Regional District of Nanaimo
Collaborative Water Monitoring

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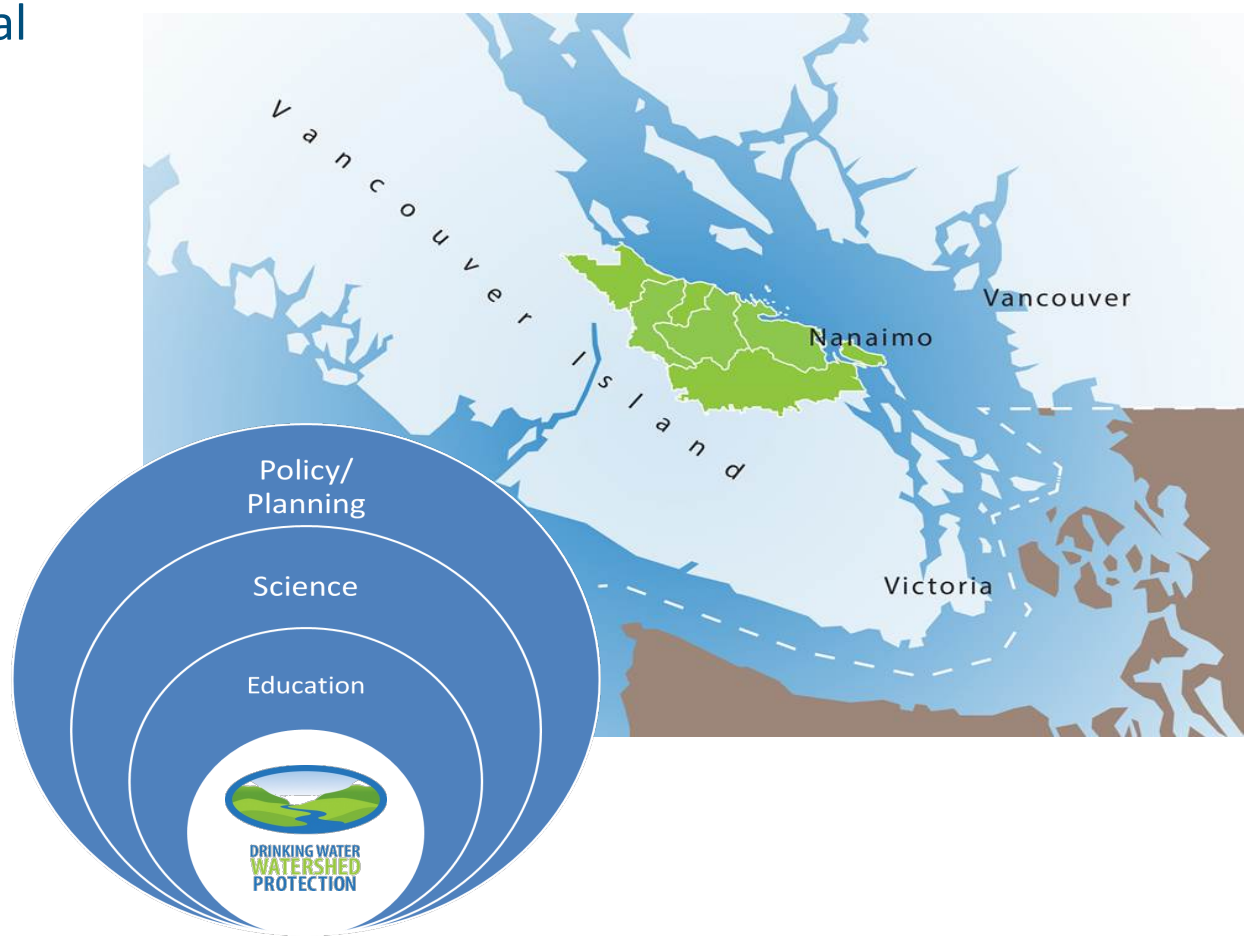
For March 7, 2019 - POLIS webinar on collaborative water monitoring

DRINKING WATER & WATERSHED PROTECTION

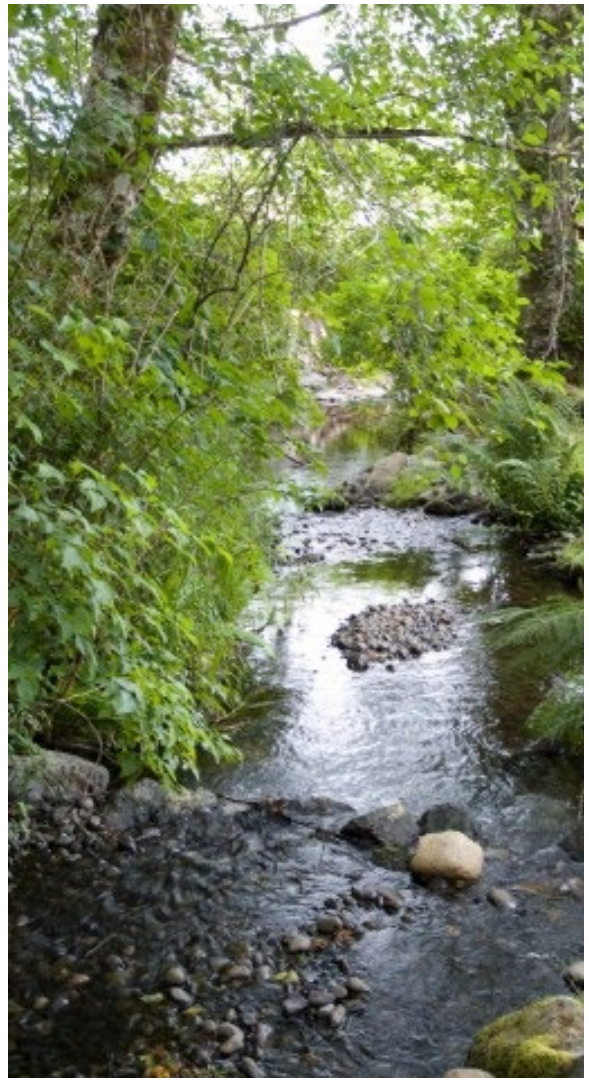
The DWWP Program helps achieve the Regional Board's strategic goals to:

- Maintain healthy and adequate supply of water
- Protect water quality and ecosystem values
- Encourage innovative regional planning



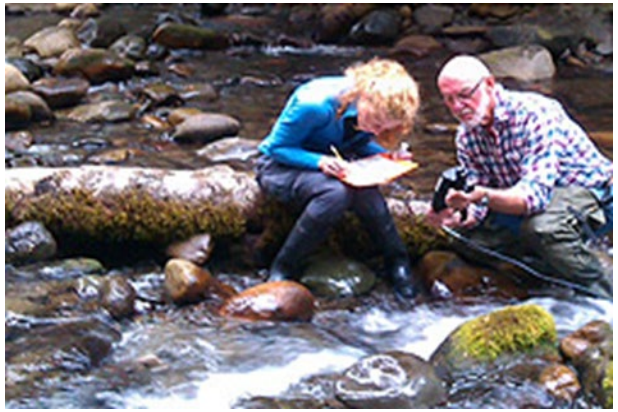
FUNDING MODEL

- Entire DWWP Program is funded via **regional parcel tax** ($8/parcel/year) paid into by the 7 Electoral Areas and 4 Municipalities.
- This includes all **education, science/monitoring and policy initiatives**; 2 permanent full time staff plus 1.5 temp staff currently.
- Received $200K Towns for Tomorrow Grant between 2011-2013 for capital costs to establish monitoring programs.
    - Included BC Observation Well Network Expansion well drilling, and purchasing sets of surface water quality monitoring equipment, groundwater level loggers
- Monitoring programs have operational budget of approx. $25,000 per year (not including staff time).
- Leverage funding & in-kind partnerships with senior gov. agencies, industry and magnetize in-kind volunteer time from active community members.



SCIENCE - MONITORING INITIATIVES

Surface Water Quality: *Community Watershed Monitoring Network*

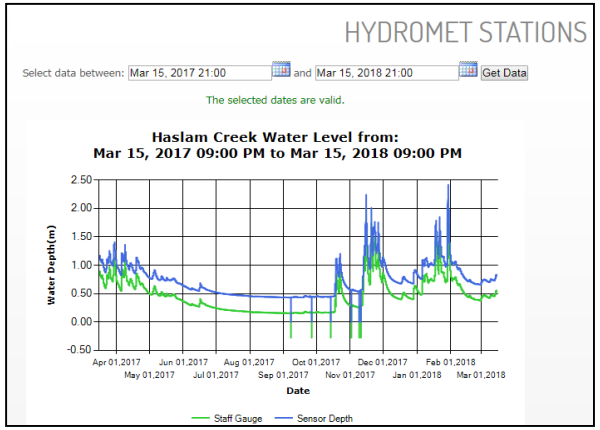


- *Sample for turbidity, temperature, dissolved oxygen, conductivity*
- *13 stewardship groups trained to provincial protocol*
- *24 watersheds*
- *60+ sites*
- *Since 2011*
- *Data into BC EMS Database*

Groundwater Observation Well Network: Volunteer & Provincial

- *Supported the addition of 16 BC Observation Well Network monitoring wells in our region*
- *Established 30 Volunteer monitoring wells*
- *Monitor groundwater levels and conductivity (coastal wells)*
- *Data into BC Aquarius Portal*

Hydrometric & Climate Monitoring



- *Added 4 new streamflow monitoring sites; 2 new climate monitoring sites*
- *Partnered with FLNRO, DFO, Island Timberlands & private landowners*
- *Data in BC Aquarius Portal*

COLLABORATIVE WATER MONITORING PRINCIPLES

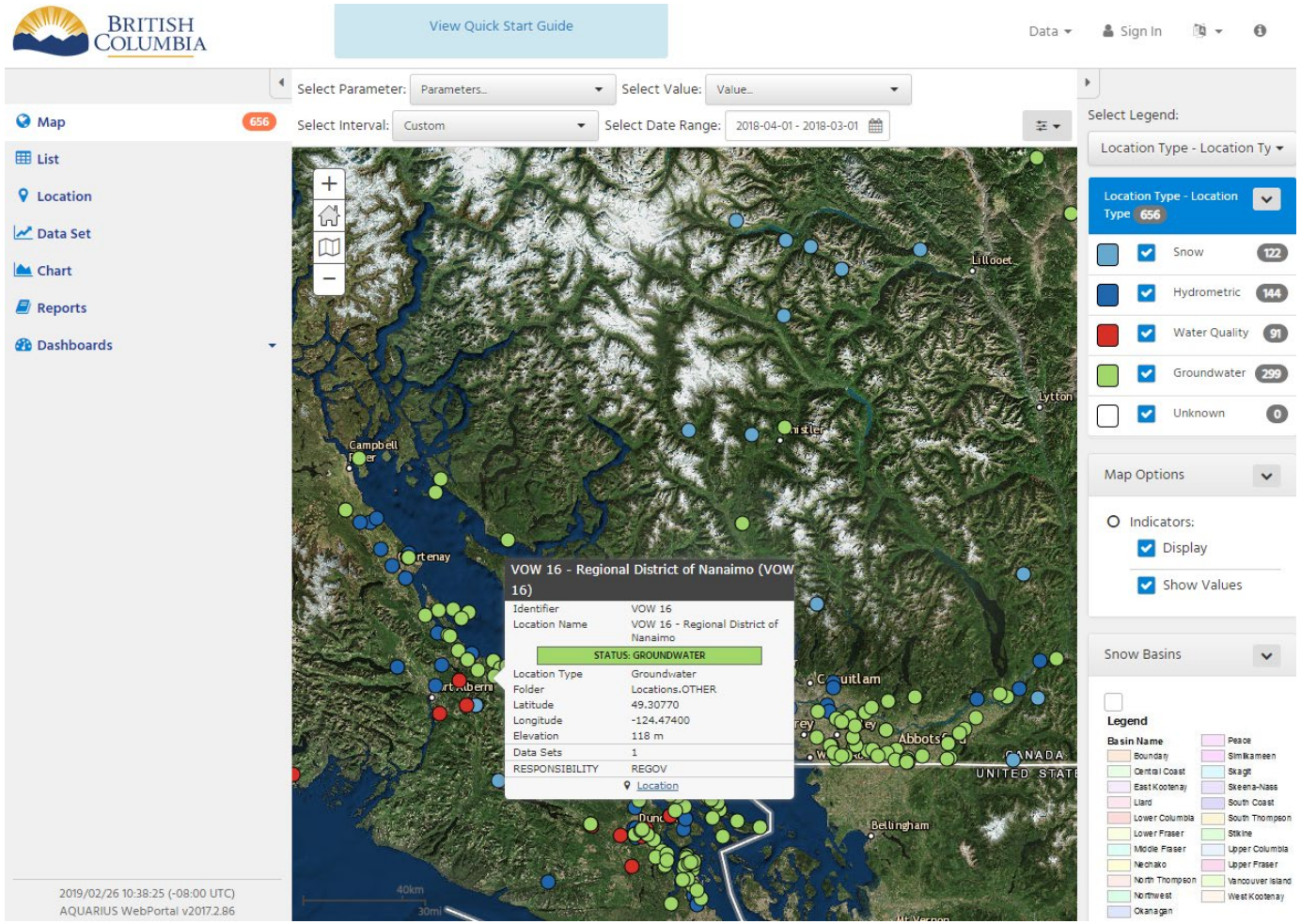
- Formation:
  - determine data gaps to guide program implementation
  - align with Provincial networks
  - engage citizens & professionals
- Structure:
  - RDN staff coordinate monitoring locations, manage equipment, train and liaise with volunteers in the community, enter data into Provincial databases, engage professionals to analyze trends
- Data quality:
  - Adhere to Provincial protocols, manufacturer's guidelines, advice from consulting professionals, perform QA / QC; track metadata. When shared, we are listed as data authority.

DATA SHARING & VISUALIZATION

Groundwater level data & Hydrometric data

Third-party data contributor to Provincial portal (AQUARIUS) rather than creating our own separate platform.

aqrt.nrs.gov.bc.ca



Welcome to our new Data Submission Webpage

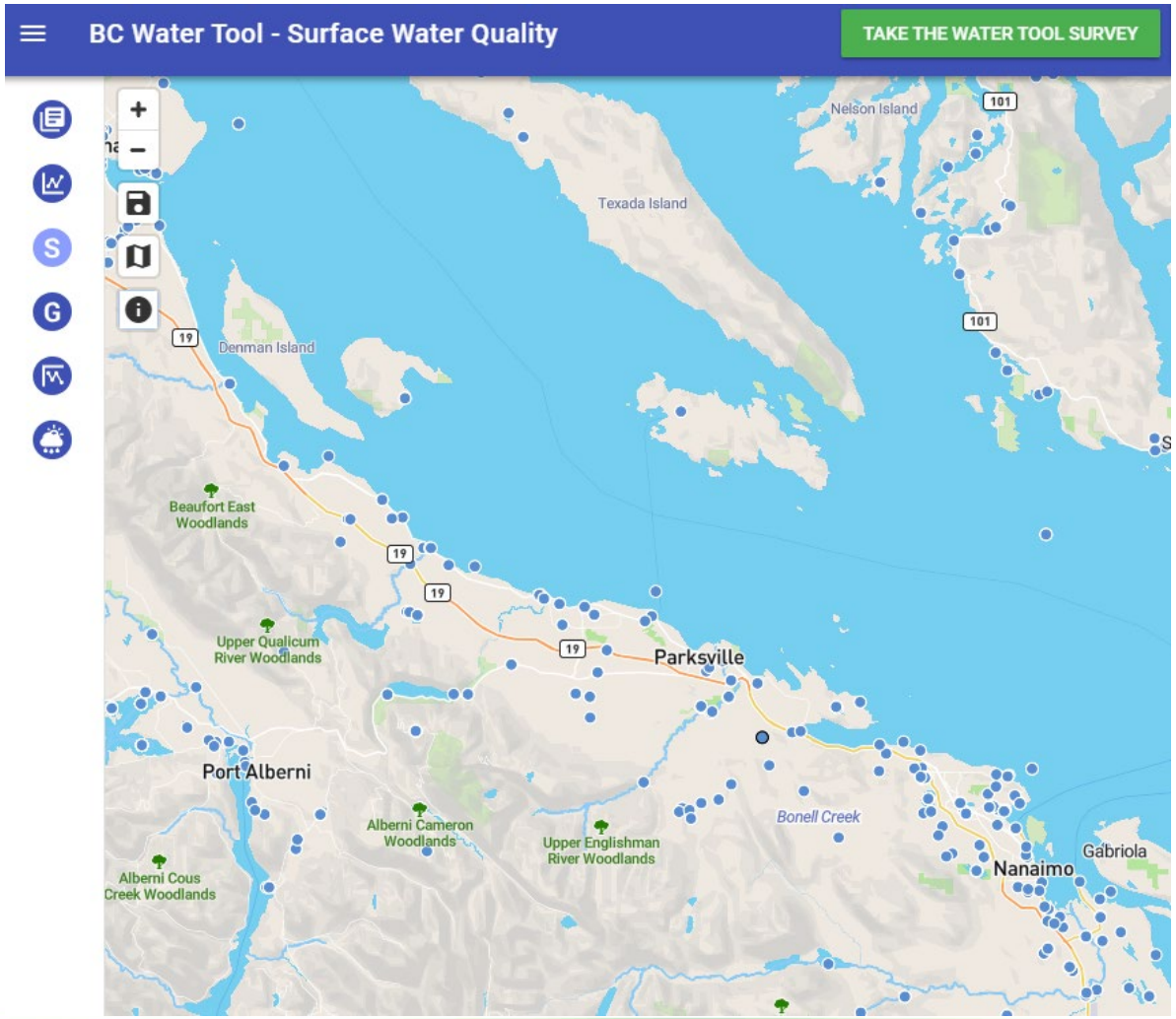
We now a have information and a streamlined process for data partners to share their continuous (time series) water related data with the Province. Our goal is to capture automated groundwater, water quality, hydrometric and snow data, and make it available as a shared resource through our 'Real-time Water Data' tool and the Data Catalogue under Open Government Licence.

Submit any questions or comments to Aquarius@gov.bc.ca

Mary Jane Jojic
Water Data Specialist
Environmental & Climate Monitoring Section
Knowledge Management Branch
Ministry of Environment & Climate Change Strategy
250-354-6850

DATA SHARING & VISUALIZATION

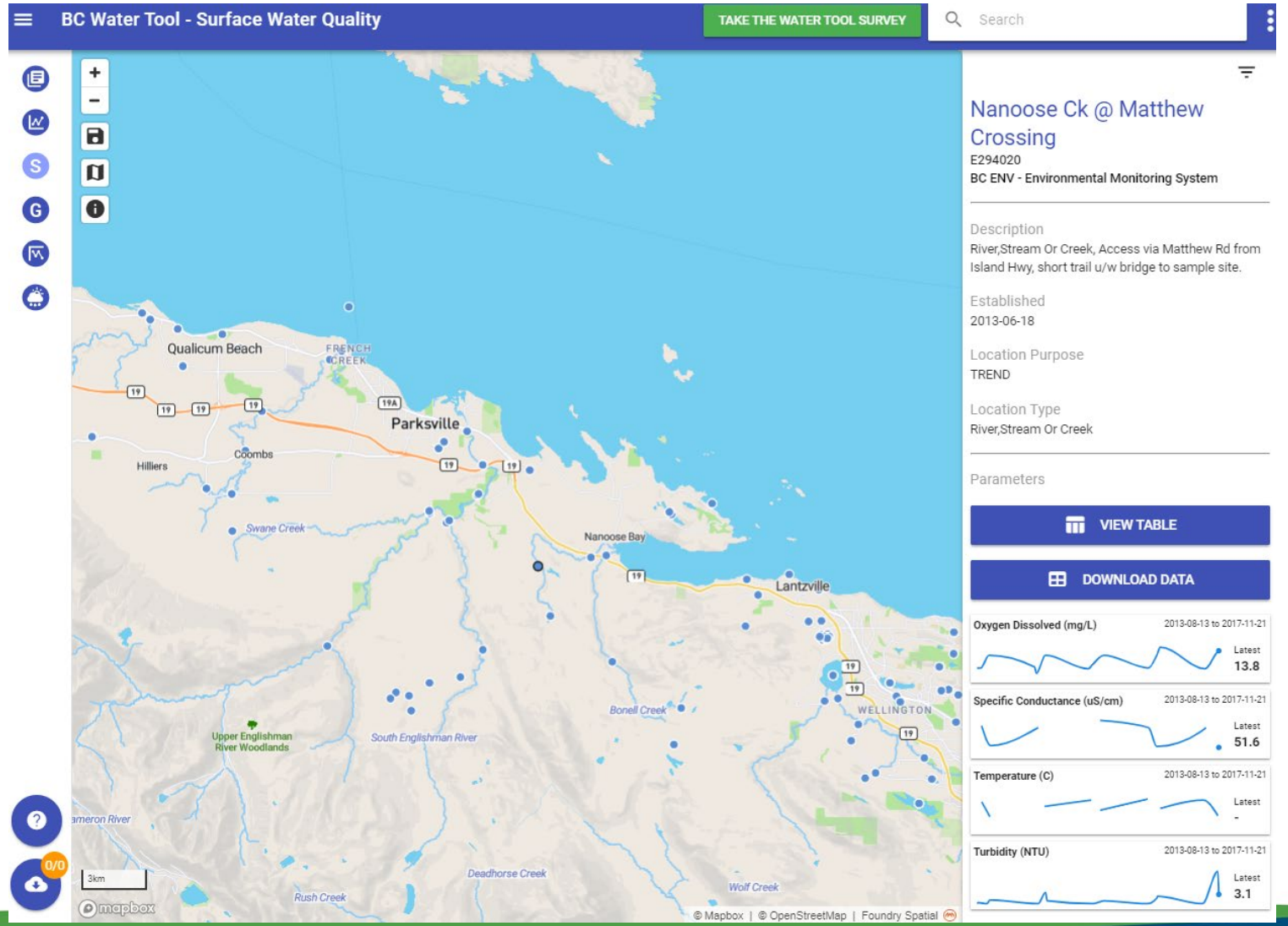
Upload our **surface water quality data** to Provincial EMS database (Environmental Monitoring System)…



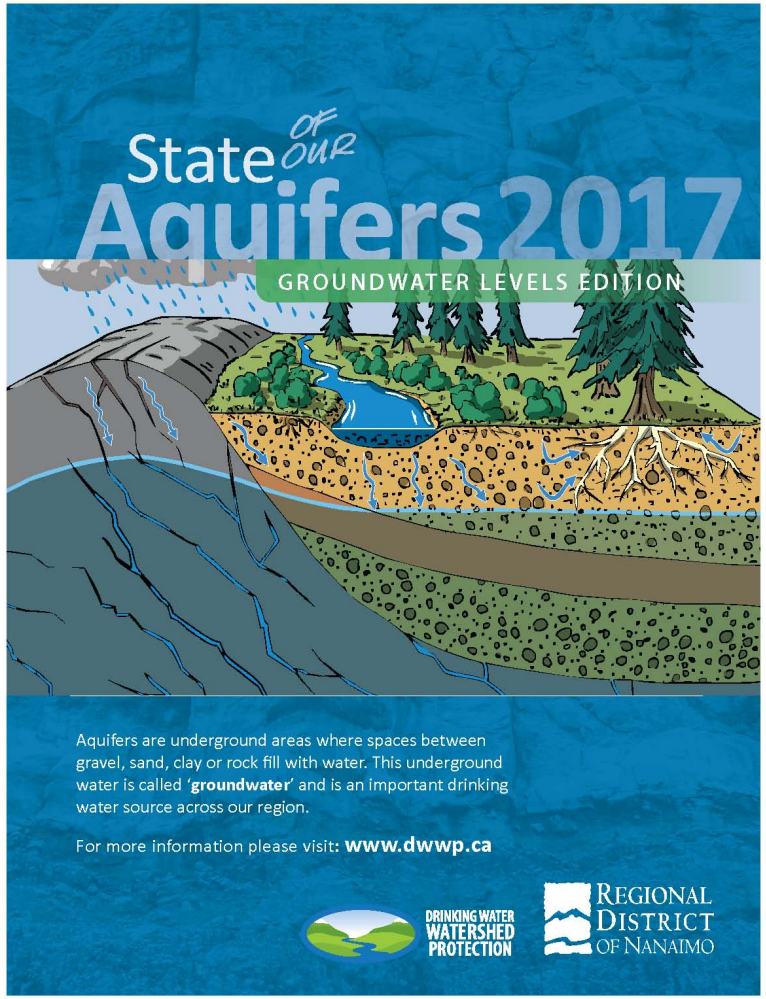
DATA SHARING & VISUALIZATION

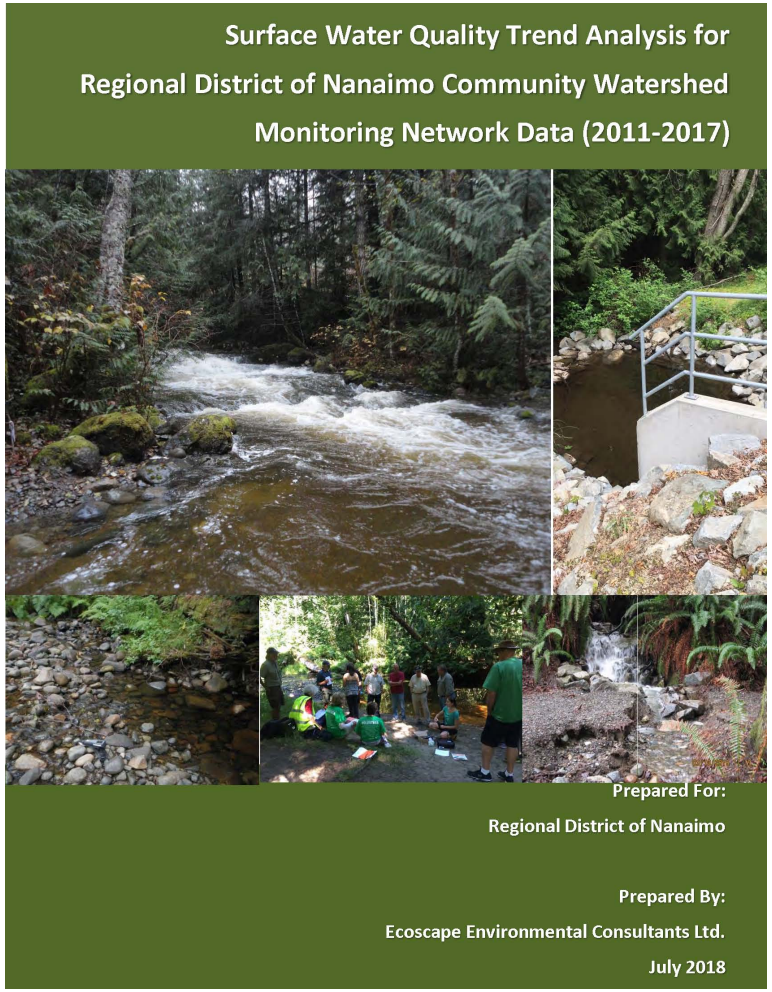
…where it is publicly available, viewable spatially & downloadable in BC Water Tool.

kwt.bcwatertool.ca/surface-water-quality

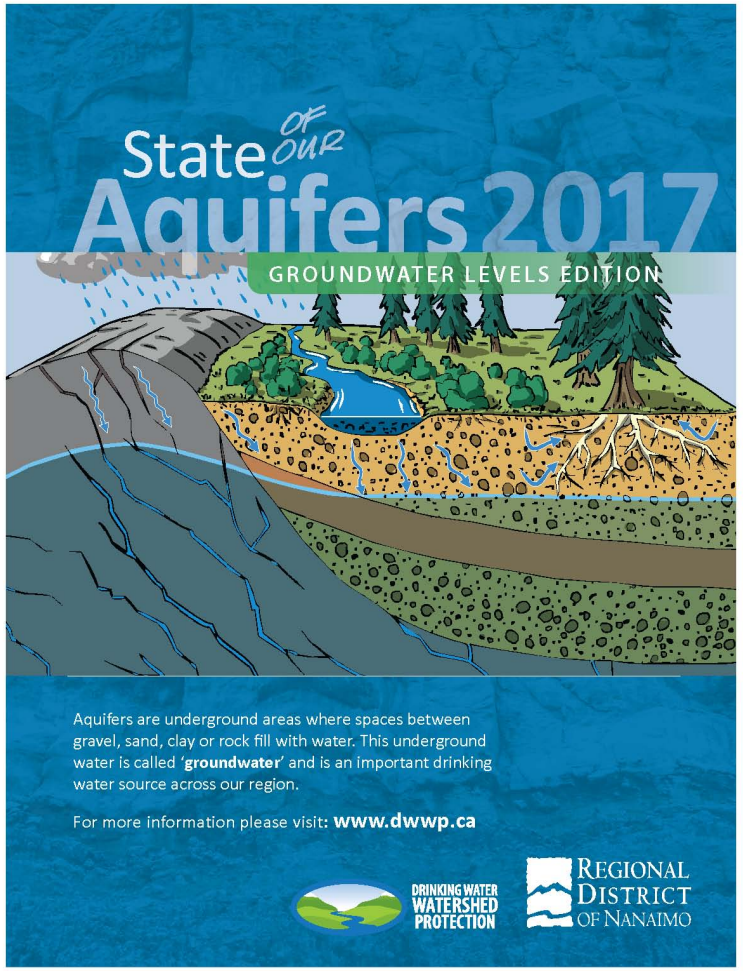


REPORTING & ANALYSIS





REPORTING & ANALYSIS



Trends

Across our region, the trends in water levels vary from aquifer to aquifer. Looking at the last 5 years of data in comparison to the whole historical dataset can give an indication if aquifer levels are reacting differently in recent years.

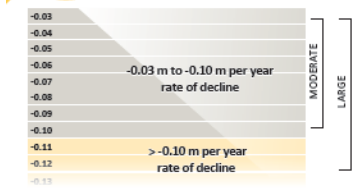
An interesting finding is that some groundwater levels are increasing in recent years even if historically their trend was stable or declining.

In other aquifers, the rate of decline has accelerated over the past 5 years, potentially due to more extraction or site specific climate variation where those areas received less precipitation than average.

TREND	# of Aquifers Last 5 years	# of Aquifers Historically
Stable	3	3
Increasing	2	-
Declining	5	5
Variable	2	2
Not enough data	5	7

What do we need to keep an eye on?

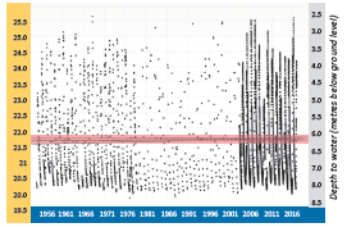
Where we are observing declining aquifer levels, it is in terms of a few centimeters per year. We are not at a point of alarm, just observing trends to inform water management to be proactive and help to stop or reverse trends where possible. This information helps convey that water is not infinite, even on our wet coast. Some things are beyond our control, such as the timing of amount of rainfall we receive to recharge groundwater levels. Other things are within our control such as water use habits and land-use decisions.



Stable

160 WR 6 Aquifer 160 – Cassidy (lower)
This aquifer has displayed stable groundwater levels over decades. Cycles of drier and wetter years have not influenced the water level. For instance, during drier years (1984 to 1994) water level has not followed the precipitation trend. Minimum and maximum water levels have remained stable as well.

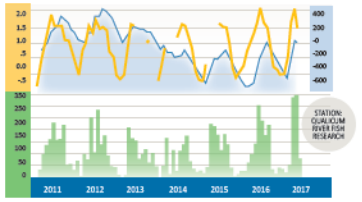
Well ID: OW228 (Provincial overburden obs. well)



Daily water level and trend line estimation (1954-2016)

664 WR 2 Aquifer 664 – Little Qualicum River Valley
This aquifer has displayed **very stable groundwater levels** even through years with below average precipitation.

Well ID: OW389 (Provincial overburden obs. well)

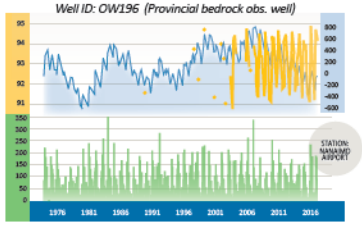


Month end groundwater levels compared to cumulative precipitation departure curve and total monthly precipitation (2010-2016)

Increasing

709 WR 7 Aquifer 709 – Gabriola
The long-term trend is stable and the water level has risen to ground surface most years suggesting the aquifer is seasonally filling up. However the trend has been decreasing in the last few years, corresponding to declining average precipitation.

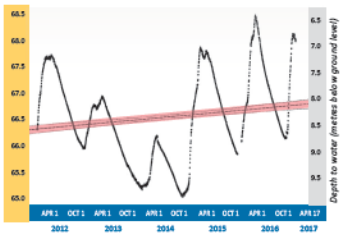
Well ID: OW196 (Provincial bedrock obs. well)



Month end groundwater levels compared to cumulative precipitation departure curve and total monthly precipitation (1973-2016)

416 WR1 Aquifer 416 – Bowser Deep Bay
Groundwater levels have been stable since 1990 and increasing over the past 5 years. The increase might be due to stable extraction levels and wetter conditions. There is a delay of five months for the water level to fully react to precipitation.

Well ID: OW310 (Provincial overburden obs. well)

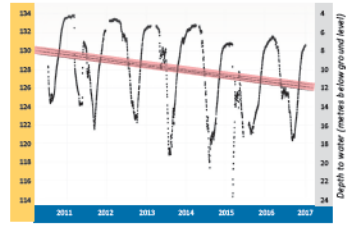


Daily water level and trend line estimation (2010-2016)

Declining

211 WR 5 Aquifer 211 – Benson Meadows
Fractured rock aquifers like this one have limited space in the fractures for water to be stored, making it more vulnerable to over pumping. There is a delay of two to three months before water levels react to precipitation. In addition, during this time (2010-2016), a decreasing precipitation trend is happening.

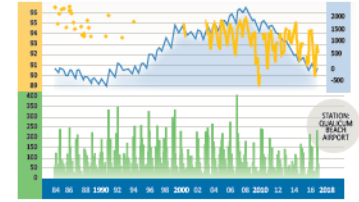
Well ID: OW388 (Provincial bedrock obs. well)



Daily water level and trend line estimation (2010-2016)

220 GRAPH WR 3 Aquifer 220 – Errington
The declining trend in precipitation coincides with the large decreasing trend in water level. There is a delay of two to three months before the water level fully reacts to precipitation.

Well ID: OW287 (Provincial bedrock obs. well)



Month end groundwater levels compared to cumulative precipitation departure curve and total monthly precipitation (1984-2016)

GROUNDWATER ELEVATION - METRES ABOVE SEA LEVEL
MONTHLY TOTAL PRECIPITATION (mm)
CUMULATIVE PRECIPITATION DEPARTURE – CPD (mm)

CPD is utilized to describe if precipitation was above or below average in a certain period. This is then used to evaluate the correlation with groundwater levels.

REPORTING & ANALYSIS

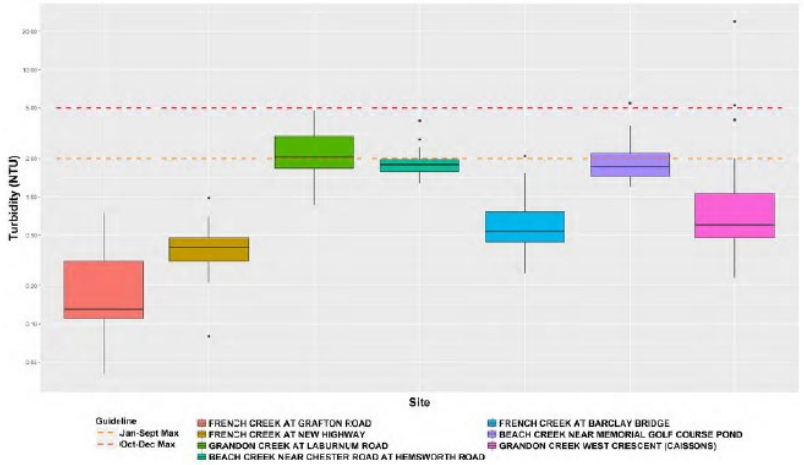


Figure A28. Summer 2011-2017 turbidity of CWMN sites in Water Region 3 (French Creek) with Englishman River water quality objectives.

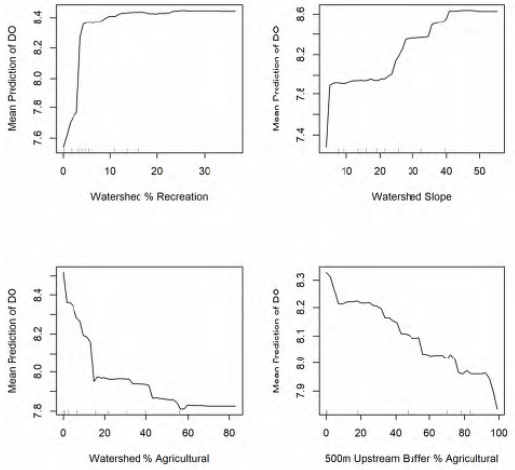


Figure A151. Partial Dependence plots for top four predictors of summer DO model.

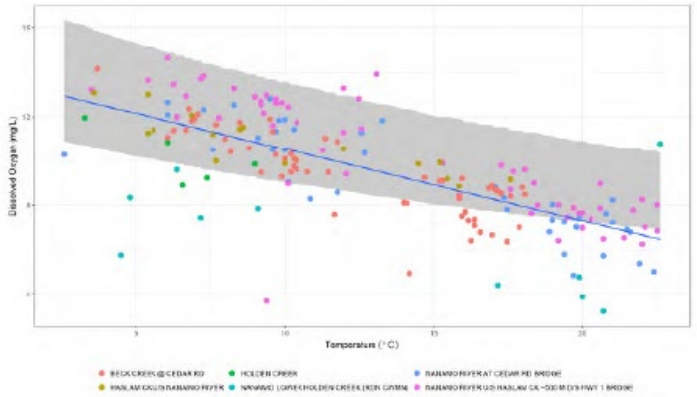


Figure A135. Nanaimo River Water Region Dissolved Oxygen and Water Temperature data for all available CWMN data. The grey shaded areas depicts ±20% of oxygen saturation.

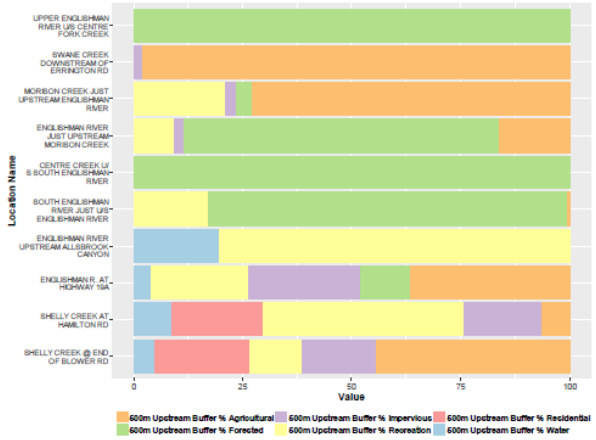


Figure A4. Percent land use composition for CWMN site 500m Upstream Buffer of Water Region 4 (Englishman River).

Surface Water Quality Trend Analysis for Regional District of Nanaimo Community Watershed Monitoring Network Data (2011-2017)

Prepared For:

Regional District of Nanaimo

Prepared By:

Ecoscape Environmental Consultants Ltd.

July 2018

OPERATIONALIZING THE DATA

How is the data used? How could it be used?

Regional District / Local Gov

Land Use & Infrastructure Planning

- In trend analysis to understand local conditions, identify issues, & prioritize efforts.
- For development application review
- To support Official Community Plan updates, Servicing feasibility review

Province

Water Authorizations & Regulation

- In trend analysis to understand issues
- For E-referrals – water license applications, resource permits
- In targeting monitoring network expansion

Professionals

Assessments & Reports

- As baseline data to inform desktop analysis
- Build trust with industry

Public / Community

Build awareness and support for water protection

- Communicated in newsletters, public presentations, web resources etc. to raise water literacy
- By volunteers for grant applications & stewardship initiatives.

COLLABORATIVE WATER MONITORING

…JULIE'S SOUND BYTES

"Decision makers are required to make decisions based on best available information… if we increase the availability, breadth and resolution of data within our region, then it would follow that our region would benefit from BETTER knowledge-based DECISIONS based on our local water data"

"There is strength in joint fact-finding: we engage broadly around water monitoring questions at the local level and strive to generate a commonly-held understanding in the data across levels of government, stakeholders, scientists, citizens· This builds trust in the process and an ongoing commitment to working together"

COLLABORATIVE WATER MONITORING

What's missing?

First Nations partnerships are something we have only just begun to establish in terms of collaborative monitoring programs, most actively with the Qualicum First Nation thus far.

This important area of collaboration is a focus for the next decade of the program and beyond.

THANK YOU!

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