Appendix U

Attenuation Calculations

1.Assessment of Predevelopment Runoff into the CCC SW system

Papanui Pak'nSave Considers only the supermarket portion of the site

KEY
Tables Associated with Flow Rates
Tables Associated with Volumes
Other Tables
Inputs
Key Results

Table 1 Pre Development runoff

Land use	Runoff Coefficient	Area (m²)
Roof	0.9	6624
Pavement	0.9	10448
Shingle	0.5	0
Landscape	0.3	5641
Site	0.75	22713

Christchurch Rainfall Intensities (Spreadsheet includes 16%)

Table 2 CCC Intensities mm/hr (includes 16% climate change allowance) mm/hr

Return Period	Duration										
	10min	20min	30min	1hr	2hr	6hr	12hr	18hr	24hr	30hr	48hr
5yr	41.0	28.9	23.6	16.7	11.8	6.8	4.8	3.9	3.4	2.9	2.1
10yr	49.4	34.9	28.4	20.1	14.2	8.2	5.8	4.7	4.1	3.5	2.5
20yr	58.1	41.0	33.4	23.6	16.6	9.6	6.8	5.5	4.8	4.1	2.9
50yr	70.3	49.6	40.5	28.6	20.2	11.6	8.2	6.7	5.8	4.9	3.6

Table 3 Pre Development Flow rate from Site l/sec

Return Period	Duration										
	10min	20min	30min	1hr	2hr	6hr	12hr	18hr	24hr	30hr	48hr
5yr	194.3	136.9	111.8	79.1	55.9	32.0	22.6	18.4	16.0	13.6	9.8
10yr	234.1	165.4	134.6	95.2	67.3	38.6	27.2	22.2	19.2	16.4	11.8
20yr	275.3	194.3	158.3	111.8	78.7	45.4	32.0	26.1	22.6	19.3	13.9
50yr	333.1	235.0	191.9	135.5	95.7	55.0	38.8	31.7	27.4	23.4	16.9

Table 4 Pre-Development Volumes from Site m³

Return Period	Duration										
	10min	20min	30min	1hr	2hr	6hr	12hr	18hr	24hr	30hr	48hr
5yr	116.6	164.3	201.3	284.9	402.5	691.8	976.3	1194.3	1379.6	1473.7	1694.8
10yr	140.4	198.4	242.2	342.8	484.4	834.1	1176.9	1440.0	1662.0	1775.6	2046.9
20yr	165.2	233.1	284.9	402.5	566.3	980.4	1383.7	1691.7	1952.7	2087.8	2407.1
50yr	199.9	282.0	345.4	487.8	689.1	1187.2	1676.4	2050.9	2366.2	2527.9	2914.7

Table 5 Post development discharging directly to CCC system. (non attenuated)

Land use	Runoff Coefficient	Area (m²)
Roof	0.9	5299
Pavement	0.9	12140
Shingle	0.5	0
Landscape	0.3	3003
Site	0.81	20442

Total post development hardstand	19710	m²
Total new roof area	7570	m²
Portion of roof attenuated	30%	m²
Roof area attenuated	2271	m²
Roof area not attenuated	5299	m²
Hardstand not attenuated	12140	m²

Total new pavement area	12140	m²
Portion of pavement attenuated	0%	m²
Pavement area atttenuated	0	m²
Pavement area not attenuated	12140	m²

Note Re table 5: supermarket roof 6300m², Canopy roof 250m² , total 6550m²
6300 m²

Table 6 Non attenuated flow rate into CCC network l/sec

Return Period	Duration										
	10min	20min	30min	1hr	2hr	6hr	12hr	18hr	24hr	30hr	48hr
5yr	189.0	133.2	108.8	77.0	54.4	31.2	22.0	17.9	15.5	13.3	9.5
10yr	227.7	160.9	130.9	92.7	65.5	37.6	26.5	21.6	18.7	16.0	11.5
20yr	267.8	189.0	154.0	108.8	76.5	44.2	31.2	25.4	22.0	18.8	13.6
50yr	324.1	228.7	186.7	131.8	93.1	53.5	37.8	30.79	26.65	22.8	16.4

Table 8 New hardstand discharging to some sort of storage

Land use	Runoff Coefficient	Area (m²)
Roof	0.9	2271
Pavement	0.9	0
Shingle	0.5	0
Landscape	0.3	0
Site	0.90	2271

Area Calc Check			
Pre development		22713	
Post development attenuated	20442		
Post development not attenuated	2271		
Sum		22713	OK

2270m² is the minimum roof catchment area that can be directed to the tanks to satisfy the attenuation requirements. A greater roof area than this minimum is proposed to be sent to the storage tanks which will have an overflow to be determined during detailed design.

Table 9 Total Flows to Storage l/sec

Return Period	Duration										
	10min	20min	30min	1hr	2hr	6hr	12hr	18hr	24hr	30hr	48hr
5yr	23.3	16.4	13.4	9.5	6.7	3.8	2.7	2.2	1.9	1.6	1.2
10yr	28.0	19.8	16.1	11.4	8.1	4.6	3.3	2.7	2.3	2.0	1.4
20yr	33.0	23.3	19.0	13.4	9.4	5.4	3.8	3.1	2.7	2.3	1.7
50yr	39.9	28.2	23.0	16.2	11.5	6.6	4.6	3.8	3.3	2.8	2.0

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Table 10 Total Volumes Sent to Storage during storm duration m³

Return Period	Duration										
	10min	20min	30min	1hr	2hr	6hr	12hr	18hr	24hr	30hr	48hr
5yr	14.0	19.7	24.1	34.1	48.2	82.9	117.0	143.1	165.3	176.6	203.1
10yr	16.8	23.8	29.0	41.1	58.0	99.9	141.0	172.5	199.2	212.8	245.3
20yr	19.8	27.9	34.1	48.2	67.9	117.5	165.8	202.7	234.0	250.2	288.4
50yr	23.9	33.8	41.4	58.5	82.6	142.3	200.9	245.8	283.5	302.9	349.3

Table 16 Restricted flow rate from the site (for 48hr 1:50 yr event) l/sec

Pree development flow rate from site	27.4	L/sec
Unattenuated discharge from site	26.6	L/sec
Permitted discharge rate from storage	0.7	L/sec

This is the permitted flow rate from the site for the design storm

Permitted flow rate from storage

Table 17 Volume Losses via attenuated flow during a storm event m³

Return Period	Duration										
	10min	20min	30min	1hr	2hr	6hr	12hr	18hr	24hr	30hr	48hr
5yr	0.4	0.9	1.3	2.7	5.3	16.0	32.0	48.0	64.0	80.0	127.9

This is the water lost through restricted outlet for the time of the stor

Table 18 Volume to be Stored m³

Return Period	Duration										
	10min	20min	30min	1hr	2hr	6hr	12hr	18hr	24hr	30hr	48hr
5yr	13.5	18.8	22.8	31.5	42.9	66.9	85.0	95.1	101.3	96.6	75.2
10yr	16.4	22.9	27.7	38.4	52.7	84.0	109.0	124.6	135.2	132.8	117.3
20yr	19.3	27.0	32.8	45.6	62.5	101.5	133.8	154.7	170.0	170.2	160.5
50yr	23.5	32.9	40.1	55.8	77.2	126.3	168.9	197.8	219.6	223.0	221.3

Table 19 Storage Provided m³

Watertanks	No. x size	0	0		0 m³
Basin	l x w x h	0	0	0	0 m³
Rectangular	l x w x h	25	3	3	225 m³
Total					**225** m³

preliminary tank dimensions if a single tank only is considered for attenuation requirements

Minimum 225m³ of site storage is proposed .

Table 20 Events Greater than Storage Capacity m³

Return Period	Duration										
	10min	20min	30min	1hr	2hr	6hr	12hr	18hr	24hr	30hr	48hr
5yr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10yr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20yr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50yr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note re

For design event required storage is satisfied

Powell Fenwick

Project name : Papanui Pak'nSave
Job no. : 171259/C/2
Sketch title : Attenuation Calcs

Date : 26 Apr 2019
Scale : 1:200 @ A3
Drawn : KGB
Sketch : C43