GeoEngineers

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Memorandum

To:	Stephanie Potts, Washington State Department of Ecology
From:	Bridget August, LG, LHG and John Monahan, FP-C (GeoEngineers, Inc.)
Date:	February 21, 2020
File:	00504-161-00
Subject:	WRIA 8 Growth Projections – Final Draft

INTRODUCTION

GeoEngineers, Inc. (GeoEngineers) is providing technical support to the Washington State Department of Ecology (Ecology) and the Watershed Restoration and Enhancement (WRE) Committees for Water Resource Inventory Areas (WRIAs) 7, 8 and 9. This memorandum provides a summary of the deliverable for Work Assignment GEO102, Task 3, WRIA 8 Growth Projections.

BACKGROUND AND CONTEXT

The Streamflow Restoration Act (SRA, Chapter 90.94 Revised Code of Washington) specifies that by June 30, 2021, Ecology must establish a WRE Committee and adopt a WRE Plan in the Cedar-Sammamish Watershed (WRIA 8). The WRE Plan needs to address impacts on streamflows from consumptive use from new domestic permit-exempt wells anticipated between January 19, 2018 and January 18, 2038.

The WRE Plan must estimate growth projections for the watershed for January 2018 through January 2038 (at a minimum). Based on the projected growth, the plan will estimate the amount of rural growth and associated water use from new permit exempt well connections.

Ultimately, WRE Plan growth projections need to address the following two primary questions:

1. How many new permit-exempt domestic well connections (PE wells[1]) could be installed throughout the watershed over the next 20 years?
2. Where could the PE sourced growth occur at the subbasin level?

WRIA 8 includes parts of unincorporated King and Snohomish County and 30 incorporated cities and towns. The methods used to estimate the number and location of new wells in unincorporated and incorporated areas in WRIA 8 are summarized below.

[1] "PE wells" is used to refer to new homes associated with new permit-exempt wells and also new homes added to existing wells, including homes on group systems relying on permit-exempt wells.

GROWTH PROJECTION METHODS

GeoEngineers worked with the WRIA 8 – Cedar-Sammamish WRE Committee to define growth projection methods and growth projections for WRIA 8. The WRIA 8 growth projection methods included using King and Snohomish County historical building permit and year-built data to predict potential PE well growth over the 20-year planning horizon. This methodology assumes that the rate and general location of past growth will continue over the 20-year planning horizon. Using past building permits to predict future growth is one of Ecology's recommended methods (Ecology 2019). Projecting future PE well growth involves accounting for populations that will be served by community water systems and municipalities (Ecology 2019). Due to data availability, King and Snohomish County used different methods to remove those populations from the PE well growth estimates. Snohomish County considered distance to existing water lines, whereas King County considered rates of connection to water service within water service area boundaries.[2] King and Snohomish County completed their analyses in-house and the methods are described in detail in Attachments A and B, respectively, and summarized below.

GeoEngineers also completed an analysis of potential PE well growth within the incorporated and unincorporated Urban Growth Areas (UGAs) using Ecology's Well Report Viewer database. The methods and assumptions are also described below and GeoEngineers data tables are included in Attachment C.

In addition, King County also completed a PE Well Potential Assessment which identified potential parcels where growth could occur within rural King County. Snohomish County completed a similar assessment which they have referred to as a Rural Capacity Analysis. The PE Well Potential Assessment and Rural Capacity Analysis results were used to assess whether a subbasin (as identified by the WRE Committee) has the capacity to accommodate the number of PE wells in the 20-year growth projection. In those areas where the number of projected PE wells exceeded the potential parcels available, the wells were reallocated to the nearest subbasin with similar growth patterns and parcel capacity. The King County PE Well Potential methods and assumptions are described in Attachment A and summarized below. The Snohomish County Rural Capacity Analysis methods and assumptions are described in Attachment B and summarized below.

King County Unincorporated Area Past Trends Analysis

King County does not have a growth target for the unincorporated rural area and therefore decided to use building permit data as its chosen method to assess future growth potential. King County elected to complete the WRIA 8 historic growth analysis for the King County portion of the WRIA in-house using 2000 to 2017 building permit data for new residential structures from the King County Assessor's office. The analysis estimated the number of recently built homes that relied on PE wells as their water source in unincorporated King County, both inside and outside of water service areas. King County used historic rates of connection to water service because the County does not have county-wide information on the location of water lines.

King County used the time period 2000 through 2017 because those data were available. The building permit data for 2000 through 2017 includes both periods of high growth and periods of low growth. King County

[2] Water service area boundaries include areas currently served by existing water lines and may also include areas not yet served by water lines.

compared these data with information from Vision 2040 and population data and is confident in using the average of this time period to project into the future.

King County used the results from the historic growth analysis to determine the projected number of PE wells per year and over the 20-year planning horizon for unincorporated King County. GeoEngineers then used the King County historic growth results to estimate the number of potential new PE wells per subbasin over the 20-year planning horizon. King County historic growth and PE well projection methods and data tables are provided in Attachment A for reference. This methodology assumes that the rate and location of past growth will continue over the 20-year planning horizon. This method is referred to as the King County Past Trends Analysis and the general methodology used was as follows:

King County:

- Obtain available King County building permit and parcel data for new residential structures (2000 to 2017).
- Use centroid of parcel to determine location relative to other boundaries (e.g. WRIA, inside or outside water district service areas, King County stream basin, WRIA 8 subbasin, etc.).
- Assess the total number of permits and average number of permits per year for the WRIA.
- Link building permits and parcel data layers to determine water source for each building permit/parcel. The parcel database indicates the water source as "public" (pub) for buildings connected to water service, "private" (pvt) for buildings relying on a permit-exempt well, and "other" (unknown/null). The "other" category includes parcels listing their water source as "unknown," referring to parcels with no assigned water source (likely vacant land or unoccupied structure) or "null," referring to building permits that did not link to existing parcels. King County used the "other" category to calculate an error of 6 percent (of the total number of building permits).[3]
- Determine the number of building permits/parcels inside and outside the water service areas that have a water source as:
    - Public water (pub)
    - Private water (PE wells) (pvt)
    - Other (unknown/null)
- Calculate the percentage of building permits for each type of water source (pub, pvt or other) by subbasin and the WRIA overall.
- Use the annual average number of permits per year multiplied by the percentage of permits/parcels on private water (pvt) to determine the projected number of PE wells per year.

[3] King County's percent error uses the number of unknown water use type parcels (unknown) plus those permit records that don't match parcel information (null), divided by the total number of permits for that area. The null data type, based on selected assessment of un-joined data, appears to be related to development that is not fully completed/sold. These developments are typically on public water.

- Multiply the number of PE wells per year by 20 to calculate the total PE wells projected over the 20-year planning horizon for unincorporated rural King County.

GeoEngineers:

- Use the annual average number of permits per year multiplied by the past percentage of growth per subbasin and percentage of building permits using a private water source (well) per subbasin to determine a projected number of PE wells per year for each subbasin.
- Multiply the number of PE wells per year per subbasin by 20 to calculate the estimated total of PE wells projected over the 20-year planning horizon for each subbasin.
- Add 6 percent error to 20-year growth projections per subbasin (error is based on the "other/null" category as described above).
- Tabulate the total growth projected over the 20-year planning horizon, including the 6 percent error, for each subbasin and sum to get the total of PE wells projected over the 20-year planning horizon in rural unincorporated King County.

Snohomish County Unincorporated Past Trends Analysis

Snohomish County elected to complete the WRIA 8 growth projection analysis for the Snohomish County portion of the WRIA in-house. Snohomish County used a different methodology than King County for their past trends analysis. They developed their growth projections by using a GIS model to identify areas where homes are likely to connect to water service, based on proximity to existing water distribution lines. Areas that were not proximal to existing water distribution lines were assumed to be served by a domestic PE well. For their growth projections, they referred to these areas as "water service areas" and "PE Well Areas" respectively. Snohomish County used this spatial model, in combination with analysis of year-built data for recently built single-family residences, to develop growth scenarios.

Snohomish County developed two growth projection scenarios by: 1) looking at past development trends in PE well areas for each HUC-12[4] within its portion of WRIA 8 and using those trends to estimate the number and location of new homes over the planning horizon, and 2) using population projections from the Snohomish County 2015 Comprehensive Plan to estimate the number and location of new homes relying on wells over the planning horizon. The subbasins in the Snohomish County portion of WRIA 8 generally correspond to individual HUC-12s or an aggregation of multiple HUC-12s (Attachment B) and, for the purpose of growth projections in WRIA 8, the terms are used interchangeably. The term "Housing Unit (HU)" refers to an individual home or single-family residence.

In addition to the growth projection scenarios, Snohomish County developed a Rural Capacity Analysis that identified the total number of parcels that could be developed with a home relying on a PE well in each subbasin. The Rural Capacity Analysis was used to identify whether the number of available parcels that could be developed with homes relying on a PE well could accommodate the projected growth in each subbasin.

[4] HUC-12 is a level of Hydrologic Unit Code.

At the request of the WRE Committee, GeoEngineers developed a third growth projection scenario using the population growth rate from the 2012 Office of Financial Management (OFM) high population forecast for Snohomish County.

The WRE Committee discussed the three scenarios and agreed to move forward with the first scenario, the Snohomish County Past Trends Analysis, as the 20-year growth projection method for the Snohomish County portion of WRIA 8. Year-built data was derived from the County's permit data as provided to the Assessor by Snohomish County Planning and Development Services (PDS) and includes all new single-family residences in the WRIA built between 2008 and 2018, located outside of cities, UGAs, national and state forest lands, government property and tribal lands. Snohomish County used the time period 2008 through 2018 because those data were available. This methodology assumes that the rate and location of past growth will continue over the 20-year planning horizon. Snohomish County growth projection methods and data tables are provided in Attachment B for reference. The general methodology is as follows:

- Obtain available year-built data from the Snohomish County Assessor's Office for all single-family residences (i.e. HUs) in the WRIA built between 2008 and 2018.
- Use centroid of parcel to determine location of each HU relative to other boundaries (e.g. WRIA, cities, UGAs, national and state forest lands, government property, tribal lands, subbasin, water lines, zoning, etc.).
- Assign the 2008-2018 HUs to "Public Water Service Areas" or "P_E Well areas" based on the distance to existing water mains (data derived from water system comprehensive plans).
    - HUs designated to "Public Water Service Areas" (i.e. will not rely on a PE well) include:
        - HUs that are not part of a subdivision and any portion of the property boundary is located within 100 feet of a water main. [5]
        - HUs that are part of a rural cluster subdivision (RCS) and located within ¼ mile of a water main.[6]
    - All other HUs designated to "P_E Well areas."
- Determine the number of HUs per subbasin for each type of water source (Public Water Service Areas and P_E Well Areas).
- Calculate the percentage of HUs per subbasin for each type of water source.
- Divide the total number of HUs for WRIA 8 by 11 to calculate the average number of SFRs per year over the past 11 years (2008-2018).
- Multiply the average number of HUs per year by 20 to calculate the estimated total of HUs projected over the 20-year planning horizon for rural unincorporated Snohomish County.

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[5] 100 feet is selected due to lot sizes in the rural area, cost to extend water service, buy-in from rural water utilities as a reasonable assumption, and requirements in Snohomish County's draft water code (Attachment B).

[6] As of April 2009, this is a requirement in Snohomish County code for rural cluster subdivisions, however, most RCS that have been built were grandfathered to the previous rules which did not include this requirement to connect to public water (Attachment B).

- Apply HU projections to WRIA 8 subbasins based on the past percentage of growth per subbasin and past percentage of HU for each type of water source.
- The projection of HUs located within P_E Well Areas represents the total number of PE wells projected over the 20-year planning horizon in rural unincorporated Snohomish County.

GeoEngineers UGA Well Log Spot Check

As described above, the King and Snohomish County Past Trends Analysis focused on the potential for PE wells to be installed within rural, unincorporated King and Snohomish Counties. The King and Snohomish County methods do not account for potential PE wells in cities or UGAs. However, early in the growth projection planning process, the WRIA 8 WRE Committee recommended looking at the potential PE well growth within UGAs. GeoEngineers completed an analysis of potential PE well growth within the incorporated and unincorporated UGAs using Ecology's Well Report Viewer database. UGA well log spot check data tables are included in Attachment C. The general methodology used was as follows:

- Obtain tabular and spatial data from Ecology's Well Report Viewer database (1998 through 2018). Ecology's complete Well Report Viewer database was filtered for water wells 6 to 8 inches in diameter and greater than 30 feet deep, which are typical dimensions and depths for domestic wells. PE wells greater than 8 inches in diameter are cost prohibitive and uncommon. Similarly, wells shallower than 30 feet are more susceptible to contamination and are also uncommon, especially in urban areas. Ecology does not have the ability to filter for permit-exempt domestic wells. Information in the database is based on records submitted by the well driller.
- Filter database for wells located within UGAs. Note that well locations were estimated to the nearest ¼-¼ section.
- Review randomly selected water well reports and note the well type (e.g. domestic, industrial, municipal, irrigation, test well, or other), and well location (physical address and/or parcel number).
- Determine the number of wells that were:
    - Domestic (assumed to be PE wells)
    - Irrigation
    - Other (test, municipal, dewatering, industrial, mitigation, UIC, deepened or refurbished wells)
    - Incorrect (location, date, etc.)
- Calculate the percentage of each type of well (domestic, irrigation, other and incorrect).
- Multiply the percentage of domestic wells (assumed to be PE wells) by the total number of wells located within UGAs to estimate the number of domestic wells installed over the past 20-year period.
- Cross-check the physical address of the wells with the UGA boundary to determine in which subbasin the domestic wells were located.
- Tabulate the total number of domestic wells per subbasin.
- Multiply the total number of domestic wells per subbasin by 20 to calculate the estimated number of PE wells located within the UGA projected over a 20-year period for each WRIA 8 subbasin.

King County PE Well Potential Assessment

King County also completed a PE Well Potential Assessment which evaluated the parcels available for future growth in unincorporated King County. The purpose of the PE Well Potential Assessment was to determine if there would be enough parcels to accommodate the 20-year growth projection at the WRIA and subbasin level. In those areas where the number of projected PE wells exceeded the potential parcels available, GeoEngineers reallocated those wells to the nearest subbasin with parcel capacity and similar growth patterns. King County used historic rates of connection to water service because the County does not have county-wide information on the location of water lines. King County PE well potential data tables are included in Attachment A. The general methodology used was as follows:

King County:

- Use assumptions and screening criteria to identify parcels with potential for future growth by subbasin. A list of assumptions made by King County is provided in Attachment A.
- Use centroid of parcel to determine location information (e.g. WRIA, inside or outside water district service areas, WRIA 8 subbasin, etc.).
- Use King County parcel attribute data to determine total number of parcels and dwelling units per subbasin. A dwelling unit (DU) is a rough estimate of subdivision potential based on parcel size and zoning (e.g. a 22-acre parcel zoned RA-5 is assumed to have 4 dwelling units).
- Determine the number of parcels and dwelling units that would be inside or outside water district service boundaries.
- Calculate water source projections for public connections and PE sourced parcels:
    - Public connection parcels would be those located within water district service boundaries and were calculated based on historic rates of connection to public water within each subbasin.
    - The remaining number of parcels located within water district service boundaries that exceeded the historic rate of public water connection were assigned to be PE sourced (e.g. served by a PE well).
    - PE sourced parcels were calculated based on the number of parcels located outside water district service boundaries plus the remaining parcels from “inside” water district boundaries, as described above.
- Calculate the shortfall or surplus of available parcels to be sourced by PE wells by taking the total PE sourced DUs minus the 20-year growth projection from the King County past trends analysis.

GeoEngineers:

- If the projected PE well growth exceeds the total number of available PE sourced parcels, reallocate shortfall to adjacent subbasin with parcel capacity and similar growth patterns.

Snohomish County Rural Capacity Analysis

Snohomish County completed a Rural Capacity Analysis in 2011 that resulted in an assigned future capacity for each parcel in the rural area. Snohomish County updated their 2011 analysis for the purpose of WRE planning to determine if there would be enough parcels to accommodate the 20-year growth projection at the

WRIA and subbasin level. In those areas where the number of projected PE wells exceeded the potential parcels available, GeoEngineers reallocated those wells to the nearest subbasin with parcel capacity and similar growth patterns. The parcels included in the Snohomish County Rural Capacity Analysis were selected based on a set of assumptions, which are outlined in Attachment B. The Snohomish County Rural Capacity methods and data tables are also included in Attachment B. The general methodology used was as follows:

Snohomish County:

- Use assumptions and screening criteria to identify parcels with potential for future growth by subbasin. A list of assumptions made by Snohomish County are provided in Attachment B.
- For each parcel, obtain or calculate total acres, buildable acres, percent buildable acres and density based on zoning and land use designation (i.e. HUs per acre).[7]
- Assign development status (e.g. vacant, partially used or re-developable).
- Calculate basic capacity based on development status and density (e.g. if vacant, future capacity = total acres x density).
- Deduct new HUs built after 2011 from the 2011 available capacity to create an estimate of the capacity remaining as of 2019.
- Assign parcels to "Public Water Service Areas" or "P_E Well Areas" per the methodology described in the Past Trends Analysis.
- Aggregate capacity data by subbasin. Parcels located on HUC boundaries were assigned based on the centroid of the parcel.
- Calculate the shortfall or surplus of available parcels to be sourced by PE wells by taking the total PE sourced parcels (P_E Well Areas) minus the 20-year growth projection from the Snohomish County past trends analysis.

GeoEngineers:

- If the projected PE well growth exceeds the total number of available PE sourced parcels, reallocate shortfall to adjacent subbasin with parcel capacity and similar growth patterns.

GROWTH PROJECTON RESULTS

The King and Snohomish County Past Trends Analysis and GeoEngineers UGA Well Log Spot Check results were combined to determine the total number of projected PE wells per subbasin within WRIA 8. Using the King County PE Well Potential Assessment and Snohomish County Rural Capacity Analysis, GeoEngineers compared the total available PE sourced parcels (i.e. DUs and HUs) per subbasin with the projected growth per subbasin. In those areas where the number of projected PE wells exceeded the potential parcels available, GeoEngineers reallocated those wells to the nearest subbasin with parcel capacity and similar growth patterns. The results are summarized in Table 1 and shown on Figure 1. GeoEngineers estimates 967 new permit-exempt domestic

[7] All subdividable parcels were assumed to develop using the rural cluster option. This option achieves the highest density.

well connections in WRIA 8 over the 20-year planning horizon. The following is a brief summary of the calculations used to complete the WRIA 8 growth projection analysis:

- King County used the average number of building permits per year (102) for the 18-year period from 2000 to 2017, multiplied by the historic percentage of homes using PE wells (34.2 percent) to determine a projected number of new PE wells per year (35) in the WRIA 8 portion of rural unincorporated King County. The number of PE wells per year (35) was then multiplied by 20 to determine the estimated total of PE wells projected over the 20-year planning horizon (698) for rural unincorporated King County. (Note that due to rounding, the total number is 698).
- To estimate the 20-year PE well projection per subbasin, GeoEngineers used the average number of building permits per year (102), multiplied by the historic distribution of growth per subbasin. The average building permits per subbasin was then multiplied by the historic percentage of homes using PE wells to estimate the average number of PE wells per year per subbasin. The number of PE wells per year per subbasin was then multiplied by 20 to calculate the estimated total of PE wells over a 20-year period per subbasin. A 6 percent error was then added to each subbasin total. The total number of estimated PE wells, including the 6 percent error, is 740. See Attachment A for detailed results.
- Snohomish County used the total number of HUs built during the 11-year period from 2008-2018 (238), divided by 11 to determine the average number of HUs built per year (22) for rural unincorporated Snohomish County. The average number of HUs per year (22) was multiplied by 20 to estimate the total number of HUs projected over the 20-year planning horizon (440) for the rural unincorporated Snohomish County portion of WRIA 8. (Note that due to rounding, the total number is 440 vs. 434, as shown in Attachment B).
- The total number of HUs (440) was then multiplied by the historic percentage of HUs in P_E Well Areas per subbasin. The number of HUs in P_E Well Areas per subbasin was added together to determine the estimated total of PE wells (equivalent to HUs in P_E Well Areas) over a 20-year period in rural unincorporated Snohomish County (210). (Note that due to rounding, the total number is 210 vs. 208, as shown in Attachment B).
- GeoEngineers also completed a UGA Well Spot Check for wells from the Ecology Well Report Viewer database that plot within the Urban Growth Area. Of the wells that plotted in WRIA 8, 205 wells were located within the UGA for 1998 through 2018. GeoEngineers checked about 56 percent of the wells by looking at the well logs and noting whether the wells were identified as being for domestic, irrigation, or other purposes (e.g. test, industrial, errors, etc.). According to the well logs, about 8 percent of the wells were for domestic use.
- GeoEngineers took the number and distribution of wells from the 1998-2018 data and projected the same rate and distribution per subbasin for the 20-year planning horizon. The estimated number of PE wells within the UGA over the 20-year period is 17. (Note that due to rounding, the total number is 17 vs. 16). See Attachment C for detailed results.
- King County completed a PE Well Potential Assessment and Snohomish County completed a Rural Capacity Analysis to determine whether a subbasin has capacity for the number of wells in the 20-year projection.

- The PE Well Potential Assessment showed a capacity shortfall of 1 well in the Upper Cedar subbasin, which is mostly protected from development. Therefore, the projected PE well in the Upper Cedar subbasin was reallocated to the adjacent Lower Cedar subbasin.
- The Snohomish County Rural Capacity Analysis showed a capacity shortfall of 59 wells in the Little Bear subbasin. These 59 wells were reallocated to the Bear/Evans subbasin because it has parcel capacity, is adjacent and has similar growth patterns. (Note that due to rounding, the total shortfall is 59 vs. 57, as shown in Attachment B).

TABLE 1. GROWTH PROJECTIONS FOR NEW PE WELLS IN WRIA 8 – CEDAR-SAMMAMISH 2018 TO 2038

Subbasins[1]	King County Past Trends[2]	Snohomish County Past Trends[3]	UGA Well Log Spot Check[4]	Total PE Wells[5] per Subbasin[6]
Seattle/Lake Union	0	--	0	0
Puget Sound Shorelines	0	--	2	2
Swamp/North	0	0	5	5
Little Bear	0	118	0	118
Sammamish River Valley	8	--	0	8
Bear/Evans	138	92	4	234
Greater Lake Washington	0	--	4	4
May/Coal	15	--	0	15
Lake Sammamish Creeks	6	--	0	6
Issaquah	235	--	0	235
Lower Cedar	338	--	2	340
Upper Cedar	0	--	0	0
Totals	**740**	**210**	**17**	**967**

Notes:
1 = Subbasins from proposal approved at September 26, 2019 WRE Committee meeting.
2 = Based on 20-year estimate of potential new PE wells in unincorporated King County, plus 6% error.
3 = Based on 20-year estimate of potential new PE wells in unincorporated Snohomish County.
4 = Based on spot-check of Ecology Well Report Viewer database. Accounts for potential wells within the incorporated and unincorporated Urban Growth Areas (UGAs) over the 20-year planning period.
5 = "PE Wells" is used to refer to new homes associated with new permit-exempt wells and also new homes added to existing wells on group systems relying on permit-exempt wells.
6 = Includes redistribution of 1 well from Upper Cedar subbasin to Lower Cedar subbasin in the King County portion of WRIA 8 and 59 wells from Little Bear subbasin to Bear/Evans subbasin in the Snohomish County portion of WRIA 8.

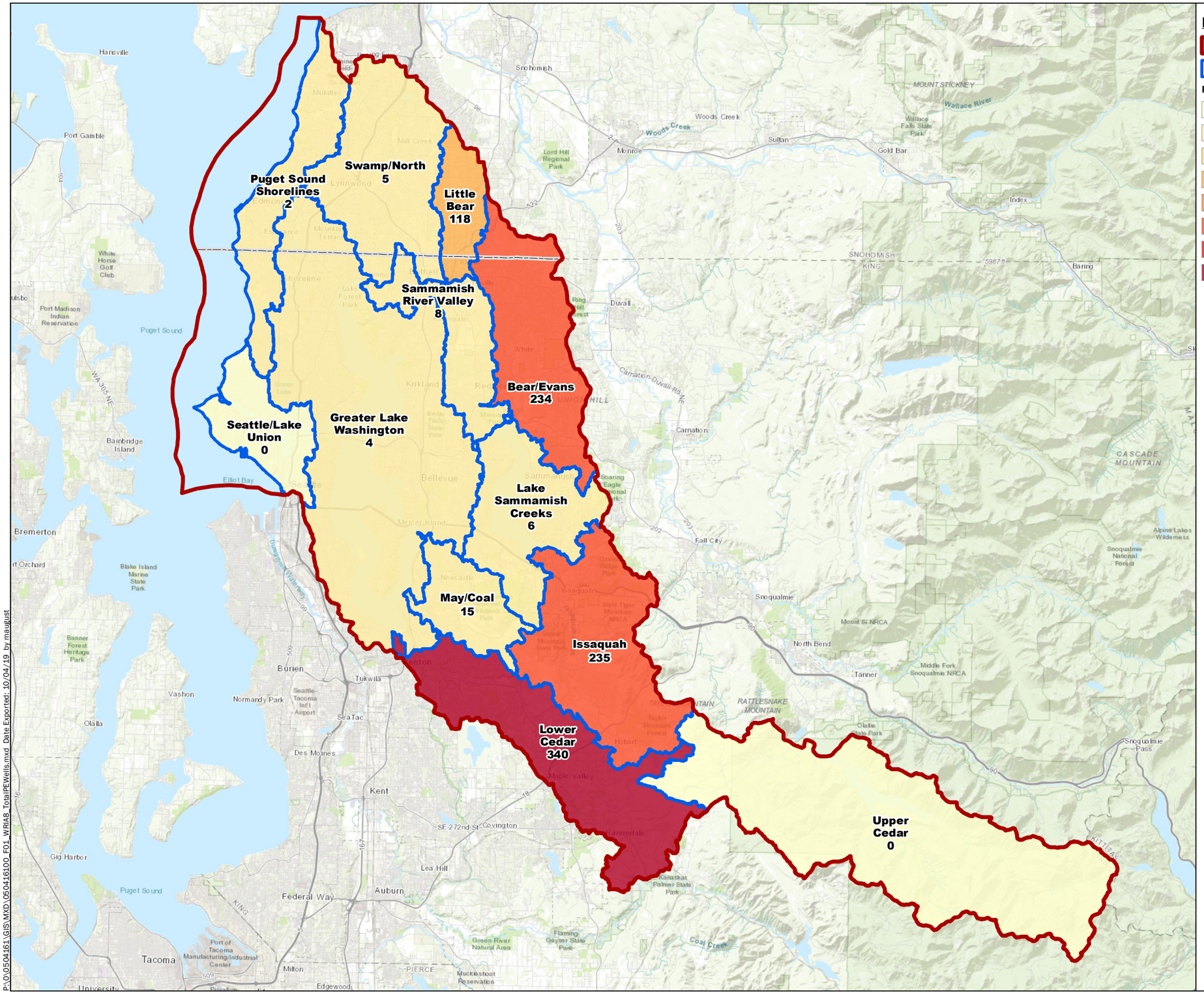
NEXT STEPS

- The WRIA 8 WRE Committee agreed to move forward with the WRIA planning process using 967 as the WRIA 8 20-year PE well growth projection to develop consumptive use estimates.

REFERENCES

Department of Ecology (Ecology), 2019. Final Guidance for Determining Net Ecological Benefit, GUID-2094 Water Resources Program Guidance. Washington State, Department of Ecology, Publication 19-11-079, p. 131.

Attachments:
Figure 1. WRIA 8 Distribution of Projected Permit-Exempt Wells 2018-2038
Attachment A. King County Growth Projections and Permit Exempt Well Potential Methods, Assumptions and Data Tables
Attachment B. Snohomish County Growth Projections and Rural Capacity Analysis Methods, Assumptions and Data Tables
Attachment C. GeoEngineers UGA Well Log Spot Check Data Tables



Legend

- WRIA 8 Boundary
- WRIA 8 Proposed Subbasins

Projected Permit-Exempt Wells 2018-2038

- 0
- 1 - 50
- 51 - 100
- 101 - 150
- 151 - 200
- 201 - 250
- 251 - 300
- >300

Projected WRIA 8 PE Well Total = 967

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: ESRI Topographic Map Base

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

N W E S

5 0 5

Miles

WRIA 8 Distribution of Projected Permit-Exempt Wells 2018-2038

Watershed Restoration and Enhancement Plan
Snohomish and King Counties, Washington

GeoEngineers

Figure 1

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ATTACHMENT A

King County Growth Projections and Permit Exempt Well Potential Methods, Assumptions and Data Tables

King County
Water and Land Resources Division
Department of Natural Resources and Parks
King Street Center
201 South Jackson Street, Suite 704
Seattle, WA 98104-3855
206-477-4800 Fax 206-296-0192
TTY Relay: 711

TECHNICAL MEMORANDUM

December 12, 2019

TO: Stephanie Potts, Ingria Jones, Rebecca Brown, and Stacy Vynne McKinstry, Streamflow Restoration Implementation leads, Water Resources Program, Washington State Department of Ecology

FM: Eric Ferguson, LHG, Science and Technical Support Section, Water and Land Resources Division, Department of Natural Resources and Parks

RE: King County Growth Projections for all Watershed Restorations and Enhancement Committees – WRIAs 7, 8, 9, 10, and 15

This memorandum summarizes the work that King County did in support of generating 20-year growth projections in the rural areas of the county for Watershed Restoration and Enhancement committee (WREC) work. This effort will be incorporated into another technical memorandum that is area specific for each Watershed Resource Inventory Area (WRIA). The additional memorandum will be authored by consultants working for the Washington State Department of Ecology.

Introduction

King County is participating in five WRECs, one for each of the WRIA within its boundary. King County is providing growth projections for each area that assesses a two-part question:

A. How much potential growth could occur during the 20-year (2018-2038) planning period?

B. Where could that growth occur at a sub-basin/watershed scale within each WRIA?

Principles

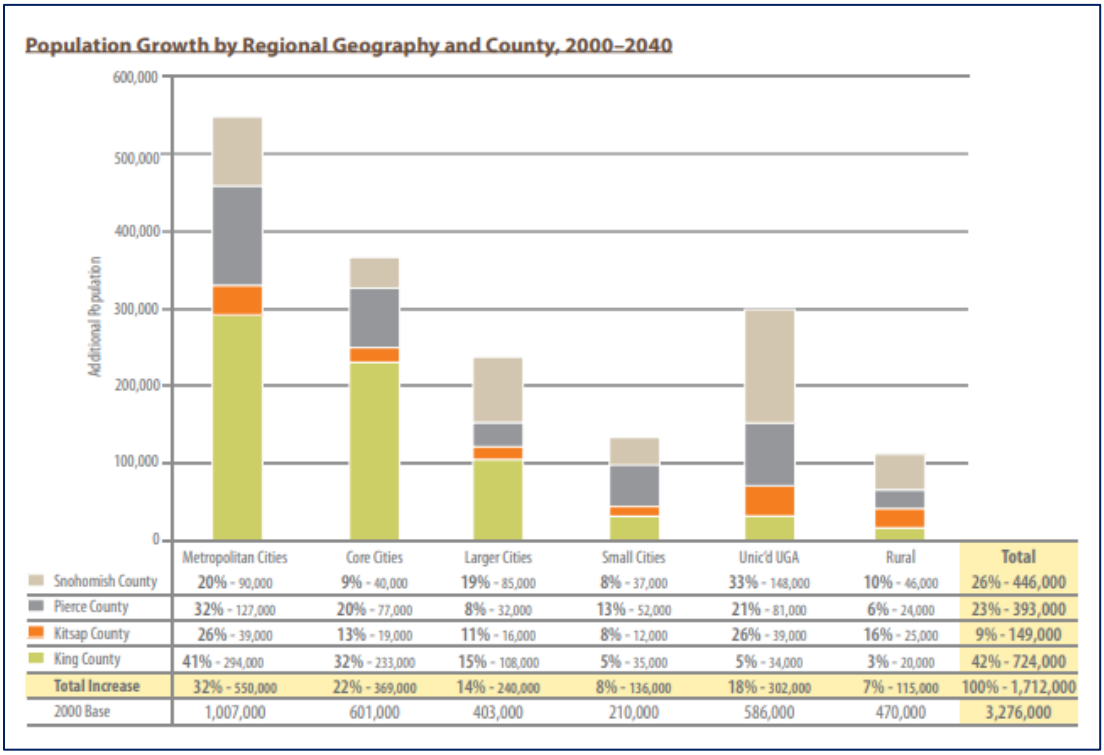
King County does not have growth targets for unincorporated rural areas in the county. All growth targets are for the urban growth area (UGA). No changes to the UGA boundary are intended during the 20-year planning period.

The following are highlights from planning policies:

- Accommodate most recent 20-year population forecast from OFM, and 20-year jobs forecast from Puget Sound Regional Council.
- Plan for growth consistent with Regional Growth Strategy
  - Focus growth in cities with major centers, and in other large cities
  - Limit development in Rural Areas, protect Resource Lands

Source: Policy DP-11 in Countywide Planning Policies, 2012

Population growth in the unincorporated rural area is estimated to be about 20,000 people or ~3% of overall population from Vision2040, Figure 1.



	Metropolitan Cities	Core Cities	Larger Cities	Small Cities	Unic'd UGA	Rural	Total
Snohomish County	20% - 90,000	9% - 40,000	19% - 85,000	8% - 37,000	33% - 148,000	10% - 46,000	26% - 446,000
Pierce County	32% - 127,000	20% - 77,000	8% - 32,000	13% - 52,000	21% - 81,000	6% - 24,000	23% - 393,000
Kitsap County	26% - 39,000	13% - 19,000	11% - 16,000	8% - 12,000	26% - 39,000	16% - 25,000	9% - 149,000
King County	41% - 294,000	32% - 233,000	15% - 108,000	5% - 35,000	5% - 34,000	3% - 20,000	42% - 724,000
Total Increase	32% - 550,000	22% - 369,000	14% - 240,000	8% - 136,000	18% - 302,000	7% - 115,000	100% - 1,712,000
2000 Base	1,007,000	601,000	403,000	210,000	586,000	470,000	3,276,000

Figure 1. Estimated population growth for rural King County from 2000-2040 is 20,000, King County, Vision 2040.

Note: the updated Vision (2050) document is due to be adopted in May 2020. The updated growth for rural King County is planned to be about 1% during 2017–2050 period (or ~6,000 people).

Methods

The first part of the growth projection assessment was performed in order to respond to the question: "How many new single-family permit-exempt well connections will be installed throughout each watershed over the next 20 years?" King County does not have a growth target

for the unincorporated rural area (as noted above) and therefore decided to use building permit data (for new residential structures) as its chosen method to assess future growth potential.

The following is the methodology used to assess the potential growth:

1. Compiled 18 years (2000–2017) of building permit data for new residential structures;
    a. This data was subdivided into two periods: 2000–2009 and 2010–2017, Table 1; each period has a range of low to high growth.

Table 1. Building permits from 2000-2017; new residental structures only

Building permits (unincorporated rural KC)	
2000-2009	4595
2010-2017	1252
Total	5847

2. Used GIS to provide location based information about building permits
    a. Use centroid of the building permit/parcel to assess location relative to other boundaries such as WRIA boundaries, stream basins, water district service areas, sub-basin delineations.
    b. Assess the number of permits per each WRIA, Table 2

Table 2. Building permits by WRIA

WRIA*	Total permits	Permits per year	Percentage of total
7	1864	104	32%
8	1836	102	31%
9	1430	79	24%
10	100	6	2%
15	617	34	11%

* = WRIA boundaries are delineated by Ecology coverage

3. Linked building permits and parcel data layers to assess percentage of parcels using public versus private water with parcel attribute data.
4. Determined the number of building permits/parcels that have a water source as:
    a. Public (pub) water
    b. Private (pvt) water (Permit-Exempt wells)
    c. Other (unknown/null)
        i. “unknown” refers to parcels with no assigned water source (likely unoccupied structure)
        ii. “null” refers to those building permits that did not link to existing parcels.

iii. This category can be used as an "error" since it refers to the amount of information that is undetermined and could potentially be private sourced.

5. Calculated the percentage of building permits for each type of water source (i.e. public, private or other) for entirety of King County as shown in Table 3 below as well as by WRIA and its sub-basin delineations.

Table 3. Water source by parcel/permit

Type of water use	Total permits	Percentage of total
Public	3113	53%
Private	2369	40%
Other -unknown	73	1%
Other - null	292	5%

6. Used the annual average number of permits per year multiplied by the percentage of permits/parcels on private water to determine a projected number of Permit Exempt (PE) wells per year, Table 4.

   Multiplied the number of PE wells per year by 20 to calculate the estimated total of PE wells projected over a 20-year period for unincorporated rural King County, Table 4.

Table 4. Average number of permit exempt well users by WRIA for the planning period.

WRIA*	Permit-exempt well/year^	20-year estimate	Error®
7	46	926	6%
8	35	698	6%
9	29	578	6%
10	4	81	2%
15	18	368	4%

* = WRIA boundaries are delineated by Ecology coverage
^ = WRIA specific percentage of private well users
® = Error calculated from percentage of building permits with "other" water service

Projected number of permit-exempt wells for time period (01/18/2018 to 01/18/2038) for all of King County is 2650. Each WRIA has a series of tables of this specific information, see Tables.

The second part of the growth projection assessment was performed in order to respond to the question: "Where will the well connections be installed?" The PE potential assessment is a GIS assessment of current (2019) parcel data. This work used a series of assumptions to assess potential area of growth within the county, specifically at the sub-basin scale as defined by the WREC for each WRIA.

The following are the assumptions used to refine the parcels:

- Outside Urban Growth Boundary
- Outside Forest Production District
- Outside Agriculture Production District
- Not Encumbered by K`C Parks or TDR conservation easements
- Not enrolled in Farmland Preservation Program
- Not Owned by Public Agencies
- Vacant land (with appraised improvements <$10,000)
- Have at least 1 acres of land outside 100 year Floodway and Severe River Channel Migration Hazard Areas.
- Parcel size – 1 acre or greater.
- Zoning – no exclusion and maximum density allowed by current zoning

7. Used centroid of the refined parcel data to determine location information, similar to step 2 (above).
8. Linked parcel and assessor attribute data to determine total number of parcels and dwelling units per sub-basin. A dwelling unit (DU) is a rough estimate of subdivision potential based on parcel size and zoning (e.g., a 22-acre parcel zoned RA-5 is assumed to have 4 dwelling units).
9. Determined the number of parcels and DUs that are inside or outside water district service boundaries.
10. Calculated water use projections for public connections and PE sourced parcels:
    a. Public connection parcels are located within water district service boundaries and are calculated based on historic rates of connection to public water within each sub-basin, assessed in step 5 (above).

    b. Any remaining number of parcels located within water district service boundaries are assigned to be PE sourced.

    c. PE sourced parcels were calculated based on the number of parcels located outside water district service boundaries plus the remaining parcels from “inside” water district boundaries, as described above, Table 5.

Table 5. Permit exempt (PE) estimate along with PE potential assessment data.

WRIA*	PE 20yr estimate^	Parcel^	DU
7	926	1175	1901
8	698	819	1070
9	578	746	1077
10	81	72	82
15	368	788	888

* = WRIA boundaries are delineated by Ecology coverage
^ = WRIA specific percentage of private well users
DU = Dwelling unit as noted in step 9.

WRIA specific data along with sub-basin assessments can be found in the Tables.

References

King County Countywide Planning Policies
https://www.kingcounty.gov/depts/executive/performance-strategy-budget/regional-planning/CPPs.aspx

https://www.kingcounty.gov/~/media/depts/executive/performance-strategy-budget/regional-planning/CPPs/2012-CPPsAmended062516withMaps.ashx?la=en

Vision 2040 link:
https://www.kingcounty.gov/~/media/depts/executive/performance-strategy-budget/regional-planning/Comp%20Plan/VISION_2040_-_2008.ashx?la=en

King County Growth Projection data tables by WRIA (Watershed Resource Inventory Area)

King County - Unincorporated

WRIA 8 Growth Projections *Draft 9/25/19*

WRIA (Ecology Coverage)	(KC building permitting data) 2000-2009	2010-2017		total	permits per year
8	1354	482		1836	102

% of county-wide total: 31%

WRIA 8 Future Permit-	PE/yr	20 yr est
	35	698

Water District info	2000-2009	2010-2017		total
total	1354	482		1836
wtr dst (within water district)	1226	422		1648
no dst (outside water district)	128	60		188

Ag PD	permits	% of WRIA total
WRIA 8	2	0%
Forest PD	permits	% of WRIA total
WRIA 8	1	0%

Historic Percentages		
	pub	0.595
	pvt	0.342

Water service info	(derived from KC parcel attribute data)			
public water system (pub)	843	250		1093
well - private water (pvt)	498	130		628
other	13	102		115
total	1354	482		1836

Existing	2000-2009	2010-2017	Total
PE wells	498	130	628
error	1%	21%	6%

WRIA 8 - Historic Growth and Water Use by Subbasin

Sub-basin delineations *v 9/25/19*

Sub-basin w/ permits	Number of permits	Distribution of growth
Seattle/ Lake Union	Urban	0%
Puget Sound Shorelines	Urban	0%
Swamp/North	Urban	0%
Little Bear Creek	0	0%
Samm River Valley	109	6%
Bear/Evans	516	28%
Greater Lake Washington	3	0%
May/Coal (Cedar)	134	7%
Lake Samm creeks	5	0%
Issaquah Creek	367	20%
Lower Cedar	701	38%
Upper Cedar	1	0%
total	1836	100%

Water use by basin

pub	pvt	oth	%pub	%pvt
0	0	0	0%	0%
0	0	0	0%	0%
0	0	0	0%	0%
0	0	0	0%	0%
96	7	6	88%	6%
376	117	23	73%	23%
3	0	0	100%	0%
113	13	8	84%	10%
0	5	0	0%	100%
144	199	24	39%	54%
361	286	54	51%	41%
0	1	0	0%	100%
1093	628	115	total	1836

WRIA 8 - 20 year PE Well Projection by Subbasin

permits/year 102

Added by GeoEngineers:

Average bldg. permits per year	Average wells per year (pvt)	Total wells in 20 years	Total wells in 20 years + 6% error	Total Rounded	Sub-basins	Distribution of PE
0.0	0.0	0.0	0.0	0	Seattle/ Lake Union	0%
0.0	0.0	0.0	0.0	0	Puget Sound Shorelines	0%
0.0	0.0	0.0	0.0	0	Swamp/North	0%
0.0	0.0	0.0	0.0	0	Little Bear Creek	0%
6.1	0.4	7.8	8.2	8	Samm River Valley	1%
28.7	6.5	130.0	137.8	138	Bear/Evans	19%
0.2	0.0	0.0	0.0	0	Greater Lake Washington	0%
7.4	0.7	14.4	15.3	15	May/Coal (Cedar)	2%
0.3	0.3	5.6	5.9	6	Lake Samm creeks	1%
20.4	11.1	221.1	234.4	235	Issaquah Creek	32%
38.9	15.9	317.8	336.8	337	Lower Cedar	46%
0.1	0.1	1.1	1.2	1	Upper Cedar	0%
102.0	**34.9**	**697.8**	**739.6**	**740**		

WRIA 8 - Permit-Exempt Well Potential Assessment

Assessment of potential parcels for future growth

Sub-basins	Number of parcels	Number of Dwelling Units (DU)
Seattle/ Lake Union	Urban	Urban
Puget Sound Shorelines	Urban	Urban
Swamp/North	Urban	Urban
Little Bear Creek	0	0
Samm River Valley	85	88
Bear/Evans	398	526
Greater Lake Washington	0	0
May/Coal (Cedar)	142	163
Lake Samm creeks	20	21
Issaquah Creek	429	534
Lower Cedar	578	818
Upper Cedar	0	0
total	1652	2150

Water district boundaries: Inside parcels	Inside DU	Outside Parcels	Outside DU	sub-basin
0	0	0	0	Seattle/ Lake Union
0	0	0	0	Puget Sound Shorelines
0	0	0	0	Swamp/North
0	0	0	0	Little Bear Creek
85	88	0	0	Samm River Valley
398	526	0	0	Bear/Evans
0	0	0	0	Greater Lake Washington
142	163	0	0	May/Coal (Cedar)
18	19	2	2	Lake Samm creeks
242	291	187	243	Issaquah Creek
492	713	86	105	Lower Cedar
0	0	0	0	Upper Cedar
1377	1800	275	350	

Water Use Projection: public connection parcels	public connection DU	PE sourced parcels	PE sourced DU	20 year well projection (incl error)	Shortfall (red if present) in 20 year well projection	Redistribution - 20 year well projection
0	0	0	0	**0**	0	**0**
0	0	0	0	**0**	0	**0**
0	0	0	0	**0**	0	**0**
0	0	0	0	**0**	0	**0**
75	78	10	10	**8**	2	**8**
290	383	108	143	**138**	5	**138**
0	0	0	0	**0**	0	**0**
120	137	22	26	**15**	11	**15**
0	0	20	21	**6**	15	**6**
95	114	334	420	**235**	185	**235**
253	367	325	451	**337**	114	**338**
0	0	0	0	**1**	-1	**0**
833	1080	819	1070	740	--------	740

total parcels 1652 | total DU 2150 | total parcels 1652 | total DU 2150

20 year Permit Exempt well total *740*

Notes:

The Permit-Exempt Well Potential Assessment is outlined in red

Columns in yellow include redistribution of wells in the 20 year growth projection, based on the permit-exempt well potential assessment done by King County.

Red numbers *indicate a shortfall (more 20 year projected PE wells than parcels/DU)*

Blue numbers *indicate redistribution of 20 year PE projected numbers*

ATTACHMENT B

Snohomish County Growth Projections and Rural Capacity Analysis Methods, Assumptions and Data Tables

Snohomish County Methodology – housing unit growth forecasts by WRIA

1) Using year-built statistics from the Assessor database. This data is derived from the county's permit data as provided to the Assessor by Planning and Development Services (PDS).
    a. All new single-family residences (SFRs) in the WRIA (by HUC 12) built between 2008 and 2018, located outside of the cities, UGAs, national and state forest lands, government property and tribal lands.
2) Assigning the 2008-2018 SFRs to "Public Water Service Areas" or to "P_E Well areas"
    a. Depending on distance to existing water main – water main data is derived from system comprehensive plans:
        i. New homes not part of a subdivision located within 100' of a water main.
            1. 100' is selected due to lot sizes in the rural area, cost to extend water service, buy-in from rural water utilities as a reasonable assumption, and requirements in the county's draft water code.
        ii. New homes that were part of a rural cluster subdivision (RCS) within ¼ mile
            1. As of April 2009, this is a requirement in county code for rural cluster subdivisions – (however, most RCS that have been built were grandfathered to the previous rules which did not include this requirement to connect to public water)
3) The distribution of future growth by WRIA and by HUC12 is assumed to mirror the distribution observed from past growth using (1) a straight-line forecast, and (2) a forecast based on an adopted control total. The number of new homes expected over the next twenty years looks at two options:
    a. A straight-line forecast based on the past housing unit change: average annual change 2008-2018 extended out an additional 20 years;
    - or -
    b. Housing Unit forecast based on County-adopted growth targets (2015 comprehensive plan), urban/rural growth share policy and observed (2008-2018) growth shares for each WRIA. Table 1 shows HU forecasts by WRIA for "PE Well Areas" and "Water Service Areas."

Table 1-2015 Comprehensive Plan Growth Forecast: Urban/Rural Growth Share and Projected New Housing Units in PE Well and Water Service Areas by WRIA

2015 Snohomish County Comp Plan			Snohomish County population growth forecast (Pop. Change) 2018 to 2038	2016 Countywide Planning Policy Population Allocation		Rural/Resource growth share by WRIA (Based on rural growth share) 2008-2018		
2011	Adopted Growth Target 2035	Avg. Annual increase 2011-2035		Urban share 92.1%	Rural share 7.9%	WRIA 3 & 5 (33%)	WRIA 7 (62%)	WRIA 8 (5%)
717000	955257	9927	198548	182862	**15685**	5176	9725	784
New Housing Units (HUs) by WRIA 2018-2038: (Rural Avg HU size* = 2.75)						1882	**3536**	**285**
Allocation of NEW HU based on SnoCounty Model for likely "Water Service Areas" and "P-E Well Areas"			Total Available HU Capacity (Sheet 1)				13994	646
			Growth Share in "Water Service Area" (Sheet 1)				59%	52%
			Growth Share in "P-E Well Area" (Sheet 1)				41%	48%
			New HU in "Water Service Area" 2018- 2038				2086	148
			New HU in "P-E Well Area" 2018- 2038				**1450**	**137**

* Rural Avg Housing Unit (HU) size is based on adopted growth targets; based on Population and HU increase 2011-2035.

Parcels included in the future capacity analysis were selected based on the following criteria:

1) All parcels .5 acre or larger marked as “vacant”, or with “0” or “Null” in the improvement value field in the Assessor data base located within the unincorporated rural and resource areas (outside of cities and outside of the unincorporated UGA) –
   a) Includes agricultural areas and private forest lands (non-state and non-federal). Does not include tribal lands within the Tulalip Reservation – development in this area is under Tribal planning and jurisdiction.
   b) The lot size of .5 acre or larger will likely meet requirements for accommodating both a well and a septic system (sewer hook-up is not allowed outside the UGA). Wells and septic systems must be separated from each other a specified distance – this includes separation on a single parcel and from the systems on adjacent parcels. Lots under .5 acre in size are somewhat unusual in the rural area due to zoning code – most likely to occur as lot fragments created by right-of-way or located around lakes due to legacy zoning (Waterfront Beach = WB).
   c) Within cities and UGAs, residential lot sizes are small (typically the minimum necessary to meet front, back and side yard setback requirements) and public water and sewer are available. The likelihood of new permit-exempt wells for domestic use is very low and possibly zero. County data since the state legislation was passed (RCW 90.94) in January 2018, shows that there have been zero new wells inside the unincorporated UGA; 99 new wells outside of the UGA. Cities typically report that new wells for domestic use are not allowed within city limits.
2) All parcels that are underdeveloped and large enough to subdivide (i.e. one house on ten or twenty acres in an R-5-acre zone)

3) All subdividable parcels where assumed to develop using the rural cluster option – this option achieves the highest density.
4) Parcels were assigned to "Public Water Service Areas" or to "P_E Well areas" per the methodology described above.
5) Land capacity analysis conducted in 2011 was used to assign the number of new housing units that could potentially be built on each parcel. This analysis considered future land use designation from the comprehensive plan with reductions for critical areas.
6) Capacity data was aggregated by HUC12 assigning parcels on HUC boundaries according to parcel centroid.
7) At the HUC12 level, new housing units built after 2011 were deducted from the 2011 available capacity to create an estimate of the capacity remaining as of 2019.

2011 Rural Capacity Analysis

The rural capacity analysis conducted using the 2011 Assessor data resulted in an assigned future capacity for each parcel in the rural area. It should be noted that this analysis of the rural area employed a similar, but less robust model than is used to determine future capacity within the UGAs.

The rural land capacity analysis is summarized as follows:

1) For each parcel the following data was obtained or calculated:
    a. Total acres
    b. Buildable acres (total acres less critical areas)
    c. Percent buildable acres (buildable / total) – if percent buildable is less than 35%, additional capacity is reduced per "f" below.
    d. Density based on land use designation (dwelling units per acre)
        i. For land use designations where Rural Cluster Subdivisions are allowed, density assumes maximum potential under RCS.
    e. Development status was assigned:
        i. Vacant = Improvement value less than $2000
        ii. Partially used = existing home and less than 1000 sq ft commercial
        iii. Redevelopable = improvement value / land value ratio is less than 1
    f. Calculate basic capacity:
        i. If vacant, future capacity = total acres * density (dwelling units/acre)
        ii. If partially used or redevelopable, future capacity = total acres * density – existing dwelling units (DUs)
        iii. If buildable area is less than 35% of total area, capacity is reduced to 75% and will be reduced further if buildable area is less than 20% (50% capacity); and further still if less than or equal to 10% (.25%)
        iv. If buildable area is zero, capacity is assigned as 1 (reasonable use criteria per property rights laws)
        v. Old substandard lots over ½ acre not otherwise accounted for in above steps, capacity = 1
        vi. Assign 0 new residential capacity for:
            1. Areas where residential is not allowed
            2. Existing use codes are incompatible with residential

3. Government property
4. Open space or Native Growth Protection Area (NGPA)
5. Land value is less than $500
6. Conservation Futures restrict residential development
7. Other development moratoriums related to potable water availability

vii. Pending project capacity from actual project applications

SNOHOMISH COUNTY WRIA 7 - HUC 12 Name	Growth Forecast Scenarios - New Homes						2019 Available Capacity			Capacity Surplus or Shortfall Current Trends Scenario			Capacity Surplus or Shortfall Comp Plan Targets		
	Current Trends			V 2040 Comp Plan Targets											
	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas
Little Pilchuck River	525	236	289	373	168	205	2142	834	1308	1617	598	1019	1769	666	1103
Quilceda Creek (1)	302	51	251	214	36	178	1213	466	747	911	415	496	999	430	569
Lower Pilchuck River	789	560	229	560	397	163	2309	1488	821	1520	928	592	1749	1091	658
Woods Creek	713	489	224	506	347	159	1904	1206	698	1191	717	474	1398	859	539
Tulalip Creek - Frontal Possession Sound (1)	453	249	204	321	177	145	603	379	224	150	130	20	282	202	79
French Creek	416	293	124	296	208	88	1093	904	189	677	611	65	797	696	101
Snohomish River - Frontal Possession Sound	480	362	118	341	257	84	574	382	192	94	20	74	233	125	108
Elwell Creek - Skykomish River	149	33	116	106	23	83	593	156	437	444	123	321	487	133	354
Evans Creek - Snohomish River	333	220	113	236	156	80	889	659	230	556	439	117	653	503	150
Peoples Creek - Snoqualmie River	116	18	98	83	13	70	404	50	354	288	32	256	321	37	284
McCoy Creek - Skykomish River	91	24	67	65	17	48	297	60	237	206	36	170	232	43	189
Wallace River	78	18	60	55	13	43	454	182	272	376	164	212	399	169	229
Lower Sultan River	145	93	53	103	66	37	254	82	172	109	-11	119	151	16	135
Upper Pilchuck River	327	278	49	232	197	35	1012	800	212	685	522	163	780	603	177
Lower South Fork Skykomish River	38	0	38	27	0	27	96	0	96	58	0	58	69	0	69
Lower North Fork Skykomish River	15	0	15	10	0	10	70	0	70	55	0	55	60	0	60
Cherry Creek - SnoCo Portion	11	0	11	8	0	8	35	0	35	24	0	24	27	0	27
Olney Creek	0	0	0	0	0	0	5	0	5	5	0	5	5	0	5
Upper Sultan River	0	0	0	0	0	0	2	0	2	2	0	2	2	0	2
Middle North Fork Skykomish River	0	0	0	0	0	0	45	0	45	45	0	45	45	0	45
Total WRIA 7	4981	2924	**2059**	3536	2075	**1463**	13994	7648	6346	9013	4724	4287	10458	5573	4883

(1) Connections to public water are likely to be over-estimated due to capacity issues with Seven Lakes Water Association.

Excluded HUCs: (all urban or all forest) Powder Mill Gulch - Frontal Possession Sound, Middle Sultan River, Upper North Fork Skykomish, Upper Beckler River, Lower Beckler River, Rapid River, Upper North Fork Tolt (SnoCo portion).

SNOHOMISH COUNTY WRIA 8 - HUC 12 Name	Growth Forecast Scenarios - New Homes						2019 Available Capacity			Capacity Surplus or Shortfall - Current Trends Scenario -			Capacity Surplus or Shortfall - Comp Plan Targets -		
	Current Trends			V 2040 Comp Plan Targets											
	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas
North Creek (2)	0	0	0	0	0	0	7	5	2	7	5	2	7	5	2
Bear Creek - Sammamish River	275	100	175	181	66	115	393	275	118	118	175	-57	212	209	3
Bear Creek	159	126	33	105	83	22	253	145	108	94	19	75	148	62	86
Total WRIA 8	434	226	208	286	149	137	653	425	228	219	199	20	367	276	91

(2) North Creek is located entirely within the county's Southwest Urban Growth Area (SWUGA) where connection to water providers is nearly certain. Providers have verified capacity in their water system comprehensive plans.

Additional changes to forecast not reflected here:

1. Revise allocations in HUCs where forecast exceeds available capacity.
2. Revise allocations within UGAs to add potential for limited number of new wells based on GeoEngineers analysis.
3. Revise connections to public water system in HUCs where public water service is already at capacity due to water rights.
4. Add growth forecasts from Tulalip Planning for WRIA 7.

ATTACHMENT C
GeoEngineers UGA Well Log Spot Check Data Tables

GeoEngineers - Incorporated (UGA) WRIA 8 Growth Projections

Developed 8/9/19

GeoEngineers - UGA Well Log Spot Check						
Period	Total Wells	Total Wells Spot Checked	Domestic wells (includes Group B wells)	Irrigation wells	Other (Test, Municipal, Dewatering, Industrial, Mitigation, UIC, Deepened or Refurbished)	Incorrect (Location, Date, etc.)
1998-2007	129	66	7	40	14	5
2008-2018	76	48	2	11	28	7
Totals	205	114	9	51	42	12
Percent of Total		56%	8%	45%	37%	11%
Potential number of new wells based on percentage of past 20 year total (205)						
WRIA 8			**16**	92	76	22

Notes:

Domestic and Irrigation well numbers have been adjusted based on information provided by The Highlands, Olympic View Water & Sewer District, City of Redmond, City of Sammamish and cross-checking well address with UGA boundary.

A total of 21 wells logged as "domestic" are actually irrigation wells and were moved to that category.

The remaining domestic wells that have been spot checked are located in the following City UGAs: Maple Valley (1), Mukileto (1), Mill Creek (3), Maltby (1), Kirkland (1) and Seattle (1).

Service Area/City Policy Notes:

Alerwood Water and Wastewater District - expanding service rapidly.

Redmond - PE wells not allowed. No new wells for irrigation that they know of.

Sammamish - PE wells not allowed. No known areas that can not be reached by public water.

The Highlands - all public water. Most lots have wells for irrigation due to large lawn size.

Woodway - all public water. Many lots have wells for irrigation due to large lawn size.

GeoEngineers - Incorporated (UGA) WRIA 8 Growth Projections

Proposed subbasins	Spot Checked 1998-2007	Spot Checked 2008-2018	Total	Total Potential Wells in UGA in 20 years	Total Rounded	County	City UGA
1 - Seattle/Lake Union	0	0	0	0.00	0	King	
2 - PS Shorelines	1	0	1	1.77	2	Sno co/King co	Mukilteo
3 - Swamp North	3	0	3	5.31	5	Sno co/King co	Mill Creek
4 - Little Bear	0	0	0	0.00	0	Sno co/King co	
5 - Samm Rvr Valley	0	0	0	0.00	0	King co	
6 -Bear/Evans	1	1	2	3.54	4	Sno co/King co	Maltby
7 - Greater Lake Washington	1	1	2	3.54	4	Sno co/King co	Kirkland/Seattle
8 - May/Coal	0	0	0	0.00	0	King	
9 - Lk Samm Creeks	0	0	0	0.00	0	King	
10 - Issaquah	0	0	0	0.00	0	King	
11 - Lower Cedar	1	0	1	1.77	2	King	Maple Valley
12 - Upper Cedar	0	0	0	0.00	0	King	
Totals	7	2	9	15.93	17		

Note: This tables includes data for wells in Ecology's Well Report database, filtered for a depth greater than 30 feet and diameter 6-8 inches. Ecology does not have the ability to filter for permit-exempt domestic wells. Information in the database is based on records submitted by the driller. Well Report Data and Images released from the Department of Ecology are provided on an “AS IS” basis, without warranty of any kind.