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WATERSHED BULLETIN Volume 1, Issue 1: June 2024

COLUMBIA BASIN GROUNDWATER MONITORING PROJECT:

SPRING GROUNDWATER LEVELS HIGHLIGHT VARIABILITY AND NEED FOR EXPANDED MONITORING

Living Lakes Canada acknowledges that this project is taking place in the unceded traditional territories of the Ktunaxa, Lheidli T'enneh, Secwepemc, Sinixt and Syilx Nations who have stewarded these lands for generations.

Low snowpacks over the winter across the B.C. Columbia Basin region are raising concerns about water supply during the hotter, drier months later in the year. Decision makers require current and localized information to respond to these changes and concerns.

Through the Columbia Basin Groundwater Monitoring Program, Living Lakes Canada is collecting long-term groundwater level data at 32 observation wells across the region to effectively inform sustainable water management. This program aims to monitor groundwater across a range of geographical, topographical, climatic, hydrological and water use conditions across the Basin, as well as aquifers with varying amounts of development. Hourly groundwater level measurements are collected at the wells to determine how levels change seasonally and from year to year.

The program partners with well owners to establish a cost-effective network of Volunteer Observation Wells (VOWs) across the Canadian Columbia Basin region. Living Lakes Canada is currently monitoring 32 VOWs. This work complements the Provincial Groundwater Observation Well Network, which currently monitors 8 wells across the Basin.

The groundwater data from this program is made publicly available to well owners, decision makers, researchers, and more on the open access Columbia Basin Water Hub. The Groundwater Monitoring Program is a component of the Columbia Basin Water Monitoring Framework.


VOLUNTEER OBSERVATION WELL
LLC PHOTO

Throughout the year, the Living Lakes team of staff, contractors, and volunteers conduct seasonal site visits to the wells. With spring site visits having recently concluded in April, this Watershed Bulletin explores the findings and examines the trends of the data collected up to the end of March 2024. Note that since these site visits, much of the southern Interior including the Columbia Basin experienced a cool and relatively wet spring season in May and into June but any shorter term effects from this may be seen in data that are downloaded during the next round of site visits.

VARIABILITY, TRENDS, AND HYDROLOGICAL CONNECTIONS

In March 2024, some wells recorded their lowest levels to date (VOW 10 - see Figure 1; VOW 13, 14, 18 - see Appendix A). A qualitative look at the longer-term groundwater trends for these wells suggests a declining trend since monitoring began approximately 5 years ago.

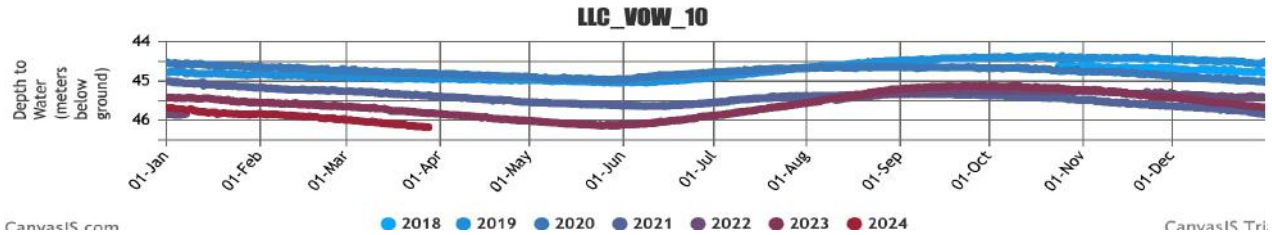


Figure 1. Groundwater levels in VOW 10, located in Windermere in a confined sand and gravel aquifer within an alluvial terrace on the benches above the Columbia River. In March 2024, notice the lowest levels recorded for that month, and the overall declining trend in groundwater levels.

Several of the wells in the program show earlier rises in water levels in February and March compared to previous years, with some wells having levels at the end of March higher than in recent years (e.g. VOW 09 - see Figure 2; VOW 02, 16, 20, 25, 29, 30 - see Appendix B).

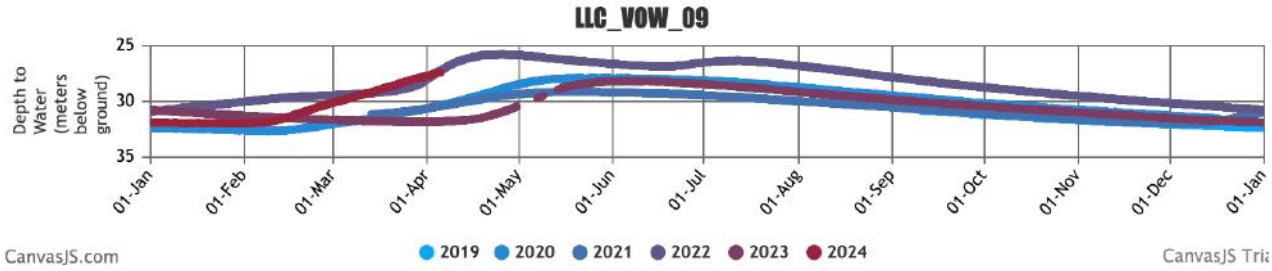


Figure 2. Groundwater levels in VOW 09, which is located in an unconfined sand and gravel aquifer within an alluvial terrace near the confluence of the Slocan and Kootenay Rivers. Multiple years of data show how levels change seasonally and year-to-year. Notice the early and steep rise in water level in February 2024 compared to previous years.

These wells are likely hydraulically connected to surface water and located in aquifers whose levels are streamflow driven, or they are in recharge-driven systems that are highly responsive to recharge (see Gullacher et. al. 2021 for a description of groundwater response mechanisms).

Recharge may be occurring earlier in these aquifers this year due to higher early season water level rises in surface water and a low to mid-elevation snowpack that melted earlier this year compared to previous years.

Other wells display water levels and patterns that show declining trends (as described above), some have remained similar over the past few years, while others exhibit trends that are too subtle to clearly identify without detailed analysis. **This highlights the variability across aquifers and the different conditions (e.g. climate, water use, topography, geology, response time to recharge) that exist throughout the Basin.**

VOLUNTEER OBSERVATION WELL. LLC PHOTO.

Monitoring across a range of different aquifer types and conditions demonstrates the seasonal and long-term variability in groundwater levels throughout the Basin. For example, the seasonal water level peak in **VOW 15** occurs around June each year (Figure 3). In contrast, water levels in **VOW 10** peak each year in October (Figure 1).

VOW 15 is in an unconfined sand and gravel aquifer (**Aquifer 816**) located between Columbia Lake and the Kootenay River. Water levels in the aquifer are likely influenced by nearby surface water, and we see peak groundwater levels occur around the same time as peak surface water levels (around June).

VOW 10 is located on the Columbia Valley benchlands in Windermere, where the lithology is complex and there may be multiple aquifers stacked in the area (**Aquifer 453**). More analyses are warranted to further understand the seasonal and long term water levels trends.

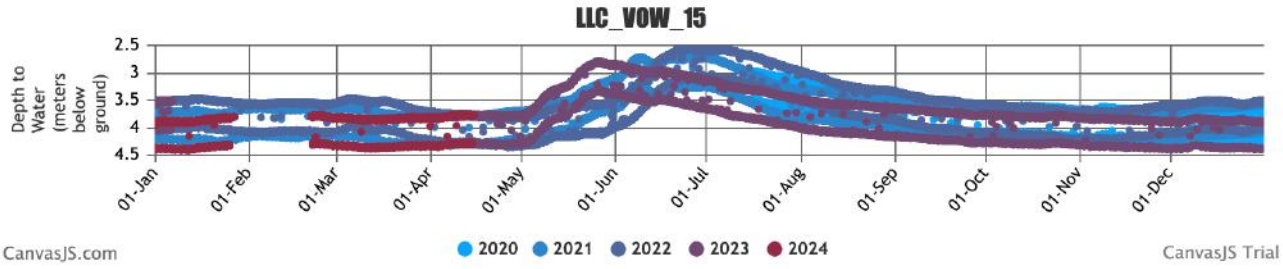


Figure 3. Groundwater levels in VOW 15, located in Canal Flats in an unconfined sand and gravel aquifer in the Columbia Valley floodplain. Notice the highest annual water levels typically occur in June. This well is actively pumped as a water supply well.

"As residents of rural Cranbrook, we are worried about the effects of groundwater use in our area, and about current drought conditions that may impact our personal groundwater resources. As well owners, we are reassured that through Living Lakes monitoring of groundwater levels, we have the information we need to manage and protect our aquifer."

Pat and Dave Hall, Cranbrook, BC

DISCUSSION

Groundwater levels serve as an indicator of groundwater levels serve as an indicator of relative changes in groundwater storage. These levels depend on the balance between the amount of water entering an aquifer (recharge) and the amount leaving it (discharge). Recharge, storage, and discharge are influenced by various factors, including geology, topography, land cover, climate, and water withdrawals for human use.

Aquifer water levels can respond to changes in recharge and discharge over different time scales, ranging from days to decades, depending on the characteristics of the aquifer. For example, a well in a valley bottom aquifer that is hydraulically connected to surface water, like a nearby river, may show rapid changes in water levels that reflect the river's levels.

In contrast, a deep well at higher elevations in the mountains might show a delayed response to recharge, as it takes time for precipitation and snowmelt to infiltrate down to the aquifer. However, a high elevation well located in bedrock may exhibit a quick response to recharge if it is connected to surface runoff through cracks and faults, and such wells tend to show a greater seasonal water level variation than wells in valley-bottom locations.

When making groundwater-related decisions, it is important to be aware of this variability and to have aquifer-specific data to know how an aquifer responds to different hydrological conditions.

> "As consultants specialized in hydrogeology, we often work on projects for clients that support aquifer protection and management. Rarely do clients monitor continuous groundwater levels. The long-term data sets collected by others such as the data from the Columbia Basin Groundwater Monitoring are extremely valuable to assess groundwater level trends and seasonality, understand aquifer conditions and better inform aquifer protection and management strategies."
>
> *Geneviève Pomerleau, M.Sc., P.Eng.*
> *Senior Hydrogeologist, Environment, AtkinsRéalis*

KEY TAKEAWAYS

To summarize:

- Low snowpacks and drought conditions across the region are leading to concerns about water supply and highlighting the need for comprehensive watershed monitoring and planning.
- Aquifers across the Columbia Basin have different characteristics and respond differently to surface conditions, underscoring the need for expanded groundwater monitoring.
- Some aquifers in the Living Lakes network are showing lower levels this year than in previous years.
- Other aquifers show rises in water levels earlier this spring compared to previous years, which may be connected to an earlier low elevation snowmelt in 2024.
- To avoid aquifer depletion and ensure long-term water availability, the rate of groundwater withdrawal should not cause a year-to-year decline in water levels.

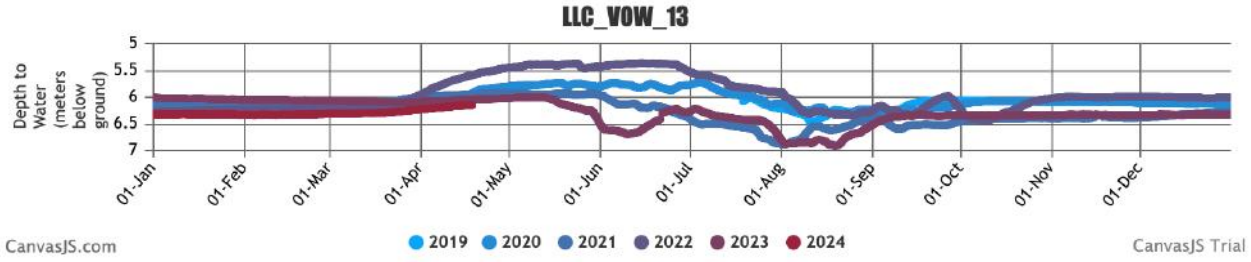
Different aquifers across the region will respond differently to future changes in climate, snow and precipitation, changes in landcover (such as impacts of wildfires) and potential increases in groundwater withdrawals with increased population and development. **Having aquifer-specific information on groundwater levels can help support effective water management, ensuring supply for people and the ecosystems that rely on groundwater.** The aim of Living Lakes is to provide this aquifer-specific information at a local scale.

CONTACT

groundwater@livinglakescanada.ca
www.livinglakescanada.ca/groundwater

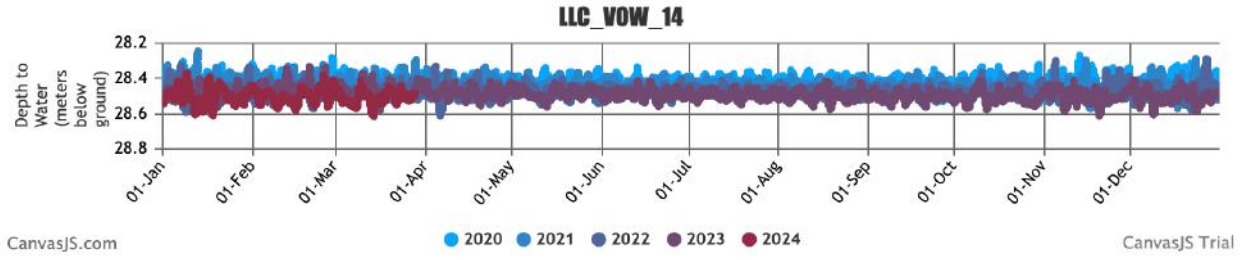
APPENDIX A - WELLS WITH LOWEST LEVELS TO DATE RECORDED IN 2024

VOW 13 - Brisco (Sylvania Rd)



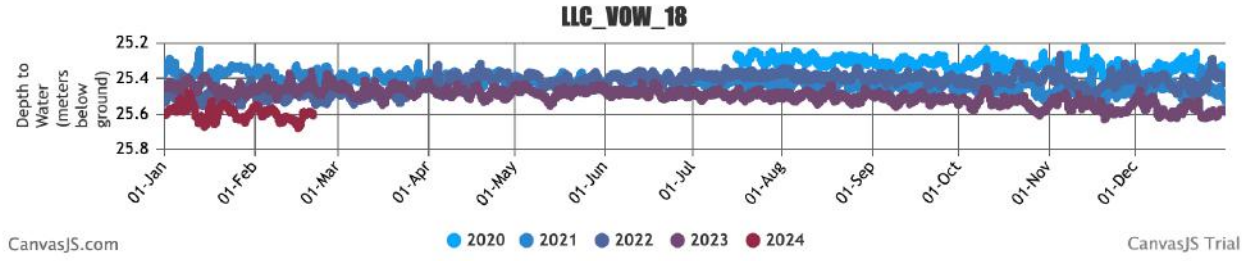
Groundwater levels in VOW 13, located in Brisco in a confined sand and gravel aquifer within an alluvial terrace. In March 2024, notice the lowest levels recorded that month, and levels from January to April this year (2024) are lower than previous years. This well is influenced by pumping of a nearby well for irrigating a home garden during the summer months as can be seen by the drawdown starting around mid May each year.

VOW 14 - North of Fairmont (Westside Rd)



Groundwater levels in VOW 14, located on the western benchlands of the Columbia Wetlands between Invermere and Fairmont on the Westside Road. It is in an undeveloped area where there are very few wells. It is in a confined sand and gravel aquifer within an alluvial terrace. This well has a very thick confining layer, and changes over the last 4-5 years are small, on the order of 30 cm. In March 2024, notice the lowest levels recorded that month, and the overall decreasing trend in groundwater levels.

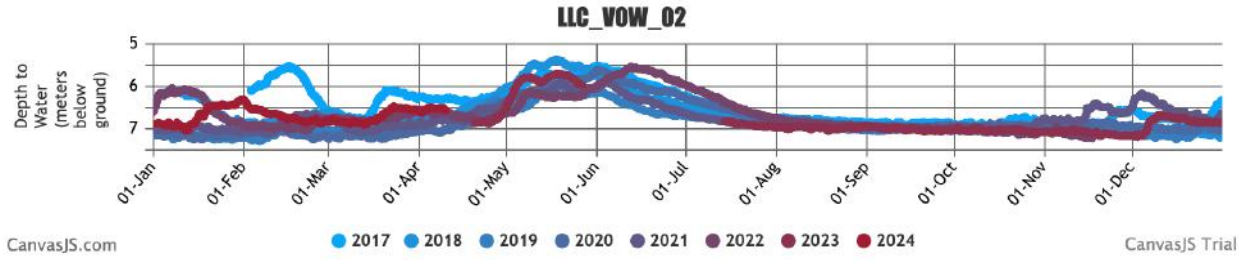
VOW 18 - North of Skookumchuk (Hwy 93/95)



Groundwater levels in VOW 18, located in a rural area between Skookumchuk and Canal Flats in a confined sand and gravel aquifer within an alluvial terrace. In March 2024, notice the lowest levels recorded that month, and the overall decreasing trend in groundwater levels.

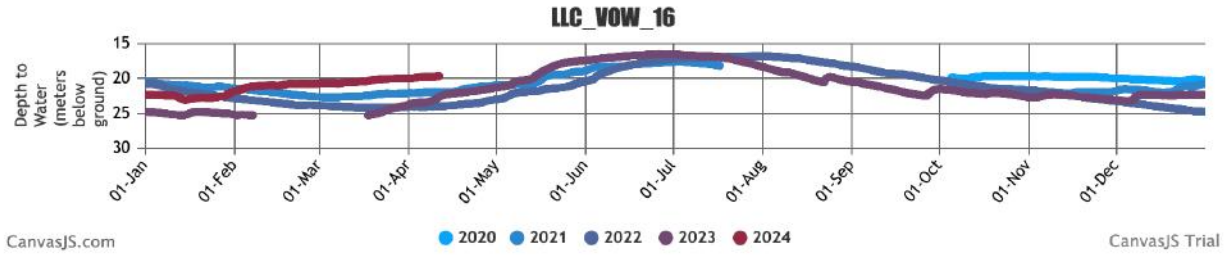
APPENDIX B - WELLS WITH EARLIER RISES IN WATER LEVELS RECORDED IN 2024

VOW 02 - Creston (South Goat River Rd)



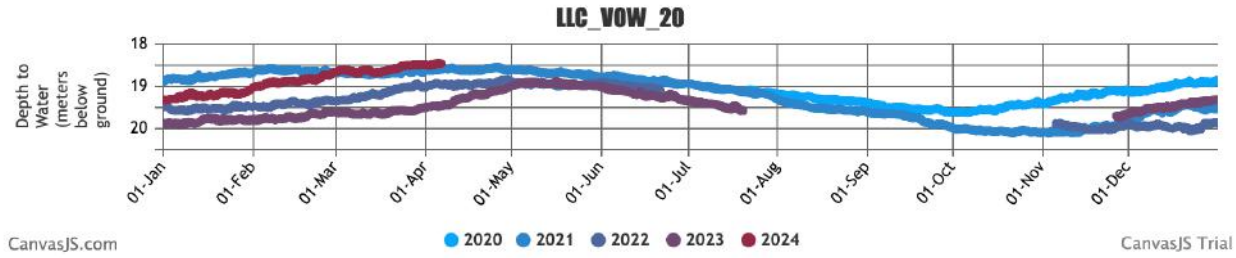
Groundwater levels in VOW 02, located near Creston is a confined or semi-confined gravel aquifer in a floodplain. Notice the rise in water levels occurring earlier in spring 2024, compared to previous years.

VOW 16 - Edgewood (Monashee Ave)



Groundwater levels in VOW 16, located in Edgewood in a confined sand and gravel aquifer. Notice the rise in water levels occurring earlier in spring 2024, compared to previous years.

VOW 20 - South of Silverton (Oma Rd)

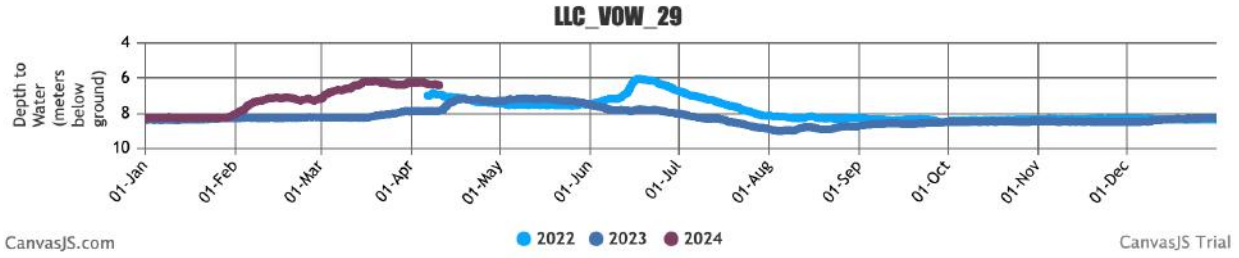


Groundwater levels in VOW 20, located near Silverton in fractured crystalline bedrock in mountainous terrain. Notice the rise in water levels occurring earlier in spring 2024, compared to previous years.

VOW 25 - Nelway (Rosebud Lake Rd)

Groundwater levels in VOW 25, located near Nelway in what is likely a sand and gravel aquifer. Notice the rise in water levels occurring earlier in spring 2024, compared to previous years.

VOW 29 - Canyon (Samuelson Rd & 48th St)



Groundwater levels in VOW 29, located near Canyon in a bedrock aquifer. Notice the rise in water levels occurring earlier in late winter and early spring 2024, compared to previous years.

VOW 30 - Slocan Park (Park Rd)

Groundwater levels in VOW 30, located in Slocan Park in a confined sand and gravel aquifer of glacial origin. Notice the rise in water levels occurring earlier in spring 2024, compared to previous years.