Okanagan Basin
WATER BOARD

Underground Stormwater Infiltration Model Bylaw

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Introduction

The purpose of the project is to help local governments assess and manage the risk to groundwater quality that is posed by unregulated use of underground stormwater infiltration systems. This document contains the most relevant excerpts from the final project report, including:

- an **information backgrounder** to provide context for the issue and outline the steps to assess risk and integrate policy on underground infiltration into local government processes;
- a **model Underground Stormwater Infiltration bylaw** that can be adapted and adopted in its entirety, or from which clauses can be extracted and added to an existing subdivision bylaw; and
- an example **Terms of Reference for an Underground Stormwater Infiltration System Plan**.

UNDERGROUND STORMWATER INFILTRATION

How to evaluate and manage risk to groundwater quality in your community

What are the benefits of on-site stormwater infiltration?

Local governments and land developers in British Columbia generally have a strong awareness of the connection between stormwater management (also called rainwater management) and watershed health and protection. Stormwater management practices in B.C. are generally founded on the provincial publication *Stormwater Planning: A Guidebook for British Columbia*[1] (the Guidebook).

Many municipalities have bylaws that require retention of rainwater on site. **On-site infiltration greatly reduces the volume of runoff and the level of pollutants that flow to watercourses, wetlands, and other aquatic ecosystems.** Surface infiltration facilities in the form of bioretention areas and swales are most common, but underground infiltration systems such as perforated manholes and infiltration trenches are often used on development sites where the available surface area for stormwater management is limited.

What is the risk from underground infiltration?

Underground infiltration is generally considered a best practice for managing stormwater. These systems pose low risk to surface and groundwater resources when properly sited, designed, and maintained. Most pollutants in urban runoff are present at low levels, and many common pollutants are subject to adsorption, degradation, and filtration.

However, underground infiltration systems can provide a direct path for pollutants at ground surface to enter the underlying aquifer (especially a shallow aquifer), as well as nearby surface waters and environmentally sensitive areas (e.g. wetlands). Pollutants that reach the aquifer cannot be observed visually and are therefore less likely to be detected and treated or removed. Once contaminated, it can be difficult and costly to clean up an aquifer. In many areas, groundwater recharges rivers and other watercourses, especially during low-flow conditions. Therefore, it is important for every community to protect groundwater quality, even if surface water is the main drinking water source. **Many communities have not considered the risk to groundwater quality when mandating the use of on-site infiltration and retention.**

[1] Stephens, K., P. Graham, and D. Reid. 2002. Stormwater Planning: A Guidebook for British Columbia. Available online at: www2.gov.bc.ca/gov/DownloadAsset?assetId=FA2C4B4B9B9F47F5981272B98894655D.

Is your groundwater quality at risk?

Four factors increase the risk of groundwater contamination from underground stormwater infiltration systems. **By considering and addressing these risk factors, underground infiltration systems can be designed and operated with minimal risk to groundwater.**

1. **Accessibility to pollutant sources:** locating facilities in watersheds or certain land use types with high potential for pollutant sources (e.g. busy highways);
2. **Facility design:** designing underground infiltration systems that convey water directly into the saturated zone or close to the aquifer, or that do not include appropriate pre-treatment facilities;
3. **Subsurface conditions:** locating facilities in certain types of geologic formations that permit rapid movement of water, or that do not filter pollutants; and
4. **Maintenance and operation:** inadequately maintaining and monitoring the facilities and the environmental conditions at the site.

A solid understanding of watershed characteristics, stormwater management practices, and subsurface conditions is fundamental to assessing and managing the risk of underground stormwater infiltration facilities.

The steps for integrating processes to assess and manage underground stormwater infiltration are summarized below.

Step 1: Assess risk and build risk management framework

The first step is to identify at-risk areas so you can focus priority action. Liquid waste management plans and/or stormwater management plans can provide the overall framework for the risk assessment and management program. These plans can also describe how risk mitigation measures will be fully integrated into local government procedures and policies.

Liquid Waste Management Plans

Liquid waste management plans (LWMPs) allow municipalities to develop community-specific solutions for wastewater management that meet or exceed existing regulations. The provincial Interim Guidelines for Preparing Liquid Waste Management Plans[2] outlines the recommended planning process. A stormwater management component is a requirement for approved LWMPs.

Integrated Stormwater Management Plans

In B.C., the term integrated stormwater management plan (ISMP) is widely accepted by local governments and environmental agencies to describe a comprehensive, ecosystem-based approach to rainwater management.[3] The purpose of an ISMP is to provide direction for future development plans and

[2] Ministry of Environment. 2011. Interim Guidelines for Preparing Liquid Waste Management Plans. URL: http://www2.gov.bc.ca/gov/DownloadAsset?assetId=9D3A9727A8F647808DF1A1E2D62C862B&filename=guide_to_preparing_liquid_waste_mgmt_plans.pdf.

[3] Chapter 9 of the Guidebook provides information on how to develop and implement an ISMP.

identify infrastructure needs. Best management practices and risk management strategies for the siting, design, and maintenance of underground stormwater infiltration systems may be included in an ISMP.

Step 2: Implement risk management strategies

A multi-faceted approach to managing risk to groundwater quality from underground infiltration is recommended. The approach can include drainage plans and hydrogeological assessments that identify opportunities and constraints, policy and best practices guidance, regulation, and education.

Drainage Plans

Often, ISMPs are the overarching umbrella for more specific drainage (or watershed) plans. Drainage plans establish specific strategies and conceptual plans for managing stormwater. They are good tools for assessing opportunities and constraints to underground stormwater infiltration. They can be used to determine the suitability ranking (e.g. well-suited, moderately suited, poorly suited/limited) of the subsurface in the drainage area to infiltrate stormwater based on consideration of groundwater conditions, surficial geology, and surface slopes. Drainage plans can provide recommendations on the watershed, sub-watershed, and catchment level.

Hydrogeological Assessments

Hydrogeological assessments can be used to identify hydrogeologically sensitive areas where subsurface stormwater infiltration systems should not be used. Hydrogeologically sensitive areas commonly have the following characteristics:

- soil conditions with limited infiltration capacity;
- poorly draining and/or low permeability soils;
- shallow bedrock;
- shallow groundwater;
- floodplains; and/or
- known or suspected groundwater discharge areas, such as springs, seepage zones, wet areas.

Municipalities can require hydrogeological impact assessment reports for specific development locations. Many municipalities provide developers with terms of reference for these reports.

Policies and Best Practices

In 2014, the B.C. Ministry of Environment prepared a best practices guide for underground stormwater infiltration.[4] The guide provides a summary table of recommended practices (pages i & ii). It is likely that your ISMP could be supplemented with best practices from this table. Alternatively, your community may already have a stormwater best practices guide that you could amend to include these best practices.

[4] Rathfelder, K. and M. Wei. 2014. Underground Stormwater Infiltration: Best Practices for Protection of Groundwater Resources in British Columbia. Available online at www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/library/underground_stormwater_infiltration-2014.pdf

Regulation

Broad policies and best practices must be augmented with effective implementation tools (i.e. regulatory bylaws that require compliance). Regulatory oversight for the design and operation of underground stormwater infiltration systems occurs at the municipal level or is carried out by the B.C. Ministry of Transportation and Infrastructure. Owners and operators are responsible for identifying and meeting all applicable local regulations and requirements. You can either adopt a bylaw specific to underground stormwater infiltration systems or integrate the subject into a current bylaw (or bylaws).

Underground Stormwater Infiltration System Bylaw

If risk to groundwater quality in your community is deemed high, you can adopt a specific bylaw that focuses on underground stormwater infiltration systems. A model bylaw that can be adapted to your community's needs is attached.

Subdivision Bylaw

Many communities address stormwater in their subdivision bylaw. Subdivision bylaws establish service levels and servicing standards for new development. Language could be drawn from the attached model bylaw for underground infiltration systems and integrated into your existing subdivision bylaw. Subdivision bylaws often refer to the drainage (watershed) plans.

Design Drawings, Criteria and Guidelines

Design drawings, standards and guidelines can be used to provide clarity and conciseness regarding the municipality's expectations and requirements for underground stormwater infiltration systems. They typically define the technical information that land developers must submit to the municipality to obtain development approvals.

Education

Educational materials (e.g. information pamphlets, web text, newsletter articles) can be used by a local government to communicate (1) why it is essential to consider risks to groundwater quality when installing underground stormwater infiltration systems, (2) what must be done to mitigate these risks, and (3) the costs and benefits of undertaking the mitigation measures.

Step 3: Develop operating procedures

Operating procedures include the day-to-day activities that are completed or commissioned by the local government to confirm that management strategies are successfully mitigating risk. Procedures may include incident response and reporting, groundwater quality monitoring, staff training, and requirements for underground infiltration facility maintenance and monitoring.

*Note: text in [ ] must be tailored to suit local government preparing the model bylaw

[B.C. municipality/district]

Underground Stormwater Infiltration Bylaw

Under its statutory powers, including ss. 938 and 540 of the *Local Government Act* [or for municipalities: s. 938 of the *Local Government Act* and s. 69 of the *Community Charter*], the [body, e.g. Municipal Council of [municipality/district]] ENACTS AS FOLLOWS:

1. Definitions

   In this Bylaw:

   "Qualified Professional" means a person with appropriate background in hydrogeology or geotechnical engineering who is licensed to practice engineering and geoscience (P.Eng., P.Geo., or Eng.L., Geo.L.);

   "Stormwater" means drainage water resulting from rainfall or other natural precipitation from the atmosphere, which runs over impervious surfaces and is typically channeled into storm sewers and watercourses;

   "Terms of Reference" means a document that describes the requirements for technical reports submitted to meet requirements of land and development bylaws of [the municipality/district];

   "Underground Stormwater Infiltration System" or "System" means a stormwater collection system that has its point of infiltration to the environment below ground surface, such as manholes (also known as soakaway sumps or dry wells), percolation systems such as infiltration trenches and infiltration pits, and boreholes and drilled wells;

   "Underground Stormwater Infiltration System Plan" or "Plan" means a detailed plan for the siting, design and maintenance of an Underground Stormwater Infiltration System at a development site, prepared by a Qualified Professional in accordance with the Terms of Reference provided by [the municipality/district], and describing, among other things:
   (a) the type of System to be installed on the site;
   (b) the design criteria and technical specifications for all elements of the System;
   (c) the location of the System on the development site; and
   (d) a plan for the ongoing operation, monitoring and maintenance of the System.

2. Purpose

   This Bylaw is enacted for the purpose of reducing the risk of contamination of [the municipality/district]'s aquifers due to the infiltration of contaminated stormwater, by ensuring that new developments, other than those specifically exempted under this Bylaw, install a professionally-designed Underground Stormwater Infiltration System on site that follows the

design criteria provided by [the municipality/district] and that these Systems are properly operated and maintained on an ongoing basis.

3. Application

This Bylaw applies to all developments on lands within [the municipality/district] that involve the construction of paved or roofed areas, or of areas covered by impermeable surfaces, other than the following:

(a) [e.g., small developments below a certain square footage];
(b) [e.g., could exempt developments in regions within the municipality/district where underground stormwater infiltration is not a significant concern];
(c) [other applications].

4. Underground Stormwater Infiltration System Requirements

(1) No person shall begin construction of a development to which this Bylaw applies without first submitting to [the municipality/district] an Underground Stormwater Infiltration System Plan for the development prepared by a Qualified Professional as per the Terms of Reference provided by [the municipality/district], and having the Plan approved by [the municipality/district].
(2) A person carrying out a development to which this Bylaw applies must ensure that an Underground Stormwater Infiltration System is installed on site in accordance with the Plan submitted for the site under Subsection (1).
(3) The owner of a site where a System has been installed shall ensure that the System continues to be operated, monitored and maintained on an ongoing basis in accordance with the Plan submitted for the site under Subsection (1).
(4) No person shall directly or indirectly deposit or permit discharge of substances in a manner that could interfere with the proper operation of, obstruct flow to, or damage a System, or contravene a Plan.

5. Enforcement

(1) A person who contravenes any provision of this bylaw commits an offence, and is liable upon conviction to a fine not to exceed [e.g., $10,000.00].
(2) Where an offence is committed or continues for more than one day, the person who commits the offence shall be deemed to have committed a separate offence for each day on which the offence occurs or continues.
(3) Nothing in this bylaw shall limit [the municipality/district] from pursuing any other remedy that would otherwise be available to [the municipality/district] at law.

6. General

(1) The headings in the Bylaw are included for convenience only, and are not be construed as defining or limiting the scope or intent of the provisions of this Bylaw.

*Note: text in [ ] must be tailored to suit local government preparing the model bylaw

(2) If any provision of this Bylaw is found invalid by a court of competent jurisdiction, the invalid portion may be severed from the Bylaw and this shall not affect the validity of the remainder of the Bylaw.

7. Citation

This Bylaw may be cited for all purposes as [correct title and no].

READ A FIRST TIME THIS	[day]	day of	[month], [year]
READ A SECOND TIME THIS	[day]	day of	[month], [year]
READ A THIRD TIME THIS	[day]	day of	[month], [year]
ADOPTED THIS	[day]	day of	[month], [year]

[Signature blocks]

Example Terms of Reference for
An Underground Stormwater Infiltration System Plan

1.0 GENERAL

Where appropriate site conditions are present, it may be desirable to discharge runoff to ground to reduce downstream impacts and to enhance groundwater recharge. A comprehensive Underground Stormwater Infiltration System Plan (3 copies) must be prepared by a Qualified Professional, submitted to, and approved by the [the municipality/district]. The following general conditions apply to the Plan:

1.1 The Plan is to include information outlined in this Terms of Reference.

1.2 The Plan must be prepared by Qualified Professional.

1.3 The Qualified Professional must sign and seal each report submitted to the [the municipality/district].

1.4 Depending on the site conditions and proposed activities, a geotechnical or hydrogeological report may also be required.

2.0 UNDERGROUND STORMWATER INFILTRATION SYSTEM PLAN

Note: An Underground Stormwater Infiltration System Plan may be included as a sub-section to an overall Stormwater Management Plan for the development, or may be prepared separately.

The Underground Stormwater Infiltration System Plan must include the following information:

2.1 The presence of hydrogeologically sensitive areas (HSAs), which commonly have the following characteristics:

- ground conditions with limited soil infiltration capacity
- poorly draining and/or low permeability soils
- shallow bedrock
- shallow groundwater
- known or suspected groundwater discharge areas (springs, seepage zones, wet areas
- floodplains

2.2 Hydrogeological data acquisition and analysis to support minor and major event designs.

2.3 Impact(s) assessment on local, adjacent and downslope properties resulting from minor and major event stormwater disposal to ground.

2.4 The potential effects from combined stormwater and residential irrigation on local, adjacent and downslope properties.

2.5 The potential impacts of site grading and fill emplacement on stormwater management.

2.6 A discussion of stormwater quality and drawings showing the location and details of proposed water quality best management practices.

2.7 An investigation of infiltration capacities and recommended design parameters.

2.8 An investigation of on-site and downslope soil/fill material stability under proposed infiltration conditions.

2.9 Recommendations to limit stormwater infiltration, where HSAs are present.

2.10 Recommended works and construction methods to prevent or mitigate potential in-ground stormwater disposal issues.

3.0 ASSURANCES & LETTER OF NOTICE

The Qualified Professional shall provide in writing the following specific assurances to [the municipality/district]:

4.0 INSURANCE

The Qualified Professional shall provide [the municipality/district] with evidence of professional liability insurance coverage (that does not lapse) in the amount of at least $1,000,000 as provided to their client.

5.0 COVENANTS

The owner/developer may be required by [the municipality/district] to register a covenant against the property title at the Land Titles Office as notification to future landowners. The covenant will incorporate provisions included in the geotechnical report(s) and will indemnify [the municipality/district] against all claims. It must be in a form as required by [the municipality/district], granted to [the municipality/district] in priority of all liens, charges and encumbrances and executed in registrable form by the person who owns the land. During the construction phase, enforcement of the covenant provisions are the responsibility of the owner/developer and the Qualified Professional.

6.0 PERFORMANCE ASSURANCE (BONDING OR LETTER OF CREDIT)

It is anticipated that works recommended by the Qualified Professional will be adhered to. If [the municipality/district] has concerns – with respect to site grading for example – the owner/developer may also be required [the municipality/district] to provide bonding as security for performance of the on-site and off-site construction works and the provisions outlined in the professional report(s) pertaining to that construction.

7.0 PEER REVIEW

[The municipality/district] may require a professional peer review for conformance to good engineering practice and adherence to these guidelines on a case-by-case basis. The peer review shall be completed

by a Qualified Professional with [the municipality/district] selecting form a list of consultants proposed by the applicant. Any costs incurred by [the municipality/district] to conduct a peer review shall be borne by the owner/developer. The professional engaged by [the municipality/district] shall notify the responsible professional in writing of the peer review.

The peer review may identify deficiencies in field investigations, analysis and/or reporting. All deficiencies will need to be resolved prior to issuance of permits.