Executive Summary

The City of Courtenay Integrated Rainwater Management Plan (IRMP) is a community wide plan to guide changes in the way rainwater is managed. This plan was developed in response to community concerns about drought, flooding, and impacts to the aquatic environment.

Project Overview

The City initiated development of the integrated rainwater management plan and organized the work into three phases.

- Phase 1 (Jan 2019) – Development of stormwater trunks model to identify key deficiencies
- Phase 2 (Dec 2020) – Watershed analysis: hydrogeological assessment, geotechnical assessment, environmental assessment, stakeholder engagement.
- Phase 3 (Nov 2023) – Development of implementation plan, organized into three parts:
    - Complete Stormwater Modelling and Capital Plan.
    - Analyze Environmental Impacts Associated with Stormwater.
    - Develop an Integrated Rainwater Management Strategy.

This third phase presents a recommended approach to facilitate a transition from the conventional conveyance of stormwater to managing rainwater as a resource using an integrated rainwater approach.

The development of the IRMP is aligned with the provincial guidelines described in Stormwater Planning: A Guidebook for British Columbia. IRMP is a master plan informed by the City of Courtenay Official Community Plan (OCP), Bylaw No. 3070, 2022, that identifies the work needed to implement the policies described in the OCP.

Rainwater Management Key Issues & Impacts

In an undeveloped watershed, rainwater is absorbed by soils, evapotranspirated from leaves, and infiltrated into the ground, where it replenishes groundwater, aquifers, and freshwater springs. A small amount of rain runs off the landscape, travelling into 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 impermeable surfaces, and so it is collected in underground stormwater pipes that discharge the water directly into waterways. Cities rely on stormwater conveyance systems to keep roads and buildings dry during rainfall events, but this conveyance system has a number of impacts, which include:

Flooding: Less water is absorbed by the landscape, and a larger volume of water is directed downstream.

Erosion of the 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: Water has limited ability to absorb into soils and replenish groundwater resources. Groundwater is an essential source of water during dry summer months. If groundwater cannot be sufficiently recharged by rain during the wet months, it exacerbates drought conditions.

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

Currently, the City of Courtenay manages most stormwater using a conventional conveyance network that discharges to receiving streams. A few site-specific rainwater source control projects, including raingardens, detention facilities and treatment devices, have been implemented and demonstrate various methods to manage stormwater.

The IRMP seeks to understand the operation of the stormwater system and the impacts associated with it, in an effort to propose changes to halt, and potentially reverse impacts over time.

IRMP Phase 3 Methodology

Part 1 – Stormwater Model & Capital Plan

To understand the operation of the stormwater system, 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 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 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 Rainwater Management Strategy

A rainwater management strategy was developed to identify the options and opportunities for the City to improve rainwater management going forward.

This is involved an analysis of best management practices, an analysis of rainwater management targets, a performance review of source control projects already in service, and an assessment of stormwater catchment performance. Following this analysis, an implementation strategy to shift the management of rainwater was prepared.

Implementation Plan

	Recommendation	Timeline	Cost
Capital Upgrade Plan for Storm Sewers			
1	The capital plan for the IRMP includes prioritized and costed upgrades for trunk sewer infrastructure identified for the near and medium term, 1 to 10 years in the future (Section 5 and Appendix G). Note: The allocation of funding for upgrades will impact the timing and progress of upgrade completion and the program timing may need to be reviewed or adjusted in the future. As noted above, the estimated costs for capital upgrades are based on 2022 cost data, and the level of uncertainty in the costing should be assumed to increase as time passes due to the volatility in construction and infrastructure supply markets.		
	Priority 1: Capital Upgrades	1-2 Years	$3,419,000
	Priority 2: Capital Upgrades	3-5 Years	$5,720,000
	Priority 3: Capital Upgrades	6-10 Years	$8,584,000
2	Explore additional and alternative funding sources for storm system upgrades (Section 6):		
a	Review existing funding options, including DCCs for areas where development is occurring, and combining infrastructure upgrades, such as storm pipes with road or water main upgrades, to reduce costs.	Immediate	Existing resources
b	Increase funding for storm drainage operation and capital projects for the short term to start to bridge the gap in funding and system renewals and upgrades. Consider a ramp up of increasing fees for stormwater if the full increase per property is not considered to be acceptable for a single-year increase to property taxes. Start to bring the storm system into alignment with long-term system operation and service goals.	1-3 Years	Existing staff and council resources
c	Investigate infrastructure grant opportunities to fund critical upgrades, multiple-benefit projects, and others that fit grant program parameters.	1 – 10 Years	Existing Resources
d	Review whether a formalised stormwater utility is a good fit for the long term and, if so, pursue setup.	4 – 10 Years	$200,000

	Recommendation	Timeline	Cost
Updates to Subdivision and Development Servicing Bylaw 2919 (2018)			
3	Update the 100-year return period design IDF curve to incorporate 95th percentile climate change increase in rainfall to be more conservative in the design of major system infrastructure (Section 3.1 and Appendix J).	1-2 Years	Existing Resources
4	Update the City's Supplementary Design Guidelines, Section 4, to create Section 4.3.4 Rainwater Management (Section 7.1):	1-3 Years	$100,000
a	Add requirement that all new and re-development is required to provide on-site rainwater management to capture and infiltrate 42 mm or rainfall in 24 hours.	1-2 Years	Existing Resources
b	Note infiltration exceptions. E.g., if the site is located over bedrock that does not infiltrate or if there is an identified geotechnical hazard (desktop study required, at a minimum, to identify potential hazard areas and considerations), such as an embankment, that infiltration should be separated from.	1-2 Years	Existing Resources & $50,000
c	Determine acceptable approach for infill single family residential lots (single lot development or re-development) and specify in this section. Explore the option of, disconnecting roof leaders from the storm system . If roof leader disconnection is pursued, then the City's Building bylaw would also require updating to allow disconnection.	1-4 Years	$50,000
d	Add requirement for all lots to incorporate minimum 300 mm of absorbent topsoil on all restored vegetated areas (lawns and shallow garden areas) of the lot.	Coord. w/ (4c)	Coord. w/ (4c)
e	Add a reference to a guideline or standards for rainwater management system design. Initially this should be an available guideline, such as the Metro Vancouver Stormwater Source Control Design Guidelines, but this should be updated to City-specific guidance or standards if and when they are developed (See #13, below).	1-2 Years	Existing Resources
5	Update the City's Supplementary Design Guidelines, Section 4.11.8, to be called Water Quality Treatment and add water quality requirements (Section 7.1):	1-2 Years	Existing Resources
a	Water quality treatment must be provided to treat the runoff of the rainwater capture target, i.e. 42 mm in 24 hours, to remove 80% of inflow TSS by mass from runoff from vehicle-accessible impervious surfaces such as roads, lanes, and parking areas, with rain gardens and bioswales preferred for treatment of road runoff to remove 6-PPD Quinone.	As Part of (5)	As Part of (5)

	Recommendation	Timeline	Cost
b	Note that water quality treatment and volume capture can be combined in the same facility when the target volume is routed to an infiltration rain garden (bioretention) or bioswale that both treats and infiltrates the target volume.	As Part of (5)	As Part of (5)
Protect and Enhance Environmental Values			
6	Look for opportunities to expand and revegetate riparian areas when possible, whether by negotiating additional setback, acquiring public rights-of-way, or improving publicly owned properties (Section 7.2).	1 – 10 Years, and Beyond	Dependent on Acquisition or Enhancement
7	Build on infrastructure projects, when possible, to improve environmental conditions such as fish passage (Section 7.2):		
a	Fish barriers were identified in Phase 2 IRMP (see Appendix L). Note: Fish bearing streams in the Phase 2 report have a calculated "% fish bearing", which indicates the fraction of the stream length that is accessible to fish. Streams with lower % fish bearing length and streams with high value habitat should be prioritized for improvements to fish accessibility by removal of fish barriers when there is an opportunity to do so.	1 – 10 Years, and Beyond	Incremental Increase in Cost when done as part of pipe upgrades
Programs and Operational Updates			
8	Promote green infrastructure to mitigate impacts of development and investigate methods of supporting green infrastructure implementation including (Section 8.1):		
a	Develop area-specific development cost charges dedicated to fund stormwater management, planning, and outreach activities within a specified area. This can be combined with reduced stormwater fees or charges in exchange for green infrastructure practices. External support for study likely needed to identify areas and develop costs.	4-10 Years, Coord w/ (2e)	Existing Resources and ~$85,000
b	Consider special assessment fees for new development in environmentally sensitive areas or land integral to the City's green infrastructure policy. Requires additional external consultant support to build on work completed in Phase 2 of IRMP.	4-10 Years, Coord w/ (2e)	$50,000 - $70,000
c	Allocate funds and staff time specifically to support construction of stormwater management facilities and green infrastructure. This would be in addition to funds for upgrades and maintenance of the existing system.	2-10 Years	Existing Resources; may need External Support

	Recommendation	Timeline	Cost
d	Develop design guidance and standards for green infrastructure to clarify what is allowed, efficient, and best practice (see Section 9). Develop internal processes to review, inspect, approve, and track green infrastructure installations.	2-5 Years	Existing Resources and New Staff for Internal Processes
e	Encourage bio-engineering methods for bank stabilization and erosion remediation rather than riprap and consider including in the Supplementary Design Guidelines.	2-5 Years	Existing Resources
9	Develop a plan for allowing off-site stormwater management for development on public land (Section 8.2) as a way to maximize the rainwater management mitigation for sites in constrained situations.		
a	Consult internally with staff on risks and concerns for implementation of off-site stormwater management	1-4 Years	Existing Resources
b	Identify situations and applications when off-site stormwater management would be acceptable, and limitations when it would not be acceptable. May require external consultant support on technical specifics and limitations	1-4 Years	Existing Resources; Potential Consultant
10	Consult internally and externally and develop long-term plan for maintenance of green infrastructure over time as implementation on public property increases maintenance needs and workload (Section 8.3). Plan to build City capacity over the long term.	2-5 Years (planning) Ongoing (implementation)	Existing and New Internal Resources
11	Develop communication and outreach in support of IRMP and green infrastructure programs (Section 8.3):		
a	Develop a long-term communications plan for releasing new information on stormwater and rainwater management and related City initiatives and for reminding the public about existing programs and initiatives to raise and maintain awareness of the City's work on these issues and its importance for watershed health.	1-2 Years and Ongoing	Existing Resources
b	Develop programs and funding for collaboration with streamkeepers and other environmental advocacy groups.	1-5 Years	Existing Resources and Grant Funding
c	Assess the feasibility of partnering with volunteer groups such as streamkeepers for monitoring and environmental enhancement projects.	1-5 Years	Existing Resources
d	Promote existing and new stormwater and rainwater management facilities and inform the public how they contribute to watershed health with signage to inform and engage the public with in-situ installation.	1-2 Years and Ongoing	Existing Resources

	Recommendation	Timeline	Cost
Plan and Fund Future Work Needed to Support the IRMP Goals and Desired Outcomes			
12	Develop City-specific rainwater management guidance or standards to facilitate implementation of rainwater management in accordance with recommended rainwater management targets. The guidance would support the design of functional rainwater management facilities and reduce the burden of effort for designers trying to meet the City's targets. Guidance would also streamline the City review processes for rainwater management facilities to reduce the burden of effort on the City staff. Includes internal and external consultation. (Section 9.1).	2-5 Years	$100,000+
13	Detailed assessment of detention pond capacities to better understand the level of detention performance provided by existing ponds in current conditions in comparison to the City's detention performance requirements and if there are gaps in detention capacity or controls that need to be and can be improved. Assessment may be limited to ponds with reported or suspected shortfalls in operational performance. Options for improving performance or making up for a gap in performance can be assessed for individual locations to extent needed to address concerns. (Section 9.2).	1-4 Years	$50,000-$75,000
Monitoring and Adaptive Management to Keep the IRMP On Track			
14	Implement a monitoring plan for long-term monitoring of watershed health and other key performance indicators (Section 10.1). The monitoring plan is based on the provincially approved Metro Vancouver Monitoring and Adaptive Management Framework (MAMF).		
a	Flow monitoring in priority catchments on a recurring basis every 2 to 5 years. Costs can vary widely, estimate of costs is on an annual basis for range of monitoring.	1-5 Year (Recurring)	$10,000 to 50,000
b	Water quality monitoring of receiving watercourses on a minimum 5 year cycle. Can be implemented across the City on a rotational basis to annualize the work and costs.	5 Year Cycle (Recurring)	$25,000 to $50,000
c	Development of systems for tracking spatial data on rainwater management facilities installed, soil infiltration testing locations and results, and data from stakeholder collaborations.	1-5 Years	Existing Resources
d	Additional water quality monitoring in-pipe or at end of pipe to understand stormwater discharge quality could be added to the monitoring; allocating annual operational budget for monitoring may smooth the process over the long term.	Similar to (14b)	$25,000

	Recommendation	Timeline	Cost
15	Implement adaptive management to review monitoring results and progress on IRMP tasks on a recurring basis at least once every 5 years (Section 10.2)		
a	Review tracking, data, and trends to understand changes in receiving water systems and health, and to understand progress and changes toward implementation of IRMP objectives. Likely requires external support for initial analysis, could be taken on by staff for subsequent analysis if desired.	5-10 Year (Recurring)	$10,000 to 50,000
b	If adverse trends in watershed health are observed in the monitoring data, review the mitigations and level of implementation, and assess what changes should be made to address the issue(s) and change the adverse trends.	5-10 Year (Recurring)	Existing Resources; Potential External Support