The Corporation of the City of Courtenay

Staff Report

To: Council **File No.:** 5335-20

From: Director of Infrastructure and Environmental Engineering **Date:** Nov 27, 2024

Subject: Integrated Rainwater Management Plan

PURPOSE: To seek council support for the adoption and implementation of the Integrated Rainwater Management Plan.

BACKGROUND:

The City of Courtenay Integrated Rainwater Management Plan (IRMP) is a master plan to manage rainwater in a way that protects the aquatic environment, and mitigates the impact of drought and flooding.

This project was developed in response to community concerns. It was initiated in 2019, with the development of a stormwater trunks model to identify key deficiencies of the municipal stormwater system. The next phase of work engaged interested parties, and completed environmental assessments to understand the characteristics of local watersheds, for which the municipal stormwater system exists. The third and final phase of IRMP development, completed additional analysis and put these pieces together to identify opportunities to address drought, flooding and impacts to the aquatic environment.

Impacts of Stormwater

The way water is managed on the landscape affects the health of our streams, rivers and oceans.
An undeveloped watershed acts like a sponge. Rainwater is absorbed by soil and infiltrated into the ground, where it replenishes groundwater, aquifers, and freshwater springs. The small proportion of rainfall that cannot be absorbed, runs off the landscape and collects in streams, creeks, lakes and rivers, as it travels toward the ocean.

As cities develop, a network of roads and buildings are constructed. Rainwater cannot be absorbed by these hard-impermeable surfaces, so a much larger proportion of rainfall runs off the landscape; washing sediment, contaminants and debris into waterbodies. This runoff is known as stormwater, and the volume of stormwater is proportional to the surface area of hard-impermeable surfaces. Urban areas rely on a network of stormwater pipes to convey water away from roads and buildings during rainfall events, and this conveyance system is associated with a number of watershed impacts, including:

- **Downstream Flooding:** Less water is absorbed by the landscape, and a larger volume of water is directed downstream. Flooding of downstream areas may have significant financial implications.
- **Erosion of creeks and rivers:** The extra volume of water in waterways accelerates erosion, causing property damage, and depositing sediment in gravel beds.
- **Water quality issues:** Stormwater washes contaminants off of developed areas and directs them into waterways.
- **Drought:** Groundwater is an essential source of water during dry summer months, when rainfall is rare. If impermeable surfaces prevent rainwater from absorbing into soil and sufficiently recharging groundwater during the wet months, it worsens drought conditions.

- **Ecosystem impacts:** Poor water quality, degradation of riparian areas, and barriers to fish passage stress aquatic species, and adversely impact biodiversity.

These impacts are common across urbanized areas, and can be addressed by managing rainwater differently. Municipalities across BC have been working to revise their approach to manage stormwater. The provincial guidelines described in Stormwater Planning: A Guidebook for British Columbia outline the best practices for managing rainwater and addressing these impacts.

The IRMP is a master plan designed to implement the community vision described in the City of Courtenay Official Community Plan (OCP), Bylaw No. 3070, 2022. It is intended to guide the evolution of rainwater management practices within the City of Courtenay, to advance climate action and community well-being.

Moving Toward an Integrated Approach

Manging rainwater using an integrated approach recognizes the relationship between the natural environment and the built environment. It understands that municipal stormwater systems are built within watersheds. Land clearing, development, and other land use changes within the watershed, have an impact on waterways. The IRMP strives to manage this impact, and achieve three key outcomes:

1. **Protect watershed health**. This is accomplished by preserving natural drainage routes as much as possible, limiting impervious areas, retaining trees and forest cover, and directing rainwater to absorptive soil. This allows water to soak into the ground and replenish groundwater, which reduces the volume of water that runs off the landscape. Water quality also improves, because soil acts as a filter, removing contaminants that would have otherwise washed into streams. Tools to manage rainwater in this way are collectively known as stormwater source control. Examples of stormwater source control tools include: absorbent landscaping, rain gardens, bioswales, infiltration facilities, green roofs, and rainwater re-use.
2. **Safely convey large rainfall events.** Large intense rainfall events cannot be managed using infiltration alone. For these events, the stormwater system must be designed to safely manage flows without property damage or flooding. This is critical to manage more intense storms and increased rainfall that are expected in the future.
3. **Engage the community.** Much of the land within local watersheds is privately owned, therefore solutions will be most effective if land owners are informed of rainwater management best practices for their property, and the community is engaged in restoration and monitoring of waterways.

The City of Courtenay has a number of rainwater source control projects that have been incorporated into private developments, or streetscapes to infiltrate rainwater. The 5th street raingardens are an example of this. Furthermore, the City also has an engaged community invested in the restoration and monitoring of waterways. The IRMP seeks to build on this work, identify strategic opportunities to scale up, and move toward managing rainwater using an integrated approach. It is expected that this integrated approach will also enhance climate resilience, by reducing the climate risks of drought and flooding.

DISCUSSION:

This phase of the IRMP was organized into the three parts, summarized below.

- *Part 1 - Stormwater Model & Capital Plan.* A comprehensive InfoSWMM stormwater model was developed, and calibrated using flow data. The model was run under various rainfall events to assess the performance of the stormwater system under typical rainfall conditions, and extreme rainfall conditions. The capacity and the condition of the pipes and culverts was analyzed. A risk matrix was

developed to assess the likelihood of failure, and consequence of failure of each component. Components of the system that pose the greatest risk were included in the capital plan, and prioritized for upgrade in the next 2,5, or 10 years.

- *Part 2 – Analysis of Environmental Impacts of Stormwater.* The local environmental impacts associated with the stormwater system were analyzed by assessing the condition of the watersheds within the City of Courtenay. This involved an analysis of watershed and riparian corridor cover, benthic invertebrates, fish passage along creeks, and surface water quality.
- *Part 3 – Development of a Rainwater Management Strategy*. Options and opportunities to improve rainwater management were identified. This involved stakeholder engagement, analysis of best management practices, analysis of rainwater management targets, a review of source control projects already in service, and an assessment of stormwater catchment performance.

Implementation Plan

A set of recommendations are proposed for implementation following adoption of the integrated rainwater management plan. These recommendations were organized into an implementation plan that is presented in Table 11-1 of the Integrated Rainwater Management Plan provided in Attachment 2. The key recommendations are described in the sections below.

1. Invest in the Stormwater System

Capital upgrades are required to ensure heavy rainfall can be accommodated by the City of Courtenay's drainage systems. This will prevent damage to infrastructure, and localized flooding. The municipal stormwater system is known as the minor drainage system, and it is designed to manage routine rainfall events, up to and including the 10-year design storm. During large intense rainfall events, up to and including the 100-year design storm, it is expected that the stormwater system will become overwhelmed, and creeks and roadways will provide a safe drainage path. This is known as the major system.

The infoSWMM stormwater model assessed the performance of the minor and major system under typical rainfall conditions, and extreme rainfall conditions for both the existing land use, and anticipated future land use in a future climate scenario. This analysis identified a number of locations where upgrades are needed to address deficiencies in the stormwater system. Components of the system that pose the greatest risk were included in the IRMP's proposed capital plan, and staff will review and prioritize for upgrade, considering all utility needs. By addressing these deficiencies, City infrastructure can become more resilient to the risk of increased rainfall.

Proposed capital projects are summarized in Table 5-4 of the Integrated Rainwater Management Plan provided in Attachment 2. This table summarizes the asset type, existing size, required size, project rationale, and estimated cost for each project. The degree to which each pipe or culvert is undersized is measured using a ratio of existing flowrate divided by future flowrate (ex: q/Q). If this ratio is less than one, the current pipe size is adequate, and investment is required to remediate a poor condition. If the ratio is greater than one, an increase in size is required to provide a safe drainage path. The proposed projects have been prioritized according to risk, with projects that address the greatest risks, to be completed first. A summary of the proposed capital plan is presented in the table below.

Time	Project Cost Total	Culvert Projects	Stormwater Main Projects
Year 1-2	$4,614,000	4	2
Year 3-5	$26,059,000	8	0
Year 6-10	$10,309,000	6	4
Total	**$40,982,000**	**18**	**6**

Culvert projects were prioritized in the capital plan, because of their fundamental role in the major drainage system. Undersized creek culverts are likely to cause flooding and damage to infrastructure. Replacement and upgrade of creek culverts also presents an opportunity to address perched culverts that have become a barrier for fish passage. The timing of stormwater main capital projects may be adjusted to align with water, sewer, and/or roadway upgrades along the same stretch of road. Culvert projects are independent of utility upgrades in the roadway, and can be planned independently.

Prior to construction, the details of each proposed capital project will be further developed in a detailed design phase. This design work will confirm sizing requirements, consider site specific conditions, refine the cost estimate, and engage those interested in and affected by the project.

The capital plan was developed assuming typical annualized funding of $2M, with the exception of a single culvert upgrade project in year 5 with an estimated cost of $21M, due to the depth of cover material. If additional annual funding were allocated, these priority projects could be completed more quickly.

To determine the amount of annual funding required to cover the renewal costs of the City's drainage mains and culverts, the replacement value for these assets was determined. The estimated 35-year total renewal need for linear storm assets is $101M, with an annualized need of $2.9M. Therefore, an annual capital investment of at least $2.9 M is required to address deficiencies with the existing storm system.

An analysis of City of Courtenay stormwater infrastructure spending from 2015 to 2022 was completed. The average annual capital investment in stormwater infrastructure was found to be $143,000. A detailed summary of this assessment is presented in Table 6-1 of the Integrated Rainwater Management Plan provided in Attachment 2. This chronic underfunding has created a municipal stormwater system with multiple vulnerabilities that need to be addressed to protect public safety, avoid flooding and property damage.

It is recommended that the City invest a minimum of $2.9M annually in stormwater infrastructure to meet the capital renewal needs of the system.

2. Update Subdivision and Development Servicing Bylaw

The City of Courtenay Subdivision and Development Servicing Bylaw regulates the subdivision and development of land with the City, and outlines standards for works and servicing. A number of revisions are proposed to ensure new development does not increase the likelihood of flooding, or advance degradation of receiving waters. Proposed updates include:

- **Implement volume-based Rainwater Management Targets.** Currently the City regulates the stormwater runoff rate, which does not address the increased volume of stormwater runoff

generated from developed areas. It is proposed that the City regulate the volume of stormwater runoff by adopting a rainfall capture target of 42 mm in 24 hours which corresponds with the 50% of rainfall associated with a 2-year storm.

- **Develop a Water Quality target.** The City of Courtenay does not have a water quality target. It is proposed that the City require treatment of stormwater to reduce the amount of sediment that is discharged to creeks.
- **Increased Intensity-Duration-Frequency (IDF) Curve.** Historic rainfall data is used to create rainfall intensity curves that define the design storms used to size pipes, and other stormwater infrastructure. A review found the City's IDF curves to be adequate for small storms up to and including the 50-year storm. It is proposed that the City increase the IDF curve for the 100-year storm so new infrastructure is built to accommodate the uncertainty of climate change.

It is expected that meeting the new rainwater management targets for water volume, and water quality will require the development of green infrastructure such as raingardens, bioswales, absorbent landscaping, permeable pavement, and infiltration chambers. To ensure this new green infrastructure achieves the intended targets, and can be readily maintained by Operations staff, it is proposed that technical guidelines for Stormwater Source Control Design be developed, and adopted in the Subdivisions and Development Servicing Bylaw.

3. Develop Rainwater Source Control Projects on Public Land

Within existing neighbourhoods, a considerable amount of stormwater runoff is generated from City owned roads, and sidewalks. Impacts to local waterways have been observed in monitoring programs, and there is a desire from the community to address these impacts. Recently provincial legislation supporting small scale multi-unit housing zoning (SSMUH) was adopted. It is expected that as neighbourhoods undergo redevelopment, impermeable surfaces on any given lot will increase, thereby increasing the stormwater runoff, and the impact to local creeks and streams.

To manage this increase in stormwater within existing neighbourhoods, it is proposed that the City develop rainwater source control projects and green infrastructure on public land such as road-right of ways, and parks. Further study is proposed to identify suitable locations for this infrastructure, and develop detailed designs.

4. Protect and Enhance Environmental Values

The municipal stormwater system is built within a watershed. Environmental assessments of the receiving creeks and rivers in the City of Courtenay have identified impacts of stormwater management related to fish passage; impervious cover in the watershed and riparian areas; and abundance and diversity of benthic invertebrates. By addressing these impacts, the City can prevent further degradation of receiving waters, and may be able to reverse these impacts over time. It is proposed that the City remove barriers to fish passage as part of capital project upgrades, restore degraded riparian areas on public lands, and stabilize creek banks using bioengineering methods, instead of rip rap.

5. Establish Monitoring Program & Adaptive Management

Monitoring is required to understand the performance of the stormwater system, and the impact of stormwater on receiving waters. It can be used to track the progress of IRMP implementation over time. The findings from routine monitoring can be used to optimize rainwater management and effectively address

environmental impacts. To date, monitoring by the City has been done on an as needed basis to support the operation of the stormwater system, or the development of the IRMP.

Going forward, it is proposed that a long-term monitoring program be established. As part of this monitoring effort, the City can explore options to support and engage local watershed groups to contribute their monitoring data.

6. Public Engagement

Public Engagement is necessary to address sources of pollution across the watershed, and improve rainwater management practices on private land.

Pollutants in stormwater may originate from numerous sources such as roof treatments; garden, lawn and park maintenance; vehicle washing; and pet waste. Public education materials can help the public understand their role in preventing these sources of pollution.

A large proportion of the land within urban watersheds is privately owned. Riparian areas, and receiving waters may also be located on private land. For this reason, it is proposed that the City develop public education materials to support landowners in improving rainwater management on private land. Examples of opportunities for improved rainwater management include: directing roof leaders to absorbent landscaping, rainwater re-use systems, permeable pavement, maintenance of oil-grit separators, and restoration of degraded riparian areas.

POLICY ANALYSIS:

The development of the Integrated Rainwater Management Plan is informed by:

- The *Community Charter* which outlines the scope of authority of the City of Courtenay.
- The *Local Government Act* which delegates authority to municipalities to manage drainage
- The *Riparian Areas Protection Act, and the Riparian Areas Protection Regulation* which allows local governments to establish permit requirements to protect riparian areas during development
- Stormwater Planning: A Guidebook for British Columbia

In addition to provincial regulations and guidance documents, the development of this plan was informed by best management practices from other regions within British Columbia, including the City of Vancouver, Metro Vancouver, the City of Nanaimo, and the Town of Comox. The recommendations are aligned with the City of Courtenay Official Community Plan.

FINANCIAL IMPLICATIONS:

The cost associated with each recommendation have been estimated, and are presented in Chapter 11 of the Integrated Rainwater Management Plan, provided in Attachment 2. Further studies and assessment are required to advance key recommendations over the next 5 years. The cost of follow-up work is estimated to be $900,000 over 5 years, which is equivalent to an annual amount of $180,000. It is proposed that a minimum annual investment of $2.9M be allocated to stormwater capital projects. These capital projects will address key vulnerabilities within the stormwater system, and build resilience to intense rainfall events.

Following adoption of the IRMP, the finer details of the implementation plan will be developed and these estimates will be revisited. Once estimates have been reviewed and confirmed by staff, they will be incorporated in the 5-year financial plan, for council consideration.

ADMINISTRATIVE IMPLICATIONS:

The Integrated Rainwater Management Plan was developed by the Infrastructure and Environmental Engineering, with support from Operational Services, in collaboration with Kerr Wood Liedal (KWL) Consulting Engineers. It is expected that implementation of the plan will require collaboration from across the organization.

- Infrastructure and Environmental Engineering may offer technical support for implementation, lead follow-up assessments, manage stormwater infrastructure asset information, and advance capital projects.
- Development Services may lead the revision of bylaws, including updates to the Subdivision and Development Servicing Bylaw, and the Development Cost Charges Bylaw.
- Operations may lead the maintenance, and repair of the stormwater system, rainwater management infrastructure, and City Parks.
- Communications may assist with the development of public education campaigns

Once the IRMP is adopted, the details of implementation projects will be further developed, and each department will determine how to incorporate these projects into their workplans.

STRATEGIC PRIORITIES REFERENCE:

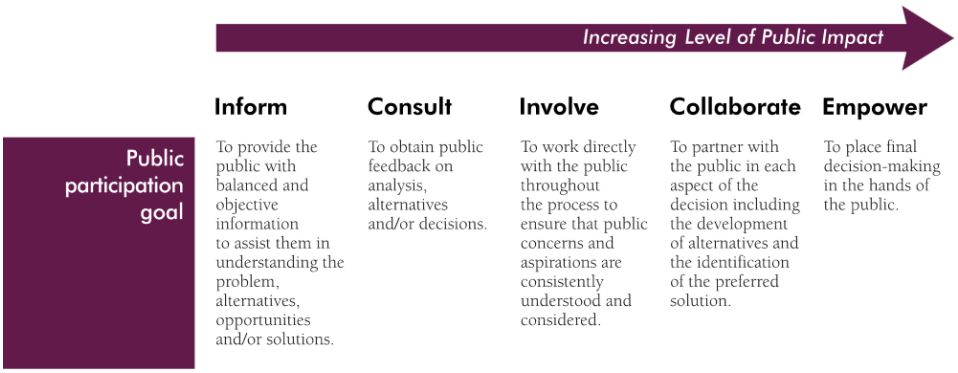
This initiative addresses the following strategic priorities:

- Buildings and Landscape - Update Subdivision Bylaw, including offsite frontage improvements
- Buildings and Landscape - Update Development Cost Charges (DCC) Bylaw
- Natural Environment - Promote and communicate the Urban Forest Strategy & Tree Protection Bylaw and review Bylaw
- Municipal Infrastructure - Continued regional collaboration: Regional Growth Strategy, Liquid Waste Management Plan, South Sewer Conveyance, organics/solid waste, air quality, and regional parks
- Social Infrastructure - Develop measures and criteria to track progress for the OCP's four cardinal directions: reconciliation, community well-being, equity, and climate action

Choose an item.

PUBLIC ENGAGEMENT:

The development of the IRMP *involved* interested community groups, and the K'ómoks First Nation based on the IAP2 Spectrum of Public Participation. This included a survey, workshop, and follow-up meetings. Following adoption of the IRMP, staff will *Inform* the public by developing a communications campaign to educate and engage the public. Projects related to the implementation of the IRMP will require additional public engagement that is specific to the project.



OPTIONS:

1. THAT Council adopt the Integrated Rainwater Management Plan; and

   THAT Council direct staff to staff to implement the recommendations described in the implementation plan, and include budget for related projects in the 5-year financial plan.

2. THAT Council provide alternative direction to staff.

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ATTACHMENTS:

1. Presentation – Courtenay IRMP – Phase 3
2. Integrated Rainwater Management Plan – Phase 3 Report
3. Integrated Rainwater Management Plan – Phase 3 Report Appendices

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