



# 1302, 1308 & 1318 East 12<sup>th</sup> Avenue

## Preliminary Integrated Rainwater Management Report

File No. 22179

April 11<sup>th</sup>, 2022

Revision: 1

# CREUS Engineering Ltd

610-EAST TOWER, 221 ESPLANADE W, N. VANCOUVER, BC V7M 3J3

Civil Engineers & Project Managers

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## 1.0 Introduction

**XXG Apartment Ltd.** has retained **Creus Engineering Ltd.** to prepare a Preliminary Integrated Rainwater Management Plan for the proposed development at **1302, 1308 & 1318 East 12<sup>th</sup> Avenue**, Vancouver, BC.

The following report and associated documents demonstrate how the proposed development meets the City's requirements for retention, rate control, treatment and safe conveyance of onsite stormwater. These documents were prepared in accordance with the Citywide Integrated Rainwater Management Plan and the Rainwater Bulletin dated July 11, 2018.

### 1.1 Citywide Integrated Rainwater Management Plan Objectives

The **Citywide Integrated Rainwater Management Plan (IRMP)** was developed to reduce the growing demand on the City's sewer infrastructure due to climate change and increasing density. The Citywide IRMP promotes green infrastructure practices that act at the source to reduce the volume and release rate and improve the quality of stormwater entering the City's sewer system. These strategies help to reduce the quantity of harmful pollutants entering receiving water bodies and work to return stormwater to natural pathways by use of infiltration, evaporation and evapotranspiration.

Per the Citywide IRMP guidelines, the proposed development must meet the following criteria:

#### 1.1.1 Volume Reduction

Runoff from the first 24 mm of rainfall from all areas including rooftops, paved areas, and landscape must be retained on site. Best Management Practices (BMPs) must be prioritized accordingly:

Best Management Practices			
	BMPs	Included in Project	Notes
Tier 1	Rain Water Harvesting	No	Due to space & budget constraints the project will not be pursuing rainwater harvesting.
	Green Roofing	Yes	This project has incorporated green roofing across the site that will store stormwater will temporarily store stormwater where some will undergo evapotranspiration and some will gradually release it to the drainage system .
	Soil Infiltration	Yes	The project has incorporated off-slab permeable paving that will store & infiltrate stormwater back into natural pathways while naturally treating the runoff.
Tier 2	Absorbent Landscape on Slab	No	The project has currently selected to use green roof (Tier 1) rather than absorbent landscape on slab.
	Closed Bottom Planter Boxes	No	The project has currently selected to use green roof (Tier 1) rather than closed bottom planter boxes.
	Lined Bio Retention Systems	No	Due to limited space onsite the project will not be pursuing lined bio retention systems
Tier 3	Detention Storage with Slow Release	Yes	Due to the extents of the parkade sub surface infiltration is not permitted. A detention tank c/w flow control structure & water treatment unit are proposed.

The proposed storage measures for this development are **green roof, off-slab permeable paving, and a detention tank**. Further information on these measures can be found in Section 4.1 of this report.

### 1.1.2 Release Rate

The release rate objective is to maintain the pre-development 1:5-year storm release rate for residential areas or the 1:10-year storm release rate for business, commercial and industrial areas. The pre-development estimate shall utilize the 2014 IDF curve and the post-development estimate shall use the 2100 IDF curve to account for climate change. This development's proposed rate control measure is a **flow control structure downstream of the detention tank** to control the **1:10-year storm**. More details on the flow control measures can be found in Section 4.2 of this report.

### 1.1.3 Water Quality

The stormwater that leaves the site must be treated to a standard of 80% TSS removal by mass. This objective can be achieved by either using an individual BMP to meet this standard or a treatment train of BMPs that, when combined, meet this standard. The required water quality treatment volume is 24 mm for low pollutant generating surfaces like roofs and 48mm for high pollutant generating surfaces like driveways. Treatment manholes are to meet the Environmental Technology Verification (ETV) Canada ISO 14034 Certification or the Washington State Department of Ecology's Technology Assessment Protocol – Ecology Program (TAPE). The treatment measures for this development includes a **Jellyfish treatment manhole** to meet this objective. The water quality requirement is discussed further in Section 4.3 of this report.

## 2.0 Pre-Development Site Conditions

1302, 1308 and 1318 East 12<sup>th</sup> Avenue is located in the Kensington-Cedar Cottage neighborhood of Vancouver. The site consists of three RM-11N lots that will be rezoned and consolidated into one parcel to accommodate a new development. The existing lots contain multiple dwellings and have a total combined area of 1057 m<sup>2</sup>.

The existing topography of the site slopes primarily to the northeast at an average grade of 4.6%. The maximum grade difference is from the southwest corner to the northeast corner; an elevation difference of 2.11 m over a distance of 46.27 m.

The existing properties likely direct some stormwater runoff from hardscape areas to onsite landscape areas. Excess runoff is expected to follow the natural grade to the northeast and drain to East 12<sup>th</sup> Avenue. Runoff from roof areas is expected to be collected in drains and flow into the storm main on East 12<sup>th</sup> Avenue. City records note the storm services to the existing properties were installed in 1994 and 2005. No records of on-site storm water retention facilities are available and it is unlikely that these properties had such systems given their age, location, and zoning.

Areas were obtained from the site survey to determine the weighted runoff coefficient of the pre-development site. **The pre-development weighted runoff coefficient was calculated to be 0.20. From this, the pre-development peak flow rate was determined to be 5.4 l/s for the 2014 1:10-year storm event with a time of concentration (TOC) of 5 minutes.**

Refer to Appendix A: Pre-Development Conditions for further details regarding the pre-development conditions and peak flow rate.

### 3.0 Post-Development Site Conditions

The proposed development consists of a six-storey residential building with at grade commercial use and two levels of underground parking. The development is bound by East 12<sup>th</sup> Avenue to the north, Clark Drive to the west, a lane to the south, and a residential building to the east. The below grade parkade is set back 1.5 m from the east property line, and extends to all other property lines.

**The 24mm target capture volume for the proposed development is 25.4 m<sup>3</sup>.**

A catchment analysis was performed on the plans provided by David Wong Sea to Sky Architecture. Of the 1057 m<sup>2</sup> area the proposed development will consist of approximately 599 m<sup>2</sup> of building/roof, 407 m<sup>2</sup> of green roof area, and 51 m<sup>2</sup> of off-slab permeable paving area. Based on these areas, **the weighted runoff coefficient for the development is 0.68. The associated post-development peak flow rate is 24.5 l/s for the 2100 1:10-year storm event with a TOC of 5 minutes.**

Refer to Appendix C: Retention Strategies for further details regarding the post-development conditions and peak flow rate.

### 4.0 Proposed Rainwater Management Measures

The proposed rainwater management strategy for this development includes **Tier 1, Tier 2 and Tier 3 measures** to meet the City of Vancouver's rainwater management requirements as described in Section 1.0 of this report. These strategies include the following BMPs: green roof, off-slab permeable paving, and a detention tank complete with a flow control structure and treatment manhole. The green roof and permeable pavers will capture and store the rain that falls directly on it. All additional runoff will be directed to the storage tank for treatment, storage, and rate control.

Due to the extents of the parkade subgrade infiltration is not feasible on this site. As a result, a geotechnical report is not required for the purpose of the rainwater management plan.

**Landscape areas on site have been maximized** on the ground floor and roof while still maintaining the City's requirements for amenity spaces, private patios, and walkways. During design development, to make best use of the Tier 1 and Tier 2 measures, wherever possible, runoff from hardscape areas will be drained to green roof or pavers for storage. However, some hardscaped areas cannot be directed to green roof or pavers because they are elevated above the surrounding hardscape areas. Runoff from roof levels and hard surfaces unable to drain to green roof or pavers will be collected in drains and be directed to the detention tank for treatment, storage, and rate control.

Refer to Appendix C: Retention Strategies for further details regarding the proposed rainwater management strategy. A landscaping and grading plan (including soil volumes) will be provided in the building permit submission to support the proposed landscape capture.

## 4.1 Volume Reduction

### 4.1.1 Tier 1

**Green roof** - 407 m<sup>2</sup> of green roof is proposed for the development. The green roof will be located on level 6, level 5, and level 2 roof areas. The manufacturer of the green roof, and the green roof thickness is not yet known but is assumed to have a minimum depth of 100 mm. It is estimated that the green roofs will contribute 9.8 m<sup>3</sup> of storage to the volume reduction requirement. This volume only accounts for the 24 mm of rain that falls directly on the green roof. An estimate of the overall capacity of the green roof is 12.3 m<sup>3</sup>. This assumes the green roof has a water holding capacity of 30%. Refer to Appendix D: Architectural Plans for further green roof details.

**Off-Slab Permeable Paving** – 51 m<sup>2</sup> of off-slab permeable paving is proposed for the development. Off-slab permeable paving is paving not over a slab that has permeable joints allowing water to drain through the pavers into the soil below. The pavers will be set on a gravel base that will allow for water to be infiltrated back into the natural soil. The off-slab permeable paving will contribute approximately 1.2 m<sup>3</sup> of storage to the volume reduction requirement. This accounts for the water falling directly on the permeable paving area. A conservative estimate of the overall storage capacity of the off-slab permeable pavers is 2.8 m<sup>3</sup>. This assumes a soil water holding capacity of 18% and a depth of 300 mm. It is likely that the off-slab permeable paving will provide more storage as the water will continuously infiltrate into the soil below. Refer to Appendix E: Landscape Plans for further permeable paving details.

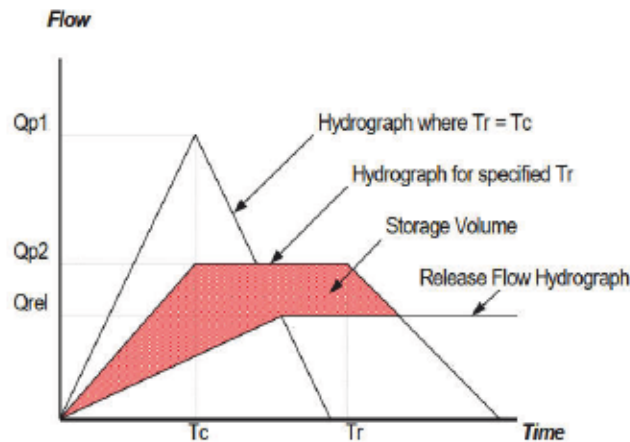
### 4.1.3 Tier 3

**Detention Tank** – A 14.4 m<sup>3</sup> detention tank is proposed for this development to store the remaining volume not captured by other BMPs. Currently, the detention tank is proposed to be within the parkade and will likely be cast-in-place concrete. The tank size and location will be determined by the architect and mechanical engineer later on in the development process. The final detailing of the detention tank will be provided in the building permit submission.

Refer to Appendix C: Retention Strategies for further details regarding the proposed volume reduction measures.

## 4.2 Flow Control Release Rate and Storage Volume

The modified rational method was utilized to determine the storage volume required to reduce the post-development peak runoff to the pre-development peak flow or less. The modified rational method is an effective and common method for calculating storage volumes when the catchment area is less than 10 acres.



The modified rational method creates three hydrographs for each of the different storm durations using the formula,  $Q=CIA$  where  $I$  is the rainfall intensity for the storm duration being analyzed. The length of the rising limb and the falling limb of each inflow hydrograph is equal to the time of concentration. The area below the hydrographs is equal to the volume of runoff. The outflow hydrograph is created by assuming that the outflow will increase linearly and reach the maximum release rate where it intersects the receding limb of the inflow hydrograph. It is assumed the release rate will equal the maximum rate thereafter. The required storage is equal to the area between the inflow hydrograph for the current storm duration and the outflow hydrograph. A storm with a duration greater than the time of concentration may produce more runoff than a storm where the duration equals the time of concentration, although the peak flowrate will be less. For this reason, storm durations from 1 minute to 24 hours are analyzed in 1 min intervals and the tank is then sized for the storm duration that produces the maximum storage volume requirement. The area between the hydrographs is determined using the following formula:

$$\text{Storage Volume} = T_r (Q_{p2} - Q_{rel}) + 0.5 T_c Q_{rel}^2 \left( \frac{1}{Q_{p2}} - \frac{1}{Q_{p1}} \right)$$

Where

- $T_i$  = duration of specified storm (seconds)
- $T_c$  = time of concentration (seconds) (TOC)
- $Q_{p1}$  = peak flow for storm duration  $T_r = T_c$  (m<sup>3</sup>/s)
- $Q_{p2}$  = peak flow for specified storm duration (m<sup>3</sup>/s)
- $Q_{rel}$  = maximum release rate (m<sup>3</sup>/s)

The maximum release rate from the tank must be less than the pre-development peak runoff and is controlled by an orifice. The maximum release rate is dependent on the orifice size and maximum water height above the orifice. The design intention is to reduce the release rate as much as possible to utilize the entire tank volume determined by the volume reduction requirement. Reducing the orifice size or water height reduces the maximum release rate and increases the required storage volume to control the design storm.

For this development, flow control will be provided by a **flow control structure located downstream of the detention tank**. The flow control structure consists of an orifice and overflow. The runoff on site will be released back into the municipal sewers at a controlled rate, using the

detention tank to store the excess water. In the case that the detention tank reaches capacity, the flow control structure will allow the water to overflow into the sewer. The exact tank dimensions are not known at this time, so the orifice size will be provided at a later date. Utilizing the modified rational method, and the pre-development release rate of 5.4 l/s, it was determined that a storm duration of 20 minutes produces the largest storage volume requirement of 7.4 m<sup>3</sup>. **Therefore, peak storage requirement to reduce the 1:10 year peak storm to pre-development levels is 7.4 m<sup>3</sup>.**

Refer to Appendix C: Retention Strategies for further details regarding the proposed flow control management measures.

### 4.3 Treatment

**A JFVLAN-IA-15C-L1 Jellyfish treatment manhole is proposed to treat runoff from pollutant generating surfaces on site to meet the treatment objectives.**

Refer to Appendix E: Treatment Manhole Details for the Jellyfish sizing report.

### 5.0 Access & Maintenance

An Integrated Rainwater Management Operations & Maintenance Manual will be provided as part of the building permit submission that details access and maintenance requirements for the proposed BMPs.

### 6.0 Summary

The proposed development utilizes Tier 1, Tier 2, and Tier 3 best management practices to meet the Citywide Integrated Rainwater Management Plan requirements. The development's IRMP includes a combination of green roof, off-slab permeable paving, and a detention tank to provide an ultimate storage capacity of 25.4 m<sup>3</sup>. The detention tank and flow control structure proposed will act to control the storm surge and reduce the calculated post-development flow rate from 24.5 l/s to 5.4 l/s, the pre-development release rate. A Jellyfish treatment manhole has been sized to treat the rainwater runoff from site. The BMPs proposed will ensure the proposed development will exceed the pre-existing site's rainwater management performance. The proposed development is not expected to have a significant impact on the City's sewer infrastructure or neighboring properties due to rainwater.

If you have any questions or require any further information, please do not hesitate to contact the undersigned.



**Creus Engineering Ltd.**

Prepared By:

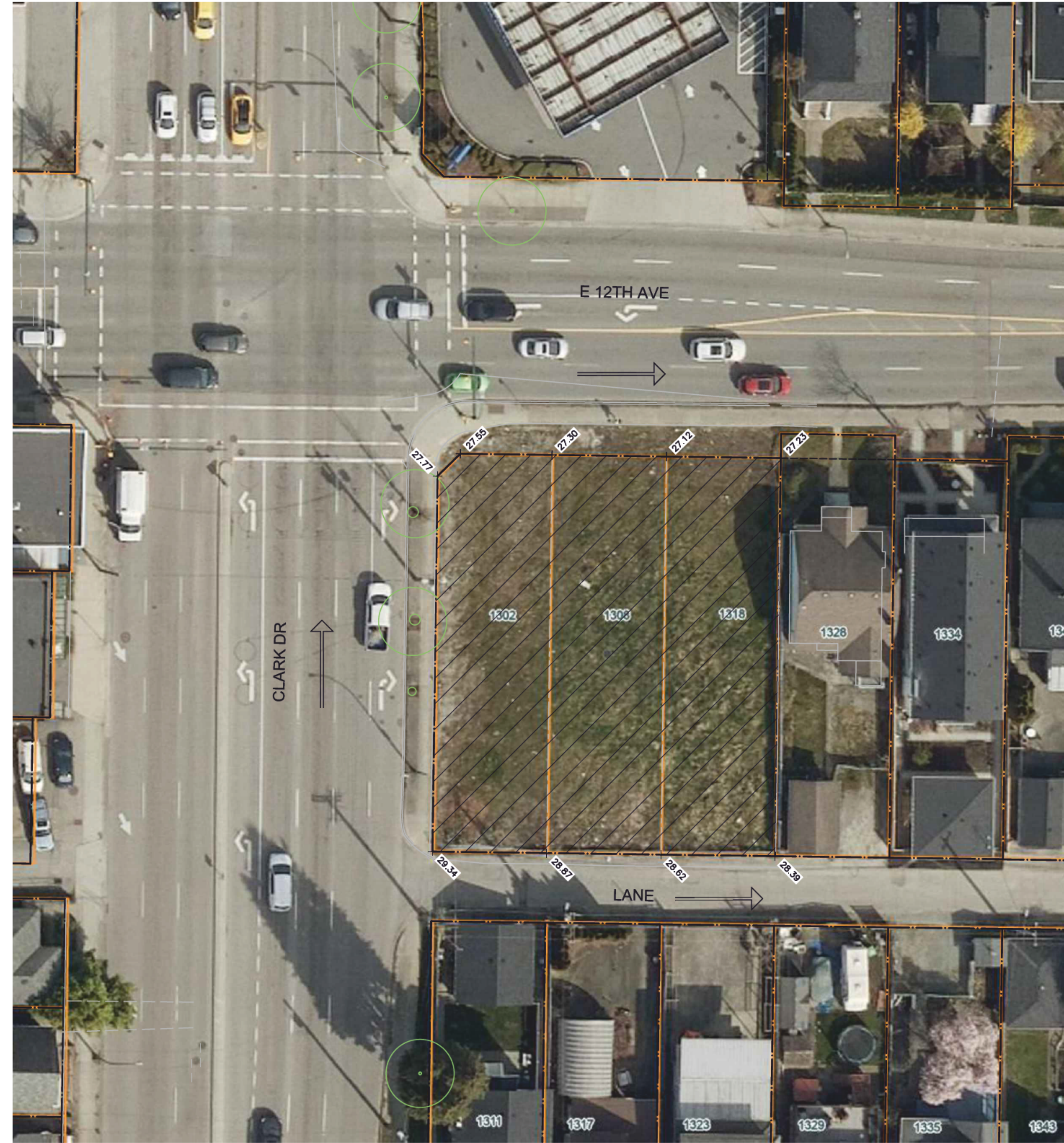
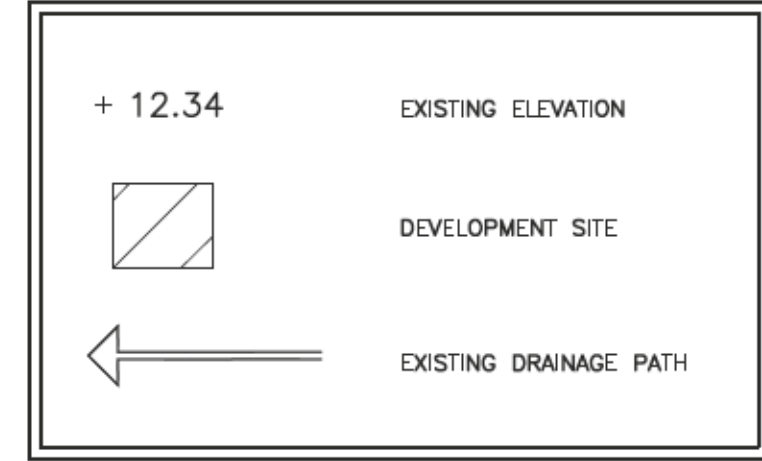
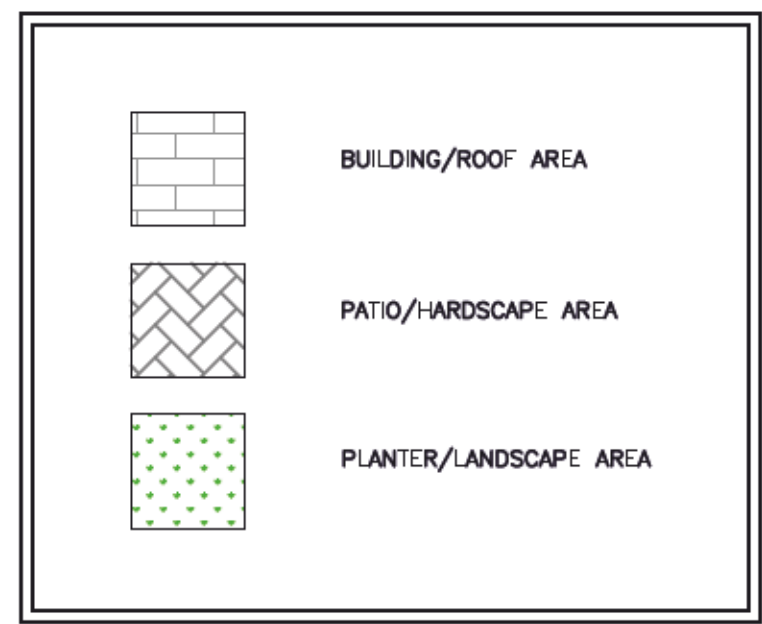
Reviewed By:

Maddy Pos, P.Eng

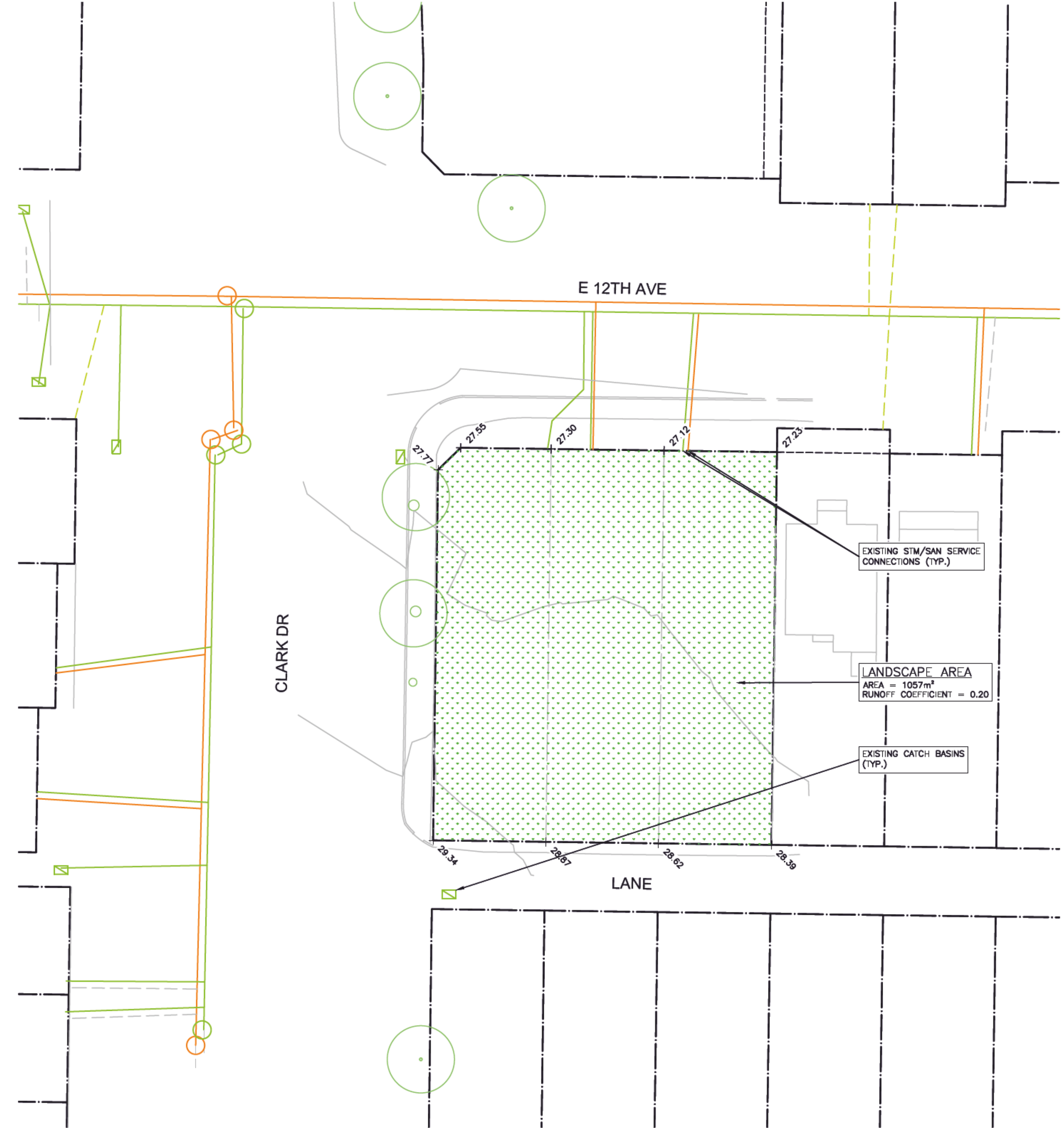
Daniel Casey, P.Eng

## Appendix A: Pre-Development Conditions

CREUS Engineering Ltd Civil Engineers			
<b>Pre-Development Peak Flow</b>			
Project:	1302, 1308 & 1318 E 12th Ave	File:	22179
Subject:	Integrated Rain Water Management Plan	Date:	4-Apr-22
Section:	Pre Development Peak Flow	By:	MCP
<b>Pre-Development Peak Flow</b>			
Catchment Area	1057 m <sup>2</sup>		
Zoning	RM-11N Multiple Dwelling		
Weighted Runoff Coefficient From Surface Areas			
Landscape Area	0.20	for	1057 m <sup>2</sup>
Weighted Runoff Coefficient For Site	0.20	for	1057 m <sup>2</sup>
Rainfall Intensity			
Pre-Development TOC	5 min	(Per CoV EDM)	
From 2014 City of Vancouver IDF Curve	92 mm/hr		
10-Year Rainfall Intensity			
<b>Pre Development Peak Flow</b>	<b>=</b>	<b>5.4 l/s</b>	



PRE-DEVELOPMENT ORTHOPHOTO



PRE-DEVELOPMENT CATCHMENT ANALYSIS

DRAWING LEGEND		
EXISTING	PROP.	TO BE REMOVED
LEGAL LINE	---	---
EASEMENT	---	---
WATERMAIN	---	---
SANITARY	---	---
STORM	---	---
HYDRO	---	---
TEL	---	---
STREETLIGHT	---	---
GAS	---	---
EXISTING	PROP.	TO BE REMOVED
FIRE HYDRANT	---	---
GATE VALVE	---	---
AIR VALVE	---	---
REDUCER	---	---
INSPECTION CHAMBER	---	---
CATCHBASIN (STD/SI)	---	---
CAP	---	---
MANHOLE	---	---
POWER POLE	---	---
STREETLIGHT	---	---

approved

client  
**XGX APARTMENT LTD**

project  
 1302, 1308 & 1318 E 12TH AVE  
 VANCOUVER, BC

title  
**INT. RAINWATER MGMT  
 PRE-DEVELOPMENT CONDITIONS**

no.	(y/m/d)	revision	chk'd
1	22-04-11	ISSUED FOR REZONING	MCP

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engineer of record	MCP	scales	hor: 1:250 vert: .
designed by	DJC	file no.	22179
drawn by	MCP	drawing no.	IRMP-1
date	2022-03-21		

## Appendix B: Post-Development Catchment Analysis

**LEGEND**

+ 12.34	EXISTING ELEVATION
+ 12.34	PROPOSED ELEVATION
→	DRAINAGE PATH

	BUILDING/ROOF AREA
	GREEN ROOF AREA
	OFF-SLAB PERMEABLE PAVING AREA

**CREUS Engineering Ltd**  
 Civil Engineers

**Catchment Summary Table**

Project: 1302, 1308 & 1318 E 12th Ave File: 22179  
 Subject: Integrated Rain Water Management Plan Date: 4-Apr-22  
 Section: Catchment Summary Table By: MCP

Catchment Area Name	Catchment Area m <sup>2</sup>	Storage Req. m <sup>3</sup>	Retention Strategy	Capture Volume m <sup>3</sup>	Excess Runoff m <sup>3</sup>	Excess Storage m <sup>3</sup>
UPPER ROOF	351	8.4	Tank	0.0	8.4	0.0
LEVEL 6	266	6.4	Green Roof, Tank	3.4	3.0	0.0
LEVEL 5	65	1.6	Green Roof, Tank	1.3	0.2	0.0
LEVEL 2 & REM. ROOF	324	7.8	Green Roof, Tank	5.0	2.8	0.0
GROUND FLOOR	51	1.2	Pavers, Tank	1.2	0.0	1.5
<b>TOTALS</b>	<b>1057</b>	<b>25.4</b>		<b>11.0</b>	<b>14.4</b>	<b>1.5</b>

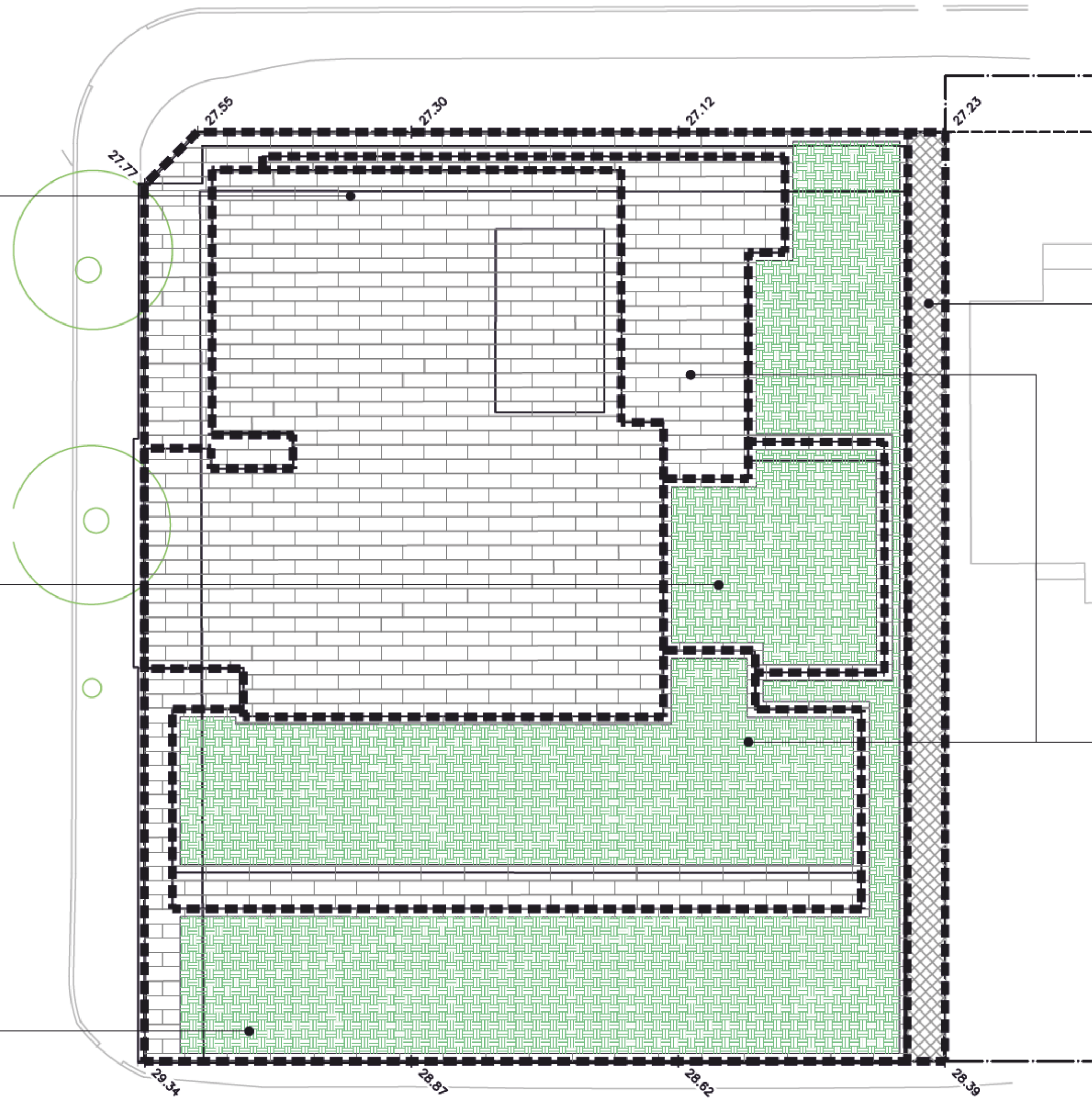
CATCHMENT SUMMARY



E 12TH AVE

CLARK DR

LANE



**Catchment Name: UPPER ROOF**

Catchment Description:  
 Extents of upper roof

Catchment Area	=	351 m <sup>2</sup>
Rainfall Target	=	24 mm
Storage Requirement	=	8.4 m <sup>3</sup>

Management Practice & Assumptions  
 Whole area is hardscape, it is assumed that the whole catchment area will collect the runoff and direct it to the storage tank; no storage is provided at source

Capture Volume	=	0.0 m <sup>3</sup>
Excess Runoff	=	8.4 m <sup>3</sup>
Excess Storage	=	0.0 m <sup>3</sup>

**Catchment Name: LEVEL 5**

Catchment Description:  
 Extents of level 5 roof

Catchment Area	=	65 m <sup>2</sup>
Rainfall Target	=	24 mm
Storage Requirement	=	1.6 m <sup>3</sup>

Management Practice & Assumptions  
 Green Roof will capture rainfall at source, hard surface to be directed to tank

Green Roof Area	=	55 m <sup>2</sup>
Green Roof Depth	=	100 mm
Green Roof Water Holding Capacity	=	30%
Storage Capacity	=	1.7 m <sup>3</sup>
Rain On Green Roof	=	1.3 m <sup>3</sup>

Capture Volume	=	1.3 m <sup>3</sup>
Excess Runoff	=	0.2 m <sup>3</sup>
Excess Storage	=	0.0 m <sup>3</sup>

**Catchment Name: LEVEL 2 & REM. ROOF**

Catchment Description:  
 Extents of level 2 roof and remaining roof

Catchment Area	=	324 m <sup>2</sup>
Rainfall Target	=	24 mm
Storage Requirement	=	7.8 m <sup>3</sup>

Management Practice & Assumptions  
 Green Roof will capture rainfall at source, hard surface to be directed to tank

Green Roof Area	=	209 m <sup>2</sup>
Green Roof Depth	=	100 mm
Green Roof Water Holding Capacity	=	30%
Storage Capacity	=	6.3 m <sup>3</sup>
Rain On Green Roof	=	5.0 m <sup>3</sup>

Capture Volume	=	5.0 m <sup>3</sup>
Excess Runoff	=	2.8 m <sup>3</sup>
Excess Storage	=	0.0 m <sup>3</sup>

**Catchment Name: GROUND FLOOR**

Catchment Description:  
 Extents of ground floor

Catchment Area	=	51 m <sup>2</sup>
Rainfall Target	=	24 mm
Storage Requirement	=	1.2 m <sup>3</sup>

Management Practice & Assumptions  
 Pavers will capture rainfall at source

Permeable Paver Area	=	51 m <sup>2</sup>
Underlying Soil Depth	=	300 mm
Soil Water Holding Capacity	=	18%
Storage Capacity	=	2.8 m <sup>3</sup>
Rainfall On Planter	=	1.2 m <sup>3</sup>

Capture Volume	=	1.2 m <sup>3</sup>
Excess Runoff	=	0.0 m <sup>3</sup>
Excess Storage	=	1.5 m <sup>3</sup>

**Catchment Name: LEVEL 6**

Catchment Description:  
 Extents of level 6 roof

Catchment Area	=	266 m <sup>2</sup>
Rainfall Target	=	24 mm
Storage Requirement	=	6.4 m <sup>3</sup>

Management Practice & Assumptions  
 Green Roof will capture rainfall at source, hard surface to be directed to tank

Green Roof Area	=	143 m <sup>2</sup>
Green Roof Depth	=	100 mm
Green Roof Water Holding Capacity	=	30%
Storage Capacity	=	4.3 m <sup>3</sup>
Rain On Green Roof	=	3.4 m <sup>3</sup>

Capture Volume	=	3.4 m <sup>3</sup>
Excess Runoff	=	3.0 m <sup>3</sup>
Excess Storage	=	0.0 m <sup>3</sup>

**DRAWING LEGEND**

	EXISTING	PROP.	TO BE REMOVED
LEGAL LINE	---	---	---
EASEMENT	---	---	---
WATERMAIN	---	---	---
SANITARY	---	---	---
STORM	---	---	---
HYDRO	---	---	---
TLS	---	---	---
STREETLIGHT	---	---	---
GAS	---	---	---
	EXISTING	PROP.	TO BE REMOVED
FIRE HYDRANT	⊗	⊗	⊗
GATE VALVE	⊕	⊕	⊕
AIR VALVE	⊙	⊙	⊙
REDUCER	⊘	⊘	⊘
INSPECTION CHAMBER	⊕	⊕	⊕
CATCHBASIN (STDS)	⊕	⊕	⊕
CAP	⊕	⊕	⊕
MANHOLE	⊕	⊕	⊕
POWER POLE	⊕	⊕	⊕
STREETLIGHT	⊕	⊕	⊕

approved

client  
**XXG APARTMENT LTD**

project  
 1302, 1308 & 1318 E 12TH AVE  
 VANCOUVER, BC

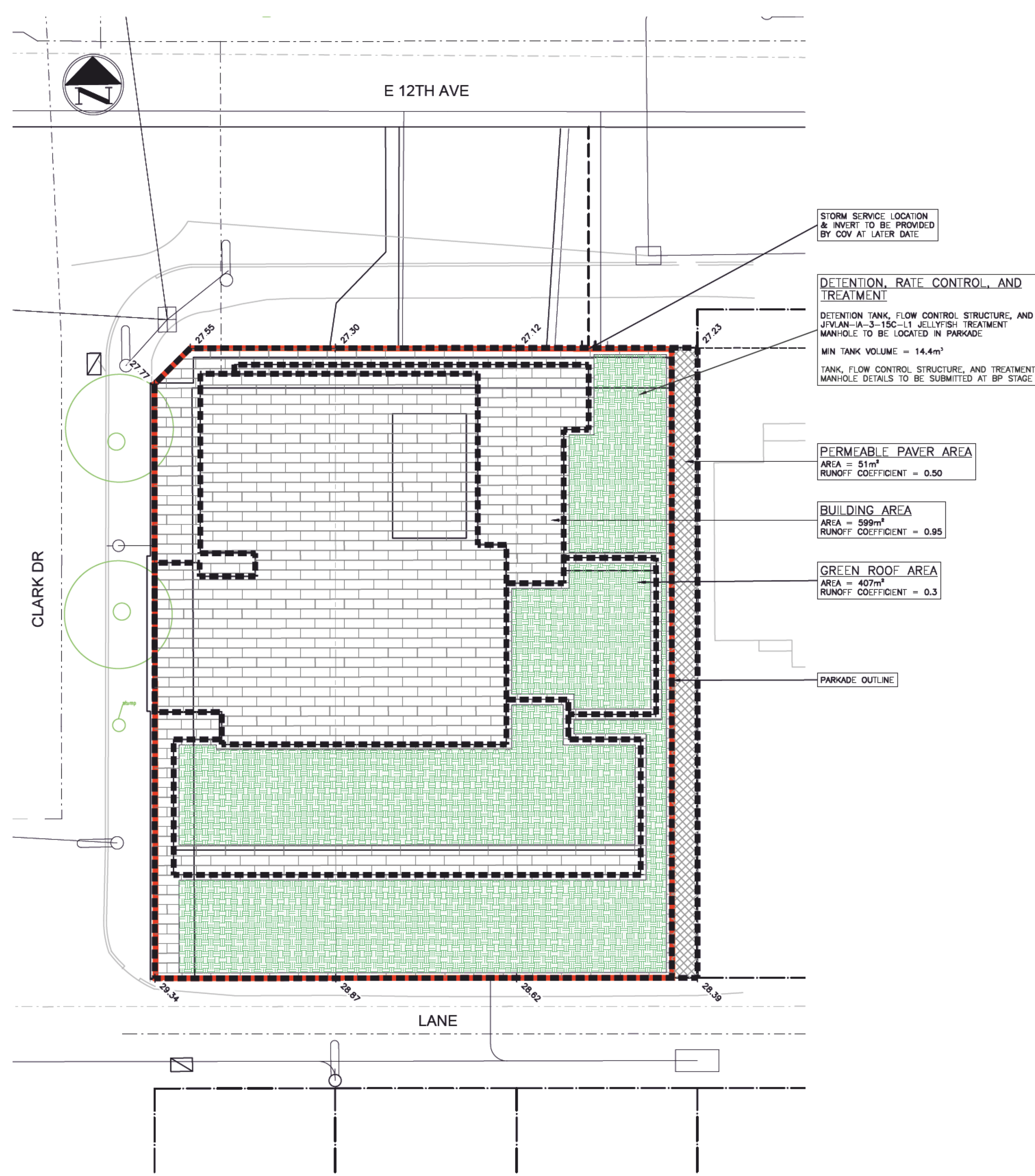
title  
**INT. RAINWATER MGMT  
 POST-DEVELOPMENT  
 CATCHMENT ANALYSIS**

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no.	(y/m/d)	revision	ch/td

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drawn by	MCP	drawing no.	IRMP-2	
date	2022-03-21			

## Appendix C: Retention Strategies



**STORM SERVICE LOCATION & INVERT TO BE PROVIDED BY COV AT LATER DATE**

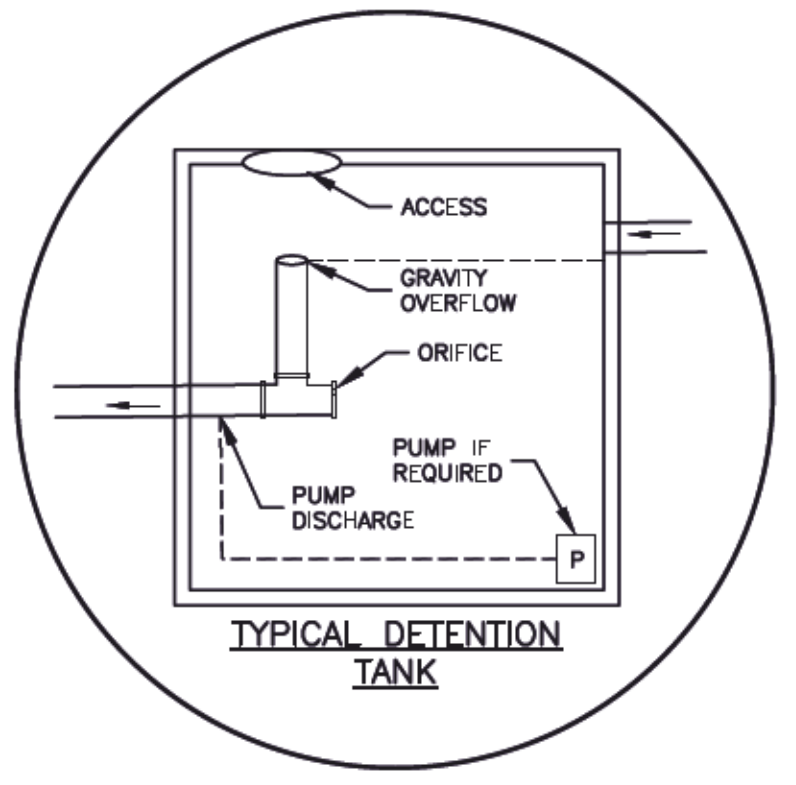
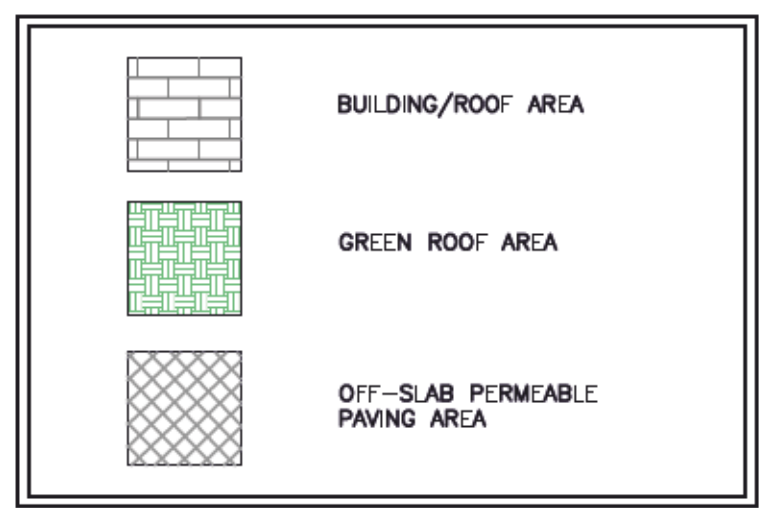
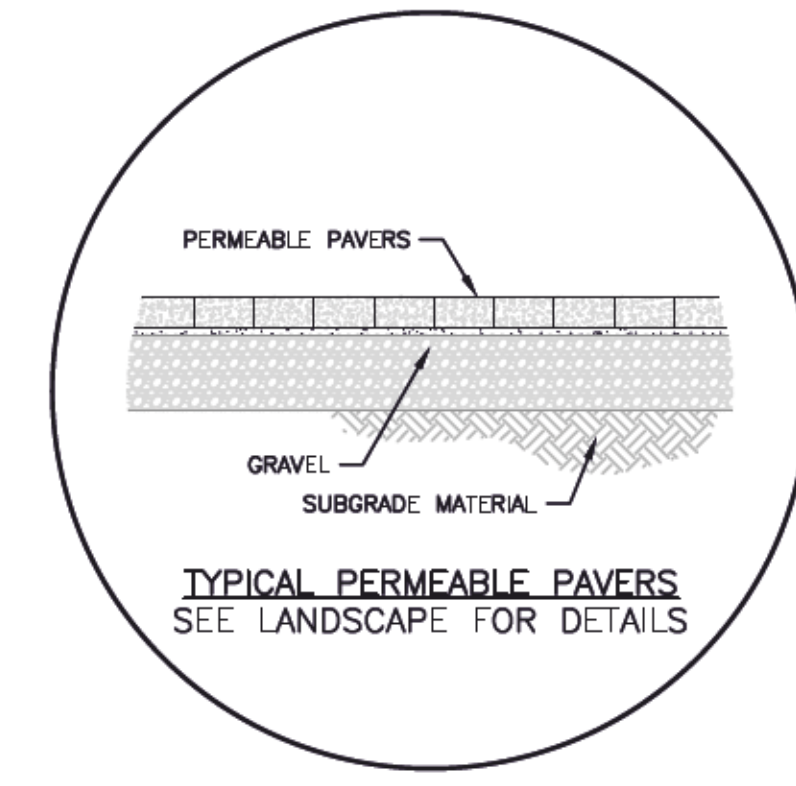
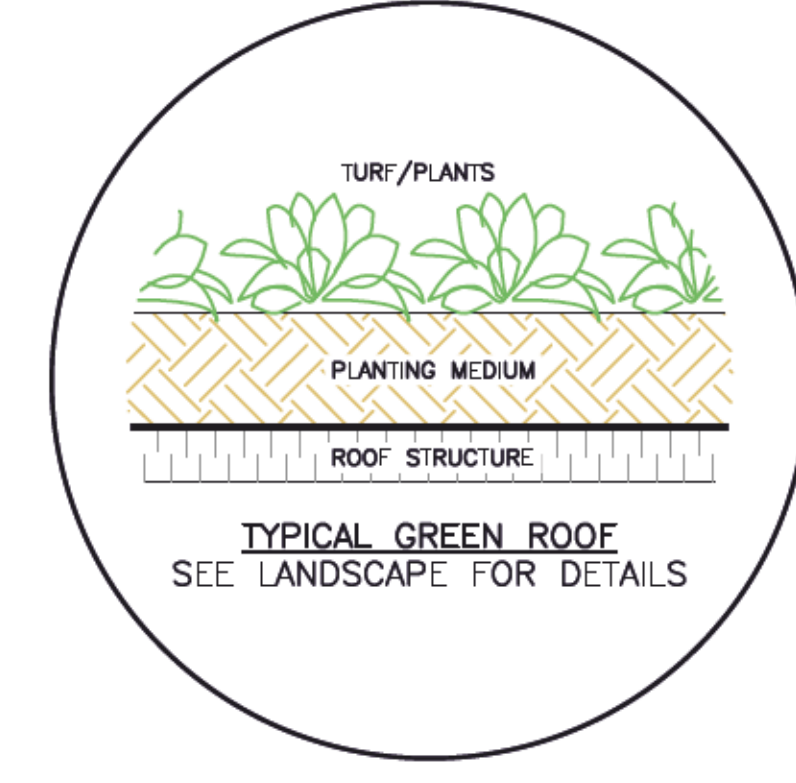
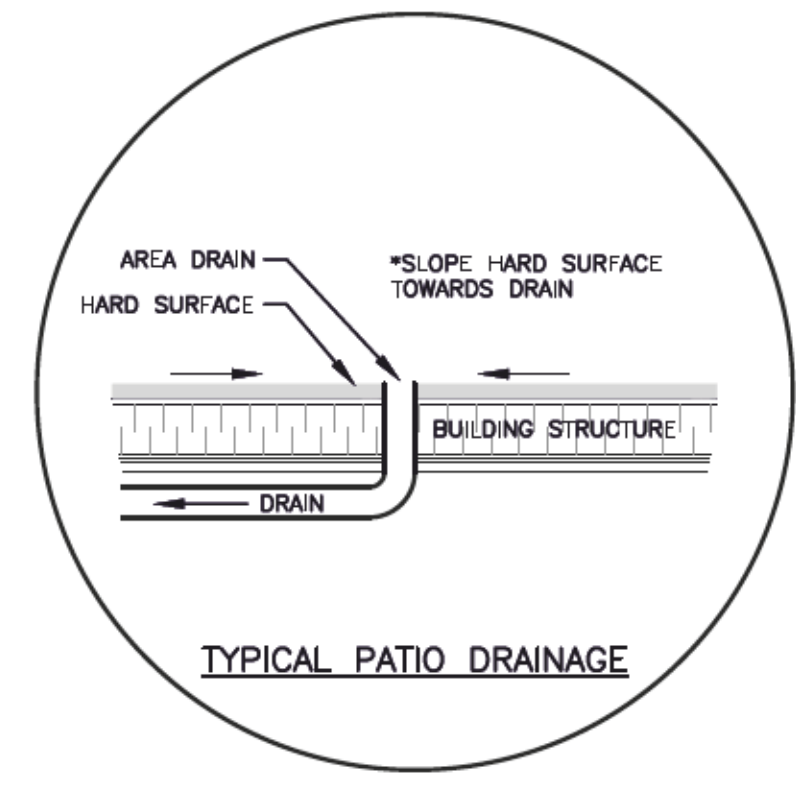
**DETENTION, RATE CONTROL, AND TREATMENT**  
 DETENTION TANK, FLOW CONTROL STRUCTURE, AND JUNCTION-A-3-15C-11 JELLYTISH TREATMENT MANHOLE TO BE LOCATED IN PARKADE  
 MIN TANK VOLUME = 14.4 m<sup>3</sup>  
 TANK, FLOW CONTROL STRUCTURE, AND TREATMENT MANHOLE DETAILS TO BE SUBMITTED AT BP STAGE

**PERMEABLE PAVER AREA**  
 AREA = 51 m<sup>2</sup>  
 RUNOFF COEFFICIENT = 0.50

**BUILDING AREA**  
 AREA = 599 m<sup>2</sup>  
 RUNOFF COEFFICIENT = 0.95

**GREEN ROOF AREA**  
 AREA = 407 m<sup>2</sup>  
 RUNOFF COEFFICIENT = 0.3

**PARKADE OUTLINE**



## CREUS Engineering Ltd

Civil Engineers

### Rate Control Analysis

Project: 1302, 1308 & 1318 E 12th Ave File: 22179  
 Subject: Integrated Rain Water Management Plan Date: 4-Apr-22  
 Section: Pre & Post Development Rate Analysis By: MCP

<b>Pre Development Peak Flow</b>	=	5.4 l/s
<b>Post Development Peak Flows</b>		
Catchment Area		1057 m <sup>2</sup>
Weighted Runoff Coefficient From Surface Areas		
Building/Roof Area	0.95 for	599 m <sup>2</sup>
Permeous Paving	0.50 for	51 m <sup>2</sup>
Green Roof	0.30 for	407 m <sup>2</sup>
Weighted Runoff Coefficient For Site	0.68 for	1057 m <sup>2</sup>
Rainfall intensity		
Post Development TOC	5 min	(Per CoV SDM)
From 2100 City of Vancouver IDF Curve		
10-Year Rainfall Intensity		123 mm/hr
<b>Post Development Peak Flow</b>	=	24.5 l/s

Duration	Intensity	Peak Flow	Rel. Rate	Difference	Volume	
min	hr.	(mm/hr)	(l/s)	(l/s)	(m3)	
1	0.017	298	59.3	5.4	53.9	3.1
5	0.083	123	24.5	5.4	19.1	5.7
10	0.167	84	16.7	5.4	11.3	6.9
15	0.25	67	13.4	5.4	8.0	7.3
20	0.333	57	11.4	5.4	6.0	7.4
25	0.417	51	10.1	5.4	4.7	7.3
30	0.5	46	9.1	5.4	3.7	7.0
35	0.583	42	8.4	5.4	3.0	6.6
40	0.667	39	7.8	5.4	2.4	6.1
45	0.75	37	7.3	5.4	1.9	5.6
50	0.833	35	6.9	5.4	1.5	4.9
55	0.917	33	6.5	5.4	1.1	4.3
60	1	31	6.2	5.4	0.8	3.5

**Peak Storage Requirement = 7.4 m<sup>3</sup>**

**Orifice Size** Orifice sizing to be determined at future date.

Stage-Storage-Discharge information dependent on tank and orifice sizing, and is to be provided at future date.

## CREUS Engineering Ltd

Civil Engineers

### Retention Facility Sizing

Project: 1302, 1308 & 1318 E 12th Ave File: 22179  
 Subject: Integrated Rain Water Management Plan Date: 4-Apr-22  
 Section: Retention Facility Sizing Calculations By: MCP

Green Roof Storage Volume		
Green Roof Area	=	407 m <sup>2</sup>
Green Roof Depth	=	100 mm
Green Roof Water Holding Capacity	=	30%
Storage Capacity	=	12.3 m <sup>3</sup>
Rainfall Depth	=	24 mm
Rainfall on Green Roof	=	9.8 m <sup>3</sup>
<b>Total Green Roof Storage</b>	=	<b>9.8 m<sup>3</sup></b>
Permeable Paver Storage Volume		
Paver Area	=	51 m <sup>2</sup>
Underlying Soil Depth	=	300 mm
Soil Water Holding Capacity	=	18%
Storage Capacity	=	2.8 m <sup>3</sup>
Rainfall Depth	=	24 mm
Rainfall on Pavers	=	1.2 m <sup>3</sup>
<b>Total Paver Storage</b>	=	<b>1.2 m<sup>3</sup></b>
Detention Tank Storage Volume		
<b>Total Tank Storage</b>	=	<b>14.4 m<sup>3</sup></b>
<b>Total Rainfall on Site</b>	=	<b>25.4 m<sup>3</sup></b>
<b>Total Storage</b>	=	<b>25.4 m<sup>3</sup></b>

### DRAWING LEGEND

	EXISTING	PROP.	TO BE REMOVED
LEGAL LINE	---	---	---
EASEMENT	---	---	---
WATERMAIN	---	---	---
SANITARY	---	---	---
STORM	---	---	---
HYDRO	---	---	---
TEL	---	---	---
STREETLIGHT	---	---	---
GAS	---	---	---
FIRE HYDRANT	⊗	⊗	⊗
GATE VALVE	⊕	⊕	⊕
AIR VALVE	⊙	⊙	⊙
REDUCER	⊘	⊘	⊘
INSPECTION CHAMBER	⊞	⊞	⊞
CATCHBASIN (STD/SI)	⊞/⊞	⊞/⊞	⊞/⊞
CAP	⊞	⊞	⊞
MANHOLE	⊞	⊞	⊞
POWER POLE	⊞	⊞	⊞
STREETLIGHT	⊞	⊞	⊞

approved

client  
**XXG APARTMENT LTD**

project  
**1302, 1308 & 1318 E 12TH AVE  
 VANCOUVER, BC**

title  
**INT. RAINWATER MGMT  
 RETENTION STRATEGIES**

1 22-04-11 ISSUED FOR REZONING MCP

no. (y/m/d) revision current rev. #

1 22-04-11 1

engineer of record MCP scales hor: 1:150 vert: .

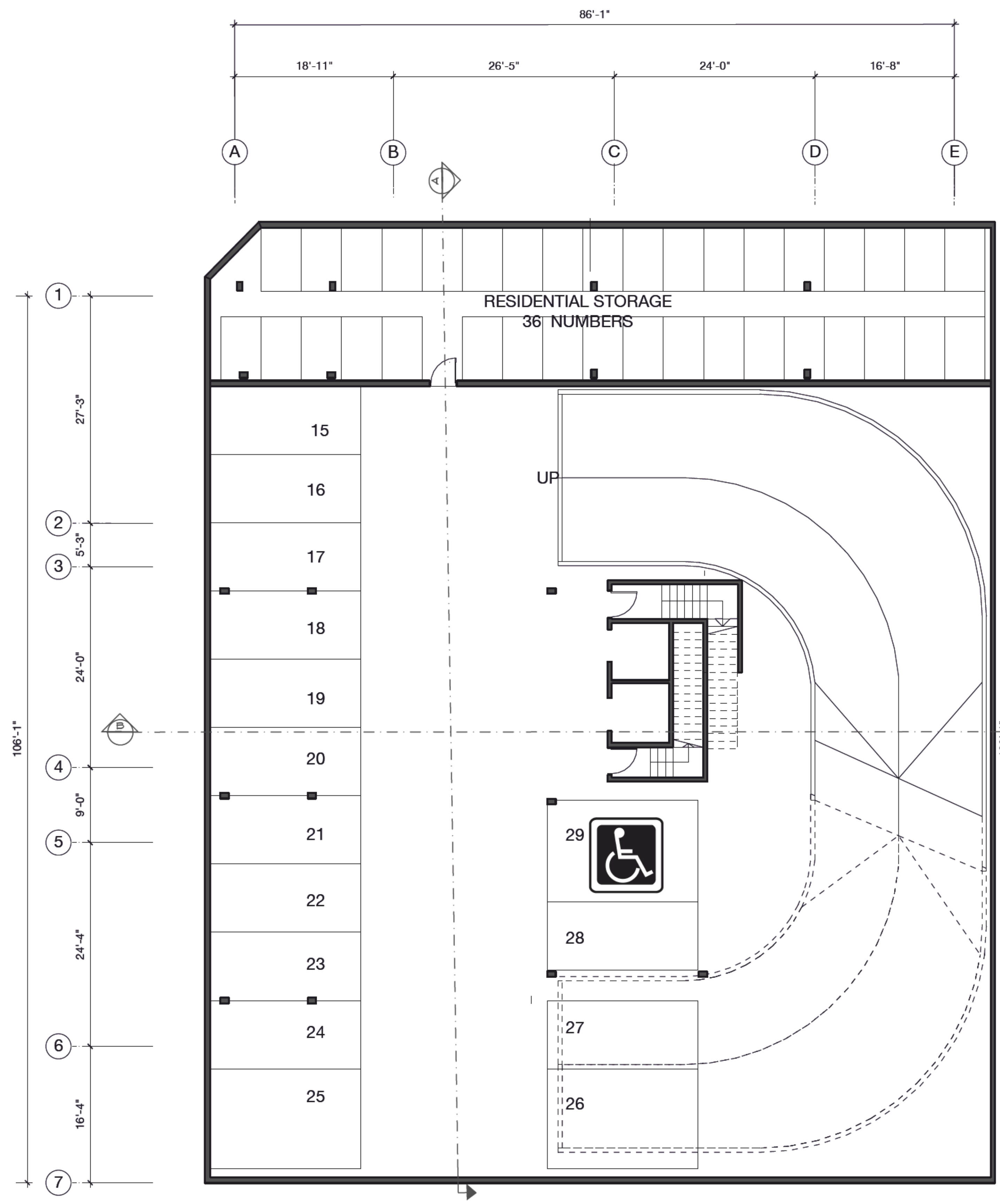
designed by DJC file no. 22179

drawn by MCP drawing no. IRMP-3

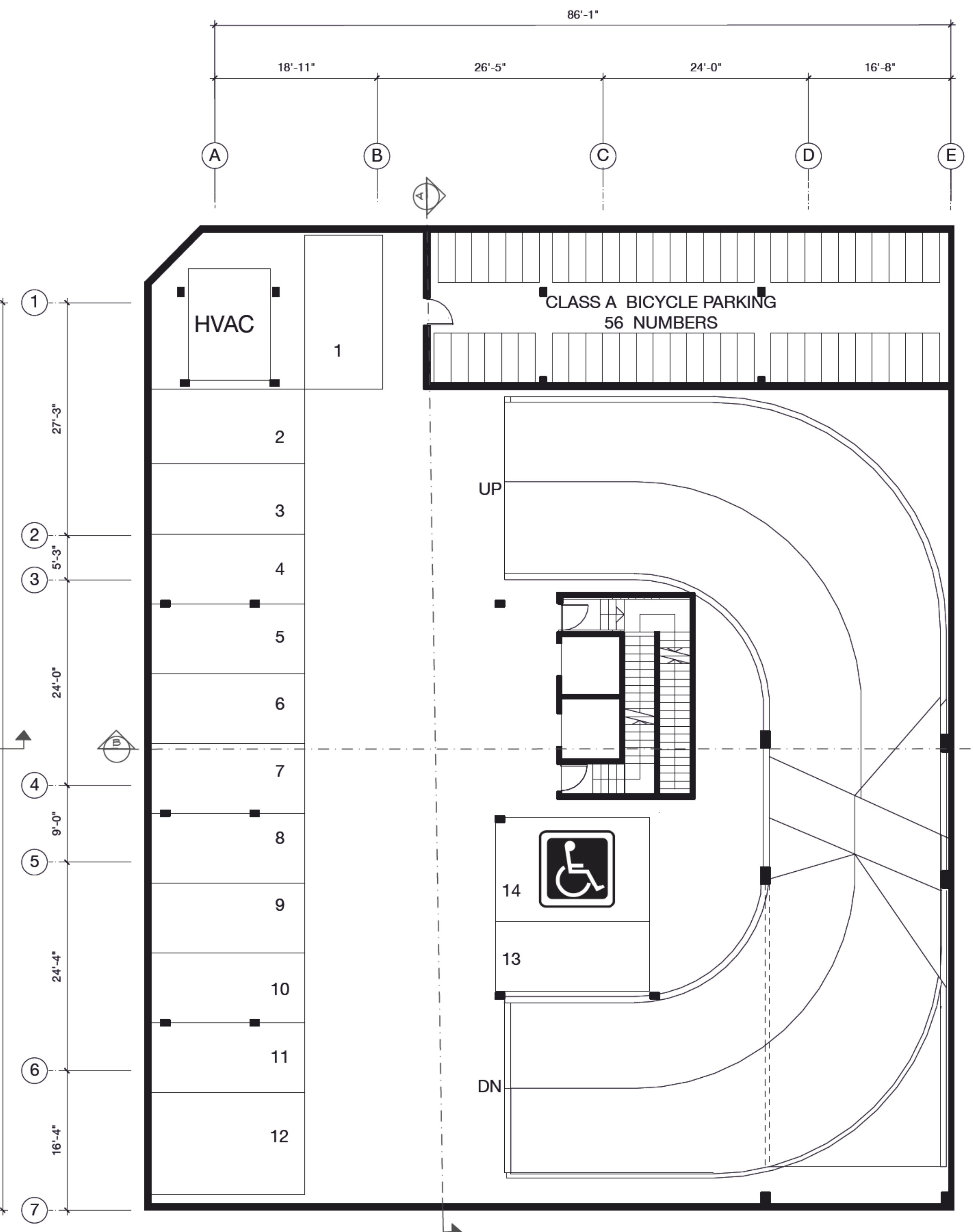
date 2022-03-21

## Appendix D: Landscape Plans





**A**  
**1** BASEMENT LEVEL 02  
1/8" = 1' - 0"  
**T**



**A**  
**2** BASEMENT LEVEL 01  
1/8" = 1' - 0"  
**T**

NO.	DATE	REVISIONS

**1308- 1318 E12TH**  
**Rezoning**

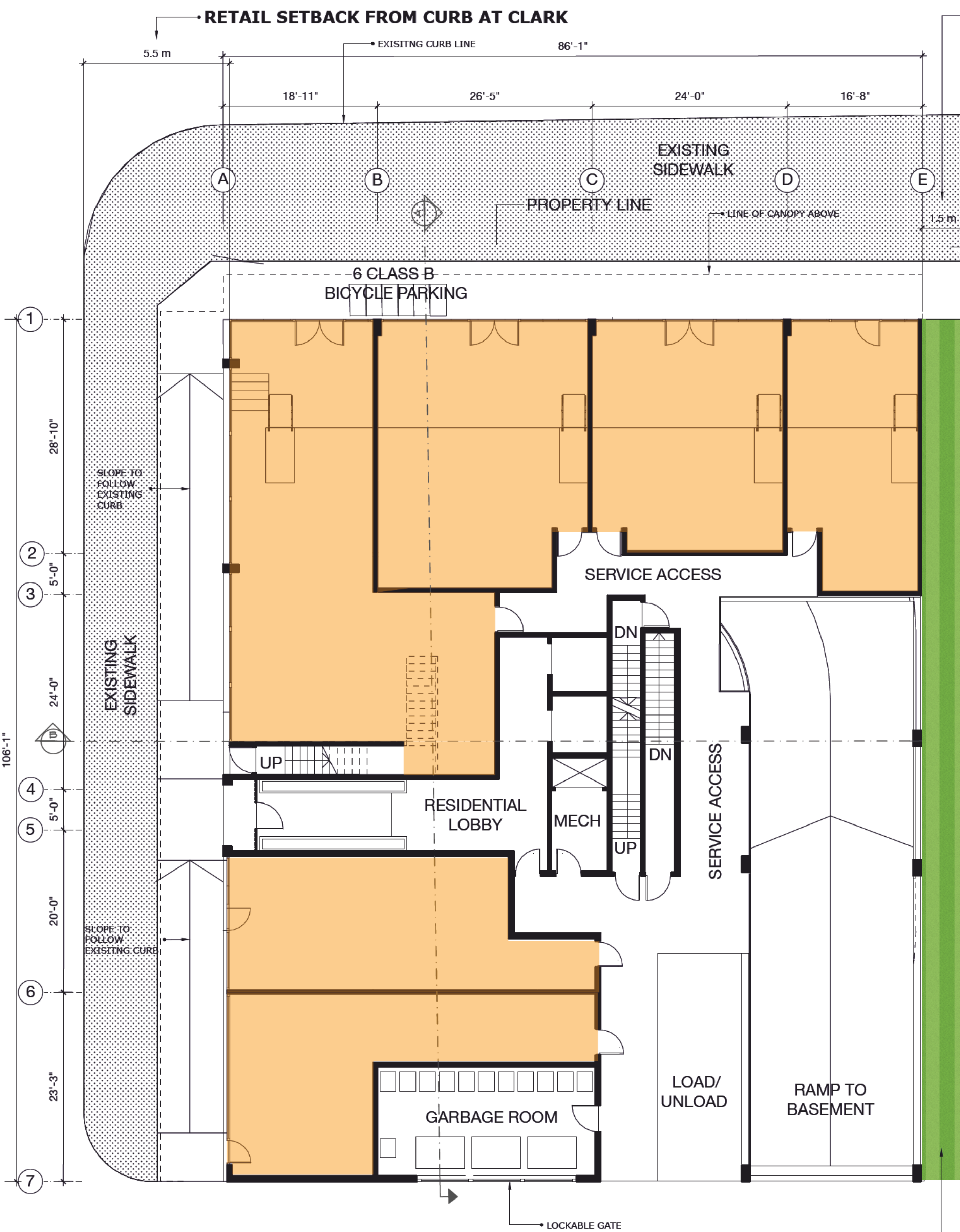
SCALE	DRAWING DATE
AS NOTED	March 28, 2022

PROJECT ADDRESS  
1308 -1318 E12th ::  
Vancouver, BC

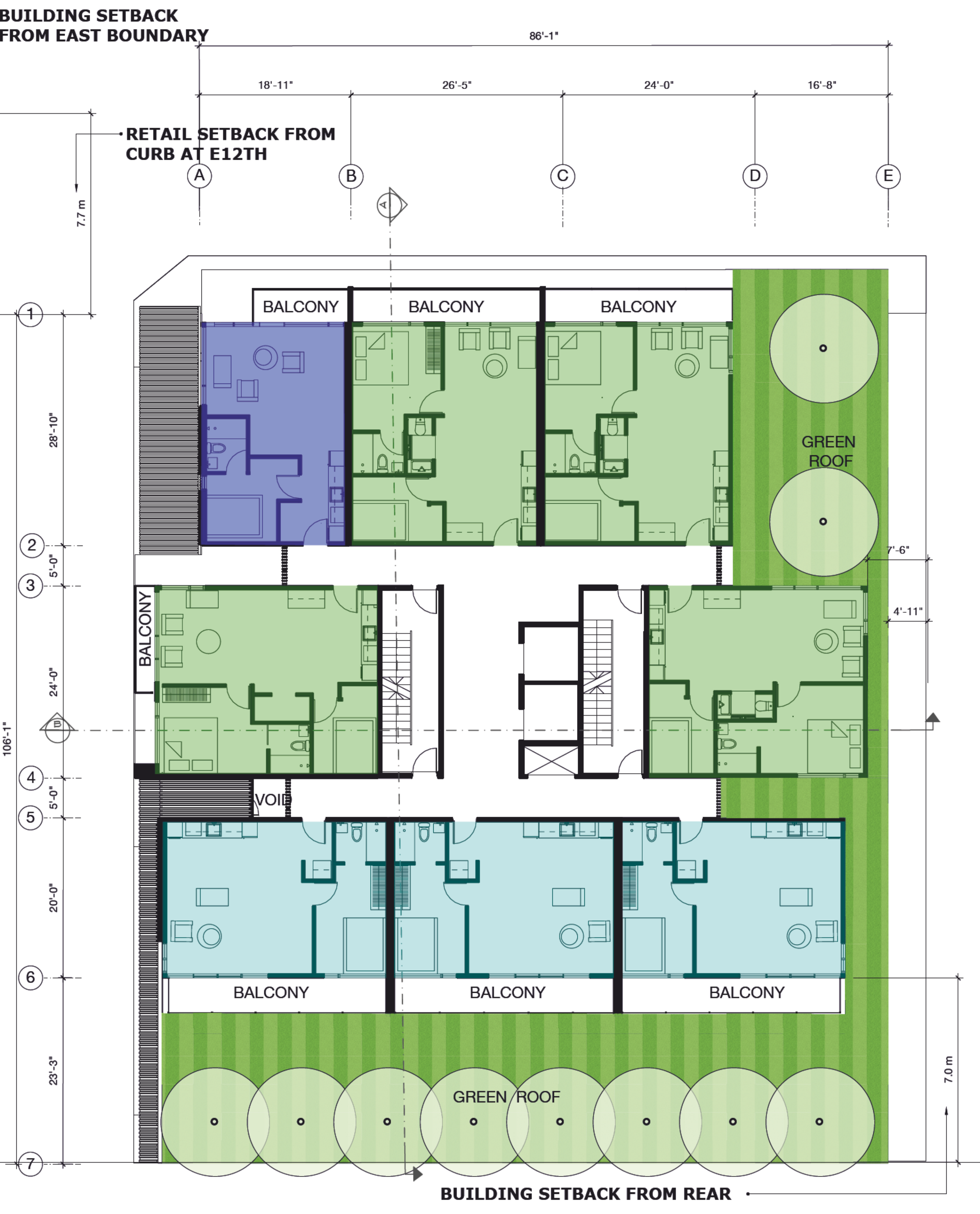
<b>BASEMENT PLANS</b>	
PROJECT NO.	<b>A4.05</b>

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NO.	REVISIONS



**A**  
**3** LEVEL 01  
1/8" = 1' - 0"



**A**  
**4** LEVEL 02  
1/8" = 1' - 0"

- COMMERCIAL RETAIL UNIT
- 1 BRM 476 SQ FT
- 1 BRM 494 SQ FT
- 2 BRM 670 SQ FT

**1308- 1318 E12TH Rezoning**

SCALE AS NOTED	DRAWING DATE March 28, 2022
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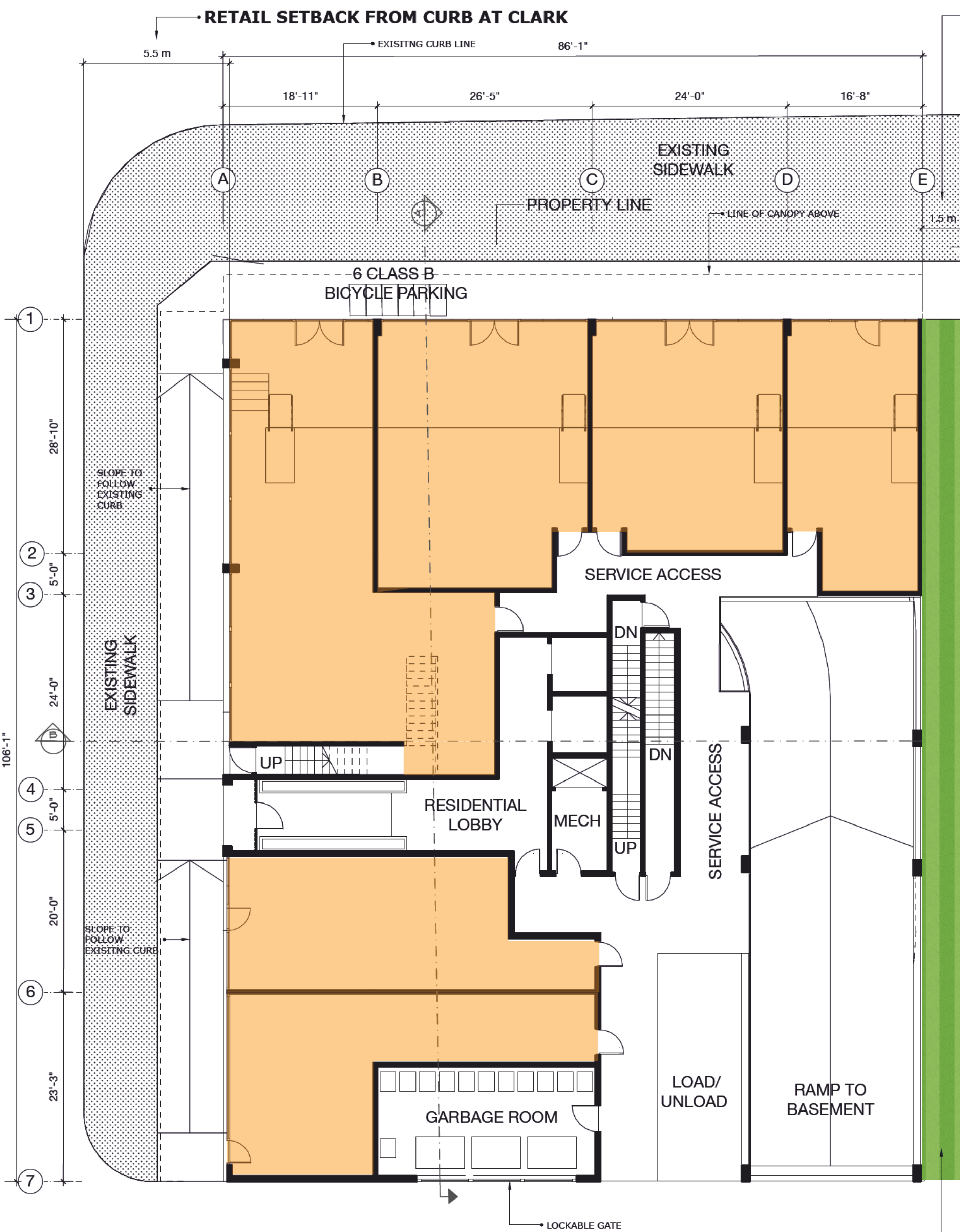
PROJECT ADDRESS  
1308 -1318 E12th ::  
Vancouver, BC

**LEVEL 01-02 PLANS**

PROJECT NO. **A4.06**

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NO.	DESCRIPTION	DATE



**A** LEVEL 01  
3 1/8" = 1' - 0"



**A** LEVEL 02  
4 1/8" = 1' - 0"

- COMMERCIAL RETAIL UNIT
- 1 BRM 476 SQ FT
- 1 BRM 494 SQ FT
- 2 BRM 670 SQ FT

**1308- 1318 E12TH  
Rezoning**

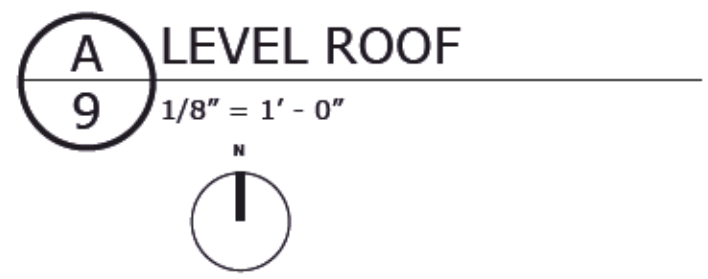
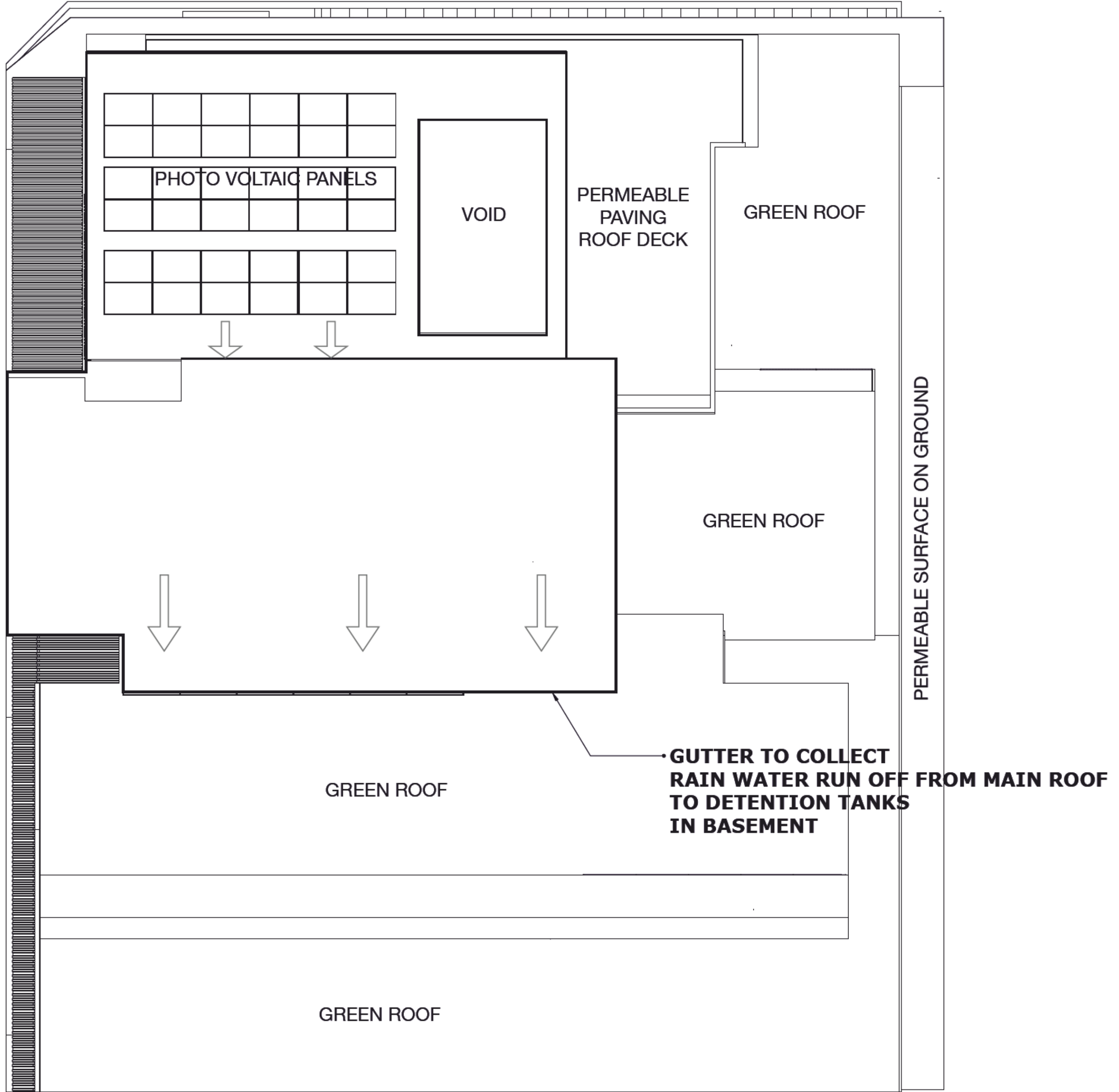
SCALE AS NOTED  
DRAWING DATE March 28, 2022

PROJECT ADDRESS  
1308 -1318 E12th ::  
Vancouver, BC

<b>LEVEL 01-02 PLANS</b>	
PROJECT NO.	<b>A4.06</b>

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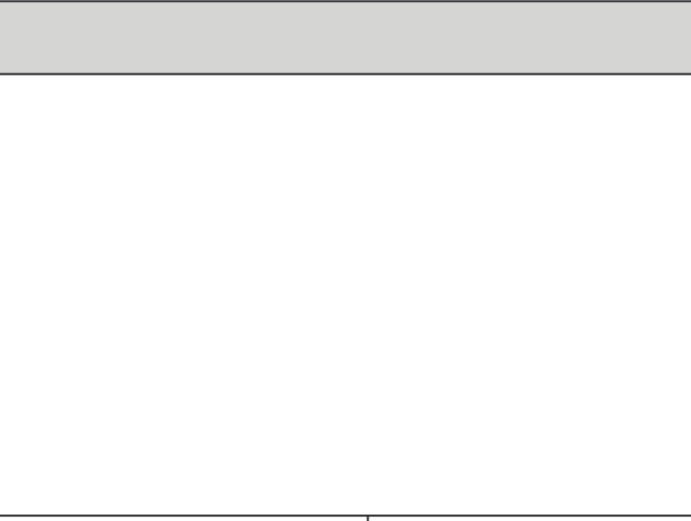
NO.	DESCRIPTION	DATE



**1308- 1318 E12TH  
Rezoning**

SCALE AS NOTED	DRAWING DATE March 28, 2022
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PROJECT ADDRESS  
1308 -1318 E12th ::  
Vancouver, BC



PROJECT NO.	<b>A4.09</b>
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## Appendix E: Treatment Manhole Details

**GENERAL NOTES:**

- ALL DIMENSIONS INDICATED ARE IN INCHES (MILLIMETERS) UNLESS OTHERWISE SPECIFIED.
- JELLYFISH STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
- UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE JELLYFISH SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
- DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
- NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

**JELLYFISH STRUCTURE & DESIGN NOTES:**

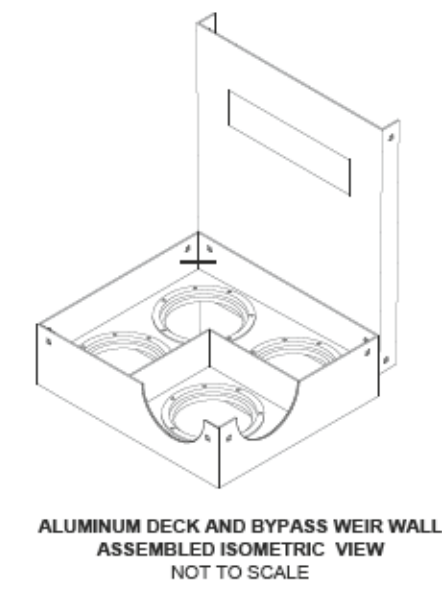
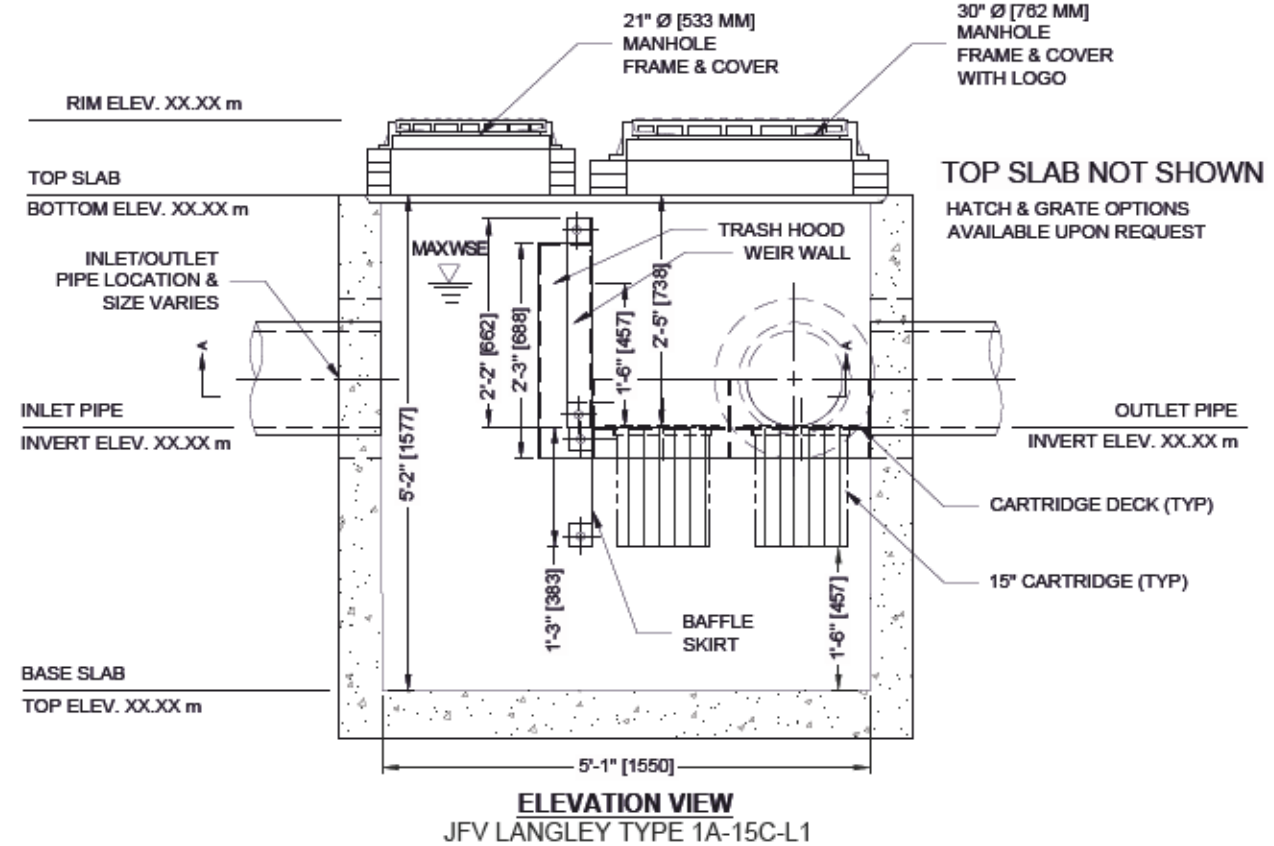
- CASTINGS OR DOORS OF THE JELLYFISH MANHOLE STRUCTURE TO EXTEND TO DESIGN FINISH GRADE. DEPTHS IN EXCESS OF 3.65 M (12') MAY REQUIRE THE DESIGN AND INSTALLATION OF INTERMEDIATE SAFETY GRATES OR OTHER STRUCTURAL ELEMENTS.
- CASTINGS AND GRADE RINGS, OR DOORS AND DOOR RISERS, OR BOTH, SHALL BE GROUTED FOR WATERTIGHTNESS.
- STRUCTURE SHALL MEET AASHTO HS-20 OR PER APPROVING JURISDICTION REQUIREMENTS, WHICHEVER IS MORE STRINGENT, ASSUMING EARTH COVER OF 0' - 3', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M308 LOAD RATING AND BE CAST WITH THE IMBRIUM LOGO.
- ALL STRUCTURAL SECTIONS AND PARTS TO MEET OR EXCEED ASTM C-478, ASTM C-443, AND ASTM D-4097 CORRESPONDING TO AASHTO SPECIFICATIONS, AND ANY OTHER SITE OR LOCAL STANDARDS.
- CONCRETE RISER SECTIONS FROM BOTTOM TO TOP WILL BE ADDED AS REQUIRED INCLUDING TRANSITION PIECES TO SMALLER DIAMETER RISERS FOR SURFACE ACCESSES WHERE WARRANTED BY SERVICING DEPTH.
- IF MINIMUM DEPTH FROM TOP OF CARTRIDGE DECK TO BOTTOM OF STRUCTURAL TOP SLAB CANNOT BE ACHIEVED DUE TO PIPING INVERT ELEVATIONS OR OTHER SITE CONSTRAINTS. ALTERNATIVE HATCH CONFIGURATIONS MAY BE AVAILABLE. HATCH DOORS SHOULD BE SIZED TO PROVIDE FULL ACCESS ABOVE THE CARTRIDGES TO ACCOMMODATE MAINTENANCE.
- STEPS TO BE APPROXIMATELY 330 MM (13") APART AND DIMENSIONS MUST MEET LOCAL STANDARDS. STEPS MUST BE INSTALLED AFTER CARTRIDGE DECK IS IN PLACE.
- CONFIGURATION OF INLET AND OUTLET PIPE CAN VARY TO MEET SITE'S NEEDS.
- IT IS THE RESPONSIBILITY OF OTHERS TO PROPERLY PROTECT THE TREATMENT DEVICE, AND KEEP THE DEVICE OFFLINE DURING CONSTRUCTION. FILTER CARTRIDGES SHALL NOT BE INSTALLED UNTIL THE PROJECT SITE IS CLEAN AND FREE OF DEBRIS, BY OTHERS. THE PROJECT SITE INCLUDES ANY SURFACE THAT CONTRIBUTES STORM DRAINAGE TO THE TREATMENT DEVICE. CARTRIDGES SHALL BE FURNISHED NEW, AT THE TIME OF FINAL ACCEPTANCE.
- THIS DRAWING MUST BE VIEWED IN CONJUNCTION WITH THE STANDARD JELLYFISH SPECIFICATION, AND STORMWATER QUALITY FILTER TREATMENT JELLYFISH DOCUMENTS.

**INSTALLATION NOTES**

- ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
- CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
- CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
- CARTRIDGE INSTALLATION, BY IMBRIUM, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE JELLYFISH UNIT IS CLEAN AND FREE OF DEBRIS. CONTACT IMBRIUM TO COORDINATE CARTRIDGE INSTALLATION WITH SITE STABILIZATION.
- CONTRACTOR TO REMOVE THE TRANSFER HOLE COVERS WHEN THE SYSTEM IS BROUGHT ONLINE AND THE SITE IS STABILIZED.

XXX.XX INFORMATION TO BE SUPPLIED BY ENGINEER OF RECORD

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL JELLYFISH FILTER REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE.



**MATERIAL LIST**

COUNT	DESCRIPTION	PROVIDED BY
XXX	15" HI-FLO CARTRIDGE	IMBRIUM
XXX	15" DRAINDOWN CARTRIDGE	IMBRIUM
XXX	CARTRIDGE BLANK (NO ORIFICE)	IMBRIUM
1	4 CARTRIDGE RECEPTACLE INSTALLATION KIT	IMBRIUM
1	ALUMINUM DECK - EJ #73010207	IMBRIUM
1	ALUMINUM BY-PASS WEIR - EJ #202202-35796	IMBRIUM
1	ALUMINUM BAFFLE SKIRT - EJ #202202-36139	IMBRIUM
0	24"X24" [610X610 MM] FRAME AND GRATE INLET	LANGLEY
1	21"Ø [533 mm] FRAME AND COVER	LANGLEY
1	30"Ø [762 mm] JELLYFISH FRAME AND COVER	LANGLEY
TBD	JOINT SEALANT	LANGLEY

**VAULT CAPACITY DATA**

SEDIMENT STORAGE CAPACITY (L, CF)	635 L
OIL STORAGE CAPACITY (L, CF)	125 L

**SITE SPECIFIC DATA REQUIREMENTS**

PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

\* PER ENGINEER OF RECORD

ONLINE JFV LAN-1A-XX-XX-15C-L1  
 PROJECT: XXXX  
 Imbrium  
 Langley Vault Type 1A  
 Scale - 1:25

MARK	DATE	REVISION DESCRIPTION	BY

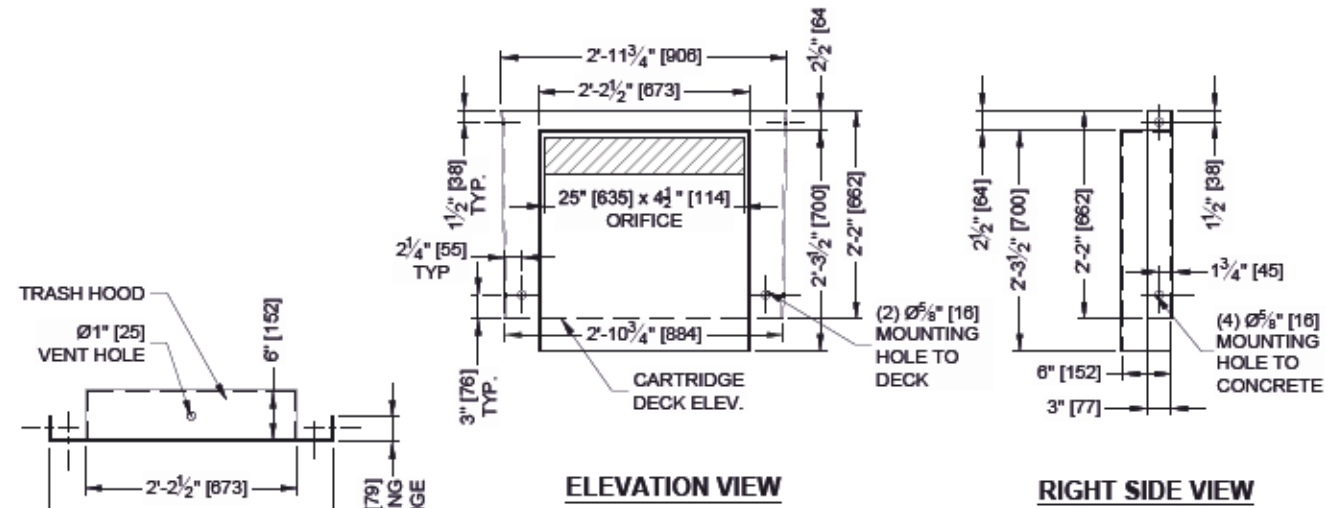
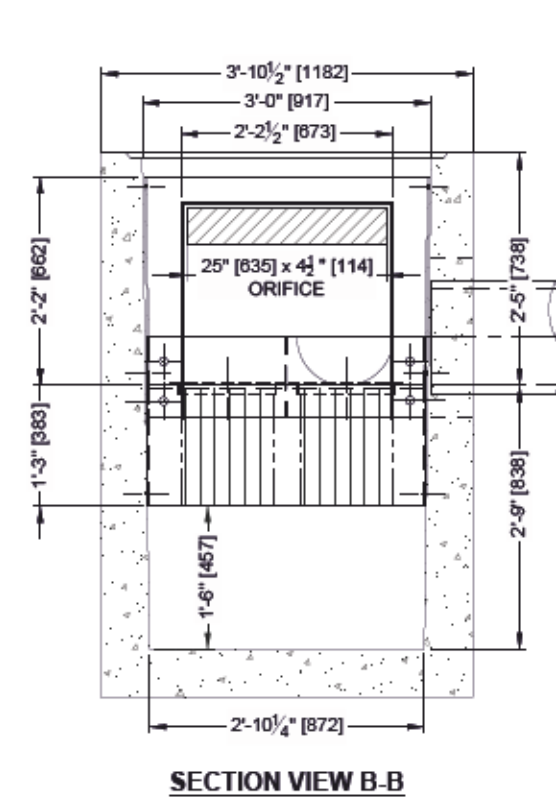
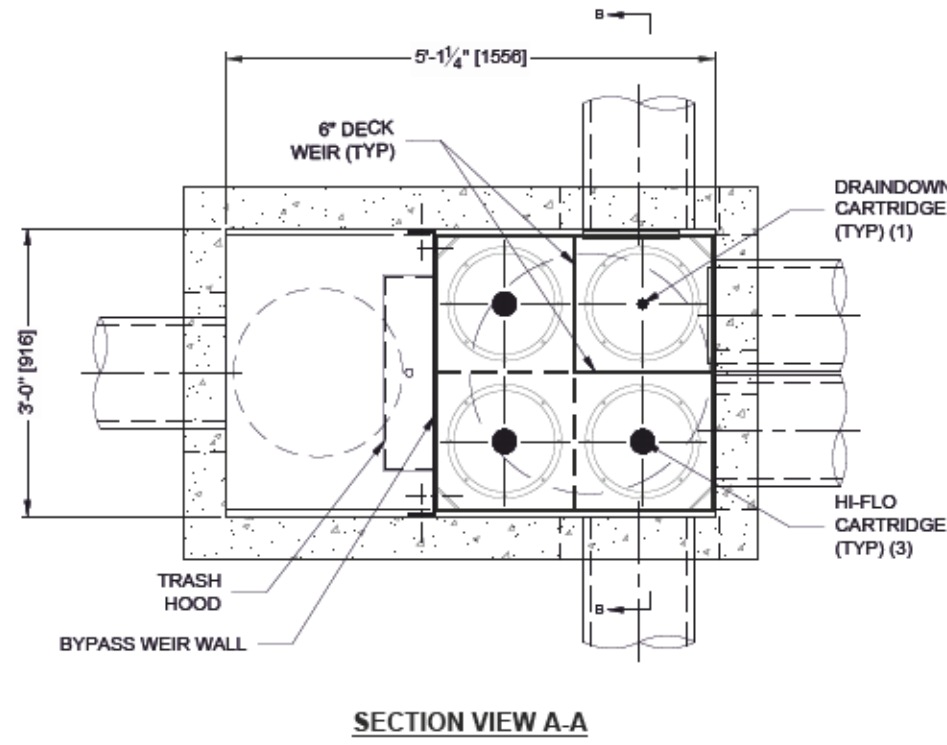
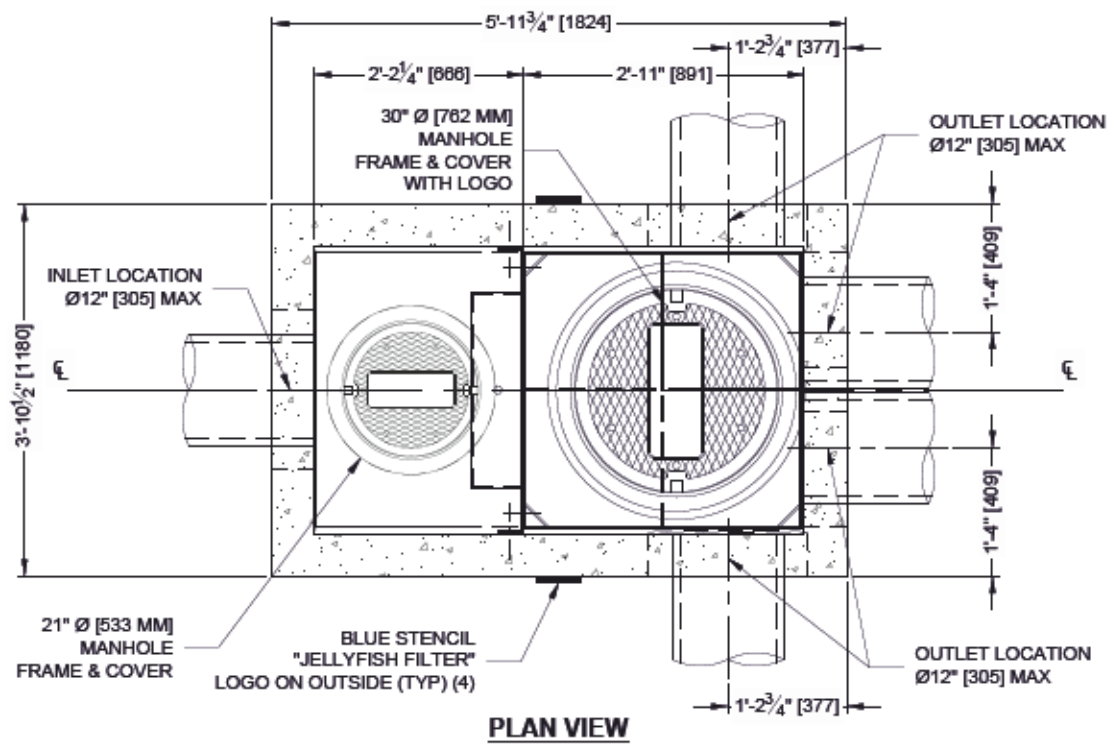
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407 FAIRVIEW DRIVE, WESTLEY, ON L1N 3A9  
 TEL: 800.265.4801 CA 416.990.0800 INTL: +1 416.990.0800  
 Imbrium  
 Jellyfish® Filter  
 THE IMBRIUM JELLYFISH FILTER IS A REGISTERED TRADEMARK OF IMBRIUM. ALL RIGHTS RESERVED.

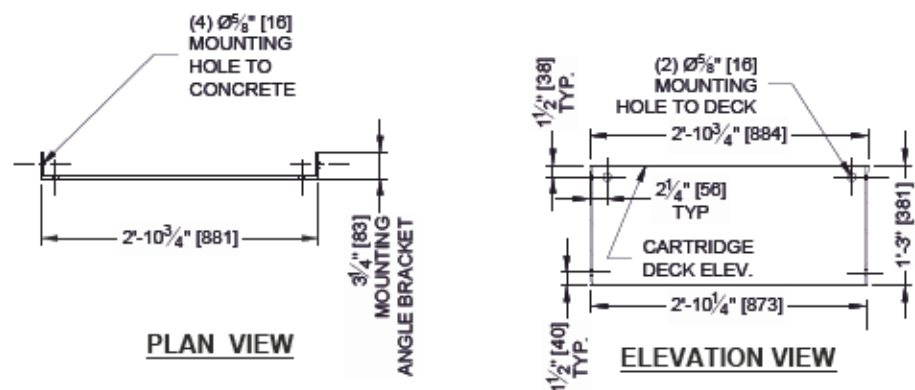
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 SHEET: 1 OF 3



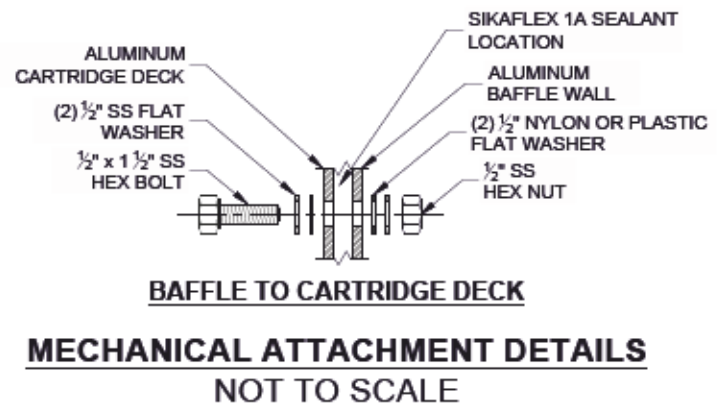
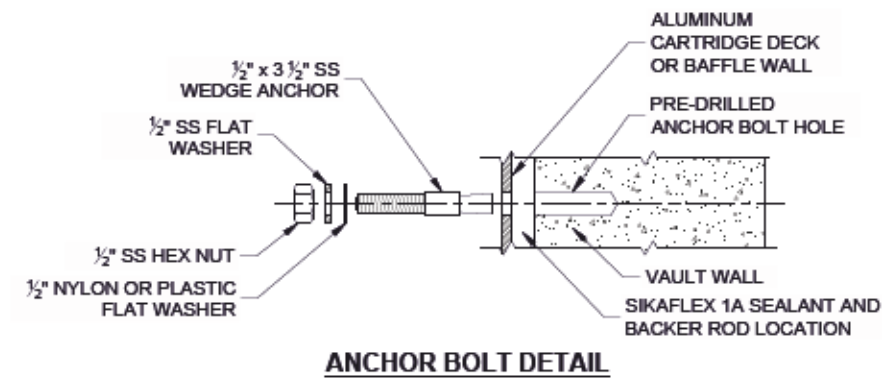
YOUR SITE: NET TO CONTACT: IMBRIUM PRODUCTS / JELLYFISH FILTER / TERRA0 DRAWINGS & DETAILS STANDARD DETAIL: JELLYFISH FILTER - INLET WALL / LANGLEY SERIE: BLANGLEY PROPOSAL DRAWING: JFVLAN-1A-15C-L1 - PROPOSAL DWG 3/25/2022 2:38 PM



**JFVLAN-1A-L1 & JFVLAN-II-L1  
 BYPASS WEIR DETAILS  
 (BYPASS CAPACITY = 2.5 CFS [70 L/s])**



**JFVLAN-1A  
 15" BAFFLE SKIRT DETAILS**



**IMBRIUM  
 PROPOSAL  
 DRAWING**

ONLINE: JFVLAN-1A - XX-XX-15C-L1 PROJECT: XXXX  Langley Vault Type 1A Scale: 1:25	
DATE:	#####
DESIGNED:	BSF
DRAWN:	BSF
CHECKED:	KS
APPROVED:	BSF
PROJECT No.:	#####
SHEET:	2 OF 3

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JELLYFISH® FILTER - SPECIFICATIONS

GENERAL

- A. WORK INCLUDED: SPECIFIES REQUIREMENTS FOR CONSTRUCTION AND PERFORMANCE OF AN UNDERGROUND STORMWATER QUALITY, MEMBRANE FILTRATION, AND TREATMENT DEVICE THAT REMOVES POLLUTANTS FROM STORMWATER RUNOFF THROUGH THE UNIT OPERATIONS OF SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.
B. REFERENCE STANDARDS: ASTM C 891: SPECIFICATION FOR INSTALLATION OF UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES
ASTM C 478: SPECIFICATION FOR PRECAST REINFORCED CONCRETE MANHOLE SECTIONS
ASTM C 990: SPECIFICATION FOR JOINTS FOR CONCRETE MANHOLES USING PREFORMED FLEXIBLE JOINT SEALANTS
ASTM D 4101: SPECIFICATION FOR COPOLYMER STEPS CONSTRUCTION
C. SHOP DRAWINGS: SHOP DRAWINGS FOR THE STRUCTURE AND PERFORMANCE ARE TO BE SUBMITTED WITH EACH ORDER TO THE CONTRACTOR. CONTRACTOR SHALL FORWARD SHOP DRAWING SUBMITTAL TO THE CONSULTING ENGINEER FOR APPROVAL. SHOP DRAWINGS ARE TO DETAIL THE STRUCTURE PRECAST CONCRETE AND CALL OUT OR NOTE THE FIBERGLASS (FRP) INTERNAL COMPONENTS.
D. PRODUCT SUBSTITUTIONS: NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD. SUBMISSIONS FOR SUBSTITUTIONS REQUIRE REVIEW AND APPROVAL BY THE ENGINEER OF RECORD, FOR HYDRAULIC PERFORMANCE, IMPACT TO PROJECT DESIGN, EQUIVALENT TREATMENT PERFORMANCE, AND ANY REQUIRED PROJECT PLAN AND REPORT (HYDROLOGY/HYDRAULIC, WATER QUALITY, STORMWATER POLLUTION) MODIFICATIONS THAT WOULD BE REQUIRED BY THE APPROVING JURISDICTIONS/AGENCIES. CONTRACTOR TO COORDINATE WITH THE ENGINEER OF RECORD ANY APPLICABLE MODIFICATIONS TO THE PROJECT ESTIMATES OF COST, BONDING AMOUNT DETERMINATIONS, PLAN CHECK FEES FOR CHANGES TO APPROVED DOCUMENTS, AND/OR ANY OTHER REGULATORY REQUIREMENTS RESULTING FROM THE PRODUCT SUBSTITUTION.
E. HANDLING AND STORAGE: PREVENT DAMAGE TO MATERIALS DURING STORAGE AND HANDLING.

PRODUCTS

- A. THE DEVICE SHALL BE A CYLINDRICAL OR RECTANGULAR, ALL CONCRETE STRUCTURE (INCLUDING RISERS), CONSTRUCTED FROM PRECAST CONCRETE RISER AND SLAB COMPONENTS OR MONOLITHIC PRECAST STRUCTURE(S), INSTALLED TO CONFORM TO ASTM C 891 AND TO ANY REQUIRED STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS; WHICHEVER IS MORE STRINGENT. THE DEVICE SHALL BE WATERTIGHT.
B. THE CYLINDRICAL CONCRETE DEVICE SHALL INCLUDE A FIBERGLASS CARTRIDGE DECK INSERT. THE RECTANGULAR CONCRETE DEVICE SHALL INCLUDE A COATED ALUMINUM INSERT. IN EITHER INSTANCE, THE INSERT SHALL BE BOLTED AND SEALED WATERTIGHT INSIDE THE PRECAST CONCRETE CHAMBER. THE INSERT SHALL SERVE AS: (A) A HORIZONTAL DIVIDER BETWEEN THE LOWER TREATMENT ZONE AND THE UPPER TREATED EFFLUENT ZONE; (B) A DECK FOR ATTACHMENT OF FILTER CARTRIDGES SUCH THAT THE MEMBRANE FILTER ELEMENTS OF EACH CARTRIDGE EXTEND INTO THE LOWER TREATMENT ZONE; (C) A PLATFORM FOR MAINTENANCE WORKERS TO SERVICE THE FILTER CARTRIDGES (MAXIMUM MANNED WEIGHT = 450 POUNDS); (D) A CONDUIT FOR CONVEYANCE OF TREATED WATER TO THE EFFLUENT PIPE.
C. MEMBRANE FILTER CARTRIDGES SHALL BE COMPRISED OF REUSABLE CYLINDRICAL MEMBRANE FILTER ELEMENTS CONNECTED TO A PERFORATED HEAD PLATE. THE NUMBER OF MEMBRANE FILTER ELEMENTS PER CARTRIDGE SHALL BE A MINIMUM OF ELEVEN 2.75-INCH (70-MM) OR GREATER DIAMETER ELEMENTS. THE LENGTH OF EACH FILTER ELEMENT SHALL BE A MINIMUM 15 INCHES (381 MM). EACH CARTRIDGE SHALL BE FITTED INTO THE CARTRIDGE DECK BY INSERTION INTO A CARTRIDGE RECEPTACLE THAT IS PERMANENTLY MOUNTED INTO THE CARTRIDGE DECK. EACH CARTRIDGE SHALL BE SECURED BY A CARTRIDGE LID THAT IS THREADED ONTO THE RECEPTACLE, OR SIMILAR MECHANISM TO SECURE THE CARTRIDGE INTO THE DECK. THE MAXIMUM TREATMENT FLOW RATE OF A FILTER CARTRIDGE SHALL BE CONTROLLED BY AN ORIFICE IN THE CARTRIDGE LID, OR ON THE INDIVIDUAL CARTRIDGE ITSELF, AND BASED ON A DESIGN FLUX RATE (SURFACE LOADING RATE) DETERMINED BY THE MAXIMUM TREATMENT FLOW RATE PER UNIT OF FILTRATION MEMBRANE SURFACE AREA. THE MAXIMUM FLUX RATE SHALL BE 0.21 GPM/FT2 (0.142 LPS/M2). EACH MEMBRANE FILTER CARTRIDGE SHALL ALLOW FOR MANUAL INSTALLATION AND REMOVAL.
D. ALL FILTER CARTRIDGES AND MEMBRANES SHALL BE REUSABLE AND ALLOW FOR THE USE OF FILTRATION MEMBRANE RINSING PROCEDURES TO RESTORE FLOW CAPACITY AND SEDIMENT CAPACITY; EXTENDING CARTRIDGE SERVICE LIFE.
E. ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.
F. THE DEVICE SHALL INCLUDE A MINIMUM 24 INCHES (610 MM) OF SUMP BELOW THE BOTTOM OF THE CARTRIDGES FOR SEDIMENT ACCUMULATION, UNLESS OTHERWISE SPECIFIED BY THE DESIGN ENGINEER. DEPTHS LESS THAN 24" MAY HAVE AN IMPACT ON THE TOTAL PERFORMANCE AND/OR LONGEVITY BETWEEN CARTRIDGE MAINTENANCE/REPLACEMENT OF THE DEVICE.
G. ALL PRECAST CONCRETE COMPONENTS SHALL BE MANUFACTURED TO A MINIMUM LIVE LOAD OF H-20 TRUCK LOADING OR GREATER BASED ON LOCAL REGULATORY SPECIFICATIONS, UNLESS OTHERWISE MODIFIED OR SPECIFIED BY THE DESIGN ENGINEER, AND SHALL BE WATERTIGHT.
H. GASKETS AND/OR SEALANTS TO PROVIDE WATER TIGHT SEAL BETWEEN CONCRETE JOINTS. JOINTS SHALL BE SEALED WITH PREFORMED JOINT SEALING COMPOUND CONFORMING TO ASTM C 990.
I. FRAME AND COVERS MUST BE MANUFACTURED FROM CAST-IRON OR OTHER COMPOSITE MATERIAL TESTED TO WITHSTAND H-20 OR GREATER DESIGN LOADS, AND AS APPROVED BY THE LOCAL REGULATORY BODY. FRAMES AND COVERS MUST BE EMBOSSED WITH THE NAME OF THE DEVICE MANUFACTURER OR THE DEVICE BRAND NAME.
J. DOOR AND HATCHES, IF PROVIDED SHALL MEET DESIGNATED LOADING REQUIREMENTS OR AT A MINIMUM FOR INCIDENTAL VEHICULAR TRAFFIC.
K. ALL CONCRETE COMPONENTS SHALL BE MANUFACTURED ACCORDING TO LOCAL SPECIFICATIONS AND SHALL MEET THE REQUIREMENTS OF ASTM C 478.
L. THE FIBERGLASS PORTION OF THE FILTER DEVICE SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE FOLLOWING STANDARD: ASTM D-4097: CONTACT MOLDED GLASS FIBER REINFORCED CHEMICAL RESISTANT TANKS.
M. STEPS SHALL BE CONSTRUCTED ACCORDING TO ASTM D4101 OF COPOLYMER POLYPROPYLENE, AND BE DRIVEN INTO PREFORMED OR PRE-DRILLED HOLES AFTER THE CONCRETE HAS CURED, INSTALLED TO CONFORM TO APPLICABLE SECTIONS OF STATE, PROVINCIAL AND MUNICIPAL BUILDING CODES, HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF SUCH DEVICES.
N. ALL PRECAST CONCRETE SECTIONS SHALL BE INSPECTED TO ENSURE THAT DIMENSIONS, APPEARANCE AND QUALITY OF THE PRODUCT MEET LOCAL MUNICIPAL SPECIFICATIONS AND ASTM C 478.

PERFORMANCE

- A. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL FUNCTION TO REMOVE POLLUTANTS BY THE FOLLOWING UNIT TREATMENT PROCESSES: SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.
B. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL REMOVE OIL, DEBRIS, TRASH, COARSE AND FINE PARTICULATES, PARTICULATE-BOUND POLLUTANTS, METALS AND NUTRIENTS FROM STORMWATER DURING RUNOFF EVENTS.
C. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TYPICALLY UTILIZE AN EXTERNAL BYPASS TO DIVERT EXCESSIVE FLOWS. INTERNAL BYPASS SYSTEMS SHALL BE EQUIPPED WITH A FLOATABLE BAFFLE, AND MUST PASS WATER OVER THE CARTRIDGE DECK, AND AVOID PASSAGE THROUGH THE BUMP AND/OR CARTRIDGE FILTRATION ZONE.
D. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TREAT 100% OF THE REQUIRED WATER QUALITY TREATMENT FLOW BASED ON A MAXIMUM TREATMENT FLUX RATE (SURFACE LOADING RATE) ACROSS THE MEMBRANE FILTER CARTRIDGES NOT TO EXCEED 0.21 GPM/FT2 (0.142 LPS/M2).
E. AT A MINIMUM, THE STORMWATER QUALITY FILTER DEVICE SHALL HAVE BEEN FIELD TESTED AND VERIFIED WITH A MINIMUM 25 QUALIFYING STORM EVENTS AND FIELD MONITORING CONDUCTED ACCORDING TO THE TARP TIER II OR TAPE FIELD TEST PROTOCOL, AND HAVE RECEIVED NJCAT VERIFICATION.
F. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TSS REMOVAL EFFICIENCY OF 95% AND A MINIMUM MEDIAN SSC REMOVAL EFFICIENCY OF 95%.
G. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED THE ABILITY TO CAPTURE FINE PARTICLES AS INDICATED BY A MINIMUM MEDIAN REMOVAL EFFICIENCY OF 75% FOR THE PARTICLE FRACTION LESS THAN 25 MICRONS, AN EFFLUENT D50 OF 15 MICRONS OR LOWER FOR ALL MONITORED STORM EVENTS, AND AN EFFLUENT TURBIDITY OF 15 NTUS OR LOWER.
H. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL PHOSPHORUS REMOVAL OF 55%, AND A MINIMUM MEDIAN TOTAL NITROGEN REMOVAL OF 50%.
I. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL ZINC REMOVAL OF 50%, AND A MINIMUM MEDIAN TOTAL COPPER REMOVAL OF 75%.

INSPECTION AND MAINTENANCE

- A. DURABILITY OF MEMBRANES ARE SUBJECT TO GOOD HANDLING PRACTICES DURING INSPECTION AND MAINTENANCE (REMOVAL, RINSING, AND REINSERTION) EVENTS, AND SITE SPECIFIC CONDITIONS THAT MAY HAVE HEAVIER OR LIGHTER LOADING ONTO THE CARTRIDGES, AND POLLUTANT VARIABILITY THAT MAY IMPACT THE MEMBRANE STRUCTURAL INTEGRITY. MEMBRANE MAINTENANCE AND REPLACEMENT SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
B. INSPECTION WHICH INCLUDES TRASH AND FLOATABLES COLLECTION, SEDIMENT DEPTH DETERMINATION, AND VISIBLE DETERMINATION OF BACKWASH POOL DEPTH SHALL BE EASILY CONDUCTED FROM GRADE (OUTSIDE THE STRUCTURE).
C. MANUAL RINSING OF THE REUSABLE FILTER CARTRIDGES SHALL PROMOTE RESTORATION OF THE FLOW CAPACITY AND SEDIMENT CAPACITY OF THE FILTER CARTRIDGES, EXTENDING CARTRIDGE SERVICE LIFE.
D. SEDIMENT REMOVAL FROM THE FILTER TREATMENT DEVICE SHALL BE ABLE TO BE CONDUCTED USING A STANDARD MAINTENANCE TRUCK AND VACUUM APPARATUS, AND A MINIMUM ONE POINT OF ENTRY TO THE SUMP THAT IS UNOBSTRUCTED BY FILTER CARTRIDGES.
E. MAINTENANCE ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.
F. FILTER CARTRIDGES SHALL BE ABLE TO BE MAINTAINED WITHOUT THE USE OF ADDITIONAL LIFTING EQUIPMENT.

EXECUTION

- A. THE INSTALLATION OF A WATERTIGHT PRECAST CONCRETE DEVICE SHOULD CONFORM TO ASTM C 891 AND TO ANY STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF MANHOLES, WHICHEVER IS MORE STRINGENT. SELECTED SECTIONS OF A GENERAL SPECIFICATION THAT ARE APPLICABLE ARE SUMMARIZED BELOW.
B. THE WATERTIGHT PRECAST CONCRETE DEVICE IS INSTALLED IN SECTIONS IN THE FOLLOWING SEQUENCE:
- AGGREGATE BASE
- BASE SLAB
- TREATMENT CHAMBER AND CARTRIDGE DECK RISER SECTION(S)
- BYPASS SECTION
- CONNECT INLET AND OUTLET PIPES
- CONCRETE RISER SECTION(S) AND/OR TRANSITION SLAB (IF REQUIRED)
- MAINTENANCE RISER SECTION(S) (IF REQUIRED)
- FRAME AND ACCESS COVER
C. INLET AND OUTLET PIPES SHOULD BE SECURELY SET INTO THE DEVICE USING APPROVED PIPE SEALS (FLEXIBLE BOOT CONNECTIONS, WHERE APPLICABLE) SO THAT THE STRUCTURE IS WATERTIGHT, AND SUCH THAT ANY PIPE INTRUSION INTO THE DEVICE DOES NOT IMPACT THE DEVICE FUNCTIONALITY.
D. ADJUSTMENT UNITS (E.G. GRADE RINGS) SHOULD BE INSTALLED TO SET THE FRAME AND COVER AT THE REQUIRED ELEVATION. THE ADJUSTMENT UNITS SHOULD BE LAID IN A FULL BED OF MORTAR WITH SUCCESSIVE UNITS BEING JOINED USING SEALANT RECOMMENDED BY THE MANUFACTURER. FRAMES FOR THE COVER SHOULD BE SET IN A FULL BED OF MORTAR AT THE ELEVATION SPECIFIED.
E. IN SOME INSTANCES THE MAINTENANCE ACCESS WALL, IF PROVIDED, SHALL REQUIRE AN EXTENSION ATTACHMENT AND SEALING TO THE PRECAST WALL AND CARTRIDGE DECK AT THE JOB SITE, RATHER THAN AT THE PRECAST FACILITY. IN THIS INSTANCE, INSTALLATION OF THESE COMPONENTS SHALL BE PERFORMED ACCORDING TO INSTRUCTIONS PROVIDED BY THE MANUFACTURER.
F. FILTER CARTRIDGES SHALL BE INSTALLED IN THE CARTRIDGE DECK AFTER THE CONSTRUCTION SITE IS FULLY STABILIZED AND IN ACCORDANCE WITH THE MANUFACTURER'S GUIDELINES AND RECOMMENDATIONS. CONTRACTOR TO CONTACT THE MANUFACTURER TO SCHEDULE CARTRIDGE DELIVERY AND REVIEW PROCEDURES/REQUIREMENTS TO BE COMPLETED TO THE DEVICE PRIOR TO INSTALLATION OF THE CARTRIDGES AND ACTIVATION OF THE SYSTEM.
G. MANUFACTURER SHALL COORDINATE DELIVERY OF FILTER CARTRIDGES AND OTHER INTERNAL COMPONENTS WITH CONTRACTOR. FILTER CARTRIDGES SHALL BE DELIVERED AND INSTALLED COMPLETE AFTER SITE IS STABILIZED AND UNIT IS READY TO ACCEPT CARTRIDGES. UNIT IS READY TO ACCEPT CARTRIDGES AFTER IS HAS BEEN CLEANED OUT AND ANY STANDING WATER, DEBRIS, AND OTHER MATERIALS HAVE BEEN REMOVED. CONTRACTOR SHALL TAKE APPROPRIATE ACTION TO PROTECT THE FILTER CARTRIDGE RECEPTACLES AND FILTER CARTRIDGES FROM DAMAGE DURING CONSTRUCTION, AND IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND GUIDANCE. FOR SYSTEMS WITH CARTRIDGES INSTALLED PRIOR TO FULL SITE STABILIZATION AND PRIOR TO SYSTEM ACTIVATION, THE CONTRACTOR CAN PLUG INLET AND OUTLET PIPES TO PREVENT STORMWATER AND OTHER INFLUENT FROM ENTERING THE DEVICE. PLUGS MUST BE REMOVED DURING THE ACTIVATION PROCESS.
H. THE MANUFACTURER SHALL PROVIDE AN OWNER'S MANUAL UPON REQUEST.
I. AFTER CONSTRUCTION AND INSTALLATION, AND DURING OPERATION, THE DEVICE SHALL BE INSPECTED AND CLEANED AS NECESSARY BASED ON THE MANUFACTURER'S RECOMMENDED INSPECTION AND MAINTENANCE GUIDELINES AND THE LOCAL REGULATORY AGENCY/BODY.
J. WHEN REPLACEMENT MEMBRANE FILTER ELEMENTS AND/OR OTHER PARTS ARE REQUIRED, ONLY MEMBRANE FILTER ELEMENTS AND PARTS APPROVED BY THE MANUFACTURER FOR USE WITH THE STORMWATER QUALITY FILTER DEVICE SHALL BE INSTALLED.

END OF SECTION

The design and information shown on this drawing is provided as a service to the project owner, and does not constitute a warranty of any kind, including but not limited to the accuracy, completeness, or reliability of the information. It is the responsibility of the user to verify the information and to consult with the appropriate regulatory agencies for any applicable requirements. If discrepancies between the applied information upon which this drawing is based and actual field conditions are discovered, the user must be responsible for any necessary design modifications. The user accepts no liability for design based on this information, except as to the accuracy of the information provided.

Table with 4 columns: MARK, DATE, REVISION DESCRIPTION, BY. The table is currently empty.

JELLYFISH FILTER SPECIFICATIONS
Jellyfish®
Langley Vault Type 1A
Scale - 1:50

imbrium
407 FAIRVIEW DRIVE, WHITE, OH, 43083
TEL: +1-614-990-0900
Jellyfish® Filter
THE PRODUCT AND MANUFACTURER ARE REGISTERED TRADEMARKS OF IMBRIUM, INC.
\*INTERNATIONAL TRADEMARK OF IMBRIUM, INC.

DATE: #####
DESIGNED: DRAWN:
CHECKED: BSF APPROVED: SP
PROJECT No.: #####
SHEET: 3 OF 3

YOUR SITE: NET TO CONTACT: IMBRIUM PRODUCTS, JELLYFISH FILTER, DETAIL STANDARD DRAWING, JELLYFISH FILTER - INLET WALL, LANGLEY SERIES, LANGLEY PROPOSAL, DRAWING, 3056/022 2:38 PM



# Jellyfish® Filter Sizing Report

04/08/2022

Province:	British Columbia
City:	Vancouver
Nearest Rainfall Station:	VANCOUVER INTL AP
Climate Station ID:	1108395
Years of Rainfall Data:	20

Site Name:	
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Drainage Area (ha):	0.146
Runoff Coefficient 'c':	0.75

Is the Jellyfish Filter OFF- LINE of the Drainage System?	No
Peak Conveyance (maximum) Flow Rate (L/s)	37.60
Required Water Quality Runoff Volume Capture (%)	90
Required Water Quality Treatment Flow Rate (L/s)	1.20
Average Annual Rainfall Depth (mm)*	937
Influent TSS Concentration Rate (mg/L)	Low (60 mg/L)
Upstream Pre-treatment?	No
Estimated Average Annual Sediment Load (kg/yr)	55

\*source: Environment Canada

Notes:

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Project Name:	1302, 1308, & 1318 East 12th Ave
Project Number:	10186
Designer Name:	LJ Khakh
Designer Company:	Langley
Designer Email/Phone:	lkhakh@langleyconcretegroup.com
EOR Name:	Maddy Pos
EOR Company:	Creus Engineering
EOR Email:	mpos@creus.ca
EOR Phone:	

## Jellyfish Filter Recommendation

Jellyfish Filter Model	JFVLAN-IA-3-1-15C-L1
Internal Vault Dimension (m)	1.55 x 0.91
# of Hi-Flo Cartridges	3
# of Draindown Cartridges	1
Required Treatment Flow Rate (L/s)	1.2
Treatment Flow Rate Provided (L/s)	4.9
Peak By-Pass Capacity Provided (L/S)	60
Required Sediment Capacity (kg/yr)	55
Sediment Capacity Provided (kg/yr)	56

**Recommended On-line  
Jellyfish Filter Model**

**JFVLAN-IA-3-1-15C-  
L1**

## JELLYFISH FILTER SIZING OVERVIEW

The Jellyfish Filter model JFVLAN-IA-3-1-15C-L1 is recommended to meet the water quality objective of removing 80% TSS by treating a flow rate of 4.9 L/s, which meets or exceeds treatment of 90% of the average annual rainfall based on 20 years of VANCOUVER INTL AP rainfall data. The Jellyfish Filter model has a sediment capacity of 56 kg, which meets or exceeds the estimated average annual sediment load for the site.

Regular scheduled maintenance is necessary to assure proper functioning of the Jellyfish Filter. The maintenance interval is designed to be approximately every 12 months, but this may vary significantly with site loading conditions and upstream pretreatment measures. Biannual inspections, as well as inspection after storms of unusually high intensity or long duration, are recommended.

## THIRD-PARTY TESTING AND VERIFICATION

- ▶ Third-party field tested in accordance with TARP Tier II Protocol
- ▶ TAPE field testing results certified by WA Ecology with GULD for Basic Treatment and Phosphorus Treatment
- ▶ Third-party verified in accordance with ISO 14034 Environmental Technology Verification (ETV)
- ▶ Third-party verification by New Jersey Corporation for Advanced Technology (NJCAT)

## POLLUTANT REMOVAL PERFORMANCE

- ▶ Total Suspended Solids (TSS) 83% - 90%
  - ▶ Total Nitrogen (TN) 31% - 55%
  - ▶ Total Zinc (TZn) 39% - 75%
  - ▶ Total Phosphorus (TP) 59% - 92%
  - ▶ Total Copper (TCu) 75% - 99%
  - ▶ Oil & Grease 43% - 100%
  - ▶ Total Trash 99%
- Source: ISO 14034 ETV Verification Statement, TAPE Field Study
- Source: Monteco Research and Development Centre Floatables Testing

# Jellyfish® Filter Sizing Report

This report provides information for the sizing and specification of the Jellyfish Filter. When designed properly in accordance to the guidelines detailed in the Jellyfish Filter Technical Manual, the Jellyfish Filter will exceed the performance and longevity of conventional horizontal bed and granular media filters. Please see [www.ImbriumSystems.com](http://www.ImbriumSystems.com) for more information.

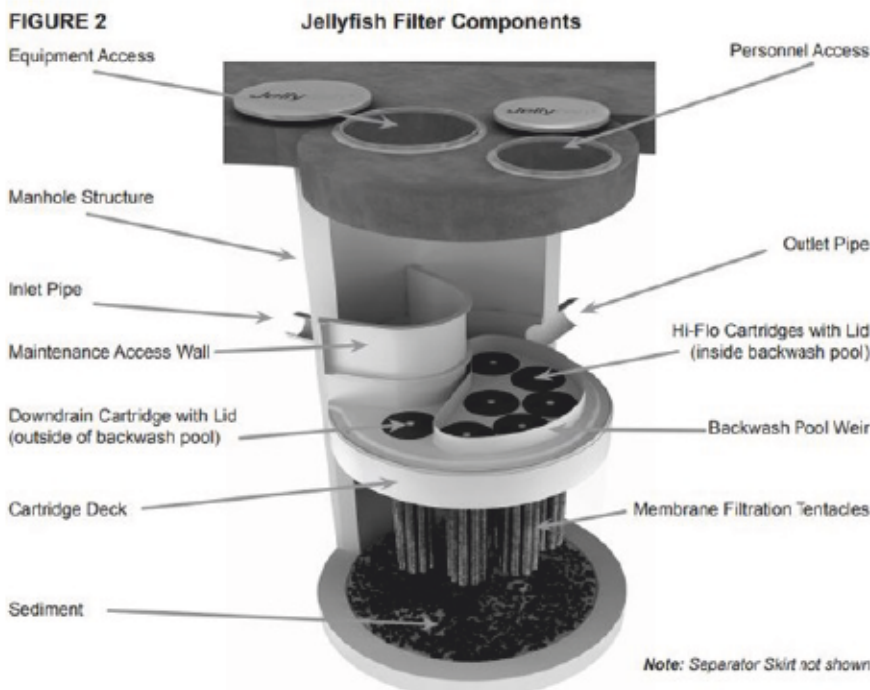
## JELLYFISH FILTER SYSTEM OVERVIEW

The Jellyfish Filter is a patented stormwater quality treatment technology featuring high flow pretreatment and membrane filtration in a compact stand-alone system. Jellyfish Filter removes floatables, trash, oil, debris, TSS, fine silt-sized particles, and a high percentage of particulate-bound pollutants; including phosphorus, nitrogen, metals and hydrocarbons. The high surface area membrane cartridges, combined with up-flow hydraulics, frequent passive backwashing, and rinseable / reusable cartridges ensure long-lasting performance.

## JELLYFISH FILTER OPERATION

- ▶ Stormwater enters the Jellyfish Filter through the inlet pipe or inlet grate, builds driving head, and traps floating pollutants behind the maintenance access wall and below the cartridge deck.
- ▶ Water is pushed down below the cartridge deck where a separation skirt around the cartridges directs oil, trash and debris outside the filtration zone, allowing sand-sized particles to settle in the sump.
- ▶ Water is directed to the filtration zone, enters the membranes, and exits through the top of the cartridges into the backwash pool. Once the treated water has filled the backwash pool, treated water overflows the weir and exits via the outlet pipe.
- ▶ The membrane filters provide a very high surface area to effectively remove fine sand and silt-sized particles, and a high percentage of particulate-bound pollutants such as nitrogen, phosphorus, metals and hydrocarbons, while ensuring long-lasting treatment.
- ▶ After every storm peak, the filtered water in the backwash pool flows back through the hi-flo membrane cartridges into the lower chamber. This passive backwash, coupled with vibrational pulses and gravity, extends cartridge service life for future storm events.
- ▶ The draindown cartridge(s) located outside the backwash pool enables water levels to balance.

The Jellyfish Filter and components are depicted in Figure 2 below



# Jellyfish® Filter Sizing Report

## JELLYFISH FILTER STANDARD DESIGN

► Typically, the Jellyfish Filter is designed in an off-line configuration, as all stormwater filter systems will perform for a longer duration between required maintenance services when designed and applied in off-line configurations. Depending on the design parameters, an optional internal bypass may be incorporated into the Jellyfish Filter, however, the inspection and maintenance frequency will be increased as compared to an off-line system.

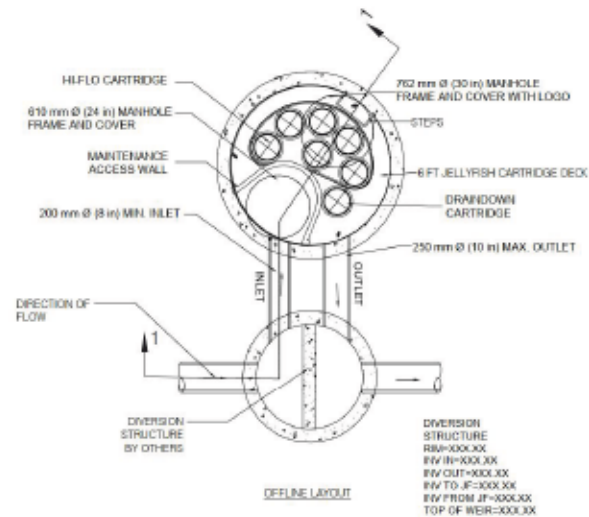
► Typically, 18 inches (457 mm) of driving head is designed into the system, calculated as the difference in elevation between the top of the diversion structure weir and the invert of the Jellyfish Filter outlet pipe. Design driving head can range from 12 to 24 inches (305 to 610mm) depending on specific site requirements, and requires additional sizing and design assistance.

► Typically, the Jellyfish Filter is designed with the inlet pipe invert configured 6 inches (150 mm) above the outlet pipe invert elevation. However, depending on site parameters, this can vary to an optional configuration with the inlet pipe entering the unit below the outlet invert elevation. Outlet pipe invert is always set at the Jellyfish Filter deck elevation.

► The Jellyfish Filter can accommodate multiple inlet / outlet pipes within certain restrictions.

► While the optional below deck inlet pipe configuration offers 0 to 360 degree flexibility between the inlet and outlet pipe, typical systems conform to the following:

Example: Typical Off-line Jellyfish Filter Layout



Model Name	Model Diameter		Minimum Angle Between Inlet / Outlet Pipes	Minimum Inlet Pipe Diameter		Minimum Outlet Pipe Diameter	
	(m)	(ft)		(mm)	(in)	(mm)	(in)
JF4	1.22	4	62°	150	6	200	8
JF6	1.83	6	59°	200	8	250	10
JF8	2.44	8	52°	250	10	300	12
JF10	3.05	10	48°	300	12	450	18
JF12	3.66	12	40°	300	12	450	18

► The Jellyfish Filter can be built at all depths of cover generally associated with conventional stormwater conveyance systems. For sites that require minimal depth of cover for the stormwater infrastructure, the Jellyfish Filter can be applied in a shallow application using a hatch cover. The general minimum depth of cover using a hatch is 36 inches (915 mm) from the bottom side of the top slab to the outlet pipe invert.

► The Jellyfish Filter will function effectively under submerged conditions, however, maintenance and cartridge cleaning may be more frequent. Please contact your local representative for submerged Jellyfish Filter applications.

► Jellyfish Filter systems may incorporate grated inlets depending on system configuration.

► For sites with water quality treatment flow rates or sediment mass loadings that exceed the design rates of the largest standard Jellyfish Filter models, systems can be designed that hydraulically connect multiple Jellyfish Filters in parallel.

# Jellyfish® Filter Sizing Report

## SIZING FOR THE STORMWATER QUALITY EVENT

► The Jellyfish Filter is sized to meet both an estimated annual sediment load and a water quality flow rate. The water quality flow rate is typically determined as the flow rate associated with the 90th percentile average annual rainfall event. The Jellyfish Filter sizing program uses a local rainfall dataset based on a minimum of ten (10) years of historic rainfall information from Environment Canada. Most rainfall events are much smaller than design storms used for urban drainage models. In any given area, most frequently recurrent rainfall events are of low intensity and depth.

### RAINFALL DATA FROM THE VANCOUVER INTL AP RAINFALL STATION

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)
1.0	37.9	37.9	0.3
2.0	29.0	66.9	0.6
3.0	15.8	82.7	0.9
4.0	8.3	91.0	1.2
5.0	3.8	94.8	1.5
6.0	1.8	96.6	1.8
7.0	1.3	97.9	2.1
8.0	0.5	98.5	2.4
9.0	0.3	98.7	2.7
10.0	0.2	99.0	3.0
11.0	0.2	99.2	3.3
12.0	0.0	99.2	3.7
13.0	0.2	99.4	4.0
14.0	0.1	99.5	4.3
15.0	0.0	99.5	4.6
16.0	0.0	99.5	4.9
17.0	0.0	99.5	5.2
18.0	0.0	99.5	5.5
19.0	0.0	99.5	5.8
20.0	0.0	99.5	6.1
25.0	0.2	99.8	7.6
30.0	0.0	99.8	9.1
35.0	0.2	100.0	10.7
40.0	0.0	100.0	12.2
45.0	0.0	100.0	13.7
50.0	0.0	100.0	15.2

Climate Station ID: 1108395 Years of Rainfall Data: 20

# Jellyfish® Filter Sizing Report

## JELLYFISH FILTER MODEL NAMING CONVENTION

### OFF- LINE Manhole Configuration

Example (1): JF6-6-1

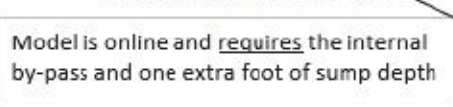


Example (2): JF4-2-1-27

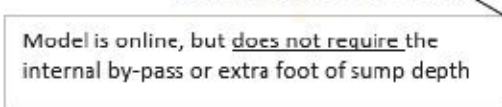


### ON- LINE Manhole Configuration

Example (1): JF8-10-2-L1



Example (2): JF8-10-2-L0



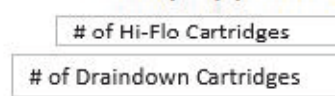
**Note:**  
Standard manhole cartridge length is 54 inches (1372 mm). Cartridge length is only included in the model name if it is not the standard 54 inch (1372 mm) length.

### ON- LINE / OFF- LINE Vault Configuration

Example (1): JFVLAN-III-6-3-27



Example (2): JFVLEC-V-30-6-54



## JELLYFISH FILTER CONFIGURATIONS

The Jellyfish Filter can be designed in a variety of configurations: manhole, vault\*, fiberglass tank, or custom configuration. Typically, 18 inches (457 mm) of driving head is designed into the system. \*Vault configuration only available in BC.

Please contact Imbrium Systems at (800) 565-4801 or by email at [info@imbriumsystems.com](mailto:info@imbriumsystems.com) to inquire about custom configurations.

Jellyfish Filter cartridges are available in various lengths as depicted in Table 1 below:

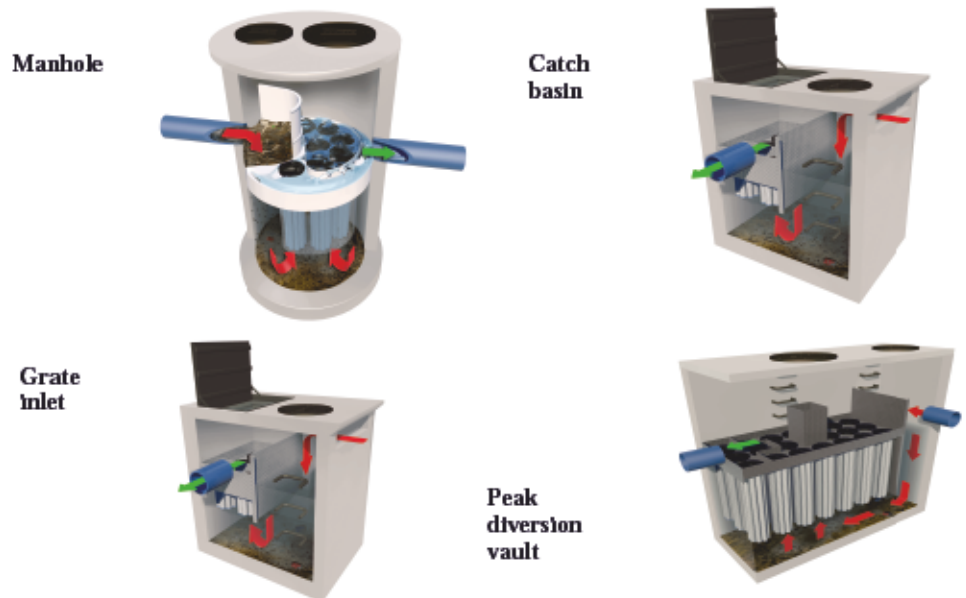


Table 1 - Cartridge Lengths / Weights and Cartridge Orifice Diameters

Cartridge Lengths	Dry Weight	Hi-Flo Orifice Diameter	Draindown Orifice Diameter
15 inches (381 mm)	10 lbs (4.5 kg)	35 mm	20 mm
27 inches (686 mm)	14.5 lbs (6.6 kg)	45 mm	25 mm
40 inches (1,016 mm)	19.5 lbs (8.9 kg)	55 mm	30 mm
54 inches (1,372 mm)	25 lbs (11.4 kg)	70 mm	35 mm

# Jellyfish® Filter Sizing Report

## INSPECTION & MAINTENANCE

The primary purpose of the Jellyfish Filter is to capture and remove pollutants from stormwater runoff. As with any filtration system, captured pollutants must be removed to maintain the filter's maximum treatment performance. Regular inspection and maintenance are required to insure proper functioning of the system. Maintenance frequencies and requirements are site specific and vary depending on pollutant loading. Maintenance activities may be required in the event of an upstream chemical spill or due to excessive sediment loading from site erosion or extreme runoff events. It is a good practice to inspect the system after major storm events.

**Inspection activities are typically conducted from surface observations and include:**

- Observe if standing water is present
- Observe if there is any physical damage to the deck or cartridge lids
- Observe the amount of debris in the Maintenance Access Wall (MAW)

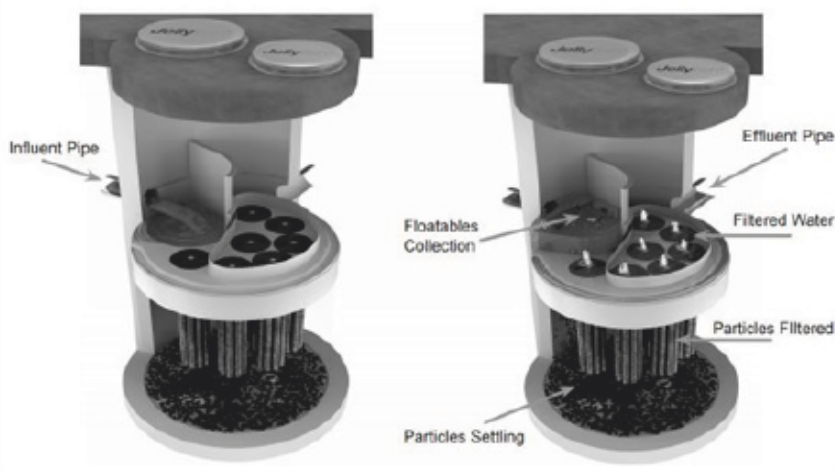
**Maintenance activities typically include:**

- Removal of oil, floatable trash and debris
- Removal of collected sediments from manhole sump
- Rinsing and re-installing the filter cartridges
- Replace filter cartridge tentacles, as needed.

It is recommended that Jellyfish Filter inspection and maintenance be performed by professionally trained individuals, with experience in stormwater maintenance and disposal services. Maintenance procedures may require manned entry into the Jellyfish structure. Only professional maintenance service providers trained in confined space entry procedures should enter the vessel. Procedures, safety and damage prevention precautions, and other information, included in the Jellyfish Filter Owner's Manual, should be reviewed and observed prior to all inspection and maintenance activities.

FIGURE 1

**Jellyfish Filter Treatment Functions**  
Membrane Filtration  
Section View with Maintenance Access Wall (MAW) Cutaway



### STANDARD JELLYFISH FILTER DRAWINGS

For standard details, please visit <http://www.imbrium.com/stormwater-treatment-solutions/jellyfish-filter>

### STANDARD JELLYFISH FILTER SPECIFICATION

For specifications, please visit <http://www.imbrium.com/stormwater-treatment-solutions/jellyfish-filter>

# Jellyfish® Filter Sizing Report

## STANDARD PERFORMANCE SPECIFICATION

### STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

#### PART 1 – GENERAL

##### 1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

##### 1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental Management – Environmental Technology Verification (ETV)

##### 1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: filtration surface area, treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, filtration treatment device product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

#### PART 2 – PRODUCTS

##### 2.1 GENERAL

2.1.1 Maintenance Access to Captured Pollutants The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the internal components. Access shall have a minimum clear vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of their installed placement for the entire length of the cartridge.

2.1.2 Pollutant Storage: The Filter device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants.

# Jellyfish® Filter Sizing Report

## PART 3 – PERFORMANCE

### 3.1 GENERAL

3.1.1 Verification – The stormwater quality filter treatment device shall have been field tested in accordance with either TARP Tier II Protocol (TARP, 2003) and New Jersey Tier II Stormwater Test Requirements – Amendments to TARP Tier II Protocol (NJDEP, 2009) or Washington State Technology Assessment Protocol – Ecology (TAPE), 2011 or later version. The field test shall have been verified in accordance with ISO 14034:2016 Environmental Management – Environmental Technology Verification (ETV). See Section 3.2 of this specification for field test performance requirements.

### 3.2 FIELD TEST PERFORMANCE

The field test (as specified in section 3.1.1) shall have monitored a minimum of twenty (20) TARP or TAPE qualifying storm events, and report at minimum the following results:

3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have ISO 14034 ETV verified load based median TSS removal efficiency of at least 85% and load based median SSC removal efficiency of at least 98%.

3.2.2 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

3.2.3 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, and an effluent d50 of 15 microns or lower for all monitored storm events.

3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce turbidity such that effluent turbidity is 15 NTU or lower.

3.2.5 Nutrients & Metals – The stormwater quality filter treatment device shall have ISO 14034 ETV Verified minimum load based removal efficiencies for the following:

3.2.5.1 Total Phosphorus (TP) Removal - Median TP removal efficiency of at least 49%.

3.2.5.2 Total Nitrogen (TN) Removal - Median TN removal efficiency of at least 39%.

3.2.5.3 Total Zinc (Zn) Removal - Median Zn removal efficiency of at least 69%.

3.2.5.4 Total Copper (Cu) Removal - Median Cu removal efficiency of at least 91%.

END OF SECTION