sometimes spilled from McMillin Reservoir into the Puyallup River until around the 1970s, which was another way of temporarily trimming supply to match demand when needed.

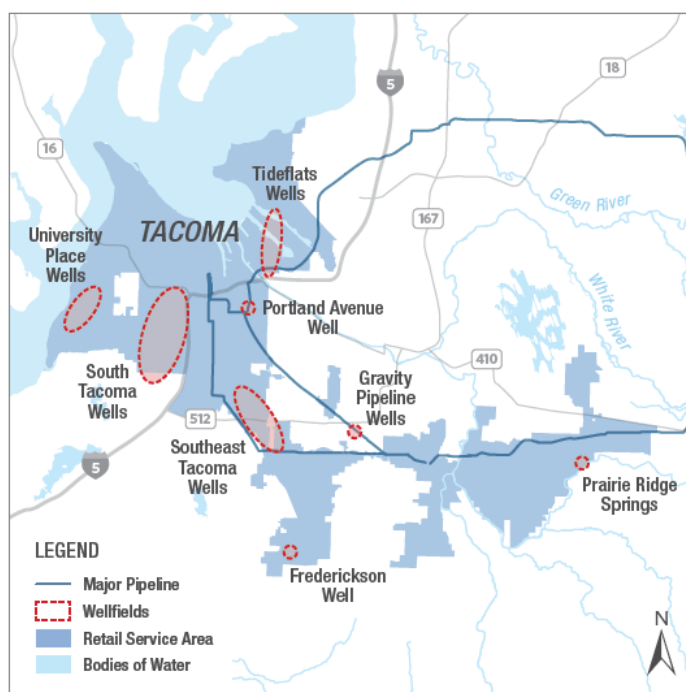
During the summer, Tacoma schedules its river diversion with the Corps so they can release the correct amount of water from HHD. This supplies Second Diversion storage to our intake downstream, and maintains instream flows. Given the need for staff at HHD to make gate adjustments, the Corps prefers for Tacoma to limit flow change requests to once or twice a week. There may also be a lag time between making a schedule change and then a pipeline change, as during low flows it may take up to a day for a change in release from the dam to show up approximately 32 miles downriver at Auburn.

Water Control Center operators used to be more empowered to regularly start and stop wells as needed to respond in real time to changes in customer demand. This has become more complicated since the caustic soda injection system now used for corrosion control at Hood Street must be manually adjusted when a well is started. River water backs up into the Wells Line when wells are off, and each well requires a different dose. This becomes much less of an issue once multiple wells are running.

There has not been an on-call water quality mechanic, which makes it difficult to start wells on nights or weekends, even in an emergency. Perhaps modifications could be made at Hood Street to resolve this issue. An alternative strategy could be to run 2 wells or more continuously during the summer, which would simplify dosing at Hood Street by providing more consistent raw groundwater, but this would result in higher costs, especially for power and labor. It could also complicate perfection of the SDWR, which involves demonstrating full use to Department of Ecology so the temporary water right permit can be converted to a more permanent certificate.

5. WATER RIGHTS AND RESILIENCE

Through system acquisition, Tacoma Water has inherited water rights in the University Place, Southeast Tacoma, and Dash Point areas. These are shown in the figure below and in Appendix D. New water rights are generally not available.



In some cases, Tacoma Water wells have not yet been fully developed to utilize the individual water rights associated with the various sources of supply. Several water right permits (Fred1, 14A, TF2) are in danger of lapsing if not extended, or the wells constructed and put into use. Extensions are good for 5 years, but some of these have had multiple extensions, so it may be more difficult to keep getting extended without some evidence of progress.

The Vulnerability Assessment discusses how a large earthquake has the potential to sever Pipelines 1 and 5, potentially leaving some customers out of service for months in a worse case event. Should that occur, in town groundwater wells could be a way to restore service sooner, if power (or generators) and an intact distribution system are available.

6. WATER YIELD SUPPLY AND DEMAND MODEL

In an effort to better understand and quantify available supplies and drought resilience, Tacoma Water recently partnered with HDR Engineering to create an Integrated Resource Plan (IRP). Approximately \$1 million was invested in this effort, including contracts with two external firms and loaded internal labor. Much of the expense was to develop a Water Yield and Demand Model (WYSDM) that could be used in the future by Tacoma Water for both calculation of firm yield and better quantifying drought management.

6.1. Platform

WYSDM uses RiverWare software, which is a decision support platform developed by the University of Colorado. The software is widely used in the western United States by the Corps of Engineers, Bureau of Reclamation, Bonneville Power Administration, many electric utilities, multiple water utilities, and others.

Bill Zimmerman of Tacoma Water completed a demand forecast in 2015 that was used in WYSDM.

HDR obtained climate change data from the University of Washington Climate Impacts Group (CIG), who was working in conjunction with King County Department of Natural Resources and Parks. Based on the central tendency from 10 climate change models, surface water yield is predicted to decline on the order of 18% between 2018 and 2050.

Two engineers from Tacoma Water were sent to RiverWare training. HDR also built a Graphical User Interface (GUI) to simplify use of the model by Tacoma Water. The current contract amendment with HDR was made to allow some relatively minor improvements to the model to improve some of the details, as well as its usefulness and usability.

6.2. Assumptions

The Public Advisory Committee for the Integrated Resource Plan agreed to a Resource Adequacy Standard of mandatory curtailment in 1 of 25 years, on average. When running the model, to allow a safety factor that provides for future uncertainty during a drought, the minimum well use that allows maximum system reliability (typically 0 or 1 voluntary curtailments in 25 years) was assumed for design. When the model runs, it goes through each year at a time using predetermined rules, and determines the frequency and volume of any deficit. However, in the middle of a drought, a utility must consider trends and forecasts, and take proactive steps to ensure both demands and instream flows are met continuously.

A number of additional assumptions need to be input to the model. Overall, it is felt that these represent a reasonable future. Keep in mind, the intent is to rerun the model periodically going forward, to adjust as conditions change. More specifics are listed below.

1. Central tendency climate changes (not best or worst case)
2. Most likely forecast of population
3. Run wells for continuously for 6 months July-December
4. No HHD Fish Passage Facility (AWSP Phase I not complete)
5. 30 MG of reservoir storage can be used for peak day
6. Annual shortage >400 MG = mandatory curtailment
7. 14 MGD Partners (matches actual in 2017)
8. 10 MGD wholesale (5 MGD actual in 2015)
9. No change in demand from WestRock

The model assumes all available wells will be started in July, and kept running continuously through December. Typically, it is only during a drought, and in the summer and fall, that there is a potential for minimum instream flows to not be readily met with natural inflows. The model will trim back well production if demand is less than that day.

Overall, this is a reasonable approximation for groundwater, although in practice some deviations are likely. As in 2015, some wells would likely be started earlier during a dry spring, to help preserve instream flows during refill and cooperate with the GRFMC. Also, in this event, a minimum use of surface water, perhaps 30 or 40 MGD, would generally be maintained to avoid problems with chemical feed systems at low flows.

6.3. Results

As shown in Appendix A, the model runs indicate approximately 40 MGD of reliable in-town wells are needed by 2024. Although using the central tendency climate change model indicates 37 MGD would be sufficient, this was rounded up to 40 MGD in light of the results from using other climate change models.

This timeline was used to allow sometime to make the improvements. Coincidentally, this value is close to the average daily demand without the Partners and WestRock of approximately 37 MGD over the last 10 years. It is also close to the winter demand without the Partners of approximately 44 MGD.

Note that this reliable wells number should be increased by a safety factor to determine the number. A tech memo from HDR assumes a 15% backup capacity is typical. For example, using this assumption, 40 MGD of reliable wells would mean 47 MGD of wells nominally “available”.

During a drought, there will inevitably be pressure from stakeholders to keep more water in the river, largely through additional curtailment and use of groundwater. Although unlikely, there is also a possibility of an extreme variation in weather that could stretch the system beyond the design parameters. However, the 40 MGD number was developed by considering the rules in a logical way, and is thought to be adequate. Setting a groundwater target will simplify drought management and avoid having to worry about “last minute” repairs during a drought, when vendors are already busy and may be more expensive to get under contract.

6.4. Future

Looking out another 5 years, to 2029, the central tendency climate change model indicates approximately 4 MGD more groundwater will be needed

With future population growth and climate change, the model is indicating approximately 55 MGD of reliable wells will be needed by 2070. This is as far out as WYSDM is set up to model. On average, approximately 1 MGD will need to be added every 3 years between now and then.

However, these additional improvements may not be necessary if other system improvements are made, such as completion of AWSP Phase I (construction by the Corps of downstream fish passage at HHD, and elimination of the donation of half the municipal storage). Changes in future conservation trends or to existing large industrial customers also have the potential to reduce demand in the future. Climate change, population, economic, and land use (urban vs. suburban) trends also require some rather speculative assumptions. The intent is for WYSDM to be continuously updated to keep current with these system yields and requirements.

The [Water Utility Climate Alliance](#) (which includes Seattle Public Utilities, Portland Water Bureau, and several other large utilities) talks about planning for future water supplies being an example of Decision Making under Deep Uncertainty (DMDU). It is important to consider multiple possible futures, rather than just one optimal plan designed for a single, best-estimate future. It is easy to find supply planning documents from decades ago and multiple utilities that were built on assumptions that turned out to not be true. Eventually there are diminishing returns in taking more time to polish the numbers and pull in the latest methods. Being flexible and adaptive in real time, and taking low regret (low and moderate cost) measures, are some ways to manage long-term risks.

7. RELIABILITY AND COST EFFECTIVENESS ANALYSIS

A comprehensive analysis to our groundwater system is needed. Here is a description of the approach used.

7.1. Method

There are many parts to a well. The reliability of each component at every well was estimated with a letter grade. This simplifies the analysis by putting everything into 1 of 5 “buckets”, and allows the percent reliability associated with each letter grade to be easily changes globally. The scoring is based on documented condition assessments done this year by a team including the electrical group, Wells and Gravity crews, as well as engineers.

An example is below. This scoring considers that at Well 1B, the design capacity of the pump and motor is 4.3 MGD, and the current nominal capacity is 3.5 MGD. Then the scoring reduces the capacity of this well to 1.8 MGD is expected currently. (In other words, the expected flow is reduced to allow for equipment breakdowns, aquifer drawdown, etc. The nominal flow assumes all pumping equipment is fully functional.)

	Electrical	Safety	Pump	Motor	Cable	Aquifer / Screen	Treatment	Building / Seismic	Booster Pumping	Exercise Frequency	Additional Treatment		Overall Average
Grade	C	B	B	B	B	D	B	C	B	B	A	→	C
% Reliability	96	97	97	97	97	74	97	90	97	97	100	→	52

In this and many other cases, no single component seems to represent a large threat of failure. However, when all the possible points of failure are considered together, the overall reliability is more concerning.

The spreadsheet considers both initial capital and life cycle costs, and divides each by both instantaneous flow (Q_i in MGD) and annual volume (Q_a in AF). All 4 of these numbers are considered; and the weights can be adjusted in the analysis.

Initially there was a focus on initial capital cost, and an emphasis on doing just enough to make each well be considered available. After consultation with Asset Management, multiple scenarios were created to consider life cycle costs. This revealed it is much more cost effective to make a small number of wells very reliable, instead of holding onto a larger number of wells with marginal reliability. Having reliable facilities avoids having to develop higher cost sites, and even with run to failure old equipment eventually has to be repaired and replaced. It also showed that larger wells are a better deal, since much of the costs per site are essentially fixed.

The costs of outlying wells were adjusted to account for the estimated benefits of further securing the water right, having a more resilient supply with distributed sources, and having less vulnerability to contamination by accessing multiple aquifers. At the present time, these appear insufficient to change the results of the cost analysis. However, this could change in the future, especially if groundwater needs increase over time.

7.2. Projects Considered

Perhaps the most obvious are to rehabilitate the existing wells, and add corrosion control facilities where these are not already available (GPL, UP, SE, PRS, PA1). Other options include building out facilities where we already have water rights.

Less conventional alternatives considered include the following:

1. Construct a new pump station at 1st Way to move additional groundwater from Lakehaven into Pipeline 5 (Lakehaven was willing to sell 6 MGD in 2015, but has indicated at times only 2 MGD may be available at the existing 356th St connection).
2. Install or stage equipment at Eagle Lake to expedite pumping water from the lake into the Green River during a drought. The intent would be to use this system as in 1987 and 2015, where the lake was pumped at a relatively high rate for several days during a significant drought. This also generally mirrors the way we have been using large amounts of groundwater recently. (In contrast, the current Eagle Lake Siphon Project BCE appears to propose drawing down the lake each year at a relatively low rate, in part as mitigation for new permit-exempt wells in downstream private developments. While this methodology may be more competitive for grant funding and obtaining ongoing permits, the immediate short-term impact is significantly less than a bigger well that could potentially reduce Tacoma's surface water diversion by a larger amount.)
3. Build a third 33 MG tank at McMillin Reservoir to provide additional storage that could be drawn down over a few days to help meet peak demands.
4. Add additional treatment facilities at the Central Treatment Plant to allow reuse of wastewater, likely at WestRock.
5. Provide additional pump stations from Pipeline 1 to potentially move groundwater into all portions of the service area (Cumberland and Bonney Lake), and allow the Green River Facility to be shut down for a sustained period.
6. Proceed with peak shaving measures described in the IRP, which might include public outreach to limit summer landscape watering and third tier rates.

Additional possible supply actions, some of which do not require capital spending and are therefore excluded from the analysis described previously, are shown in Appendix H of the Water Shortage Response Plan.

7.3. O&M Costs

Operation and maintenance costs for running most wells were recently estimated around \$150 to \$250 per MG. This number assumes each well is run as much as possible (up to 9 months a year, depending on the water right), and all facilities have chlorination, pH adjustment, and fluoridation to meet current standards. Some wells are \$400 per MGD or more if wells with more treatment needs or fewer days of annual availability are considered. These numbers are considered in the life cycle cost analysis described previously.

The power demand charge makes it expensive to start a well if it will only be used for a short period of time. If a well has been off for the past 12 months, turning it on costs approximately \$7,000 on average (range is \$4k to \$25k each). Similarly, starting all the pumps at Hood Street Pump Station costs approximately \$50k (South Tacoma Pump Station, which is also only used to pump groundwater, is similar). It is possible to administratively disconnect wells to stop the 12-month cycle of charges, although typically this is something that would only be done once a year for the entire groundwater system.

Given that the surface water treatment plant has dedicated full time staff, is already paying power demand charges, and has water rights to run year round, it is hard for groundwater to compete on unit cost alone. O&M costs for the GRFF are typically estimated around \$65 per MG. However, costs could temporarily be higher there in the unusual circumstance of North Fork water not being available during a time of high raw water turbidity.

8. CURRENT WELLS STATUS

The average age of the well pumps and motors is approximately 34 years (range 10 to 89 years). The median age is 32 years, which reflects that a handful of very old equipment is pushing up the average. Although some pumps and motor have been later rebuilt, many of these have not been pulled within staff memory. Recent thinking has been that because we have inherited so many wells that are rarely used, it is okay if some will not start due to deferred maintenance because we can just move on to the next ones. However, when life cycle costs are considered, a more cost effective way to manage these assets would be to pick a subset of wells that are truly needed, and then focus on making these reliable.

The age of equipment is more than just a hypothetical concern. Recently Well 12A failed (pump was originally purchased in 1962; motor in 1972). In 2015, Wells 2B, SE8, and GPL1 were pulled; these all remain out of service for various reasons. There have been other failures as well, as shown in the Wells Status Summary list. The combination of equipment past its design life and infrequent use lowers the expected reliability of most facilities.

It should also be noted that most of the large wells are in the South Tacoma Wellfield. These wells all feed into the Wells Line, which discharges into Hood Street Reservoir and feeds the 251 (Tideflats) zone. WestRock uses most of the water in this zone, although the mill could potentially be shut down in a severe drought. To get this groundwater to the higher zones where most customers are, it must be pumped again through Hood Street, South Tacoma, or Marine View Pump Station.

9. NEXT STEPS

A comprehensive Business Case Evaluation (BCE) is being written to recommend improvements to the entire groundwater system in the near future. This includes an estimate of how much groundwater is currently available, as well as a recommended alternative for improvements to modernize the wells and provide 40 MGD.

This process should be repeated about every 3-5 years so plans can be adjusted in response to changing conditions in the future. Given that the analysis shows the groundwater is needed now, recent years have been relatively dry, and drought conditions could develop any year with limited warning, there is some urgency in keeping this process moving forward as much as possible.

Beyond the capital and extraordinary maintenance work proposed in the BCE previously mentioned, further consideration of specific plans to exercise available wells should be done. Similarly, wells that are not being used should be mothballed or abandoned. This will involve considering the value of the water potentially produced (which may only be in very infrequent circumstances right now, although this might change in future decades), and balancing that with the O&M cost of keeping up the facility and equipment.

RELATED DOCUMENTS

- Plans and Agreements
 - [Integrated Resource Plan](#)
 - [Habitat Conservation Plan](#)
 - Muckleshoot Agreement
 - [Water Shortage Response Plan 2018](#) (Appendix H)
 - [Water System Plan 2018](#) (Chapters 3, 4, and 5)
- Reports and Memos
 - Well Condition Assessments (from 2019)
 - Corrosion Control Assessment TM for Task 500 – Operational Changes and Capital Improvements (dated June 5, 2018)
 - Tacoma Water Corrosion Control Assessment Final Report (dated June 8, 2018)
 - Ground Water Yield Summary (IRP Task 401)
 - Groundwater Supply Capacity Assessment and Expansion Alternatives (IRP Task 403)
 - Future Well Use & New Well Development Planning Assumptions and Issues (dated Nov 30, 2009)
- Business Case Evaluation (BCE) SharePoint Sites
 - Wells Master Plan
 - 2019-2020 Supply System Improvements
 - 2019-2020 Wells Renewal and Replacement
 - Corrosion Control Treatment for GPL Wells
 - Eagle Lake Siphon
 - Hood Street Generator Replacement
 - New Wells
 - South Tacoma Pump Station Capacity Restoration
 - STPS and HS Facilities Seismic Improvements
 - Well 12A Pipe Supports

APPENDICES

- A. Summary Tables of WYSDM Runs
- B. Key Model Inputs for Running WYSDM
- C. Calculation of Optimal Available Groundwater
- D. Diversions of the White and Black Rivers
- E. Wells Map
- F. Cost Comparison Spreadsheets
 - 1. Entire Excel File
 - 2. Letter Grades (PDF)
 - 3. Costs of Recommended Alternative (PDF)
- G. Well Status Summary (PDF)

APPENDIX A – SUMMARY TABLES OF WYSDM RUNS

2010 Historical Hydrology and Climate July Start, Lock Out Extra Wells									
Input Well Capacity (MGD)	Curtailments in 25 years			Wholesale Percent Reliability	Maximum Annual Shortage (MG)	Annual Wells (kAF)		Output Average Well Use (MGD)	RAS Met ?
	Vol	Man	Tot			Avg	Max		
31	1	0	1	95%	102	17.5	17.5	31	No
35	1	0	1	95%	79	19.6	19.6	35	No
36	1	0	1	95%	70	20.3	20.3	36	No
37	1	0	1	95%	63	20.9	20.9	37	Yes
38	1	0	1	95%	63	21.4	21.5	38	Yes
69	1	0	1	95%	63	27.1	27.2	48	Yes

Service Area Population Estimate = 314,077

Tacoma Average Annual Demand = 17.1 BG

(Tacoma ADD = 46.9 MGD)

Total Average Annual Demand = 25.9 BG

(Total ADD = 71.1 MGD)

Tacoma Annual Conservation Adoption = n/a

Average Annual Maximum HHD Municipal Storage = 19,651 AF

2010 Bias-Corrected (DHSVM Processed) Historic Hydrology July Start, Lock Out Extra Wells									
Input Well Capacity (MGD)	Curtailments in 25 years			Wholesale Percent Reliability	Maximum Annual Shortage (MG)	Annual Wells (kAF)		Output Average Well Use (MGD)	RAS Met ?
	Vol	Man	Tot			Avg	Max		
31	3	0	3	85%	147	17.5	17.5	31	No
35	3	0	3	85%	105	19.6	19.6	35	No
37	3	0	3	85%	89	20.9	20.9	37	No
38	3	0	3	85%	88	21.4	21.5	38	Yes
69	3	0	3	85%	88	27.4	27.5	49	Yes

Service Area Population Estimate = 314,077

Tacoma Average Annual Demand = 17.4 BG

(Tacoma ADD = 47.6 MGD)

Total Average Annual Demand = 26.2 BG

(Total ADD = 71.8 MGD)

Tacoma Annual Conservation Adoption = n/a

Average Annual Maximum HHD Municipal Storage = 19,085 AF

2017 Historic Climate								
July Start, Lock Out Extra Wells								
Input Well Capacity (MGD)	Curtailments in 25 years			Wholesale Percent Reliability	Maximum Annual Shortage (MG)	Annual Wells (kAF)		Output Average Well Use (MGD)
	Vol	Man	Total			Average	Max	
31	1	0	1	95%	115	17.5	17.5	31
37	1	0	1	95%	68	20.9	20.9	37
38	1	0	1	95%	63	21.5	21.5	38
69	1	0	1	95%	63	27.8	27.9	50

Service Area Population Estimate = 326,763

Tacoma Average Annual Demand = 18.1 BG

(Tacoma ADD = 49.7 MGD)

Total Average Annual Demand = 27.0 BG

(Total ADD = 72.9 MGD)

Tacoma Annual Conservation Adoption = 78 MG

Average Annual Maximum HHD Municipal Storage = 19,649 AF

2019 Central Tendency (Beijing Model) Climate Change								
July Start, Lock Out Extra Wells								
Input Well Capacity (MGD)	Curtailments in 25 years			Wholesale Percent Reliability	Maximum Annual Shortage (MG)	Annual Wells (kAF)		Output Average Well Use (MGD)
	Vol	Man	Total			Average	Max	
31	1	0	1	95%	48	17.5	17.5	31
32	1	0	1	99%	27	18.1	18.1	32
33	0	0	0	99%	0	18.4	18.4	33
35	0	0	0	99%	0	19.6	19.6	35
37	0	0	0	99%	0	20.9	20.9	37

Service Area Population Estimate = 330,751

Tacoma Average Annual Demand = 18.1 BG

(Tacoma ADD = 49.5 MGD)

Total Average Annual Demand = 26.9 BG

(Total ADD = 73.7 MGD)

Tacoma Annual Conservation Adoption = 183 MG

Average Annual Maximum HHD Municipal Storage = 18,562 AF

2022 Central Tendency (Beijing Model) Climate Change July Start, Lock Out Extra Wells								
Input Well Capacity (MGD)	Curtailments in 25 years			Wholesale Percent Reliability	Maximum Annual Shortage (MG)	Annual Wells (kAF)		Output Average Well Use (MGD)
	Vol	Man	Total			Average	Max	
31	3	0	3	95%	172	17.5	17.5	31
35	1	0	1	99%	31	19.6	19.6	35
36	0	0	0	99%	0	20.3	20.3	36
38	0	0	0	99%	0	21.5	21.5	38
40	0	0	0	99%	0	22.4	22.4	40

Service Area Population Estimate = 336,733

Tacoma Average Annual Demand = 18.5 BG

(Tacoma ADD = 50.7 MGD)

Total Average Annual Demand = 27.3 BG

(Total ADD = 74.8 MGD)

Tacoma Annual Conservation Adoption = 331 MG

Average Annual Maximum HHD Municipal Storage = 18,544 AF

2024 Central Tendency (Beijing Model) Climate Change July Start, Lock Out Extra Wells								
Input Well Capacity (MGD)	Curtailments in 25 years			Wholesale Percent Reliability	Maximum Annual Shortage (MG)	Annual Wells (kAF)		Output Average Well Use (MGD)
	Vol	Man	Total			Average	Max	
31	3	0	3	95%	222	17.5	17.5	31
36	1	0	1	99%	24	20.3	20.3	36
37	0	0	0	99%	0	20.9	20.9	37
38	0	0	0	99%	0	21.5	21.5	38
40	0	0	0	99%	0	22.4	22.4	40

Service Area Population Estimate = 339,572

Tacoma Average Annual Demand = 18.3 BG

(Tacoma ADD = 50.2 MGD)

Total Average Annual Demand = 27.2 BG

(Total ADD = 74.4 MGD)

Tacoma Annual Conservation Adoption = 422 MG

Average Annual Maximum HHD Municipal Storage = 18,466 AF

2024 Worst Case (Hot and Dry / Canadian Model) Climate Change July Start, Lock Out Extra Wells								
Input Well Capacity (MGD)	Curtailments in 25 years			Wholesale Percent Reliability	Maximum Annual Shortage (MG)	Annual Wells (kAF)		Output Average Well Use (MGD)
	Vol	Man	Total			Average	Max	
31	3	1	4	85%	723	17.5	17.5	31
36	2	1	3	91%	480	20.3	20.3	36
37	2	1	3	91%	446	20.9	20.9	37
45	2	0	2	91%	133	24.7	24.8	44
47	2	0	2	91%	73	25.5	25.5	45
48	1	0	1	95%	73	25.8	25.8	46
50	1	0	1	95%	73	26.4	26.4	47
55	1	0	1	95%	73	27.6	27.6	49
69	1	0	1	95%	73	28.1	28.2	50

Service Area Population Estimate = 339,572

Tacoma Average Annual Demand = 18.8 BG

(Tacoma ADD = 51.6 MGD)

Total Average Annual Demand = 27.6 BG

(Total ADD = 75.7 MGD)

Tacoma Annual Conservation Adoption = 422 MG

Average Annual Maximum HHD Municipal Storage = 18,567 AF

2024 Wet and Less Warm (Japan Model) Climate Change July Start, Lock Out Extra Wells								
Input Well Capacity (MGD)	Curtailments in 25 years			Wholesale Percent Reliability	Maximum Annual Shortage (MG)	Annual Wells (kAF)		Output Average Well Use (MGD)
	Vol	Man	Total			Average	Max	
31	1	1	2	91%	1,045	17.5	17.5	31
37	1	1	2	91%	509	20.9	20.9	37
45	2	0	2	91%	103	24.7	24.8	44
46	2	0	2	91%	101	25.1	25.1	45
47	2	0	2	91%	78	25.4	25.4	45
48	2	0	2	91%	78	25.7	25.7	46
69	2	0	2	91%	78	27.9	28.0	50

Service Area Population Estimate = 339,572

Tacoma Average Annual Demand = 18.5 BG

(Tacoma ADD = 50.7 MGD)

Total Average Annual Demand = 27.3 BG

(Total ADD = 74.8 MGD)

Tacoma Annual Conservation Adoption = 422 MG

Average Annual Maximum HHD Municipal Storage = 18,667 AF

2024 Most Stressed (Hot and Dry Climate Change, Higher Population Growth) July Start, Lock Out Extra Wells								
Input Well Capacity (MGD)	Curtailments in 25 years			Wholesale Percent Reliability	Maximum Annual Shortage (MG)	Annual Wells (kAF)		Output Average Well Use (MGD)
	Vol	Man	Total			Average	Max	
31	5	3	8	70%	1,537	17.5	17.5	31
37	4	2	6	75%	1,130	20.9	20.9	37
40	2	2	4	80%	920	22.4	22.4	40
45	2	1	3	85%	591	25.1	25.2	45
48	1	1	2	91%	402	26.7	26.8	48
49	2	0	2	91%	356	27.1	27.2	48
50	2	0	2	91%	310	27.5	27.5	49
55	2	0	2	91%	198	28.6	28.7	51
57	2	0	2	91%	161	29.0	29.1	52
58	2	0	2	91%	157	29.1	29.2	52
59	2	0	2	91%	154	29.2	29.3	52
60	2	0	2	91%	153	29.2	29.3	52
69	2	0	2	91%	153	29.2	29.3	52

Service Area Population Estimate = 393,687

Tacoma Average Annual Demand = 21.0 BG

(Tacoma ADD = 57.4 MGD)

Total Average Annual Demand = 29.8 BG

(Total ADD = 81.6 MGD)

Tacoma Annual Conservation Adoption = 489 MG

Average Annual Maximum HHD Municipal Storage = 18,465 AF

2024 Least Stressed (Central Tendency Climate Change, Quicker Conservation) July Start, Lock Out Extra Wells								
Input Well Capacity (MGD)	Curtailments in 25 years			Wholesale Percent Reliability	Maximum Annual Shortage (MG)	Annual Wells (kAF)		Output Average Well Use (MGD)
	Vol	Man	Total			Average	Max	
31	2	0	2	95%	141	17.5	17.5	31
33	1	0	1	95%	57	18.4	18.4	33
34	1	0	1	96%	28	19.0	19.0	34
35	0	0	0	99%	0	19.6	19.6	35
37	0	0	0	99%	0	20.9	20.9	37

Service Area Population Estimate = 339,572

Tacoma Average Annual Demand = 17.8 BG

(Tacoma ADD = 48.8 MGD)

Total Average Annual Demand = 26.6 BG

(Total ADD = 73.0 MGD)

Tacoma Annual Conservation Adoption = 938 MG

Average Annual Maximum HHD Municipal Storage = 18,493 AF

2024 Central Tendency (Beijing Model) Climate Change July Start, Lock Out Extra Wells; <i>WestRock at 0 MGD</i>								
Input Well Capacity (MGD)	Curtailments in 25 years			Wholesale Percent Reliability	Maximum Annual Shortage (MG)	Annual Wells (kAF)		Output Average Well Use (MGD)
	Vol	Man	Total			Average	Max	
15	3	0	3	91%	180	8.3	8.3	15
18	1	0	1	95%	59	10.1	10.1	18
19	1	0	1	95%	34	10.7	10.7	19
20	0	0	0	99%	0	11.3	11.3	20
25	0	0	0	99%	0	14.1	14.1	25
31	0	0	0	99%	0	16.6	16.7	30

Service Area Population Estimate = 339,572

Tacoma Average Annual Demand = 12.9 BG

(Tacoma ADD = 35.4 MGD)

Total Average Annual Demand = 21.8 BG

(Total ADD = 59.6 MGD)

Tacoma Annual Conservation Adoption = 422 MG

Average Annual Maximum HHD Municipal Storage = 18,767 AF

2029 Central Tendency (Beijing Model) Climate Change July Start, Lock Out Extra Wells								
Input Well Capacity (MGD)	Curtailments in 25 years			Wholesale Percent Reliability	Maximum Annual Shortage (MG)	Annual Wells (kAF)		Output Average Well Use (MGD)
	Vol	Man	Total			Average	Max	
31	3	1	4	85%	437	17.5	17.5	31
40	1	0	1	99%	16	22.4	22.4	40
41	0	0	0	99%	0	23.0	23.0	41
42	0	0	0	99%	0	23.5	23.6	42
45	0	0	0	99%	0	24.7	24.8	44

Service Area Population Estimate = 342,999

Tacoma Average Annual Demand = 18.8 BG

(Tacoma ADD = 51.6 MGD)

Total Average Annual Demand = 27.6 BG

(Total ADD = 75.7 MGD)

Tacoma Annual Conservation Adoption = 574 MG

Average Annual Maximum HHD Municipal Storage = 18,233 AF

2070 Central Tendency (Beijing Model) Climate Change July Start, Lock Out Extra Wells								
Input Well Capacity (MGD)	Curtailments in 25 years			Wholesale Percent Reliability	Maximum Annual Shortage (MG)	Annual Wells (kAF)		Output Average Well Use (MGD)
	Vol	Man	Total			Average	Max	
40	7	1	8	75%	893	22.3	22.4	40
50	3	0	3	85%	194	26.7	26.9	48
51	3	0	3	85%	149	26.9	27.2	48
52	3	0	3	85%	85	27.2	27.5	49
53	3	0	3	85%	44	27.5	27.7	49
55	3	0	3	85%	44	27.9	28.1	50
60	3	0	3	85%	44	28.4	28.7	51
69	3	0	3	85%	44	28.4	28.7	51

Service Area Population Estimate = 368,630

Tacoma Average Annual Demand = 19.9 BG

(Tacoma ADD = 54.4 MGD)

Total Average Annual Demand = 28.7 BG

(Total ADD = 78.6 MGD)

Tacoma Annual Conservation Adoption = 941 MG

Average Annual Maximum HHD Municipal Storage = 16,854 AF

2070 Central Tendency (Beijing Model) Climate Change July Start, Lock Out Extra Wells, Provide HHD Fish Passage Facility								
Input Well Capacity (MGD)	Curtailments in 25 years			Wholesale Percent Reliability	Maximum Annual Shortage (MG)	Annual Wells (kAF)		Output Average Well Use (MGD)
	Vol	Man	Total			Average	Max	
40	3	1	4	85%	979	22.3	22.4	40
50	3	0	3	85%	148	26.7	26.9	48
51	3	0	3	85%	79	26.9	27.2	48
52	3	0	3	85%	44	27.2	27.5	49
53	2	0	2	91%	44	27.5	27.7	49
55	2	0	2	91%	44	27.9	28.1	50
69	2	0	2	91%	44	28.4	28.7	51

Service Area Population Estimate = 368,630

Tacoma Average Annual Demand = 19.9 BG

(Tacoma ADD = 54.4 MGD)

Total Average Annual Demand = 28.7 BG

(Total ADD = 78.6 MGD)

Tacoma Annual Conservation Adoption = 941 MG

Average Annual Maximum HHD Municipal Storage = 16,854 AF

APPENDIX B – KEY MODEL INPUTS FOR RUNNING WYSDM

- WYSDM GUI - Capacity Planning
- Available Models - Deterministic
- Climate
 - Typically use central tendency for climate change
 - {30} bcc-csm1-1-m (from Beijing Climate Center)
 - RCP 8.5 (little to no large-scale climate action and high greenhouse gas emission rates) is assumed for all climate change model runs
 - “Most Stressed” uses hot and dry (worst case) conditions for climate change
 - {31} CanESM2 (from Canadian Centre for Climate Modelling and Analysis)
 - For wet and less warm climate change
 - {38} MIROC5 (from Japan Agency for Marine-Earth Science and Tech)
 - For historic climate (actual data, no climate change modeling)
 - {1} historic deterministic
 - For historic climate, but modeled with DHSVM (Distributed Hydrology Soil Vegetation Model) to make more comparable to climate change runs
 - {20} historic 1980 to 2010
- Groundwater – Wellfield Pumping – City Fields
 - Per the User’s Guide, the model looks at each month, and then automatically calculates groundwater pumping (Mode 3) if no data is entered
 - To manually enter groundwater pumping, first enter a false annual amount and rate using the “Set Annual Limits” tab to change the monthly pumping from NaN (not a number) to a non-zero number (value does not matter as long as all 12 months each year show pumping)
 - Next, enter in the values wanted (for example, run 40 mgd during July-December), which sets monthly pumping to zero during the other months
 - Groundwater is pumped continuously and at a constant rate during July through December (6 months)
 - 1 MGD = 200 MG = 1 kAF
 - 10 MGD = 1,800 MG = 6 kAF
 - 20 MGD = 3,700 MG = 11 kAF
 - 28 MGD = 5,200 MG = 16 kAF (2015 actual volume)
 - 30 MGD = 5,500 MG = 17 kAF
 - 35 MGD = 6,400 MG = 20 kAF
 - 40 MGD = 7,300 MG = 22 kAF
 - 45 MGD = 8,100 MG = 25 kAF
 - 50 MGD = 9,200 MG = 28 kAF
 - 55 MGD = 10,100 MG = 31 kAF
 - 65 MGD = 11,900 MG = 37 kAF
 - 69 MGD = 12,700 MG = 39 kAF (full groundwater right)
 - Conversion factors
 - 30.5 days per month
 - 1 MG = 3.069 AF

- Does not include an allowance for mechanical / electrical failures, aquifer drawdown, etc.
 - For example, if a 15% backup capacity is assumed, then to get 55 MGD of reliable well production, 63 MGD of wells are needed
- Demand Forecast
 - Population Projection
 - Typically leave as default {1} Most Likely Forecast
 - For “Most Stressed”, change to {3} Broadshoulders
 - Population Data
 - Enter a specific year (for example, 2038)
 - Climate Data
 - Enter a specific year (for example, 2038)
 - Source of projection data
 - Typically leave as default
 - {1} Conservation from Tacoma’s Long term Model 2017
 - For “Least Stressed” or “Peak Shaving”
 - Change to {2} Estimated by HDR Engineering
- Demands – Basic Settings
 - Use year 2017 partner demands (14 MGD = 5.1 BG)
 - Scale wholesale demands on default year 2016
 - Assume 10 MGD (3.7 BG) of wholesale demand
 - 5 MGD of actual wholesale demand in 2015
 - This incorporates a safety factor due to imperfect forecasts of the weather for the rest of the year
 - Actual groundwater pumped in 2015 was similar to what the modeled calculated based on 10 MGD of wholesale
 - Can demand be curtailed based on the drought management plan?
 - Enter {0} No (instead of default {1} Yes)
- Pot Donations
 - How long after Howard Hanson reservoir fills should the initial donation be made to Section 1135?
 - Typically leave as default 3 days
 - For Fish Passage Facility (“FPF”) runs only (completion of AWSP Phase I), enter 0 days
 - What is the maximum amount that can be donated to Section 1135 in any given day?
 - Typically leave as default 10,000 acre-ft
 - For “FPF” runs only, enter 0 acre-ft
 - Should WYS DM automatically donate water between municipal pots if needed?
 - Enter {1} Yes (instead of default {0} No)
- Details
 - Eagle Lake
 - Eagle Lake is not used (default)
 - Infrastructure
 - 30 MG of reservoir storage can be temporarily drawn down to help meet peak day demands (default)

- Run Model
 - Scenario: [Custom]
 - Run Start Year
 - Try to center on year being run whenever possible
 - For example, if 2038, run 2026-2050
 - Historic runs are available for 1915 to 2017
 - Last 25 years of historical record are 1993-2017
 - Climate change runs are available for 2010 to 2070
 - First 25 years of climate change are 2010-2034
 - Number of Years to Evaluate: 25
 - Each run takes roughly 30-60 minutes
 - Running more years would take longer, but also be more precise and reveal additional extreme possibilities
 - Run Type: Deterministic
 - Click Begin
- Metric Results
 - Click Integrated Resource Plan Metrics
 - Use Save As to create a record in both an Excel file and a PDF
 - To freeze the Excel file (that is, stop it from automatically updating with new data the next time WYSDM is run) when saving it, go to the Formulas tab, click Calculation Options, and select Manual
- Annual shortages of more than 400 MG are considered mandatory curtailments
 - Based on past experience, voluntary conservation can reduce demand by approximately 9-10% in July and August
 - Partner shortages are disregarded, since the Partners would need to rely on their own wells in this case
- Big changes to the assumptions, such as switching between “FPF” and no fish passage at HHD, may require the next run to be done with a clean copy of the entire model folder (~23.1 GB)
 - If there is room on your drive, while running the model, you can speed things up by at the same time copying and pasting over a new clean copy of the model with a different file name, for use during the next run

APPENDIX C – CALCULATION OF OPTIMAL AVAILABLE GROUNDWATER

Summary of WYSDM Model Runs

2024 Central Tendency (Beijing Model) Climate Change July Start, Lock Out Extra Wells, 61-Year Run 2010-2070*														
Input Well Capacity (MGD)	Curtailments in 61 Years			Curtailments in 25 Years			Wholesale Percent Reliability	Maximum Annual Shortage (MG)	Total Shortage (MG)		Annual Wells (kAF)		Output Average Well Use (MGD)	RAS Average Annual Tacoma Shortage (MG)
	Vol	Man	Total	Vol	Man	Total			61 Years	25 Years	Avg	Max		
31	11	1	12	4.5	0.4	4.9	85%	848	1474	604	17.4	17.5	31	5.0
35	4	1	5	1.6	0.4	2.0	91%	504	640	262	19.6	19.6	35	1.0
40	4	0	4	1.6	0	1.6	93%	161	249	102	22.3	22.4	40	0.0
45	4	0	4	1.6	0	1.6	93%	44	118	48	24.6	24.7	44	0.0

Service Area Population Estimate = 339,572

Tacoma Average Annual Demand = 18.3 BG (Tacoma ADD = 50.2 MGD)

Total Average Annual Demand = 27.2 BG (Total ADD = 74.4 MGD) ← includes wholesale, Partners, and 5 MGD safety factor

Tacoma Annual Conservation Adoption = 422 MG

Average Annual Maximum HHD Municipal Storage = 17,978 AF

**This is the longest model run with climate change that is possible in WYSDM, to give better resolution of the extreme years of interest when shortages are most likely*

Comparative Cost-Benefit Analysis for Various Groundwater Availabilities**

	Status Quo	Alternative 1		
Scenario	Existing Condition 31 MGD Groundwater	Lowest Cost (Recommended) 40 MGD Groundwater	35 MGD Groundwater	45 MGD Groundwater
Expected ¹ Flow (MGD)	31	40	36	45
Nominal ² Flow (MGD)	63	47	43	53
Pump Sta. Cap. ³ (MGD)	39	37	39	41
Capital Costs	--	\$ 12.30 M	\$ 8.56 M	\$ 17.17 M
Ongoing O&M Costs (per year)	\$ 2.20 M	\$ 1.59 M	\$ 1.48 M	\$ 1.74 M
Risk Cost ⁴ (61 years)	\$ 147 M	\$ 25 M	\$ 64 M	\$ 12 M
Net Present Value ⁵ (100 years)	- \$ 206 M	- \$ 109 M	- \$ 125 M	- \$ 113 M
Wells and Other Sources	* Add 2C,4A,7B,9A, 10C,13A,UP1/10, SE2/6/11/11A, PA1,PRS Delete GPL1	1B,3A,5A,6B, 8B,11A,12A, GPL1/2	* Add 9A Delete GPL1/2	* Add 4A,9A
Pump Stations	* Add MV1/2/3/4/7	HS, ST, MV5/6	* Add MV7	* Add HS4 (new)

* Facilities are compared to Alternative 1 (Recommended).

**Costs and flows are estimated in the Wells Cost Comparison spreadsheet.

¹ Expected Flow is reduced to allow for equipment breakdowns, aquifer drawdown, etc.

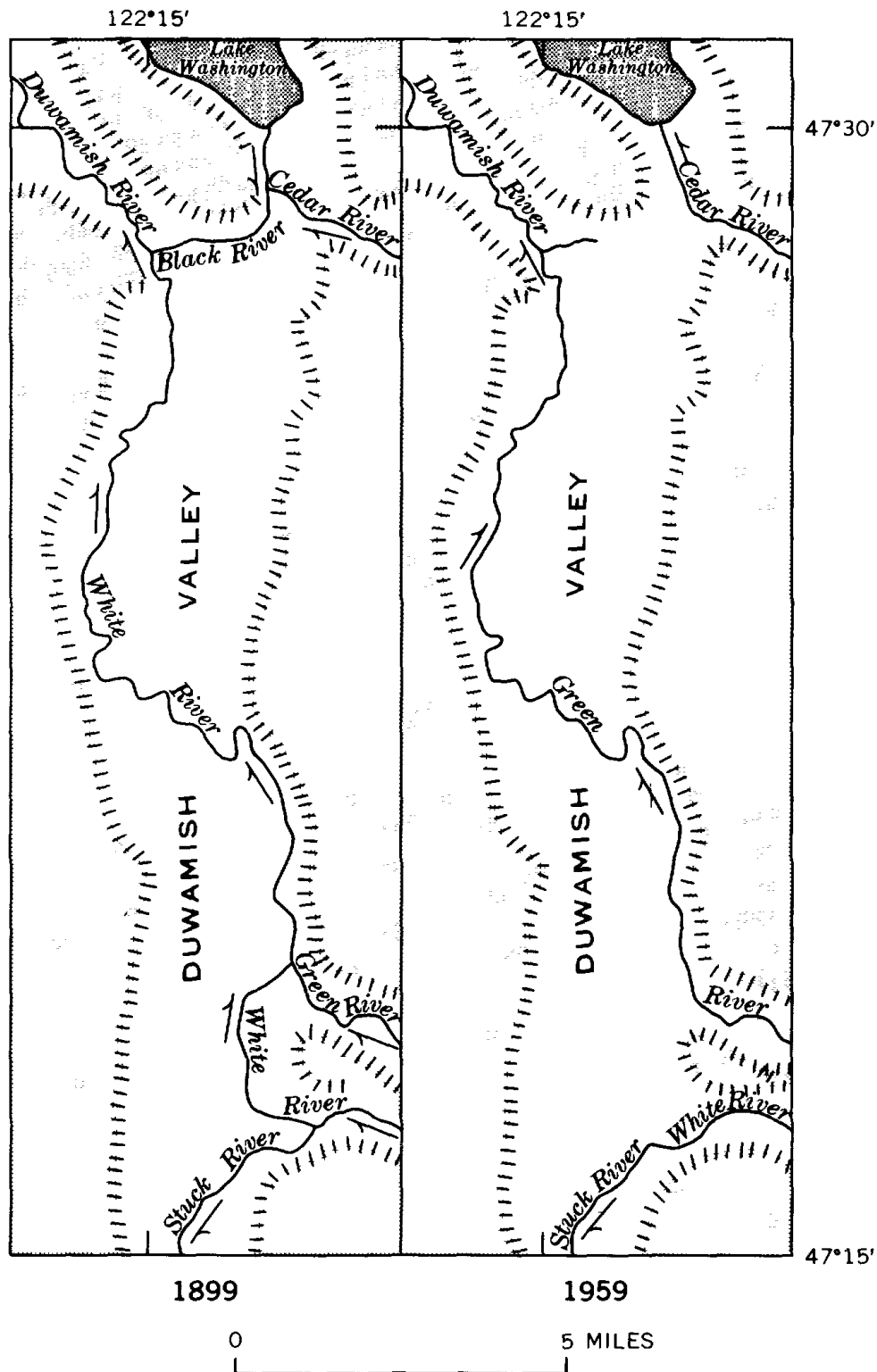
² Nominal Flow assumes all pumping equipment at every site is fully functional, and excludes non-well options.

³ Pump Sta. Cap. is nominal capacity of the 3 pump stations associated with the South Tacoma Wells.

⁴ The cost of a shortage is estimated at \$100,000 per MG. Section 5.3.4.3 of the 2016 Tacoma Water: Seismic Vulnerability Assessment states "After internal analysis of the impacts to select major businesses in the area...TW determined that the approximate economic impact to the region from a loss of activity in the Tide Flats to be approximately \$3 million per day." Assuming the Tideflats uses approximately 20 MGD, this works out to a \$150,000 risk cost per MG of shortage. However, there is a note in the Analytical Template (on the Data Tables sheet) stating that beyond the basic water requirement, the willingness to pay is \$0.2874 per gallon (that is, \$287,400 per MG). Both these figures seem high though, especially if the shortage happens during the summer and mostly just reduces lawn watering.

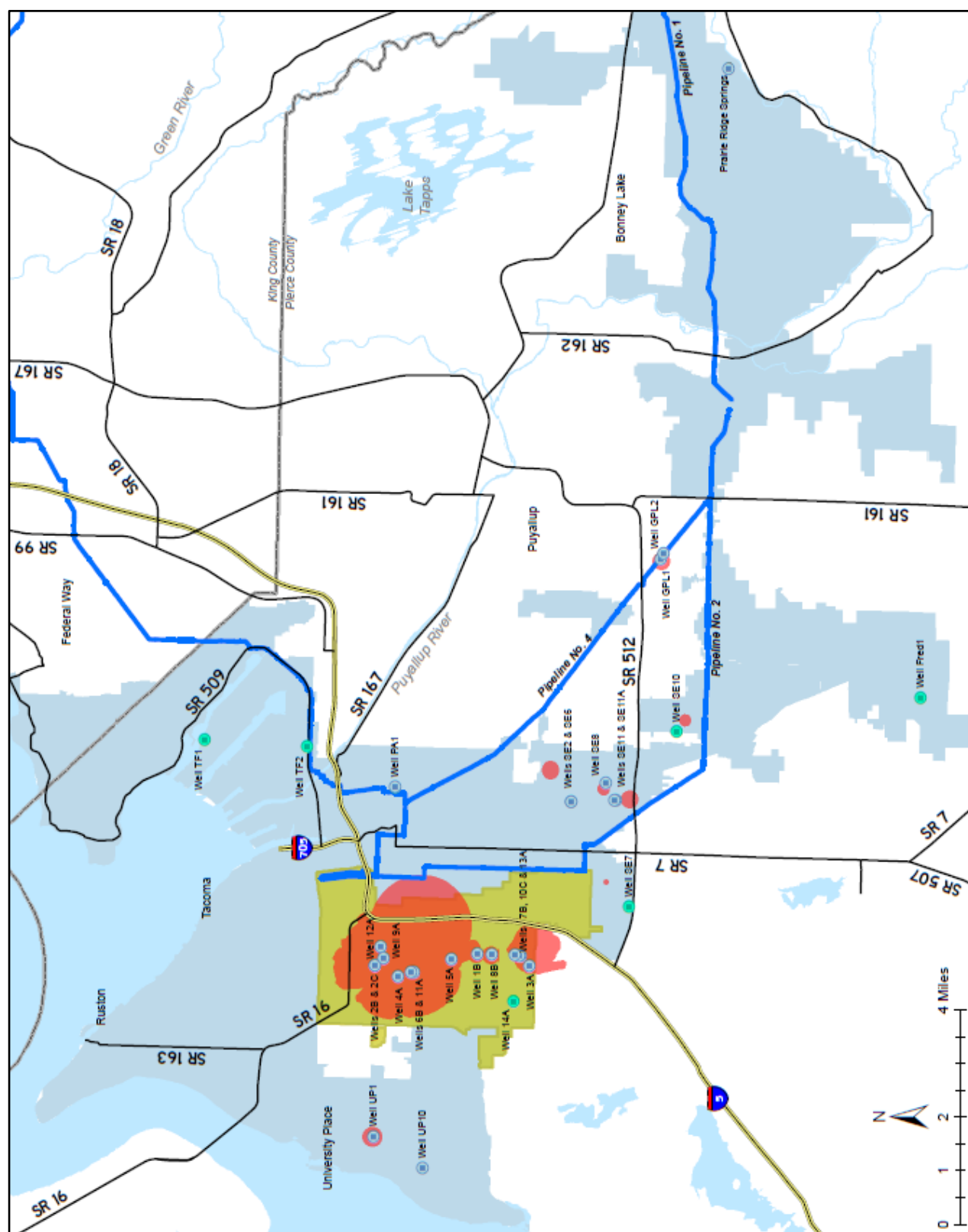
⁵ NPV is from the Analytical Template (Benefits are assumed to be zero, so only Costs count toward NPV).

APPENDIX D – DIVERSIONS OF THE WHITE AND BLACK RIVERS



By Donal R. Mullineux - Geology of the Renton, Auburn, and Black Diamond Quadrangles, King County, Washington. (United State Government Printing Office, Washington: 1970), Public Domain, <https://commons.wikimedia.org/w/index.php?curid=31299307>

APPENDIX E –WELLS MAP



From Figure 4-2 of the 2018 Water System Plan

TACOMA WATER BUSINESS CASE EVALUATION

LONG FORM



Project Title Wells Master Plan (Groundwater Prioritization)

Project Summary Information

Who is	Responsible	Accountable	Consulted (as appropriate)	Informed (as appropriate)
Title	Project Manager	Project Sponsor	Reference Group, Project Team	Financial Stewardship, Superintendent and Management Team
Name(s)	Jason Moline 253-396-3383 jmoline@ cityoftacoma.org	Glen George 253-502-8737 ggeorge1@ cityoftacoma.org	Casey Jarbeaux, Dave Boehm, Jason Scott, Kim DeFolo, Michael Duffy, Mike Gorenson, Michael Washington, Rob Walker	Andrew Zarembo, Jim Goodman, Marc Powell, Ryan Flynn, Scott Dewhirst, Shannon Wall, Stuart Vaughan

Original Request Date	September 30, 2019
Latest Amendment Date	n/a
Latest Updated Business Case	March 11, 2020
Estimated Start Date	January 2020
Estimated Completion Date	December 2025
Project Source (Ex: VA, Regulatory, SAMP)	Wells SAMP Integrated Resource Plan / Si88

Budget Information

Existing 2019/2020 Capital Budget	\$1.28 million (already budgeted for GPL and 12A)
2021/2022 Capital Budget Request	\$3.30 million
CIP: 2023/2024 plan	\$5.72 million (plus \$2.00 million carry forward for GPL CC)
CIP: 2025/2026 plan	N/A
Total project estimate	\$9.02 million (plus \$3.28 million already budgeted)

Previously Funded Project	
Project #	
Expenses to date	

Thresholds for Amendment or New Business Case Required

Action Required*	Total Spend
Amendment Required	\$ 200,000
New Business Case Required	\$1,000,000

*Project Manager must submit a Business Case Amendment or a New Business Case if the higher of these thresholds is projected to be met during project execution.

1. Project Overview

1.1. Problem Statement

The Water Supply Yield and Demand Model (WYSDEM) developed with the Integrated Resource Plan (IRP) indicates Tacoma Water should have approximately 40 MGD of reliable groundwater supply available at essentially all times. Given the current condition of the wells, our reliability estimates indicate only about 31 MGD would be available on average now. What should Tacoma Water do to ensure we have enough ground water available according to our models?

Please refer to the separate Wells Master Plan document for further details.

1.2. Project Description

For all alternatives except the status quo, specific facilities are hardened to bring these up to current standards. The intent is to maintain fewer wells, but in a more reliable state, to maintain the desired level of system reliability while reducing life cycle costs.

Primary tasks to be performed at the selected facilities include the following:

- Pull and Rehabilitate
 - Rebuild or replace all pumps and motors near design life (~30 years old)
 - Both submersibles and vertical turbines
 - Both wells and associated pump stations
 - Follow recommendations from the equipment vendor
 - Replace the power cable
 - Review the productivity of the well, and size new equipment accordingly
 - Consider converting submersible motors to vertical turbines when appropriate
 - Consider variable frequency drives (VFDs)
 - Repair and recoat column pipe as needed
 - Hire a hydrogeologist to TV (put a video camera down and televise) the well casing
 - Clean well screens and address flow reductions
 - Bail, rehab, or redrill the well as recommended
 - Make other minor improvements recommended by the hydrogeologist

- Electrical
 - Replace all motor control centers (MCCs) past design life (~30 years old)
 - Provide or update soft start
 - Add Simocode motor protections
 - Integrate controls
 - Replace obsolete Rotork valve actuators
 - Make all sites genset ready (add a quick connect for a generator)
 - May be more complicated for > 480 V (GPL, pump stations)
 - Consider 480 V conversion of higher voltage sites
 - Includes GPL wells, HSPS, STPS as needed
 - May not be feasible due to larger cable requirements
 - Make other minor improvements recommended by electrical staff
- Corrosion Control
 - Design and build new corrosion control facilities if recommended in the Corrosion Control Study from HDR
- Miscellaneous
 - Make other minor improvements recommended by mechanics

It is also suggested that going forward, each well be pulled again approximately every 15 to 25 years for inspection and rehabilitation. However, after the first round is completed in 2024, the next round of pulls could likely be deferred until around 2035. The intent of restarting the program somewhat early would be to get on a routine schedule of proactively working on a few wells at a time. A regular program is thought to have benefits to resiliency and cost, rather than deferring maintenance, and then trying to catch up by rebuilding every well in the system over a relatively short time.

While this program is more intensive than recent practices, it is comparable to what is done by the RWSS Partners and many other nearby utilities.

Other wells will be mothballed. Specifics of this should be determined separately later. It is expected that once the proposed work is complete, at other groundwater facilities 3-phase power will be administratively disconnected, buildings will generally be left in place, and exterior maintenance will be continued. The intent is to minimize ongoing expenses and not to use these wells in the near future, but leave the option open for these sites to be rehabilitated and brought back online if future analyses indicate this is necessary.

There might be different levels of mothballing; for example, exterior maintenance only versus complete abandonment (demolition and sale of surplus property). New water rights are very difficult to obtain and generally not available, so consideration of actions such as selling off real property with a groundwater right should be done with caution and only after thorough review.

Cross-project dependencies include the following related BCEs.

- Hood Street Facilities Seismic Improvements
- Hood Street Reservoir Seismic Improvements
- South Tacoma Pump Station Seismic Improvements
- Pipeline No. 1 Pressurization Project

The above projects all temporarily decrease supply by taking production facilities out of service. The schedules will be coordinated by the respective project managers to make sure demands can still be met, and minimize the combined impacts. See section 2.1 for additional information about the three projects for seismic improvements.

The Eagle Lake Siphon BCE is also a related project in the sense that it also is intended to help meet our instream flow obligations for the Green River. At the steady low flow rates proposed though, combined with the long circuitous path (~10 miles of natural channel) to reach the reservoir behind Howard Hanson Dam, its impact is considered relatively negligible for the purposes of the Wells Master Plan.

1.3. Assumptions

Because nearly 50 possible facilities were reviewed, the cost estimates here are very high level and will need to be refined further as individual projects are developed. Some key assumptions behind these preliminary budgetary cost estimates are listed below.

- If pumps or motors are less than 20 years old, it is assumed these can be inspected and continue to be used. Should extensive rehabilitation or replacement be necessary, costs will increase.
 - Although in some cases rehabilitation of existing pumps and motors may be considered, based on our experience at Well 12A, this is not expected to create significant cost savings over replacing all these with new.
- Potential additional costs for converting from submersible motors to vertical turbines, such as for new buildings or soundproofing, are not included.
 - Existing submersible motors in the Tacoma Water system typically have mercury seals, but vendors for the most part no longer service or sell these. Concerns about potential spills of this hazardous liquid metal into water wells or near workers now tend to overshadow the reliability advantages of mercury seals. Submersible motors with double mechanical seals are estimated to have approximately half the expected 40 to 50 year life of motors with mercury seals.
 - The phasing out of mercury seals in submersible motors now makes using vertical turbines more appealing than in the past. Vertical turbines are less susceptible to corrosion, and can also be inspected and repaired without pulling the well. However, a vertical turbine may require a building, ventilation, sound reduction, and a long shaft down to the aquifer that could freeze up if not exercised periodically.
- For new MCCs at higher voltage facilities (such as at the GPL wells, Hood Street Pump Station, or South Tacoma Pump Station), costs increase by 50%, whether or not the facility is converted to 480 V.
- The cost of purchasing or renting a genset is not included.

- An additional 30% was added to most capital costs (except corrosion control) to allow for soft costs (~10%, including design/engineering and internal labor) and contingencies (~20%).
 - The 20% contingency money is also intended to allow repairs at wells with unaccounted failures that need to be addressed, since we are not moving forward with Wells Rehabilitation & Replacement money. Since all the wells we propose to use in the next several years are being rehabilitated, it was not thought necessary to add in additional funds separately.
- All corrosion control costs from HDR were increased by 130% (that is, multiplied by 2.3), based on estimates by Water Treatment & Quality Planning for the GPL Wells. Reasons for this include the following.
 - HDR's assumed caustic dose was quite low.
 - They assumed no redundancy for tanks / pumps.
 - The tank was smaller than a full load.
 - Design / engineering and internal labor costs were excluded.
- No additional water quality measures are needed, beyond corrosion control for outlying wells (that is, those not near South Tacoma Way).
 - No additional fluoridation facilities will be required.
 - Existing blowers at Well 12A continue to adequately address remaining VOCs from the Time Oil Superfund site, even if the plume migrates in the future due to increased groundwater use or other reasons.
 - There is a risk that STPS will need additional corrosion control in the future. The diffused aeration system just barely meets our required setpoint, so additional caustic soda facilities may be required in the future. They are not warranted at this time, though.
 - Right now, PFAS regulation is in its infancy, but more regulations are expected. We believe that with blending at Hood St or STPS, we can mitigate any PFAS levels in the South Tacoma wells (except 10C and possibly 7B); however, there is a slight risk that changes in pumping frequency, aquifer changes, or EPA/DOH standards could require us to shut down other wells or construct treatment. At this early stage, we cannot be sure.

During predesign and design, more detailed cost estimates will be developed. If the overall costs in the Wells Master Plan BCE are significantly exceeded, an amendment or new BCE would be needed to complete the remaining work.

An annual exercise plan is also recommended. The details could vary based on staff recommendations going forward, but a preliminary cost estimate was made using the assumptions below.

- Test run each facility using a genset twice a year
 - Annually perform wire to water and megger testing
- Run each well briefly on line power in 1 of every 4 years
- Run each well on line power nearly as much as possible in 1 of every 10 years

Perhaps a few wells could be run continuously during part of each year to avoid the complications of turning the treatment system at Hood Street on and off repeatedly, and low river flows could trigger running additional wells.

See also Section 3.2.3.

1.4. Anticipated Quantifiable & Non-Quantifiable Benefits/Outcomes

The benefits (that is, avoided risk) are being able to reliably provide supply to meet system demands, and comply with the terms of the Muckleshoot agreement. This is consistent with the 2018 Integrated Resource Plan and Si88.

Groundwater supplies would be needed during a low likelihood but high consequence event, such as a severe drought. An attempt has been made to quantify the dollar value of this, although it requires some assumptions. There is also value in customer and stakeholder relations to being able to show drought preparedness, even at times when these wells are not running.

See also the separate Wells Master Plan document.

1.5. Comparative Cost-Benefit Analysis

	Status Quo	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Scenario	Existing Condition	Lowest Cost (Recommended)	Include UP, SE, and PRS	South Tacoma Only	55 MGD / Year 2070
Expected ¹ Flow (MGD)	31	40	40	40	56
Nominal ² Flow (MGD)	63	47	46	51	69
Pump Sta. Cap. ³ (MGD)	39	37	32	44	44
Capital Costs	--	\$ 12.30 M	\$ 15.79 M	\$ 13.50 M	\$ 30.66 M
Previously Budgeted ⁴	\$ 0.78 M	\$ 3.28 M	\$ 3.28 M	\$ 0.78 M	\$ 3.28 M
Capital Costs Not Prev. Budgeted	--	\$ 9.02 M	\$ 12.51 M	\$ 12.72 M	\$ 27.38 M
Ongoing O&M Costs (per year)	\$ 2.20 M	\$ 1.59 M	\$ 1.64 M	\$ 1.95 M	\$ 2.35 M
Risk Cost (25 years)	\$ 39 M	--	--	--	--
Simplified Net Cost ⁵ (25 years)	\$ 94 M	\$ 52 M	\$ 57 M	\$ 62 M	\$ 89 M
Net Present Value ⁶ (100 years)	- \$ 169 M	- \$ 82 M	- \$ 88 M	- \$ 100 M	- \$ 134 M
Wells and Other Sources	1B,2C,3A,4A, 5A,6B,7B,8B, 9A,10C,11A, 12A,13A, GPL2,UP1/10, SE2/6/11/11A, PA1,PRS	1B,3A,5A,6B, 8B,11A,12A, GPL1/2	* Delete 6B; Add UP1, SE11/11A, PRS	* Add 2B,2C,4A,9A, 13A; Delete GPL1/2	* Add 2B, 2C,4A,7B,9A, 13A,14A,UP1, SE2/6/11/11A, Lakehaven, Peak Shaving
Pump Stations	HS, ST, MV1-7	HS, ST, MV5/6	* Delete MV5/6	* Add MV7, HS4 (new)	* Add MV7, HS4 (new)

* Facilities are compared to Alternative 1 (Recommended)

¹ Expected Flow is reduced to allow for equipment breakdowns, aquifer drawdown, etc.

² Nominal Flow assumes all pumping equipment at every site is fully functional, and excludes non-well options

³ Pump Sta. Cap. is nominal capacity of the 3 pump stations associated with the South Tacoma Wells

⁴ Previously Budgeted Funds are from BCEs approved earlier for Well 12A Rehabilitation (\$492,280), Well 12A Blower and MCC Rehab (\$190,000), Well 12A Pipe Supports (\$100,000), and Corrosion Control Treatment for GPL Wells (\$2,500,000)

⁵ Simplified Net Cost neglects interest and discount rates

⁶ NPV is from the Analytical Template (Benefits are assumed to be zero, so only Costs count toward NPV)

2. Project Management Plan

2.1. Project Timeline and Resources

Preferably no more than 3 wells and 1 pump station would be unavailable at a time. The work would need to be staged to meet this constraint. Work on each set could probably be done in within around 18 months. It is assumed that all work at each site (rehab or replace mechanical equipment, clean well casing, electrical, corrosion control, treatment enhancements, etc.) would be done during the same time period.

Seismic improvements at South Tacoma Pump Station and Hood Street are being planned separately. Construction at STPS is scheduled during November 2021 and February 2022. It will not be possible to run wells to Hood Street during January to July 2022.

The procurement process may make it difficult for work to proceed as quickly as we might like. Generally, a consulting hydrogeologist would be selected first based on qualifications. Then a crane would be brought in under contract to work with the crews. Once the pump and motor are pulled, a vendor would inspect it, which may involve shipping it back to the factory. Once the necessary work is determined, this would be bid out. To repair existing equipment, or to buy from a specific preferred manufacturer (such as Byron Jackson), typically each manufacturer has a very limited number of authorized dealers for the region. Repair or replacement of large pumps and motors typically has a long lead time, on the order of around 6 months. Then the crane and crew will be needed again to reinstall the well. Occasionally subsequent testing reveals problems, as occurred recently at GPL1. See also section 3.2.3.

A suggested timeline is below. The specific facilities addressed each year could vary somewhat depending on the alternative selected.

- 2020
 - Research and determine procurement processes
 - Select and contract with hydrogeology consultant
 - Select and contract with designer of GPL corrosion control improvements
 - Decide on 480 V conversion of GPL, STPS, HSPS
 - Advise on any impacts to separate seismic projects at STPS, HSPS
 - Plan and design 3A, 8B, MVPS
 - Substantially complete 12A
- 2021
 - Substantially complete 3A, 8B, MVPS
 - Plan and design 5A, 6B, GPL, Hood Street treatment enhancements
- 2022
 - Resolve issue with the existing flow meter at STPS
 - Obtain permits for and bid GPL
 - Plan and design HSPS
 - Substantially complete 5A, 6B

- 2023
 - Construct GPL
 - Substantially complete GPL1/2, HSPS, Hood Street treatment enhancements
 - Plan and design 1B, 11A, STPS
- 2024
 - Startup GPL
 - Substantially complete 1B, 11A, STPS

Short form BCEs are being submitted for the biennium when construction is planned. Some additional dollars are being requested earlier in this long form BCE to allow for design, as well as any potential unexpected costs that exceed the included contingency of approximately 20%.

2.2. Project Management

The project would be managed by 3 engineers, as broken out below.

- Planning & Engineering (P&E) / Project Delivery / Project Support & Execution
 - Overall project manager
 - May have an engineer from P&E / Water Resources perform these tasks
- P&E / Electrical & Control Systems – Electrical work
- P&E / Water Treatment & Quality Planning – Treatment improvements

Also, Maintenance & Construction would coordinate pulling each well and pump.

2.3. Impacts to Stakeholders

Business Unit	Contact Person	Required resources
Planning & Engineering (P&E)/ Electrical & Control Systems, Electrical AMP Team	Michael Duffy, Jason Scott, Duc Vuong	Senior Principal Engineer, Principal Engineer, Senior Engineer, Electricians, Systems Integrator (S&B)
P&E / Project Delivery / Construction Management	Geff Yotter	Construction Inspector
P&E / Project Delivery / Project Support & Execution, Pump Stations AMP Team	Ryan Flynn, Michael Washington, Ralph Eaton	Principal Engineer, Professional Engineer, Engineering Technician
P&E / Water Treatment & Quality Planning, Treatment and Monitoring AMP Team	Kim DeFolo, Mike Gorenson, Bill Cummins	Principal Engineer, Professional Engineer, Water Quality Mechanic
P&E / Water Resources, Wells AMP Team	Glen George, Jason Moline	Wells SAMP Lead, Professional Engineer
P&E	Melissa Anderson, Denyse Kerlee	Administrative Assistant
Maintenance & Construction / Field Operations / Maintenance / Wells	Stuart Vaughan, Jim Goodman	Wells Crew
Maintenance & Construction / Planning & Logistics	Rob Walker, Jeff Krier	Planner, Scheduler, Warehouse Technician
Procurement and Payables	Alex Clark	Senior Buyer
Legal	Martha Lantz	Attorney
External Contractors	To be determined	Consulting Hydrogeologist, Pump Vendor Representative, Consulting Engineer, Construction Contractor
Pierce County Planning and Land Use	To be determined	Conditional Use Permit Reviewer / Planner

2.4. Contracting Approach

We will contact Procurement about the possibility of combining all maintenance and repair services into one large contract, or a few large contracts. This may be complicated because some of the work could be arguably be considered engineering (selected based on qualifications per state law), and other could be considered public works and improvements (low bid).

To minimize time spent with administrative and procurement tasks, it is suggested that a large contract be created with each outside vendor that would cover work throughout the wellfield over the next few years. Otherwise, up to 5 separate contracts may be needed for each of the approximately 12 facilities selected to remain available. This may also help prevent procurement issues as the cumulative dollar amount increases when going site to site.

An engineering consultant will be selected for design of corrosion control facilities. This would include work at GPL1/2 (as well as at UP, SE, PRS if we elect to retain any of these facilities at the present time).

The assistance of a consultant might also be useful to address the concerns with caustic soda dosing at Hood Street when starting or stopping wells, although we have some ideas and S&B may be able to help with the controls too. However, this issue was brought up with the consultant throughout the design of the Hood St facility and there was no clear solution at the time.

Similarly, a contractor would be used to build corrosion control improvements.

A groundwater consultant will also be needed to clean well screens and the bottom of the casing pipe. They would also help us determine the cause of flow issues.

A well equipment vendor would be used to evaluate, repair, and/or replace pumps and motors once these are pulled.

Electrical equipment including new MCCs, valve actuators (Rotorks), and genset connections will be necessary. A contractor will need to be hired if the electrical group does not have in house capacity to install the new equipment.

2.5. Timing

It is estimated that the work can be completed in about 5 years with current staffing levels, although interest has been expressed in trying address deferred maintenance at wells ideally within 2 years. Design of corrosion control facilities should begin soon, as it will likely take a while for engineering and construction.

The intent is to start at selected facilities with known issues when possible, to get the most return on investment first.

As improvements are made to the selected wells, and we get to or exceed 40 MGD of reliable groundwater capacity, more formal efforts could be taken to mothball other wells.

3. Alternatives Analysis

3.1. Alternative Status Quo – Business as Usual

This is the “do nothing” alternative. It does not provide the recommended amount of groundwater. The separate Wells Master Plan document describes the potential problems of this, including possibly not meeting customer demand or instream flow obligations.

It is also the most expensive option, in part due to the cost of maintaining obsolete facilities. This option also continues to hold on to many facilities that cannot normally be used, generally due to water quality restrictions. The elevated risk and cost both create urgency to make a decision and move away from the status quo.

Section 5.3.4.3 of the 2016 Tacoma Water: Seismic Vulnerability Assessment states “After internal analysis of the impacts to select major businesses in the area (RockTenn [now WestRock], US Oil, Marina, Graymont Western, and Metals Recycling, TW determined that the approximate economic impact to the region from a loss of activity in the Tide Flats to be approximately \$3 million per day.” Assuming the Tideflats uses approximately 20 MGD, this works out to a \$150,000 risk cost per MG of shortage.

WYSDM was used to calculate the shortages predicted over 25 years, as shown in the table below. This is based on an analysis of year 2024, using a 25-year run, and assuming central tendency climate change.

Shortages in a 25-Year Model Run for Year 2024 with Central Tendency Climate Change

Simulated Year*	Volume (MG)
2013	20
2024	222
2036	20
Total	262

*(*These simulated years can be thought of as 25 statistically generated possible versions of 2024, rather than a specific weather forecast for each year made long in advance. WYSDM models future long-term climate trends, but does not provide a single deterministic prediction of weather variability in a specific future year.)*

Keep in mind that a model run with more years would include more extreme years, so this would increase the risk cost. However, it was thought that the relatively high cost of a shortage used was already conservative enough, given the uncertainties

3.1.1. Project Costs

Life Cycle Costs in Millions

Equalized Annual Costs**	Wells	Pump Stations	TOTAL
Equipment Renewal	\$ 0.91	\$ 0.42	\$ 1.33
Pull	\$ 0.04	\$ 0.02	\$ 0.06
Test	\$ 0.14	\$ 0.06	\$ 0.20
Exercise	\$ 0.14	\$ 0.02	\$ 0.16
Additional Treatment	\$ 0.34	-	\$ 0.34
Mothball	\$ 0.11	-	\$ 0.11
TOTAL	\$ 1.68	\$ 0.52	\$ 2.20

(**Many of these life cycle costs, especially equipment renewal and pulling, are likely to only be incurred once over a period of maybe 20 to 40 years. However, for this analysis, the cost of these projects was spread evenly throughout all years.)

Some of these costs could arguably be refined further, although this would be difficult in part due to limited data collection and availability. While the numbers could be debated, this high-level analysis already helps make some valid points. We have historically been reluctant to routinely pull, test, and exercise wells because of the cost, but it is worth noting that these are a relatively small part of the life cycle costs. We have tended to hang onto unused facilities (such as Well UP10 and other “emergency” sources), but the cost of this (while still maintaining the facility, occasionally replacing broken equipment, paying for power, keeping records, etc.) is significant. Some sites have had relatively recent capital investments made (such as 10C and PRS), only to be essentially taken out of service due to recent regulatory developments (PFAS, corrosion control, etc.). Finally, even if we defer some maintenance, eventually broken equipment will need to be replaced to make a source functional and useful during a drought.

Analytical Template 100-Year Costs in Millions

Costs	100 Year Present Value
Capital Costs One-time	-
Ongoing Life Cycle Costs	\$ 96.4
Risk cost	\$ 72.6
Total Costs	\$ 169.0

At times in the past, there has been a practice of running most or all wells at least once in every 5 years. This use was part of an effort to retain the water right by being able to demonstrate what the Washington State Department of Ecology refers to as “active compliance”. The cost of the practice is only included above for wells that are functional and have corrosion control. The 2003 Municipal Water Law passed by the state legislature made municipal water rights not subject to relinquishment for non-use. Although water rights law can be complex and subject to change, listing the groundwater rights in the Water System Plan is thought to provide “safe harbor”. However, if desired, a small portable pump could be dropped down all but the deepest mothballed wells, and run briefly at a relatively low cost.

3.1.2. Quantifiable & Non-Quantifiable Benefits

See Section 1.4.

3.1.3. Risks and Constraints

See Sections 1.4. and 3.2.3.

3.1.4. Sensitivity Analysis

See Section 3.2.4.

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3.2. Alternative 1 – Recommended Alternative

The analysis indicates this is the lowest cost way to provide the recommended 40 MGD. This level of service eliminates the risk cost in this analysis. (Theoretically, there is always some risk of an extreme weather event causing a water shortage, but when WYSDM indicates 0 MG of shortage over a 25-year run, this is considered negligible for this analysis.)

The following facilities would be invested in to bring these up to current standards:

- Wells 1B, 3A, 5A, 6B, 8B, 11A, 12A, GPL1, and GPL2
- Hood Street and South Tacoma Pump Stations
- Pumps 5 and 6 at Marine View Pump Station

Some smaller, site-specific projects are also listed below.

- 1B: Modify or replace existing building that has ventilation issues
- 3A: Provide separation in the well column of the shallow and sea-level aquifer
 - It may be necessary to modify the well to only pump from the sea-level aquifer, which would lower PFAS levels
 - If production decreases, improvements at Well 13A may be needed to compensate
 - 13A is deep, non-detect for PFAS, and provides WCC flexibility
- 6B: Adjust depth of pump to reduce late-season drawdown; consider additional measures if recommended by consultant
- 8B: Revise downstream piping to provide adequate backpressure on pump
- 12A: Possible seismic measures to protect blower towers
 - All work at Wells 12A has already been approved under previous BCEs
- Hood Street: Improve the existing treatment facility to simplify starting and stopping wells, especially at low flows (approx. 5-10 MGD)
 - Add a check valve at the inlet from the Wells Line
 - Adjustments to programming / dosing can be considered, but are not as straightforward as they might seem due to all the variables with the wellfield
 - Change programming to adjust caustic dosing based on which wells are running
 - Delay the beginning of caustic injection when the first well is started
- Marine View Pump Station: Remove the smaller pumps (1-4), and move electrical gear inside the existing building

The following facilities will be mothballed (see section 1.2 for more information about this):

- Existing Wells 2B, 2C, 4A, 7B, 9A, 10C, 13A, UP1, UP10, PA1, SE2, SE6, SE8, SE11, SE11A, TF1
- Prairie Ridge Springs
- Sites for other SE, UP, and DP wells
- Proposed Wells 14A, TF2, Fred1 (in permit status)
- Pumps 1-4 and 7 at Marine View Pump Station

3.2.1. Project Costs

Breakdown of estimated capital costs are below, both by type of work and by facility. An additional 20% was typically added to the initial estimate of capital costs to allow for soft costs, including design and project management. (The exception to this is for corrosion control facilities, where the estimate from Water Treatment & Quality Planning already had soft costs built in.) A table of estimated O&M costs is also provided.

Note that the columns below may not add due to rounding.

Capital Costs in Millions by Type of Work

One-Time Costs	Wells	Pump Stations	TOTAL
Pull / Rehab	\$ 3.6	\$ 2.6	\$ 6.2
Electrical	\$ 1.5	\$ 1.2	\$ 2.7
Corrosion Control	\$ 2.5	-	\$ 2.5
Misc	\$ 0.4	\$ 0.4	\$ 0.8
TOTAL	\$ 8.0	\$ 4.3	\$ 12.3

Capital Costs in Millions by Facility

Facility	Cost
Well 1B	\$ 0.45
Well 3A	\$ 0.51
Well 5A	\$ 0.44
Well 6B	\$ 0.26
Well 8B	\$ 0.50
Well 11A	\$ 0.47
Well 12A	\$ 0.78
Wells GPL1 & GPL2	\$ 4.64
Hood Street PS & Treatment	\$ 2.08
South Tacoma PS	\$ 1.53
Marine View PS (Pumps 6 & 7)	\$ 0.64
TOTAL	\$ 12.30

Life Cycle Costs in Millions

Equalized Annual Costs	Wells	Pump Stations	TOTAL
Equipment Renewal	\$ 0.49	\$ 0.36	\$ 0.85
Pull	\$ 0.02	\$ 0.02	\$ 0.04
Test	\$ 0.08	\$ 0.06	\$ 0.14
Exercise	\$ 0.09	\$ 0.02	\$ 0.11
Additional Treatment	\$ 0.08	-	\$ 0.08
Mothball	\$ 0.36	\$ 0.01	\$ 0.37
TOTAL	\$ 1.05	\$ 0.46	\$ 1.59

Analytical Template 100-Year Costs in Millions

Costs	100 Year Present Value
Capital Costs One-time	\$ 12.7
Ongoing Life Cycle Costs	\$ 69.7
Risk cost	-
Total Costs	\$ 82.3

3.2.2. Quantifiable & Non-Quantifiable Benefits

This alternative would allow us to access the Gravity Pipeline Wellfield that we otherwise could not, which could be useful if issues were to develop in the South Tacoma Wellfield. This also potentially increases supply resilience and helps maintain the associated water rights.

See also Section 1.4.

3.2.3. Risks and Constraints

Much of the work is extraordinary or deferred maintenance. The average age of the equipment is 33 years. For comparison, the design life of pumps and motors is typically considered to be around 20 to 30 years.

The extent of repairs needed will not be known exactly until after the well is pulled and the equipment can be visually inspected. The nature of working with and around existing equipment makes the cost estimate less certain than with new construction. Possible issues include the following:

- Severe corrosion of column and casing pipes
 - Need for cathodic protection measures
- Damage to cable or equipment when pulling and replacing the well
- Limited availability of vendors and consultants due to other opportunities
- Delays while obtaining permits from Pierce County for a new treatment building (and possibly buildings for converting to vertical turbines) at the GPL wells

- Coordination of multiple parties (see also section 3.2.5), including:
 - Consulting hydrogeologist (such as Robinson Noble)
 - Consulting engineer for corrosion control design (such as HDR)
 - Pump / motor equipment vendor (such as PumpTech)
 - Electrical equipment vendor
 - Tacoma Water electrical staff
 - Tacoma Water Wells Crew
 - City of Tacoma Procurement and Payables

If it is determined that more work than was anticipated is needed, perhaps additional funds could be provided in subsequent biennia so all the work can be completed. Or an additional contingency could be budget initially, perhaps assuming all pumps and motors are replaced rather than just rehabilitated.

3.2.4. Sensitivity Analysis

Unlike many BCEs, this analysis looked at the entire groundwater system, rather than just one or a few projects. Many costs and reliabilities were estimated at a high level. The assumptions are thought to be reasonable overall, although many of these could be debated by reasonable parties. The cost estimates will be updated as work progresses.

The alternatives listed below (and also in section 1.3) outline some other options that would likely be more competitive if some of the assumptions were revised.

3.3. Alternative 2 – Add UP, SE, and PRS

The Management Team may wish to consider keeping some additional outlying wells available, especially UP1, SE11/SE11A, and Prairie Ridge Springs. These may be useful for seismic resiliency, water rights, or pipeline shutdowns, which are somewhat outside the scope of the current analysis that focuses primarily on drought needs. It is also difficult to quantify these benefits. Keeping a foothold in these more remote facilities may also help set us up more options for the future. Although this work adds cost, this is partially offset by fewer needs from the South Tacoma Wells.

This is similar to Alternative 1, except the added facilities are used instead of Well 6B and Marine View Pump Station.

3.3.1. Project Costs

Capital Costs in Millions by Type of Work

One-Time Costs	Wells	Pump Stations	TOTAL
Pull / Rehab	\$ 4.3	\$ 2.2	\$ 6.5
Electrical	\$ 1.8	\$ 1.0	\$ 2.8
Corrosion Control	\$ 5.6	-	\$ 5.6
Misc	\$ 0.4	\$ 0.4	\$ 0.8
TOTAL	\$ 12.1	\$ 3.6	\$ 15.8

Capital Costs in Millions by Facility

Facility	Cost
Well 1B	\$ 0.45
Well 3A	\$ 0.51
Well 5A	\$ 0.44
Well 8B	\$ 0.50
Well 11A	\$ 0.47
Well 12A	\$ 0.78
Wells GPL1 & GPL2	\$ 4.64
Well UP1	\$ 1.17
Wells SE11 and SE11A	\$ 1.58
Prairie Ridge Springs	\$ 1.64
Hood Street PS & Treatment	\$ 2.08
South Tacoma PS	\$ 1.53
TOTAL	\$ 15.79

Life Cycle Costs in Millions

Equalized Annual Costs	Wells	Pump Stations	TOTAL
Equipment Renewal	\$ 0.58	\$ 0.26	\$ 0.84
Pull	\$ 0.03	\$ 0.01	\$ 0.04
Test	\$ 0.10	\$ 0.05	\$ 0.15
Exercise	\$ 0.10	\$ 0.02	\$ 0.12
Additional Treatment	\$ 0.17	-	\$ 0.17
Mothball	\$ 0.30	\$ 0.02	\$ 0.32
TOTAL	\$ 1.28	\$ 0.36	\$ 1.64

Analytical Template Costs in Millions

Costs	100 Year Present Value
Capital Costs One-time	\$ 16.3
Ongoing Life Cycle Costs	\$ 71.9
Risk cost	-
Total Costs	\$ 88.1

3.3.2. Quantifiable & Non-Quantifiable Benefits

This alternative would allow us to access multiple wellfields (Gravity Pipeline, University Place, Southeast Tacoma, and Prairie Ridge) that we otherwise could not, which could be useful if issues were to develop in the South Tacoma Wellfield. This also potentially increases supply resilience, and helps maintain the associated water rights for future system changes. The value of this is difficult to quantify; it is a judgement call if the benefits justify the over \$3 million increase to initial capital cost.

In addition to the cost increase, it is also worth considering that operating and maintaining the small outlying sites (including 4 new corrosion control facilities) may be a significant inconvenience to staff when these wells are run, even though each produces only a relatively small quantity of water. It may be best to hold off on the additional small wells for now, and then reconsider after a few years if more wells are needed.

See also Sections 1.4. and 3.3.

3.3.3. Risks and Constraints

See Section 3.2.3.

3.3.4. Sensitivity Analysis

See Section 3.2.3.

3.4. Alternative 3 – South Tacoma Only

It is possible to meet the reliability target with only South Tacoma Wells. Partway through the analysis, this option seemed like a way to avoid paying for additional corrosion control facilities. However, to provide enough pump station capacity to use all wells in the event of a WestRock shutdown, this alternative would require adding another pump at Hood Street, for which there is no existing spot. The associated high cost is not very attractive.

This is also similar to Alternative 1, except for the following:

- Include Wells 2B, 2C, 4A, 9A, and 13A
- Exclude Wells GPL1 and GPL2
- Include Pump 5 at Marine View Pump Station
- Modify Hood Street Pump Station to add a 4th Pump

3.4.1. Project Costs

Capital Costs in Millions by Type of Work

One-Time Costs	Wells	Pump Stations	TOTAL
Pull / Rehab	\$ 3.2	\$ 2.9	\$ 6.1
Electrical	\$ 1.3	\$ 1.3	\$ 2.6
Corrosion Control	-	-	-
Misc	\$ 0.4	\$ 4.3	\$ 4.8
TOTAL	\$ 4.9	\$ 8.5	\$ 13.5

Capital Costs in Millions by Facility

Facility	Cost
Well 1B	\$ 0.45
Well 2B	\$ 0.29
Well 2C	\$ 0.14
Well 3A	\$ 0.51
Well 4A	\$ 0.32
Well 5A	\$ 0.44
Well 6B	\$ 0.26
Well 8B	\$ 0.50
Well 9A	\$ 0.58
Well 11A	\$ 0.47
Well 12A	\$ 0.78
Wells 13A	\$ 0.22
Hood Street PS & Treatment	\$ 2.08
Pump 4 at Hood Street PS	\$ 3.97
South Tacoma PS	\$ 1.53
Marine View PS (Pumps 5-7)	\$ 0.96
TOTAL	\$ 13.50

Life Cycle Costs in Millions

Equalized Annual Costs	Wells	Pump Stations	TOTAL
Equipment Renewal	\$ 0.60	\$ 0.45	\$ 1.05
Pull	\$ 0.03	\$ 0.02	\$ 0.05
Test	\$ 0.08	\$ 0.07	\$ 0.15
Exercise	\$ 0.10	\$ 0.03	\$ 0.13
Additional Treatment	\$ 0.01	-	\$ 0.01
Mothball	\$ 0.58	-	\$ 0.58
TOTAL	\$ 1.38	\$ 0.57	\$ 1.95

Analytical Template Costs in Millions

Costs	100 Year Present Value
Capital Costs One-time	\$ 13.9
Ongoing Life Cycle Costs	\$ 86.3
Risk cost	-
Total Costs	\$ 100.2

3.4.2. Quantifiable & Non-Quantifiable Benefits

See Section 1.4.

3.4.3. Risks and Constraints

See Section 3.2.3.

3.4.4. Sensitivity Analysis

See Section 3.2.4.

3.5. Alternative 4 – 55 MGD / Year 2070

This is generally similar to making all the facility investments described in Alternatives 2 and 3, plus the following:

- Include Wells 7A, SE2, and SE6
- Construct Well 14A (currently just a hole in the ground and a water right permit)
- Exclude Prairie Ridge Springs
- Lakehaven (build a station to pump Lakehaven's groundwater into Pipeline 5)
- Aggressive Peak Shaking (further reduce water consumption in the summer)

This option is largely shown for long-term planning purposes, to provide an idea of what additional groundwater facilities may be needed in approximately 50 years if no other changes to supply or demand occur. This information may be useful for managing water rights and properties.

3.5.1. Project Costs

Project costs are shown in the tables below. Costs from the Lakehaven Pump Station and Aggressive Peak Shaving are shown as "Other", since these deliver water from outside sources or through additional conservation.

Capital Costs in Millions by Type of Work

One-Time Costs	Wells	Pump Stations	Other	TOTAL
Pull / Rehab	\$ 5.9	\$ 2.9	-	\$ 8.8
Electrical	\$ 2.5	\$ 1.3	-	\$ 3.8
Corrosion Control	\$ 6.0	-	-	\$ 6.0
Misc	\$ 5.5	\$ 4.3	\$ 2.3	\$ 12.1
TOTAL	\$ 19.8	\$ 8.5	\$ 2.3	\$ 30.7

Capital Costs in Millions by Facility

Facility	Cost	Nominal Flow (MGD)	Annual Volume (kAF)
Well 1B	\$ 0.45	3.5	2.0
Well 2B	\$ 0.29	2.0	0.4
Well 2C	\$ 0.14	2.9	0.5
Well 3A	\$ 0.51	4.1	2.3
Well 4A	\$ 0.32	1.3	0.7
Well 5A	\$ 0.44	6.5	3.7
Well 6B	\$ 0.26	3.9	1.8
Well 7B	\$ 0.90	1.2	0.4
Well 8B	\$ 0.50	4.4	2.1
Well 9A	\$ 0.58	4.5	3.8
Well 11A	\$ 0.47	8.8	4.9
Well 12A	\$ 0.78	5.0	4.2
Well 13A	\$ 0.22	1.1	0.8
Well 14A (New Facility)	\$ 4.97	3.9	0.7
Wells GPL1 & GPL2 (Add CC)	\$ 4.64	7.8	4.4
Well UP1 (Add CC)	\$ 1.17	1.6	0.7
SE2 & SE6 (Replace CC)	\$ 1.62	1.2	0.7
SE11 & SE11A (Add CC)	\$ 1.58	1.7	0.7
Hood Street PS & Treatment	\$ 2.08	15	8.5
Pump 4 at HSPS (New Facility)	\$ 3.97	5	2.8
South Tacoma PS	\$ 1.52	16.7	9.4
Marine View PS: Pumps 5-7	\$ 0.96	7.0	4.0
Lakehaven PS (New Facility)	\$ 1.95	3	1.7
Peak Shaving (New Program)	\$ 0.33	5	0.9
TOTAL	\$ 30.66		

Life Cycle Costs in Millions

Equalized Annual Costs	Wells	Pump Stations	Other	TOTAL
Equipment Renewal	\$ 0.94	\$ 0.45	\$ 0.02	\$ 1.41
Pull	\$ 0.05	\$ 0.02	-	\$ 0.07
Test	\$ 0.16	\$ 0.07	-	\$ 0.23
Exercise	\$ 0.13	\$ 0.03	\$ 0.02	\$ 0.18
Additional Treatment*	\$ 0.20	-	\$ 0.12	\$ 0.32
Mothball	\$ 0.14	-	-	\$ 0.14
TOTAL	\$ 1.63	\$ 0.57	\$ 0.16	\$ 2.35

(*Or other additional costs, such as for an ongoing Peak Shaving program)

Analytical Template Costs in Millions

Costs	100 Year Present Value
Capital Costs One-time	\$ 31.6
Ongoing Life Cycle Costs	\$ 103.0
Risk cost	-
Total Costs	\$ 134.6

3.5.2. Quantifiable & Non-Quantifiable Benefits

See Sections 1.4. and 3.5.

3.5.3. Risks and Constraints

See Section 3.2.3.

3.5.4. Sensitivity Analysis

See Section 3.2.4.

3.6. Justification of recommended alternative

The recommended approach – Alternative 1 – is the lowest cost way to get to the 40 mgd of reliable capacity recommended by yield modeling at this time. This would modernize our current “go to” wells and associated pump stations, as well as make the high producing GPL wells available. In future years, if more groundwater is needed, improving some of the outlying wells may become a more attractive option as our needs and situation evolve.

4. Supporting Documentation

Document Name
• Wells Master Plan Report
• Short Form BCEs for Individual Wells and Associated Pump Stations
• Well 12A Rehabilitation BCE (and 2019-2020 Wells R&R BCE)
• Well 12A Blower Motor and MCC Rehab BCE
• Well 12A Pipe Supports BCE
• Corrosion Control Treatment for GPL Wells BCE
• Hood Street Facilities Seismic Improvements BCE
• Hood Street Reservoir Seismic Improvements BCE
• South Tacoma Pump Station Seismic Improvements BCE
• Pipeline No. 1 Pressurization Project BCE
• Eagle Lake Siphon Project BCE

Tacoma Water PFAS Sampling
2018/2019
EPA 537 Full 14 Compound List

	Compound Abbreviation	PFOS	PFOA	PFNA	PFHxS	PFBS	GenX (HFPO-DA)	Hazard Index	PFHpA	PFHxA	PFDA	PFDoA	PFTDA	PFTrDA	PFUnA	NetFOSAA	NMeFOSAA	
	Compound Name	Perfluorooctanesulfonic Acid	Perfluorooctanoic Acid	Perfluorononanoic Acid	Perfluorohexanesulfonic Acid	Perfluorobutanesulfonic Acid	Hexafluoropropylene oxide dimer acid	Calculated (Not including GenX)	Perfluoroheptanoic Acid	Perfluorohexanoic Acid	Perfluorodecanoic Acid	Perfluorododecanoic Acid	Perfluorotetradecanoic Acid	Perfluorotridecanoic Acid	Perfluoroundecanoic Acid	N-ethyl Perfluorooctanesulfonamidoacetic Acid	N-methyl Perfluorooctanesulfonamidoacetic Acid	TOTAL - All 14 Compounds
	Units	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	dimensionless	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	
	Method Detection Limit	0.2	0.23	0.35	0.46	0.73	NOT MEASURED		0.36	0.39	0.28	0.64	1.4	0.83	0.44	0.5	0.36	
	EPA Proposed MCL or HBWC	4	4	10	9	2000	10	1										
Source	WA SAL	15	10	9	65	345	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	
PRIMARY SOURCES																		
Green River - Raw	9/25/2018	ND	ND	ND	ND	ND		0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Green River - Treated	9/25/2018	ND	ND	ND	ND	ND		0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
North Fork #6	9/25/2018	ND	ND	ND	ND	ND		0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SEASONAL SOURCES - TYPICALLY BLENDED																		
Well 1B	9/5/2018	4.3	3.3	ND	3.9	3.4		0.44	1.4	4.7	ND	ND	ND	ND	ND	ND	ND	21.4
Well 3A	9/5/2018	10	3.6	0.6	8.2	4.4		0.97	1.3	2.7	ND	ND	ND	ND	ND	ND	ND	31.8
Well 3A (resample)	10/4/2018	14	2.4	0.6	5.2	2.4		0.64	0.89	1.5	ND	ND	ND	ND	ND	ND	ND	27.6
Well 5A	9/5/2018	2.2	1.6	ND	2.5	2.3		0.28	0.79	1.6	ND	ND	ND	ND	ND	ND	ND	11.3
Well 6B	10/23/2018	1.9	5.1	ND	5.8	5.2		0.65	2.5	4.3	ND	ND	ND	ND	ND	ND	ND	25.4
Well 8B	9/5/2018	5.2	2.4	ND	4.6	3.4		0.51	0.9	2	ND	ND	ND	ND	ND	ND	ND	19.0
Well 9A	10/24/2018	1.2	0.98	ND	2.2	1.8		0.25	0.37	0.94	ND	ND	ND	ND	ND	ND	ND	7.7
Well 11A	10/23/2018	2.2	2.6	ND	4.1	5.1		0.46	1.3	2.9	ND	ND	ND	ND	ND	ND	ND	18.7
Well 12A	9/5/2018	0.56	0.72	ND	3.1	1.6		0.35	ND	0.81	ND	ND	ND	ND	ND	ND	ND	7.1
Well 13A	10/17/2018	ND	ND	ND	ND	ND		0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Well GPL2	10/22/2018	2.5	2.3	ND	2.2	2.6		0.25	1.1	2.4	ND	ND	ND	ND	ND	ND	ND	13.3
BLENDED ENTRY TO DISTRIBUTION																		
Hood Street Outlet	9/5/2018	8.1	2.6	0.74	5.9	3.4		0.73	1.1	2.4	ND	ND	ND	ND	ND	ND	ND	25.0
RARELY USED OR EMERGENCY SOURCES																		
Well 2C	11/7/2018	ND	ND	ND	ND	ND		0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Well 4A	10/24/2018	4.7	1.5	ND	2.6	1.4		0.29	0.77	1.5	ND	ND	ND	ND	ND	ND	ND	12.8
Well SE2	10/22/2018	5.0	ND	ND	6.6	3.2		0.73	ND	ND	ND	ND	ND	ND	ND	ND	ND	15.5
Well SE8	9/25/2018	0.47	ND	ND	3.8	1.1		0.42	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.8
Well SE11A	11/7/2018	1.1	ND	ND	3.8	1.2		0.42	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.5
Well UP1	4/25/2019	0.43	0.53	ND	1.5	2.0		0.17	ND	0.50	ND	ND	ND	ND	ND	ND	ND	5.1
Well PA1	5/8/2019	ND	ND	ND	ND	ND		0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Prairie Springs	10/17/2018	0.20	0.34	ND	ND	ND		0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.5
TAKEN OUT OF SERVICE																		
Well 7B	10/4/2018	35	8.7	5.3	22	6.2		2.98	3.0	7.3	ND	ND	ND	ND	ND	ND	ND	90.5
Well 10C	9/5/2018	140	24	21	67	19		9.55	7.2	22	ND	ND	ND	ND	ND	ND	ND	309.8
Well 10C (resample)	10/17/2018	51	9	3.6	40	11		4.81	3.8	12	ND	ND	ND	ND	ND	ND	ND	135.2
Well 10C - Treated	10/17/2018	46	7.3	2.1	36	10		4.22	3.1	11	ND	ND	ND	ND	ND	ND	ND	119.7

Red = Values > EPA Proposed Orange = Values > 80% x (EPA Proposed)

ND = Not detected, less than Method Detection Limit

Results in italics were measured >MDL and <MRL.

NOTE: During sampling, (1) South Tacoma wells were either blended at Hood Street Reservoir or run to blow-off and (2) individual wells were run to blow-off and not into distribution. Well 10C and Well 7B were taken out of service following the 2018 results.

Red = Values > EPA Proposed Orange = Values > 80% x (EPA Proposed)
 ND = Not detected, less than Method Detection Limit
Results in italics were measured >MDL and <MRL.
NOTE: During sampling, (1) South Tacoma wells were either blended at Hood Street Res



Water Source Analysis

		Primary Sources (Finished)		Secondary Source In-Town Wells (Typically Sampled at Wellhead, Raw)													Secondary Source Wells, Outside City Limits (Typically Sampled at Wellhead, Raw)						
Parameter	Maximum Contaminant Level (MCL)	Green River	North Fork Wellfield	1B	2C	3A	4A	5A	6B	7B	8B	9A	11A	12A	13A	PA Well	SE11/ 11A	SE2/6	SE8	Prairie Springs	GPL1	GPL2	UP1
Acidity		<1.0	<0.0010	2.6	4.55	23.9	29.83	20.5	1.7	4.2	3.5	19.48	4.7	<1.0	<1.0	2.16	7.65	9.56	21.3	4.15	8.2	4.3	<0.1
Alkalinity as CaCO3		27.3	30.8	83.2	70	86.3	111	77	63.9	74	86.3	104	72.4	132	63.2	60.3	77.1	62.2	82.2	105	81.8	86.1	77.0
Ammonia-Nitrogen		<0.050	<0.050	<0.05	0.46	<0.050	<0.03	0.13	<0.050	0.8	<0.050	0.03	<0.050	<0.050	<0.050	0.07	0.05	< 0.03	<0.050	<0.03	<0.050	<0.050	<0.05
Antimony	0.006	<0.003	<0.003	<0.003	<0.001	<0.003	<0.001	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.001	<0.003	<0.003	<0.003	<0.003	<0.003
Arsenic	0.01	<0.0010	<0.0010	0.0017	0.001	<0.0010	0.001	<0.0010	<0.0010	<0.0014	0.0011	<0.0014	<0.0010	<0.001	<0.0010	0.0061	<0.0014	<0.001	<0.001	<0.0014	0.0013	0.0011	<0.0014
Aluminum	0.014	0.01	0.01	<0.01	NS	0.012	<0.05	<0.01	<0.01	<0.05	<0.01	<0.05	<0.010	<0.01	<0.010	<0.05	<0.05	<0.05	<0.010	<0.05	<0.010	<0.010	<0.05
Barium	2	<0.10	<0.1	<0.1	0.004	<0.1	0.004	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	<0.1	<0.1	0.003	<0.10	<0.1	<0.10	<0.1	<0.1
Beryllium	0.004	<0.00030	<0.00030	<0.0003	<0.001	<0.0003	<0.001	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.001	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Cadmium	0.005	<0.0010	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Calcium	12	6	6	67	6.35	61	21.7	50	40	19	66	19	39	85	20	12	19	14.8	57	33	54	60	14
Chloride	250	3	2.1	6.3	1.8	7.4	14	7.2	8.2	<20	6.4	22	8.7	10.5	1.8	<20	<20	6.3	9.6	<20	7.4	7	<20
Chromium	0.1	<0.0070	<0.007	<0.007	<0.001	<0.007	<0.010	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	0.001	0.001	<0.007	<0.007	<0.007	<0.007	<0.007
Color (color units)	15	<5	<5	<5	10	<5	<5	<5	<5	<15	<5	<15	<5	<5	<5	<15	<15	<5	<5	<15	<5	<5	<15
Conductivity (UMHOS)	700	69.1	52.6	193.8	137	215.4	292	205.6	176.8	230	191.2	300	212.8	282.9	109.7	120	210	179	198.6	250	199.4	207.7	190
Copper	1.3	<0.02	<0.02	<0.02	<0.005	<0.02	<0.005	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.054	<0.005	0.038	0.16	<0.020	<0.02	<0.02
Cyanide	0.2	<0.05	<0.04	<0.05	<0.04	<0.040	<0.040	<0.010	<0.05	<0.010	<0.05	<0.040	<0.05	<0.05	<0.05	<0.040	<0.040	<0.040	<0.040	<0.040	<0.05	<0.05	<0.05
Fluoride	4	0.63	0.6	<0.20	0.2	<0.20	<0.20	<0.20	<0.20	0.83	<0.20	0.75	<0.20	<0.20	<0.20	<0.5	<0.1	<0.2	<0.2	<0.5	<0.20	<0.20	<0.5
Hardness as CaCO ₃	17	12	12	106	28.6	106	121	108	86	93	106	110	88	164	41	56	85	71.1	104	120	96	102	88
Iron	0.3	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.17	<0.1	<0.1	<0.10	<0.1	<0.1	<0.1	<0.1
Lead	0.015	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0012	<0.001	<0.001	<0.001
Magnesium		<1.0	<1.0	9.5	3.1	11.4	16.3	14.1	11.2	11	9.7	14	11.2	19.2	5.1	6.4	9	8.3	11.4	10	10.2	9.33	13
Manganese	0.05	0.021	<0.01	<0.01	0.058	<0.01	0.024	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.081	0.061	<0.01	<0.001	<0.010	<0.01	<0.010	<0.01	<0.01
Mercury	0.002	<0.00020	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0007
Nickel		<0.0050	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrate	10	<0.20	0.31	3.45	<0.5	2.3	1.6	3.48	3.74	1.6	2.65	2.5	4.22	3.66	<0.2	<0.5	1.3	2.5	0.78	4.2	2.8	2.5	2.2
Nitrite	1	<0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.12	<0.1	<0.10	<0.1	<0.1
Ortho-Phosphate		0.011	<0.01	0.114	0.37	0.057	0.03	0.043	0.032	0.084	0.091	<0.049	0.034	0.032	0.218	0.25	0.039	0.017	0.028	0.02	0.058	0.057	0.22
pH (units)		8.52	8.4	7.55	7.4	7	7.11	7.25	7.2	7.62	7.06	7.1	7.56	8.14	7.97	7.2	7.13	6.42	7.07	7	6.89	7.18	6.9
Selenium	0.05	<0.0020	<0.002	<0.002	<0.005	<0.002	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Silica		14.3	15.9	35.5	57.7	28.4	32.3	32	31.6	26.1	34.6	31.76	30.3	35	49.4	45.11	28	25.6	27.9	22.9	32.6	32.4	33.6
Silver	0.1	<0.01	<0.01	<0.01	<0.010	<0.01	<0.01	<0.1	<0.01	<0.1	<0.01	<0.1	<0.01	<0.01	<0.01	<0.1	<0.1	<0.01	<0.01	<0.1	<0.01	<0.01	<0.1
Sodium		9.7	7.8	8	17.8	7.1	13.1	7.7	9.6	16	7.7	31	10	11.6	8.5	6.4	7.4	6.7	8.2	6.9	5.2	6	9
Sulfate	250	3.4	1.8	12.9	<10	11.2	16	14.3	13.1	<50	12	<50	13.6	18.3	<1.0	<50	<50	8.2	10.6	<50	9.4	7.8	<50
Temp		14.8	7.9	9.8	12.8	14.2	10.4	12.1	13	11.1	16.2	10.3	14.6	15.8	15.4	10.9	11.7	12.4	14	14.9	10.4	14.2	12.1
Thallium	0.002	<0.0010	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Dissolved Solids	500	126	68.5	158	130	141	1000.0	138.5	146	140	156	190	153.5	226	104	<100	140	120	125.5	160	154	156	160
Total Solids		NS	NS	NS	NS	NS	NS	NS	NS	110	NS	NS	NS	NS	NS	NS	140	NS	NS	NS	NS	NS	NS
Total Suspended Solids		<1	<1	<1	<4	2.2	<4	2.6	<1.0	<5.0	<1.0	<4	2.7	<1.0	<1.0	<4	<1	<4	1.1	<4	<1.0	<1.0	<4
Turbidity (NTU)	5	0.09	0.24	0.04	0.31	0.26	1.41	0.05	0.43	1.11	0.65	0.19	0.2	0.2	0.21	4.9	0.26	4.47	0.37	0.64	0.06	0.16	0.2
Zinc	5	<0.2	<0.2	<0.2	<0.005	<0.2	0.008	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.005	<0.20	<0.2	<0.2	<0.2	<0.2

*All values represent most current data as of 1/1/2023.
*All parameters were measured in mg/L unless otherwise specified
*Maximum contaminant level represents maximum allowable limit as set forth by the EPA
*NS indicates no sample taken for that parameter
*ND indicates no detection of parameter

APPENDIX B

SIGNATURE PAGE

SIGNATURE PAGE

CITY OF TACOMA TACOMA WATER

All submittals must be in ink or typewritten, executed by a duly authorized officer or representative of the bidding/proposing entity, and received and time stamped as directed in the **Request for Qualifications near the beginning of the specification**. If the bidder/proposer is a subsidiary or doing business on behalf of another entity, so state, and provide the firm name under which business is hereby transacted.

REQUEST FOR QUALIFICATIONS SPECIFICATION NO. TW23-0153F Wellfield Treatment Evaluation Engineering Services

The undersigned bidder/proposer hereby agrees to execute the proposed contract and furnish all materials, labor, tools, equipment and all other facilities and services in accordance with these specifications.

The bidder/proposer agrees, by submitting a bid/proposal under these specifications, that in the event any litigation should arise concerning the submission of bids/proposals or the award of contract under this specification, Request for Bids, Request for Proposals or Request for Qualifications, the venue of such action or litigation shall be in the Superior Court of the State of Washington, in and for the County of Pierce.

Non-Collusion Declaration

The undersigned bidder/proposer hereby certifies under penalty of perjury that this bid/proposal is genuine and not a sham or collusive bid/proposal, or made in the interests or on behalf of any person or entity not herein named; and that said bidder/proposer has not directly or indirectly induced or solicited any contractor or supplier on the above work to put in a sham bid/proposal or any person or entity to refrain from submitting a bid/proposal; and that said bidder/proposer has not, in any manner, sought by collusion to secure to itself an advantage over any other contractor(s) or person(s).

Bidder/Proposer's Registered Name

Signature of Person Authorized to Enter Date
into Contracts for Bidder/Proposer

Address

Printed Name and Title

City, State, Zip

(Area Code) Telephone Number / Fax Number

Authorized Signatory E-Mail Address

State Business License Number
in WA, also known as UBI (Unified Business Identifier) Number

E.I.No. / Federal Social Security Number Used on Quarterly
Federal Tax Return, U.S. Treasury Dept. Form 941

State Contractor's License Number
(See Ch. 18.27, R.C.W.)

E-Mail Address for Communications

Addendum acknowledgement #1_____ #2_____ #3_____ #4_____ #5_____

THIS PAGE MUST BE SIGNED AND RETURNED WITH SUBMITTAL.

APPENDIX C

SAMPLE CONTRACT AND INSURANCE REQUIREMENTS

SERVICES CONTRACT

Click here for the [Contract Questionnaire Popup Quick Reference](#)

Start Questionnaire

Finalize Document

THIS CONTRACT, made and entered into effective as of [Month] [Day], [Year] ("EFFECTIVE DATE"), by and between the CITY OF TACOMA, a municipal corporation of the State of Washington (hereinafter referred to as the "CITY"), and [INSERT legal name of Supplier exactly as it appears in Ariba including any dbas or trade names], (hereinafter may be referred to as "CONTRACTOR" or "SUPPLIER");

In consideration of the mutual promises and obligations hereinafter set forth, the Parties hereto agree as follows:

1. Scope of Services

The CONTRACTOR agrees to diligently and completely perform the services or deliverables consisting of [INSERT A BRIEF DESCRIPTION OF THE WORK TO BE PERFORMED] as is described in [Exhibit A, B, ETC., if needed] attached hereto and incorporated herein.

2. Changes to Scope of Work

The CITY shall have the right to make changes within the general scope of services or deliverables upon execution in writing of a change order or amendment hereto. If the changes will result in additional work effort by CONTRACTOR, the CITY will agree to reasonably compensate the CONTRACTOR for such additional effort up to the maximum amount specified herein or as otherwise provided by City Code.

3. Term

All services shall be satisfactorily completed on or before [INSERT CONTRACT TERMINATION DATE] and this Contract shall expire on said date unless mutually extended by a written and executed Amendment to this Contract.

4. Delay

Neither party shall be considered to be in default in the performance of this Contract to the extent such performance is prevented or delayed by any cause which is beyond the reasonable control of the affected party and, in such event, the time for performance shall be extended for a period equal to any time lost as a result thereof. In the event CONTRACTOR is unable to proceed due to a delay solely attributable to CITY, CONTRACTOR shall advise CITY of such delay in writing as soon as is practicable.

5. Compensation

The CITY shall compensate the CONTRACTOR for the services and deliverables performed under this Contract [on the basis of] [EXHIBIT XXXX and/or a DESCRIPTION OF COMPENSATION ARRANGEMENTS –MILESTONES, TIME AND MATERIALS, LUMP SUM ETC.]

6. Prevailing Wages

- A. If federal, state, local, or any applicable law requires CONTRACTOR to pay prevailing wages in connection with this Contract, and CONTRACTOR is so notified by the CITY, then CONTRACTOR shall pay applicable prevailing wages and otherwise comply with the Washington State Prevailing Wage Act (RCW 39.12) in the performance of this Contract.
- B. If applicable, a Schedule of Prevailing Wage Rates and/or the current prevailing wage determination made by the Secretary of Labor for the locality or localities where the Contract will be performed is made of part of the Contract by this reference. If prevailing wages apply to the Contract, CONTRACTOR and its subcontractors shall:
 1. Be bound by and perform all transactions regarding the Contract relating to prevailing wages and the usual fringe benefits in compliance with the provisions of Chapter 39.12 RCW, as amended, the Washington State Prevailing Wage Act and/or the Davis-Bacon Act (40 U.S.C. 3141- 3144, and 3146-3148) and the requirements of 29 C.F.R. pt. 5 as may be applicable, including the federal requirement to pay wages not less than once a week.
 2. Ensure that no worker, laborer or mechanic employed in the performance of any part of the Contract shall be paid less than the prevailing rate of wage specified on that Schedule and/or specified in a wage determination made by the Secretary of Labor (unless specifically preempted by federal law, the higher of the Washington state prevailing wage or federal Davis-Bacon rate of wage must be paid.
 3. Immediately upon award of the Contract, contact the Department of Labor and Industries, Prevailing Wages section, Olympia, Washington and/or the federal Department of Labor, to obtain full information, forms and procedures relating to these matters. Per such procedures, a Statement of Intent to Pay Prevailing Wages and/or other or additional documentation required by applicable federal law, must be submitted by CONTRACTOR and its subcontractors to the CITY, in the manner requested by the CITY, prior to any payment by the CITY hereunder, and an Affidavit of Wages Paid and/or other or additional documentation required by federal law must be received or verified by the CITY prior to final Contract payment.

7. Not to Exceed Amount

The total price to be paid by CITY for CONTRACTOR'S full and complete performance of the Scope of Work hereunder shall not exceed \$ [INSERT TOTAL AMOUNT OF CONTRACT] plus applicable taxes without a written and executed Amendment to this Contract. Said price shall be the total compensation for CONTRACTOR'S performance hereunder including, but not limited to, all work, deliverables, materials, supplies, equipment, subcontractor's fees, and all reimbursable travel and miscellaneous or incidental expenses to be incurred by CONTRACTOR.

In the event the CONTRACTOR incurs cost in excess of the sum authorized for service under this Contract, the CONTRACTOR shall pay such excess from its own funds, and the CITY shall not be required to pay any part of such excess, and the CONTRACTOR shall have no claim against the CITY on account thereof.

8. Payment

CONTRACTOR shall submit [Pick one of the following monthly, weekly, annual, Contract milestone, other (describe in detail)] invoices for services completed and/or deliverables furnished during the invoice period. Upon CITY'S request, CONTRACTOR shall submit necessary and appropriate documentation, as determined by the CITY, for all invoiced services and deliverables. For transactions conducted in SAP Ariba, invoices shall be submitted directly through Ariba. For invoices paid by ACH or by check, unless stated otherwise, invoices shall be electronically submitted by email with corresponding PO number or other identifying number listed in the subject line to accountspayable@cityoftacoma.org.

Payment shall be made through the CITY'S ordinary payment process, and shall be considered timely if made within 30 days of receipt of a properly completed invoice. All payments shall be subject to adjustment for any amounts, upon audit or otherwise, determined to have been improperly invoiced. The CITY may withhold payment to the CONTRACTOR for any services or deliverables not performed as required hereunder until such time as the CONTRACTOR modifies such services or deliverables to the satisfaction of the CITY.

9. Payment Method

The City's preferred method of payment is by ePayables (Payment Plus), followed by credit card (aka procurement card), then Electronic Funds Transfer (EFT) by Automated Clearing House (ACH), then check or other cash equivalent. CONTRACTOR may be required to have the capability of accepting the City's ePayables or credit card methods of payment. The City, in its sole discretion, will determine the method of payment for this Contract.

10. Independent Contractor Status

The services and deliverables shall be furnished by the CONTRACTOR as an independent Contractor, and nothing herein contained shall be construed to create an employer and employee relationship. The CONTRACTOR shall provide at its sole expense all materials, office space, and other necessities to perform its duties under this Contract, unless stated otherwise in this Contract.

No payroll or employment taxes of any kind shall be withheld or paid by the CITY with respect to payments to CONTRACTOR. The payroll or employment taxes that are the subject of this paragraph include, but are not limited to, FICA, FUTA, federal income tax, state personal income tax, state disability insurance tax and state unemployment insurance tax. By reason of CONTRACTOR's status as an independent Contractor hereunder, no workers' compensation insurance has been or will be obtained by the CITY on account of CONTRACTOR. CONTRACTOR may be required to provide the CITY proof of payment of these said taxes and benefits. If the CITY is assessed or deemed liable in any manner for those charges or taxes, the CONTRACTOR agrees to hold the CITY harmless from those costs, including attorney's fees.

11. Services Warranty

The CONTRACTOR warrants that all services performed pursuant to this Contract shall be generally suitable for the use to which CITY intends to use said services and deliverables as expressed in the Scope of Work. In the performance of services under this Contract, the CONTRACTOR and its employees further agree to exercise the degree of skill and care required by customarily accepted good practices and procedures followed by professionals or service providers rendering the same or similar type of service. All obligations and services of the CONTRACTOR hereunder shall be performed diligently and completely according to such professional standards.

12. Contract Administration

[INSERT NAME TITLE AND DEPARTMENT OF CONTRACT ADMINISTRATOR] for the CITY shall have primary responsibility for contract administration and approval of services to be performed by the CONTRACTOR, and shall coordinate all communications between the CONTRACTOR and the CITY.

13. Specific Personnel

If before, during, or after the execution of this Contract, CONTRACTOR represents to the CITY that certain personnel would or will be responsible for performing services and deliverables under this Contract, then the CONTRACTOR is obligated to ensure that said personnel perform said Contract services to the maximum extent permitted by law. This Contract provision shall only be waived by written authorization by the CITY, and on a case-by-case basis.

The CONTRACTOR shall establish and maintain records in accordance with requirements prescribed by the CITY, with respect to all matters related to the performance of this Contract. Except as otherwise authorized by the CITY, the CONTRACTOR shall retain such records for a period of _____ [INSERT THE TIME THE RECORDS SHOULD BE KEPT. MOST COMMON IS 6 YEARS] years after receipt of the final payment under this Contract or termination of this Contract.

14. Notices

Except for routine operational communications, which may be delivered personally or transmitted by electronic mail all notices required hereunder shall be in writing and shall be deemed to have been duly given if delivered personally or mailed first-class mail, postage prepaid, to the parties at the following addresses:

CITY:	CONTRACTOR:
Name:	Name:
Title:	Title:
Address:	Address:
Telephone No.:	Telephone No.:
E-mail:	E-mail:

15. Termination

- A. Except as otherwise provided herein, the CITY may terminate this Contract at any time, for CITY's own reasons and without cause, by giving ten (10) business days written notice to CONTRACTOR. In the event of termination, all finished and unfinished work prepared by the CONTRACTOR pursuant to this Contract shall be provided to the CITY. CITY may terminate this Contract in the event of any material breach of any of the terms and conditions of this Contract if CONTRACTOR's breach continues in effect after written notice of breach and 30 days to cure such breach and fails to cure such breach.
- B. In the event CITY terminates this Contract due to the CITY's own reasons and without cause due to the CONTRACTOR's actions or omissions, the CITY shall pay the CONTRACTOR the amount due for actual work and services necessarily performed under this Contract up to the effective date of termination, not to exceed the total compensation set forth herein.
- C. In the event of material default or breach by CONTRACTOR of any of the terms or conditions of the Contract, CITY may, at its election, procure services and deliverables under this CONTRACT from other sources, and may deduct from the unpaid balance due CONTRACTOR, or collect against the bond or security (if any), or may invoice and recover from CONTRACTOR all costs paid in excess of the price(s) set forth in the Contract.
- D. Termination of this Contract by CITY shall not constitute a waiver of any claims or remaining rights the CITY may have against CONTRACTOR relative to performance hereunder.

16. Suspension

The CITY may suspend this Contract, at its sole discretion, upon seven (7) business days' written notice to the CONTRACTOR. Such notice shall indicate the anticipated period of suspension.

Any reimbursement for expenses incurred due to the suspension shall be limited to the CONTRACTOR'S reasonable expenses and shall be subject to verification. The CONTRACTOR shall resume performance of services under this Contract without delay when the suspension period ends. Suspension of this Contract by CITY shall not constitute a waiver of any claims or remaining rights the CITY may have against CONTRACTOR relative to performance hereunder.

17. Federal Funds

If federal funds will be used to fund, pay or reimburse all or a portion of the services or deliverables provided under the Contract, the terms and conditions set forth at Appendix A to this Contract are incorporated into and made part of this Contract and CONTRACTOR will comply with all applicable provisions of Appendix A and with all applicable federal laws, regulations, executive orders, policies, procedures, and directives in the performance of this Contract. If CONTRACTOR's receipt of federal funds under this Contract is as a sub-recipient, Appendix B, "Sub-recipient Information and Requirements" must be completed and incorporated into and made part of this Contract.

18. Taxes

Unless stated otherwise herein, CONTRACTOR is responsible for the payment of all charges and taxes applicable to the services performed under this Contract, and CONTRACTOR agrees to comply with all applicable laws regarding the reporting of income, maintenance of records, and all other requirements and obligations imposed pursuant to applicable law. If the CITY is assessed, made liable, or responsible in any manner for such charges or taxes, the CONTRACTOR holds CITY harmless from such costs, including attorney's fees.

If CONTRACTOR fails to pay any taxes, assessments, penalties, or fees imposed by any governmental body, including by Tacoma City ordinance, and including by a court of law, CITY will deduct and withhold or pay over to the appropriate governmental body those unpaid amounts upon demand by the governmental body. Any such payments shall be deducted from the CONTRACTOR's total compensation.

19. Licenses and Permits

The CONTRACTOR, at its expense, shall obtain and keep in force any and all necessary licenses and permits. The CONTRACTOR shall obtain a business license as required by Tacoma Municipal Code Subtitle 6B.20 and shall pay business and occupation taxes as required by Tacoma Municipal Code Subtitle 6A.30. If applicable, CONTRACTOR must have a Washington state business license.

20. Indemnification

CONTRACTOR shall indemnify, defend, and hold harmless the CITY, its officials, officers, agents, employees, and volunteers, from any and all claims, demands, damages, lawsuits, liabilities, losses, liens, expenses and costs arising out of the subject matter of this Contract; provided that this provision shall not apply to the extent that damage or injury results from the sole negligence of the CITY, or its officers, agents, or employees. This indemnification shall extend to and include attorneys' fees and the cost of establishing the right of indemnification hereunder in favor of the CITY. This indemnification shall survive the termination of this Contract.

It is expressly agreed that with respect to design professional services performed by CONTRACTOR herein, CONTRACTOR's duty of indemnification, including the duty and cost to defend, against liability for damages arising out of such services or out of bodily injury to persons or damage to property shall, as provided in RCW 4.24.115 apply only to the extent of CONTRACTOR's negligence.

21. Title 51 Waiver

CONTRACTOR specifically assumes potential liability for actions brought by the CONTRACTOR'S own employees against the CITY and, solely for the purpose of this indemnification and defense, the CONTRACTOR specifically waives any immunity under the state industrial insurance law, Title 51 RCW. THE CONTRACTOR RECOGNIZES THAT THIS WAIVER WAS THE SUBJECT OF MUTUAL NEGOTIATION.

22. Insurance

During the course and performance of the services herein specified, CONTRACTOR will maintain the insurance coverage in the amounts and in the manner specified in the City of Tacoma Insurance Requirements as is applicable to the services and deliverables provided under this Contract. The City of Tacoma Insurance Requirements documents are fully incorporated herein by reference.

Failure by CITY to identify a deficiency in the insurance documentation provided by CONTRACTOR or failure of CITY to demand verification of coverage or compliance by CONTRACTOR with these insurance requirements shall not be construed as a waiver of CONTRACTOR's obligation to maintain such insurance.

23. Nondiscrimination

The CONTRACTOR agrees to take all steps necessary to comply with all federal, state, and City laws and policies regarding non-discrimination and equal employment opportunities. The CONTRACTOR shall not discriminate in any employment action because of race, religion, creed, color, national origin or ancestry, sex, gender identity, sexual orientation, age, marital status, familial status, veteran or military status, the presence of any sensory, mental or physical disability or the use of a trained dog guide or service animal by a disabled person. In the event of non-compliance by the CONTRACTOR with any of the non-discrimination provisions of this Contract, the CITY shall be deemed to have cause to terminate this Contract, in whole or in part.

24. Conflict of Interest

No officer, employee, or agent of the CITY, nor any member of the immediate family of any such officer, employee, or agent as defined by City ordinance, shall have any personal financial interest, direct or indirect, in this Contract, either in fact or in appearance. The CONTRACTOR shall comply with all federal, state, and City conflict of interest laws, statutes, and regulations.

The CONTRACTOR represents that the CONTRACTOR presently has no interest and shall not acquire any interest, direct or indirect, in the program to which this Contract pertains which would conflict in any manner or degree with the performance of the CONTRACTOR'S services and obligations hereunder. The CONTRACTOR further covenants that, in performance of this Contract, no person having any such interest shall be employed. The CONTRACTOR also agrees that its violation of the CITY'S Code of Ethics contained in Chapter 1.46 of the Tacoma Municipal Code shall constitute a breach of this Contract subjecting the Contract to termination.

25. Public Disclosure

This Contract and documents provided to the CITY by CONTRACTOR hereunder are deemed public records subject to disclosure under the Washington State Public Records Act, Chapter 42.56 RCW (Public Records Act). Thus, the CITY may be required, upon request, to disclose this Contract and documents related to it unless an exemption under the Public Records Act or other laws applies. In the event CITY receives a request for such disclosure, determines in its legal judgment that no applicable exemption to disclosure applies, and CONTRACTOR has complied with the requirements herein to mark all content considered to be confidential or proprietary, CITY agrees to provide CONTRACTOR ten (10) days written notice of impending release. Should legal action thereafter be initiated by CONTRACTOR to enjoin or otherwise prevent such release, all expense of any such litigation shall be borne by CONTRACTOR, including any damages, attorneys fees or costs awarded by reason of having opposed disclosure. CITY shall not be liable for any release where notice was provided and CONTRACTOR took no action to oppose the release of information. Notice of any proposed release of information pursuant to Chapter 42.56 RCW, shall be provided to CONTRACTOR according to the "Notices" provision herein.

26. Confidential or Proprietary Records Must be Marked

If CONTRACTOR provides the CITY with records that CONTRACTOR considers confidential or proprietary, CONTRACTOR must mark all applicable pages of said record(s) as "Confidential" or "Proprietary." If CONTRACTOR fails to so mark record(s), then (1) the CITY, upon request, may release said record(s) without the need to satisfy the notice requirements above; and (2) the CONTRACTOR expressly waives its right to allege any kind of civil action or claim against the CITY pertaining to the release of said record(s).

27. Approval for Release of Information Related to Contract

If requested by CITY, CONTRACTOR shall not release any information or documentation concerning the work under this Contract or any part thereof for marketing, advertising, or other commercial activities or publication including, but not limited to, news releases or professional articles without CITY's prior written approval. CONTRACTOR may submit at any time for review and approval a generic abstract describing the component parts of the completed Scope of Services ("Project Abstract"). After receiving written approval of the Project Abstract from the CITY, the CONTRACTOR may make minor insignificant changes to the Project Abstract and use all or parts of the Project Abstract in proposals.

This Section shall survive for six (6) years after the termination or expiration of this Contract.

28. Dispute Resolution

In the event of a dispute pertaining to this Contract, the parties agree to attempt to negotiate in good faith an acceptable resolution. If a resolution cannot be negotiated, then the parties agree to submit the dispute to voluntary non-binding mediation before pursuing other remedies. This provision does not limit the CITY'S right to terminate authorized by this Contract.

29. Miscellaneous Provisions

Governing Law and Venue

Washington law shall govern the interpretation of this Contract. Pierce County shall be the venue of any mediation, arbitration, or litigation arising out of this Contract.

Assignment

The CONTRACTOR shall not assign, subcontract, delegate, or transfer any obligation, interest or claim to or under this Contract or for any of the compensation due hereunder without the prior written consent of the CITY.

No Third Party Beneficiaries

This Contract shall be for the sole benefit of the parties hereto, and nothing contained herein shall create a contractual relationship with, or create a cause of action in favor of, a third party against either party hereto.

Waiver

A waiver or failure by either party to enforce any provision of this Contract shall not be construed as a continuing waiver of such provisions, nor shall the same constitute a waiver of any other provision of this Contract.

Severability and Survival

If any term, condition or provision of this Contract is declared void or unenforceable or limited in its application or effect, such event shall not affect any other provisions hereof and all other provisions shall remain fully enforceable. The provisions of this Contract, which by their sense and context are reasonably intended to survive the completion, expiration or cancellation of this Contract, shall survive termination of this Contract.

Entire Agreement

This Contract and the attached Exhibits and Appendices, as modified herein, contain the entire agreement between the parties as to the services to be rendered hereunder. All previous and contemporaneous agreements, representations or promises and conditions relating to the subject matter of this Contract are superseded hereby.

The Parties hereto mutually acknowledge, understand and agree that the terms and conditions set forth herein shall control and prevail over any conflicting terms and conditions stated in any attachments hereto.

Modification

No modification or amendment of this Contract shall be effective unless set forth in a written and executed Amendment to this Contract.

IN WITNESS WHEREOF, the Parties hereto have accepted and executed this Contract, as of the Effective Date stated above, which shall be Effective Date for bonding purposes as applicable. The undersigned Contractor representative, by signature below, represents and warrants they are duly authorized to execute this legally binding Contract for and on behalf of Contractor and further represents and warrants that Contractor is not suspended, debarred, or otherwise disqualified under federal, state, or local law from participating in this Contract.

CITY OF TACOMA:

Signature:

Name:

Title:

CONTRACTOR:

Signature:

Name:

Title:

(City of Tacoma use only - blank lines are intentional)

Director of Finance: _____

Deputy/City Attorney (approved as to form): _____

Approved By: _____

Approved By: _____

Approved By: _____

Approved By: _____

Approved By: _____

APPENDIX A
FEDERAL FUNDING

1. COPELAND ANTI-KICKBACK ACT

For Contracts subject to Davis Bacon Act the following clauses will be incorporated into the Contract:

- A. CONTRACTOR shall comply with 18 U.S.C. § 874, 40 U.S.C. § 3145, and the requirements of 29 C.F.R. pt. 3 as may be applicable, which are incorporated by reference into this Contract.
- B. CONTRACTOR or subcontractor shall insert in any subcontracts the clause above and such other clauses federal agencies may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all of these Contract clauses.
- C. Breach. A breach of the contract clauses above may be grounds for termination of the contract, and for debarment as a contractor and subcontractor as provided in 29 C.F.R. § 5.12.

2. EQUAL EMPLOYMENT OPPORTUNITY

During the performance of this Contract, CONTRACTOR will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. If the CONTRACTOR does over \$10,000 in business a year that is funded, paid or reimbursed with federal funds, CONTRACTOR will take specific and affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following:

- A. Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. CONTRACTOR agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.
- B. CONTRACTOR will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.
- C. CONTRACTOR will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant.

This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the Contractor's legal duty to furnish information.

- D. CONTRACTOR will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
- E. CONTRACTOR will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- G. In the event of CONTRACTOR's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this Contract may be canceled, terminated, or suspended in whole or in part and the CONTRACTOR may be declared ineligible for further federally funded contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
- H. CONTRACTOR will include the portion of the sentence immediately preceding paragraph (A) and the provisions of paragraphs (A) through (G) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. CONTRACTOR will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance:

Provided, however, that in the event CONTRACTOR becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the CONTRACTOR may request the United States to enter into such litigation to protect the interests of the United States.

3. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

- A. Overtime requirements. Neither CONTRACTOR or subcontractor contracting for any part of the Contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
- B. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (3)(A) of this section the CONTRACTOR and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such CONTRACTOR and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (3)(A) of this section, in the sum of \$27 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (3)(A) of this section.
- C. Withholding for unpaid wages and liquidated damages. The CITY shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the CONTRACTOR or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such CONTRACTOR or sub-contractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (3)(B) of this section.
- D. Subcontracts. The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (3)(A) through (D) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime CONTRACTOR shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (3)(A) through (D) of this section.

4. CLEAN AIR ACT

- A. CONTRACTOR agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. § 7401 et seq.

- B. CONTRACTOR agrees to report each violation to the CITY and understands and agrees that the CITY will, in turn, report each violation as required to assure notification to the Federal Emergency Management Agency, and the appropriate Environmental Protection Agency Regional Office.

CONTRACTOR agrees to include these requirements in each subcontract exceeding \$150,000 financed in whole or in part with federal funds.

5. FEDERAL WATER POLLUTION CONTROL ACT

- A. CONTRACTOR agrees to comply with all applicable standards, orders, or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq.
- B. CONTRACTOR agrees to report each violation to the CITY and understands and agrees that the CITY will, in turn, report each violation as required to assure notification to the appropriate federal agency.
- C. CONTRACTOR agrees to include these requirements in each subcontract exceeding \$150,000 financed in whole or in part with federal funding.

6. DEBARMENT AND SUSPENSION

- A. This Contract is a Covered Transaction for purposes of 2 C.F.R. pt. 180 and 2 C.F.R. pt. 3000. As such, the CONTRACTOR is required to verify that none of the contractor's principals (defined at 2 C.F.R. § 180.995) or its affiliates (defined at 2 C.F.R. § 180.905) are excluded (defined at 2 C.F.R. § 180.940) or disqualified (defined at 2 C.F.R. § 180.935).
- B. CONTRACTOR must comply with 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C, and must include a requirement to comply with these regulations in any lower tier Covered Transaction it enters into.
- C. This certification is a material representation of fact relied upon by the CITY. If it is later determined that the CONTRACTOR did not comply with 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C, in addition to remedies available to CITY, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment.
- D. CONTRACTOR agrees to comply with the requirements of 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C throughout the period of this Contract and to include a provision requiring such compliance in its lower tier covered transactions.

7. BYRD ANTI-LOBBYING AMENDMENT

- A. Contractors who apply or bid for an award of \$100,000 or more shall file the required certification with CITY. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, officer or employee of Congress, or an employee of a Member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 U.S.C. § 1352. Each tier shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the recipient who in turn will forward the certification(s) to the CITY.
- B. If applicable, CONTRACTOR certification required by Appendix A to 44 CFR Part 18 contained at Appendix A-1 to this Contract is incorporated into this Contract.

8. PROCUREMENT OF RECOVERED MATERIALS

- A. In the performance of this Contract, CONTRACTOR shall make maximum use of products containing recovered materials that are EPA-designated items unless the product cannot be acquired:
 - 1. Competitively within a timeframe providing for compliance with the contract performance schedule;
 - 2. Meeting contract performance requirements; or
 - 3. At a reasonable price.
 - B. Information about this requirement, along with the list of EPA- designated items, is available at EPA's Comprehensive Procurement Guidelines web site, <https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program>.
 - C. CONTRACTOR also agrees to comply with all other applicable requirements of Section 6002 of the Solid Waste Disposal Act.
- 9. CONTRACTOR** shall be required to comply with 2 CFR part 25, and obtain a unique entity identifier and/or be registered in the federal System for Award Management as appropriate.

APPENDIX A-1

APPENDIX A to 44 C.F.R. PART 18 – CERTIFICATION REGARDING LOBBYING Certification for Contracts, Grants, Loans, and Cooperative Agreements

Supplier certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Supplier, by Contract signature, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. Chap.38, Administrative Remedies for False Claims and Statements, apply to this certification and disclosure, if any.



CITY OF TACOMA INSURANCE REQUIREMENTS FOR CONTRACTS

This Insurance Requirements shall serve as an attachment and/or exhibit form to the Contract. The Agency entering a Contract with City of Tacoma, whether designated as a Supplier, Contractor, Vendor, Proposer, Bidder, Respondent, Seller, Merchant, Service Provider, or otherwise referred to as "Contractor".

1. GENERAL REQUIREMENTS

The following General Requirements apply to Contractor and to Subcontractor(s) performing services and/or activities pursuant to the terms of this Contract. Contractor acknowledges and agrees to the following insurance requirements:

- 1.1. Contractor shall not begin work under the Contract until the required insurance has been obtained and approved by the City of Tacoma.
- 1.2. Contractor shall keep in force during the entire term of the Contract, at no expense to the City of Tacoma, the insurance coverage and limits of liability listed below and for Thirty (30) calendar days after completion of all work required by the Contract, unless otherwise provided herein.
- 1.3. Liability insurance policies, except for Professional Liability and Workers' Compensation, shall:
 - 1.3.1. Name the City of Tacoma and its officers, elected officials, employees, and agents as **additional insured**
 - 1.3.2. Be considered primary and non-contributory for all claims with any insurance or self-insurance or limits of liability maintained by the City of Tacoma
 - 1.3.3. Contain a "Waiver of Subrogation" clause in favor of City of Tacoma
 - 1.3.4. Include a "Separation of Insureds" clause that applies coverage separately to each insured and additional insured
 - 1.3.5. Name the "City of Tacoma" on certificates of insurance and endorsements and not a specific person or department
 - 1.3.6. Be for both ongoing and completed operations using Insurance Services Office (ISO) form CG 20 10 04 13 and CG 20 37 04 13 or the equivalent
 - 1.3.7. Be satisfied by a single primary limit or by a combination of a primary policy and a separate excess umbrella
- 1.4. A notation of coverage enhancements on the Certificate of Insurance shall not satisfy these requirements below. Verification of coverage shall include:
 - 1.4.1. An ACORD certificate or equivalent
 - 1.4.2. Copies of requested endorsements
- 1.5. Contractor shall provide to City of Tacoma Procurement & Payable Division, prior to the execution of the Contract, Certificate(s) of Insurance and endorsements from the insurer certifying the coverage of all insurance required herein. Contract or Permit number and the City of Tacoma Department must be shown on the Certificate of Insurance.



CITY OF TACOMA INSURANCE REQUIREMENTS FOR CONTRACTS

- 1.6. A renewal Certificate of Insurance shall be provided electronically prior to coverage expiration via email sent annually to coi@cityoftacoma.org.
- 1.7. Contractor shall send a notice of cancellation or non-renewal of this required insurance within Thirty (30) calendar days to coi@cityoftacoma.org.
- 1.8. "Claims-Made" coverages, except for pollution coverage, shall be maintained for a minimum of three years following the expiration or earlier termination of the Contract. Pollution coverage shall be maintained for six years following the expiration of the Contract. The retroactive date shall be prior to or coincident with the effective date of the Contract.
- 1.9. Each insurance policy must be written by companies licensed or authorized (or issued as surplus line by Washington surplus line broker) in the State of Washington pursuant to RCW 48 with an (A-) VII or higher in the A.M. Best key rating guide.
- 1.10. Contractor shall not allow any insurance to be cancelled, voided, suspended, or reduced in coverage/limits, or lapse during any term of this Contract. Otherwise, it shall constitute a material breach of the Contract.
- 1.11. Contractor shall be responsible for the payment of all premiums, deductibles and self-insured retentions, and shall indemnify and hold the City of Tacoma harmless to the extent such a deductible or self-insured retained limit may apply to the City of Tacoma as an additional insured. Any deductible or self-insured retained limits in excess of Twenty Five Thousand Dollars (\$25,000) must be disclosed and approved by City of Tacoma Risk Manager and shown on the Certificate of Insurance.
- 1.12. City of Tacoma reserves the right to review insurance requirements during any term of the Contract and to require that Contractor make reasonable adjustments when the scope of services changes.
- 1.13. All costs for insurance are included in the initial Contract and no additional payment will be made by City of Tacoma to Contractor.
- 1.14. Insurance coverages specified in this Contract are not intended and will not be interpreted to limit the responsibility or liability of Contractor or Subcontractor(s).
- 1.15. Failure by City of Tacoma to identify a deficiency in the insurance documentation or to verify coverage or compliance by Contractor with these insurance requirements shall not be construed as a waiver of Contractor's obligation to maintain such insurance.
- 1.16. If Contractor is a government agency or self-insured for any of the above insurance requirements, Contractor shall be liable for any self-insured retention or deductible portion of any claim for which insurance is required. A certification of self-insurance shall be attached and incorporated by reference and shall constitute compliance with this Section.



CITY OF TACOMA

INSURANCE REQUIREMENTS FOR CONTRACTS

2. SUBCONTRACTORS

It is Contractor's responsibility to ensure that each subcontractor obtain and maintain adequate liability insurance coverage that applies to the service provided. Contractor shall provide evidence of such insurance upon City of Tacoma's request. Failure of any subcontractor to comply with insurance requirements does not limit Contractor's liability or responsibility.

3. REQUIRED INSURANCE AND LIMITS

The insurance policies shall provide the minimum coverages and limits set forth below. Providing coverage in these stated minimum limits shall not be construed to relieve Contractor from liability in excess of such limits.

3.1 Commercial General Liability Insurance

Contractor shall maintain Commercial General Liability Insurance policy with limits not less than One Million Dollars (\$1,000,000) each occurrence and Two Million Dollars (\$2,000,000) annual aggregate. This policy shall be written on ISO form CG 00 01 04 13 or its equivalent and shall include product liability especially when a Contract is solely for purchasing supplies. It includes Products and Completed Operations for three years following the completion of work related to performing construction services. It shall be endorsed to include: A per project aggregate policy limit (using ISO form CG 25 03 05 09 or equivalent endorsement)

3.2 Commercial (Business) Automobile Liability Insurance

Contractor shall maintain Commercial Automobile Liability policy with limits not less than One Million Dollars (\$1,000,000) each accident for bodily injury and property damage and bodily injury and property damage coverage for owned (if any), non-owned, hired, or leased vehicles. Commercial Automobile Liability Insurance shall be written using ISO form CA 00 01 or equivalent. Contractor must also maintain MCS 90 and CA 99 48 endorsements or equivalent if "Pollutants" are to be transported unless in-transit Pollution coverage is covered under required Contractor's Pollution Liability Insurance.

3.3 Workers' Compensation

Contractor shall comply with Workers' Compensation coverage as required by the Industrial Insurance laws of the State of Washington, as well as any other similar coverage required for this work by applicable federal laws of other states. Contractor must comply with their domicile State Industrial Insurance laws if it is outside the State of Washington.

3.4 Employers' Liability Insurance

Contractor shall maintain Employers' Liability coverage with limits not less than One Million Dollars (\$1,000,000) each employee, One Million Dollars (\$1,000,000) each accident, and One Million Dollars (\$1,000,000) policy limit.

3.5 Professional Liability Insurance or Errors and Omissions

For contracts with professional licensing, design, or engineering services. Contractor and/or its subcontractor shall maintain Professional Liability or Errors and Omissions with limits of One Million Dollars (\$1,000,000) per claim and Two Million Dollars (\$2,000,000) in the aggregate covering acts, errors and omissions arising out of the professional services under this Contract. Contractor shall maintain this coverage for Two Million Dollars (\$2,000,000) if the policy limit includes the payment of claims or defense costs, from the policy limit. If the scope of such design-related professional services includes work related to pollution conditions, the Professional Liability policy shall include Pollution Liability coverage.



CITY OF TACOMA INSURANCE REQUIREMENTS FOR CONTRACTS

3.6 Other Insurance

Other insurance may be deemed appropriate to cover risks and exposures related to the scope of work or changes to the scope of work required by City of Tacoma. The costs of such necessary and appropriate Insurance coverage shall be borne by Contractor.