Auckland Unitary Plan Implementation: Stormwater Management Approach

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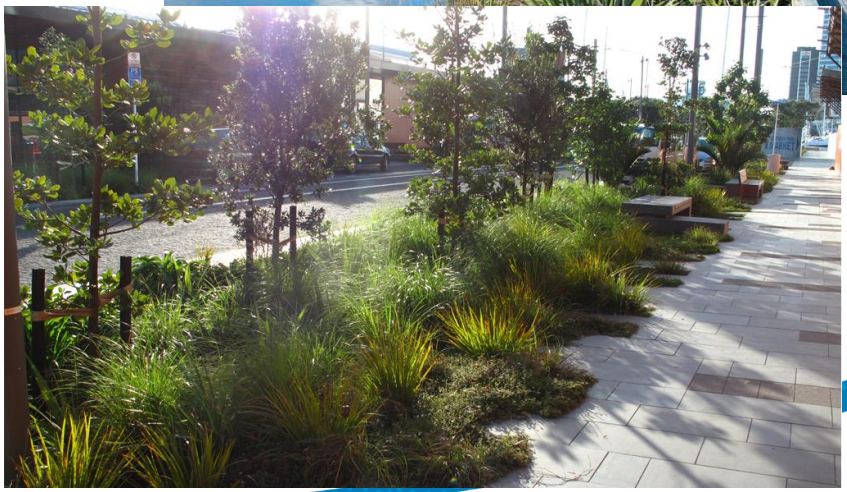
Unitary Plan Stormwater Management Approach

- Unitary Plan Requirements
- Devices
- Designing Bioretention for SMAF Hydrology
- Integrated Solutions – Putting it all together
- Project example – Belmont SHA



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Unitary Plan Stormwater Management Requirements: Basic Concepts

- Flooding
- Contaminant Management
- Hydrology Management
  - **Retention** (Volume Reduction)
  - Detention (Attenuation)

- Other Issues
  - Retention of streams (smaller catchments)

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Unitary Plan – Stormwater Management Requirements

Hydrology (e.g. SMAF) & Quality	**Quality**
Hydrology (e.g. SMAF)	**Nothing**

Potential outcomes of the planning assessment

+/-

Flooding

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Devices

Device	SMAF Detention	SMAF Retention	Quality	Flooding	Note
Pervious paving	✓	✓	✗	✗	Avoid impervious surfaces At source
Living Roof	✓	✓	✗	✗	
Bioretention (Unlined)	✓	✓	✓	✗	Mitigate for impervious surfaces created at source
Bioretention (Lined)	✓	✗	✓	✗	
Reuse	✓	✓	✗	✗	
Wetlands (& Ponds)	✓	✗	✓	✓	Communal device

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Living Roof

- Design considerations:
  - Structural support for the building
  - Physical access for maintenance or viewing, and associated safety features
  - Vertical drainage features
  - Location of other mechanical building services on the rooftop (e.g. HVAC, satellite TV, etc.)
  - The presence/absence of a maintenance contract.

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Pervious Paving

- Refers to any system providing hard or trafficable areas which also provides for downward percolation of stormwater runoff.

- For sizing & design reference GD01/TP10

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Reuse

- For sizing reference GD01/TP10
- Tank size approximately 2.5 m^3 per 100 m^2 of roof area
- Can use ½ m^3 retention and the rest detention

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Bioretention

- Rain garden
- Tree pit
- Bioretention swale

- Sizing
  - SMAF 1
    - 5% of catchment area
  - SMAF 2
    - 3.5% of catchment area
  - Quality
    - 2% of catchment area

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Wetlands (& Ponds)

- Provide detention, water quality and flood protection
- Do NOT provide retention

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Designing Bioretention for SMAF Hydrology

- Basic Concepts
  - Retention (Volume Loss)
  - Detention
- Bioretention Sizing (SMAF1)

	A	B	C
1			Instructions
2			Input yellow cells only
3	90th / 95th %ile Rainfall Depth (mm)	35	From Fig. 13 and Fig. 14 of TR2013/035
4	Pre-development Curve Number	74	From Table 3.3 of TP108
5	Impervious Area (m^2)	1000	
6	Soil Infiltration Rate (mm/hr)	2	Use default value of 2 mm/hr unless specific infiltration data is available (e.g. via TP58 infiltration methodology)
7	Evapotranspiration Rate (mm/day)	3	Use default value of 3 mm/day for typical vegetation. Use higher values for trees.
8			
9	Impervious Runoff (TP108)		
10	Storage (mm)	5.2	
11	Runoff depth (mm)	30.5	
12			
13	Pre-Development Runoff (TP108)		
14	Storage (mm)	89.2	
15	Runoff Depth (mm)	7.5	
16			
17	Hydrology Management Runoff Depth (mm)	22.9	
18	**Hydrology Management Volume (m^3)**	**22.94**	
19	**Detention Volume (m^3)**	**17.94**	
20	**Retention Volume (m^3)**	**5.00**	
21			
22	**Minimum Infiltration Area Required (m^2)**	**32.68**	This is the infiltration area of the rain garden required to regenerate the retention volume in 72 hours
23			
24			
25	Rain Garden Design Parameters		
26			
27	Ponding Area (m^2)	45	
28	Ponding Depth (mm)	200	
29	Media Depth - including transition layer (mm)	600	
30	Aggregate Depth - above underdrain invert (mm)	200	
31	Aggregate Depth - below underdrain invert (mm)	450	
32	Infiltration Area (m^2)	33.0	This must be at least as large as the value in Cell B22
33			
34	Media Void Space (%)	30%	Use default value of 30%
35	Aggregate Void Space (%)	35%	Use default value of 35%
36			
37	Ponding Volume - Detention (m^3)	9.00	
38	Media Volume - Detention (m^3)	7.02	
39	Aggregate Volume - Detention (m^3)	2.31	
40	Aggregate Volume - Retention (m^3)	5.20	
41			
42	Total Detention Volume Provided (m^3)	**18.33**	
43	Total Retention Volume Provided (m^3)	**5.16**	
44			

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Sizing Example - Bioretention

	Retention, detention and water quality treatment		Water quality treatment only
Specification	SMAF1	SMAF2	
Infiltration footprint	≥ 3.5%	≥ 3.5%	N/A
Ponding footprint	≥ 5%	≥ 3.5%	≥2%
Ponding depth (including mulch at a depth of 50-75 mm)	≥ 200 mm	≥ 150 mm	≥ 100 mm
Media depth	≥ 500 mm	≥ 500 mm	≥ 500 mm
Transition layer	100 mm	100 mm	100 mm
Drainage layer	≥ 200-300 mm	≥ 200-300 mm	≥ 200-300 mm
Storage layer depth (below underdrain invert)	≥ 450 mm	≥ 450 mm	None
Infiltration rate of subsoils for retention	>2 mm/hr	>2 mm/hr	N/A
Infiltration rate of media	50-300 mm/hr	50-300 mm/hr	≤1000 mm/hour
Slope	A bioretention device may be used on slopes steeper than 1V:4H if the effects have been assessed by a geotechnical engineer		
Other	Standard specifications should be met for all other components including: transition layer, bioretention media, underdrain and aggregate		

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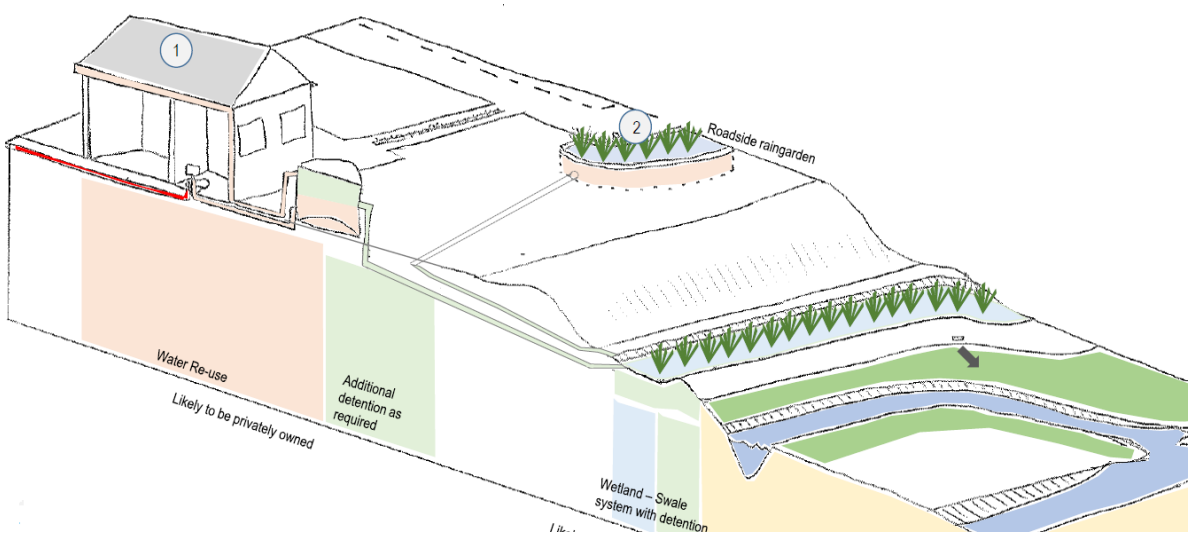
Integrated Solutions – Putting it all together



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Project example of integrated solutions – Belmont SHA

- Located 2 km west of the Pukekohe central business district and covers an area of approximately 70 ha of former horticultural land.
- The proposed development will be a mixture of residential densities with an average lot size of 300 m^2

- The solution is to:
  - retain, enhance and daylight the natural stream
  - onsite flow controls (tanks) with impervious area limits for the houses
  - onsite flow controls (rain gardens and tree pits) for the roads
  - utilise naturalised detention basins adjacent to the stream to avoid increasing upstream and downstream flooding – these have swales in them for detention of road runoff and therefore a treatment train is provided
  - protect the integrity of the 1% AEP flood plain and secondary flow paths

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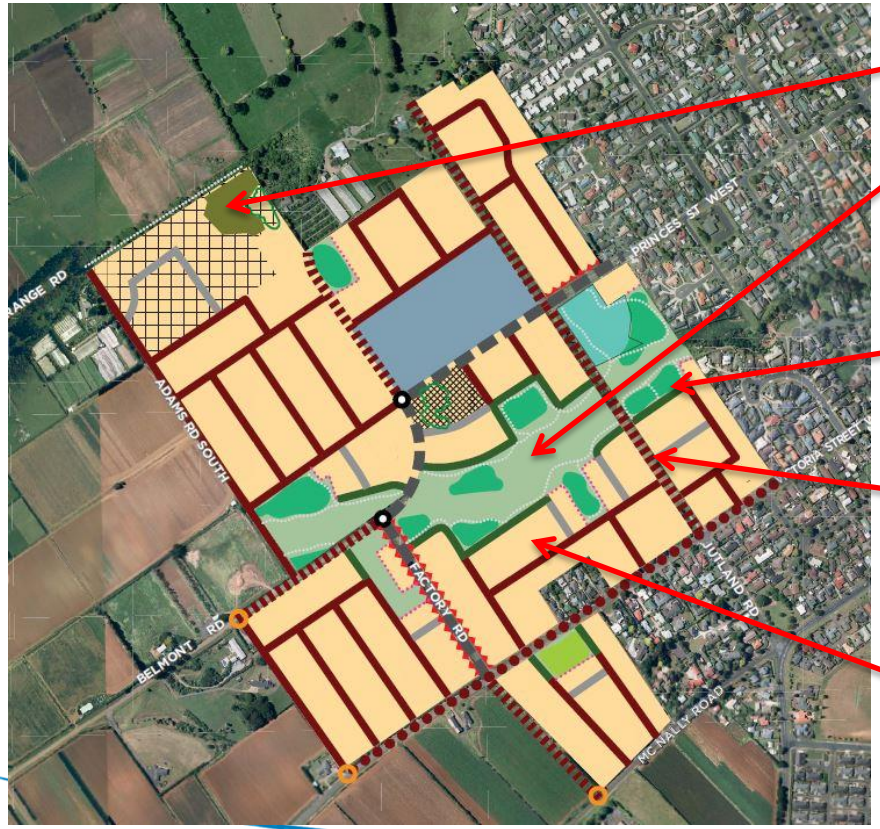

Receiving Environments

Detention and flood attenuation basins

Roads: Retention only

Lots: Retention and detention on site

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Discussion

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