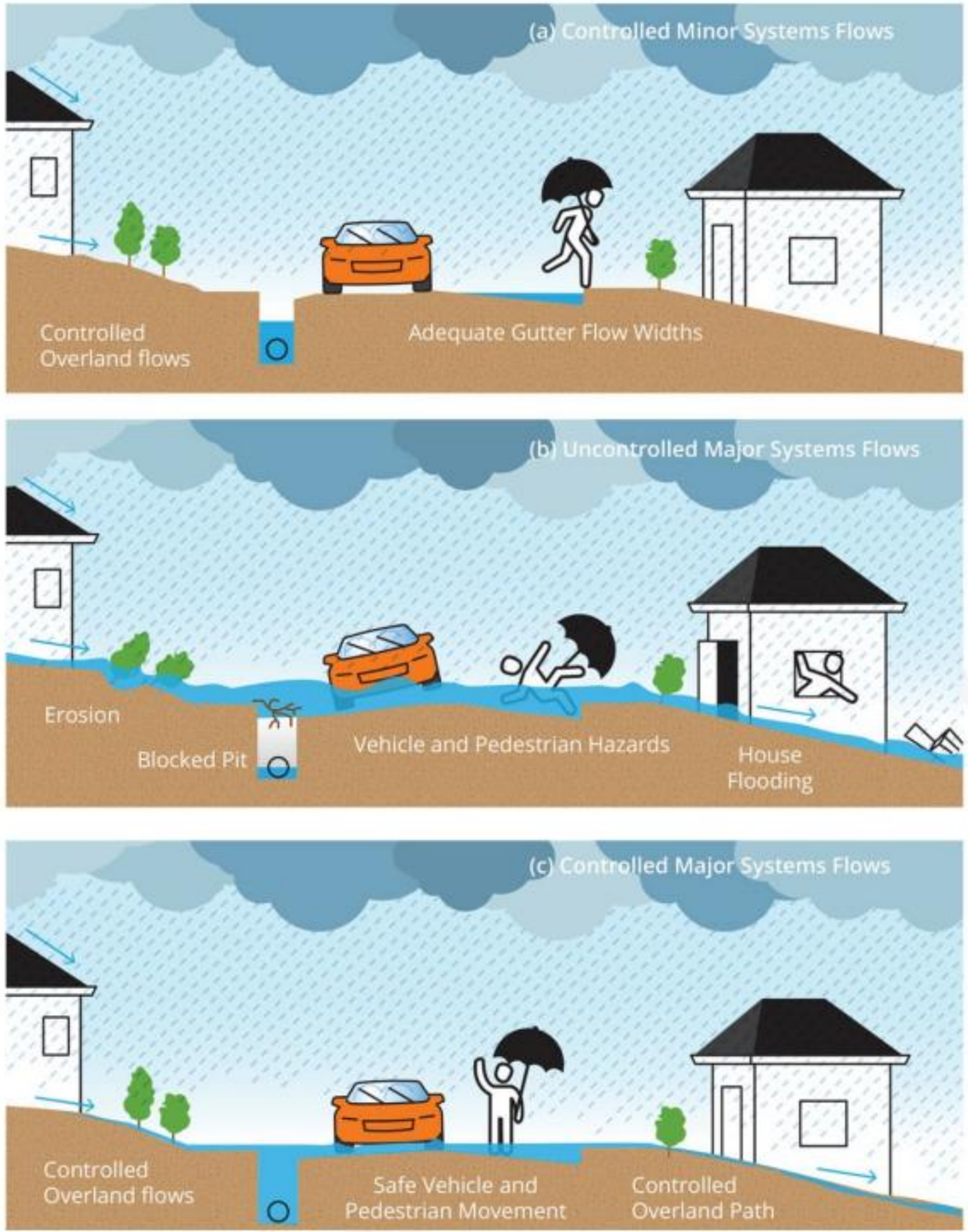
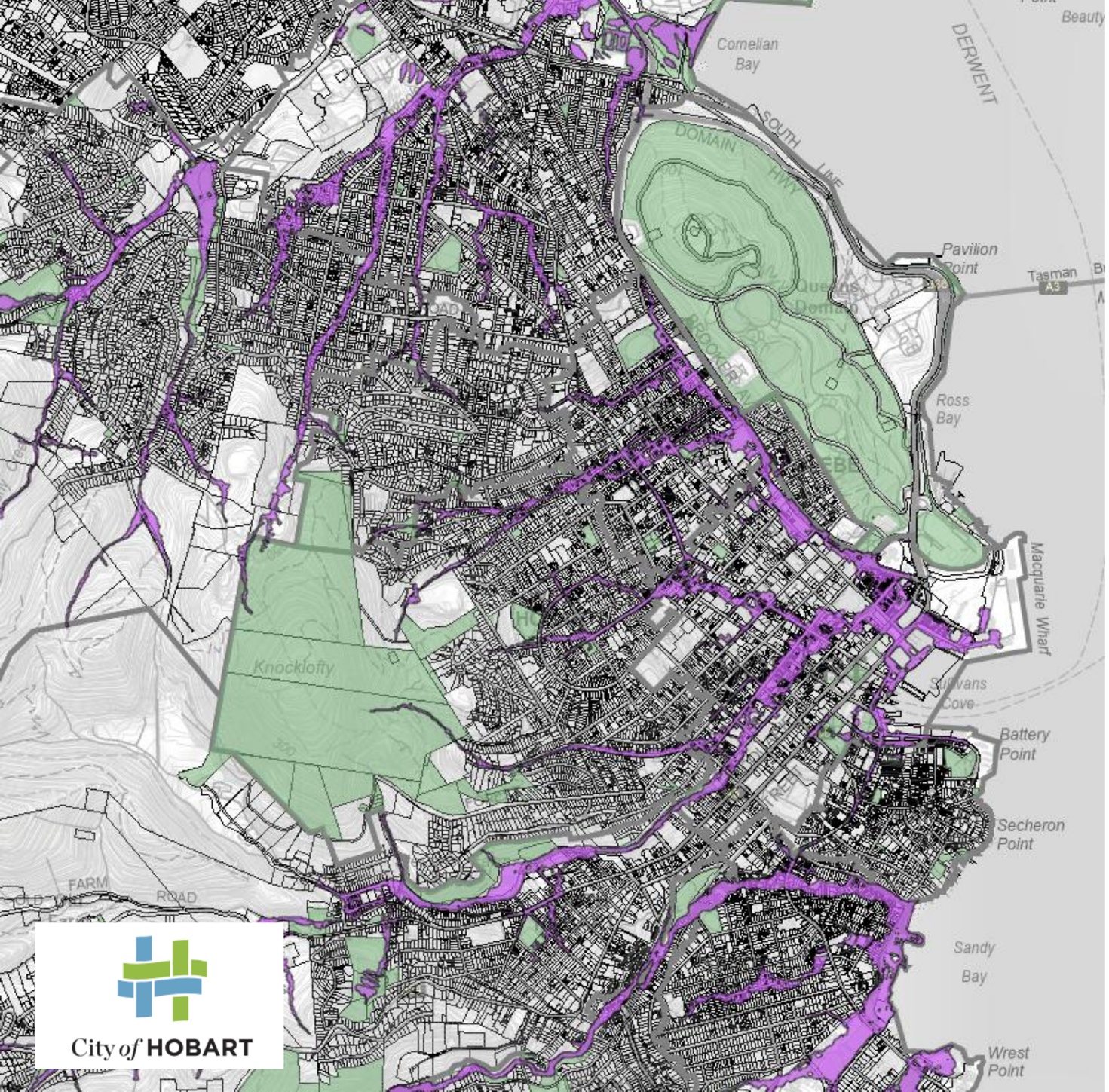
Selecting climate change factors for stormwater and flooding management

City of HOBART

Figure 8 Minor and Major Concepts for Conveyance Networks image from ARR 2019 Chapter 9





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Why are we here?

- New climate change factors
- Consideration of risk and investment

Infrastructure investment

Revaluation summary:

- 33,509 assets
- $499 mil assets + rivulet tunnel currently being valued (~$100 mil)
- 350km piped network
- 15,564 pipes

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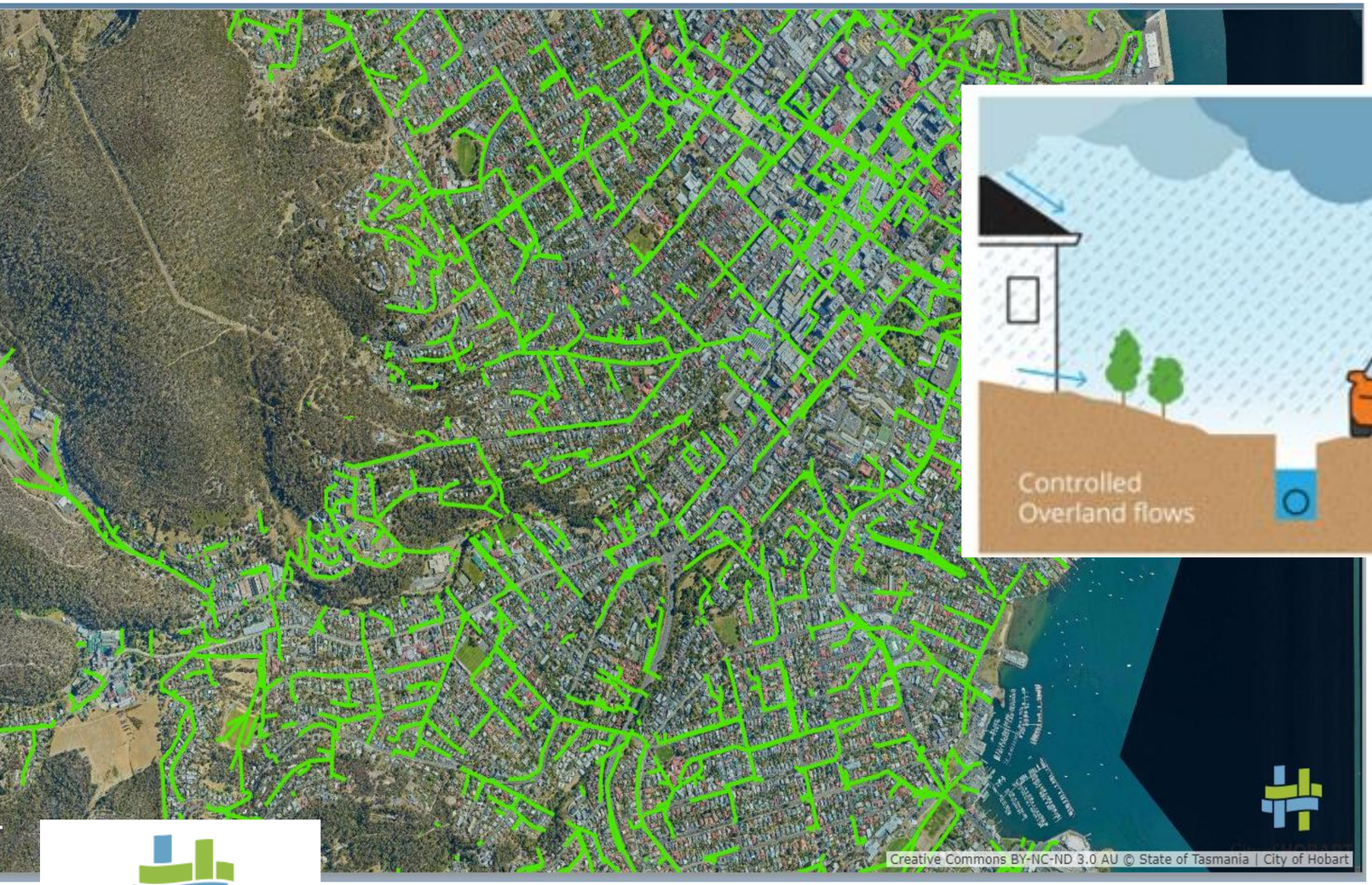
Minor v Major infrastructure and consequences.



1. Minor pipes
2. Trunk mains
3. Overland flow paths
4. Rivulets

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1. Trunk mains
2. Overland flow paths
3. Rivulets

Climate change factors – current (2024)

Uncertainty

	≤ 1 hr
Central (median) estimate (%/°C)	15
'Likely' range (corresponding to ~66%[a] range) (%/°C)	7-28

[a]Consistent with terminology used by the IPCC the 66% range

Climate Change Factors

Rainfall Factors

SSP1-2.6

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.18	1.17	1.16	1.14	1.13	1.12	1.12	1.11	1.1	1.1
2040	1.21	1.19	1.17	1.16	1.15	1.14	1.13	1.12	1.11	1.11
2050	1.22	1.2	1.18	1.17	1.15	1.15	1.14	1.13	1.12	1.11
2060	1.23	1.21	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2070	1.24	1.22	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2080	1.23	1.21	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2090	1.23	1.21	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2100	1.22	1.2	1.19	1.17	1.16	1.15	1.14	1.13	1.12	1.12

SSP2-4.5

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.18	1.17	1.16	1.14	1.13	1.12	1.12	1.11	1.1	1.1
2040	1.22	1.2	1.19	1.17	1.16	1.15	1.14	1.13	1.12	1.12
2050	1.27	1.24	1.23	1.21	1.19	1.18	1.17	1.16	1.15	1.14
2060	1.3	1.27	1.25	1.23	1.21	1.2	1.19	1.18	1.16	1.16
2070	1.33	1.3	1.28	1.26	1.24	1.22	1.21	1.19	1.18	1.17
2080	1.37	1.33	1.31	1.28	1.26	1.24	1.22	1.21	1.2	1.19
2090	1.4	1.36	1.34	1.31	1.28	1.26	1.24	1.23	1.21	1.2
2100	1.41	1.37	1.35	1.32	1.29	1.27	1.25	1.24	1.22	1.21

SSP3-7.0

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.18	1.17	1.16	1.14	1.13	1.12	1.12	1.11	1.1	1.1
2040	1.23	1.21	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2050	1.29	1.26	1.24	1.22	1.2	1.19	1.18	1.17	1.16	1.15
2060	1.35	1.32	1.3	1.27	1.25	1.23	1.22	1.2	1.19	1.18
2070	1.42	1.38	1.35	1.32	1.29	1.28	1.26	1.24	1.22	1.21
2080	1.5	1.45	1.42	1.38	1.35	1.33	1.3	1.28	1.26	1.25
2090	1.59	1.53	1.49	1.44	1.4	1.38	1.35	1.33	1.3	1.29
2100	1.66	1.59	1.55	1.5	1.45	1.42	1.39	1.37	1.34	1.32

SSP5-8.5

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.2	1.18	1.17	1.16	1.14	1.13	1.13	1.12	1.11	1.11
2040	1.26	1.24	1.22	1.2	1.18	1.17	1.16	1.15	1.14	1.14
2050	1.34	1.31	1.29	1.26	1.24	1.23	1.21	1.2	1.18	1.18
2060	1.42	1.38	1.35	1.32	1.29	1.28	1.26	1.24	1.22	1.21
2070	1.52	1.47	1.43	1.4	1.36	1.34	1.31	1.29	1.27	1.26
2080	1.63	1.57	1.52	1.48	1.43	1.4	1.37	1.35	1.33	1.31
2090	1.77	1.69	1.64	1.58	1.52	1.49	1.45	1.42	1.39	1.37
2100	1.86	1.77	1.71	1.64	1.58	1.54	1.5	1.47	1.43	1.41

WMA water https://ccc.wmawater.com.au/

Home | WMA Climate Change Calculator

A historical 1.0% AEP event (BOM 2016 IFD) is equivalent to a 1 in X AEP event in the future

	SSP1	SSP2	SSP3	SSP5
2024	52.6	52.6	52.6	52.6
2030	49.1	48.5	48.3	46.0
2050	41.5	36.0	32.7	28.4
2090	40.5	23.9	15.2	10.9
Mean over design life	42.1	32.3	25.6	20.5

A historical 1.0% AEP (BoM 2016 IFD) will become more likely in the future depending on the climate change SSP. The table shows what the new probability of the 1 in 100 AEP will be (1 in X AEP where X is the number in the table).

Urban Drainage Act 2013

4. Objects of Act

The objects of this Act are –

(a) to protect people and property by ensuring that stormwater services, infrastructure and planning are provided so as to minimise the risk of urban flooding due to stormwater flows; and

(b) to provide for the safe, environmentally responsible, efficient and sustainable provision of stormwater services in accordance with the objectives of the resource management and planning system of Tasmania as set out in Schedule 1 .

Risk Management Framework

What is an acceptable level of risk to community??

Risk Categories	Consequence Scale				
	Insignificant Issue that is managed as part of Business as Usual.	**Minor** An event, the consequence of which can be absorbed but management effort is required to minimise the impact. Localised impact for a Group or Network	**Moderate** A significant event, which can be managed under normal circumstances. Impact requiring Executive oversight and Director-level action	**Major** A critical event. Impact requiring ELT management and oversight and notification to Council	**Catastrophic** A disaster. Long-term or widespread impact requiring ELT and Council time and effort over multiple months and deviation from strategic plan
Customer and Community The impact on the City's customers including ratepayer and its communities.	Insignificant impact on customers and the community. Essential communication systems unavailable for up to 2 hours. Decline of economic activity and/or loss of asset value <0.004% of gross area product (~<$350,000).	Affected community can continue to function without unreasonable impact. Essential communication systems unavailable for 4 hours. Decline of economic activity and/or loss of asset value >0.004% of gross area product (~>$350,000).	Standard community function likely to be affected. Costs may be incurred by individuals and businesses whilst services are reinstated. Inability to resume essential communication systems for 1-2 days. Decline of economic activity and/or loss of asset value >0.04% of gross area product (~>$3.5 mil).	Standard community function will to be affected. Significant costs may be incurred by individuals and businesses whilst services are reinstated. Essential communication systems unavailable for 2-5 days. Decline of economic activity and/or loss of asset value >0.4% of gross area product (~>$35 mil).	Significant and ongoing impact to community function. Significant community costs incurred. Essential communication systems unavailable for more than 5 days. Decline of economic activity and/or loss of asset value >4% of gross area product (~>$350 mil).

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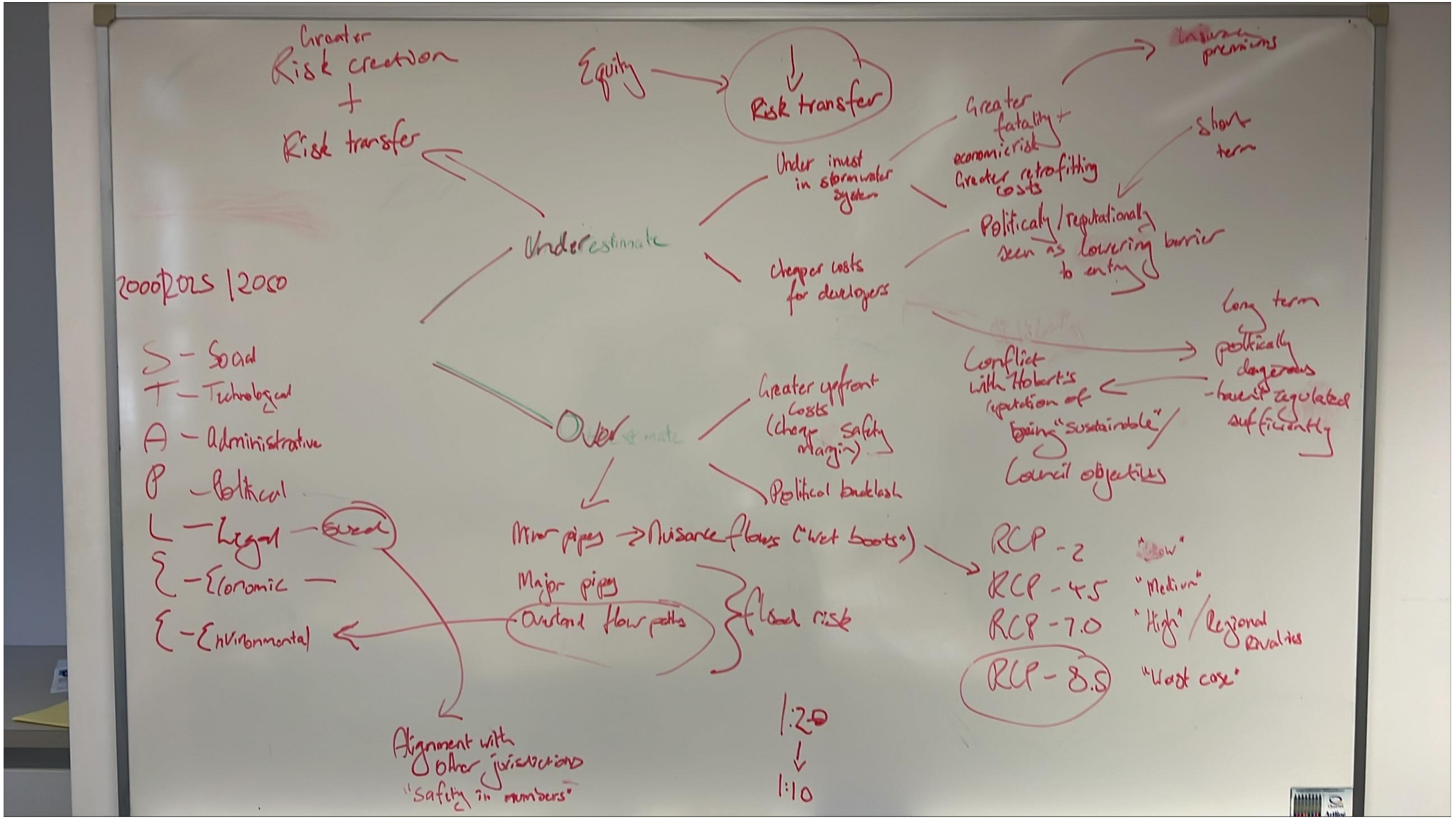
Risk based approach - process



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Minor pipes

Primary parties: Developers and Councils

Possible risks:
- More frequent nuisance flooding
- Increased cost – short vs long term
- Under/over investment in capacity
- Legal action taken against Council
- Reputational damage

Recommended climate change scenario: SSP1-2.6

Risk matrix settings

Consequence							
	5	*Catastrophic*	M 5	H 10	H 15	E 20	E 25
	4	*Major*	M 4	M 8	H 12	H 16	E 20
	3	*Moderate*	L 3	M 6	M 9	H 12	H 15
	2	*Minor*	L 2	M 4	M 6	M 8	H 10
	1	*Insignificant*	L 1	L 2	L 3	M 4	M 5
			Rare	*Unlikely*	*Possible*	*Likely*	*Almost Certain*
			1	2	3	4	5
			Likelihood				

SSP3-7.0

SSP2-4.5

SSP1-2.6

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Trunk mains

Primary parties: Council

Possible risks:
- More frequent flooding – injury; property damage
- Increased cost – short vs long term
- Under/over investment in capacity
- Legal action taken against Council
- Reputational damage

Recommended climate change scenario: SSP3-7.0

Risk matrix settings

Consequence							
	5	*Catastrophic*	M 5	H 10	H 15	E 20	E 25
	4	*Major*	M 4	M 8	H 12	H 16	E 20
	3	*Moderate*	L 3	M 6	M 9	H 12	H 15
	2	*Minor*	L 2	M 4	M 6	M 8	H 10
	1	*Insignificant*	L 1	L 2	L 3	M 4	M 5
			Rare	*Unlikely*	*Possible*	*Likely*	*Almost Certain*
			1	2	3	4	5
			Likelihood				

SSP2-4.5

SSP3-7.0

SSP1-2.6

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Overland flow paths

Affected parties: Developers, residents, Council

Possible risks:
- More frequent flooding
- Increased cost – short vs long term
- Under/over investment in capacity
- Legal action taken against Council – constricted development
- Reputational damage

Recommended climate change scenario: SSP3-7.0

Risk matrix settings

Consequence							
	5	*Catastrophic*	M 5	H 10	H 15	E 20	E 25
	4	*Major*	M 4	M 8	H 12	H 16	E 20
	3	*Moderate*	L 3	M 6	M 9	H 12	H 15
	2	*Minor*	L 2	M 4	M 6	M 8	H 10
	1	*Insignificant*	L 1	L 2	L 3	M 4	M 5
			Rare	*Unlikely*	*Possible*	*Likely*	*Almost Certain*
			1	2	3	4	5
			Likelihood				

SSP1-2.6

SSP2-4.5

SSP3-7.0

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Rivulets

Primary parties: Residents and Council

Possible risks:
- More frequent flooding
- Increased cost – short vs long term
- Under/over investment in capacity
- Liability
- Community – death, injury and property damage
- Reputational damage

Recommended climate change scenario: SSP3-7.0

Risk matrix settings

Consequence							
	5	*Catastrophic*	M 5	H 10	H 15	E 20	E 25
	4	*Major*	M 4	M 8	H 12	H 16	E 20
	3	*Moderate*	L 3	M 6	M 9	H 12	H 15
	2	*Minor*	L 2	M 4	M 6	M 8	H 10
	1	*Insignificant*	L 1	L 2	L 3	M 4	M 5
			Rare	*Unlikely*	*Possible*	*Likely*	*Almost Certain*
			1	2	3	4	5
			Likelihood				

SSP2-4.5

SSP1-2.6

SSP3-7.0

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Recommendations

1. Endorse that Council undertakes work to formalise Councils approach to management of overland flow paths in private property.

2. Adopt SSP1-2.6 with 5% AEP events as an interim climate change factor for the management of minor pipes.

3. Adopt SSP3-7.0 with a 1% AEP as an interim climate change factor for the management and mapping of overland flow paths.

4. Adopt SSP3-7.0 with a 1% AEP as an interim climate change factor for trunk main management and modelling.

5. Adopt SSP3-7.0 with a 1% AEP as an interim climate change factor for the management of Rivulets

6. Endorse a project funded through the current Integrated Hazard Vulnerability Assessment project to investigate:

- Financial impact of adopting different climate factors to Council
- Risk and liability impact to council of adopting different climate factors to Council and to the community
- Community engagement to assist in determining acceptable or expected levels of service and risk tolerance
- Development of a flood related risk statement or level of service guidelines to support consistent decision making and investment.

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Next steps

Disaster Ready Fund Project – economic pathways analysis – understand level of future investment required to meet expected service levels

Community education and risk tolerance

Survey Questions:	Proportion of respondents considering acceptable the described flood scenario:				
	Never acceptable	up to 1% AEP	up to the 2% AEP	up to the 5% AEP	up to the 10% AEP
13. How often would you consider acceptable to have shallow floodwaters in your yard or driveway?	42%	58%	26%	17%	13%
14. How often would you consider acceptable to have ankle-deep floodwaters inside your home or business building?	74%	23%	7%	3%	1%
15. How often would you consider acceptable to have floodwaters up to the ceiling of the ground floor of your home or business building?	94%	6%	1%	0%	0%
16. How often would you consider acceptable to have a flood that could pose a threat to the stability of your house or business building?	89%	11%	3%	1%	0%
17. How often would you consider acceptable to have a flood that could cut-off access to hospitals, aged care or schools for several hours?	63%	37%	16%	13%	11%
18. How often would you consider acceptable to have floodwaters enter buildings such as hospitals, aged care or schools?	81%	19%	5%	3%	3%