Mitigating Tire Wear Toxicant & Stormwater Runoff Pollution Through Rain Gardens on Vancouver Island

Year 1 (2025 – 2026) Summary Report

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1.0 INTRODUCTION

First described in the 1990s as 'urban runoff mortality syndrome' (URMS), the underlying cause of widespread mortality in returning coho salmon (*Oncorhynchus kisutch*) in Puget Sound urban streams was not identified until 2020 (Scholz et al. 2011; Tian et al. 2021). The compound N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine (6PPD) is added to numerous rubber products, including tires, as an antiozonant, reacting preferentially with ozone to extend the lifespan of tire rubber. The reaction with ozone produces N-(1,3-dimethylbutyl)-N-phenyl-p-phenylenediamine quinone (6PPD-quinone; 6PPDQ), which has been identified as the primary toxicant responsible for URMS in coho salmon. Since that time, other toxicology studies have confirmed that multiple salmonid species are vulnerable to 6PPDQ at parts-per-trillion concentrations, including coastal cutthroat trout (*O. clarkii clarkii*) and rainbow trout/steelhead (*O. mykiss*). These three species (coho salmon, cutthroat trout, rainbow trout) are commonly found in many small urban streams for a large portion of their lives and for some, their entire lifespan.

As tires wear, particles accumulate on road surfaces and are transported into aquatic environments via stormwater runoff or snowmelt, where associated contaminants can interact with and harm sensitive species. Urban centres continue to grow, creating higher quantities of impervious surfaces. Associated with those impervious surfaces are 6PPDQ and a myriad of other harmful contaminants that are shed from vehicles, including but not limited to heavy metals (zinc, lead, iron, copper, chromium), oil, fuel, and polycyclic aromatic hydrocarbons (Zhao et al. 2024).

Since 2023, the British Columbia Conservation Foundation's Aquatic Research & Restoration Centre (BCCF ARRC) and Vancouver Island University's Centre for Health & Environmental Mass Spectrometry (VIU CHEMS) lab, have been working on a widescale 6PPDQ monitoring program in partnership with nearly 40 groups comprised of local First Nations and community-led stewardship groups across the east coast of Vancouver Island (ECVI), from Campbell River to Victoria. This program was funded for three years (2023 – 2026) by the BC Salmon Restoration and Innovation Fund. Over that time, more than 7,000 water samples were collected from across ECVI and analyzed for 6PPDQ presence and concentration. From those results, the project team is working with partnered organizations to identify locations to construct rain gardens, a type of green stormwater infrastructure that filters stormwater before it enters creeks and stormwater infrastructure. Preliminary studies have found that rain gardens can remove more than 90% of 6PPDQ that is introduced (Rodgers et al. 2023), making them the

most effective means of removing 6PPDQ currently known. To date, BCCF ARRC and VIU CHEMS have been discussing sites with project partners within the stormwater infrastructure catchments that had the highest 6PPDQ concentrations detected throughout the timeframe of the 6PPDQ monitoring efforts.

2.0 PROJECT OBJECTIVES

This project has two primary objectives: [1] remove harmful toxicants from the environment before they can be transported to critical freshwater habitats for salmonids and [2] educate the local community with regards to the benefits of rain gardens and possible end-of-pipe solutions.

The project has three primary goals: [1] design and construct rain gardens in partnership with local community groups and municipalities in locations that have been identified as areas of concern with regards to the tire wear toxicant, 6PPDQ; [2] once constructed, evaluate the efficacy of each rain garden for removing 6PPDQ; and [3] host a one-day workshop in 2027 – 2028 open to the public that will involve sharing information about green stormwater infrastructure and mitigation strategies that are effective at removing 6PPDQ.

3.0 PROJECT ACTIVITIES

3.1 Stakeholder Meetings & Preliminary Designs

Throughout the 2025 – 2026 fiscal year, BCCF ARRC and VIU CHEMS met with project partners to identify potential locations for the construction of rain gardens. Meetings were held throughout the ECVI to ensure that the majority of organizations engaged through the sampling program were part of planning mitigation strategies. Sampling groups that were located in rural areas were not part of these planning meetings as there was little to no 6PPDQ detected within the creeks in their regions. Planning efforts were focused in urban areas where concentrations of 6PPDQ were highest.

3.1.1 VICTORIA STAKEHOLDER MEETING

A meeting was held on January 7, 2026 with staff from the Ministry of Transportation and Transit (MOTT), Peninsula Streams and Shorelines (PSS), VIU CHEMS, and BCCF ARRC. The

meeting was held in Cedar Vale North Park (Langford, BC) as a specific site was being discussed along the Millstream Creek. A large portion of Highway 1 drains into Millstream Creek on the downstream side of the highway, flowing over land directly into the creek. This runoff had many of the highest 6PPDQ detections of any point source samples throughout the 6PPDQ monitoring study; therefore, it was considered a high concern. The area of concern (i.e., where the runoff flows) is entirely within MOTT lands, within the highway setback.

After the preliminary meeting, MOTT conducted a site visit and survey of the site, and drafted preliminary drawings for a stepped treatment system that would slow stormwater runoff and allow it to filter before reaching the creek during most rainfall events (see Appendix A). A follow up meeting was held in late January 2026 to discuss the preliminary design and brainstorm potential means to create the most efficient design for removal of 6PPDQ.

Additional communications were had with the City of Langford Parks to discuss the potential of access through the park for any remediation activities in the future. The Parks staff were very open to the idea of upgrading an existing culvert that runs under a walking path and the potential for stormwater treatment in the area since it would greatly benefit their team and minimize trail maintenance.

BCCF ARRC and VIU CHEMS are continuing discussions with MOTT for the Millstream Creek site. Additionally, BCCF ARRC and VIU CHEMS are still engaging with MOTT, PSS, and other stakeholders in the Victoria region to continue identifying other potential rain garden locations in the future.

3.1.2 PARKSVILLE STAKEHOLDER MEETING

A meeting was held on January 16, 2026 at the Parkville City Hall Council Chambers with staff from the City of Parkville and the Regional District of Nanaimo, members of the Mid Vancouver Island Habitat Enhancement Society, VIU CHEMS, and BCCF ARRC.

Data that was collected as part of the 6PPDQ monitoring program from 2023 through 2026 was reviewed to steer the conversation and identify the watersheds most impacted by 6PPDQ in Parkville. In total, 125 samples had been collected from 6 locations within the City of Parksville; locations included streams and stormwater outfalls. The areas that were most impacted were those upstream of the outfalls that were monitored: Mills Street outfall, Sutherland outfall, and Carey/Romney Creek outfall. In total, eight potential locations were identified within these

storm infrastructure ‘watersheds’, including sites at local schools, a community garden, and within busy roundabouts.

The sites identified in Parksville are currently lower on the overall priority list as these identified outfalls flow into larger waterbodies (i.e., Englishman River Estuary, Parkville Bay) that quickly dilute contaminants, compared to outfalls that flow into small, urban streams. The sites within the Carey/Romney Creek watershed will be investigated further for future rain garden construction opportunities as this is a creek that many in the community are interested in reviving, if possible.

3.1.3 CAMPBELL RIVER STAKEHOLDER MEETING

A meeting was held on January 19, 2026 at a local church in Campbell River. Meeting participants included City of Campbell River, We Wai Kai Nation, Province of British Columbia, and Greenways Land Trust (local eNGO) staff, volunteers from the Campbell River Environmental Committee and Save Simms Creek, VIU CHEMS, and BCCF ARRC.

Data that was collected as part of the 6PPDQ monitoring program from 2023 through 2026 was reviewed to steer the conversation and identify the watersheds most impacted by 6PPDQ in Campbell River. In total, 343 samples had been collected from 9 waterways at 14 locations in and around the City of Campbell River. From the data, the two watersheds identified as the most impacted were Simms Creek and Nunns Creek. Within these two watersheds, seven potential locations were identified.

Following the meeting, City of Campbell River staff worked with volunteers to collect additional samples from areas of interest to help identify the most impactful locations within specific parking lots that rain garden(s) could be constructed. Their sampling crew is completing preliminary sampling in April 2026 that will inform the final site to be selected. BCCF ARRC will continue working with MDI Landscaping at this site within the Simms Creek watershed to finalize a potential design that will be provided to the City of Campbell River for review.

3.1.4 COURTENAY STAKEHOLDER MEETING

A meeting was held on January 19, 2026 at the Quality Foods board room in Courtenay with staff from the City of Courtenay and Project Watershed, volunteers from Millard Piercy Watershed Stewards and Morrison Creek Streamkeepers, VIU CHEMS, and BCCF ARRC.

Data that was collected as part of the 6PPDQ monitoring program from 2023 through 2026 was reviewed to steer the conversation and identify the watersheds most impacted by 6PPDQ in Courtenay. In total, 144 samples had been collected from 3 waterways at 9 locations in and around the City of Courtenay. From the data, the most impacted watershed identified was Piercy Creek; it had both high concentrations recorded as well as previous coho mortality events observed. Within this watershed, five potential locations were identified. Following the meeting, City of Courtenay staff provided in-kind time gathering GIS resources that could be utilized for additional site selection.

No sites within this watershed were identified for immediate construction, but they will be re-visited in the short-term to determine the feasibility of rain garden(s) in this area moving forward.

3.1.5 NANAIMO STAKEHOLDER MEETINGS

The Nanaimo meeting with stakeholders was hosted in two parts. As Nanaimo has been VIU CHEMS and BCCF ARRC's primary sampling area, this is the municipality on the Island with the greatest amount of 6PPDQ data to consider for site selection. The first meeting was held on January 21, 2026 at Vancouver Island University with staff from the City of Nanaimo, Regional District of Nanaimo, and the Nanaimo and Area Land Trust, a volunteer from Departure Creek Streamkeepers, VIU CHEMS, and BCCF ARRC. The preliminary meeting provided the attendees with an overview of the 2,382 samples that were collected from 15 waterways at 87 locations between 2023 and 2026. There was a preliminary discussion around site selection where three sites were discussed and a strategy for site selection was decided.

Following the first meeting, BCCF ARRC reviewed the 6PPDQ data, identifying the point sources (i.e., outfalls) that had the highest 6PPDQ concentrations. From there, BCCF ARRC staff reviewed maps to identify locations within those stormwater catchment areas that would be suitable for rain garden construction or other mitigation strategies (i.e., daylighting pipes to bring water to the surface and slow it down, and/or locations for end-of-pipe solutions). In total, 11 point source locations and their catchments were reviewed.

In the second meeting that occurred on March 4, 2026 with attendees from the same organizations as the first meeting, 19 sites were reviewed and discussed. The top site identified for impact, educational opportunities, and engaging a large neighbourhood was the site at Georgia Avenue Elementary School. Staff from the school have since expressed interest in

having a rain garden built and discussions and preliminary designs are underway. In addition to this site, other locations were discussed and visited to determine their potential. Other promising locations within the City of Nanaimo include: parking lots at Vancouver Island University, local malls and grocery store parking lots already equipped with raised 'vegetation islands', and other elementary and secondary school parking lots.

3.2 Outreach

In addition to the stakeholder meetings that have been held throughout the east coast of Vancouver Island, BCCF ARRC has also shared this project and its objectives with the greater community at outreach events, through social media, and at committee meetings, when possible.

In 2025 – 2026, BCCF ARRC attended six outreach events/workshops and shared an overview of the project. In total, over 900 people attended these workshops and events, hearing the presentation given and/or engaging at the BCCF ARRC information booth.

Additionally, the project was recently shared in BCCF ARRC's tire wear toxicant bi-annual newsletter that was released in late March 2026. This newsletter was delivered to 584 people.

Further, BCCF ARRC is part of the Mid Island Stewardship Caucus, a group comprised of local organizations and stakeholders within the Regional District of Nanaimo. When possible and appropriate, BCCF ARRC provides project updates and highlights new projects. In 2025 – 2026, the ARRC team attended six of these meetings.

NEXT STEPS

In 2026 – 2027, BCCF ARRC will continue working with project partners to finalize site selection and designs, as well as begin construction on at least one rain garden (site will be determined by approval timeline for those sites selected). Further site selection, particularly in Victoria and Duncan, and inquiries will be made to property owners to begin the relationship building steps necessary for approvals on properties not owned by municipalities or regional governments.

The goal is to build a rain garden by the end of 2026 so that planting can occur during the fall and winter months. This timing will allow plants time to establish good root development, and minimize plant stress and watering requirements during the early stages of plant

establishment. Following construction, the VIU CHEMS students aim to coordinate sample collection (discrete grab samples and use of passive samplers, if possible) at the inflow and outflow of the rain garden to assess its ability to remove 6PPDQ.

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