

## GRI PATHWAYS STUDY - SUMMARY SHEET

### PURPOSE

The “Rainwater Infrastructure Building Typologies Pathways Study” (**GRI Pathways Study**) was undertaken to better understand what **GRI tool combinations** are most suitable to meet the Rain City Strategy (RCS) performance **targets** (e.g. retain 24 mm/day, 48 mm/day) for various representative **building-site typologies** on private property. A range of site conditions were incorporated. The study also sought to better understand:

- ❖ the capital **costs** of these GRI tool combinations,
- ❖ the **co-benefits** (e.g. urban heat mitigation, groundwater recharge, twelve others), and
- ❖ the **barriers** and **solutions** to implementation.

### RESULTS

This work produced a preferred set of GRI tool combinations (**‘compliance pathways’**) for each building-site typology. Accompanying **commentary** and **recommendations** inform the ongoing development of rainwater management policies for the City.

### CHAPTERS AND CONTENT

CHAPTERS	ES PAGE NO.	PAGE NO.
<b>Executive Summary (ES)</b>	<b>ES Page 4</b>	
<b>TASK 2: Building-Site Typologies</b> (e.g., small lot, low-rise, mid-rise, high rise, other)	<b>ES Page 4</b>	<b>Page 50</b>
<b>TASK 3: Rainwater Management Tools</b> (e.g., green roof, bioretention, tree trench, detention tank, non-potable water reuse, treatment device, other)	<b>ES Page 7</b>	<b>Page 75</b>
<b>TASK 4: GRI Design Methodology</b> (current state, jurisdictional scan, current and recommended GRI design methodology, design tool)	<b>ES Page 8</b>	<b>Page 89</b>
<b>TASK 5: Performance Modelling and Solution Sets (“Pathways”)</b> (variables, development and policy considerations, approach (includes 73,000 scenarios), results)	<b>ES Page 17</b>	<b>Page 165</b>
<b>TASK 6: Costing</b> (GRI unit capital costs, total capital costs for each typology’s compliance pathway, total cost as percent of overall building construction cost)	<b>ES Page 23</b>	<b>Page 228</b>
<b>TASK 7: Co-Benefits</b> (metrics (economic, environmental, community, resiliency), scoring, weighting)	<b>ES Page 25</b>	<b>Page 306</b>
<b>TASK 8: Barriers and Solutions</b> (physical, regulatory, procedural, economic, cultural)	<b>ES Page 28</b>	<b>Page 318</b>
<b>TASK 9: Policy Considerations</b>	<b>ES Page 31</b>	<b>Page 336</b>
➤ <b>SECTION 1: Solution Sets &amp; Release Rate Analysis</b> (key takeaways, observations)	<b>ES Page 31</b>	
➤ <b>SECTION 2: Policy Options &amp; Recommendations</b> (alignment with HWP, performance-based design standard, release rate reduction)	<b>ES Page 37</b>	
➤ <b>SECTION 3: Implementation Steps</b> (specific GRI Types, implementation of policy, interim steps)	<b>ES Page 40</b>	
<b>WORKSHOP 1</b>	<b>ES Page 48</b>	<b>Page 373</b>
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### RELATION TO CURRENT RAINWATER MANAGEMENT POLICY ON PRIVATE PROPERTY

RCS performance targets have been superseded by other rainwater management requirements on private property (see Vancouver Building By-law). GRI Pathways Study findings remain an informative resource for those pursuing retention-based approaches.

## EXAMPLES OF SUMMARY TABLES

Table ES 2 – Summary of Modelling Variables

Retention Compliance Standard	Site Conditions		Development and Policy Conditions	
	Pre-Development Condition	Soil Infiltration Rate	Infiltration Area Available	Non-Potable Reuse
<ul style="list-style-type: none"> <li>24 mm</li> <li>48 mm</li> </ul>	<ul style="list-style-type: none"> <li>No pre-development (Natural conditions, 0% impervious)</li> <li>Less than post-development (50% of typology impervious)</li> <li>Equivalent to post-development (100% of typology impervious)</li> </ul>	<ul style="list-style-type: none"> <li>High (50 mm/hr)</li> <li>Medium (20 mm/hr)</li> <li>Low (5 mm/hr) None (0 mm/hr)</li> </ul>	<b>Foundation Setback</b> <ul style="list-style-type: none"> <li>Typical (5 m)</li> <li>Reduced (3 m)</li> <li>No setback (0 m)</li> </ul> <b>Parkade Setback</b> <ul style="list-style-type: none"> <li>Parkade minimum - occupies only the building footprint</li> <li>Parkade maximum - occupies portion of parcel equal to total impervious area (i.e., 90-100% of parcel)</li> </ul>	<ul style="list-style-type: none"> <li>Typical non-potable demands (flushing + irrigation)</li> <li>Expanded non-potable demands (including clothes washing and cooling makeup)</li> </ul>

Table ES 7 – Pathway Solution Set Summary Table

Pathway Category:	1	2	3	4	5
Retention Standard:	24 mm			48 mm	n/a (Tier 3)
Soil Conditions:	No infiltration	Low infiltration (5 mm/hr)			n/a
Setback/Parkade:	n/a	Typical (Full)	Reduced		n/a
<b>Small Lot Residential Low Massing</b> Stories: 2 GFA: 225 m <sup>2</sup>	<i>No viable pathway</i>	<ul style="list-style-type: none"> <li>Bioretention</li> </ul>	<ul style="list-style-type: none"> <li>Bioretention</li> </ul>	<ul style="list-style-type: none"> <li>Bioretention</li> </ul>	<ul style="list-style-type: none"> <li>Detention &amp; Treatment device</li> </ul>
<b>Small Lot Residential High Massing</b> Stories: 2 GFA: 375 m <sup>2</sup>	<i>No viable pathway</i>	<ul style="list-style-type: none"> <li>Green roof</li> <li>Bioretention</li> <li>Permeable pavement</li> </ul>	<ul style="list-style-type: none"> <li>Bioretention</li> </ul>	<ul style="list-style-type: none"> <li>Green roof</li> <li>Subsurface infiltration</li> </ul>	<ul style="list-style-type: none"> <li>Detention &amp; Treatment device</li> </ul>
<b>Low-Rise Residential &amp; Mixed-Use</b> Stories: 3 GFA: 3,000 m <sup>2</sup>	<i>No viable pathway</i>	<ul style="list-style-type: none"> <li>Green roof</li> <li>Bioretention</li> </ul>	<ul style="list-style-type: none"> <li>Bioretention</li> </ul>	<ul style="list-style-type: none"> <li>Bioretention</li> <li>Permeable pavement</li> </ul>	<ul style="list-style-type: none"> <li>Detention &amp; Treatment device</li> </ul>
<b>Mid-Rise Residential &amp; Mixed-Use</b> Stories: 6 GFA: 11,700 m <sup>2</sup>	<ul style="list-style-type: none"> <li>Green roof</li> <li>Rainwater harvesting</li> </ul>	<ul style="list-style-type: none"> <li>Green roof</li> <li>Rainwater harvesting</li> <li>Bioretention</li> </ul>	<ul style="list-style-type: none"> <li>Bioretention</li> <li>Permeable pavement</li> </ul>	<ul style="list-style-type: none"> <li>Green roof</li> <li>Subsurface infiltration</li> </ul>	<ul style="list-style-type: none"> <li>Detention &amp; Treatment device</li> </ul>
<b>High-Rise Residential &amp; Mixed-Use</b> Stories: 20 GFA: 16,800 m <sup>2</sup>	<ul style="list-style-type: none"> <li>Rainwater harvesting</li> </ul>	<ul style="list-style-type: none"> <li>Green roof</li> <li>Bioretention</li> </ul>	<ul style="list-style-type: none"> <li>Bioretention</li> </ul>	<ul style="list-style-type: none"> <li>Bioretention</li> <li>Permeable pavement</li> </ul>	<ul style="list-style-type: none"> <li>Detention &amp; Treatment device</li> </ul>
<b>Low/Mid-Rise Non-Residential</b> Stories: 3 GFA: 3,000 m <sup>2</sup>	<i>No viable pathway</i>	<i>n/a (parkade occupies entire site)</i>	<ul style="list-style-type: none"> <li>Bioretention</li> <li>Permeable pavement</li> </ul>	<ul style="list-style-type: none"> <li>Green roof</li> <li>Bioretention</li> <li>Permeable pavement</li> </ul>	<ul style="list-style-type: none"> <li>Detention &amp; Treatment device</li> </ul>
<b>High-Rise Non-Residential</b> Stories: 14 GFA: 61,600 m <sup>2</sup>	<ul style="list-style-type: none"> <li>Green roof</li> <li>Rainwater harvesting</li> </ul>	<i>n/a (parkade occupies entire site)</i>	<ul style="list-style-type: none"> <li>Bioretention</li> <li>Permeable pavement</li> </ul>	<ul style="list-style-type: none"> <li>Green roof</li> <li>Bioretention</li> <li>Permeable pavement</li> </ul>	<ul style="list-style-type: none"> <li>Detention &amp; Treatment device</li> </ul>

GFA = Gross Floor Area