

The key recommendations from Ecoscape's analysis included: improving streamside vegetation at priority locations; sampling for additional parameters to learn more about the source of water quality changes or issues; using the findings to direct targeted outreach and education on stormwater management and agricultural practices; updating mapping of land cover; and performing future trend analysis as more data becomes available. The DWWP Technical Advisory Committee will be consulted on how best to implement recommendations from this analysis into the ongoing CWMN program activities through the regular operational budget of the DWWP program in the coming years.

BACKGROUND

The RDN's Drinking Water and Watershed Protection program is mandated to improve information about the Region's water resources in support of better land use decisions and public understanding. In particular, the DWWP Action Plan provides direction to coordinate and support volunteers in monitoring surface water sites, and to collaborate with the Ministry of Environment (MOE) to identify water quality indicators and support the establishment of water quality objectives for important waterways.

By partnering with MOE, stewardship volunteers, and timber companies for land access, the RDN DWWP has successfully established a surface water quality monitoring network (the Community Watershed Monitoring Network or CWMN) to sample for dissolved oxygen, temperature, turbidity and conductivity. Sampling is performed at over 60 surface water sites by trained volunteers from 13 stewardship groups. This takes place annually during the summer low flow period and the fall flush period. Data has been collected since 2011, with 34 sites sampled for at least six years in both the summer and fall monitoring periods, which is considered sufficient for trend analysis. Data has been collected to provincial standards with quality assurance and quality control measures. Consulting water quality biologists, Ecoscape Environmental Ltd., performed trend analysis and statistical analysis on this dataset to provide interpretation and begin to more comprehensively answer the question – what does the data tell us?

Findings from the analysis

1. Comparison to the BC Water Quality Guidelines and Objectives to identify sites of concern

Ecoscape found that out of the 34 sites with sufficient data, 27 sites demonstrated stable water quality and changes over time were not observed. Five of the 34 sites experienced increases in mean summer and fall turbidity over the six year period. One site (Cat Stream in City of Nanaimo) experienced an increase in conductivity, while another site (Beach Creek in Town of Qualicum Beach) displayed decreasing conductivity from 2011-2017.

2. Trend analysis to detect changes in water quality over time

Frequent exceedances of the BC Water Quality Guidelines and Objectives over the 2011- 2017 period were observed at 12 sites over the study period. Seven of these 12 have high agricultural use within the watershed, two of the twelve have upstream stormwater outfalls, and three are not well understood. Ecoscape suggests that these three anomalies are likely related to annual differences in rainfall and temperature at the sites.

3. Statistical modelling to determine if watershed characteristics and land uses affect water temperature, dissolved oxygen, turbidity and conductivity.

Statistical models used by Ecoscape in the analysis showed that land use types linked with human disturbance are important indicators of water quality. To build the models, Ecoscape generated key factors that could affect water quality, also referred to as predictors or land use variables. Both human-caused and natural predictors were considered including watershed slope, watershed % impervious etc. The modelled water quality effects of each predictor were not linear, meaning that effects were more apparent as certain thresholds were reached. Watersheds – the catchment area that drains to a sample point on a stream – were used as the spatial scale for the analysis. Watersheds that were less than 60% forest use are associated with changes in turbidity and conductivity. Watersheds with greater than 20% agricultural use are associated with higher turbidity and lower dissolved oxygen. Watersheds with paved road densities greater than 0.002m per square meter are associated with increased conductivity and higher water temperatures.

Recommendations from the analysis

Ecoscape's analysis generated recommendations for each site, water region and the program as a whole. General recommendations include:

- Improve streamside vegetation at seven key sites¹ with prescribed riparian planting.
- Conduct biological monitoring for aquatic invertebrates (benthics) as an additional indicator of water quality, sensitive to human disturbances.
- Target public education on good stormwater management practices.
- Work with partner agencies responsible for stormwater infrastructure to examine opportunities for rain gardens or swales to slow and infiltrate run-off at locations with outfalls above sites with noted water quality concerns.
- Sample for Chloride as an indicator to determine if road-run off is the source of elevated conductivity at sites in watersheds with high road densities.
- Sample for Phosphorus during the summer and fall sampling periods in watersheds that have high agricultural land use or evidence of excessive algae growth.
- Refine and improve land cover mapping every 5-10 years to accurately identify changes in the extent of impervious surface, tree cover and other relevant components of the landscape. Recommend working with Vancouver Island University and RDN Planning department.

Next steps for the CWMN initiative

The DWWP Technical Advisory Committee will be consulted on how best to integrate Ecoscape's recommendations into the CWMN program activities and other DWWP supported initiatives as part of the ongoing DWWP operational plan and budget. A phased implementation of additional efforts will be required due to resource constraints and partnerships will be sought at all opportunities in order to best utilize limited resources. The findings of the Ecoscape analysis provide valuable information on the sites of concern, the trends over time and the

¹ Annie Creek (Area H), French Creek (Area F), Grandon Creek (Town of Qualicum Beach), Shelley Creek x2 (City of Parksville), Cat Stream (City of Nanaimo).

influencing factors. This information can be then used to support targeted education, restoration, land-use planning and infrastructure decisions that aim to address water quality issues.

While sampling is currently performed at over 60 surface water sites, only 34 sites had datasets sufficient for including in Ecoscape's trend analysis – i.e. at least six years of sample data for both the summer and fall monitoring periods. Sufficient data for the majority of the remaining sites should be available to proceed with additional trend analysis in 2020 or after, and is planned for the DWWP operating budget and work plan.

The results from this analysis will be shared with key decision makers and influencers so the findings can direct interventions where water quality improvements are needed. With this in mind, presenting this report to municipal councils at the City of Nanaimo, City of Parksville, Town of Qualicum Beach and District of Lantzville, the RDN Agricultural Advisory Committee and other interested stakeholder groups is recommended.

ALTERNATIVES

1. That the Board endorse presentations to the City of Nanaimo, the City of Parksville, the Town of Qualicum Beach and the District of Lantzville councils to provide the results of the Surface Water Quality Trend Analysis for RDN Community Watershed Monitoring Network Data (2011-2017) report.
2. Provide alternate direction to RDN staff.

FINANCIAL IMPLICATIONS

This trend analysis was completed at a cost of \$19,843 from the operational budget of the Drinking Water and Watershed Protection (DWWP) program. Budget to address the recommendations presented in the study and future additional trend analysis is captured within the 5-Year Financial Plan for DWWP and will be delivered through ongoing program operations as guided by the DWWP Technical Advisory Committee.

STRATEGIC PLAN IMPLICATIONS

The water quality data collected by trained volunteers through the RDN's Community Watershed Monitoring Network and the recent analysis summarized in this report aligns with and supports the following 2016-2020 Board Strategic Priorities:

Focus On The Environment- We Will Have A Strong Focus On Protecting And Enhancing Our Environment In All Decisions

Focus On Relationships- We Look For Opportunities To Partner With Other Branches Of Government/Community Groups To Advance Our Region

Focus On Relationships- We Recognize All Volunteers As An Essential Component Of Service Delivery. We Will Support The Recruitment And Retention Of Volunteers

Focus On Relationships- We Look For Opportunities To Partner With Other Branches Of Government/Community Groups To Advance Our Region

Focus On Economic Health- We Recognize The Importance Of Water In Supporting Our Economic And Environmental Health



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Attachments

1. Ecoscape – Surface Water Quality Trend Analysis for Regional District of Nanaimo Community Watershed Monitoring Data (2011-2017)