



# City of Vancouver *Planning By-law Administration Bulletins*

## Planning, Urban Design and Sustainability Department

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# Rainwater Management Bulletin

*Authority - Director of Planning  
Effective July 11, 2018*

### In this Bulletin, the following definitions apply:

“Green infrastructure” means an approach to water management that mimics the natural water cycle by reducing and treating rainwater at its source while delivering environmental, social, and economic benefits.

“Rainwater” means rainfall and other natural precipitation.

“Best management practice” means common best practices to improve rainwater management.

“Rainwater drainage” means runoff that is the result of rainfall or other natural precipitation or from melting snow or ice.

“Rainwater Management System” means a system for collecting, retaining, detaining, treating and conveying rainwater and rainwater drainage. The system may include: catch basins, sewers, pumps, facilities/structures/devices used for storage, detention and quality treatment of rainwater and rainwater drainage (including natural ecosystem based facilities/structures/devices). The system does not include sanitary plumbing or service connections in buildings.

“Rainwater Management Plan” means a hydrological and hydraulic study, certified by a Professional Engineer, which sets out a comprehensive approach to planning, design, implementation and operation of a rainwater management system in a manner that optimizes reduced environmental impacts and drainage efficiency. The Rainwater Management Plan sets out the size, location and configuration of the rainwater management system on the development site and includes associated methodology, calculations, and drawings that demonstrate how the requirements imposed on the development will be met.

### Introduction

Onsite rainwater management is needed to mitigate the impacts of increased yearly precipitation due to climate change, increased development density, and decreased pervious surfaces that allow rainwater to infiltrate, all of which when combined will increase the occurrence of excess rainwater overwhelming the sewers leading to combined sewer overflows. The use of water sensitive site design and green infrastructure practices or source controls keeps harmful stormwater pollutants from entering our receiving waters and adds resiliency to the City’s drainage system, which is predicted to experience wetter winters, drier summers, and more frequent occurrence of intense storms.

**July 2018**

The purpose of this bulletin is to provide applicants information on the process and required submissions related to onsite rainwater management that meets the Citywide Integrated Rainwater Management Plan (IRMP) requirements for retention, rate control, cleaning, and safe conveyance. Sites having a total site size of 8,000 m<sup>2</sup> or more, or containing 45,000 m<sup>2</sup> or more of new development floor area, are to follow the requirements laid out in the Rezoning Policy for Sustainable Large Developments.

## Rainwater Management Requirements

Applicants will be required to produce a Rainwater Management Plan (RWMP) that details how the onsite rainwater management system meets the requirements outlined below, prepared, signed and sealed by a subject matter expert (Professional Engineer), subject to review. The applicant is to demonstrate how the proposed system will meet the following:

### 1. Volume Reduction

1.1. Capture 24 mm of rainfall in 24-hours (or 70% of the average annual rainfall volume) from all areas, including rooftops, paved areas, and landscape and infiltrate, evaporate or reuse it.

1.1.1. Landscape areas over native subsoils with appropriately sized growing medium meet the 24 mm capture requirement. See Design Resources below for guidance on sizing topsoil for rainwater management.

1.1.2. All proposed landscape areas are to ensure adequate growing medium for both horticultural and rainwater management needs.

1.2. The applicant must prioritize methods of capture according to the three tiers below, beginning with Tier 1. Justification must be provided for using the 2<sup>nd</sup> and 3<sup>rd</sup> tier options. Some acceptable exemptions have been outlined below. The tiers are as follows:

**Tier 1:** Use volume reducing green infrastructure practices. Acceptable practices include but are not limited to: infiltration into in-situ soil, rainwater harvesting and re-use, and green roofs.

**Tier 2:** Use non-infiltrating landscapes. For example, rainwater can be directed to absorbent landscape on slab, closed bottom planter boxes, and lined bioretention systems.

**Tier 3:** Use detention in combination with a water quality treatment practice as a last resort. Allowable release rate for detention facilities is described below.

### Acceptable Exemptions

Justifications for not using 1<sup>st</sup> tier green infrastructure practices will be reviewed at the discretion of the City. Exemptions may be granted but are not limited to the following reasons:

Tier 1 Exemptions:

- Low infiltration capacity (e.g. less than 1.5 mm/hr);
- Limited available space for engineered infiltration systems due to onsite conditions, such as tree retention;
- Seasonally high groundwater table or bedrock within 0.6 m of the bottom of the practice;
- Contamination concerns; and
- Slope stability concerns (as supported by a preliminary geotechnical study, see submission requirements below).

Tier 2 Exemptions:

- Limited available space for non-infiltrating facilities due to onsite conditions, such as tree retention.

## 2. Release Rate

- 2.1. The rainwater management system for the building(s) and site shall be designed such that the peak flow rate discharged to the sewer under post-development conditions is not greater than the peak pre-development flow rate for the return period specified in the City of Vancouver's Intensity-Duration-Frequency curve (IDF curve)(see attached IDF curves). The City of Vancouver's 2014 IDF curve shall be utilized for pre-development design flow calculations, and the City's 2100 IDF curve, which takes into account the effects of climate change, shall be utilized for post-development design flow calculations. Pre-development, in this context, means the site's immediate use preceding development.

## 3. Water Quality

The water quality requirements are outlined below. The water quality volume to be treated varies depending on the type of pollutant generating surface.

- 3.1. The first 24 mm of rainfall from all pervious and impervious surfaces shall be treated to remove 80% Total Suspended Solids (TSS) by mass prior to discharge from the site. For impervious surfaces with high pollutant loads, including roads, driveways, and parking lots, the rainfall to be treated increases to the first 48 mm of rainfall. Treatment can be provided by either one green infrastructure practice or structural Best Management Practice (BMP) or by means of a treatment train comprised of multiple green infrastructure practices or structural BMPs that can be demonstrated to meet the 80% TSS reduction target.

3.1.1. Vegetated practices or absorbent landscapes that infiltrate or filter the appropriate water quality volume (based on the type of pollutant generating surface) through a minimum of 450 mm of growing medium are assumed to meet the quality requirement. The Metro Vancouver Stormwater Source Control Design Guidelines referenced below outlines growing medium specifications.

3.1.2. For proposed proprietary treatment devices:

- 3.1.2.1. Provide product information for proposed proprietary treatment devices.
- 3.1.2.2. Products need to meet the above treatment standard and be certified by either the Washington State Department of Ecology's Technology Assessment Protocol – Ecology Program (TAPE) or Environmental Technology Verification (ETV) Canada. The applicant may propose other technologies but must provide supporting information that shows the technology meets the treatment standard.

## Design Resources

The Metro Vancouver Stormwater Source Control Design Guidelines is available as a design resource to address the above volume reduction and water quality requirements, and also contains information on construction considerations and staging as well as facility maintenance.

<http://www.metrovancouver.org/services/liquid-waste/LiquidWastePublications/StormwaterSourceControlDesignGuidelines2012StormwaterSourceControlDesignGuidelines2012.pdf>

## Submission Requirements

**At time of an application to rezone a development site:** Submissions for an application to rezone must include the following elements:

- A preliminary Rainwater Management Plan, outlining the rainwater management approach to be taken on site and how the project will meet the requirements for volume reduction, rate control, and quality. This approach is to inform a detailed Rainwater Management Plan that is to be submitted prior to enactment. The Rainwater Management Plan must be coordinated with the open space plan, site plan, landscape plans and all approved policies and guidelines in respect to the project.

RWMP submissions must include the following elements:

- Pre-development site plan showing orthophoto, existing drainage areas , and onsite and downstream offsite drainage appurtenances;
  - A proposed site plan that delineates building location, underground parking extents, and drainage areas and includes the area measurements for pervious/impervious areas. The site plan shall also identify appropriately sized green infrastructure practices for each of the drainage areas;
  - Hydrologic and hydraulic analysis prepared by a qualified professional in the area of rainwater management showing how the site will meet the above requirements;
  - Justifications for not using Tier 1 and Tier 2 green infrastructure practices must be included in the RWMP;
  - Details on how the rainwater management requirements set out above will be achieved through any development phases and once all development phases are complete; and
  - Supplementary documentation for any proprietary products that clearly demonstrates how they contribute to and/or meet the above requirements.
- A preliminary geotechnical study supporting assumptions made in the preliminary RWMP, that includes the following:
    - An evaluation of the potential for and risks of onsite rainwater infiltration, such as slope stability and soil contamination;
    - Results of infiltration testing at likely locations for infiltration practices and a proposed design infiltration rate;
    - Soil stratigraphy; and
    - Depth to bedrock and seasonally high groundwater at likely locations for infiltration practices.

**Prior to the Enactment of a By-law to rezone a development site:** Every applicant will be required to provide a final signed and sealed RWMP completed by a Professional Engineer, with an accompanying final geotechnical study. The content and supporting documentation is to be updated to reflect all material changes to the proposed development and new/refined supporting data, calculations, plans, reports and other materials following submission of the preliminary RWMP.

Specifically, the final RWMP shall include:

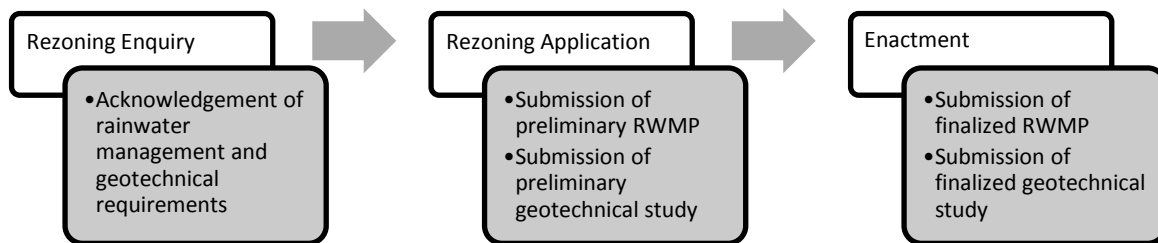
1. Final hydrologic and hydraulic analysis based upon the final design of the rainwater management system;
2. Confirmation that access has been provided for maintaining the rainwater management system, such as providing truck access for pumping out sediment traps; and
3. A maintenance and operation guide for the rainwater management system that is provided to the eventual owner or party responsible for maintenance.

**Prior to Development Permit Application:**

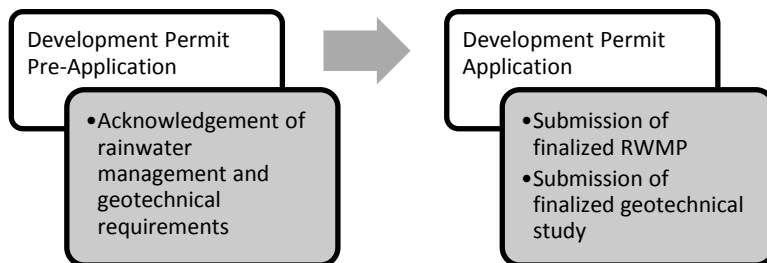
- For applicants proceeding from a rezoning: no additional reporting on the rainwater management system is required following the submission of the final RWMP and geotechnical study at the time of Enactment.
- For applicants applying directly at the development permit stage: a preliminary RWMP is not required and applicants are to submit a finalized RWMP and geotechnical study. Both must include the same minimum elements described above for the preliminary and final RWMP and geotechnical study submissions and must have been signed and sealed by a qualified Professional Engineer.

**Application Flow Diagrams**

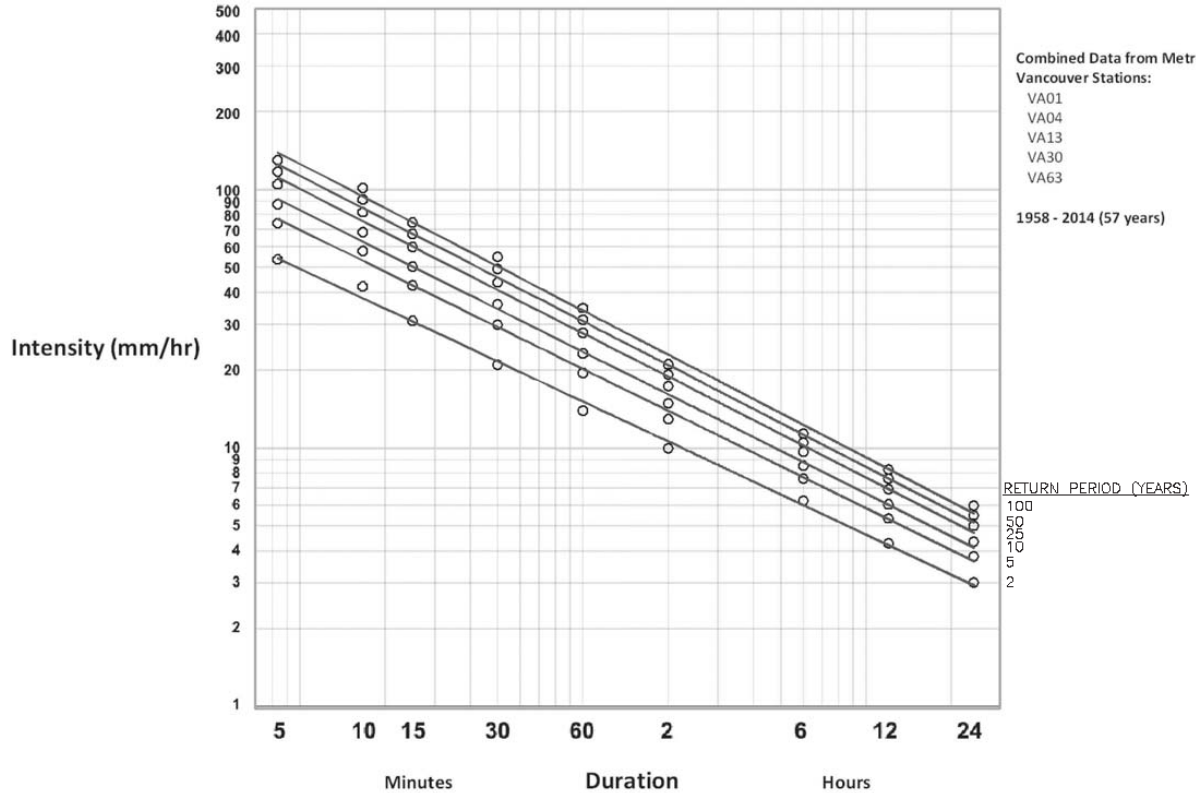
**Rezoning Applications:**



**Direct Development Permit Applications (currently only applicable in the Cambie Corridor):**



**City of Vancouver - IDF Curves (2014)**



Combined Data from Metro Vancouver Stations:  
VA01  
VA04  
VA13  
VA30  
VA63

1958 - 2014 (57 years)

RETURN PERIOD (YEARS)  
100  
50  
25  
10  
5  
2

INTENSITY DURATION FREQUENCY (IDF) EQUATION INTERPOLATION COEFFICIENTS (2014)

$$R = A * T^B$$

WHERE:  
T = TIME IN HOURS  
A,B = COEFFICIENTS  
R = RAINFALL INTENSITY IN mm/hr

RECCURANCE INTERVAL	PROBABILITY	A	B
1 IN 2 YR	50%	15.13	-0.514
1 IN 5 YR	20%	20.21	-0.538
1 IN 10 YR	10%	23.56	-0.548
1 IN 25 YR	4%	27.78	-0.558
1 IN 50 YR	2%	30.90	-0.563
1 IN 100 YR	1%	34.00	-0.567

SOURCE:  
"VANCOUVER RAINFALL STUDY AND IDF UPDATE," URBAN SYSTEMS LTD, VANCOUVER BC, DECEMBER 2015.

APPLICATION

10 YEAR - DESIGN, BUSINESS, COMMERCIAL AND INDUSTRIAL AREAS.  
5 YEAR - DESIGN, RESIDENTIAL AREAS, INVESTIGATIONS

MINIMUM INLET TIME

RESIDENTIAL AREA	10 MINS.
BUSINESS	5 MINS.
CENTRAL BUSINESS DISTRICT & WEST END	5 MINS.



**CITY OF VANCOUVER - ENGINEERING SERVICES**

**RAINFALL IDF GRAPH AND  
MINIMUM PIPE SLOPES AND  
EQUATIONS**

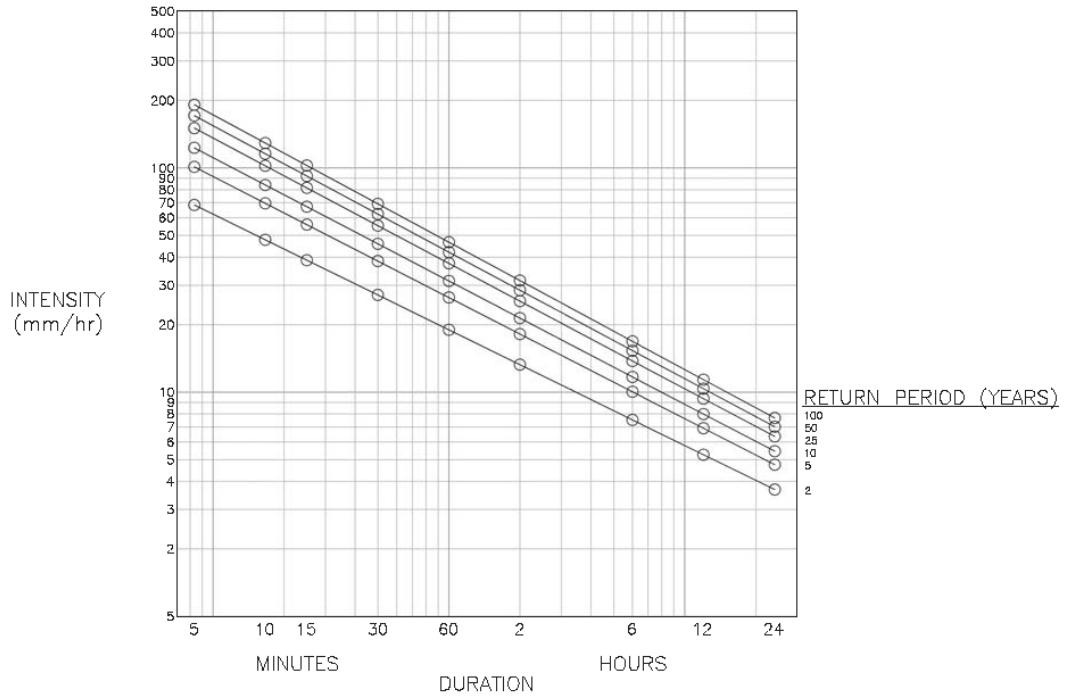
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CITY OF VANCOUVER – IDF CURVES (2100)



INTENSITY DURATION FREQUENCY (IDF)  
EQUATION INTERPOLATION COEFFICIENTS (2100)

$R = A * T^B$

WHERE:  
T = TIME IN HOURS  
A,B = COEFFICIENTS  
R – RAINFALL INTENSITY IN mm/hr

RECURRANCE INTERVAL	PROBABILITY	A	B
1 IN 2 YR	50%	18.96	-0.516
1 IN 5 YR	20%	26.41	-0.540
1 IN 10 YR	10%	31.32	-0.550
1 IN 25 YR	4%	37.51	-0.559
1 IN 50 YR	2%	42.09	-0.564
1 IN 100 YR	1%	46.64	-0.568

SOURCE:  
"VANCOUVER RAINFALL STUDY AND IDF UPDATE,"  
URBAN SYSTEMS LTD, VANCOUVER BC,  
PS20150252, DECEMBER 2015.

APPLICATION

25 YEAR – TRIBUTARY AREA GREATER THAN 40.5ha (100acres)  
10 YEAR – DESIGN, BUSINESS, COMMERCIAL AND INDUSTRIAL AREAS.  
5 YEAR – DESIGN, RESIDENTIAL AREAS, INVESTIGATIONS

MINIMUM INLET TIME

RESIDENTIAL AREA	10 MINS.
BUSINESS	5 MINS.
CENTRAL BUSINESS DISTRICT & WEST END	5 MINS.

ENGINEERING SERVICES - CITY OF VANCOUVER



SEWERS & DRAINAGE DESIGN BRANCH  
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SEWER – STANDARDS  
RAINFALL INTENSITY EQUATION  
2100 IDF CURVE

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