
TO: Murray Walters, A/GM Regional & Community Utilities **DATE:** June 7, 2021 - *updated June 29, 2021*

FROM: Julie Pisani, Drinking Water and Watershed Protection Program Coordinator **FILE:** 5600-07

SUBJECT: Regional Groundwater Levels Analysis – Pre-Summer 2021

BACKGROUND

In 2020, the RDN Drinking Water and Watershed Protection (DWWP) program had a regional analysis of groundwater levels completed to support water managers in the region in preparation for the summer period ahead. A technical report from Waterline Resources Inc. (Waterline) provided an update on longer-term and seasonal trends observed in the aquifers within our region. The report summarized current conditions and related that back to community water service areas and un-serviced areas alike. The [Regional Groundwater Level Analysis for Summer 2020](#) was presented to the RDN Board in June 2020 and deferred until July 2020 at which point it was received by the Board for information.

In 2021, the RDN DWWP program engaged Waterline to provide an abbreviated update to the reporting done in 2020. The groundwater level data reported on previously was current to May 2020, whereas the latest update now brings the currency to March 2021.

As in the prior update, there are some gaps in available data, so the analysis only represents the data available at time of reporting. The data available for and used in the 2021 analysis includes 30 RDN Volunteer Observation Wells (VOW) and 10 Provincial Groundwater Observation Network Wells (OW). Please refer to annotated Figure 2 below.

This update covers 18 (of the 22) mapped aquifers that are monitored in the region; nine of which are bedrock aquifers and the other nine are surficial (sand and gravel) aquifers. Please refer to annotated Figure 3 below.

This memo will summarize the seasonal and historic trends of the above-mentioned wells and aquifers, and discuss the application of this information. A link is provided to the updated data tables and graphs provided as appendices from Waterline.



- LEGEND:**
- RDN Volunteer Observation Well Network (VOWN)
 - Provincial Observation Well Network (PGOWN)
 - RDN Water Service Areas
 - Water Works/Improvement Districts
 - Municipal Water Service Areas
 - Water Regions
 - First Nations Reserve
 - Parks and Protected Areas
 - Provincial Park
 - Ecological Reserve

Yellow highlighted labels indicate which PGOWN and VOW wells were included in the 2021 data analysis.

0 5 10 15 km

Scale: 1:300000

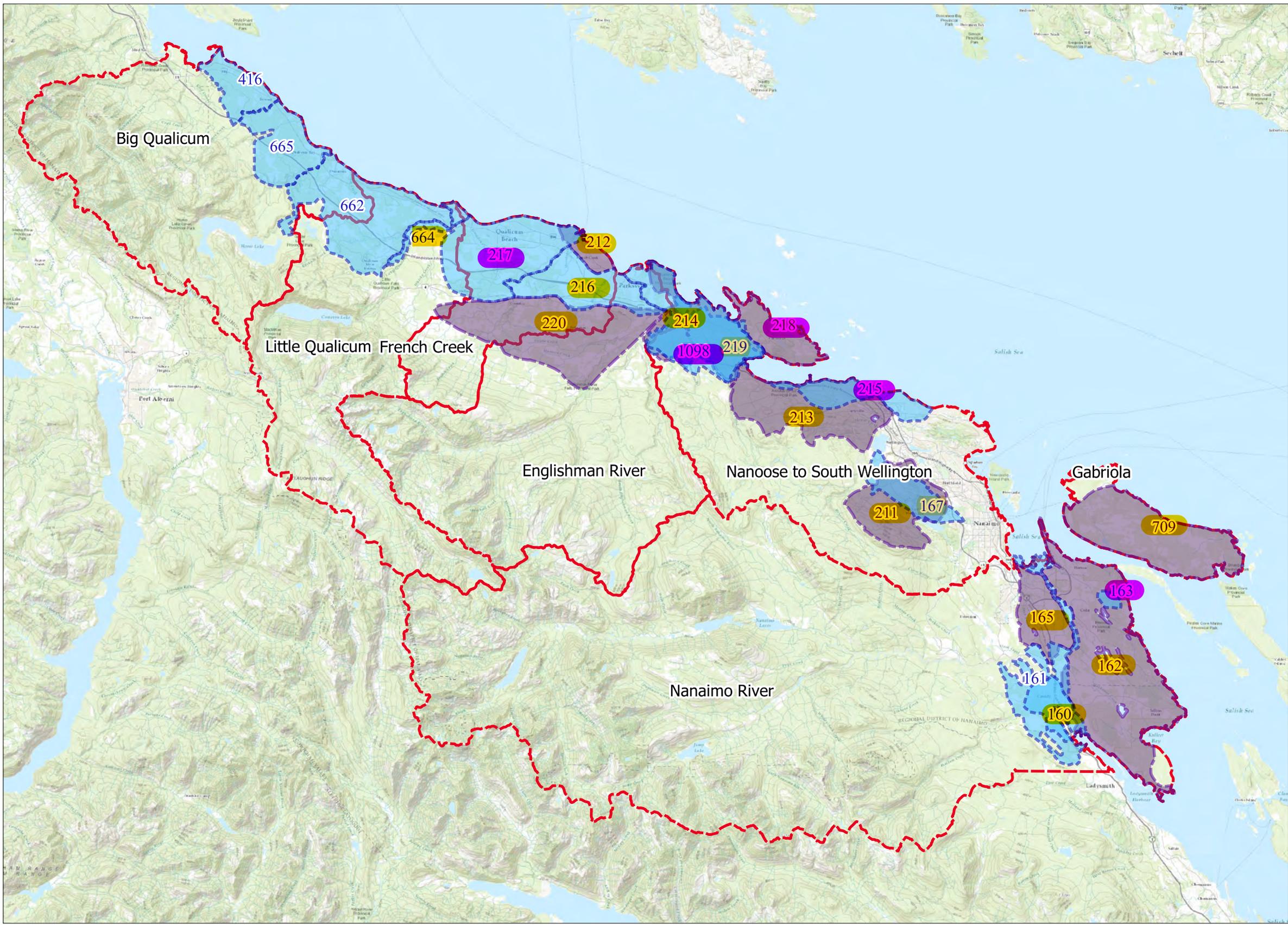
Coordinate system: WGS 84 / Pseudo Mercator

PROJECT
 Drinking Water and Watershed Protection Program - Regional Groundwater Level Analysis May 2021
 Submitted to the Regional District of Nanaimo Water Services

TITLE
VOW and PGOWN Locations

	PREPARED BY: Waterline Resources Inc.	FIGURE 2
	PROJECT: 2590-20-001	
	COMPILED BY: MS	
	DATE ISSUED: 2020-May-27	
	REVISED: 2020-June-2 by RDN	

Sources:
 This map contains data licensed under the Open Government License - British Columbia.
 Regional District of Nanaimo.
 World Imagery: ESRI wms service, http://server.arcgisonline.com/arcgis/rest/services/World_Imagery/MapServer/WMTS



LEGEND:

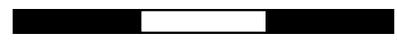
- Water Regions
- Aquifer in Overburden (ID #)
- Aquifer in Bedrock (ID #)

*Note: only mapped aquifers associated with known VOWN and PGOWN locations are displayed.

Yellow highlighted labels indicate which aquifers were included in the 2021 data analysis.

Pink highlighted labels indicate aquifers included in the 2021 analysis where PGOWN data was not available, and only RDN VOW data was used for the trend analysis.

0 5 10 15 km



Scale: 1:300000

Coordinate system: WGS 84 / Pseudo Mercator

Sources:
 This map contains data licensed under the Open Government License - British Columbia.
 Mapped aquifers: British Columbia, Ministry of Environment Water Protection and Sustainability (BC MoE). 2020. Ground Water Aquifers Database. <https://apps.nrs.gov.bc.ca/gwells/>. Accessed May 2020
 Regional District of Nanaimo.
 World Topographic Map: ESRI wms service, http://server.arcgisonline.com/arcgis/rest/services/World_Topo_Map/MapServer/WMTS?

PROJECT
 Drinking Water and Watershed Protection Program - Regional
 Groundwater Level Analysis May 2021
 Submitted to the Regional District of Nanaimo Water Services

TITLE
**Regionally Mapped Surficial and
 Bedrock Aquifers**

PREPARED BY: Waterline Resources Inc.
PROJECT: 2590-20-001
COMPILED BY: MS
DATE ISSUED: 2020-May-27
REVISED: 2021-June-2 by RDN

SUMMARY

Seasonal Conditions & Longer-Term Trends

As of March 2021, seven aquifers were reporting **average seasonal levels**.

Ten aquifers in the region were tracking at **below seasonal average** groundwater levels. Five of those are bedrock aquifers and five are surficial aquifers. The **bedrock aquifers** reported to be at **seasonal lows** are also experiencing **longer-term declining trends**, as follows:

- Aquifer 220 – Errington/Coombs – bedrock (2 monitoring wells)
- Aquifer 211 – Benson Meadows – bedrock (1 monitoring well)
- Aquifer 709 – Gabriola – bedrock (3 monitoring wells)
- Aquifer 162 – Cedar-Yellowpoint – bedrock (7 monitoring wells)

Three **surficial aquifers** were also reporting **seasonal lows** and **longer-term declining trend**:

- Aquifer 217 – Qualicum Beach – surficial (1 monitoring well) *
- Aquifer 215 – Lantzville – surficial (1 monitoring well) *
- Aquifer 163 – Cedar – surficial (1 monitoring well) *

However, these aquifers were flagged as having a shortfall of Provincial observation well data for late 2020 - early 2021 to support the current trending. Therefore, these longer-term trends are considered less comprehensive and more localized to the RDN VOW wells that provided the data for the analysis. This caveat is denoted with an asterisk (*) and is also noted as the case for two other aquifers later in this memo.

By contrast, three aquifers that were reporting **seasonal low levels** this March are experiencing **longer-term increasing trends**:

- Aquifer 664 – Little Qualicum – surficial (1 monitoring well)
- Aquifer 213 - Upper Lantzville - bedrock (3 monitoring wells)
- Aquifer 160 – Cassidy – surficial (1 monitoring well)

Eight of the 18 aquifers reported on were analyzed to have **increasing longer-term trends**, based on available data between 2013-2021. Of these, four aquifers were also displaying **average seasonal levels**, as follows:

- Aquifer 212 – French Creek – bedrock (1 monitoring well)
- Aquifer 216 – Parksville – surficial (4 monitoring wells)
- Aquifer 167 – Millstone Valley – surficial (1 monitoring well)
- Aquifer 1098 – Nanoose – surficial (2 monitoring wells) *

One aquifer showed both an **increasing longer-term trend** and **above average seasonal levels**:

- Aquifer 219 – Nanoose – surficial (3 monitoring wells)

Three aquifers, all bedrock, were analyzed to have **variable historic trends**, stemming from the fact that different wells in the same aquifer had observed different trends based on the heterogenic nature of aquifer properties such as water-bearing fractures and recharge, or variable local effects from pumping. This heterogeneity is to be expected in bedrock aquifers where water-bearing fractures are randomly distributed and discontinuous.

- Aquifer 214 – Nanoose – bedrock (5 monitoring wells) → **Large Decline** to **Increasing**
- Aquifer 218 – Nanoose Peninsula – bedrock (2 monitoring wells) * → **Moderate Decline** to **Increasing**
- Aquifer 165 – South Wellington – bedrock (2 monitoring wells) → **Moderate Decline** to **Stable**

For the methodology used to determine historical and seasonal trends, please refer to sections 3.2 and 3.3 of the 2020 report, as the methods were consistent across reporting years.

Application

This information provides a snapshot of groundwater conditions in the region heading into the summer months. The seasonal conditions observed in early spring, as reported in this memo, can provide an early indication of where heightened water conservation measures may be needed this summer. Watching weather patterns in June, July, August and how that translates into community water demand and/ or low streamflow, will further inform water service providers and well owners across the region. Water service areas have currently implemented the annual watering restrictions framework to promote conservation. The primary measures to respond to potential groundwater shortages include water conservation (efficient irrigation, rainwater harvesting, soil improvements, efficient appliances) and eliminating leaks.

The aquifers reported at seasonal lows are not sources for larger community water supply systems, but they do support private domestic wells and small water systems.

Understanding the seasonal conditions of a well or aquifer in relation to longer-term groundwater level trends offers important context and can help prioritize policy solutions for areas that are under more water stress due to aquifer characteristics, climate impacts and localized demand.

Data Tables and Graphs

The updated data tables and hydrographs from Waterline can be found at this link: [Regional Groundwater Level Trend Analysis 2021](#) and include the following:

Appendix A – Overview of Groundwater Observation Well Data provides a detailed table that reports the historical and seasonal groundwater level trend per mapped aquifer, based on either Provincial or RDN observation wells. It also notes which community water service areas, if any, are associated with which aquifer and lists the total number of registered wells correlated to each mapped aquifer to get a sense of the density of private wells relying on the aquifer outside the serviced areas. [Note that this number of private wells is not exhaustive as, a) there are also many registered wells that are uncorrelated to an aquifer but fall within the spatial extent of the aquifer – see stats via the [BC Aquifer Database](#) and, b) further still, there are many unregistered wells that are not accounted for].

Appendix B – Long Term Groundwater Level Trend Results provides a table with the long-term groundwater level trend results calculations and hydrographs for each observation well used for this

reporting, showing the full dataset available 2013-2021 for level fluctuations over time, charted against precipitation.

Appendix C – Seasonal Groundwater Level Trend Results provides the seasonal groundwater level trend results in a summary table as well as in hydrographs for each observation well used in this analysis, plotting each year of data against the months of the year to see seasonal averages and inter-annual variation, including the most current 2021 data at time of reporting.

This information will also be shared with well monitoring volunteers, local water purveyors, Provincial staff in groundwater protection, and posted on the RDN website for public reference.