Appendix 7

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Luke Mari,
Project Planner
Planster

Rainwater Management – 1000 Beckwith Avenue

Luke:

The following are background thoughts on options for Rainwater management for the proposed development at 1000 Beckwith Avenue. I have included a rationale for seeking the District of Saanich's consideration of the option of separated sources of runoff and the differential treatment and detention of each of the sources.

The following are the principal observations and recommendations arising from my assessment of Best Management Practices that should apply to this property.

- We have assessed the existing upland plant community that has historically received the rainwater runoff from the site.
- We have walked the drainage ditch that routes Saanich road runoff south along the property border that presently turns west along the Aspen copse and then discharges into the southwest corner of the property.
- Steve McLeish and I have prepared a conceptual routing for the rainwater runoff from the three sites. Conceptual drainage map appended.
- It is recommended that the rainwater management for the site be separated into three distinct sources:
    - Roof runoff
    - Driveway runoff
    - Foundation perimeter and landscaped yard runoff
- The roof runoff could be discharged directly into Beckwith Pond, without treatment or detention – provided that the roof membranes are of an approved membrane that does not release pollutants.
- The driveway runoff shall be treated and detained using an engineered rainwater management system to ensure discharges are routed to existing streams and/or roadside drainage swales.
- The project engineer shall prepare an operating and maintenance program to the satisfaction of the project QEP, Landscape Architect and the District of Saanich.

- Provision of a rainwater detention and treatment system shall be of a simple design requiring minimal operation and maintenance by home owners or the District of Saanich.
- All necessary on-site treatment, and detention, shall be based upon a plan that captures, infiltrates, and slows rainwater runoff prior to the runoff's discharge into the existing streams and/or roadside drainage swales.
- The architect, Landscape Architect, civil engineer, and the QEP shall review the proposed roof materials to ensure they meet the runoff water quality standard necessary to protect the receiving environments. The review of the roof materials is not required prior to the issuance of a Building Permit.

I look forward to your review of the above and the appended background rationale for report and the option of separated sources of runoff and the differential treatment and detention of each of the sources.

Sincerely,

Wm. Patrick Lucey, B.Sc., B.A. (WD), M.Sc., R.P. Bio., CBiol., MRSB
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Proposed Rainwater Management Strategy for 1000 Beckwith Road

Background Rationale for Rainwater Management

As part of the CRD and Municipal planning process, Development Permit Areas have been established as part of a Rainwater (stormwater) Management Program. In British Columbia the "Partnership for Water Sustainability" has pioneered the adoption of development on a site and campus-level that supports implementation of performance metrics whose targets and actions will result in how land will be (re)developed so that stream and watershed health are protected and-or restored.

An intrinsic component of this program is the conservation of pre-development rainwater runoff quantities and water quality attributes to protect the variety of downstream receiving environments, such as streams, ponds, wetlands, and the ocean. In particular, the design of the majority of rainwater management facilities is to meet a simple metric – *"if the stream flows and durations of flow can be maintained without increasing the magnitude and duration of above average stream discharges, then success can be demonstrated"* (Primer on Water Balance Methodology for Protecting Watershed Health: integrating the site with the watershed, stream, and aquifer; The Partnership for Water Sustainability in BC, 2014). The key design and planning method is *"the flow paths of water in the watershed and the flow in streams"*. Thus, the majority of rainwater management is intended to address landscapes in which the rainwater runoff, from any and all surfaces, will be routed into streams (lotic) and/or wetlands/ponds (lentic) receiving environments.

The maintenance of average stream discharges is intended to prevent excessive in-stream volumes that exceed the vegetated watershed channel shaping events (a 2-year storm flow event for most west coast streams; Rosgen, Applied River Morphology, 1996). Increasing the frequency of the channel shaping event results in channel degradation and erosion, and the subsequent loss of riparian and aquatic habitat. As streams become degraded they loose their natural functional resistance and resilience to flood events with a consequent loss of their functional condition, or health.

The challenge faced during planning and design is understanding both how to prevent the excessive frequency of average stream discharges and how the type of immediate downstream receiving environment influences the design of rainwater management facilities. When the downstream receiving environment consists of a significant body of water, such as a pond, lake, or ocean, there is a capacity for the receiving environment to function as a hydraulic shock absorber, eliminating the potential for erosion-based flow velocities. Thus, if rainwater runoff can be directed directly into an aquatic environment that is not subject to potential erosion from above-average flow velocities, then the need for detention becomes unnecessary.

The preservation of the downstream receiving environment's health must also include receiving the discharge of runoff water quality that will not adversely affect its health. Thus, identifying the sources of potential pollutants, and the profile of potential pollutants in the runoff, is essential to conserving the health of the receiving environment. Typically, in residential landscapes there are three general sources of runoff that should be considered when reviewing the potential sources of pollutants:

- Roof runoff
- Driveway/road runoff
- Foundation perimeter and landscaped yard runoff

A review of the literature indicates that the pollutants being discharged from the above three sources of runoff can vary widely, depending upon material composition, history, and interaction between the rainwater precipitation pattern and the materials (e.g., first flush characteristics, age of the materials, their life-history, *et cetera*). Typical residential soils, including perimeter drainage systems, that capture and redirect shallow groundwater away from building foundations, yield a capacity for infiltration and detention of rainwater flows and for providing a treatment capacity, both of which result in the protection of downstream receiving environments. If approximately 90% of the average annual rainfall events can be captured and infiltrated downstream stream environments will be afforded an appropriate degree of protection.

The typical concrete and asphalt (impervious) driveway surfaces are known to be a source of a broad range of pollutants that have a capacity to adversely affect downstream aquatic receiving environments, requiring both detention and treatment, based upon the scale of the impervious surfaces and the precise nature of the downstream receiving environment. The literature is replete with designs and methods for detaining and treating runoff from driveway surfaces.

In the past few years there has been a discussion in the scientific literature regarding the water quality originating from a range of roof membranes and materials. Laboratory studies have shown that roofing materials can be a source of pollutants leaching into the downstream receiving environment, with the roofing materials potentially being a reservoir of nutrient and metals pollutants. Some common high level contaminants include:

- pH
- nitrate
- phosphorus, and
- heavy metals

There are two periods in the life of a roof's membrane material that pose a potential risk to the downstream receiving environment from runoff – early and late life. Research has shown that certain roofing materials can continue to release pollutant concentrations-of-concern over long time periods (60+ years), depending upon whether – 1) roof materials were sealed to prevent degradation, 2) fluctuating temperatures and ultra-violet light exposure, and 3) ongoing interactions between the roof surface and chemicals in the rainwater. Thus, regional environmental factor affecting the latter attributes and processes, related to rainwater interactions, with roofing materials, are crucial in determining the potential for pollutant discharge concentrations during the life cycle of a roof membrane.

The highest long-term effects of these variables on the timing of early life wash-off is a function of climatic factors with accelerated aging and pollutant release in areas with high UV exposure and greater temperature fluctuations, as well as industrial air pollution deposition, both dry and wet deposition. One area of research that is ongoing is the species of pollutant in either its total form or the bioavailable, dissolved fractions.

The literature has shown that roof material's composition influences the potential for pollutant discharges:

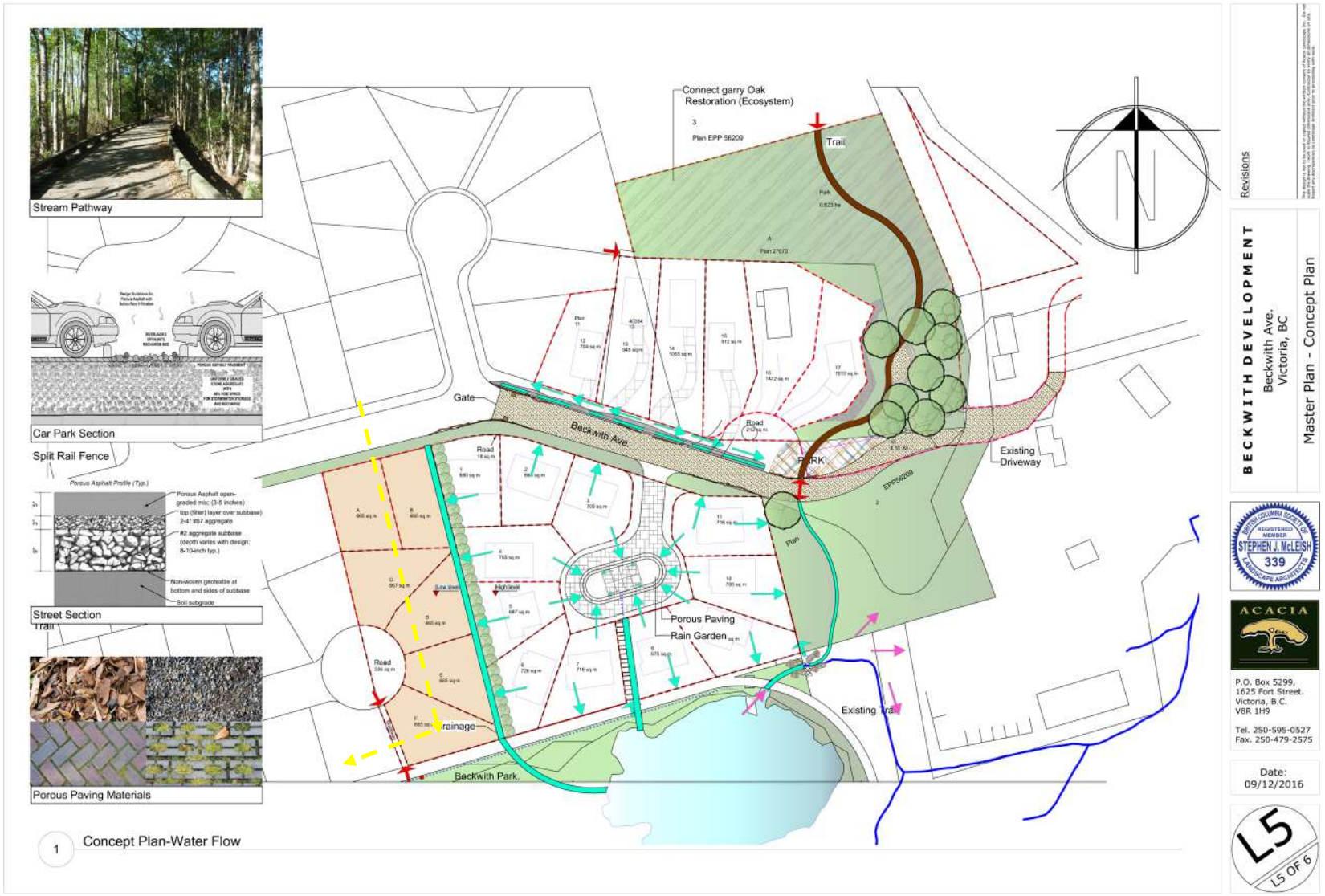
- Many traditional materials may have a 'reservoir' of pollutants potentially available for release.
- Rainfall pH values in the 3.7 – 6 range can result in cedar shakes having a runoff pH of <5. It should be noted, however, that rainfall pH along the west coast of North America is typically in the 4.5 – 6.0 pH range naturally, resulting from the sulphate concentrations originating from the Pacific Ocean, leading to the creation of an acidic precipitation.

Local landscape and aquatic environments have evolved over time to be acclimated to an acidic rainfall.

- Median nutrient loading is typically within the range acceptable for protecting aquatic life; there are minimal nutrient concentrations in rainwater originating from the Pacific Ocean and coastal environments have limiting nutrients affecting primary productivity (e.g., most freshwaters on the coast are phosphorus limited, while marine waters are nitrogen limited).
- Wood roofing materials typically release more nitrogen (N), while green roofs (not being considered here but which have been the subject of much research, with some application in B.C.) release more phosphorus (P); N or P concentrations released from roof materials have been shown to be low.
- Heavy metals concentrations from traditional roofing materials have been shown to be related to copper (Cu) and zinc (Zn).
    - Copper has been shown to be elevated in wood products, especially in roof materials treated with Cu as a biocide or wood preservative
    - Zinc is present in elevated concentrations in roofing materials using uncoated, galvanized metal; zinc is the sacrificial cation in many galvanizing applications; the zinc may be intended as a slow release biocide
- Traditional roof membrane materials, such as certain cedar shakes and uncoated galvanized metal, may require rainwater runoff from these materials to be treated prior to discharge into aquatic environments.

If the selection of roof materials avoids the use of treated cedar shakes and uncoated galvanized metal the roof runoff should be of a quality that will not require treatment prior to its discharge into the receiving environment (e.g., freshwater wetland, pond, stream, or the upper intertidal).

The architect and the QEP should review the proposed roof materials to ensure they meet the runoff water quality standard necessary to protect the marine receiving environment. The review of the roof materials is not required prior to the issuance of a Building Permit.



Conceptual routing of rainwater runoff from the three property parcels. Note the existing drainage from Beckwith Avenue drains south as shown by the dashed yellow arrows. The proposed re-routing of the runoff would be into Beckwith Pond, shown by the solid green line.