greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

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Committee	Hutt Valley Flood Management Subcommittee
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Waiwhetu Stream Floodplain Management Plan

1. Purpose

To update the Subcommittee on the development of a Floodplain Management Plan (FMP) for the Waiwhetu Stream.

To highlight community involvement through the Friends of Waiwhetu Stream (FoWS) in this process

2. The decision-making process and significance

No decision is being sought in this report.

This report is intended to inform the Subcommittee on the progress of development of a floodplain management plan for the Waiwhetu Stream.

3. Background

In the 19 March 2013 meeting, the Subcommittee was informed of the development and investigation of four flood plain management option combinations for the Waiwhetu Stream. This report provides an abridged summary of the option combination investigations.

3.1 Option Combinations

In earlier stages of the development of the floodplain management plan, nine option combinations were developed and assessed based on their perceived impacts. From these nine option combinations, four were taken forward for further technical investigation, including implementation cost and damages prevented benefit ratio. The option combinations being 2, 6, 7, and 8.

3.1.1 Existing flood risk

The current flood extent for the 1%AEP/ 1-in-100 year return period flood event is illustrated by the plan shown in Fig.1 in the attachment to this report. A total of 73 floor levels of homes are predicted to be flooded during a flood event of this magnitude.

The two key areas where houses are flooded are circled in red, on the existing flood risk map shown in Figure 1 in the attachment to this report.

3.1.2 Option combination 2

This combination primarily uses non-structural approaches to manage flood risk in the Waiwhetu catchment. The combination allows extensive nuisance flooding on public and private property to remain, while targeting the protection of building floor levels to a 1% AEP/1-in-100 year return period flood event level where simple and practical solutions exist. It recognises the high flood risk in the lower catchment (Riverside Drive South) and uses Council-led managed retreat as a mechanism to change existing land use to be more compatible with the flood risk.

The combination also includes provision for minor structural upgrades to bridges and in stream works to address known hydraulic constraints.

The modelled flood improvement benefit is illustrated in Figure 2 in the attachment to this report. In this option combination scenario the number of flooded floor levels in the 1-in-100 year return period flood event is reduced from 73 to 12.

3.1.3 Assumed Benefits Assessment

This option combination was assessed as having the following benefits during earlier stages of investigation;

Flood Protection Benefit	Moderate
Implementation Cost Benefit	Moderate
Maintenance Cost Benefit	Good
Sustainability	Good
Environmental Benefit	Good
Amenity Benefit	Good
Community Acceptance	Moderate

3.1.4 Option combination 6

This combination largely relies on the current management techniques employed within the catchment to manage flood risk. It contains some optimising modifications to the existing measures to protect private building floor levels from inundation in a 2% AEP flood. It includes provision for minor structural upgrades to bridges and in stream works to address known hydraulic constraints.

The option combination also includes investment in Civil Defence and Emergency Management (CDEM) to provide a more effective warning and evacuation system and the implementation of planning controls to help ensure development is carried out in a way compatible with the residual flood risk.

The modelled flood improvement benefit is illustrated in Figure 3 in the attachment to this report. In this option combination scenario the number of flooded floor levels for the 1-in-100 year return period flood event is reduced from 73 to 18.

3.1.5 Assumed Benefits Assessment

This option combination was assessed as having the following benefits during earlier stages of investigation;

Flood Protection Benefit	Bad
Implementation Cost Benefit	Good
Maintenance Cost Benefit	Good
Sustainability	Good
Environmental Benefit	Good
Amenity Benefit	Moderate
Community Acceptance	Bad

3.1.6 Option combination 7

The development of this combination was strongly influenced by community consultation. The combination includes targeted structural flood defence, bridge and channel upgrades to provide close to a 2% AEP channel capacity and protect habitable floor levels from the 1% AEP flood.

The modelled flood improvement benefit is illustrated in Figure 4 in the attachment to this report. In this option combination scenario the number of flooded floor levels in a modelled 1-in-100 year flood event is reduced from 73 to 12.

3.1.7 Assumed Benefits Assessment

Flood Protection Benefit	Moderate
Implementation Cost Benefit	Moderate
Maintenance Cost Benefit	Moderate
Sustainability	Moderate
Environmental Benefit	Moderate
Amenity Benefit	Moderate
Community Acceptance	Moderate

3.1.8 Option combination 8

This combination uses extensive channel modification, structural flood defences and bridge replacements to protect private land from inundation in up to a 1% AEP flood. It also uses partial detention storage in the middle and upper catchment.

The modelled flood improvement benefit is illustrated in Figure 5 below. In this option combination scenario the number of flooded floor levels in the modelled 1-in-100 year return period flood event is reduced from 73 to 8.

3.1.9 Assumed Benefits Assessment

Flood Protection Benefit	Good
Implementation Cost Benefit	Bad
Maintenance Cost Benefit	Bad
Sustainability	Bad
Environmental Benefit	Moderate
Amenity Benefit	Moderate
Community Acceptance	Moderate

3.2 Cost Benefit assessment of option combinations

The technical assessment which produced the predicted flood spreads, shown in Figures 1 to 5 included as an attachment to this report, developed as a result of modelling of the option combinations. This analysis highlighted a poor cost benefit ratio for all option combinations, and highlighted some additional channel breaches which would occur in those option combinations which made use of stopbanks or floodwalls. The investigation work identified approaches which provided efficient flood management, and highlighted those which were of high cost but little benefit.

The flood management option combinations which apply to the middle and upper catchment areas are at a stage where a preferred option combination could be recommended, however a preferred option combination in the lower catchment area continues to be difficult to identify.

The cost benefit ratios are summarised in the following table;

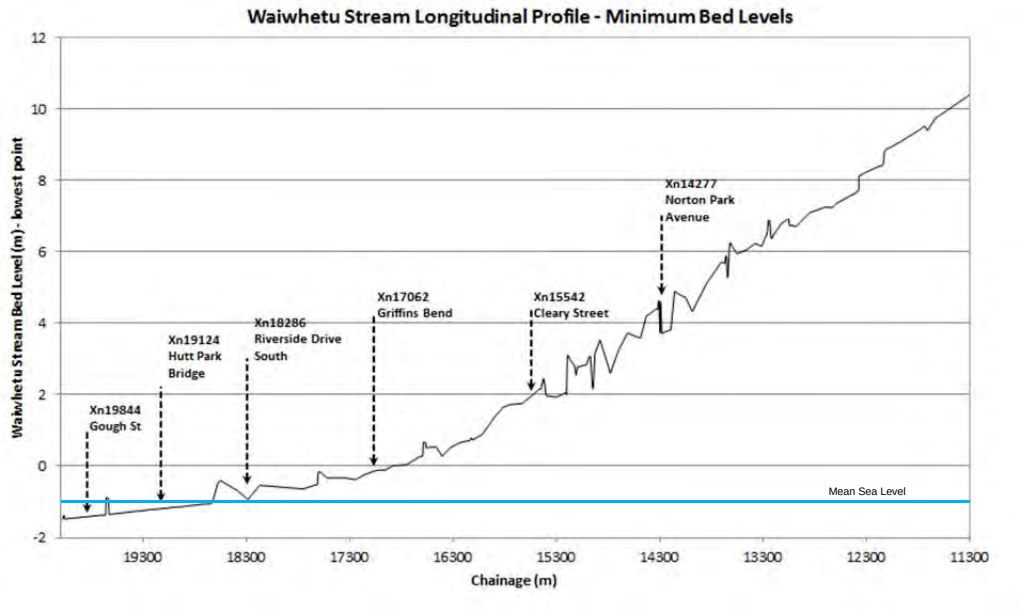
Event	Existing Catchment	Option 2	Option 6	Option 7	Option 8
Average Annual Damages	$0.45m	$0.28m	$0.44m	$0.29m	$0.16m
NPV Of Direct Damages	$5.5m	$3.5m	$5.4m	$3.6m	$2.0m
Benefit In Reduced Direct Damages	-	$2.0m	$0.1m	$1.9m	$3.5m
Total Cost Of Option	-	$40.6m	$14.6m	$23.4m	$45.2m
Benefit / Cost Ratio	-	0.05	0.00	0.08	0.08

These cost benefit ratios are driven by the low incidence of flooding during more frequent flood events. Present levels of protection are equivalent to a 1-in-40 year return period flood event.

3.3 Lower Catchment Issues

In the lower catchment, particularly the areas adjacent to the tidal reach of the Waiwhetu stream, it is a difficult to manage flood risk, which over time is predicted to get worse. Much of the flooding issue downstream of Whites Line East is related to the low ground levels and tidal impacts. A simple interpretation of these levels means that further increases in channel capacity will provide little benefit to flood protection levels. The result of this is that option selection is pushed in the direction of managed retreat, house raising or stopbanks/floodwalls.

This effect is best illustrated by the graph below which shows the minimum bed level of the Waiwhetu stream over-plotted with the mean sea level as a solid blue line. Locations have been included for reference.



3.4 Refinement of the option combinations

Scoping work to refine the four option combinations is underway and any identified work will commence in the next financial year. Some details regarding key issues with the option combinations are discussed below.

3.4.1 Friends of Waiwhetu Stream refinement of option combination 7

Following technical investigation of the option combinations a workshop was held with the Friends of Waiwhetu Stream regarding refinement of the community led option combination 7. This discussed strengths and weaknesses of that option combination and will lead into a refined version. This workshop modified some of the approaches taken based on further community feedback. Work for this is currently being scoped.

3.4.2 Refinement of option combination 2

Option combination 2, which investigates feasibility of managed retreat, provides improved long term benefits but will have high short term impacts on localised parts of the community in the areas targeted by this approach. The community has expressed some interest in this approach but is very nervous of the impacts of this at an individual level.

A significant amount of additional work will be required to develop managed retreat approaches for the Waiwhetu stream. This will have future cost and time implications if this option combination is pursued.

3.4.3 Option Combination 6

Option combination 6 does not meet the objectives of the plan development, and would require acceptance of a lower level of flood protection by the community. Further development of this option combination may provide a

cheaper short term benefit, however this would result in an earlier future work burden. The community has expressed an interest in this combination due to lower cost, even though it does not meet the project objectives agreed with them.

3.4.4 Option Combination 8

Option combination 8 provides a high standard of protection, however, this also comes at significant cost. While this option is technically feasible it has issues dealing with climate change impacts, and creation of residual risk. The community understand the flood protection benefits of this option combination, however there are concerns around the environmental and social impacts of the required works.

3.4.5 Climate Change Impacts

In addition to assessment of the option combinations against the current flood risk, climate change scenarios were run to identify resilience of the option combinations. These climate change scenarios modelled the 1%AEP/1-in-100 year return period flood event, and the 0.5%AEP/1-in-100 year return period flood event. The results of this modelling in terms of flooded floor levels is shown in table 1 below.

Flood Event	Existing	Option 2	Option 6	Option 7	Option 8
1% AEP/ 100 year return period flood current flood risk	73	12	18	12	8
1% AEP/ 100 year return period flood with climate change impacts	84	35	55	50	43
0.5% AEP/ 200 year return period flood with climate change impacts	121	46	72	65	62

This table highlights the resilience of option 2 over time, which focuses on managed retreat from high flood risk areas. This contrasts starkly with options 6, 7, and 8 which lose almost all benefit when assessed against the same criteria.

3.4.6 Combined Natural Hazards

In addition to the flood hazards affecting the lower Waiwhetu catchment the area is identified as an area of high risk for combined earthquake hazards which includes consideration of tsunami, ground shaking, liquefaction, faulting and ground damage. A copy of the combined hazard maps for the Hutt Valley are included as an attachment to this report.

4. Maintenance and Operations

4.1 Weed management contract renewal

GWRC plans to renew the contract for weed management within the channel of the Waiwhetu Stream. The ongoing management has been able to make use of the available budget focus more on the control of Willow weed due to the

efforts of the Friends of Waiwhetu Stream to eradicate Cape Pond Weed from the stream.

4.2 Friends of Waiwhetu Stream

The Friends of Waiwhetu Stream have developed a weed eradication programme targeting cape pond weed. This programme has been successful at eradicating cape pond weed from 3/4 of the length of the stream.

A monthly meeting schedule has been established between GWRC, HCC officers and the Friends of Waiwhetu stream to assist with identifying overlaps and co-ordinate work programmes.

5. Communication

A workshop with the Friends of Waiwhetu Stream to further develop option combination 7 was held on the 2nd of May 2013.

An update will be circulated to the community upon completion of scoping work to identify the next step in investigation work.

6. Recommendations

That the subcommittee:

1. ***Receives** the report.*
2. ***Notes** the content of the report.*
3. ***Endorses** the continued investigation of the managed retreat option within combinations 2 and 7.*

Report prepared by:	Report approved by:	Report approved by:	Report approved by:
Alistair J N Allan	Mark Hooker	Graeme Campbell	Wayne O'Donnell
Senior Projects Engineer	Team Leader, Investigations, Strategy and Planning	Manager Flood Protection	General Manager Catchment Management

Attachments:

1. Waiwhetu Stream Modelled Flood Extents;
   - Existing flood risk – 1-in-100 year return period flood event
   - Option Combination 2 – 1-in-100 year return period flood event
   - Option Combination 6 – 1-in-100 year return period flood event
   - Option Combination 7 – 1-in-100 year return period flood event
   - Option Combination 8 – 1-in-100 year return period flood event

2. Seismic Hazard Map for Hutt Valley – WGN#1219019

Fig 1 - Existing flood risk – 1-in-100 year return period flood event

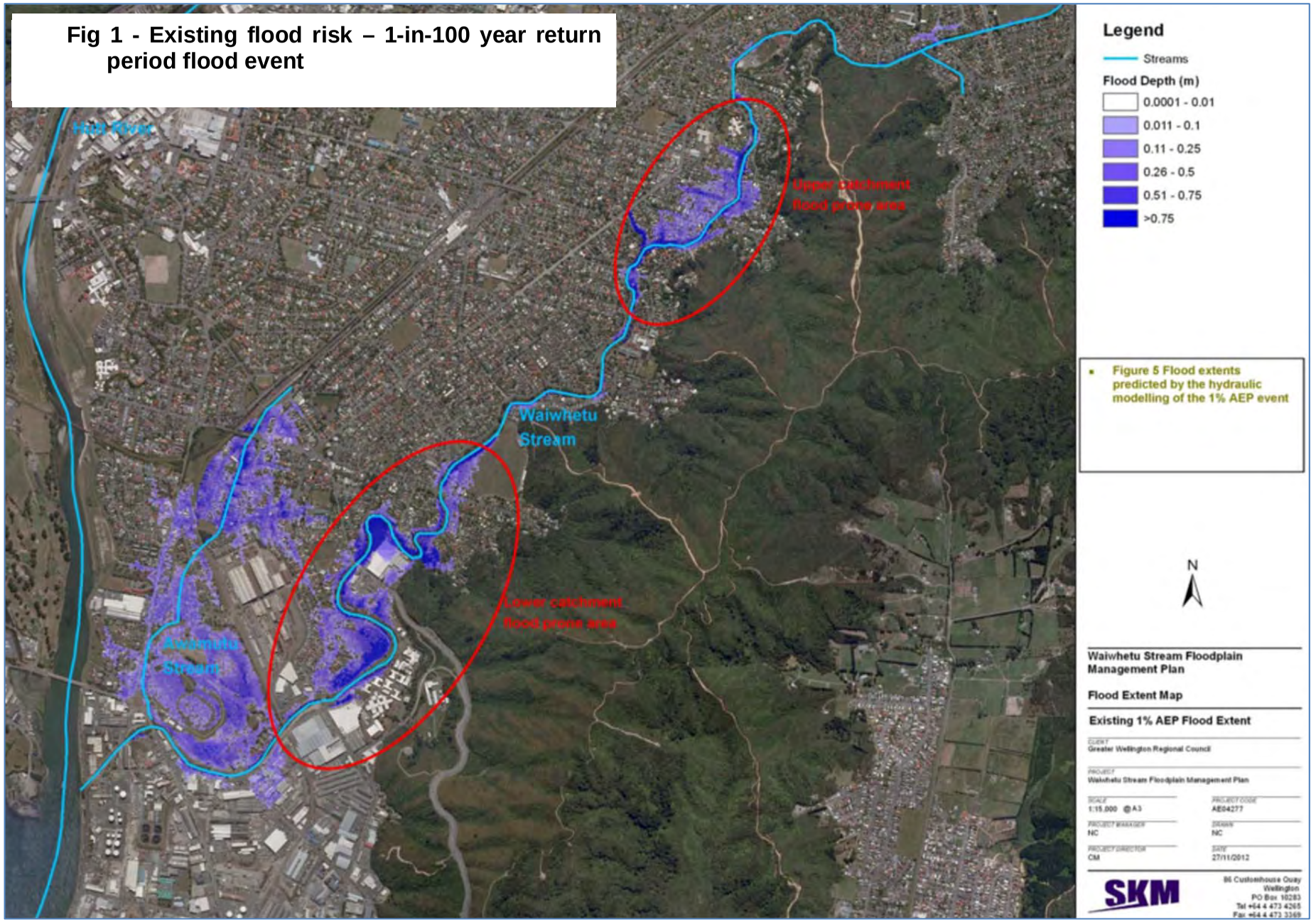


Fig 2 - Option Combination 2 – 1-in-100 year return period flood event

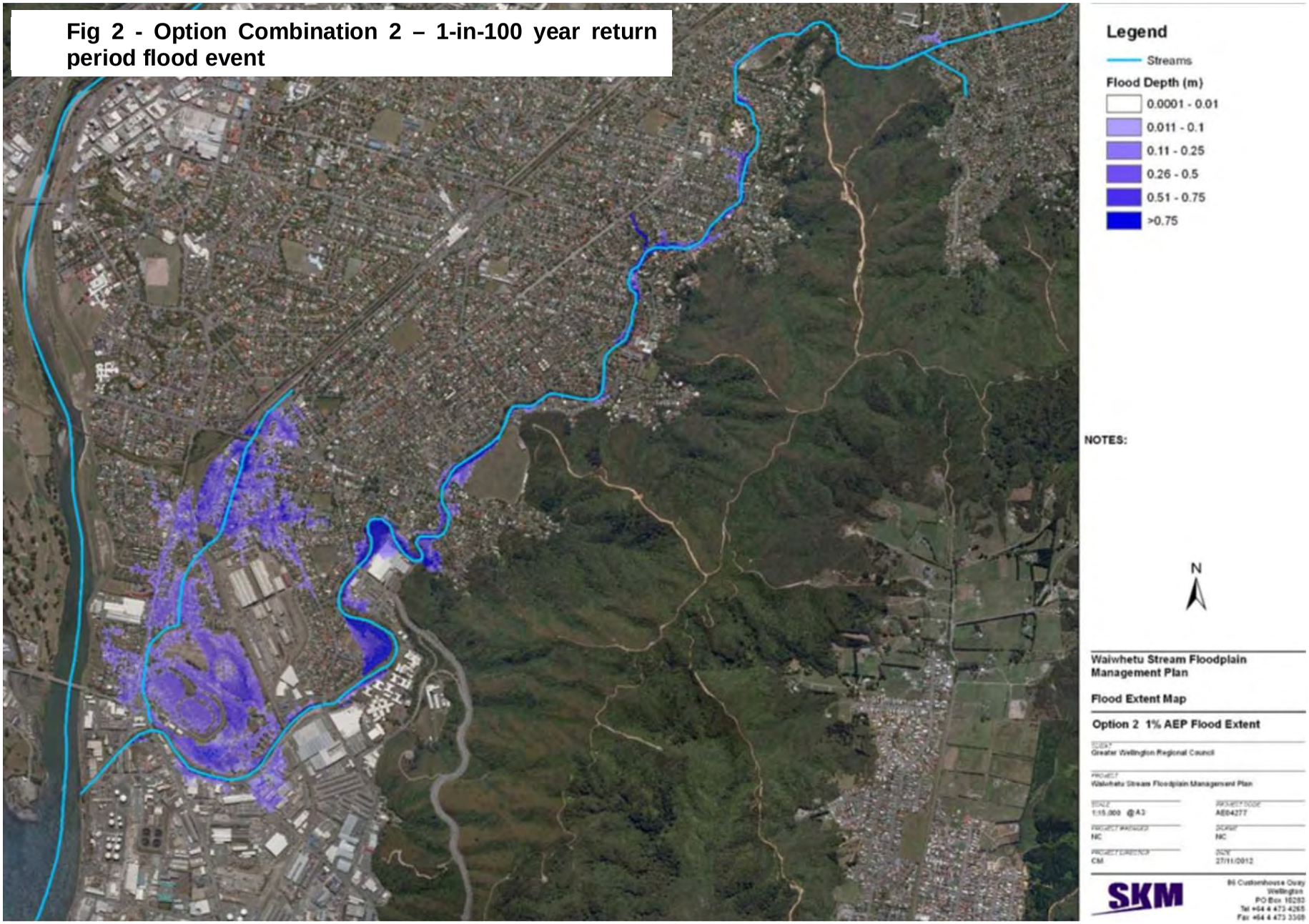


Fig 3 - Option Combination 6 – 1-in-100 year return period flood event

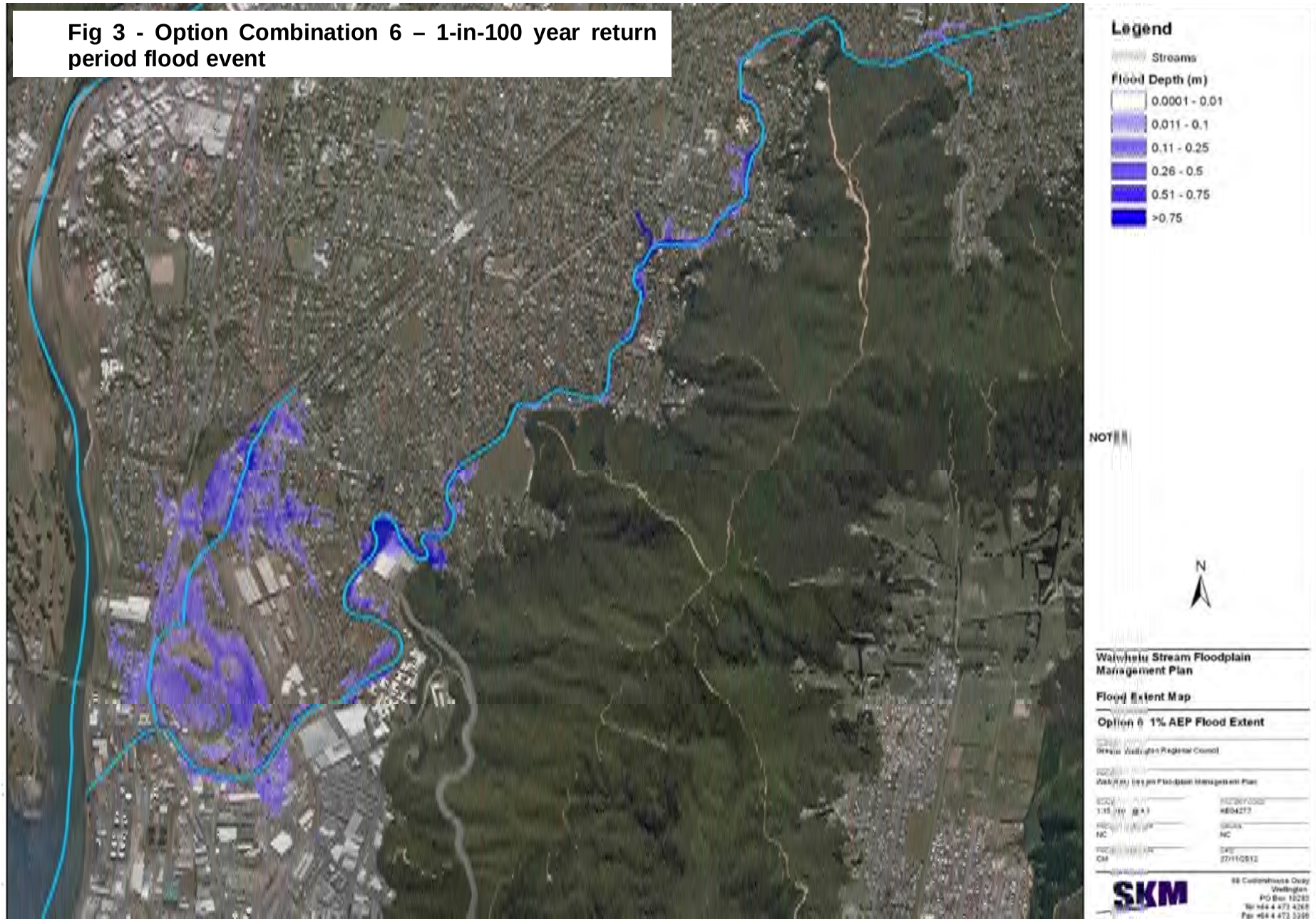


Fig 4 - Option Combination 7 – 1-in-100 year return period flood event

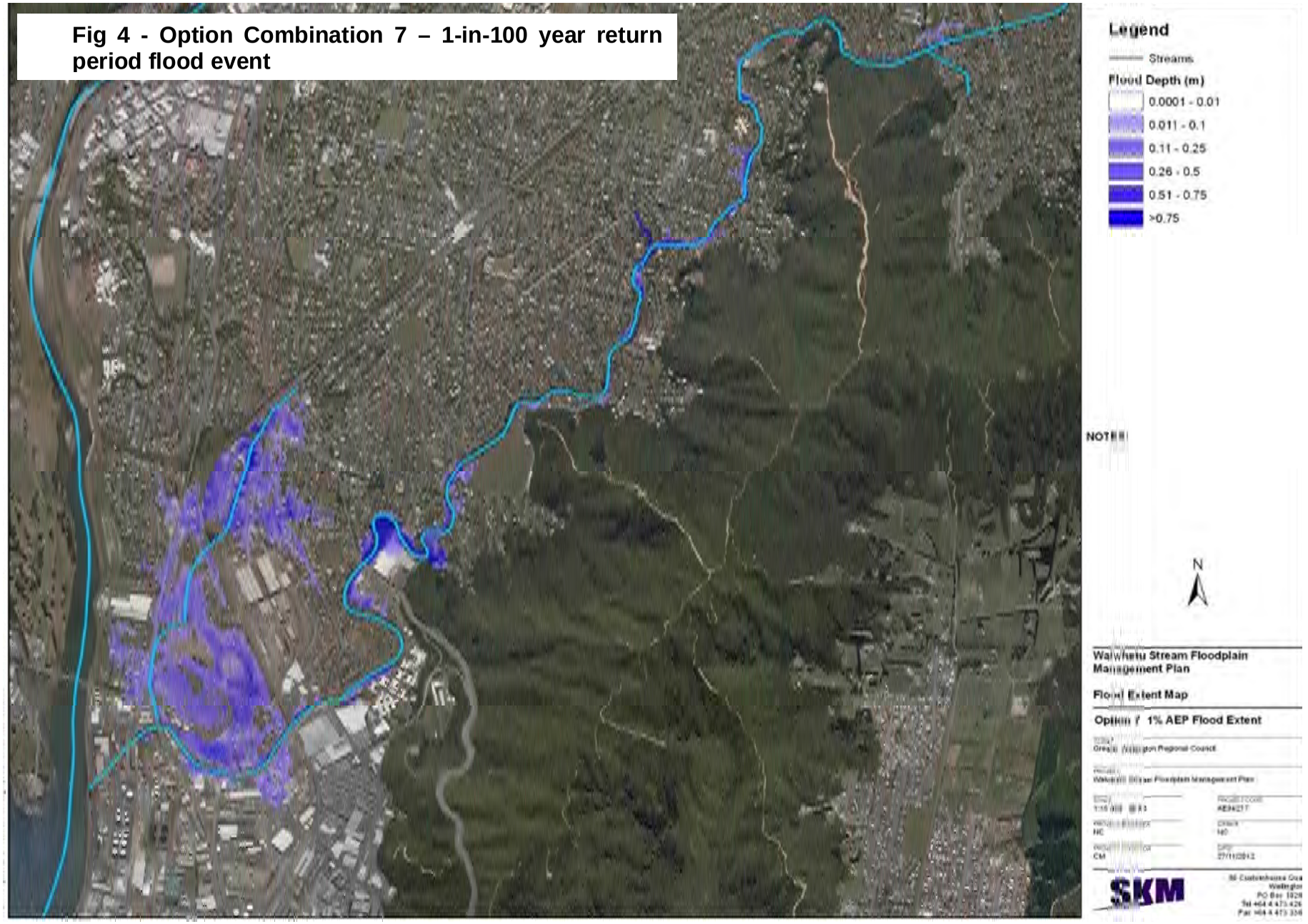
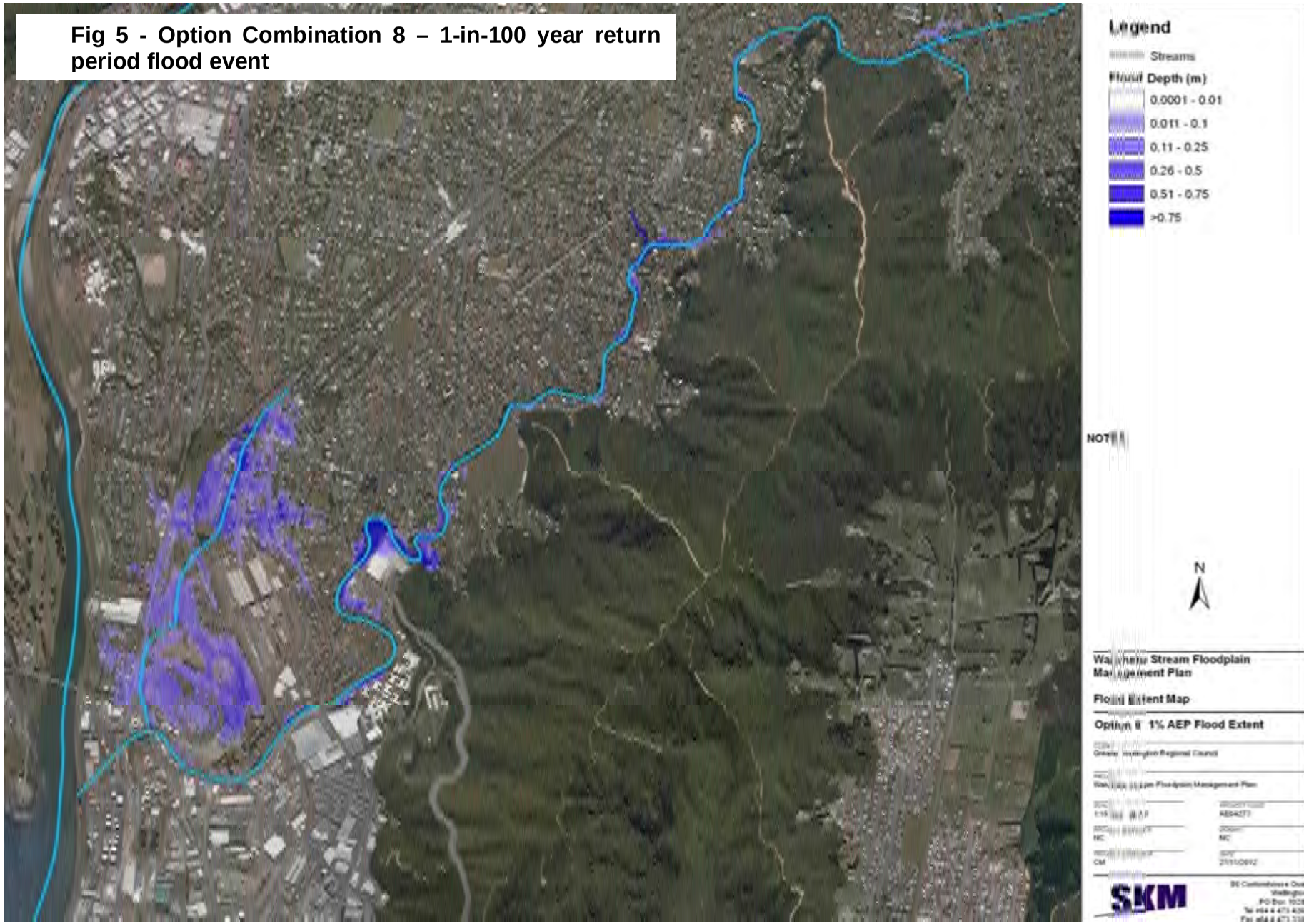
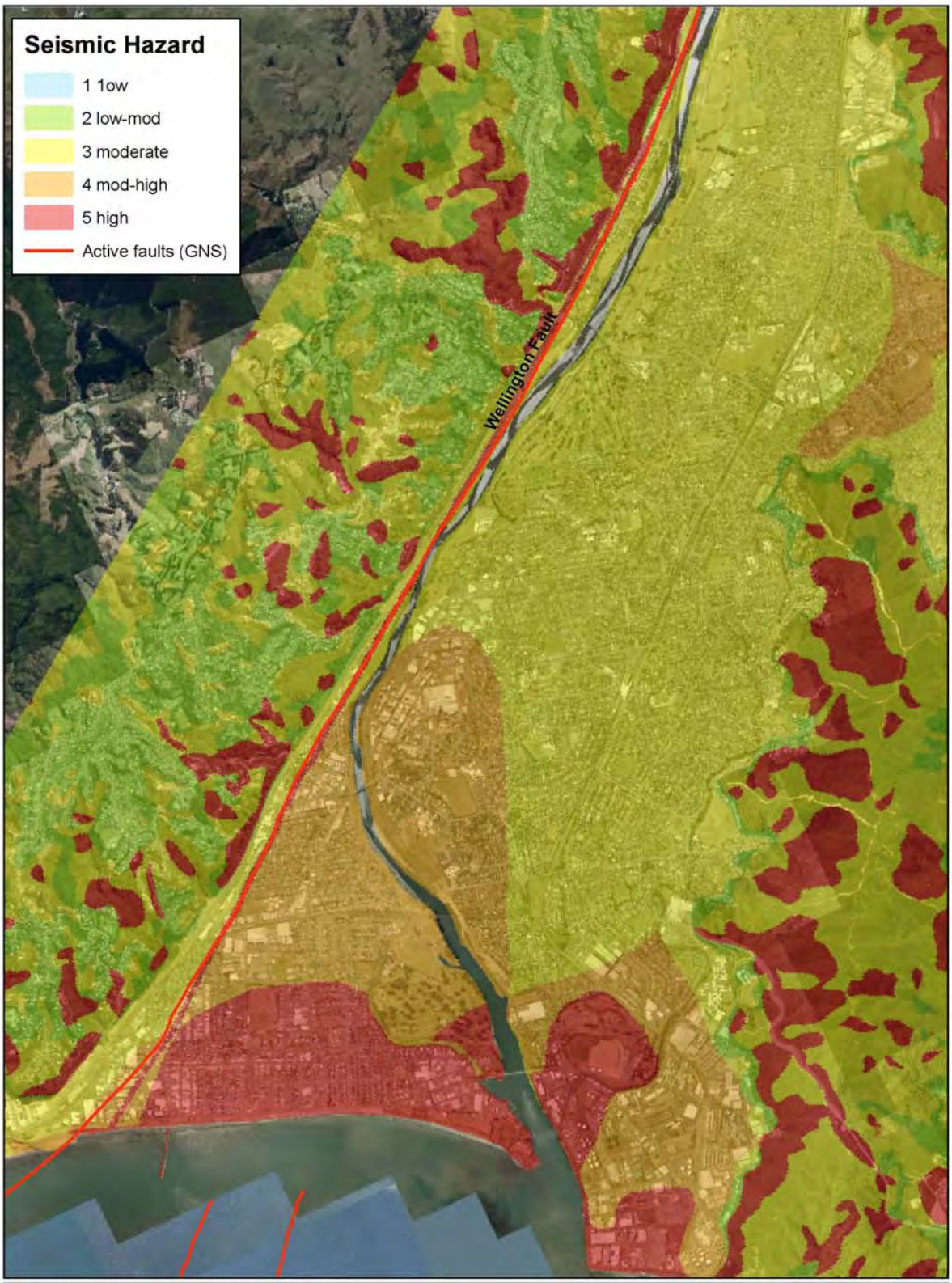


Fig 5 - Option Combination 8 – 1-in-100 year return period flood event





TITLE: HUTT VALLEY COMBINED SEISMIC HAZARD

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