Executive Summary

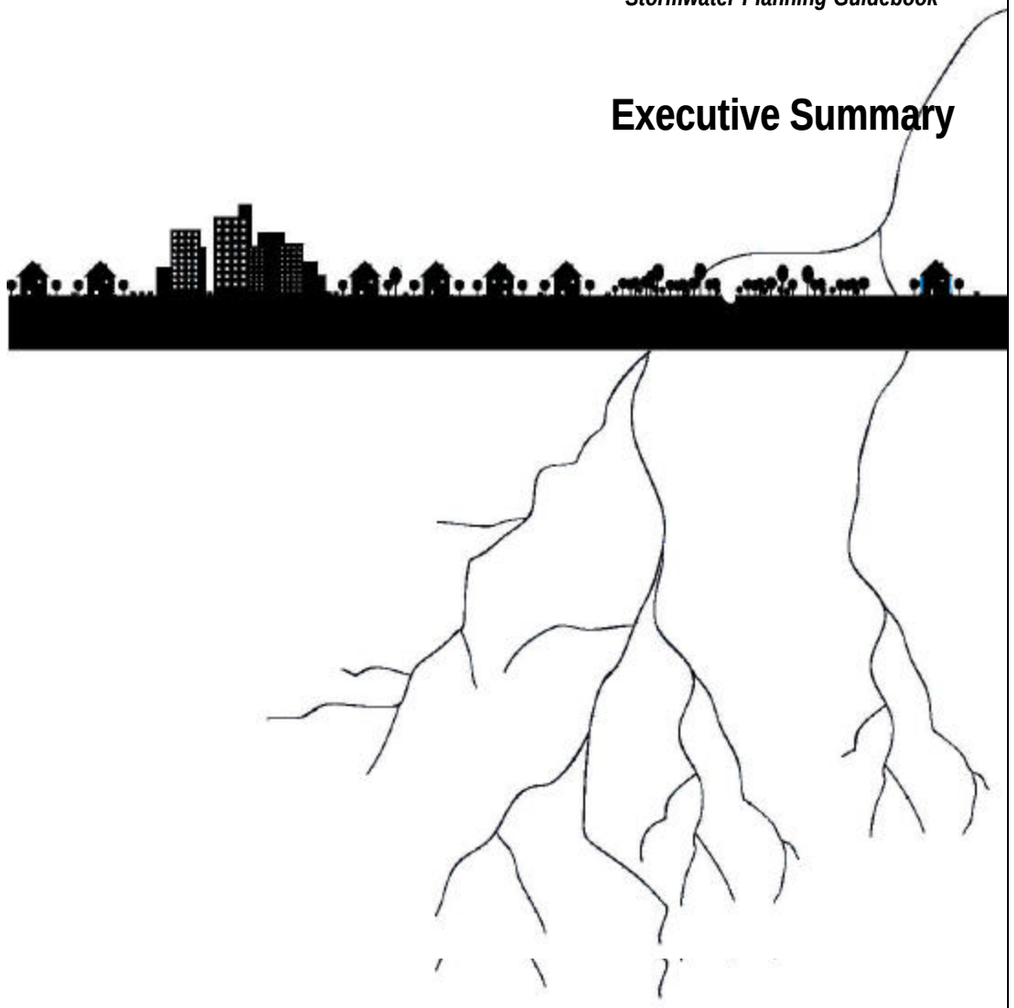


Table of Contents

Executive Summary

Stormwater management in British Columbia is a key component of protecting quality of life, property and aquatic ecosystems.

The science and practice of stormwater management is constantly evolving, in British Columbia and around the world. Within BC, the range of stormwater management activity varies from completely unplanned in many rural areas, to state-of-the-art in some metropolitan centres. The purpose of this Guidebook is to provide a framework for effective stormwater management that is usable in all areas of the province.

The Guidebook presents a methodology for moving from planning to action that focuses the limited financial and staff resources of governments, non-government organizations and the development community on implementing early action where it is most needed.

The Guidebook is organized in three parts: Part A defines the problem, Part B provides solutions and Part C defines the process.

The Guidebook provides a comprehensive understanding of the issues and a framework for implementing an integrated approach to stormwater management. Case study experience underpins the approaches and strategies that are presented in the Guidebook.

Stormwater Component of Liquid Waste Management Plans

In British Columbia, the *Local Government Act* has vested the responsibility for drainage with municipalities. With the statutory authority for drainage, local governments can be held liable for downstream impacts that result from changes to upstream drainage patterns – both volume and rate. The *Act* also enables local governments to be proactive in implementing stormwater management solutions that are more comprehensive than past practice.

Furthermore, a stormwater component is a requirement for approved *Liquid Waste Management Plans* (LWMPs). Guidelines for developing a LWMP were first published in 1992. LWMPs are created by local governments under a public process in co-operation with the Province.

An OCP Provides the Foundation for a LWMP

There is a clear link between the land use planning required of local governments in the *Local Government Act* and the LWMP process. In most cases where an *Official Community Plan* (OCP) is in place, the local government planning statement (bylaw) will form the basis for a LWMP. The purposes of a LWMP are to minimize the adverse environmental impact of the OCP and ensure that development is consistent with Provincial objectives.

OCPs tend to be led by planners, with input from engineers on infrastructure sections. LWMPs tend to be led by engineers, with little or no input from planners. Both processes involve approval by a Local Council or a Regional Board.

In some cases, a LWMP process may be a trigger that focuses attention on stormwater management. Public concern related to flooding or habitat loss may be the trigger. Or an OCP public process may communicate public interest in raising local environmental and habitat protection standards.

Whatever the driver, at the end of the process an OCP should include goals and objectives for stormwater management. These goals and objectives, or a variant of them, might first reside in a LWMP, and then be adapted to the OCP in the next review process. Or they may originate in the OCP process, and then be detailed through a LWMP. Either way is entirely acceptable.

Integrated Stormwater Management Planning

In British Columbia, the term *Integrated Stormwater Management Plan* (ISMP) has gained widespread acceptance by local governments and the environmental agencies to describe a comprehensive approach to stormwater planning. The purpose of an ISMP is to provide a clear picture of how to be proactive in applying land use planning tools to protect property and aquatic habitat, while at the same time accommodating land development and population growth.

Part A – Why Integrated Stormwater Management?

Part A identifies problems associated with traditional stormwater management and provides the rationale for a change from traditional to integrated stormwater management. Some guiding principles of integrated stormwater management are introduced.

Part A also builds a science-based understanding of how natural watersheds function and how this function is affected by land use change.

Part B – Integrated Stormwater Management Solutions

Part B outlines the scope and policy framework for integrated stormwater management, and presents a cost-effective methodology for developing stormwater solutions.

Step #1 - Identify At-Risk Drainage Catchments

A methodology is presented for identifying at-risk drainage catchments to focus priority action. The methodology relies on a roundtable process that brings together people with knowledge about future land use change, high-value ecological resources and chronic flooding problems. The key is effective integration of planning, engineering and ecological perspectives.

Step #2 - Set Preliminary Performance Targets

A methodology is presented for:

- Developing watershed performance targets based on site-specific rainfall data, supplemented by streamflow data (if available) and on-site soils investigations
- Translating these performance targets into design guidelines that can be applied at the site level to mitigate the impacts of land development

The Guidebook documents British Columbia case studies of stormwater policies and science-based performance targets applied to both greenfield and urban retrofit scenarios.

Step #3 - Select Appropriate Stormwater Management Site Design Solutions

Guidance is provided for selecting appropriate site design solutions to meet performance targets. Examples include:

- Design and performance of stormwater source controls for various land uses
- Watershed scale modeling of the effectiveness of site design solutions

British Columbia case studies are examined for greenfield and urban retrofit scenarios. A 'Water Balance Model' is also applied for linking performance targets to design guidelines for source control and runoff conveyance.

Part C – Moving from Planning to Action

Part C describes a process that will lead to better stormwater management solutions.

The role and design of action plans are introduced to bring a clear focus to what needs to be done, with what priority, by whom, with related budgets.

Tips are provided on processes that produce timely and high-quality decisions.

Part C also provides guidance for organizing an administrative system and financing strategy for stormwater management.

A final section on building consensus and implementing change describes how to develop a shared vision and overcome barriers to change.

Two acronyms provide a useful summary of the principles and elements of integrated stormwater management:

A D A P T

to the

C U R E

ADAPT –
The Guiding Principles of Integrated Stormwater Management

The acronym **ADAPT** summarizes five guiding principles for integrated stormwater management. The Guidebook is based upon these five principles.

Agree that stormwater is a resource

Design for the complete spectrum of rainfall events

Act on a priority basis in at-risk drainage catchments

Plan at four scales – regional, watershed, neighbourhood & site

Test solutions and reduce costs by adaptive management.

Guiding Principle 1 - Agree that Stormwater is a Resource

Stormwater is no longer seen as just a drainage or flood management issue but also a resource for:

- fish and other aquatic species
- groundwater recharge (for both stream summer flow and for potable water)
- water supply (e.g. for livestock or irrigation)
- aesthetic and recreational uses

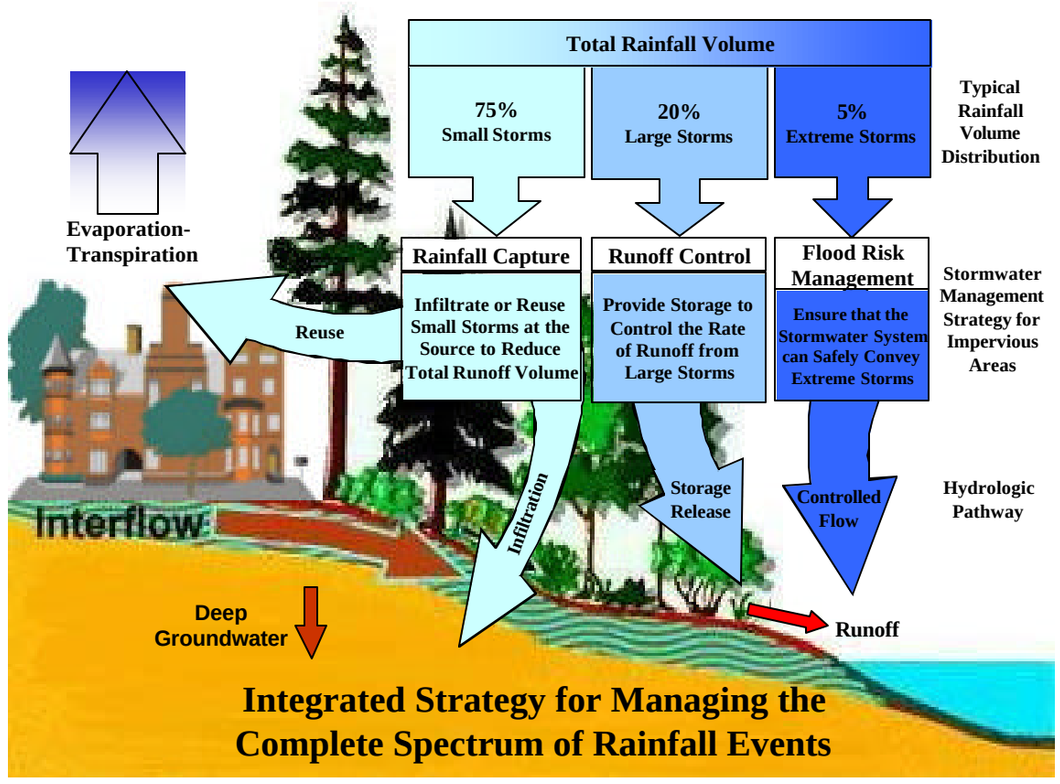
Guiding Principle 2 - Design for the Complete Spectrum of Rainfall Events

Integrated stormwater solutions require site design practices that provide:

- **Rainfall Capture for Small Storms (runoff volume reduction and water quality control)** –
  Capture the small frequently occurring rainfall events at the source (building lots and streets) for infiltration and/or re-use.
- **Runoff Control for Large Storms (runoff rate reduction)** –
  Store the runoff from the infrequent large storms (e.g. a mean annual rainfall), and release it a rate that approximates the natural forested condition.
- **Flood Risk Management for the Extreme Storms (peak flow conveyance)** –
  Ensure that the drainage system can safely convey extreme storms (e.g. a 100-year rainfall).

The Integrated Strategy

Guiding Principle 2 forms the foundation of integrated stormwater solutions that mimic the most effective stormwater management system of all - a naturally vegetated watershed. This means that rainfall from frequent small events must be infiltrated into the ground or re-used within the watershed, as illustrated below.



Comparison with Conventional Stormwater Management

Conventional 'flows-and-pipes' stormwater management is limited because it focuses only on the fast conveyance of the extreme storms and often creates substantial erosion and downstream flooding in receiving streams.

Similarly, a detention-based approach is only a partial solution because it allows the small storms that comprise the bulk of total rainfall volume to continue to create erosion and impacts on downstream aquatic ecosystems.

Neither of these approaches fully prevents the degradation of aquatic resources or flooding risks to property and public safety.

In contrast, the Guidebook approach is to eliminates the root cause of ecological and property impacts by designing for the complete spectrum of rainfall events. Solutions described in the Guidebook include conventional, detention, infiltration and re-use approaches for rainfall capture, runoff control and flood risk management.

Guiding Principle 3 - Act on a Priority Basis in At-Risk Drainage Catchments

Priority action should be focused in at-risk drainage basins where there is both high pressure for land use change and a driver for action. The latter can be either:

- a high-value ecological resource that is threatened, or
- an unacceptable drainage problem

The stormwater management policies and techniques implemented in at-risk catchments become demonstration projects.

Guiding Principle 4 - Plan at Four Scales – Regional, Watershed, Neighbourhood and Site

Integrated stormwater management must be addressed through long-term planning at each of the regional, watershed, neighbourhood and site scales.

- **At the Regional and Watershed Levels** – Establish stormwater management objectives and priorities
- **At the Neighbourhood Level** – Integrate stormwater management objectives into community and neighbourhood planning processes
- **At the Site Level** – Implement site design practices that reduce the volume and rate of surface runoff and improve water quality

Guiding Principle 5 - Test Solutions and Reduce Costs by Adaptive Management

Performance targets and stormwater management practices should be optimized over time based on:

- monitoring the performance of demonstration projects
- strategic data collection and modeling

As success in meeting performance targets is evaluated, the stormwater management program can be adjusted as required.

CURE – The Elements of an Action Plan

The acronym **CURE** focuses attention on the four key types of actions that must all work together to implement integrated stormwater management solutions:

- **C**APITAL INVESTMENT – Short-term capital investment will be needed to implement early action in at-risk drainage basins. Improvements to existing drainage system are often the most significant capital investments required. A financing plan should provide an ongoing source of funds for watershed improvements.

- **U**NDERSTANDING SCIENCE – Improved understanding of a watershed, the nature of its problems, and the effectiveness of technical solutions is key to an adaptive approach. Stormwater management practices can be optimized over time through the monitoring of demonstration projects, combined with selective data collection and modeling.

- **R**EGULATORY CHANGE – Changes in land use and development regulations are needed to achieve stormwater performance targets. Changes to land use planning and site design practices are needed to eliminate the root cause of stormwater related problems. These changes must be driven by regulation.

- **E**DUCATION AND CONSULTATION – Changes to land use planning and site design practices can only be implemented by building support among city staff, the general public and the development community through education and consultation.

Translating a Vision into Action

It is important to establish a long-term shared vision at the start of any watershed planning initiative. A vision that is shared by all stakeholders provides direction for a long-term process of change. The vision becomes a destination, and an action plan provides a map for getting there.

Actions plans must be long-term, corresponding to the time frame of the vision. Action plans must also evolve over time.

Ongoing monitoring and assessment of progress towards a long-term vision will improve understanding of the policy, science and site design components of integrated stormwater management. This improved understanding will:

- Lead to the evolution of better land development and stormwater management practices
- Enable action plans to be adjusted accordingly

An adaptive management approach to changing stormwater management practices is founded on learning from experience and adjusting for constant improvement.

Building Blocks

The Guidebook elaborates on three fundamental objectives that become building blocks for a long-term process of change:

- **Achievable and Affordable Goals** - Apply a science-based approach to create a shared vision for improving the health of individual watersheds over time.
- **Participatory Decision Process** - Build stakeholder consensus and support for implementing change, and agree on expectations and performance targets.
- **Political Commitment** – Take action to integrate stormwater management with land use planning.