

Rainwater management in the Comox Valley Regional District electoral areas: current practices and future options



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by

Tanis Gower, RPBio.
Fernhill Consulting
#210 – 2202 Lambert Drive
Courtenay, BC V9N 1Z8



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1. Project scope

Tanis Gower of Fernhill Consulting was hired as a “Rainwater Coordinator” to accomplish the following:

- i) oversee and participate in a legal and technical review of Comox Valley Regional District (CVRD) stormwater/rainwater-related bylaws, policies and procedures;
- ii) develop the scope for a pilot project on rainwater management within CVRD electoral areas;
- iii) Work with the Ministry of Transportation and Infrastructure (MOTI) towards improved, collaborative management of rainwater, with the eventual goal of MOTI support for an implementation agreement and/or MOU to address issues related to rural development, drainage and infrastructure.
- iv) engage with member municipalities to explore economies of scale in rainwater management
- v) provide specific language recommendations for an updated zoning bylaw and/or Official Community Plan updates.

The full scope of work for the Rainwater Coordinator is found in Appendix 1. Please note that specific language recommendations as per “v” above are not found in this report, as this task will require further guidance. Some options for making these language updates are found in Appendix 4.

2. Current stormwater/rainwater management in the CVRD

For the purposes of this report the term “rainwater management” is used, as it reflects an evolving philosophy of addressing rainwater where it falls, rather than managing stormwater “runoff” from developed areas. However the term “stormwater” has been more commonly used to date and is used interchangeably with the term “rainwater” in this report. Rainwater management is best done in the context of overall watershed health, where the built and natural parts of the watershed are managed as a whole, with the aim of restoring or maintaining (to the extent possible) the pre-development hydrologic functioning. Thus the term “integrated watershed management” is also used in this report.

CVRD bylaws and policies that relate to rainwater management were compiled by the Rainwater Coordinator to facilitate the legal review, and are found in Appendix 2. CVRD policies are supportive of improved rainwater/watershed management. However, there is currently no mechanism to manage the cumulative hydrological effects of development. In other words, the current framework allows for piecemeal improvements, but does not effectively address flooding or the incremental degradation of the receiving environment.

Policies that support rainwater and integrated watershed management are found in the:

- Regional Growth Strategy;
- Regional Sustainability Strategy;
- Official Community Plan; and,
- Electoral Area and Local Area Plans.

Key policy statements from the above documents are found in Table 1 and Appendix 3. Outside of development permit areas there is little application of the guidance from these policies. The limited provisions that guide on-the-ground practices are outlined in Appendix 2, and are found within the Zoning bylaw and Development Permit Area guidelines and in the Development Approval Information Areas for Union Bay and Anderton Road.

Table 1: Key policy statements for rainwater management in the CVRD electoral areas

Key Statement	Location in Planning Documents
Development proposals shall be required to address stormwater management to ensure that post-development peak flows do not exceed pre-development peak flows.	<ul style="list-style-type: none">▪ Official Community Plan (OCP)▪ Royston LAP (a requirement for the pending stormwater management plan)
In <i>Rural Areas</i> the regional district should work with the Ministry of Transportation and Infrastructure to develop guidelines for an Integrated Stormwater Management to be used in the subdivision approval	<ul style="list-style-type: none">▪ Official Community Plan

Key Statement	Location in Planning Documents
process	
<p>The Regional District will promote the consideration of alternative road development standards that respect the following integrated stormwater management principles:</p> <ol style="list-style-type: none"> 1. Keeping impervious surfaces to the minimum necessary, including consideration of one-way lanes or reduced pavement width on minor local roads that serve only a few residents; 2. Filtration of runoff through open vegetated swales; 3. Maximum use of infiltration to the ground watertable , while respecting the need for pavement sub-base drainage; 4. Minimal use of curb or catch basin inlets and piped solutions; and 5. Maximum retention of native vegetation, including retention of trees or woods in the right-of-way where this is safe and economic. 	<ul style="list-style-type: none"> ▪ Electoral Area 'A' OCP: policies ▪ Area 'A' Union Bay LAP: Policies ▪ Electoral Area 'B' OCP: policies ▪ Anderton Road LAP: policies ▪ Electoral Area 'C' Land use, greenways and LAP for Saratoga / Miracle Beach: Policies
<p>It is critical to recognize that all land alteration and development affects stormwater runoff and that effects are cumulative. Development proposals shall be required to use best management practices for stormwater management, aquifer recharge and watershed management to ensure that post-development peak flows do not exceed pre-development peak flows and to maintain recharge of aquifers. One principle of stormwater management is to direct water back to the ground wherever possible to minimize channellization and piping. Some examples of appropriate practices include:</p> <ol style="list-style-type: none"> 1. Minimize impervious surfaces through the use of gravel for parking areas, and porous materials for paths, patios, and other use areas. If driveway paving is required due to a steep slope use tire track paving with grass in the middle. 2. Drain roof water to the surface and disperse it into the ground, using such devices as splash pads and exfiltration galleries; 3. Thick organic layer of growing medium through cleared/disturbed area to promote growth of vegetation and water retention; 4. Direct water to grass slopes, swales and areas with thick vegetation; 5. Use stormwater detention ponds with adequate storage between high and low water to store all site water, and with a control structure to release low flows only; 6. Use wetlands which can improve quality of stormwater through biofiltration; 	<ul style="list-style-type: none"> ▪ Area 'A' OCP: policies ▪ Area 'A' Union Bay LAP: Policies ▪ Area A Union Bay LAP, Kensington DPA #17 expands upon this ▪ Area 'B' OCP: policies ▪ Anderton Road LAP: policies ▪ Electoral Area 'C' Land use, greenways and LAP for Saratoga / Miracle Beach: policies

Key Statement	Location in Planning Documents
<p>7. Retain as much existing vegetation as possible and where clearing has occurred, plant native trees and shrubs to restore the vegetative mass. Plant shrubs an average of 0.5 metres (20 inches) apart. Where the slope is over 20%, hydroseed around plants to retain soil and use other techniques such as willow wattles where required.</p>	
<p>Local government agencies, senior government agencies and residents of the Comox Valley shall be encouraged to work cooperatively in the testing and implementation of a variety of methods for stormwater management</p>	<ul style="list-style-type: none"> ▪ Electoral Area 'A' OCP: policies ▪ Union Bay LAP: Policies (with one word change) ▪ Area 'B' OCP (policies) ▪ Anderton Road LAP: policies
<p>Undertake a Stewardship Implementation Program, with the following components:</p> <ul style="list-style-type: none"> ▪ A Watershed Management Pilot Project, in concert with senior government agencies, to identify technical and administration arrangements for practical implementation of integrated stormwater and environmental stewardship. (The Washer Creek watershed area may provide an ideal pilot project.) (The Anderton Road area may provide an ideal pilot project) (Black Creek and the Saratoga/Miracle area may provide an ideal rural pilot project for an integrated watershed, stormwater and wastewater management plan) • A Watershed Best Practices Manual developed with senior government assistance. • A Water Quality Bylaw, to set performance standards for erosion control and water quality measures, and to allow local government ticketing as an expedient alternative (to charges under the Fisheries Act) for minor offences. 	<ul style="list-style-type: none"> ▪ Area 'A' OCP: implementation ▪ Union Bay LAP: implementation ▪ Area 'B' OCP: implementation ▪ Anderton Road LAP: implementation (with the exception of the last point) ▪ Electoral Area 'C' Land use, greenways and LAP for Saratoga / Miracle Beach: implementation

Further policy statements are found in “Appendix 3: CVRD rainwater policy key statement locations”, including support for establishing stormwater management-related local service areas in the Wilkinson Road area, Queen’s Ditch watershed, Anderton Road area, and Saratoga/Miracle Beach areas.

3. Legal and technical review

The CVRD hired West Coast Environmental Law (WCEL) to review existing and potential legal and regulatory options to improve rainwater management within CVRD boundaries. The Rainwater Coordinator facilitated and oversaw this work.

The final report (found in Appendix 4) provides a synopsis of the current CVRD regulatory context, and provides options for introducing new policies, bylaws or service areas, or amending existing bylaws. It also stresses the importance of developing an overall strategy and policies regarding rainwater management. Ideally this would be based on a strategic plan for implementing integrated watershed management, which would be supported by a technical assessment and a community and stakeholder consultation to help determine priorities.

Jurisdiction and the risk of taking on new responsibilities were also reviewed. The CVRD will likely not expose itself to more liability by taking a more active role in rainwater management, provided that it ensures that any program or service is offered with reasonable care to those likely to be impacted by the program or service. Local governments can also be liable in nuisance for instances of downstream flooding associated with inadequate upstream drainage. If increased development is the cause, and if the local government has not taken any action to address it, then the local government may be liable. This opinion is based on previous cases where the local government was aware of the problem and did not adequately address it. Thus the CVRD may decrease its liability for nuisance flooding by properly addressing rainwater/stormwater management.

The following are options available to the CVRD. These are summarized from the legal review and are not in order of priority; a more comprehensive and prioritized discussion of next steps is found in Section 7:

1. Increased involvement in subdivision approvals:

- a. An implementation agreement with MOTI, providing a protocol and rainwater-related guidance or standards for the subdivision approval process;
- b. Development of a subdivision and servicing bylaw that includes rainwater management performance standards, and/or;
- c. Taking on the Approving Officer authority under the Land Title Act.
(This option involves costs and uncertainty and isn't necessarily useful if 1.a and/or 1.b is implemented.)

2. Updated Development Permit Areas, which more effectively address rainwater management and include performance standards. This could include a requirement to consider the BC Water Balance Model.

3. Creating regulatory bylaws for run-off, landscaping and topsoil requirements, which will create obligations for green infrastructure measures for all developments and re-developments, including single family properties.

4. Updating zoning bylaws to include actual or effective pervious area requirements and/or landscaping/runoff requirements.

5. Building bylaw: the issuance of a building permit can be made conditional on meeting the requirements of, for example, a subdivision servicing bylaw.

6. Creating a drainage service region-wide, or within a priority watershed, through an establishing by-law. Creating a region-wide service area would likely be the most effective way to achieve integrated watershed management in the district.

7. Creating a region-wide service area for research, planning and public education. This could allow longer-term planning, capacity building, assessment of priority areas, coordination of activities with member municipalities, and assist in building public support for action.

8. Providing rainwater management policies and guidance for OCP amendments, as a reference point for updating existing bylaws and developing new bylaws.

9. Developing a Design and Policy Manual for Rainwater Management to provide guidance for developers and the approving officer with respect to meeting subdivision servicing requirements and conditions for development permits.

WCEL's legal review is provided as Appendix 4.

4. Pilot project

A pilot project was to be developed to test integrated rainwater management approaches. Four options were explored:

1. Demonstrate the new regulatory approach. This option would take place once new policies and/or bylaws were developed, to explore compare options or test the effectiveness of particular approaches before making regulatory changes.
2. Residential source control retrofits. This option would be for the purposes of demonstrating a community based source control approach that could be adopted more widely. Choosing an appropriate location and selecting appropriate monitoring parameters and procedures would be important considerations. This option would be appropriate if site-level source controls, including retrofits, were part of a larger CVRD strategy.
3. Green street pilot. As the Ministry of Transportation and Infrastructure (MOTI) is largely responsible for managing drainage in the CVRD, this option would involve working with MOTI to develop a green infrastructure project in a road ROW or new subdivision. While working on a new development is preferable, a retrofit is also a possibility. As this project involves collaboration with MOTI it would also develop a closer working relationship, something that the CVRD is also seeking.
4. Watershed-wide interventions. This option would involve choosing a specific watershed to pilot a watershed-wide approach. It would involve interventions as described in options 2 and 3, and would eventually include creek and riparian restoration and neighbourhood-level stormwater detention, as required.

Option three was chosen as it is the most practical at this time. It also has the added benefit of developing a closer working relationship with MOTI. The challenge to this approach is the lack of pending development in the short term. Retrofit options are also a challenge within the narrow roadways in the regional district. Thus two pilot project concepts were developed:

- i) A pilot green street project in the next significant subdivision development within a CVRD electoral area. This pilot will demonstrate new and improved approaches to rainwater infiltration and detention within road rights-of-way.
- ii) A retrofit of street ditches that can be implemented in the short term. This retrofit does not address flooding or erosion concerns, but does improve habitat in Brooklyn Creek, which flows in ditches along Parry Place. Thus this pilot demonstrates the natural habitat aspect of integrated watershed management.

Pilot Project Concept #1: green streets in the next major subdivision in a CVRD electoral area

Estimated planning costs: To be determined (TBD). This pilot will require consultant expertise as well as CVRD and MOTI staff time. Consultant expertise may be covered in part or in full by the developer.

Estimated capital costs: to be borne by the developer as a cost of development.

Estimated maintenance costs and responsibilities: TBD

Intended outcome: i) to demonstrate an approach that can be replicated more widely across the Regional District's electoral areas, ii) to develop staff expertise and experience, and iii) to develop a closer working relationship with MOTI.

Timeline: TBD – dependant on subdivision proposals moving ahead.

Pilot Project Summary:

Alternative roadway and boulevard designs to infiltrate, detain and/or clean runoff have been widely tested in other jurisdictions. The purpose of this pilot is to introduce these measures to the CVRD. This is best done during the planning stages for a subdivision. These alternate designs will require more up-front planning time and expense but will not necessarily cost more to build. (They may cost less.) Responsibility and budgets for any ongoing maintenance will have to be determined and assigned during the planning stages.

Properties within the CVRD electoral areas that are expected to develop in the short to medium term are:

- Kensington Island Properties
- Saratoga/Miracle Beach

Please note that this proposed pilot addresses roadways only. By the time this pilot occurs the CVRD/MOTI may be ready to also request rainwater source control designs for the subdivided lots.

To prepare for this pilot project, the CVRD should develop a strategy and approach together with the MOTI and the potential developer(s).

Available funding sources:

1. The Federation of Canadian Municipalities Green Fund – Water Funding has the following criteria for feasibility studies or field tests to address stormwater management (up to 50% of eligible costs are covered):

Your project must demonstrate the potential to eliminate all site runoff for the 90th rainfall event.

The **90th rainfall event** is the "90th storm event," or the storm event that is greater than or equal to 90% of all 24-hour storms recorded on an annual basis. The goal of stormwater management projects is to prevent the runoff generated by this storm event through water capture and treatment. For more information, see the [Stormwater Manager's Resource Center](#).

Examples:

- swales
- rainwater collection
- green roofs
- permeable pavement

FUNDING DEADLINE: year-round (monthly reviews)

2. Union of BC Municipalities Gas Tax: likely eligibility under Integrated Community Sustainability Planning Projects - Innovation Fund. Note: this is for the planning phase. For capital projects a separate application is required. Up to 100% of costs covered. FUNDING DEADLINE is likely to be May 31, 2013.

Pilot Project Concept #2: ditch improvements/retrofits along Parry Place

Estimated planning cost (actual and in-kind) in 2013: \$15,000*

Estimated capital cost: \$20,000-60,000*

*Actual costs to be determined. Capital costs will vary greatly depending on the complexity of the plan and the length of ditch to be addressed.

Intended outcome: This would be a pilot for converting ditches into more natural fish habitats in other areas of the CVRD. More importantly, it is a way for the CVRD and MOTI to work together to improve Brooklyn Creek as part of a multi-jurisdictional effort with the Town of Comox and the City of Courtenay. This effort could occur through the established "Convening for Action for Vancouver Island" (CAVI) Regional Team.

Timeline: planning in 2013, implementation in August/September 2014. Alternatively, planning can be postponed to 2014 to better align with CAVI efforts.

Background: rural areas typically have their streams converted into ditches – either by creating a ditch network that replaces small streams entirely, or by deepening and straightening the natural stream channel. In many areas the land is drained by creating ditches where no surface channels previously existed. It is common to have underground drainage (drain tiles or pipes) that empties into the ditch network. The ditch network will

drain into a “natural” stream in areas where such streams still exist. Where fish access and water quality permit, ditches can still support coho salmon and cutthroat trout, among other species. The water quality and water temperature in ditches will affect the fish habitat downstream.

Ditches provide an important drainage function and most ditches cannot be removed or have their capacity reduced without affecting established land uses. Where land uses have changed there is an opportunity to restore fish habitat. It is also possible in some cases to maintain the function of a ditch while improving its value to fish.

Brooklyn Creek is of interest because of flooding and erosion issues that cross jurisdictions. There is to be a multi-jurisdictional focus on Brooklyn Creek through CAVI in 2013. This may result in joint planning efforts and in changes to how rainwater and run-off is managed in the watershed. A “Blueprint” (long-term plan to improve watershed health) may be developed.

Pilot project summary: The MOTI owns the drainage right-of-way (ROW) along Parry Place as well as along all other roads in the District. Parry Place has a ROW width of 20 meters, plus a hydro ROW, that makes for wide road shoulders on this low-use, dead-end road. This could allow for a reshaping of the ditch into a more natural profile, and for adding riparian plantings without affecting drainage capacity. A more detailed assessment would be required to determine the possibilities, especially with respect to maintaining drainage capacity. Ideally, a future phase would also allow for improving the open channel which drains the Longlands golf course just upstream. Discussions with the landowner would be required. It should also be noted that the MOTI owns a drainage ROW through 1160 Parry Place, which is immediately downstream of the Parry Place ditches. This is where the main channel of Brooklyn Creek “starts”, with drainage entering via Parry Place and from a culvert from Crown Isle (Pond 20). This corridor through private property may eventually need to be addressed to deal with erosion that may have been caused by increased runoff from Crown Isle. That work may be informed by this pilot project.

Relationship to the Brooklyn Creek CAVI efforts: It should be noted that the CVRD may participate in efforts in the Brooklyn Creek watershed beyond this proposed pilot project. Funding from the Electoral Areas budgets may be targeted towards developing a Brooklyn Creek Blueprint, together with resources from Courtenay and Comox. This is likely to occur over a period of three or more years and may require an overall budget of \$50,000 to \$100,000 or more, depending on the studies and public engagement that is required. Some resources may be available via grants.

Available funding sources: The following sources address this type of habitat improvement project.

1. RBC Blue Water Program. Deadline was January 11, 2013. There should be a similar deadline in 2014. This program supports projects that feature improved control and management of urban storm or rain water, and protection and restoration of urban

waterways, among other things. Funding is up to \$100,000 but is usually less than \$20,000.

2. TD Friends of the Environment. Applications are assessed quarterly. This source would likely not cover the whole capital program but would cover aspects of the work (e.g. plant stock). Funding is usually up to \$5,000.

Other funding sources may also be available, e.g. the Habitat Conservation Trust Fund, the Comox Valley Community Foundation and the Victoria Foundation.

MOTI has offered to bring financial resources to this project (\$5,000 – 10,000) if it can be done before March 31, 2013. MOTI also has in-kind resources including a provincial biologist versed in developing these kinds of projects.

5. Engagement with Ministry of Transportation and Infrastructure

The Rainwater Coordinator's TOR included an item to "work with MOTI towards improved management of rainwater issues in CVRD electoral areas including but not limited to the following:

- a. Restoration of MoTI's approval and enforcement process for driveway construction and ditch modifications performed by private property owners
- b. Increasing MoTI's responsiveness to property owners experiencing drainage and rainwater problems
- c. Utilization of green infrastructure best practices and incorporation of climate change adaptation principles into MoTI's planning, design, construction and maintenance of roadway drainage systems
- d. Incorporation of green infrastructure best practices and climate change adaptation principles in MoTI's subdivision review process with respect to rainwater management
- e. Obtaining MoTI's participation and assistance in the development of an integrated watershed approach to rainwater and drainage management with local governments in the Comox Valley
- f. Obtaining MoTI's support for the creation of an Implementation Agreement between the CVRD and MoTI in accordance with the Regional Growth Strategy to create a mechanism to address rural development, drainage and infrastructure issues."

Most of the above items would occur over the longer term, and this project was intended to initiate a conversation and to create a stronger working relationship with MOTI. This working relationship has indeed been strengthened over the two meetings and various phone conversations over the course of this project. Much of the conversation revolved around initiating a joint project (see Section 4 above), but a more general conversation was also had regarding rainwater management practices. Staff at the regional MOTI office are open to more collaboration and dialogue. More information is found in Appendix 5 (meeting minutes).

6. Engagement with Comox Valley Municipalities

The Rainwater Coordinator met with planning and engineering staff at the three CVRD municipalities. This was done to share information and to learn of each municipality's rainwater management efforts. In future the CVRD and Courtenay, Cumberland and Comox may be able to achieve economies of scale for rainwater information and planning, particularly when rainwater issues cross jurisdictional boundaries. The minutes of these meetings are found in Appendix 5.

There is an appetite and a need for more rainwater-related information sharing and collaboration between the local governments in the CVRD. Three main areas of collaboration came out of these meetings and more will emerge over time. The CAVI forum may be a venue for this increased collaboration:

1. The Town of Comox is undergoing a stringent stormwater management planning process for the NE part of their municipality. This includes requirements for retaining the pre-development hydrology (with the exception of existing road networks) for the study area. This methodology and standard have the potential for adoption by other jurisdictions in the CVRD.
2. The Village of Cumberland is updating their OCP during the same timeframe as the CVRD. They are interesting in sharing information and wording.
3. There is a general acknowledgement by the three municipalities that rainwater/stormwater management and capacity could be improved. There is a potential role for the CVRD in helping increase the knowledge and capacity of local governments and local consultants, through workshops or other forums. The CRD may be able to advise in this area as they have been playing this role in the Capital Region.

The City of Courtenay is currently undertaking a flood management study. Modeling and mapping will be done to help determine flood construction levels, the impacts of sea level rise, and setbacks for future development. While stormwater runoff may have some impact on major flood levels it will be minor compared to other factors. Thus this effort is largely separate from the initiatives described in this report.

7. Next steps

The following are suggested next steps for the short, medium, and long term.

Short Term (2013 and 2014):

1. Work with the CVRD municipalities under the CAVI (Convening for Action for Vancouver Island) umbrella, to develop management recommendations for the Brooklyn Creek Watershed.
2. Develop rainwater management policy statements and Development Permit Area (DPA) guidelines for the Official Community Plan (OCP) update happening in 2013. OCP policy statements could include an objective related to the need to address climate change impacts on rainwater management, could specify the BC Water Balance Model as a decision support tool. Adaptive management should also be mentioned. DPA updates should include performance standards. This may include a requirement to consider the Water Balance Model. Topsoil and water conservation requirements would also be helpful.
3. Explore economies of scale in rainwater management and planning with the CVRD municipalities - e.g.: language for the OCP update (with Cumberland), transferable technical performance standards (with Comox), and the feasibility of a single subdivision Approving Officer for all local governments.
4. Work with the Ministry of Transportation and Infrastructure (MOTI) to develop a more comprehensive and overarching approach to rainwater management in areas currently experiencing development pressure (e.g., Seal Bay). This may include technical studies (e.g., hydrological modeling), a protocol for referrals and approvals, and/or standards for subdivision approvals. A Memorandum of Understanding (MOU) may be required. Over time this approach could be translated to the region as a whole.
5. Develop an overall approach for implementing rainwater management in the CVRD electoral areas. This will include a review of staff capacity and budgets, identification of desired technical performance standards, and the identification of desired bylaw updates and new bylaws (see below). A strategy for public and stakeholder engagement should be developed.

Medium Term (2014-2016)

6. Develop an integrated suite of bylaw updates and new bylaws (as applicable), to implement rainwater management OCP policy in the CVRD electoral areas. This may include:
 - a. A subdivision and servicing bylaw that includes rainwater management standards.

- b. Regulatory bylaws for run-off, landscaping and topsoil requirements, which will create obligations for green infrastructure measures for all developments and re-developments, including single family properties. This could be a stand-alone landscaping bylaw, and/or be incorporated into zoning and subdivision bylaws, development permit area requirements, and as a requirement for a building permit.
- c. Updated zoning bylaws to include actual or effective pervious area requirements and/or landscaping/runoff/topsoil requirements.
- d. An updated building bylaw to make the issuance of a building permit conditional on meeting the requirements of, for example, a subdivision servicing bylaw.

Long term (2015 – 2018)

7. Explore the creation of region-wide integrated watershed management. This may include:

- a. Creating a drainage service region-wide, or within a priority watershed, through an establishing by-law. Creating a region-wide service area would likely be the most effective way to achieve integrated watershed management in the district.
- b. Creating a region-wide service area for research, planning and public education. This could allow longer-term planning, capacity building, assessment of priority areas, coordination of activities with member municipalities, and assist in building public support for action.
- c. Working with the CVRD municipalities to explore integrated, region-wide urban and rural standards for managing rainwater.
- d. Developing a region-wide Design and Policy Manual for Rainwater Management to provide guidance for developers and the approving officer with respect to meeting subdivision servicing requirements and conditions for development permits.

8. Resources

Existing information was surveyed in order to inform this report and to support future efforts.

A review of other jurisdictions was completed in order to determine current practices and programs and to inform technical performance standards for any future bylaws. This review is found in “Appendix 6: Examples from other jurisdictions.”

The experience of the following jurisdictions may be particularly informative:

- The Capital Regional District has taken on a coordinating role with respect to stormwater – this includes monitoring of water quality, education and capacity building, and the development of an Integrated Watershed Management Program for the region. The CRD is also in the process of assuming direct responsibility for stormwater management in three smaller municipalities. The Bowker Creek Blueprint was coordinated by the CRD.
- Metro Vancouver municipalities are developing integrated stormwater management plans under Metro Vancouver’s Liquid Waste Management Plan (LWMP). This LWMP can be seen as a rainwater management plan for the region. The performance measures and other approaches used are transferable to other jurisdictions.
- The District of North Vancouver is using clear stormwater performance targets within a Design Criteria Manual referenced in its Development Services Bylaw. This includes the use of the Water Balance Model. The District is also developing the Hastings Creek Watershed Blueprint.
- The District of Central Saanich may have transferable OCP wording recommendations and has experience with Integrated Stormwater Management Plans (2009) in rural environments.
- The District of Sooke has a 2011 Liquid Waste Management Plan for rainwater that includes strict controls for each development to manage its own stormwater. Action is underway to adopt a new subdivision approval bylaw and a rainwater quality protection bylaw is under development. Some OCP wording and subdivision bylaw wording may be transferable. Sooke is also developing rainwater management plans for 18 watersheds over 7 years and undertaking a LID pilot project.
- The District of Metchosin has a rainwater bylaw. Some performance standards and drainage criteria may be transferable.
- The City of Chilliwack has a Surface Water Policy and Design Criteria manual, which replaced the drainage part of their subdivision bylaw. They have very clear performance standards based on the *Provincial Stormwater Guidebook*. Chilliwack also has a landscaping bylaw and related requirements within development permit areas.

- The City of Nanaimo requires all development to meet pre-development flows for 10 year events. Baseline conditions are based on a forested site and detention ponds are no longer used.
- The District of Lantzville has a Subdivision Servicing Bylaw that incorporates LID standards and specifies rainwater management designs. A ‘net zero’ increase in runoff is required.
- The City of Coquitlam has a subdivision servicing bylaw and supporting policy and design manual
- The City of Vernon has landscaping bylaws.
- The City of Prince George and the City of Richmond have zoning bylaws with landscaping requirements.
- The City of Kamloops building permits require a landscaping plan.
- Rainwater harvesting best practices from the Regional District of Nanaimo may inform an integrated watershed approach.

Existing guidance is also found in a 2002 study done for the Lazo Creek/Queens Ditch watershed, by expert Will Marsh.¹ This report contains guidance for watershed management planning as well as information about green infrastructure measures and strategies for implementing best management practices. In addition it contains recommended subdivision standards. This document can help inform next steps.

Appendix 7 to this report contains a backgrounder entitled “Rainwater Management in the Comox Valley”. This resource, developed to support this report, is intended to provide a shared baseline of knowledge for staff members as the next steps are implemented.

¹ Marsh, William M. 2002. Towards a Management Plan for the Lazo Watershed and Queen’s Ditch. Prepared for the Regional District of Comox-Strathcona, April 2002.

Appendix 1: Scope of work – Rainwater Coordinator

Background

In recent years there has been an increase in the number of rainwater and drainage related problems that have arisen in the electoral areas of the Comox Valley Regional District (CVRD). These include flooding, slope stability issues and erosion resulting in property damage, public safety concerns, road closures and water quality impacts. While the CVRD has no jurisdiction or responsibility to manage rainwater and drainage in many of these cases, affected residents are contacting the CVRD as the local government responsible for electoral areas.

In the CVRD electoral areas and throughout the province, the Ministry of Transportation and Infrastructure (MoTI) has the primary responsibility for managing rainwater and drainage outside of municipal boundaries through the construction and maintenance of the provincial road network as well as through the subdivision process. While CVRD does not have a drainage or rainwater service, nor the appropriate staff expertise or regulatory tools, it does play an advisory role as part of the subdivision referral process through the provincial approving officer. CVRD staff have had success in the past working with MoTI on a case by case basis, however formal agreements will provide a more efficient approach in the long term.

Rainwater and drainage related problems can be attributed to insufficient planning, construction and maintenance of roadway drainage, poor rainwater management practices at the subdivision approval stage, and construction of driveway accesses across ditches without proper drainage controls. With regard to the latter, MoTI is no longer issuing residential driveway access permits and, according to residents, these are now being constructed without standards or proper guidance and methods. Increased development activity as well as changes to the frequency and magnitude of storm events, are also compounding problems.

CVRD does have responsibility to ensure proper rainwater and drainage management when land alteration occurs as a result of development that was enabled by CVRD, such as through a rezoning or development permit process. In these cases the CVRD has the authority to require that a rainwater management plan be prepared by a professional engineer to ensure that predevelopment peak runoff flows are maintained, that water quality is protected and that best management practices are utilized. There are currently no legal tools (e.g. development permit areas) that CVRD can use to focus on rainwater management for single family residential development resulting from subdivision.

The CVRD Regional Growth Strategy identifies the need for a strategic relationship with the Ministry to address drainage issues, planning for rainwater, climate change adaptation and rural road infrastructure issues. Detailed analysis and recommendations on improvements are needed to ensure that the processes and requirements of the CVRD and MoTI are effective, follow best management practices and that no gaps in responsibility are present. While rainwater and drainage issues are often dealt with on a case by case

basis, an integrated basin-wide approach is ultimately required to handle issues that affect all local governments within the CVRD. This integrated watershed-scale approach has been a key message and topic of discussion at the Convening for Action on Vancouver Island-Comox Valley learning lunch series which has been ongoing since 2007/2008.

At the CVRD Committee of the Whole meeting of August 9, 2011, a number of motions were carried forward in support of taking steps toward improving the effectiveness of rainwater management in the CVRD electoral areas. The adopted resolutions included the commitment of \$20,000 from Community Works Funds for each of the electoral areas A, B, and C for a total of \$60,000 toward the legal and technical review of current CVRD bylaws, policies and procedures to ensure that the CVRD is exercising due diligence with respect to rainwater management within its existing jurisdiction. Further, the Committee resolved to determine whether the municipalities in the Comox Valley as well as MoTI would have an interest in working together toward the development of an integrated watershed approach to rainwater management.

Scope

The CVRD seeks to engage a Rainwater Coordinator to oversee work on rainwater management issues and to move forward with the development of an integrated watershed approach to rainwater management. The scope of work will include but not be limited to the following:

1. Facilitate a legal and technical review of CVRD bylaws, development permit guidelines, policies and procedures
2. Develop a pilot project on rainwater management to analyze rainwater management issues in the CVRD electoral areas.
3. Coordinate with MoTI and member municipalities on how to work together on rainwater management issues

Detailed Scope of Work

The detailed scope of work will include but not be limited to the following:

- 1) Facilitate a legal and technical review of CVRD bylaws, development permit guidelines, policies and procedures related to rainwater management:
 - a. Develop a scope of work for a legal and technical review of CVRD bylaws, development permit guidelines, policies and procedures that will encompass the following :
 - i. A review of rainwater management jurisdictional restrictions and responsibilities, including identification of any gaps in responsibility.
 - ii. Complete a risk assessment to gain an understanding of the potential implications and risks to the CVRD in working with the province to develop a shared responsibility model for drainage and rainwater management - possibly including the establishment of service areas to manage road drainage and subdivision processes, as well as regulations for land alteration on private properties.

- iii. Provide recommendations – including specific language for legislative change – to address areas of weakness within and among CVRD bylaws, development permit guidelines, policies and procedures as they relate to rainwater management, including but not limited to the following:
 - 1. Consistency
 - 2. Consideration of downstream and basin-wide impacts for both urban and agricultural areas
 - 3. Consideration of cumulative development impacts, including single family residential development
 - 4. Ensuring the long term operation, maintenance and security of any systems that are engineered or built on site
 - 5. Identification of any barriers in existing regulations to better rainwater management
 - 6. Identify options for CVRD to establish a service to address rainwater management including a risk assessment of establishing a service.
 - b. Provide guidance to legal review team, including the identification of specific bylaws, development permits, and other policy documents or studies to be reviewed.
 - 2) Develop the scope for a pilot project on rainwater management within CVRD electoral areas.
 - a. Identify at-risk drainage catchments (catchments where conditions combine existing and/or pending development with high risks of either drainage problems and/or environmental impacts) with potential for testing integrated rainwater management approaches
 - b. Scope to include a budget, identification of potential funding sources, timeline for implementation, and a description of the intended outcome.
 - 3) Work with MoTI towards improved management of rainwater issues in CVRD electoral areas including but not limited to the following:
 - a. Restoration of MoTI's approval and enforcement process for driveway construction and ditch modifications performed by private property owners
 - b. Increasing MoTI's responsiveness to property owners experiencing drainage and rainwater problems
 - c. Utilization of green infrastructure best practices and incorporation of climate change adaptation principles into MoTI's planning, design, construction and maintenance of roadway drainage systems

- d. Incorporation of green infrastructure best practices and climate change adaptation principles in MoTI's subdivision review process with respect to rainwater management
 - e. Obtaining MoTI's participation and assistance in the development of an integrated watershed approach to rainwater and drainage management with local governments in the Comox Valley
 - f. Obtaining MoTI's support for the creation of an Implementation Agreement between the CVRD and MoTI in accordance with the Regional Growth Strategy to create a mechanism to address rural development, drainage and infrastructure issues.
- 4) Work with member municipalities to explore economies of scale in provision of rainwater information and joint planning when rainwater issues cross electoral area or municipal boundaries
 - 5) Develop specific language recommendations for incorporating rainwater management implementation into CVRD zoning bylaw and/or official community plan updates

Deliverables

1. Draft and final reports on results of the legal and technical review	2 copies plus digital
2. Draft and final reports on pilot project	2 copies plus digital
3. Minutes for all meetings held by the coordinator	Digital

Timeline

August 1, 2012	Project start date
October 30, 2012	Legal and technical review complete
October 30, 2012	Pilot project Phase I complete: Project scope for electoral area rainwater management pilot project
November 30, 2012	Project completion, final report due
January 2013	Presentation to Electoral Area Services Committee
2013	Pilot project Phase II: Rainwater management pilot project implementation subject to project funding approval

Appendix 2: CVRD rainwater management: legislation and policies

September 2012

Legislation/ Policy	Details
Rural Official Community Plan Policies	<p>Policy A.2(g) and (h)</p> <ul style="list-style-type: none"> Landowners and developers shall be required to protect natural drainage patterns which are vital to down-slope and surrounding wetlands and streams. The Regional District shall establish servicing design standards for all development and standards shall be compatible with municipal standards for areas adjacent to a municipality. <p>Policy A.5(a) to (d)</p> <ul style="list-style-type: none"> Land development and management guidelines to decrease the impact of stormwater runoff on adjacent and downhill properties including Agricultural Land Reserve lands and receiving water bodies shall be developed and implemented in consultation with local government and senior government agencies. The land use policies in the Plan shall work to ensure an adequate supply and quality of water for fish bearing streams and existing settlement and economic activities. At the next annual review of the <i>OCP</i> following the completion of a watershed management plan for a watershed in the Plan area, strategic level watershed management policies shall be considered for inclusion in the <i>OCP</i>. The Ministry of Environment Land Development Guidelines shall be used to minimize the impact of stormwater runoff. <p> http://www.env.gov.bc.ca/wld/documents/bmp/devwithcare2012/DWC-Section-2.pdf http://www.env.gov.bc.ca/wld/documents/bmp/devwithcare2012/DWC-Section-3.pdf http://www.env.gov.bc.ca/wld/documents/bmp/urban_ebmp/EBMP%20PDF%206.pdf </p> <p>Policy C.10 (a) to (d) and (f)</p> <ul style="list-style-type: none"> Development proposals shall be required to address stormwater management to ensure that post-development peak flows do not exceed pre-development peak flows.

	<ul style="list-style-type: none"> • The use of innovative technologies for the collection, treatment and discharge of wastewater and stormwater shall be encouraged. • The preparation, adoption and implementation of a Liquid Waste Management Plan for the rural electoral areas of the Comox Valley shall be supported. • Where deemed appropriate by a Liquid Waste Management Plan, Development Cost Charges, and Local Service Areas bylaws shall be considered as a means of ensuring the appropriate collection, treatment, and disposal of all wastewaters. • The Regional District shall work cooperatively with local government and senior government agencies to develop stormwater management plans that support groundwater recharge, retention and re-use of winter stormwater, and address water quality.
Regional Growth Strategy Policies	<p>Policies:</p> <p>5C-1 Local OCPs should include policies that encourage permeable surfaces within the design of new developments and public spaces.</p> <p>5C-2 In watersheds of water supply lakes, local governments and the Ministry of Transportation and Infrastructure should work cooperatively towards a target of less than 10 percent impermeable surfaces.</p> <p>5C-3 In <i>Rural Areas</i> the regional district should work with the Ministry of Transportation and Infrastructure to develop guidelines for an Integrated Stormwater Management to be used in the subdivision approval process</p> <p>5C-4 In order to ensure a sustainable aquaculture industry, local OCPs should include policies that require the cleansing of any stormwater draining into Baynes Sound.</p>
Regional Sustainability Strategy (non-binding guidance)	<p>Objective 2.1.3: Sustainable practices are used in site planning for new projects and redevelopment projects.</p> <p>Goal 3.7: Stormwater (rainwater) is managed to maintain the performance of watershed systems, preserve ecosystem health and protect groundwater.</p> <p>Objective 3.7.1: Buildings and sites are designed to manage stormwater in an ecologically sensitive manner.</p>

Implementation agreement with MOTI to implement aspects of the Regional Growth Strategy, and related operational agreements	<p>From the RGS:</p> <p>To ensure a collaborative planning process between local governments and MoTI to implement the goals and policies of the RGS. In the electoral areas, the MoTI is currently the approving officer for plans of subdivision. Therefore, to achieve the goals and objectives of the RGS related to regional growth management, it is important that MoTI work cooperatively with the CVRD:</p> <ul style="list-style-type: none"> • Prepare an RGS Implementation Agreement with MoTI on subdivision approval to address RGS policies and interests of local government including road network planning, stormwater management, cycling infrastructure, alternative infrastructure standards, transit infrastructure and road design standards. • RGS policies and goals will frame the Implementation Agreement and the principles outlined in Appendix A of the RGS.
MOTI subdivision referrals: advisory role	Currently respond to referral requests
Development permit areas	<p><u>Relevant Development permit areas:</u></p> <p><u>NOTE:</u> DPA 1 for aquatic environmentally sensitive areas may include measures for stormwater management, but these are not explicitly required. The heron and eagle nests (DPAs 3 and 4) will require some natural vegetation to be retained but will have limited effect on stormwater unless a stormwater management plan is required for other reasons. DPAs 2, 5 and 8 are to protect development from hazardous conditions. These are relevant because steep areas require special attention to drainage and runoff. However only DPA 8 (steep slopes) directly addresses stormwater quantity and quality leaving the parcel and affecting downstream areas. Guidelines for DPAs 6 and 7 (commercial/industrial uses and resort tourism) also directly address stormwater issues including potential downstream effects.</p> <ol style="list-style-type: none"> 1. DPA 1: aquatic environmentally sensitive areas: Those areas located within 30 metres (98.4 feet) of a watercourse where fish presence is confirmed as identified within the “Comox Valley Sensitive Habitat Atlas, 2nd Edition, June 30, 2010 (CVRD Reference Copy) including all map amendments (Appendix G) dated on or before May 21, 2010.

	<ol style="list-style-type: none"> 2. DPA 2: Eagles Drive: Those portions of Lots 2, 3 and 4, Plan 62463 and Lots A, B, C, D, E, Plan VIP65412, all of Section 25, Township. 6, Comox District (Eagles Drive) that are between the natural boundary of Georgia Strait and 7.5 metres (24.6 feet) from the top of bank (see Development Permit Area Maps). 3. DPA 3 and 4, eagle and heron nests 4. DPA 5: Back Road (hazard to development) This area of approximately 4.2 hectares (10.4 acres) is dominated by a creek and ravine. The ravine varies in depth from approximately 7.0 metres (23 feet) in the south to 17 metres (55 feet) in the north. The surrounding land slopes into the ravine at various angles limiting the safe locations for residential development. A slope condition assessment of the area has been completed by HBT Agra Ltd., 3070 Barons Road, Nanaimo, BC, V9T 4B5 (Hardy BBT Limited File NX00921A dated July 19, 1991). Within their report, safe locations for the construction of a single family dwelling with a septic field sewage disposal system have been identified. To ensure the recommendations of this report are followed by all future landowners, this area is being designated as a category 2-development permit area. 5. DPA 8: Steep Slopes (hazard to development): Pursuant to Section 919.1(1)(b) “protection of development from hazardous conditions” of the <i>Local Government Act</i>, the topography of the area, as well as slope gradation and thin soil cover, renders areas with steep slopes highly susceptible to erosion and high windthrow hazard. The topography of steep slopes constrains designs and contains sensitive features. Careful control of development on these slopes is needed to reduce the risk to life and property, to protect the natural environmental values, to prevent erosion and destabilization of slopes, and to protect the visual quality of the slopes. The development permit guidelines will promote sound site design and techniques to eliminate or avoid hazards to public safety and natural resources. 6. DPA 6: commercial and industrial uses: Those parcels zoned Commercial One (C-1) and those parcels where industrial use, including both light and heavy industrial, is a permitted use pursuant to the Comox Valley Zoning Bylaw, 1986 being Bylaw No. 869 as amended from time to time by the Regional Board. 7. DPA 7: Resort Tourism: Those parcels zoned Commercial Two (C-2) pursuant to the Comox Valley Zoning Bylaw, 1986 being Bylaw No. 869 as amended from time to time by the Regional Board.
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Guidelines For DPAs 1-4 include:

A.3.2. Based on the bio-physical assessment of the site, **works or protective measures, including that vegetation or trees be planted or retained, may be required to preserve, protect, restore or enhance natural watercourses, fish habitat, riparian areas** or eagle and great blue heron nesting sites. **Additional works or protective measures may also be required to control drainage or erosion**, and to protect banks.

Guidelines for DPAs 2 and 5 include:

B.3.3 **The planting of native species of vegetation and trees, as well as the preservation of existing vegetation to control drainage and erosion**, as well as to protect bank stability will be required in accordance with the recommendations of the engineering report.

Guidelines for DPA 8 include:

B.4.2 Professional Engineer Report

Development activity within the parameters outlined in Item B.4.1 above may be considered provided that the landowners have furnished, at their expense, a report certified by a professional engineer with experience in geotechnical engineering specifying that the proposed activity will not have adverse impacts on the stability of the slope. The professional engineer shall certify that the land may be used safely for the uses intended. No development shall occur where the report indicates that a hazardous condition may result. The report shall contain the following:

- (a) Slope stability conditions prior to development, identification of any areas subject to erosion, sloughing, flooding, landslide, landslip, rockfall, windthrow, excessive run-off, siltation and if applicable, be detrimental to the fishery resource;
- (b) design guidelines to avoid stormwater runoff that could destabilize the slope;**
- (c) Information on soil types, depths and conditions;
- (d) Anticipated removal or addition of soil, sand or gravel;
- (e) Erosion control and mitigation measures during and after construction;
- (f) Plans outlining the siting of all buildings and other structures, utilities, services, driveways, parking and all other impervious surfaces;

	<p>(g) Plans and analyses of watercourse channelling and drainage systems;</p> <p>(h) Measures to safeguard adjacent properties and structures from hazards arising from the siting, the preparation of the site and the construction of the proposed development; and</p> <p>(i) Recommendations for vegetation protection, enhancement or retention where applicable.</p> <p>Recommendations contained in the report shall form conditions of the development permit.</p> <p>B.4.8 Erosion Protection and Retaining Walls</p> <p>(a) Development should be designed to minimize erosion, to manage storm water runoff, to minimize impervious surfaces, to manage for debris flow or landslide and to minimize detrimental impacts.</p> <p>(b) Erosion control measures should be implemented during and after construction. Soil conservation measures such as silt fencing, matting and trapping should be used during construction.</p> <p>(c) Use retaining walls where they can reduce disturbing the slope to provide useable construction sites. The design of retaining walls should reflect the natural character of the site.</p> <p>B.4.11 Stormwater Management</p> <p>It is recognized that the clearing, grading and servicing of sites alters their natural hydrology patterns. In recognition of this fact, a stormwater management plan shall be required. The plan would strive to protect water quality and to maintain post-development peak flows to those of pre-development flow patterns and volumes over the entire water season. This stormwater plan should be prepared by a professional engineer and should make use of such devices as permeable surface treatments, wet or dry detention ponds, constructed wetlands or other devices as deemed suitable and consistent with best management practices.</p> <p><u>Guidelines for DPAs 6 and 7 include:</u></p> <p>C3.6. Parking (c): All paved parking areas shall be included within the context of the required stormwater water plan and shall incorporate oil/water separators.</p> <p>C.3.8 Stormwater</p>
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- (a) It is recognized that the clearing, grading and servicing of sites alters their natural hydrology patterns. In recognition of this fact, it shall be required that **each development shall prepare a stormwater management plan that strives to protect water quality, and to maintain post-development peak flows to those of pre-development flow patterns and volumes over the entire water season. This stormwater plan shall be prepared by a Professional Engineer and should make use of such devices as permeable surface treatments, wet or dry detention ponds, constructed wetlands or other devices as deemed suitable and consistent with best management practices. Stormwater runoff from storage areas shall be controlled to prevent contamination of watercourses.**
- (b) **The discharge of stormwater runoff from storage areas shall be accomplished with appropriate structures and flow control mechanisms to prevent contamination of receiving waterbodies.**

Applications for areas within DPAs No. 1 and 2

D.1.1 Should use the Stream Stewardship and Land Development Guidelines published by Fisheries and Oceans Canada and Ministry of Environment, and Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia published by Ministry of Environment as development models.

Applications within DPA 8 (steep slopes)

d4.4 Shall require a stormwater management plan, which should include:

- (a) Water quality characteristics of proposed flows and suggestions of appropriate methods to deal with any quality concerns;
- (b) Identification of catchment areas, flow routes, drainage capacities, flood plain issues, quality and hydraulic constraints, erosion potential, and any specific environmental issues;
- (c) Stormwater routing using piped systems and open systems;
- (d) Stormwater controls for infiltration or groundwater recharge, if appropriate, via ditch and swale seepage systems, infiltration galleries or basins;
- (e) Impacts of irrigation on short and long term stability of any slopes;

	<p>(f) Protection of drainage swales and major event flow routes;</p> <p>(g) Proposed roof and footing drains for individual lots, on-site treatment or connections to storm sewers, appropriate means of controlling short or longterm erosion;</p> <p>(h) Hydrogeological considerations including maintenance of existing groundwater regimes;</p> <p>(i) Energy dissipation into existing ravines at source and down slope where reconcentration or erosion may occur; and</p> <p>(j) Individual lot drainage and siltation control during and after construction; and</p> <p>(k) Other information as requested by staff.</p>
Area 'A' Electoral Area Plan (OCP) – objectives and policies	<p>In addition to the OCP:</p> <p>C.8(d) The Regional District will promote the consideration of alternative road development standards that respect the following integrated stormwater management principles:</p> <ol style="list-style-type: none"> 1. Keeping impervious surfaces to the minimum necessary, including consideration of one-way lanes or reduced pavement width on minor local roads that serve only a few residents; 2. Filtration of runoff through open vegetated swales; 3. Maximum use of infiltration to the ground watertable , while respecting the need for pavement sub-base drainage; 4. Minimal use of curb or catch basin inlets and piped solutions; and 5. Maximum retention of native vegetation, including retention of trees or woods in the right-of-way where this is safe and economic. <p>C.9(a) To protect and improve water quality in Baynes Sound.</p> <p>C.9(b) To support the development and implementation of a Liquid Waste Management Plan for the Union Bay Improvement District area.</p> <p>C.10(a) The preparation, adoption and implementation of a Liquid Waste Management Plan, including a Groundwater Protection Plan, for the rural electoral area shall be supported.</p>

	<p>C.10(c) It is critical to recognize that all land alteration and development affects stormwater runoff and that effects are cumulative. Development proposals shall be required to use best management practices for stormwater management, aquifer recharge and watershed management to ensure that post-development peak flows do not exceed pre-development peak flows and to maintain recharge of aquifers. One principle of stormwater management is to direct water back to the ground wherever possible to minimize chanellization and piping. Some examples of appropriate practices include:</p> <ol style="list-style-type: none"> 1. Minimize impervious surfaces through the use of gravel for parking areas, and porous materials for paths, patios, and other use areas. If driveway paving is required due to a steep slope use tire track paving with grass in the middle. 2. Drain roof water to the surface and disperse it into the ground, using such devices as splash pads and exfiltration galleries; 3. Thick organic layer of growing medium through cleared/disturbed area to promote growth of vegetation and water retention; 4. Direct water to grass slopes, swales and areas with thick vegetation; 5. Use stormwater detention ponds with adequate storage between high and low water to store all site water, and with a control structure to release low flows only; 6. Use wetlands which can improve quality of stormwater through biofiltration; 7. Retain as much existing vegetation as possible and where clearing has occurred, plant native trees and shrubs to restore the vegetative mass. Plant shrubs an average of 0.5 metres (20 inches) apart. Where the slope is over 20%, hydroseed around plants to retain soil and use other techniques such as willow wattles where required. <p>D.11(a) Local government agencies, senior government agencies and residents of the Comox Valley shall be encouraged to work cooperatively in the testing and implementation of innovative technologies and approaches for wastewater treatment, including the use of such methods as phytoremediation and wetland systems.</p> <p>D.11(b) Local government agencies, senior government agencies and residents of the Comox Valley shall be encouraged to work cooperatively in the testing and implementation of a variety of methods for stormwater management</p>
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<p>Area 'A' Electoral Area Plan (OCP): implementation</p>	<p>A.1.5 Undertake a Stewardship Implementation Program, with the following components:</p> <ul style="list-style-type: none"> • A Watershed Management Pilot Project, in concert with senior government agencies, to identify technical and administration arrangements for practical implementation of integrated stormwater and environmental stewardship. The Washer Creek watershed area may provide an ideal pilot project. • A Watershed Best Practices Manual developed with senior government assistance. • A Water Quality Bylaw, to set performance standards for erosion control and water quality measures, and to allow local government ticketing as an expedient alternative (to charges under the Fisheries Act) for minor offences.
<p>Area 'A' Union Bay Local Area Plan: Policies</p>	<p>C.4(g) To ensure the protection of water quality in Baynes Sound it is the policy of this Plan that all new developments must have an approved integrated Storm Water Management Plan which respects the stormwater management principles of this Plan.</p> <p>8) Integrated Stormwater Management: The Kensington development area contains areas of ecological significance and lies adjacent to a sensitive eco-system – Baynes Sound. It is therefore imperative that the development must deal with changes to the hydrologic regime within the confines of the Kensington development area. This requirement demands that the pre-development hydrologic conditions in the watershed are known and understood; post-development and future climate conditions are forecasted; and measures taken to mitigate the effects of increasing impervious surfaces, interruption of subsurface and surface flows and vegetative clearing. Alternates to standard “hard” piped solutions to stormwater management, including storage and beneficial reuse, are strongly encouraged to minimize the conversion of rainfall to runoff at the source. In the design of individual lot coverage the developer is encouraged to provide for the minimum amount of impervious surfaces; and to capture, infiltrate and filter storm water on site through bio swales, detention ponds, and rain gardens. The developer should, wherever possible, reuse stormwater for beneficial purposes, such as irrigation and toilet flushing. Plans for integrated stormwater management should be done in consultation with the following provincially sponsored documents: Stormwater Planning: A guidebook for British Columbia and the Water Balance Model for British Columbia (or similar documents as available).</p>

	<p>C.8(d) The Regional District will advocate the consideration of alternative road development standards that respect the following integrated stormwater management principles:</p> <ul style="list-style-type: none"> .1 Keeping impervious surface to the minimum necessary, including consideration of one-way lanes or reduced pavement width on minor local roads that serve only a few residents .2 Filtration of runoff through open vegetated swales; .3 Maximum use of infiltration to the groundwater table, while respecting the need for pavement subbase drainage; .4 Minimal use of curbs or catch basin inlets and piped solutions; and .5 Maximum retention of native vegetation, including retention of trees or woods in the right-of-way where this is safe and economic. .6 Encourage MOTM to maintain vegetation in roadside ditches. <p>C.10(e) The preparation, adoption and implementation of a Stormwater Management Plan for the Plan area is supported. It is critical to recognize that all land alteration and development affects stormwater runoff and that effects are cumulative. The Stormwater Management Plan shall require the use of best management practices for stormwater management, aquifer recharge and watershed management to ensure that post-development peak flows do not exceed pre-development peak flows and to maintain recharge of aquifers. The Plan shall focus on the principles of minimizing piping by directing water back to the ground, the reduction of total Effective Impervious Area (EIA) in all developments, and the reduction of non-point source pollution by means of stormwater treatment. Some examples of appropriate practices could include:</p> <ul style="list-style-type: none"> .1 minimize impervious surfaces through use of gravel for parking areas, and porous materials for paths, patios, and other use areas. If driveway paving is required due to a steep slope, use tire track paving with grass in the middle; .2 drain roof water to the surface and disperse it into the ground, using such devices as splash pads and exfiltration galleries; .3 a thick organic layer of growing medium throughout cleared/disturbed area to promote growth of vegetation and water retention; .4 direct water to grass slopes, swales and areas with thick vegetation;
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	<p>.5 use stormwater detention ponds with adequate storage between high and low water to store all site water, and with a control structure to release low flows only;</p> <p>.6 use wetlands which can improve quality of stormwater through biofiltration; and</p> <p>.7 retain as much existing vegetation as possible, and where clearing has occurred, plant native trees and shrubs to restore the vegetative mass. Plant shrubs a maximum average of 0.5 metres (20 inches) apart. Where the slope is over 20%, hydroseed around plants to retain soil and use other techniques such as willow wattles where required to ensure slope stability.</p> <p>D.11(a) Local government agencies, senior government agencies and residents of the Comox Valley shall be encouraged to work cooperatively in the testing and implementation of innovative technologies and approaches for wastewater treatment, including the use of methods such as phytoremediation and wetland systems.</p> <p>D.11(b) Local government agencies, senior government agencies and residents of the area shall be encouraged to work cooperatively in the development and implementation of an innovative Stormwater Management Plan.</p>
Area 'A' Union Bay Local Area Plan: DPAs 6 and 7	<p>A.3.1 The Regional District shall set requirements for Development Permit application information by selecting from the following as relevant to the project being considered:</p> <p>...</p> <p>b) Stormwater management plan including strategies for reduction of effective impervious area of the site plan;</p>

<p>Area 'A' Union Bay Local Area Plan: Kensington DPA #17</p>	<p>NOTE: Single family residences are exempt</p> <p>Information requirements:</p> <p>6. Proposed methods of management and control of all on-site drainage (i.e., stormwater management plan);</p> <p>B.2.5 (c) Environmental Guidelines</p> <p>For additional environmental requirements, please refer to the following regulations: Development Permit Area No. 1 (Aquatic Environmentally Sensitive Areas); Development Permit No. 3 (Eagle Nest Trees); Development Permit No. 4 (Heron Nest Sites); and Bylaw No. 2782, being the "Floodplain Management Bylaw, 2005."</p> <p>In addition to the above, the following guidelines are provided</p> <p>.1 Stormwater</p> <p>It is recognized that the clearing, grading and servicing of sites alters the natural hydrology patterns. In recognition of this fact each development proposal should be accompanied by a stormwater management plan that has as its goal the prevention of any stormwater runoff to enter the ocean; and the maintenance of post-development flows to those of pre-development flow patterns and volumes over the entire winter season. Preparation, adoption and implementation of a Stormwater Management Plan, based on "Best Management Practices," for the Development Permit Area, in addition to C.10(e) Water, Wastewater and Stormwater Policies, may include some or all of the following practices:</p> <ul style="list-style-type: none"> a) use sediment control ponds; b) use rain gardens; c) encourage the installation of green roofs; d) incorporate the use of oil/water separators or an equivalent technology to remove oil wastes from stormwater; e) the use of grass swales and other alternates (e.g., infiltration trenches, rain gardens) as alternatives to curb and gutter approach should be encouraged wherever they can provide aesthetically-pleasing, practical and cost-effective alternatives to "hard" piped stormwater management solutions; f) pervious and permeable surface should be used wherever possible in order to allow
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	<p>infiltration of precipitation; and</p> <p>g) on-site stormwater detention.</p> <p>All drainage works that affect roadway ditches or culverts, will require Ministry of Transportation and Infrastructure approval.</p>
Area 'A' Union Bay Local Area Plan: Development Approval Information Areas	<p>A. Stormwater Management and Protection of the Marine and Natural Environments</p> <p>Designated areas are the rural settlement containment areas</p> <p>The guidelines do not apply to properties which are one acre or less prior to development.</p> <p>A.3.2 The following activities shall require a special application whenever they occur within the Development Approval Information Area:</p> <ul style="list-style-type: none"> a) rezoning of land; b) Development Permit application. <p>A.3.4 In conjunction with the phasing strategy required in Section C.4, each development approval shall require the preparation and approval of a „master plan“ for the entire portion of a parcel within the RSA that each phase is a component of. This master plan shall address or contain, at the request of the Regional District, some or all of the following items:</p> <p>.....</p> <p>4. An integrated stormwater management plan identifying collection and treatment methods.</p>
Area 'A' Union Bay Local Area Plan: Plan Implementation Actions	<p>A.1.2 Take the steps required to support the preparation of a community supported Liquid Waste Management Plan for the Union Bay Improvement District.</p> <p>A.1.4 Take the steps required to support the development and implementation of an innovative Stormwater Management Plan for the Union Bay Local Service Area.</p> <p>A. 1.5 Undertake a Stewardship Implementation Program, with the following components:</p> <ul style="list-style-type: none"> - A Watershed Management Pilot Project, in concert with senior government agencies, to identify technical and administration arrangements for practical implementation of integrated stormwater and environmental stewardship.

	<ul style="list-style-type: none"> - A Watershed Best Practices Manual developed with senior government assistance. - A Water Quality Bylaw, to set performance standards for erosion control and water quality measures, and to allow local government ticketing as an expedient alternative (to charges under the Fisheries Act) for minor offences.
Area 'A' Royston Local Area Plan: objectives and policies	<p>8.0 Infrastructure</p> <p>A forthcoming Stormwater Management Plan (SMP) will aim to minimize adverse affects of new development and accommodate Royston's future needs.</p> <p>8.2 Objectives</p> <p># To support the development and implementation of a Liquid Waste Management Plan (LWMP) and a Stormwater Management Plan (SMP) for the Royston Plan Area</p> <p>8.3 Infrastructure Policies</p> <p>(c) The Regional District shall develop and implement a SMP for the Royston Plan Area.</p> <p>(d) The SMP shall include _best' stormwater management practices such as aquifer recharge and watershed management to ensure that post-development peak flows do not exceed pre-development peak flows.</p> <p>(g) To ensure the protection of water quantity and quality in Roy Creek, Royston and the Village of Cumberland shall be encouraged to work co-operatively for the management of liquid waste, solid waste and stormwater.</p>
Area 'A' Royston Local Area Plan: DPA #12	<p>9.3(1) ENVIRONMENTAL PROTECTION OBJECTIVES FOR DEVELOPMENT IN THE RESIDENTIAL-CONSERVATION DESIGN AREAS (DPA #12)</p> <p>...</p> <p>to retain as much native vegetation as possible to facilitate the infiltration of groundwater</p> <p>9.3.3. Environmental Protection Guidelines in DPA #12</p>

	<p>C. STORMWATER MANAGEMENT</p> <p>The goal of stormwater management is to ensure that changes to water flow caused by development do not have an adverse impact on lives, property, public infrastructure and aquatic resources. On-site stormwater management shall be considered for all sites. Dry ponds, rain barrels and other environmentally friendly options should be considered. Wetlands and detention ponds should be considered for large development projects on sites with topography that lends itself to such designs. The width of driveways shall be minimized to limit impervious surfaces. Pervious materials for paving, such as gravel or brick should be considered where possible.</p>
Area 'A' Royston Local Area Plan: Implementation Priorities	<p>1.0 Implementation</p> <ul style="list-style-type: none"> • developing a Liquid Waste Management Plan; • developing a Stormwater Management Plan.
Area 'B' Electoral Area Plan: Policies	<p>C.8(d) The Regional District will advocate the consideration of alternative road development standards that respect the following integrated stormwater management principles:</p> <ul style="list-style-type: none"> .1 Keeping impervious surface to the minimum necessary, including consideration of one-way lanes or reduced pavement width on minor local roads that serve only a few residents; .2 Filtration of runoff through open vegetated swales; .3 Maximum use of infiltration to the groundwater table, while respecting the need for pavement sub-base drainage; .4 Minimal use of curb or catch basin inlets and piped solutions; and .5 Maximum retention of native vegetation, including retention of trees or woods in the right-of-way where this is safe and economic. <p>C.10(a) The preparation, adoption and implementation of a Liquid Waste Management Plan, including a Groundwater Protection Plan, for the rural electoral areas of the Comox Valley shall be supported. Another referendum with a public education program is recommended.</p>

	<p>C.10(c) It is critical to recognize that all land alteration and development affects stormwater runoff and that effects are cumulative. Development proposals shall be required to use best management practices for stormwater management, aquifer recharge and watershed management to ensure that post-development peak flows do not exceed pre-development peak flows and to maintain recharge of aquifers. One principle of stormwater management is to direct water back to the ground wherever possible to minimize channelization and piping but without causing flooding on adjoining and nearby parcels. Some examples of appropriate practices include:</p> <ul style="list-style-type: none"> .1 minimize impervious surfaces through use of gravel for parking areas, and porous materials for paths, patios, and other use areas. If driveway paving is required due to a steep slope, use tire track paving with grass in the middle; .2 drain roof water to the surface and disperse it into the ground, using such devices as splash pads and exfiltration galleries; .3 thick organic layer of growing medium throughout cleared/disturbed area to promote growth of vegetation and water retention; .4 direct water to areas with thick vegetation, grass slopes and swales; .5 use stormwater detention ponds with adequate storage between high and low water to store all site water, and with a control structure to release low flows only; and that do not permit fish access into ditches unless an enhanced channel is created for that purpose; .6 use wetlands which can improve quality of stormwater through biofiltration; and .7 retain as much existing vegetation as possible, and where clearing has occurred, plant native trees and shrubs to restore the vegetative mass. Plant shrubs a maximum average of 0.5 metres (20 inches) apart. Where the slope is over 20%, hydroseed around plants to retain soil. <p>C.10(d) Support the establishment of Local Service Areas for stormwater management</p>
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	<p>in the Wilkinson Road area to the northwest of the B.C. Ferry terminal and in the Queen's ditch watershed. These Local Service Areas shall make provision for services and infrastructure for area-wide stormwater collection and treatment.</p> <p>C.12(d) Active parks shall be designed in accordance with the stormwater management practices outlined in Section C.10.</p> <p>D.11(a) Local government agencies, senior government agencies and residents of the Comox Valley shall be encouraged to work cooperatively in the testing and implementation of innovative technologies and approaches for wastewater treatment, including the use of such devices as <i>phytoremediation</i> and wetland systems.</p> <p>D.11(b) Local government agencies, senior government agencies and residents of the Comox Valley shall be encouraged to work cooperatively in the testing and implementation of a variety of methods for stormwater management.</p>
Area 'B' Electoral Area Plan: DPAs #6 and #7	<p>Requirements For Development Permit Areas 6 and 7 (Commercial, Commercial/Residential and Industrial Developments)</p> <p>B.3.1 The Regional District shall set requirements for Development Permit application information by selecting from the following as relevant to the project being considered:</p> <p>b) Stormwater management plan including strategies for reduction of effective impervious area of the site plan;</p>
Area 'B' Electoral Area Plan: Implementation Actions	<p>A.1.1 Take the steps required to support the preparation of a Liquid Waste Management Plan and Groundwater Protection Plan for Area B.</p> <p>A.1.2 Take the steps required to support the establishment of Local Service Areas for stormwater management in the Wilkinson Road area to the northwest of the B.C. Ferry terminal and in the Queen's ditch watershed.</p>

	<p>A.1.5 Undertake a Stewardship Implementation Program, with the following components:</p> <ul style="list-style-type: none"> -A Watershed Management Pilot Project, in concert with senior government agencies, to identify technical and administration arrangements for practical implementation of integrated stormwater and environmental stewardship. The Anderton Road area may provide an ideal pilot project. -A Watershed Best Practices Manual developed with senior government assistance. This could be in association with the Anderton Road area pilot and other projects. -A Water Quality Bylaw, to set performance standards for erosion control and water quality measures, and to allow local government ticketing as an expedient alternative (to charges under the Fisheries Act) for minor offences.
Anderton Road LAP: Policies	<p>C.4(d) New development based upon Plan policies must employ stormwater management strategies which respect the hydrologic parameters and mitigative measures established by the Brooklyn Creek Watershed Management Study.</p> <p>C.8(d) The Regional District will advocate the consideration of alternative road development standards that respect the following integrated stormwater management principles:</p> <ul style="list-style-type: none"> .1 Keeping impervious surface to the minimum necessary, including consideration of one-way lanes or reduced pavement width on minor local roads that serve only a few residents; .2 Filtration of runoff through open vegetated swales; .3 Maximum use of infiltration to the groundwater table, while respecting the need for pavement sub-base drainage; .4 Minimal use of curb or catch basin inlets and piped solutions; and .5 Maximum retention of native vegetation, including retention of trees or woods in the right-of-way where this is safe and economic. <p>C.10(a) If restructuring does not take place and if a Liquid Waste Management Plan for all of Area B is not undertaken, a Liquid Waste Management Plan and Groundwater Protection Plan for the</p>

	<p>Anderton area shall be supported. Another referendum with a public education program is recommended.</p> <p>C.10(c) It is critical to recognize that all land alteration and development affects stormwater runoff and that effects are cumulative. Development proposals shall be required to use best management practices for stormwater management, aquifer recharge and watershed management to ensure that post-development peak flows do not exceed pre-development peak flows and to maintain recharge of aquifers. One principle of stormwater management is to direct water back to the ground wherever possible to minimize channelization and piping but without causing flooding on adjoining and nearby parcels. Some examples of appropriate practices include:</p> <ul style="list-style-type: none"> .1 minimize impervious surfaces through use of gravel for parking areas, and porous materials for paths, patios, and other use areas. If driveway paving is required due to a steep slope, use tire track paving with grass in the middle; .2 drain roof water to the surface and disperse it into the ground, using such devices as splash pads and exfiltration galleries; .3 thick organic layer of growing medium throughout cleared/disturbed area to promote growth of vegetation and water retention; .4 direct water to areas with thick vegetation, grass slopes and swales; .5 use stormwater detention ponds with adequate storage between high and low water to store all site water, and with a control structure to release low flows only, and that do not permit fish access into ditches unless an enhanced channel is created for that purpose; .6 use wetlands which can improve quality of stormwater through biofiltration; and .7 retain as much existing vegetation as possible, and where clearing has occurred, plant native trees and shrubs to restore the vegetative mass. Plant shrubs a maximum average of 0.5 metres (20 inches) apart. Where the slope is over 20%, hydroseed around plants to retain soil. <p>C.10(d) Support the establishment of Local Service Areas for stormwater management in the</p>
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	<p>Anderton Road area, and in the Queen's ditch watershed. These Local Service Areas shall make provision for services and infrastructure for area-wide stormwater collection and treatment.</p> <p>C.12(e) Active parks shall be designed in accordance with the stormwater management practices outlined in section C.10.</p> <p>D.9(b) The Town of Comox shall be encouraged to include recommendations for stormwater management in the Anderton area within the Brooklyn Creek watershed study.</p> <p>D.11(a) Local government agencies, senior government agencies and residents of the Comox Valley shall be encouraged to work cooperatively in the testing and implementation of innovative technologies and approaches for wastewater treatment, including the use of such devices as <i>phytoremediation</i> and wetland systems.</p> <p>D.11(b) Local government agencies, senior government agencies and residents of the Comox Valley shall be encouraged to work cooperatively in the testing and implementation of a variety of methods for stormwater management.</p>
Anderton Road LAP: DPAs #6 and #7	<p>B.3 Requirements For Development Permit Areas 6 and 7 (Commercial, Commercial/Residential and Industrial Developments)</p> <p>B.3.1 The Regional District shall set requirements for Development Permit application information by selecting from the following as relevant to the project being considered:</p> <p style="padding-left: 40px;">b) Stormwater management plan including strategies for reduction of effective impervious area of the site plan;</p>
Anderton Road LAP: Development Approval Information Areas	<p>A. Stormwater Management and Protection of Agricultural Land</p> <p>Designated areas are the rural settlement containment areas as shown on the LAP map.</p> <p>The guidelines do not apply to properties which are one acre or less prior to development.</p> <p>The following activities shall require a special application whenever they occur within the</p>

	<p>Development Approval Information Area:</p> <ul style="list-style-type: none"> a) rezoning of land; b) Development Permit application. <p>A.3.4 To the extent that the proposed activity or development can reasonably be expected to have an impact on any of the following, these shall be included in the information to be submitted:</p> <ul style="list-style-type: none"> a) the natural environment of the area affected, including surface drainage and groundwater, ecosystems and vegetation, soils, and identification of areas of environmental sensitivity and any rare plant or animal species;
Anderton Road LAP: Implementation Actions	<p>A.1.1 Take the steps required to support the establishment of Local Service Areas for stormwater management in the Anderton Road area, and in the Queen's ditch watershed.</p> <p>A.1.5 Undertake a Stewardship Implementation Program, with the following components:</p> <ul style="list-style-type: none"> a) A Watershed Management Pilot Project, in concert with senior government agencies, to identify technical and administration arrangements for practical implementation of integrated stormwater and environmental stewardship in the Anderton Road area. b) A Watershed Best Practices Manual developed with senior government assistance in association with the Anderton Road area pilot project.
Quenville/Huband LAP: Policies	<p>B.3.3.1 Watershed & Fish-Bearing Streams</p> <ul style="list-style-type: none"> i) Ensure that any new development does not have a negative impact upon the current hydrology of the area, including the ecological integrity of adjacent watercourses, seasonally flooded areas and wetlands. <p>B.5.3.2 Stormwater Management</p> <ul style="list-style-type: none"> i) Support the use of environmentally sound stormwater management practices to maintain the current hydrological flow regime. ii) Ensure residential developments incorporate green stormwater management practices to

	<p>mitigate flooding and/or contamination of Little River.</p> <p>iii) Encourage maximum pervious surface area in all residential development.</p> <p>iv) Encourage the City of Courtenay to implement storm water management practices which are in keeping with the intent, objectives and policies of this Plan.</p>
Croteau Beach Neighbourhood Plan: policies	<p>7.2 Suggested Residential Policies:</p> <p>It is the policy of the Croteau Beach Neighbourhood that:</p> <p>vi) wherever possible, maintain trees, minimize hard surface paving (<i>i.e.</i> water balance model), minimize building sizes and footprints, and minimize suburban style landscaping in favour of reserving land for nature to maintain the character and biodiversity of the neighbourhood;</p>
Electoral Area 'C' Land use, greenways and LAP for Saratoga / Miracle Beach: Policies	<p>C.4(n) Development cost charges and local service area bylaws shall be considered as a means of ensuring the proper collection, treatment and disposal of all wastewaters (storm and sewage) and the provision of adequate water supplies.</p> <p>C.4(a) No rezonings for development of 3 or more new parcels within the rural settlement area will be approved prior to thorough studies of water supply, wastewater treatment, and stormwater management being provided for the lands proposed for development. Additionally, these studies shall outline how the servicing for the proposed development will tie-in with and/or provide servicing benefits to the adjacent established lands within the rural settlement area. (See also Part 6 A.2 Utility Servicing Alternatives Plan).”</p> <p>C.4(b) The establishment of a Local Service Area for stormwater management in the Saratoga/Miracle Beach is recommended. The servicing study should identify stormwater management needs and related costs and delivery mechanisms.</p> <p>C.4(d) The Plan supports the following changes to residential densities as indicated on the LAP map:</p>

	<p>.2 All rezoning applications received shall include complete information in relation to water and liquid waste servicing for the subject lands. In addition, environmental assessment information, including stormwater management, shall be provided by the applicant to aid in the decision. (See Part Five: Comprehensive Plan Areas).</p> <p>.3 In the Paulsen Road area, the existing 0.4 ha (1 ac) lot size zoning regulation is to remain. Infill to the same density is encouraged on abutting lands. Provided that the development includes dedication of park and greenway systems to buffer new development from existing residential areas, and to provide space for retention of existing vegetation, stormwater management, and public trails system and amenities, the parcel size may be averaged to include a range of parcels sizes with a minimum size of 0.2ha (0.5 ac) for smallest parcels.</p> <p>.4 In Saratoga/Miracle Beach after development there shall be approximately 30% in parks, schools, greenways and stormwater management lands. Lands will be provided by dedication at subdivision, through development cost charges to purchase open space or by other means.</p> <p>C.8(i) In most cases, the MOTI will be encouraged to require rural road standards in association with rural residential and agricultural development. Urban road cross sections are to be generally avoided, except for special cases where safety or congestion warrants.</p> <p>Alternative road development standards that respect the following integrated stormwater management principles, shall be encouraged:</p> <p>.1 Keeping impervious surface to the minimum necessary, including consideration of one-way lanes or reduced pavement width on minor local roads that serve only a few residents;</p> <p>.2 Filtration of runoff through open vegetated swales;</p> <p>.3 Maximum use of infiltration to groundwater, while respecting the need for pavement sub-base drainage;</p>
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	<p>.4 Minimize use of curb or catch basin inlets and piped solutions;</p> <p>.5 Maximize retention of native vegetation, including retention of trees in the right-of-way where this is safe and economic.</p> <p>C.10(a) It is critical to recognize that all land alteration and development affects stormwater runoff and that effects are cumulative. Development proposals shall be required to use best management practices in accordance with the "<i>Land Development Guidelines</i>" to ensure that post-development Peak flows do not exceed pre-development peak flows. Development shall be encouraged to direct water back to the ground wherever possible to minimize channelization and piping but without causing flooding on adjoining and nearby parcels. Some examples of appropriate practices include:</p> <p>.1 minimize impervious surfaces through use of pervious pavement, gravel or driveway chips for parking areas, and porous materials for paths, patios, and other use areas. If driveway paving is required due to a steep slope, use tire track paving with grass in the middle;</p> <p>.2 drain roof water to the surface and disperse it into the ground;</p> <p>.3 replace a thick organic layer of topsoil and organics throughout cleared/disturbed areas to promote growth of vegetation and water retention;</p> <p>.4 direct water to grass slopes, swales and areas with thick vegetation;</p> <p>.5 use stormwater detention ponds with adequate storage between high and low water to meet the requirement of the <i>Land Development Guidelines</i>, and with a control structure to release low flows only;</p> <p>.6 use wetlands, which can improve quality of stormwater through biofiltration;</p> <p>.7 retain as much existing vegetation as possible, and where clearing has occurred, plant native trees and shrubs, to restore the vegetative mass, and supplement these with erosion control where necessary on slopes.</p> <p>These are illustrated in Figure #6: Stormwater Management Guidelines.</p> <p>C.10(c)1 The preparation, adoption and implementation of a Liquid Waste Management Plan for the Black Creek watershed is supported. This should act as a pilot project for liquid waste management in other Comox Valley watersheds.</p>
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	<p>C.10(c)2 A Liquid Waste Management Plan for the Saratoga/Miracle Beach area is supported on a priority basis. Terms of reference for this Liquid Waste Management Plan are given in Part Six.</p> <p>C.10(c) The EAP and LAP support the establishment of a Local Service Area for stormwater management in the Saratoga / Miracle Beach area. This Local Service Area shall make provision for services and infrastructure for area-wide stormwater collection and treatment.</p> <p>D.11(a) Local government agencies, senior government agencies and residents of the Comox Valley shall be encouraged to work cooperatively in the testing and implementation of a variety of methods for stormwater management.</p> <p>A.5 Terms of Reference for Evaluating the Impacts of a Development Proposal</p> <p>A.5.1 An applicant must submit an environmental assessment by a <i>professional consulting team</i> which recommends the extent of the proposed land uses, <i>ecological greenways</i> and environmental mitigating measures, supported by:</p> <ul style="list-style-type: none"> c) a hydrological assessment of drainage patterns and proposed stormwater management facilities by a professional engineer; <p>During the pre-development phase the developer is encouraged to incorporate the following principles in the layout and building designs in order to demonstrate to the regional district how these principles were included in the development proposals of land located in Comprehensive Plan Areas indicated on Map #1 Area C Electoral Area Plan:</p> <p>....</p> <ul style="list-style-type: none"> ○ integrate storm water management with riparian corridor protection strategies; ○ reduce impervious surfaces while encouraging ground water recharge; <p>A.5.3.9 Integrated Stormwater Management: It is imperative that the development proposals must deal with changes to the hydrologic regime within the confines of the</p>
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	<p>Comprehensive Development Areas affected by the proposed developments. This requirement demands that the pre-development hydrologic conditions in the applicable watershed are known and understood; post-development and future climate conditions are forecasted; and measures taken to mitigate the effects of increasing impervious surfaces, interruption of subsurface and surface flows and vegetative clearing. Alternates to standard “hard” piped solutions to stormwater management, including storage and beneficial reuse, are strongly encouraged to minimize the conversion of rainfall to runoff at the source. This will ensure that rainwater and snow filters into the soil at its source rather than causing concentrated impacts downstream by being piped into watercourses.</p> <p>In the design of individual lot coverage the developer is encouraged to provide for the minimum amount of impervious surfaces; and to capture, infiltrate and filter storm water on site through bio swales, detention ponds, and rain gardens. The developer should, wherever possible, reuse stormwater for beneficial purposes, such as irrigation and toilet flushing. Plans for integrated stormwater management should be done in consultation with the following provincially sponsored documents:</p> <p>Stormwater Planning: A guidebook for British Columbia and the Water Balance Model for British Columbia (or similar documents as available).</p>
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<p>Electoral Area ‘C’ Land use, greenways and LAP for Saratoga / Miracle Beach: Implementation Actions</p>	<p>A.2 The Regional District, in conjunction with interested parties, including the community, shall strive to complete a Utility Servicing Alternatives Plan, or a series of associated servicing studies for the Saratoga / Miracle Beach Area. Terms of reference for the plan(s) shall include consideration of the following:</p> <p>v) review of stormwater management options, including a detailed review of costs and environmental implications of:</p> <ul style="list-style-type: none"> a) Alternative roadway standards, to minimize effective impervious area and maximize infiltration. b) Creating a hydrological disconnect of roof and other paved areas. c) Design and planting of dry and wet detention ponds, constructed wetlands, and other stormwater storage devices. d) Conveyances and routes for stormwater swales, ditches, and pipes where required. <p>A.5 The Regional District shall undertake a Stewardship Implementation Program, with the following components:</p> <ul style="list-style-type: none"> a) A Watershed Management Pilot Project, in concert with senior government agencies, to identify technical and administration arrangements for practical implementation of integrated stormwater and environmental stewardship. Black Creek and the Saratoga/Miracle area may provide an ideal rural pilot project for an integrated watershed, stormwater and wastewater management plan. b) A Watershed Best Practices Manual may be developed with senior government assistance. This could be in association with the Black Creek pilot and other projects. c) A Water Quality Bylaw, to set performance standards for erosion control and water quality measures, and to allow local government ticketing for minor offences.
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Mt. Washington LAP	<p>vii) Stormwater and Snow Management</p> <p>Stormwater and snow management of parking areas and transportation routes will be planned and management strategies proposed in the secondary planning process. On-site snow dump areas for all new development shall be adequate.</p> <p>4.3 STORMWATER MANAGEMENT</p> <p>Effective management of storm water drainage at Mt. Washington presents several challenges. In combination, steep slopes, thin soils, heavy seasonal precipitation, and limited areas of flat land result in very high levels of peak runoff, particularly after a prolonged period of rainfall resulting in ground saturation. The small size and steepness of the watershed means the response time of the creek system must be rapid and, without large areas of level land, the use of detention ponds is impractical. These physical conditions, and their consequences, are outlined in detail in the Mt. Washington Resort Master Drainage Plan. The consultants identified several drainage systems traversing the Resort property, all with their headwaters on Mt. Washington's western flank. These systems are tributary to two major rivers on the east coast of Vancouver Island, the Oyster River and Browns River. Both rivers have significant water resources such as fisheries habitat, recreational uses and water demand for domestic agricultural uses. Duckenfield Creek and Ramparts Creek are the two largest streams flowing from the subject site and draining the Resort and ski-hill area. Both creeks, as well as Paradise Creek that drains the ski slopes adjacent to the old Nordic Lodge and Creek 3, are tributaries of the Browns River. Piggott Creek and Creeks 1 and 2, are tributaries of the Oyster River.</p> <p>The consultants highlighted a number of stormwater management issues and potential mitigation measures.</p> <p>The key issues are:</p> <ul style="list-style-type: none"> Controlling the quantity of runoff; Controlling the quality of runoff; Controlling potential pollutants, including suspended solids from soil eroded from construction activity and from snow removal; Establishing development setbacks from creeks;
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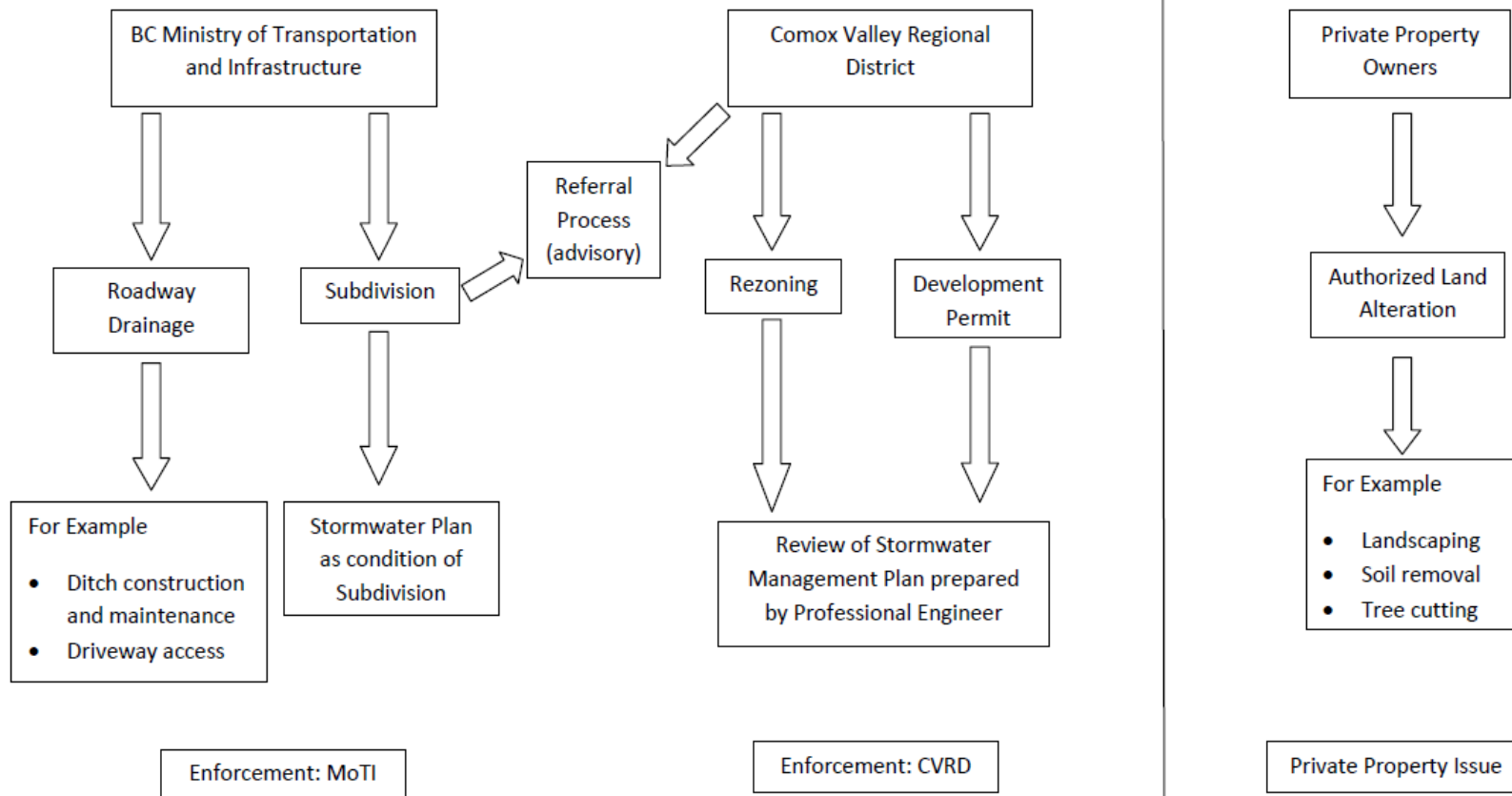
	<p>Avoiding and reducing potential flood impacts; and Setting up and maintaining an effective environmental protection program, including a review of all proposed construction projects.</p> <p>4.3.1 Objectives – Stormwater Management</p> <p>i) To moderate peak stormwater flows and minimize the impact of stormwater discharge on the downstream aquatic habitat of creek systems originating in the plan area. Protect Strathcona Park from silt, gravel, salt and contaminants.</p> <p>ii) To ensure any new development is designed so that it is consistent with the Mt. Washington Resort Master Drainage Plan.</p> <p>iii) To ensure any new development is designed so that it is consistent with the Province’s “Environmental Objectives, Best Management Practices and Requirements for Land Developments”, March 2001.</p> <p>4.3.2 Policies – Stormwater Management</p> <p>i) Update Master Drainage Plan The Resort will update the Master Drainage Plan as part of the secondary planning process to include the lands and creek systems that were recently acquired by the Resort from TimberWest and to reflect the development proposed in the secondary plans. The Resort will establish a maintenance and implementation schedule for Best Management Practices.</p> <p>ii) Development Setbacks A minimum of 15 metres (49.2 feet) will be required from the natural boundary of either side of stream corridors. Where fish presence is known to occur, development setbacks must meet the requirements of senior government regulations.</p> <p>iii) Flood Prevention Ensure that development plans are reviewed by a professional engineer to ensure there are no flood impacts from overflow of creeks or from overland flood flow. Install debris catchers above all major culverts for roadway creek crossings as recommended in the Master Drainage Plan.</p> <p>iv) Stormwater Quantity Control Undertake a detailed investigation of channel stability of Paradise, Ramparts and Piggott Creek systems downstream of the Resort to measure and quantify long-term impacts on the existing creek morphology.</p>
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	<p>v) Stormwater Quantity Control Measures As development takes place, implement a number of measures to moderate peak flows on the creek system as detailed in the Master Drainage Plan:</p> <ul style="list-style-type: none"> a) Minimize the extent of impervious surfaces where appropriate –consider porous surfaces and parking located under buildings; b) Keep minor drainage channelization to a minimum; c) Disperse flow diversion channels on ski slopes into wooded areas; d) Management stormwater by pre-development design that encourages the retention of vegetated areas and discourages small-scale dam structures; and e) Replant grassed areas with native shrubbery, particularly on ski runs. <p>vi) Stormwater Quality Control Measures Continue the active and ongoing program of source control of contaminants as outlined in the Mt. Washington Resort Corporate Environmental Policy Statement and Action Plan. As development takes place, implement a number of measures to reduce and minimize soil erosion and its impact on the creek system as detailed in the Master Drainage Plan. Some of these measures include:</p> <ul style="list-style-type: none"> a) Require detailed sediment control plans for all construction and require bonding by developers to draw on for remedial works, should a development result in downstream sediment problems; b) Require the use of sediment traps for external and internal parking areas, as well as oil/water separators in internal parking areas; c) Require 50% of all parking spaces to be contained in principle structures; cover all non-paved parking areas with a layer of crushed rock; d) Discourage paved parking areas and minimize paved road widths; and e) Encourage biofiltration swales and systems. <p>vii) Snow Management (Cross-reference Chapter 4.3) Manage snow storage as effectively as possible, implementing the measures outlined in the Master Drainage Plan. Some of these measures include:</p> <ul style="list-style-type: none"> a) Do not dump snow from parking areas directly into watercourses; b) Provide sediment traps and remove accumulated sediments to an
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	<p>appropriate off-site facility;</p> <p>c) Revegetate snow dumping areas aggressively; and</p> <p>d) Monitor the sediment levels in streams and the presence of hydrocarbons and salts in downstream soils.</p> <p>viii) Soil Stability Monitor the Ecological Greenways Crossings (Map 3) for soil stability against erosion and undertake measures to prevent or stabilize erosion through measures as outlined in the Master Drainage Plan.</p> <p>ix) Water Quality Monitoring</p> <p>Continue the active and ongoing program of water quality monitoring for the Paradise, Ramparts and Piggott Creek systems consistent with the parameters required for assessing water quality of streams that support salmonids. This program, undertaken jointly with BC Parks, operates under the requirements of the BC Ministry of Water, Land and Air Protection. Water monitoring results must be made available to the Regional District for reference purposes. Required stormwater storage to maintain the predevelopment flows must occur "off channel" and not within existing watercourses, either permanently wetted or ephemeral.</p>
Zoning bylaw	<p>5. DESIGN REQUIREMENTS</p> <p>i) The design requirements for highways shall be those enforced by the Ministry of Transportation and Infrastructure or other appropriate provincial agencies.</p> <p>ii) In those cases where dedication of lands for parks is required the Approving Officer may require, at the request of the Regional District, that the following be provided:</p> <p>a) Linear parks or walkways with a minimum width of 3.0 metres wherever a shorter, more convenient route is desired to provide pedestrian access to schools, parks and other neighbourhood amenities than that which is provided by the highway system.</p> <p>b) Adequate stormwater management to minimize additional storm water runoff from one lot to another.</p> <p>12. DRAINAGE</p> <p>i) Paved gutters, drain lines or other necessary surface drainage structures shall be constructed in accordance with accepted engineering practice where erosion due to a high run-off velocity can occur or where fish habitat could be affected. Where runoff quantities exceed natural drainage limitations, catch basins, storm sewers and</p>

	<p>detention ponds shall be constructed in accordance with accepted engineering practice and the Land Development Guidelines to mitigate impacts on fish habitat by limiting the increase in rate of water run-off to the hydraulic capacity of the natural drainage system.</p> <p>iii) Land development shall be designed in consideration of the Land Development Guidelines and the Stream Protection Regulations to minimize any disruption of the natural drainage pattern and to protect or mitigate impacts upon fish habitat.</p> <p>The multi-residential developments in the following zones all have the same “sustainability requirements” Golf Course-Residential (GCR), Mixed-Use Commercial-Residential (MUCR), Mixed-Residential (MR), Mixed Residential/Institutional (MRI):</p> <p>4. SUSTAINABILITY REQUIREMENTS</p> <p>i) Pursuant to Section 3 above, the multi-residential density provision requires the Developer to incorporate the following into the project: building design incorporating LEED™ certification, on-site storm water detention, passive solar building orientation or similar types of sustainability initiatives.</p> <p>-----</p> <p>The development of Saratoga Beach Estates phase one</p> <p>Schedule ‘A-1’ is attached hereto and form a part of the Saratoga Beach Estates Comprehensive Development Zone One (SBE-CD1). Development of the Saratoga Beach Estates phase one shall be in accordance with Schedule ‘A-1’, showing the general layout, the provision of public and private open spaces and trails and where storm water will be collected.</p>
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Responsibilities for stormwater and drainage in electoral areas



Appendix 3: CVRD rainwater policy key statement locations
September 2012

Statement	Location
Development proposals shall be required to address stormwater management to ensure that post-development peak flows do not exceed pre-development peak flows.	<ul style="list-style-type: none"> ▪ Official Community Plan (OCP) ▪ Roytson LAP (a requirement for their pending stormwater management plan)
The use of innovative technologies for the collection, treatment and discharge of wastewater and stormwater shall be encouraged.	<ul style="list-style-type: none"> ▪ OCP
Where deemed appropriate by a Liquid Waste Management Plan, Development Cost Charges, and Local Service Areas bylaws shall be considered as a means of ensuring the appropriate collection, treatment, and disposal of all wastewaters.	<ul style="list-style-type: none"> ▪ OCP
In <i>Rural Areas</i> the regional district should work with the Ministry of Transportation and Infrastructure to develop guidelines for an Integrated Stormwater Management to be used in the subdivision approval process	<ul style="list-style-type: none"> ▪ OCP
<p>The Regional District will promote the consideration of alternative road development standards that respect the following integrated stormwater management principles:</p> <ol style="list-style-type: none"> 1. Keeping impervious surfaces to the minimum necessary, including consideration of one-way lanes or reduced pavement width on minor local roads that serve only a few residents; 2. Filtration of runoff through open vegetated swales; 	<ul style="list-style-type: none"> ▪ Electoral Area 'A' OCP: policies ▪ Area 'A' Union Bay LAP: Policies (with one additional point) ▪ Electoral Area 'B' OCP: policies ▪ Anderton Road LAP: policies ▪ Electoral Area 'C' Land use, greenways and LAP for Saratoga / Miracle Beach: Policies

<ol style="list-style-type: none"> 3. Maximum use of infiltration to the ground watertable , while respecting the need for pavement sub-base drainage; 4. Minimal use of curb or catch basin inlets and piped solutions; and 5. Maximum retention of native vegetation, including retention of trees or woods in the right-of-way where this is safe and economic. 	
<p>It is critical to recognize that all land alteration and development affects stormwater runoff and that effects are cumulative. Development proposals shall be required to use best management practices for stormwater management, aquifer recharge and watershed management to ensure that post-development peak flows do not exceed pre-development peak flows and to maintain recharge of aquifers. One principle of stormwater management is to direct water back to the ground wherever possible to minimize channellization and piping. Some examples of appropriate practices include:</p> <ol style="list-style-type: none"> 8. Minimize impervious surfaces through the use of gravel for parking areas, and porous materials for paths, patios, and other use areas. If driveway paving is required due to a steep slope use tire track paving with grass in the middle. 9. Drain roof water to the surface and disperse it into the ground, using such devices as splash pads and exfiltration galleries; 10. Thick organic layer of growing medium through cleared/disturbed area to promote growth of vegetation and water retention; 11. Direct water to grass slopes, swales and areas with thick vegetation; 	<ul style="list-style-type: none"> ▪ Area ‘A’ OCP: policies ▪ Area ‘A’ Union Bay LAP: Policies (WITH ONE ADDITIONAL POINT) ▪ Area A Union Bay LAP, Kensington DPA #17 expands upon this ▪ Area ‘B’ OCP: policies ▪ Anderton Road LAP: policies ▪ Electoral Area ‘C’ Land use, greenways and LAP for Saratoga / Miracle Beach: policies

<p>12. Use stormwater detention ponds with adequate storage between high and low water to store all site water, and with a control structure to release low flows only;</p> <p>13. Use wetlands which can improve quality of stormwater through biofiltration;</p> <p>14. Retain as much existing vegetation as possible and where clearing has occurred, plant native trees and shrubs to restore the vegetative mass. Plant shrubs an average of 0.5 metres (20 inches) apart. Where the slope is over 20%, hydroseed around plants to retain soil and use other techniques such as willow wattles where required.</p>	
<p>Local government agencies, senior government agencies and residents of the Comox Valley shall be encouraged to work cooperatively in the testing and implementation of a variety of methods for stormwater management</p>	<ul style="list-style-type: none"> ▪ Electoral Area 'A' OCP: policies ▪ Union Bay LAP: Policies (with one word change) ▪ Area 'B' OCP (policies) ▪ Anderton Road LAP: policies
<p>Undertake a Stewardship Implementation Program, with the following components:</p> <ul style="list-style-type: none"> ▪ A Watershed Management Pilot Project, in concert with senior government agencies, to identify technical and administration arrangements for practical implementation of integrated stormwater and environmental stewardship. (The Washer Creek watershed area may provide an ideal pilot project.) (The Anderton Road area may provide an ideal pilot project) (Black Creek and the Saratoga/Miracle area may provide an ideal rural pilot project for an integrated watershed, stormwater and wastewater management plan) • A Watershed Best Practices Manual developed with senior government assistance. 	<ul style="list-style-type: none"> ▪ Area 'A' OCP: implementation ▪ Union Bay LAP: implementation ▪ Area 'B' OCP: implementation ▪ Anderton Road LAP: implementation EXCEPT THE LAST POINT IS ABSENT ▪ Electoral Area 'C' Land use, greenways and LAP for Saratoga / Miracle Beach: implementation

<ul style="list-style-type: none"> • A Water Quality Bylaw, to set performance standards for erosion control and water quality measures, and to allow local government ticketing as an expedient alternative (to charges under the Fisheries Act) for minor offences. 	
Take the steps required to support the development and implementation of an innovative Stormwater Management Plan for the Union Bay Local Service Area.	<ul style="list-style-type: none"> ▪ Area 'A' Union Bay Local Area Plan: Plan Implementation Actions
Support the establishment of Local Service Areas for stormwater management in the Wilkinson Road area to the northwest of the B.C. Ferry terminal and in the Queen's ditch watershed. These Local Service Areas shall make provision for services and infrastructure for area-wide stormwater collection and treatment	<ul style="list-style-type: none"> ▪ Area 'B' OCP (policies) ▪ Area 'B' OCP (implementation)
Support the establishment of Local Service Areas for stormwater management in the Anderton Road area, and in the Queen's ditch watershed. These Local Service Areas shall make provision for services and infrastructure for area-wide stormwater collection and treatment	<ul style="list-style-type: none"> ▪ Anderton Road LAP: policies
The establishment of a Local Service Area for stormwater management in the Saratoga/Miracle Beach is recommended. The servicing study should identify stormwater management needs and related costs and delivery mechanisms.	<ul style="list-style-type: none"> ▪ Electoral Area 'C' Land use, greenways and LAP for Saratoga / Miracle Beach: Policies
The EAP and LAP support the establishment of a Local Service Area for stormwater management in the Saratoga / Miracle Beach area. This Local Service Area shall make provision for services and infrastructure for area-wide stormwater collection and treatment.	<ul style="list-style-type: none"> ▪ Electoral Area 'C' Land use, greenways and LAP for Saratoga / Miracle Beach: Policies

<p>The Town of Comox shall be encouraged to include recommendations for stormwater management in the Anderton area within the Brooklyn Creek watershed study.</p>	<ul style="list-style-type: none"> ▪ Anderton Road LAP: policies
<p>Development cost charges and local service area bylaws shall be considered as a means of ensuring the proper collection, treatment and disposal of all wastewaters (storm and sewage) and the provision of adequate water supplies</p>	<ul style="list-style-type: none"> ▪ Electoral Area ‘C’ Land use, greenways and LAP for Saratoga / Miracle Beach: Policies

Appendix 4: Legal review, West Coast Environmental Law

Rainwater Management in the Comox Valley Regional District:
Working Towards an Integrated Watershed Management Approach

Review of Existing Practices and Options

Prepared for Comox Valley Regional District by West Coast Environmental Law

January 7, 2013

CONTENTS

1. Introduction – the rationale for integrated watershed management
2. Overview of BC law and policy tools for integrated watershed management
3. Consideration of existing Comox Valley Regional District laws and policies
4. Liability issues for local governments in the context of rainwater management
5. Possible next steps for Comox Valley Regional District to support transition to integrated watershed management

1.0 Introduction

1.1 The rationale for integrated watershed management

Integrated watershed management with respect to rainwater² is about managing the natural and built parts of the watershed as a whole, with the aim of getting as close as possible to pre-development hydrologic function. The spatial scale for planning and managing extends from the site to the watershed level. The timeframe is also expanded, recognizing the longer term impacts of changes to natural systems, as well as the time required, in some cases, to restore hydrologic functions that have been lost through past development practices. A watershed-level approach also means that the cumulative effects of development can be taken into consideration. Monitoring and adaptive management (improving practices over time based on results) are also important considerations.

Historically, development and urban settlement has tended to result in the loss of existing natural vegetation and topsoil in rural areas, and the prevalence of impermeable surfaces in urban areas. Rainwater has been managed by building hard infrastructure that is used to convey water away from sites.

It has become clear that focusing on the site level and relying on approaches that divert rainwater away from developed areas eventually creates problems downstream, such as erosion, pollution, flooding, habitat loss and other damage, both to natural watercourses and downstream properties. At the sites where rainwater is diverted it also fails to infiltrate the soil and recharge groundwater and aquifers. As well, as more development occurs it requires additional hard infrastructure. These capital costs together with the costs of maintaining existing infrastructure can become significant burdens for local governments and developers.³ Integrated watershed management, by protecting and restoring natural hydrologic function, offers both ecosystem benefits (such as improved stream health and biodiversity protection) and benefits for local governments with respect to reduced risks of flooding, erosion, slides and water quality problems, and the possibility of reduced lifecycle costs for infrastructure.⁴

² Rainwater is used throughout in this document in most places instead of the term “stormwater” because it better reflects current practices that aim to design for the full spectrum of rainfall events. However, where CVRD or other documents refer specifically to stormwater, e.g. integrated stormwater management plans, the terminology used in the original documents is used.

³ Josh Foster, Ashley Lowe, Steve Winkelman. *The Value of Green Infrastructure for Urban Climate Adaptation* (February 2011) <http://ccap.org/resource/the-value-of-green-infrastructure-for-urban-climate-adaptation/>

⁴ See, Partnership for Water Sustainability, *Primer on Rainwater Management in an Urban Watershed Context Integrating the Site with the Watershed and the Stream* http://bc.waterbalance.ca/files/2011/12/1_Primer-on-Rainwater-Management-in-Urban-Watershed-Context_November2011.pdf

In practice, both hard infrastructure (e.g. pipes and drains) and green infrastructure solutions (techniques that try to mimic natural systems, such as rain gardens, enhanced topsoil and others) as well as land use policies and other tools that protect and restore natural ecosystem functions are part of an integrated watershed management approach.

In the 21st century the reality of climate change means that the likelihood of increased precipitation and greater frequency and intensity of extreme precipitation events are also factors to be considered.⁵ These changes will place further demands on existing infrastructure and have implications for the design of new and renewed infrastructure. Green infrastructure solutions may be able to assist in managing some of the impacts of climate change on local government infrastructure.⁶ Climate change may also result in impacts to water supply and water quality, and increased risks of slides and other hazards, and responding to these impacts may require an integrated, watershed approach.

In British Columbia the provincial government has been supporting the development of integrated watershed management for a number of years, through the development of policies and funding incentives. *Stormwater Planning: A Guidebook for British Columbia* and *Living Water Smart, British Columbia's Water Plan*,⁷ as well as other policies and funding programs, all promote integrated watershed management and green infrastructure solutions.

2.0 Overview of BC law and policy tools for integrated watershed management

Integrated watershed management involves implementing measures at different scales in a coordinated manner. British Columbia's law and policy framework provides tools and opportunities to develop measures that apply at different scales. However, because the law and policy framework has been developed over time, in response to historical development needs and objectives, and generally without regard to maintaining natural hydrologic functions, it is not a perfect fit with integrated watershed management,

In some cases local governments may face situations where land uses upstream and outside their jurisdiction (e.g. forestry operations) have a significant impact on drainage issues downstream. As well, within a regional district, municipalities have their own,

⁵ <http://pacificclimate.org/tools-and-data/plan2adapt>

⁶ <http://waterbucket.ca/wscblog/2012/04/12/bigger-pipes-or-greener-communities-a-hydrological-assessment-of-using-green-infrastructure-practices-in-british-columbia-to-mitigate-future-flooding/>

⁷

<http://www.env.gov.bc.ca/epd/epdpa/mpp/stormwater/guidebook/pdfs/stormwater.pdf>; <http://livingwatersmart.ca/>;

<http://watersustainabilitybc.blogspot.ca/p/mission-possible-beyond-guidebook.html> See also *Integrating the Site with the Watershed and the Stream: Primer on Urban Watershed Modelling to Inform Local Government Decision Processes* <http://watersustainabilitybc.blogspot.ca/search?q=ismp+primer>

separate jurisdiction to manage rainwater and other watershed components within their boundaries. However, while recognizing that these issues exist, for the most part the law and policy toolbox currently available to local governments in BC can support an integrated approach, as will be discussed below.

It should also be noted that it is possible to implement integrated watershed management incrementally, without having to make sweeping changes all at once. This will be discussed below.

Integrated watershed management generally includes planning and implementing measures that have an impact at three descending scales: the watershed, the sub-watershed or neighbourhood level, and the site level.

The word “watershed” is itself used to describe various geographic scales. It might be used to describe a larger area that contains many smaller watersheds, e.g., the Tsolum River watershed, or it might be referring to a single, smaller watershed, e.g., the Brooklyn Creek Watershed. For the purposes of the discussion below the definition from the CVRD Regional Growth Strategy will be used:

An area of land that contributes runoff to a specific delivery point, such as the mouth of a river. Large watersheds may be composed of many smaller sub-watersheds, each contributing runoff to various streams and rivers that ultimately combine at a common delivery point.

2.1 Watershed scale law and policy

The following sub-sections provide a summary of the key law and policy tools available to a regional district to implement integrated watershed management. The discussion is meant to be illustrative, not exhaustive, and to trigger further investigation by CVRD with respect to conditions and objectives for rainwater management within its jurisdiction.

2.1.1 Watershed scale planning

At the watershed scale there are several important planning tools:

Regional Growth Strategies can be used to address a number of matters relevant to rainwater management. Because they must cover a period of at least twenty years, they can describe important, longer-term goals related to regional district services, parks and natural areas, and infrastructure. In particular they can help secure local government commitment to region-wide approaches, such as watershed-based management. It is also possible, if the political will exists within a region, for regional growth strategies to support the implementation of measures at smaller scales, such as development standards for drainage to support watershed needs, or other neighbourhood and site level approaches.

Official Community Plans (OCPs) are also forward-looking documents that set out policy objectives, and may include policies applicable to development and re-development that support an integrated rainwater management approach, as well as green infrastructure solutions. OCPs can set out policies that require consideration of the cumulative effects of proposed development on drainage and natural habitat, and can specify performance targets and other policies such as the Water Balance Model,⁸ that aim to ensure that the hydrological characteristics of the natural watershed are maintained or restored to the greatest extent possible.

At the request of the Minister of the Environment, a regional district may be requested to prepare a **Liquid Waste Management Plan (LWMP)** (*Environmental Management Act*,⁹ s.24). Through a LWMP a region can manage both sewage and rainwater, and in particular establish long term, integrated strategies for rainwater management and the protection of natural watercourses. LWMPs are also an excellent opportunity to provide the framework for developing green infrastructure. LWMPs are focused on engineering and other technical approaches to achieve planned objectives, and can complement land-use strategies for integrated rainwater management across a watershed. Developing an effective LWMP ideally involves a significant level of consultation with experts and affected stakeholders through a process that creates buy-in for eventual implementation.¹⁰

2.1.2 Watershed scale implementation

Historically, regional districts have had limited authority in relation to drainage, unless a drainage service has been enabled under the *Local Government Act* or other instrument. Drainage in electoral areas within rural regional districts has been managed by the Ministry of Transportation and Infrastructure (MoTI), and has focused mainly on drainage related to roads. In principle, if established, a regional district service area for drainage could be region-wide, or a specific to a local area. Establishing a service would allow the regional district to plan and implement an integrated and strategic approach to rainwater management within the service area, whether it was region-wide or local. Establishing a service would also create a source of funding, through property taxes or other means allowed by the *Local Government Act*, such as development cost charges.

Section 540 of the *Local Government Act* gives regional districts the authority to regulate the design and installation of drainage works provided by persons other than the district, to include natural watercourses in a regional district drainage system, and authority to set requirements with respect to the construction of dikes, maintenance of flow in streams

⁸ BC Water Balance Model <http://bc.waterbalance.ca/>

⁹ S.B.C. 2003, c.53.

¹⁰ A recent example is the LWMP prepared by Metro Vancouver, available online at <http://www.metrovancouver.org/about/publications/Publications/ILWRMP.pdf>. An example at the municipal scale is the LWMP developed by the District of Sooke, which integrated sanitary and stormwater management. www.sooke.ca/EN/main/government/devservices/environment/lwm_rain.html

and ditches, and the reclamation or protection of land at risk from sea or stream erosion. This authority allows the provision of a drainage service that can provide a consistent approach to managing rainwater within participating areas of a regional district.

While municipalities are not required to participate in the provision of a drainage service by a regional district, their cooperation at some level would be desirable if municipal lands fall within a larger area that the regional district has decided to target for rainwater management planning and implementation.

Alternatively, instead of establishing a new drainage service area or areas, a regional district could—at least in principle, if political will existed— enter into an agreement or Memorandum of Understanding with the provincial government (MoTI) to cooperate to study, plan or implement aspects of rainwater management within the electoral areas of the district. The scope of the agreement could range from matters such as hydrologic modeling, assessing the feasibility of priority areas for watershed management, providing guidelines for approving officers, etc.¹¹ However, implementing this type of agreement would require that a source of funding be identified.

2.2 Sub-watershed (neighbourhood) scale law and policy

Tools that can be used at the neighbourhood scale include subdivision approvals, subdivision and servicing bylaws, zoning bylaws and development permit areas.

The authority for **subdivision approvals** arises under the *Land Title Act*,¹² s.77. In rural areas outside municipal boundaries, regional districts may assume the subdivision approving authority (s. 77.1). However, if the regional district does not assume this authority, the default is that the authority is exercised by Cabinet-appointed Ministry of Transportation and Infrastructure approving officers (s.77.2). An approving officer can refuse a subdivision application if it does not conform to local bylaws (s. 87), such as a subdivision and servicing bylaw, or if the land has inadequate drainage installations or would adversely affect the natural environment to an unacceptable level (s.86).

Subdivision and servicing bylaws¹³ can be used to specify requirements for both on-site and off-site stormwater management plans in new subdivisions. Also, the issuance of building permits can be made conditional on the provision of the works and services

¹¹ Regional districts are granted corporate powers, including the power to make agreements, under s.176 of the *Local Government Act*. Several regional districts in BC have entered into MOUs with the provincial government, such as the Peace River Regional District and its MOU with the province concerning the “Fair Share Agreement”, which seeks to redistribute some of the revenue obtained by the province from the oil and gas industry operating in that region to the Regional District.

¹² R.S.B.C. 1996, c.250.

¹³ *Local Government Act*, s.938.

specified in the bylaw. In addition to specifying standards and specific measures, such as stormwater management plans, subdivision and servicing bylaws can require that those plans be prepared and certified by engineers with appropriate expertise and liability insurance.

Through **zoning** a regional district can limit site coverage, or the impervious “footprint” of buildings, structures, and paved parking areas and in this way promote onsite rainwater infiltration. Together with allowable densities, these site-level measures can have an effect across a broader scale when applied throughout a defined zone,¹⁴ particularly where there is significant new development or re-development.

Development permit areas (DPAs) are designated and described within an OCP. These can provide more flexible and site-specific options with respect to new development and re-development, compared to zoning bylaws. For example, a DPA can specify a certain level of onsite rainwater infiltration, while a zoning bylaw could only specify the site coverage allowed. DPAs can include guidelines that protect natural features, which will contribute to rainwater management.¹⁵ DPAs can also provide landscaping requirements and address run-off. Hydrologic and other studies can also be required as part of the application process. As well, a DPA for water conservation may include requirements about the type and placement of trees and other vegetation in proximity to the buildings and other structures in order to provide for water conservation.¹⁶

One drawback of DPAs is that if development does not proceed according to the conditions set out in a development permit, the only legal recourse available to force the developer to take action is for the local government that granted the permit to go to court to seek an injunction, which can be cost-prohibitive. However, a regional district can also create a requirement for the developer to post security, and if the work is not completed as set out in the development permit, the district can apply the security to its own costs to

¹⁴ The CVRD “Water Supply and Resource Area” zone is an example.

¹⁵ See *Local Government Act*, s. 920 (7): For land designated under section 919.1 (1) (a), a development permit may do one or more of the following:

- (a) specify areas of land that must remain free of development, except in accordance with any conditions contained in the permit;
- (b) require specified natural features or areas to be preserved, protected, restored or enhanced in accordance with the permit;
- (c) require natural water courses to be dedicated;
- (d) require works to be constructed to preserve, protect, restore or enhance natural water courses or other specified natural features of the environment;
- (e) require protection measures, including that vegetation or trees be planted or retained in order to
 - (i) preserve, protect, restore or enhance fish habitat or riparian areas,
 - (ii) control drainage, or
 - (iii) control erosion or protect banks.

¹⁶ *Local Government Act*, s.920 (10.2).

undertake remedial work. The security can be applied in relation to conditions related to landscaping, the creation of an unsafe condition or damage to the natural environment.¹⁷ If the amount of security does not cover the remedial costs, the district will be liable for any outstanding amounts.

Development approval information areas (DAIAs), also specified in an OCP, can be used to require professional impact assessment at a site-specific level within specific areas or when specific circumstances exist. DAIAs have effect where applications are being made for zoning bylaw amendments, development permits or temporary use permits. A bylaw must set out the process for requiring the information and the substance of the information that must be submitted.¹⁸ The information obtained can then be used to help inform local government decision-making about the conditions to place on development, before development takes place.

DAIAs might be used to obtain information in areas where particular rainwater management issues are known to exist (for example, natural hazards or sensitive ecosystem concerns) and where specific technical information will be of assistance to decision-makers considering permit or re-zoning applications. Information about how risks will be handled can also be required.

2.3 Site-level law and policy

At the site level, regional districts have a number of tools available to support rainwater management, set out in Part 26, Planning and Land Use provisions of the *Local Government Act*. In particular, regional districts may

1. Designate areas of land considered to be subject to flooding, erosion, land slip or avalanche as **tree cutting permit areas**, and regulate or prohibit cutting down trees in those areas, provided there is evidence of the hazard (s. 923);
2. **Regulate run-off** on properties, by specifying how (or to what extent) new paved and roofed areas manage and dispose of surface water run-off and stormwater, and can set the maximum area of land that can be covered by impermeable material (s.907);
3. Regulate the surface design of **off-street parking** (s.906);
4. Set standards for, or regulate the provision of **landscaping** in relation to zones and within zones for various purposes, including masking or separating uses, protecting, restoring or enhancing the natural environment, or preventing hazardous conditions. A landscaping bylaw can require tree planting or vegetation, or retention of existing vegetation that will support green infrastructure objectives (s.909);

¹⁷ *Local Government Act*, s.925.

¹⁸ *Local Government Act*, ss. 920.01, 920.1.

Regional governments may also establish a service regarding the **deposit and removal of soil**, and related regulations, subject to approval by the province. This can be used to establish and enforce topsoil requirements. A well-functioning topsoil layer is an important green infrastructure tool that can help reduce runoff and conserve water.¹⁹

To provide clear, lasting requirements about rainwater management measures on site, and in particular green infrastructure measures, a regional district can use **s. 219 covenants** under the *Land Title Act*²⁰, and require that they be created at the time of development or re-development.²¹ However, local governments may find it challenging to monitor compliance, and enforcement can be expensive.

3.0 Consideration of existing law and policy in Comox Valley Regional District (CVRD)

3.1 CVRD Regional Growth Strategy

The CVRD Regional Growth Strategy (RGS) sets out a general approach to infrastructure and development that can support rainwater management at the watershed scale. The RGS also acknowledges, implicitly, that there may be limits to the ability of the region and its natural systems to accommodate growth:

Infrastructure extensions should be guided by an understanding of where and how growth should occur, considering natural capacity, environmental impact, costs and efficiency, and to resolve health risk implications from failing onsite systems.²²

In addition, the CVRD Regional Growth Strategy contains a number of provisions that specifically support aspects of integrated watershed management within the Regional District:

Objective 2-A Identify and map areas for conservation - Critical watersheds: The Browns, Tsable and Oyster Rivers and Comox Lake are critical watersheds in the Comox Valley. In addition to providing drinking water sources, these watersheds provide linkages for wildlife from the east coast of Vancouver Island to the west coast, via Strathcona Park.

¹⁹ For a comprehensive overview of measures that local governments can take to protect topsoil and enhance rainwater management, see Okanagan Basin Water Board, *Topsoil Bylaws Toolkit* (2012)

http://www.obwb.ca/fileadmin/docs/TopsoilBylawsToolkit_2012.pdf

²⁰ R.S.B.C. 1996, c.250.

²¹ The City of Surrey uses a variety of covenants to support green infrastructure measures. See *City of Surrey Engineering Land Development Customers' Manual* (April 2012), Appendix 3.

²² Comox Valley Regional Growth Strategy, Bylaw No. 120, 2010.

3C-2 Encourage the development of infrastructure to help increase agricultural production such as irrigation water and regional drainage improvements.

3C-7 Support regional aquaculture industries and collaborate with them on developing foreshore land use and water management policies that protect and steward on-shore and off-shore shellfish beds and marine water quality. Policy development should include community input to address impacts (e.g., visual, waste, noise, public access and navigable waters).

5B-1 Manage development on the basis of precautionary principles within watersheds of water supply lakes. This will require development proposals to include reports by appropriate professionals to study potential impacts on water quality and quantity, including a peer review of professional findings and recommendations.

5B-4 Where development is proposed in a watershed of a water supply lake that is controlled politically by one jurisdiction, but where the lake provides a water source to other jurisdiction(s), the jurisdiction responsible for approving development within the watershed will formally consult with the jurisdictions receiving water from the watershed.

5C-1 Local OCPs should include policies that encourage permeable surfaces within the design of new developments and public spaces.

5C-2 In watersheds of water supply lakes, local governments and the Ministry of Transportation and Infrastructure should work cooperatively towards a target of less than 10 percent impermeable surfaces.

5C-3 In Rural Areas the regional district should work with the Ministry of Transportation and Infrastructure to develop guidelines for an Integrated Stormwater Management to be used in the subdivision approval process.

5C-4 In order to ensure a sustainable aquaculture industry, local OCPs should include policies that require the cleansing of any stormwater draining into Baynes Sound.

6A-2 Work towards ensuring that development does not result in negative impacts on adjoining farmlands or shellfish tenures by affecting the volume and quality of ground and surface water, in particular storm water discharge.

The Regional Growth Strategy also offers guidance with respect to an “RGS Implementation Agreement” with MoTI that would be aimed at ensuring MoTI carried out subdivision approvals with RGS goals in mind.

Overall, the CVRD Regional Growth Strategy policy objectives offer support for improved practices within the existing framework, including elements of an integrated approach, but fall short of explicitly or implicitly establishing a specific mandate for integrated watershed management.

3.2 Regional Sustainability Strategy (RSS)

The CVRD Regional Sustainability Strategy contains several goals and objectives that are supportive of integrated watershed management:

Objective 2.1.3 Sustainable practices are used in site planning for new projects and redevelopment projects

Goal 3.7 Stormwater (rainwater) is managed to maintain the performance of watershed systems, preserve ecosystem health and protect groundwater

Objective 3.7.1 Buildings and sites are designed to manage stormwater in an ecologically sensitive manner.

While these goals and objectives do not have legal force, they represent support for integrated watershed management framed in a broader sustainability context, and may provide a link to other sustainability initiatives undertaken in the CVRD, by the regional district or by member municipalities.

3.3 CVRD Rural Comox Valley Official Community Plan

The OCP policies generally appear to support an integrated approach to managing rainwater from the site level to the watershed level.

For example:

A.2(g) Landowners and developers shall be required to protect natural drainage patterns which are vital to down-slope and surrounding wetlands and streams.

“Water Quality Policies” include:

A.5(a) Land development and management guidelines to decrease the impact of stormwater runoff on adjacent and downhill properties including Agricultural Land Reserve lands and receiving water bodies shall be developed and implemented in consultation with local government and senior government agencies.

A.5 (b) The land use policies in the Plan shall work to ensure an adequate supply and quality of water for fish bearing streams and existing settlement and economic activities.

A.5(c) At the next annual review of the OCP following the completion of a watershed management plan for a watershed in the Plan area, strategic level watershed management policies shall be considered for inclusion in the OCP.

A.5(d) The Ministry of Environment Land Development Guidelines shall be used to minimize the impact of stormwater runoff.²³

There are also a number of provisions that promote minimal environmental impacts of development within the electoral areas of CVRD.

Some of the other relevant policies include:

B.11 Resource-Based Economic Activities Objectives

B.11(d) To encourage responsible agricultural and forestry practices with respect to soil conservation, water conservation, vegetation removal, and stormwater management.

B.11(e) To control the deposit and removal of soil, gravel, rock and sand and the deposit of other materials on land in the Plan area.

C.10 Wastewater and Stormwater Policies

C.10(a) Development proposals shall be required to address stormwater management to ensure that post-development peak flows do not exceed pre-development peak flows.

C.10(b) The use of innovative technologies for the collection, treatment and discharge of wastewater and stormwater shall be encouraged.

C.10(c) The preparation, adoption and implementation of a Liquid Waste Management Plan for the rural electoral areas of the Comox Valley shall be supported.

C.10(f) The Regional District shall work cooperatively with local government and senior government agencies to develop stormwater management plans that support groundwater recharge, retention and re-use of winter stormwater, and address water quality.

²³ Bylaw No. 2042, Rural Comox Valley Official Community Plan, Schedule "A".

3.4 Electoral Area and Local Area Plans

Some more specific examples of relevant policies with Local Area Plans include: alternative road development standards; developing a Liquid Waste Management Plan for the Union Bay Improvement District area, for the Royston Plan area and for Area B; and emphasis on infiltration techniques. It is also recognized in the existing policies that the impacts of development on rainwater runoff are cumulative, although there is no description of any mechanism to manage this issue.²⁴

Many of these plans have a requirement that an area-level plan for integrated stormwater management plan that supports best practices in rainwater management be developed. However, it is not clear how, i.e. with what resources, these area-level stormwater management plans will be developed (see, for example, Area “A” Union Bay Local Area Plan).²⁵ As well, there is minimal reference to the offsite impacts of any rainwater management approach that is developed for onsite purposes. An exception is the Quenville/Huband LAP which includes the objective “Ensure residential developments incorporate green stormwater management practices to mitigate flooding/or contamination of Little River.”

Several of the Local Area Plans (Wilkinson Road Area, Anderton Road Area, Queen’s ditch watershed, and Saratoga/Miracle Beach) support the establishment of Local Service Areas for stormwater management.

The local area plans also have as an objective that the Regional District should establish service design standards compatible to municipal standards for areas adjacent to a municipality, which could be helpful, depending on whether the municipal standards require service design that promotes rainwater management in a way that helps to maintain pre-development flows.

In all the Electoral Areas there are also objectives related to undertaking a Stewardship Implementation Program, which would include:

- a Watershed Management Pilot Project, in concert with senior government agencies to identify technical and administration arrangements for practical implementation of integrated stormwater and environmental stewardship.
- A Watershed Best Practices Manual developed with senior government assistance.
- A Water Quality Bylaw, to set performance standards for erosion control and water quality measures, and to allow local government ticketing as an expedient alternative (to charges under the *Fisheries Act*) for minor offences.

²⁴ Area ‘A’ Electoral Area Plan

²⁵ There are also requirements within DPAs for stormwater management plans to be provided by developers, but there is less guidance and no reference to the detailed best management practices outlined at the area level.

In general, with respect to OCP, Electoral Area and Local Area Plans, there are numerous general and even relatively specific objectives with respect to managing rainwater that support an integrated watershed management approach.

3.5 Subdivision approvals

In the CVRD, subdivision applications are handled by an approving officer appointed by MoTI. CVRD staff are consulted by MoTI when applications are being assessed, but the final decision-making power rests with the approving officer. Because CVRD does not administer a drainage or stormwater service, it does not have associated resources, staff or regulatory tools, and it addresses referrals from the approving officer on a case-by-case basis.²⁶

According to MoTI staff, many subdivisions in the CVRD are considered to be too small to require a stormwater plan and imposing such a requirement is thought to be overly onerous for developers. A stormwater plan is typically required only where a subdivision creates five or more lots. Other factors considered by the approving officer in deciding whether to require a stormwater plan include whether stormwater studies have already been done for adjacent parcels, and whether there are indications that runoff should be managed. Local knowledge plays a role. According to MoTI staff, they have noted that CVRD would like to see on-site management of stormwater, and no increase in post-development runoff, and MoTI staff are setting requirements accordingly.²⁷

We are advised that the CVRD does not have a formal policy regarding subdivisions and drainage or rainwater management within subdivisions. Further, while the *Land Title Act* empowers and in some cases requires the approving officer to consider a broad range of matters with respect to subdivision applications, there is no indication that provincial approving officers are, in general, proactively requiring subdivision applicants to demonstrate that their developments are comprehensively addressing rainwater management issues.²⁸ Primary guidance for provincial approving officers with respect to site drainage refers to “hydraulic design plans for the design, construction and maintenance of British Columbia highways”.²⁹

²⁶ Debra Oakman, Chief Administrative Officer, Staff Report to CVRD, August 9, 2011 re: Electoral area stormwater and drainage management

²⁷ See Tanis Gower, Notes from MoTI, Fernhill Consulting Meeting, December 11, 2012.

²⁸ Anecdotal evidence seems to suggest that provincial approving officers focus mainly on drainage issues related to roads and highways, and while they may look at drainage issues related to construction within subdivisions, impacts between subdivisions are not considered.

²⁹ See BC Supplement to Transport Association of Canada Geometric Design Guide, 2007 edition.

http://www.th.gov.bc.ca/publications/eng_publications/geomet/TAC/TAC_2007_Supplement/Ch1000-2007.pdf It should be noted that this document does have

The present approach with respect to drainage and rainwater management in the subdivision approval process in the unincorporated areas of CVRD seems to be somewhat *ad hoc* and does not appear to be based on clear benchmarks or any follow-up or monitoring. This approach may not be producing consistent results at the subdivision level, and probably cannot be effective at managing rainwater within the District at a watershed scale. For example, impacts from one small development might be relatively small, but multiplied across many small developments the overall impacts could be significant. There does not appear to be a mechanism for linking watershed-level objectives to this current practice, or for cooperating with other local governments within the region to achieve common goals and avoid negative consequences, or for monitoring cumulative outcomes.

3.6 Zoning

There are several provisions of the CVRD zoning bylaw³⁰ that are relevant to rainwater management:

- In cases where dedication of lands for parks is required, stormwater management must be adequate “to minimize additional storm water runoff from one lot to another”.
- Where run-off associated with development would exceed “natural drainage limitation” there is a requirement to construct catch basins, storm sewers and detention ponds to mitigate this effect.
- Land developed must be designed to minimize disruption of the natural drainage pattern and to protect or mitigate impacts upon fish habitat.
- Multi-residential developments in certain zones must have on-site storm water detention.
- The CVRD Water Supply and Resource Area limits density and lot coverage within that zone, with the aim of protecting groundwater. This measure could also be considered a component of an integrated watershed management approach, because it promotes onsite rainwater infiltration.
- CVRD may request that the approving officer not approve a development if “the anticipated development of the subdivision would provide additional stormwater runoff sufficient to overload an existing downstream drainage facility, flood adjacent lots or negatively affect the fish bearing capabilities of downstream locations.”

guidance about “Watershed Characteristics” that are supposed to be taken into consideration with respect to drainage requirements. There are also run-off requirements, and applicants must provide a report that will “allow the reviewer to understand the developer’s objectives and to thoroughly assess the hydraulic impacts of the development.”

³⁰ CVRD Bylaw 2781.

At the same time, the zoning bylaw does not specifically address site coverage in terms of actual or effective permeability. Further, uses could be further refined and limited in certain areas, as set out in an integrated watershed management plan that identified critical areas for watershed protection.

3.7 Development Permit Areas and Applications

CVRD has designated several development permit areas (DPAs) that have provisions relevant to integrated watershed management. However, the DPAs themselves only cover a small fraction of the electoral areas of CVRD, meaning that their impact at the watershed scale is limited.

DPAs are a supple tool for rainwater management because they can combine broad prescriptions for land use within an area with site specific requirements for a given development. DPAs most relevant for rainwater management are those for protection of the natural environment, management of natural hazards and water conservation CVRD DPAs with relevant requirements include:

- DPA 1 - aquatic environmentally sensitive areas.;
- DPAs 6 and 7 - addressing stormwater issues; and
- DPA 8 - steep slopes.

In addition to the DPA guidelines, in its development application procedures CVRD requires certain general information:

Any proposed development must address impacts on ground water, on-site and off-site drainage, sanitary services, flood proofing, water supply, and transportation access. This may include studies prepared by professional engineers, soil scientists, biologists, and/or geotechnical specialist(s) on any of these areas of interest prior to consideration by the regional district. Terms of reference for these studies will be specified by the regional district, when required.³¹

Having these requirements as part of development permit applications allows the district flexibility with respect to the different types of assessments and studies that developers are asked to provide. This can be helpful from the point of view of not having requirements that are unduly costly or complex where not warranted. At the same time, this places some onus on CVRD staff to have the expertise to provide terms of reference for any studies that will be requested, and thus to have some understanding of the site environment and the potential impacts of any given development. Staff also need adequate expertise and training to be able to critically evaluate any studies that are provided, notwithstanding that the studies will be prepared by professionals retained by developers.

³¹ CVRD, Bylaw No. 3, Planning Procedures & Fees Bylaw, 2008, Schedule A-4.

Development permit applications are also required to have performance bonds for landscaping.³²

Similar to the process described for subdivision applications discussed above, in the absence of an integrated watershed management approach, there does not appear to be any mechanism to relate these servicing requirements to broader rainwater management objectives for the region, i.e. at the watershed scale. Nor does there appear to be any requirement or capacity on the part of CVRD to monitor effectiveness or maintenance of servicing requirements after implementation.

3.8 Development Approval Information Areas (DAIAs)

Development Approval Information Areas have been created within rural settlement containment areas that support stormwater management and the protection of the natural environment. Requirements include, for example, a site survey showing watercourses and wetlands, sloping terrain, and existing impervious surfaces, as well as the preparation of an “integrated stormwater management plan” for the proposed new development.³³

4.0 Liability issues for local governments in the context of stormwater management

There are two types of legal claims faced by local governments in BC that are most relevant in the context of rainwater management: actions in negligence and actions in nuisance.

Most of the case law dealing with problems arising from drainage issues concerns nuisance claims. However it is important to understand the basis for negligence claims against local governments as well, because the case law around negligence generally has been consequential—and not always straightforward—for local governments in terms of how they exercise statutory authority.

4.1 Negligence claims

A local government can be found to be negligent if it can be shown that, in exercising its powers, the local government failed to exercise reasonable care towards people to whom it owes a duty of care. A key consideration is whether the harm in question was reasonably foreseeable.³⁴

³² Ibid.

³³ See, for example, Area ‘A’ Union Bay Local Area Plan, Part 5.

³⁴ *Mustapha v. Culligan of Canada Ltd.*, [2008] 2 S.C.R. 114.

While the courts have made a distinction between policy and operational decisions, holding that operational decisions are most likely to attract liability,³⁵ this can be a relatively complex area of law and the subject of significant litigation. In general, once a local government has decided to offer a program or service, it should ensure that the program or service is offered with reasonable care to those likely to be impacted by the program or service.³⁶

Several cases illustrate how negligence has been considered by the courts in the context of drainage issues:

- In a case where a blocked storm sewer flooded the lower level of a private residence, the court found that the municipality was not liable for damages. In particular, the decision by the municipality to deal with tree roots by way of hand rodding was found to be a policy decision, based on a “number of considerations including manpower, equipment costs and availability, budgets, and the effects and costs associated with the different methods of dealing with such blockages”.³⁷
- The City of Abbotsford was recently faced with a claim of negligence after a ditch that it had constructed overflowed onto a private property and into a ravine, causing erosion and damage to the property. The claimant alleged that the City had a duty to maintain the ditch, and that its failure to do so was the cause of the overflow event. The Court found that the City *did not* have a positive duty to inspect drainage systems, and that it was protected from a negligence claim by its municipal policy stating that the maintenance of City facilities, including parts of the drainage system should only be carried out in response to “reports of observed defects” by city staff or the public.³⁸
- By contrast, the City of Port Alberni was found liable in negligence for a build up of gravel in the municipal sewer system, where it had put in place an inspection program that the Court determined was inadequate in light of the inspection system it had established for this foreseeable occurrence.³⁹

From these cases it can be seen that local governments do need to be aware of the potential for negligence claims with respect to the management of rainwater, and that the best defence is likely to establish clear policies for the maintenance of drainage systems that correspond to the resources available for implementation, and to ensure the policies are followed at an operational level.

³⁵ “Policy decisions are immune from liability unless they are made in bad faith or are so irrational or unreasonable as to not be a proper exercise of discretion” *per* Dohm J in *Craxton v. North Vancouver (District)*, 2006 BCPC 212.

³⁶ *Ann v. Merton London Borough Council* (1977), [1978] AC 728 (UK HL).

³⁷ *Craxton supra*.

³⁸ *Drader v Abbotsford (City)*, 2012 BCSC 873

³⁹ *Port Alberni (City) v Moyer*, [1999] 2 MPLR (3d) 74 (BCSC) (aff’d BCCA)

4.2 Nuisance claims

Nuisance claims against local governments in relation to drainage issues have been relatively more common than negligence cases. Nuisance arises where a local government has, unreasonably, interfered with the use or enjoyment of private property. There are several types of defences⁴⁰ available to local governments, but a number of BC cases confirm that local governments can be liable in nuisance for instances of downstream flooding associated with inadequate upstream drainage.

Section 288 of the *Local Government Act* provides a measure of statutory immunity, such that damages arising from the “breakdown or malfunction”⁴¹ of (a) a sewer system (b) a water or drainage facility or system, or (c) a dike or a road” will not give rise to liability in nuisance for local governments. However, this statutory immunity has been interpreted relatively narrowly by the courts, with particular attention to whether there has truly been a “breakdown or malfunction”. Where increased development is seen to be the cause, the statutory immunity has been found not to apply, as illustrated by the following cases.

- It has been found that there is no statutory immunity for local governments where damages arise from an insufficient design that is simply inadequate for the purpose it was meant to fulfill. This was the outcome of an action brought against the then-District of Surrey with respect to flooding from a ditch that crossed the plaintiff’s farmland. Surrey was relying on the ditch to convey runoff from upstream properties. However, increased upstream development meant that runoff increased and resulted in flooding on the plaintiff’s farmland during the growing season.⁴² The Court found that increased peak flows as a consequence of urbanization were foreseen by the defendant, and it did not take steps to mitigate the flooding.
- In another case involving the District of Matsqui a farm was flooded as a result of upstream urbanization. Again, the increased development led to increased runoff volumes and peak flows being discharged into a creek adjacent to the farm. The defendant municipality was found to be aware of the problem without addressing it, and was therefore liable in nuisance.⁴³

These cases illustrate the potential exposure that local governments face with respect to downstream flooding as a result of upstream development and inadequate management of runoff. However, it is likely not practical or politically tenable for a local government to take no action to manage rainwater in an area that is becoming urbanized, and doing nothing may not be a defence to claims in nuisance. As will be discussed below, an

⁴⁰ For example, one defence available to a local government is that the nuisance is the inevitable consequence of the exercise of its statutory authority.

⁴¹ Emphasis added.

⁴² *Medomist Farms Ltd. v. Surrey (Dist.)* (1991), 62 B.C.L.R. (2d) 168 (C.A.)

⁴³ *Kerlenmar Holdings Ltd. v. Matsqui (District)*, [1991] B.C.J. No. 3123 (C.A.)

integrated approach to managing rainwater at a watershed scale may offer opportunities to identify priority areas and solutions and help avoid downstream flooding scenarios.

5.0 Possible next steps for CVRD to support transition to integrated watershed management

In order to deal proactively with the types of issues that the CVRD has already identified (risks to property and public safety, need for greater cooperation among local governments within the District, need to address a range of land use issues affecting and affected by watershed function), the CVRD could consider developing a strategic plan for implementing integrated watershed management based on a scientific-technical assessment of watershed management needs, supported by community and stakeholder consultation to identify priorities for action.

The following description of legal and policy options could be considered as initial inputs to the process of considering options for rainwater management and developing a strategic plan, although further, more specific law and policy analysis would be required for implementation:

1. **Subdivision approval process** – As discussed above, the current process, where CVRD provides input that is taken into account by the provincial approving officer, has some drawbacks. There are questions about how effective the process is on a case-by-case basis and whether there is consistency in decision making. Further, there does not appear to be any assessment of cumulative effects, monitoring of results or any mechanism to link subdivision level rainwater planning (when it occurs) to management at the watershed scale.

One option is for CVRD to **request that the province authorize it to appoint an approving officer for the rural areas within CVRD.**⁴⁴ While this might address some of the issues raised already in this report about the subdivision approval process, it might also pose some challenges. Approving officers base their decisions on a wide range of issues, as set out in the *Land Title Act*, ss.85-86, and in the case of provincial approving officers, have a team of people working with them to provide relevant information and assess reports provided by applicants. As well, the approving officers liaise with a number of government agencies. A potential CVRD-appointed approving officer would need to be adequately equipped to fulfill these duties.

The Regional District of Okanagan-Similkameen has also recently considered whether to move to a regional district appointed approving officer. In that instance, in addition to capacity issues, concerns were raised with respect to appointment and funding. It was noted, for example, that there was a risk that a Board-appointed approving officer would not be seen to be a neutral party. As well, it appears that the provincial government may not currently operate the approval service on a cost

⁴⁴ *Land Title Act*, s.77.1.

recovery basis, meaning that the district would need to address funding issues. Finally, there are some unexplored areas of potential liability, given that there do not yet appear to be any regional district appointed approving officers in BC. Who would be responsible for approving officer decisions made prior to the appointment of the new regional district approving officer?⁴⁵ What kind of liability would an approving officer face with respect to decisions made if there were problems with the consultation with all the different government agencies?

In the case of CVRD, based on the information available for this report regarding staffing and resources, it appears that there may be challenges involved for the district in assuming this function. Moreover, having a regional district approving officer would not in itself improve rainwater management within the district, because the decisions about subdivision would still be informed by existing laws, bylaws and policies.

Alternatively, **the existing process could potentially be improved through better policy guidance.** As noted above, the RGS supports the development of an implementation agreement between MoTI and CVRD to address “integrated stormwater management” in the subdivision approval process. This would seem to point to increased and specific input from CVRD in the subdivision approval process, and could take the form of a “protocol” or other document outlining procedures, prepared together by CVRD and MOTI (with possible input from the Department of Fisheries and Oceans and other government agencies). Such an agreement would presumably address subdivision standards in a more specific and consistent manner, and would be an opportunity to improve rainwater management planning at the subdivision level. It might specify guidance, in particular, for development in areas not covered by development permit requirements. This approach would rely on effective cooperation and coordination between MoTI and CVRD, and agreement on priorities and approaches.

2. Another option would be for **CVRD to exercise its authority to develop a subdivision and servicing bylaw.** This would be an investment of time and resources, and significant outreach to developers might be required, but it would be a way to ensure greater consistency in rural areas, and could ultimately benefit the development community as well through greater certainty. There are examples of subdivision and servicing bylaws in BC that have been designed with rainwater management and the watershed in mind.⁴⁶ These bylaws can also be designed so that there are less onerous requirements for smaller subdivisions or developments that are already subject to development permits and detailed guidelines. Larger projects can be required to have an on- and off-site rainwater management plan prepared by a professional engineer with relevant expertise. To allow flexibility and the ability to

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http://www.rdosmaps.bc.ca/min_bylaws/contract_reports/CorpBd/2012/05Mar01/Planning/Subdivision_Approving_Authority.pdf

⁴⁶ E.g. District of Lantzville and District of Sooke.

tailor measures to different locations and types of development, requirements may be framed in terms of performance targets. It may be possible to develop content for a subdivision and servicing bylaw working cooperatively with other local governments in the District.⁴⁷ Once a subdivision and servicing bylaw is in place, the approving officer will have to ensure that applications for subdivision conform to the bylaw.⁴⁸ This would be perhaps the most direct way of ensuring that the subdivision approval process addresses drainage issues related to property development in a manner that reflects CVRD objectives. As discussed earlier, the MoTI approving officer is currently mandated to focus primarily on drainage issues associated with roads.

3. Development permits – CVRD is already administering development permits within electoral areas, and it appears **there are opportunities to enhance the effectiveness of the development permitting process in terms of rainwater management.** A requirement to consider the BC Water Balance Model⁴⁹ in developing rainwater management plans would be helpful, along with topsoil requirements.⁵⁰ A performance target approach may be a way to encourage innovation and leadership among developers. As noted above, requirements related to water conservation often also have important co-benefits related to managing runoff, and DPAs for water conservation can apply to development and re-development of single family dwellings. As well, a water conservation DPA could potentially include all areas covered by OCPs.
4. CVRD regulatory bylaws – **CVRD can use its bylaw powers under Part 26 of the *Local Government Act* to create run-off, landscaping and topsoil requirements that will create obligations for green infrastructure measures for all developments and re-developments,** including single family properties. While it is possible to incorporate requirements about landscaping and run-off into the zoning bylaw, this will involve specifying general landscaping requirements that apply across a zone or to specific uses or locations within a zone. Another, possibly more flexible option may be to develop a stand-alone bylaw using the run-off and

⁴⁷ This has been undertaken recently in the Kootenays, where a model subdivision and servicing bylaw that will address climate change impacts is being developed for communities by the Columbia Basin Trust.

⁴⁸ An approving officer must refuse to approve a subdivision that violates an applicable subdivision or zoning bylaw: see the *Land Title Act*, s. 87(b); *Seaview Land Estates Ltd. v. South* 1981 CanLII 439 (BC CA), (1981), 28 B.C.L.R. 288, 124 D.L.R. (3d) 610 (C.A.); and *White v. Raven* 1984 CanLII 745 (BC CA), (1984), 51 B.C.L.R. 382, 7 D.L.R. (4th) 595 (C.A.)

⁴⁹ The Water Balance Model Express for Landowners is also now available. See <http://waterbucket.ca/wscblog/2012/10/30/sustainable-rainwater-management-water-balance-model-express-landowners-ready-prime-time-november-29-victoria/>

⁵⁰ See Okanagan Basin Water Board, *Topsoil Bylaws Toolkit* (2012) http://www.obwb.ca/fileadmin/docs/TopsoilBylawsToolkit_2012.pdf

landscaping powers found at s. 907 and s. 909 of the *Local Government Act*.⁵¹ This authority could be used to set requirements for a rainwater management plan triggered by applications for subdivision, development permits, and building permits, for example. This type of bylaw could also specify conditions where it did not apply, and could also provide for discretion in its application. With respect to run-off, different requirements for different terrain and surface water or groundwater conditions can be specified. The MoTI approving officer would be required to apply the requirements regarding run-off, landscaping and topsoil⁵² to applications for subdivision.

5. **Zoning bylaws** – As noted above, the site coverage requirements in zoning bylaws can be expressed in the form of actual or effective permeability to further rainwater management objectives. Some local governments incorporate comprehensive requirements with respect to landscaping and run-off into their zoning bylaws. As noted in #4, this means specifying landscaping requirements applicable to an entire zone or to uses within a zone.
6. **Building bylaw** – CVRD already has a building bylaw, and it can make the issuance of a building permit conditional on meeting the requirements of, for example, a subdivision servicing bylaw.⁵³
7. **Creating a drainage service**– This could be done region-wide, or within a priority watershed, through an establishing by-law. Creating a region-wide service area would likely be the most effective way to achieve integrated watershed management in the district. In practice this would likely be a longer-term objective, and would require a careful assessment of the rainwater needs and objectives for areas within CVRD, and across CVRD as a whole, along with the costs and benefits of different approaches. A staged approach to implementing a CVRD-wide service could involve the creation of local service areas within priority watersheds, which is already contemplated in some of the existing local area plans. This would also give CVRD a chance to acquire experience with integrated rainwater management at the watershed scale. A successful pilot (or pilots) could create momentum for further action elsewhere.

⁵¹ See, for example, the District of Metchosin Rain water management and protection bylaw. It should be noted that Metchosin relied on additional authority under the *Community Charter* in drafting this bylaw, but the provisions regarding run-off and landscaping are relevant for CVRD.

<https://metchosin.civicweb.net/Documents/DocumentDisplay.aspx?Id=276>

⁵² As noted above, for a comprehensive overview of measures that local governments can take to protect topsoil and enhance rainwater management, see Okanagan Basin Water Board, *Topsoil Bylaws Toolkit* (2012)

http://www.obwb.ca/fileadmin/docs/TopsoilBylawsToolkit_2012.pdf

⁵³ *Local Government Act*, s.938(7).

CVRD has specific authority under ss. 540 and 542 to regulate drainage and drainage works provided by others, as well as authority (ss. 541 and 543) to make watercourses part of a regional drainage system and to appropriate land that constitutes the channel or bed of a stream passing through the regional district.

An advantage of creating services, generally, is that this provides a mechanism for funding, through property taxes or fees.⁵⁴ Development cost charges could also be imposed with respect to drainage works.⁵⁵ However, there could potentially be increased exposure to liability, if, for example, drainage works managed by the CVRD cause flooding on private properties. However, to the extent that CVRD continues to plan and manage upstream development, it is not certain that it will escape any liability as a result.

8. **Creating a region-wide service area for research, planning and public education**
– This could allow longer-term planning, assessment of priority areas, coordination of activities with member municipalities, and assist in building public support for action. There is potential for this to be supported by the existing CAVI inter-regional education initiative. There may be opportunities to share and exchange planning and technical information with other local governments in CVRD, where OCP renewal is also underway. As well, the Comox Valley Land Trust is actively engaged in regional conservation planning and its conservation strategy could be a key input to an integrated watershed management plan for the CVRD.

There is precedent for this type of service in other districts; for example, the Capital Regional District (CRD) is currently revising its stormwater service to develop a regional Integrated Watershed Management Program. The CRD also offers regional capacity-building workshops and other resources to improve rainwater management under existing stormwater-related programs.

9. **OCP amendments** could provide further specific policy and planning guidance, as a reference point for updating existing bylaws and developing new bylaws. Some suggestions would include:
 - a. An objective related to the need to address climate change impacts on rainwater management in CVRD;
 - b. Specifying the Water Balance Model as a decision support tool that can assist in understanding how site and neighbourhood level measures translate into impacts at the watershed level;

⁵⁴ *Local Government Act*, s.803.

⁵⁵ *Local Government Act*, s.933.

- c. An objective related to implementing adaptive management with respect to rainwater management policies and techniques.⁵⁶

10. Developing a Design and Policy Manual for Rainwater Management - While not a legal tool, this type of manual can provide guidance for developers and the approving officer with respect to meeting subdivision servicing requirements and conditions for development permits. It provides an opportunity to develop more detailed guidance than is typically included in bylaws, and can offer a variety of approaches that may be used to meet given objectives.⁵⁷

In conclusion, there is no single pathway towards managing rainwater to achieve an integrated watershed approach, and the possible next steps discussed above are not meant to be an exhaustive list of options. It appears from the CVRD documents reviewed for this report, in particular the RGS, OCP, Area Plans and Local Area Plans that there is already significant high-level guidance to support an integrated watershed approach to rainwater management within the CVRD. However, with respect to requiring measures on the ground, outside of development permit areas, which make up only a fraction of the CVRD Electoral Areas, there is little application of the high-level guidance. Decisions about which, if any, option(s) to pursue in more detail would ideally be based on a technical assessment of needs for watershed management within CVRD, and then tailored to priorities that were identified.

⁵⁶ See the City of Victoria OCP, which includes a chapter on adaptive management: <http://www.shapeyourfuturevictoria.ca/>

⁵⁷ See, for example, City of Coquitlam, Stormwater Management Design and Policy Manual. http://www.coquitlam.ca/Libraries/City_Hall_Files/Stormwater_Management_Policy_and_Design_Manual.sflb.ashx

Appendix 5: Meeting minutes

Meeting Minutes, CVRD Rainwater Coordinator

October 26th, 2012 - Project Watershed Estuary Working Group

- Details on the scope and intended outcomes of the project were shared
- Project Watershed is interested and willing to assist
- Plans for a future technical meeting will be made

October 29th, 2012, West Coast Environmental Law, Vancouver

- Meeting with Deborah Carlson to discuss and finalize the scope of the legal review
- Conference call with Kevin Lorette to confirm approach

October 30th, 2012 – Project Watershed Board

- The scope and outcomes of the project were shared in a brief update to the board
- The Board is highly supportive

November 2nd, 2012 – Project watershed technical staff/volunteers

- Potential criteria for choosing a pilot project were explained and discussed
- Maps were reviewed and problem areas and areas with development pressure were highlighted
- There was much focus on Washer Creek (impacts and issues) due to pending development there (Kensington Heights and also potentially Sage Hills).
- There was also discussion about the Courtenay expansion area south of Millard Creek, as it already has flooding problems, plus the adjacent area recently annexed (Buckthorn) is already causing problems.
- Not much was known about the Saratoga/ Miracle beach area but the name of the residents association chair was given
- Wilkinson Road (Little River) is another potential area for a pilot.

November 16th, 2012 – Comox Valley Conservation Strategy, regular board meeting

- Brief update regarding the scope and intended outcomes of the project

MOTI/Fernhill Consulting meeting minutes: December 11, 2012, 9:00 – 10:30 a.m.

Present: Bob O'Brien, Operations Manager; Larry Park, District Technician; Tanis Gower, Fernhill Consulting

Regarding stormwater management in subdivisions:

The District Technician uses his discretion regarding whether to recommend that a stormwater management plan be required. (It is the Provincial Approving Officer that ultimately decides whether a stormwater plan is required in the preliminary subdivision approval.) Many subdivisions are too small to require a stormwater plan and such a requirement would be onerous for the landowners. A stormwater plan would typically be required where there are to be 5+ lots. In some cases there are stormwater studies done for adjacent parcels which indicate whether or not runoff is an issue and whether or not a new stormwater management plan will be required. Local knowledge of the history of the area is also a factor in deciding whether a stormwater plan will be required. MOTI is aware that the CVRD wants on site management of stormwater and that post-development runoff should not exceed pre-development runoff, so this is typically being required. Stormwater plans are reviewed by MOTI.

Bob and Larry note that the newer subdivisions are causing fewer water problems than are existing landowners who are making changes to drainage on their lands, e.g. more connections to road ditches to drain their land, or changing the stream on their lands.

Note: MOTI ditches are built to drain the road only, even though the individual lots in subdivisions typically drain to these ditches as well and are probably a greater source of runoff. Drainage from individual lots is something the CVRD can address through the building permit bylaw and/ or a subdivision and development servicing bylaw. The zoning bylaw may also apply.

Regarding a potential pilot project:

MOTI is interested to collaborate and will be looking to find a suitable site. New, larger subdivisions are not really happening so it is going to be a retrofit effort, to either i) address an area that is known to cause problems with flooding and sediment, and/or ii) address an area that is known to drain into high value stream habitat. The types of projects that could be done were discussed: a ditch could be retrofitted to provide more retention and infiltration. A ditch could be converted into a swale to address water quality (and potentially water quantity as well). It is possible that more extensive infiltration/retention could be done if the right of way were large enough (e.g. raingardens). In future, collaboration between the CVRD and MOTI could include different road standards and the use of BMPs for a new subdivision. Bob O'Brien will be taking a drive to look at a couple sites (Brooklyn Watershed, potentially Black Creek and other sites) and will be in touch with Tanis before Christmas to report whether any site seems suitable. Note: there are occasionally easements across private property for the purposes of drainage and these could present another possibility.

Bob notes that whatever is created needs to be maintained and that can be an issue with the maintenance contractor. They don't have a contract to maintain anything more complex than a ditch. If a raingarden needs maintenance, who will do it? Note: the maintenance contractor mows from 1.8 meters from the shoulder break from the road on an annual basis. This often does not include ditches that are more than 1.8 m from the shoulder break. If ditches are not maintained by the landowner and become overgrown with shrubs then the contractor will mow them occasionally for flow capacity (e.g. every 5 years).

Regarding general communication between MOTI and CVRD:

Dealing with the public in this transition period with the new RGS is sometimes challenging. More communication between the agencies (planning staff) would be helpful when specific issues arise.

Regarding driveway culverts:

The province made the decision to stop issuing licenses for driveway culverts. Bob and Larry were unaware of any issues resulting from this. When people come to their office for this purpose they give them advice and best practices. If MOTI is informed of a problematic driveway culvert they will go out and take a look. New road ditches are designed for a driveway culvert of 16". Older subdivisions may only have room for 12" culverts.

MOTI still does permits for commercial access and access to major routes (Ryan Road, 19A). They also give permits to close in a ditch to use as a parking lot.

Village of Cumberland/Fernhill Consulting Meeting Minutes:
December 18th, 2012, 1:00 – 2:15 p.m.

Present: Judy Walker, Planner; Rob Crisfield, Manager of Operations; Tanis Gower, Fernhill Consulting

Tanis described her role and the CVRD's project goals.

Judy and Rob discussed how stormwater is being managed in Cumberland, and challenges and capacity issues.

Cumberland's OCP is due for an update in 2013 and this will likely mean some updates on stormwater policies. They would appreciate working with and sharing information with the CVRD on this, as the CVRD does their own OCP.

Cumberland can be challenging for managing water through infiltration, as much of it is either bedrock or wetland. Some of the Coal Valley subdivision is on solid rock. In one area they have covenants on each lot for infiltration, with some lots more capable of this than others.

Another subdivision is Carlisle Lane – they are doing retention. This is seen as a step forward.

McElhanney Engineering is often the consultant to developers for stormwater. They typically do retention ponds. Stantec is the consultant for the Village of Cumberland to review proposals.

Cumberland has significant problems with inflow and infiltration in the older areas of the village. They also have terrible water quality going into the Trent River from their sewage plant.

Regarding green infrastructure such as swales and raingardens: Cumberland does not currently have the capacity to deal with these, as they have no parks department and no way to oversee any ongoing maintenance. Even if this option is cheaper overall it would need landowner buy-in to be able to work.

Are there downstream effects from stormwater currently? Yes, there have been complaints about the runoff from Coal Valley property, which drains to wetlands and Maple Lake. There are issues with Roy Creek. Historically the complaints were from landowners downstream of logging.

Cumberland would appreciate educational opportunities via the CVRD, to improve stormwater management. (This option was mentioned by Tanis, as this role has been taken on by the CRD in the past, for local government staff and consultants.) Cumberland could be doing more to manage stormwater.

City of Courtenay/Fernhill Consulting Meeting Minutes:
December 20th, 2012, 2:00 – 2:45 p.m.

(Notes from Tanis' pre-meeting research: the City is a member of the Water Balance Model, and requires 300 mm of topsoil (in some cases 450 mm) in all new subdivisions. Stormwater is managed depending on the development – a stormwater management plan is generally required for non-residential and multi-family DPAs. The City's engineering requirements for land development state that the developer is responsible for management of runoff on and entering the property)

Present: Tanis Gower, Fernhill Consulting. Derek Richmond, Sandy Lerwick and Nancy Hofer, City of Courtenay.

Tanis introduced herself and explained her role, the purpose of the meeting and the work the CVRD is undertaking.

Derek Richmond expressed concern and confusion about the purpose of the meeting, as collaboration with respect to these topics is already underway with CAVI. More discussion was had about the aims and outcomes of the project. Given her background,

Tanis may eventually become involved with CAVI but at this time is on a short term contract for some specific deliverables.

Derek Richmond had to depart for another meeting at 2:30 p.m. Tanis continued the discussion with Sandy and Nancy. Tanis asked specific questions about how stormwater is being managed in the City of Courtenay, what performance standards are used, how well and how consistently stormwater is managed, and who is doing the technical work.

McElhaney is the engineering consulting company used for probably 80% of the projects. The contact name is Bob Hudson. He is doing the work at Buckstone (new subdivision).

With respect to stormwater, there are no specific performance standards used. Rather, the extent of stormwater management depends on the capacity of the site. However, all development (or, potentially, all development in DPAs and along streams and wetlands) in Courtenay must adhere to the Land Development Guidelines (1992, MELP) which recommend the 2 year rain event to be maintained on site.

The topsoil requirement is there, but is not monitored or enforced. It is not known how much of a difference it makes.

In smaller developments infiltration galleries are generally required. However it is known that these will eventually get clogged and fail. There is no overflow and no way to determine when/if these galleries have failed.

Raingardens are not practical where road salts (plowed snow) can be deposited in them and kill the landscaping.

The City of Courtenay is developing a Transportation Plan. There could be some generic designs included for rainwater management in boulevards.

Stormwater management varies, and there is always room for improvement.

In general it appeared that Courtenay does not have the staff capacity to determine whether their stormwater efforts are effective at managing downstream or cumulative effects.

MOTI/Fernhill Consulting Meeting Minutes:
December 28th, 2012, 1:30 – 2:00 p.m.

Present: Tanis Gower, Fernhill Consulting; Bob O'Brien, MOTI Operations Manager

The meeting was held at Parry Place, to examine the ditch network there. Brooklyn Creek runs in a ditch on both sides of the road, from a channel through Longlands golf course. As well, a culvert from Crown Isle delivers water to this point. Bob and Tanis discussed

the possibility of using the road ROW to improve the ditches for fish habitat. Before this location is decided upon, Tanis and Bob will speak to Angie Allwood (MOTI Area Manager, Roads), as she has a great deal of local knowledge and may know of other sites where more straightforward green infrastructure can be applied or retrofitted.

Fernhill Consulting/Town of Comox Meeting Minutes:
January 10th, 2013, 2:00 – 4:00 p.m.

Present: Marvin Kamenz, head planner; Shelley Ashmore, head engineer; Tanis Gower, Fernhill Consulting.

(note: Tanis' research beforehand indicated stormwater measures in the 2011 OCP, some yet to be implemented or optional. DPAs that require stormwater management are for multi-family residential and infill housing. There are also requirements for runoff (groundwater quality and quantity) to not affect Lazo marsh (DPA 16) or fish habitat. There is also a local service area for detention ponds in a subdivision upstream of Lazo marsh. There is a general DAIA that covers the entire town. Water quality monitoring is done for Brooklyn Creek and three other areas. Comox expects to put more stormwater related measures into an updated Subdivision and Development Servicing bylaw)

Marvin is not enthusiastic about broad initiatives with high aspirations that may not produce practical results (e.g. Nature without borders, a Blueprint...)

Comox has Hilton Springs for which there are water rights in the Regional District (Queen's Ditch). They have Lazo marsh which is affected by and depends on the groundwater table.

For subdivisions, the approving officer has broad discretion to ask for stormwater management such that subdivisions are their own category for stormwater management.

Currently, Comox subdivisions include a rock pit with associated geotechnical engineer's report. They have a dual system, i.e. they design the storm drain as if there is no rock pit.

Comox is at a juncture where stormwater management has become a critical issue. The town has limited room to expand and limited areas that are not already developed, and those areas have issues with water. The focus is currently on NE Comox, where a stormwater management plan (funding by three developers) is in progress. NE Comox drains into the Queen's Ditch watershed, where flooding on agricultural land has been a legal issue. Any further development must not contribute any further runoff. This has required extra study and extra requirements because the typical engineering studies done are not adequate to deal with all runoff from a site (typical focus is on a detention pond for a certain frequency runoff event, e.g. 10 years). Comox has a consultant: Jim Dumont of Morrison and Hershfield, who is their expert and is reviewing the plans. Their in-house capacity is very low.

The performance targets that come out of the NE Comox study can hopefully be applied throughout Comox. Comox expects their Expansion Area B to have the same issues as NE Comox. It has ALR lands and unmanaged stormwater. It is next door to Crown Isle where detention ponds are not working well. Crown Isle is expanding and saying they can't meet the formerly agreed upon targets for runoff.

Comox recently spent \$2 Million on a diversion for Brooklyn Creek, to deal with flooding along the channel.

Comox has taken the approach of having extensive DPAs, but with many exemptions for standard practices such that many applications don't need a permit. There are stormwater measures for the multi-family and the infill housing DPAs. Additionally, their DPA #16 is very specific for managing the groundwater that feeds Lazo marsh, and developments can't affect groundwater quantity or quality. They also have a DAIA that covers the entire municipality and gives them discretion to require studies.

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Appendix 6: Examples from other jurisdictions

November 2012

No other regional district has enacted the suite of bylaw and policy updates that the CVRD is investigating. However there are BC examples that can inform the CVRD's efforts. This is not an exhaustive list.

Regional District of Nanaimo

- Has a subdivision servicing bylaw. With regards to stormwater, the Master Municipal Construction Documents standards must be met. No rainwater bylaws or local service areas are in place. If BMPs are referenced, it is the provincial guidebooks.
- Has a service area for watershed protection
- Has a Yellow Point Aquifer Development Permit Area for groundwater (aquifer) protection to address groundwater declines at Yellow Point. This includes subdivision (water availability from wells) and construction of individual dwellings (rainwater retention from roofs, and impervious area restrictions).
- Has a 2012 Rainwater Harvesting Best Practices Guide to ensure that residents build safe and effective rainwater harvesting systems. This guidebook is well done and can be applied to rainwater re-use in the CVRD.
- The five year Stormwater Action Plan described in the Provincial Stormwater Guidebook was not adopted.

Cowichan Valley Regional District

- Has a Cowichan Basin Water Management Plan:
Objective 4e. Promote stormwater management that emphasizes infiltration and detention and minimizes impervious surfaces to avoid increases in peak flows.
4e-1. Install appropriate stormwater management infrastructure based on Low Impact Development (reduced runoff, on-site infiltration) in new developments and retrofit existing developments to reduce peak runoff consistent with the FDMP.
4e-2. Adopt subdivision or development services bylaws and Official Community Plan policies based on Low Impact Development principles.

Capital Regional District

- Currently taking on stormwater management for the Saanich Peninsula (North Saanich, Central Saanich and Sidney municipalities). This is to be accomplished by water quality standards at the point where the runoff from a parcel hits the pipe at the property line. No specific infrastructure solutions or requirements are developed at this time. It is expected that water quantity problems will be dealt with by proxy by dealing with water quality.
- Has an Integrated Watershed Management program under development.
- Has a Stormwater, Harbours and Watersheds program. Regional water quality at stormwater outfalls and creeks has been monitored for years under the Regional Source Control program. In addition, educational and capacity building workshops are occasionally offered to member municipalities and the public.

- Since 2004 the CRD has also hosted the half-time coordinator position for the Bowker Creek Urban Watershed Renewal Initiative, which is seen as a regional pilot project. This initiative has developed the Bowker Creek Blueprint (A 100-year action plan to restore the Bowker Creek Watershed), which is a voluntary guidance document for the three municipalities and the regional district. This document is high profile and is being implemented by updating local government documents and practices.
- Previously developed the *Model Storm Sewer and Watercourse Protection Bylaw*, which was adopted by only one municipality.

Metro Vancouver

- Has a “next generation” Liquid Waste Management Plan, which can be seen as a rainwater management plan for the region. - *The long-term vision for liquid waste management in Metro Vancouver is that all elements of liquid waste will be efficiently recovered as energy, nutrients, water or other usable material or else returned to the environment as part of the hydrological cycle in a way that protects public health and the environment.*

Municipalities will:

- 1.1.20 Update municipal bylaws to require on-site rainwater management sufficient to meet criteria established in municipal integrated stormwater plans or baseline region-wide criteria. *2014*
- 1.1.21 Update municipal utility design standards and neighbourhood design guidelines to enable and encourage on-site rainwater management. *2014*
- 3.4.7 Develop and implement integrated stormwater management plans at the watershed scale that integrate with land use to manage rainwater runoff. *Plans by 2014*

Performance measures:

- watershed and stream health indicators as set out in the integrated stormwater management plan template..
- number and area [hectares] of integrated stormwater management plans completed

<http://www.metrovancouver.org/about/publications/Publications/IntegratedLiquidWasteResourceManagementPlan-ApprovedGVSDDBoard.pdf>

Central Saanich

- Has Integrated Stormwater Management Plans (2009) for three watersheds, which together cover almost the entire municipality. These are the first to be done in BC according to the guidelines in the 2002 Stormwater Guidebook. Facilities and hydraulic improvements based on modeling are proposed to deal with flooding and water quality issues but source controls are also emphasized. Recommends adopting a single Integrated Stormwater Management Bylaw that would set standards, and then make complimentary changes to manuals and other bylaws. Agricultural issues/BMPs are a big part of these plans. Page 174 has OCP policy recommendations.

http://www.centralesaanich.ca/hall/Departments/Engineering_Public_Works/Integrated_Stormwater_Management_Plan_ISMP_Study.htm

District of North Vancouver

- For rezoning, the location of services must ensure that all storm water is contained on site.
- A stormwater management plan is required for all subdivisions and other development as defined in the Development Services Bylaw (includes rezoning and building permits)
- The Development Services Bylaw references a Design Criteria Manual (1996). This has very clear performance targets (mm of rain that must be handled on site for new developments and release rates for storage facilities) based on the Provincial Stormwater Guidebook. For redevelopment, the effective impervious area must not be increased, OR, if imperviousness already exceeds 50%, the effective impervious area must be brought down to 50%. The Water Balance Model is to be used to design source controls. The Design Criteria Manual is highly detailed and where watershed studies have been conducted proponents must follow those recommendations as well.
- A bylaw and prescriptions to address impervious area increase through redevelopment are currently under development
- Hastings Creek Watershed Blueprint is in development

District of Sooke

- Has a Liquid Waste Management Plan for rainwater (2011) - to protect existing water quality, prevent future damage, and remediate areas that may already be damaged... The plan includes strict controls requiring each development site to manage its own stormwater.
http://www.sooke.ca/EN/main/government/devservices/environment/lwm_rain.html
- Action underway in 2012 to adopt bylaw 404 (subdivision approval)
- rainwater quality protection bylaw is under development
- OCP encourages use of rainwater collection systems for landscaping purposes, and minimizing impervious surfaces and using LID methods. Includes DCCs for rainwater management.
- Are proceeding with development of Rainwater Management Plans for 18 watersheds over 7 years. Four are completed.
- Undertaking a LID pilot project

City of Surrey

- Minimum topsoil depths
- Development Cost Charges for stormwater management including land acquisition (greenway) for stormwater/multi-use purposes.
- Fergus Creek watershed plan (protecting stream health in the suburban environment through large scale greenways and using analytical methodology)
- East Clayton neighbourhood (downspout disconnection and infiltration trenches)

District of Metchosin

- Has a bylaw (2004) for the protection and management of rainwater. Some of the legal authority under the *Community Charter* is available to munies but not regional districts (unless powers are referred by munies). Includes rainwater management manual and subdivision drainage certif. 90% of rainfall is to be managed on site, and source controls are advocated. There is a limit on effective impervious area of 10%. Performance standards are detailed for water quality, runoff rates and volumes, erosion and sediment control, management of effective impervious areas, and drainage systems. Design criteria are included.
<https://metchosin.civicweb.net/Documents/DocumentDisplay.aspx?Id=276>

City of Chilliwack

- Has a Surface Water Policy and Design Criteria Manual (2002), which replaced the drainage part of their subdivision bylaw
http://www.chilliwack.com/main/attachments/files/658/Surface_Water_Management.pdf
- Was used as a case study for the Provincial Stormwater Guidebook and developed useful performance standards and site design criteria
- May not have fully implemented the LID requirements and other stormwater related plans
- Has landscaping and runoff requirements in a landscaping bylaw, and also in development permit area requirements.

City of Nanaimo

- Requires all development to meet pre-development flows (surface and groundwater) for 10 year events. Detention ponds are no longer used, and pre-development baseline conditions are based on a forested site.
- DPA2 (for ESAs) requires that "development must not either increase or decrease the amount of surface and/or groundwater or affect the quality of water available"
- The subdivision bylaw potentially contradicts infiltration efforts by requiring pipes or culverts and ditches.

City of Courtenay

- Often requires exfiltration before runoff hits the storm sewer. Stormwater measures depend on the development and the capacity of the site.
- Is mapping the 200 year floodplain in the City.

District of Saanich

- Has a Watercourse and Drainage Regulation Bylaw – primarily re: not obstructing watercourses and asserting municipal control over watercourse (appropriate or compensation as part of the municipal drainage system). Some language might be useful for driveway pipe sizing. There is also language about requiring a downstream stormwater management facility and oil and grease interceptor.
- Saanich subdivision bylaw, Schedule H , to manage runoff rate (encourages storage)
- As described in the Green Infrastructure Guide (WCEL 2007), there has been a move toward rain gardens and infiltration that was not anticipated as a strategy in

the subdivision bylaw. There may be a move toward performance standards instead of a prescriptive approach.

District of Lantzville

- Has a Subdivision Servicing Bylaw that incorporates LID standards and is specific regarding rainwater management components and design.

City of Victoria

- Stormwater Utility being implemented now – refer also to Kitchener, Ontario example.
- Development Cost Charges (incentives) under development

City of Coquitlam

- Has rainwater management guidelines and Integrated Watershed Management Plans underway for each watershed
 - <http://www.coquitlam.ca/city-services/drainage-sewer/stormwater-management/rainwater.aspx>
 - <http://www.coquitlam.ca/city-services/drainage-sewer/stormwater-management/integrated-watershed-management.aspx>
- The web-based guidelines have an overall runoff reduction target (capture 75-90% of average annual rainfall volume) and source control measures that are required for new development in managed watershed. These source controls are prescriptive (not performance based). Regional water quality ponds are for areas where source controls cannot meet the water quality targets
- OCP language for rainwater management / watershed studies / adopting Stormwater Policy and Design Manual (2003)
- Subdivision development servicing bylaw and supporting stormwater management policy and design manual (2003). Engineer must prepare a stormwater management plan in accordance with the manual, with the master drainage plan, and with any watershed studies (that guide detailed design criteria) <http://www.coquitlam.ca/city-hall/bylaws/frequently-requested/subdivision-and-development.aspx>

The City of Vernon

- Has landscaping bylaws that may inform CVRD efforts.

The City of Prince George and the City of Richmond

- Have zoning bylaws with landscaping requirements that may inform CVRD efforts.

The City of Kamloops

- Building permits require a landscaping plan.

Okanagan Water Board

- Has just released the Topsoil Bylaws Toolkit, which gives local governments practical tools that support smart topsoil policies. The Toolkit presents basic principles of topsoil science and management. It also provides sample policy and bylaw language. http://waterbucket.ca/wp-content/uploads/2012/05/OBWB-and-PWSBC_Topsoil-Bylaws-Toolkit_2012.pdf
- Has a Groundwater Bylaws Toolkit
http://www.obwb.ca/groundwater_bylaws_toolkit/

See also:

Green bylaws toolkit: <http://www.greenbylaws.ca/>

Central Saanich's 2009 review of useful bylaw examples for rainwater management: <http://www.centralsaanich.ca/Assets/Central+Saanich/District+Projects/ISMP+Appendix+16.pdf>

Okanagan's homeowner's guide for using rain as a resource – Okanagan Basin Water Board 2011
http://www.okwaterwise.ca/pdf/HomeDrainageGuide_Okanagan.pdf

Green Municipal Fund's water bylaws – examples from other jurisdictions
<http://www.fcm.ca/home/programs/green-municipal-fund/program-resources/green-municipal-bylaws/water-bylaws.htm> plus Burlington's topsoil bylaw
<http://www.burlington.ca/clerks/by-laws/html/6-2003.htm>

West Coast Environmental Law's Smart Bylaw's Guide
<http://www.wcel.org/issues/urban/sbg>

Appendix 7: Backgrounder: Rainwater Management in the Comox Valley

Land use, policy and practice

By Alison Mewett, Landscape Architect

A PRIMER IN LAND USE HYDROLOGY

Rainfall

The Comox Valley receives approximately 120cm (48 inches) of precipitation/year. In pre-development scenarios the landscape was fully forested and 10-15% of this water is lost to interception and 30-40% to evapotranspiration. This accounts for as much as 50% of precipitation and explains why just clearing a forest can have a significant impact on runoff.

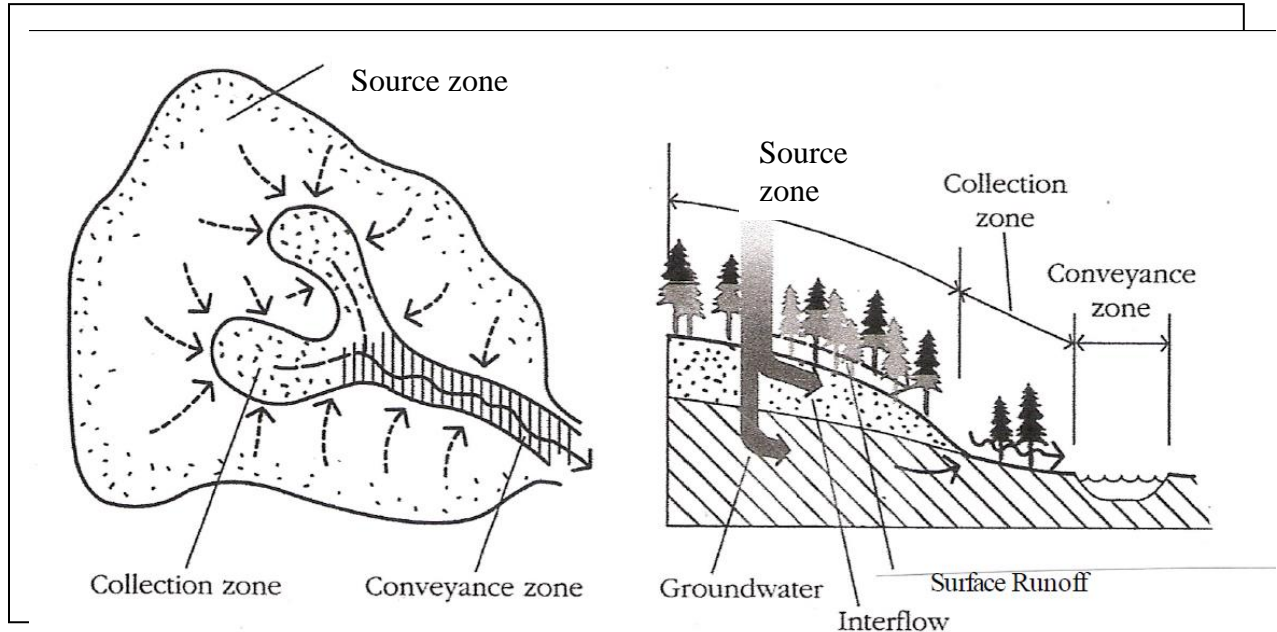
Of the rainfall that does reach the ground most is held in *depression storage* cells, small hollows and irregularities on the forest floor, such as the pits formed by uprooted trees. So abundant is depression storage in heavily forested land that it can retain all the through fall from a large winter rainstorm. This water is then subsequently slowly released into the ground. But when land is developed, no matter whether it is for farming or communities, its depression storage capacity is largely obliterated. In residential development, for example, our tendency is to grade all landscaped areas into smooth and slightly convex forms that readily and quickly shed water rather than store and infiltrate it.

Runoff Systems

A large proportion of rainwater that reaches the ground leaves the site as runoff. There are three forms of runoff: surface runoff, interflow, and groundwater. Surface runoff begins as overland flow and leads to intermittent channels, ditches, and streams. Interflow, which is far greater in volume than overland flow and the single largest source of stream flow in the upper reaches of forested watersheds in the Comox Valley, is rainwater that moves into the soil, and then slides laterally (and very slowly) downhill. The depth at which this happens depends on the soil column and depth of bedrock. In the soil layer it often moves along low impermeable horizons such as hardpan. The third form of runoff is groundwater. This is water that percolates into a deeper level of soil, surface deposits, and bedrock, saturating interstitial spaces. In large watersheds like the Tsolum River or the Trent River it is decidedly the largest source of stream flow and is instrumental in maintaining river base flows throughout the summer and fall.

Watershed Anatomy

All sites belong to watersheds and each watershed is made up of three hydrologic zones: source, collection, and conveyance. According to Marsh (2010), each functions differently and therefore requires different planning and management responses in how rainwater and stormwater should be handled.



F the greatest opportunity for stormwater mitigation

Those areas that do not have surface runoff are called noncontributing drainage areas. An obvious noncontributing area would be one with deep, permeable soils and substantial forest cover. If there aren't any streams on a site, or any signs of surface runoff, such as ephemeral channels or rills, then it is doubtful that the site generates any rain/stormwater runoff in the form of surface/overland flow. In these circumstances runoff is moved as interflow and/or groundwater, or is taken up in depression storage as soil moisture. This is particularly common in forests (and lands that were originally forested), where there is considerable surface roughness and high soil permeability and porosity, a condition found throughout the Comox Valley.

Source controls are the appropriate Best Management Practices (BMPs) in these circumstances. These measures should more or less mimic nature by holding and infiltrating rainwater at its point of origin. This can include increased canopy interception, depression storage, soil absorption, and various infiltration methods including dry wells, infiltration beds and porous pavers.

Channel and Drainage Density

Most watersheds in the Comox Valley historically had a low drainage density, meaning that the total length of stream channels per square kilometer of watershed was low. Given this, how did available rainwater run off the land if not by a system of surface

channels, or more accurately put, how did runoff water find its way to the occasional stream channel? In the absence of surface channels, the only alternative for runoff is interflow and groundwater, both exceedingly slow delivery systems.

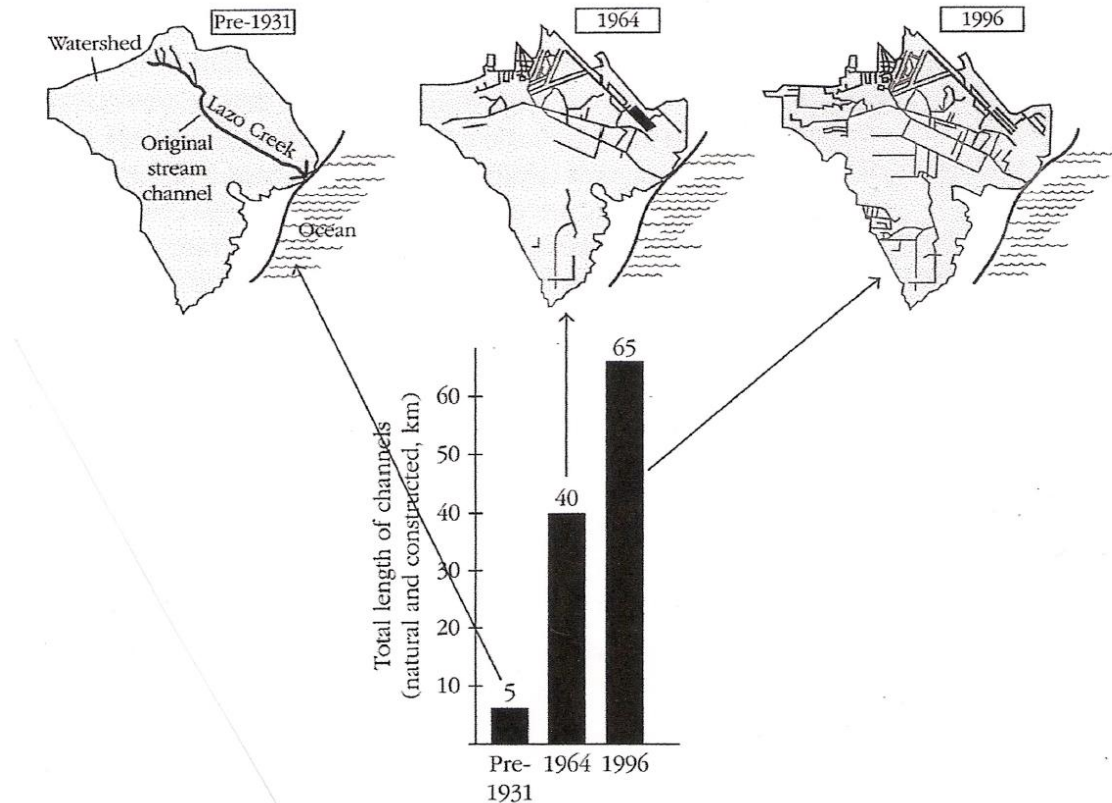


Figure 2: Drainage density change from 1931 to 1996 from road, agricultural, and urban development, a 13-fold increase

With clearing and development, these same watersheds have been transformed into systems with high drainage densities. To the original streams have been appended scores of road ditches, farm drains, and/or storm drains. This means that much of the rainwater in the watershed is now running off in channels as surface runoff, at a rate far exceeding that of interflow and groundwater. In a word, the slow underground delivery system has been overridden by a much faster system and this spells more and larger storm flows, poorer water quality, and more flooding.

Appropriate BMPs where drainage density is artificially high include:

- 1) prohibiting the addition of more artificial channels and higher drainage density within a watershed;
- 2) disconnecting the (manmade) storm drain system appended to the original stream and diverting the runoff into the ground; and
- 3) storing and infiltrating collected water rather than discharging it to a stream.

Site-scale Rainwater System

There are three parts to the site scale (as opposed to neighbourhood scale) rainwater system:

- 1) *the production system*: This is the surface water generated onsite from cleared and developed land that is available for rain/stormwater runoff. Production begins with land clearing, and commonly includes soil compaction, construction of impervious cover, and re-grading of the land;
- 2) *the removal system*: This is the means by which rain/stormwater is released from the site and discharged into a delivery system. Removal mechanisms include gutters, downspouts, ditches and yard/tile drains, and re-grading the land; and
- 3) *the delivery system*: This is the means by which rain/stormwater is conducted to a receiving water body. Delivery facilities include curbs, gutters, road ditches, storm sewers and detention ponds; all high priced infrastructure.

Once in place the removal and delivery system override or bypass the natural hydrological system, making it far more “efficient”. That is, stormwater is produced, removed from the site, and discharged into nearby streams very quickly, tens of times faster than is possible under natural conditions.

A RAINWATER MANAGEMENT POLICY AND PLANNING APPROACH

The first rule in managing water removal systems is that the further you are from the source in a runoff system, the fewer your management options and the greater the cost of management measures.

Applied to rain/stormwater, this means that (1) there are more options (that is, more latitude in the methods and techniques used) where runoff begins than further down the drainage network where it ends up, and (2) the cost of the options rises dramatically with distance down the drainage network (system). Both of these points are supported by planning and stormwater management literature, especially the latter which shows the pipe and pond approach to stormwater management to be 40 to 50 percent more expensive than source control.

The second rule in stormwater management is that there is a wide range in hydrologic performance, or hydrologic versatility, in virtually every landscape. This versatility is invariably related to geographic differences in landforms (topography), drainage, and soils. Forested landscapes such as existed over much of the primeval Comox Valley consistently produced little or no overland flow because of naturally high rates of canopy interception, depression storage and soil infiltration. By contrast, selected areas of exposed bedrock or wetlands produced local overland flow. The point is that in order to manage stormwater the hydrologic character of the land needs to be considered. This rule couples with the first one by asking how the land performs at some location and where that location is in the runoff system.

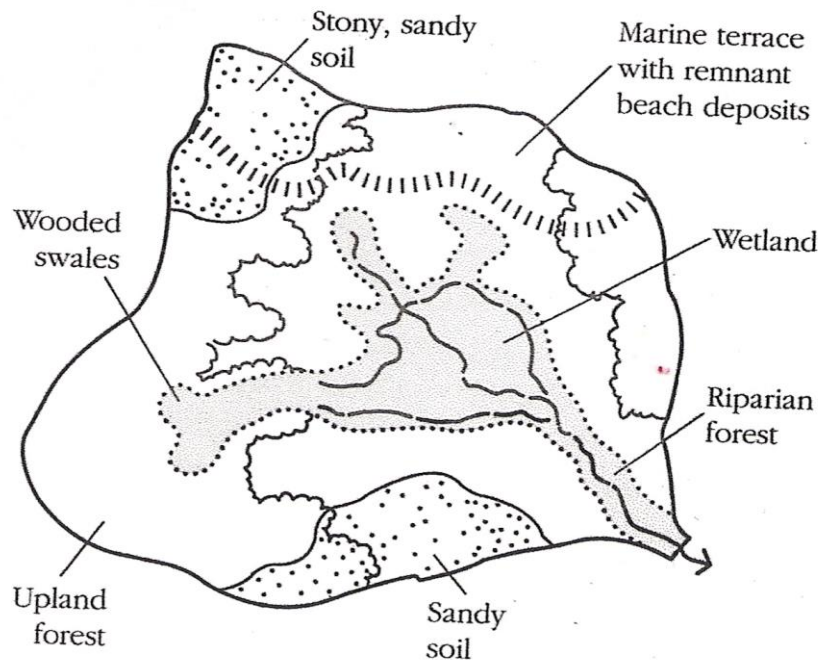


Figure 3: this diagram suggests the diversity of stormwater allocation in a diverse watershed

Perhaps the best place to begin when considering rain/stormwater management is to consider what the “best case” scenario would be for land development – especially if we could start again. In this way we can consider possible techniques or means of achieving desired outcomes; ie, what legislated options are available or could be exercised by the Regional District to achieve these outcomes.

Firstly – Do not develop on land that is poorly drained.

All land can be categorized as either *water shedding* or *water collecting*. Poorly drained lands are those that are water collecting. It is easy to classify land as either water collecting or water shedding by drawing the path of runoff on a topographic contour map (runoff, whether surface or subsurface, flows perpendicular to the contour lines). Water collecting areas will show a convergence of flow lines, whereas water shedding areas will show a divergence of flow lines.

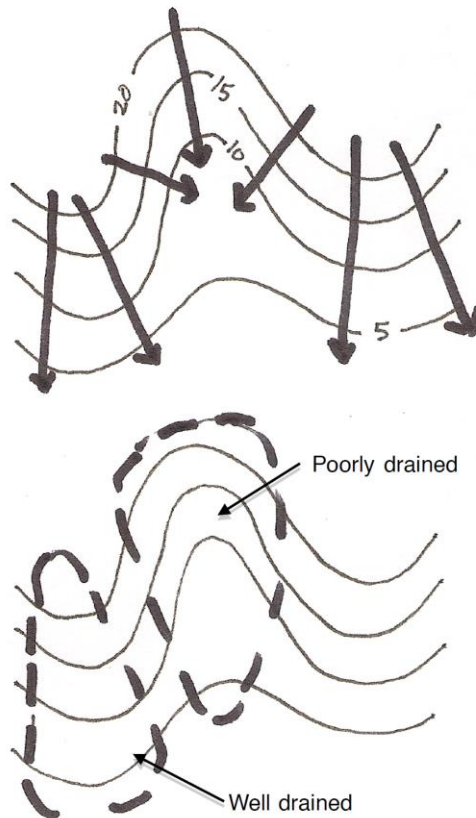


Figure 4: Runoff patterns show the resulting poorly drained vs. well drained lands

Given that there are just two types of land, where should land use facilities be placed?

There are several reasons why poorly drained, or water collecting, lands should not be developed at all:

- 1) infrastructure built in saturated soil has a significantly shorter life span, making local government replacement costs higher;
- 2) they are water storage areas; draining them, quickly, with ditches, pipes and drains, will cause more and larger flooding downstream;
- 3) they are water storage areas; draining them with ditches, pipes and drains, reduce (summer, fall) low flows in streams, thereby damaging fish habitat;
- 4) they are more expensive to build on, for a variety of reasons, leading to higher development costs;
- 5) buildings have a shorter life span, because, among other things, foundations are wet and plagued by creeping damp; and
- 6) houses, roads, pipes are more expensive to maintain.

Secondly – Use a ‘site adaptive’ approach in planning and design on the remaining lands, the water shedding lands. For those poorly drained lands that are already being developed, site adaptive design should also be employed in site layouts, building forms, and support facilities.

Within the Comox Valley there are several different types of physiography (hydrogeomorphic landscapes) that have remarkably different carrying capacities for development. These differences in physiography are derived from the way in which the land was formed and from the resulting drainage and soil characteristics. For example, Point Holmes is an area of fossil (stabilized) sand dunes composed of loose sand with exceedingly high infiltration capacities, extending to depths often exceeding 20m (60ft). The area around Crown Isle also drains well in the upper 2 meters or so (a gravelly layer) but because it is underlain by a compact glacial till (Vashon Till) drainage may be poor in some places, especially low, flat ground. In the land west of the Tsolum River the layer of Vashon Till is relatively shallow and bedrock is near or at the surface and groundwater supplies are poor, but surface runoff may be appreciable.

Each area, and indeed each site in those areas, also varies with local topography and therefore must be developed with designs, densities and construction techniques appropriate for those conditions. For example, areas with high water tables should not include basements, and areas with highly permeable soils need not employ storm sewers but should use source controls for rain/stormwater management.

It should be noted that there are other environmentally sensitive lands that should be paid specific attention, unrelated to rainwater management. For example, development along ocean shorelands has specific requirements with little or no connection to rain/stormwater management. These lands are not covered in this report.

Thirdly – Once developed, manage the land appropriately.

Within the rural areas most (MOTI) roads are drained by way of roadside ditches. Ditches are built in order to extend the life of the roadbed. However, owners of adjacent properties connect to these roadside ditches with lateral ditches and tile systems to drain their land but they do so without need of permitting or any other mechanism. Thus, no consideration is given to these questions:

- 1) is the area drained naturally part of the local drainage system;
- 2) are the ditches capable of handling the volume of water being added, or
- 3) is the receiving waterbody at the end of the ditch capable of handling the volume of runoff being added. Since all road ditches are connected to the nearest stream, this can cause both downstream flooding in the winter, and low streamflows in the summer.

BEST MANAGEMENT PRACTICES (BMPs)

If for no other reasons than cost to developers, home buyers, and communities and concerns about liability related to flooding, we recommend a source control strategy in rain/stormwater management. This approach uses best management practices that provide alternatives to the standard engineering approaches of draining land as quickly as possible by way of paving, piping, and ditching.

It is worth underscoring that the opportunity for exercising a range of BMP options declines with distance from the site while cost increases significantly with distance from the site. Below is an outline of BMP options that can be considered at each of the three levels of the rainwater system.

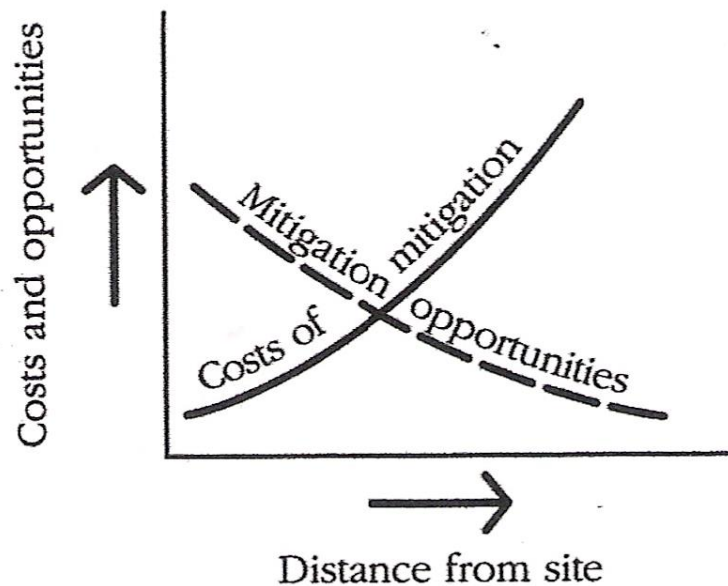


Figure 5: The general trends in mitigation (BMP) opportunities and costs with distance from the site

Production BMPs

BMPs in the production stage are used to decrease the on-site production of stormwater (ie, surface) runoff. These can be affected at the planning, design, and/or land management levels, and include, for example:

- a) regulating land use to fit the capacity of the land, for example avoiding development in poorly drained areas, including wetlands;
- b) regulating density and lot coverage to match the land's capacity for rainwater infiltration;
- c) limiting lot coverage with impervious surfaces by decreasing road widths and roof areas;
- d) limiting foundation and basement designs by, for example, not blocking existing interflow;
- e) requiring retention of on-site forest and wetland areas; and

- f) directing runoff from impervious surfaces into raingardens, cisterns, dry wells, infiltration beds, and/or yard discharge.

Removal BMPs

BMPs at the removal stage are intended to prevent rainwater from leaving the site. They are designed to disconnect the site as a source of stormwater from the watershed drainage system allowing it to function via interflow and groundwater runoff. They can reduce both stormwater volume and the site's access to drainage facilities via, for example, street gutters and stormdrains. Slowing the release of runoff and disconnecting the site can be done, for example, by:

- a) using infiltration facilities such as permeable swales, trenches, and dry wells that enhance soil intake;
- b) disconnecting downspouts from stormwater delivery systems, especially storm sewers and road ditches;
- c) diverting yard drains away from stormwater delivery systems;
- d) increasing travel time with longer and slower routing schemes, such as using depression storage and other grading features to slow runoff and promote infiltration;
- e) increasing surface roughness to slow down overland flow by, for example, planting ditches rather than paving them;
- f) disconnecting impervious surfaces from drainage systems by, for example, dispersing water from driveways into lawns, rather than directing it to ditches or pipes;
- g) using grading and planting to diffuse runoff and promote infiltration by, for example, grading concave lawns/yards to hold water, rather than berming them to shed water;
- h) using natural services such as wetlands and tree canopies to intercept and take up rainfall; and
- i) increasing top soil depths to increase soil (capillary) water storage.

Delivery BMPs

The delivery stage is the final opportunity to manage stormwater. Typically these are engineered facilities designed to move stormwater quickly from the site or cluster of sites to a stream or waterbody. They are designed to relieve developed areas of nuisance water, however, they have produced serious problems related to damage of receiving water features, safety in residential areas, and because they are expensive to build, manage, and replace. These problems can be reduced if "greener" facilities are introduced. Greener examples of delivery BMPs include:

- a) open (swale) drains without curbs or gutters;
- b) diversion channels that direct stormwater away from valued habitat and water features;
- c) rerouted flow patterns that lengthen travel time and slow delivery rates;
- d) storage basins designed to lengthen travel times and promote groundwater recharge;
- e) very low-gradient delivery systems, for example, wide swales w/ roughened beds;
- f) constructed wetlands; and

g) road infiltration trenches.

Possible Solutions

Solutions for rain/stormwater management (i.e., protection of land from erosion, flooding, and environmental damage) are as follows:

Firstly, protect those lands from development that are naturally ill-suited to development. This includes all watercourses (including, at a minimum, RAR setbacks), wetlands and all poorly drained areas (i.e., those areas that collect, rather than shed, water), and aquifer recharge areas.

Secondly, designate appropriate land uses and densities based on the carrying capacity of the land. For example, areas that are poorly drained should have a much lower density than areas that are well drained.

Thirdly, subdivide land appropriately, by, for example, encouraging clustering in order to protect that part of the site that provides valuable source control such as forested areas and wetlands.

Fourthly, ensure that design and construction employs site adaptive design principles responding to the site as it exists, replete with swales, slopes, fields, forests, springs and other features, rather using standard templates. For example, the hydrology of Point Holmes is vastly different than that of the Tsolum River basin. Site design and construction should reflect this.

Finally, ensure that appropriate land management principles are implemented such that landowners do not override on-site infiltration with, for example, lateral ditches and drains connected to road ditches.

References:

Marsh, M. William; Landscape Planning: Environmental Applications, Fifth Edition, John Wiley & Sons, 2010.

Acknowledgement: all figures from Landscape Planning: Environmental Applications, 2010. Used by permission of author.