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3 October 2012

M. Collins & Sons Holdings Pty Ltd
17 Fitzpatrick Street
Revesby, NSW 2212

Dear Mr Collins,

RE: Macarthur Road, Spring Farm – Flood Impact Assessment – Additional Information in response to OEH Letter Dated 24 September 2012 and DoPI enquiries dated 26 September 2012 (transcribed via email from Matt Collins)

1. Background

SMEC has previously prepared a Flood Impact Assessment for the proposed expansion of the existing sand mining operation located on the Nepean River Floodplain near Spring Farm (*Proposed Sand/Soil Excavation Lot 32 DP 635271, Macarthur Road, Spring Farm – Flood Impact Assessment, April 2011*). This study utilised a 2-D TUFLOW flood hydraulics model to assess the localised changes in flood velocity resultant from the proposed sand mining excavation.

Further investigation was required to assess the impact of the localised velocity changes on the degree of scour potentially impacting the stability of Macarthur Bridge. To address this, SMEC has previously prepared an additional report (*Macarthur Road, Spring Farm - Flood Impact Assessment – Scour Assessment, November 2011*).

SMEC also prepared a supplementary report on 5th September 2012 in response to queries from OEH in their letter of 5 June 2012 – the supplementary report outlined further TUFLOW flood hydraulics modelling, more detailed presentation of flood results and a river bank stability analysis. Specifically that report aimed to address the concerns raised by OEH in relation to the effect on the Nepean River bank, and also the potential effects of climate change.

The assessment also refined the hydraulic modelling of the proposed quarry, to include the modelling of the final landform, which includes an enlarged excavation footprint (compared to previous modelling), as well as some raising of ground surface elevations to the south-east of the final quarry void, proposed as a means of tailings disposal. The additional modelling work also included an extension of the modelling period to capture the potential effects of the falling limb of the flood hydrograph for a range of flood recurrence intervals, including the 20, 100 and 2000 year ARI events. In addition, the report addressed the concerns raised by OEH relating to climate change impact, as a result of rainfall intensity increases over time.

As well as the additional flood modelling, SMEC also undertook a slope stability analysis of the excavation batters as well as the Nepean River bank under a range of scenarios.

This report aims to address additional concerns raised by OEH in relation to the development, in particular the comment that reporting had not documented the effects of the development on flood levels and flood hazard at adjoining properties.

In addition, DoPI has raised some queries relating to internal proposed bunding and the relative frequency of inundation of the lower lying part of the site.

2. Data and Flood Model Parameters

This report utilises data from the Flood Impact Assessment previously conducted by SMEC (April, 2011) and subsequent TUFLOW modelling undertaken in September 2012.

Only minor TUFLOW modelling was undertaken for this letter response with additional conclusions drawn from the previous TUFLOW model runs of April 2011 and September 2012.

3. Response to Enquiries

3.1 Predicted Flood Level changes as a result of the development

DoPI appear to have misunderstood our previous report. The water surface level difference between the site and the river is a natural occurrence. As flood waters recede from the floodplain there is a natural tendency for the River levels to drop faster than the levels on the floodplain, and hence the reason why there is approximately 0.5m of water level difference between the floodplain and the river. This is not as a result of the development, nor is it caused by the proposed excavation, this is a natural phenomenon, by way of example the water level in the bottom of a sink that is draining being slightly lower than the water level at the edge of the sink, as the sink drains.

SMEC have assessed the potential impact of flood levels as a result of the development, and generally there is no predicted increase in flood level in events up to a 100 year ARI event, other than very localised effects – in fact, there will be a decrease in flood levels, as shown attached for the differences between existing and proposed case peak flood level for the 20 year ARI - refer **Figure 1** and 100 year ARI difference plots shown in **Figure2.**

As can be seen in these Figures, generally there is no predicted significant increase in flood levels anywhere in these events, rather there is an estimated decrease in peak flood level at the subject site.

3.2 Predicted Flood Hazard Changes at Adjacent Properties

Flood Hazard is defined in the NSW Floodplain Development Manual based on a risk based assessment approach, outlining the probability and consequence of flooding occurring. One typical measure for flood hazard relates to the product of velocity and depth at the subject site for the 100 year ARI event.

Plate 1 below is a typical relationship used to derive provisional Flood Hazard, using a Velocity x Depth relationship.

Plate 1 - Flood Hazard derived using Velocity x Depth product

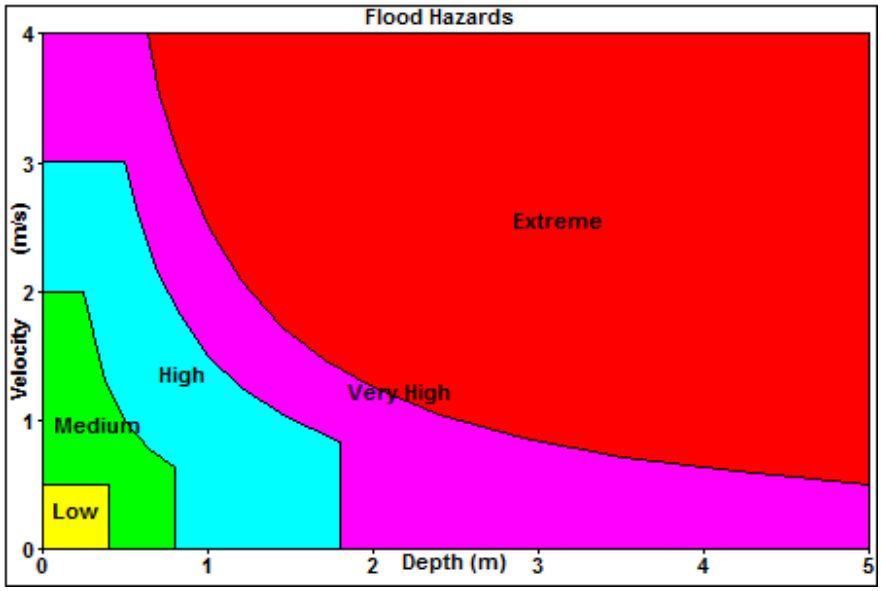


Figure 3 attached shows the existing Flood Hazard for the 100 year ARI, while **Figure 4** shows the Flood Hazard for the proposed case, for the 100 year ARI, and **Figure 5** shows the differences in the Flood Hazard for the 100 year ARI.

These results show there are no significant flood hazard effects predicted outside of the subject site for a range of recurrence intervals modelled, with the main effect being due to velocity changes post development being localised mostly within the subject site. For example, the model predicts velocity increases along the western boundary of the site (i.e. along the right bank of the Nepean River), as reported previously, and in some areas, the flood hazard changes accordingly, due to slight changes in velocity.

The modelling has demonstrated that adjoining and downstream properties are not impacted in terms of flood hazard, by the influence of floodwater as a result of the proposed sand extraction development.

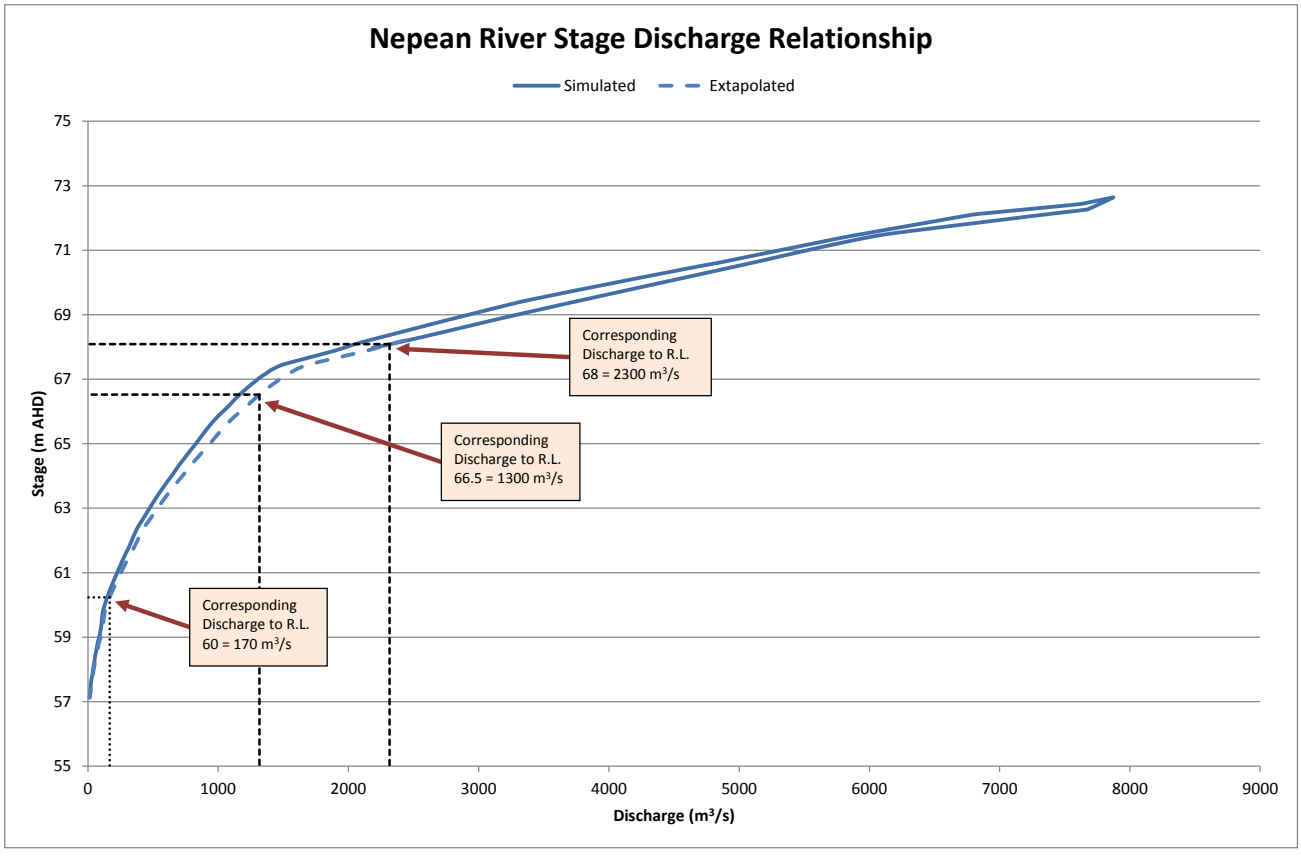
3.3 Predicted ARI at threshold of floodwaters entering the previously mined sites (i.e. Lot 1 and Lot 22)

Without extensive additional hydrological modelling, which is outside of the timeframe constraints of this supplementary report, we are unable to predict the precise level of ARI at which floodwaters first leave the river channel and inundate the floodplain areas. Previous advice by SMEC (April 2011) was based on typical channel and floodplain capacity for Australian streams, being around a 1 in 2 year ARI being a typical channel capacity, this was confirmed in the Upper Nepean River Floodplain Risk management Plan – **Section 3.2.1** (SMEC, 2001) – refer text extract below:

> *"Under flood conditions, the Nepean River overflows its banks and commences to inundate the low lying floodplain around Camden during floods in excess with an Average Recurrence Interval (ARI) of two (2) years. ".*

SMEC estimates that the point at which floodwaters first start to overtop the Nepean river bank on Lots 1 and 22 (i.e. RL 60m, AHD) is less than a 2 year ARI event (say 1 year ARI). The existing Riverbank within Lot 32 (e.g. RL 65.0m, AHD) would have a level of protection of approximately the 2 year ARI.

Plate 2 – Approximate Stage / Storage Relationship at the subject site



Using Data derived from the TUFLOW model output, and compared to an approximate flood frequency analysis for the Cowpasture Bridge Flood Warning Gauge just downstream of the site, SMEC have been able to approximate the ARI for various stage levels within the subject site. Note this is very approximate only. **Plate 2** above outlines the relationship derived.

Based on this relationship, the processing area of the site, which is located adjacent to Macarthur Road in Lot 1 has a natural ground level of approximately RL 68.0m, AHD, however, floodwater would first enter this area at, say RL 66.5m, AHD. This part of the site would begin to be inundated in events of an ARI of approximately 3 year ARI, but would not significantly be inundated until a 6 year ARI event (i.e. RL 68m, AHD). **Figure 6** shows approximate location of ground surface levels referred to in this report.

3.4 Advice on the most practical location and orientation of topsoil mounds within the extraction cells

SMEC have reviewed the proposed extraction methodology and note that it is proposed to stockpile topsoil within the working extraction areas of the pit. SMEC's opinion is that these stockpiles should be oriented with the direction of floodplain flow, and should be limited in height to three (3) metres above the pit base level, to avoid excessive scour. In addition, long term stockpiles should be spray-seed hydro-mulched with an appropriate fast-seeding native grass mix, to limit the potential for scour and erosion during a flood event.

3.5 Advice on the most practical location and orientation of landscape screening mounds surrounding the extraction cells

SMEC have reviewed the proposed landscape plan and note that includes provision for one (1) metre high landscape mounds around the outside of each extraction cell to aid in providing a visual buffer. It is SMEC's opinion that should these landscape mounds be properly constructed, using compacted locally won material, and topsoiled and planted with grasses and trees, that they should be able to withstand the action of scouring and erosion caused by floodplain flows.

4. Conclusions

Generally, the previous report dated 5 September 2012 , and this report demonstrate that there are no significant flood level, velocity or flood hazard effects predicted outside of the subject site for a range of recurrence intervals modelled, with minor changes as a result of the development being localised mostly within the subject site. For example, the model predicts velocity increases along the western boundary of the site (i.e. along the right bank of the Nepean River), however the peak velocities are not expected to cause significant scour or erosion of the riverbank, over and above the natural effects of bank undercutting in what is an active fluvial system. Similarly, as a result of velocity changes, the flood hazard will also change in similar locations as the velocity changes (as flood hazard is often measured as a velocity times depth product).

The modelling has demonstrated that adjoining and downstream properties are not impacted by the influence of floodwater as a result of the proposed sand extraction development.

Should you have any questions or wish to discuss this assessment further, please do not hesitate to contact Ben Patterson on 4925 9626 or 0408 005 660.

Yours sincerely,

Ben Patterson
Manager, Water Resources and Environment, NSW/ACT

Attachments

Attachment A – Figures 1 to 6

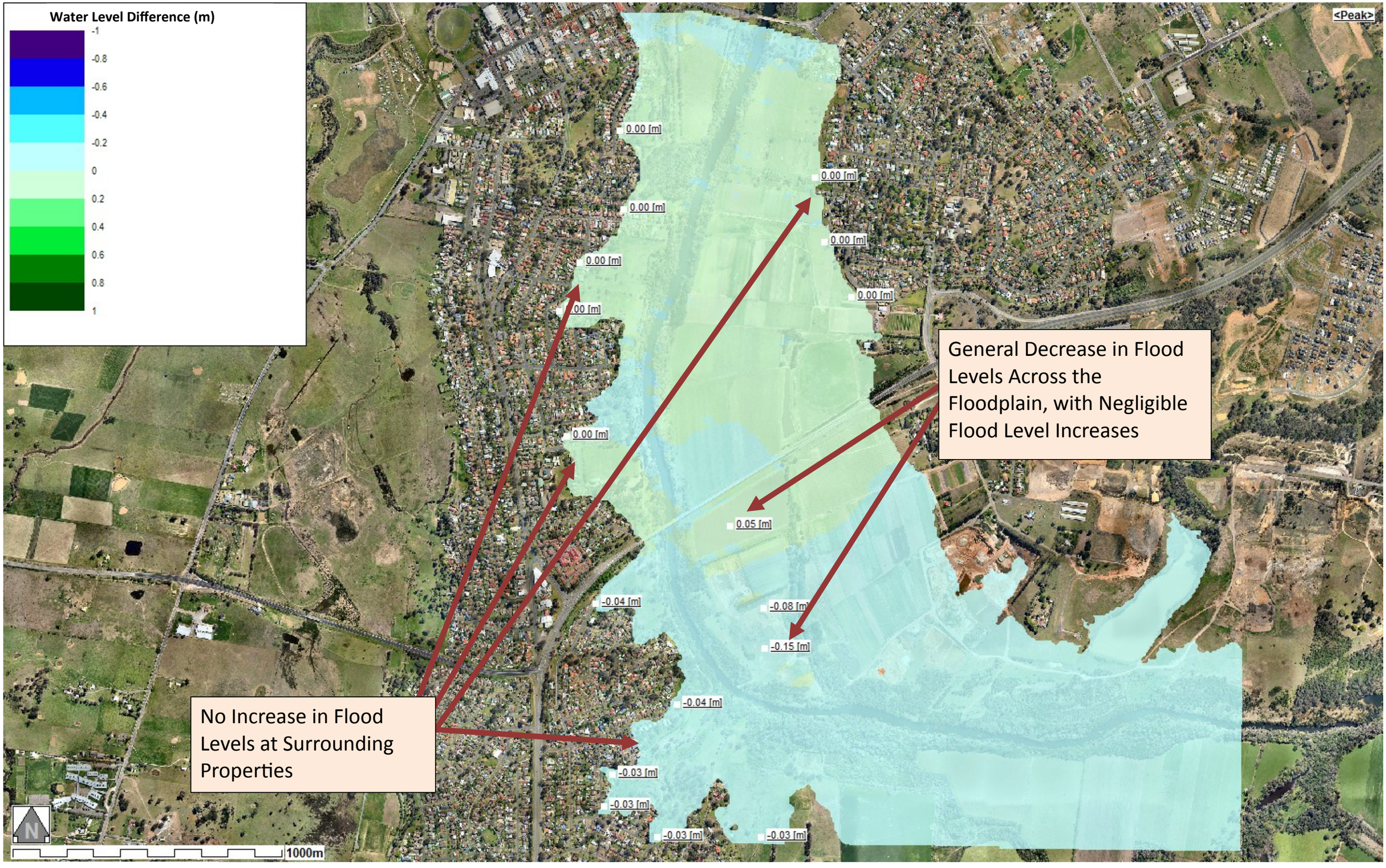


Figure 1 - 20 Year Flood Level Difference

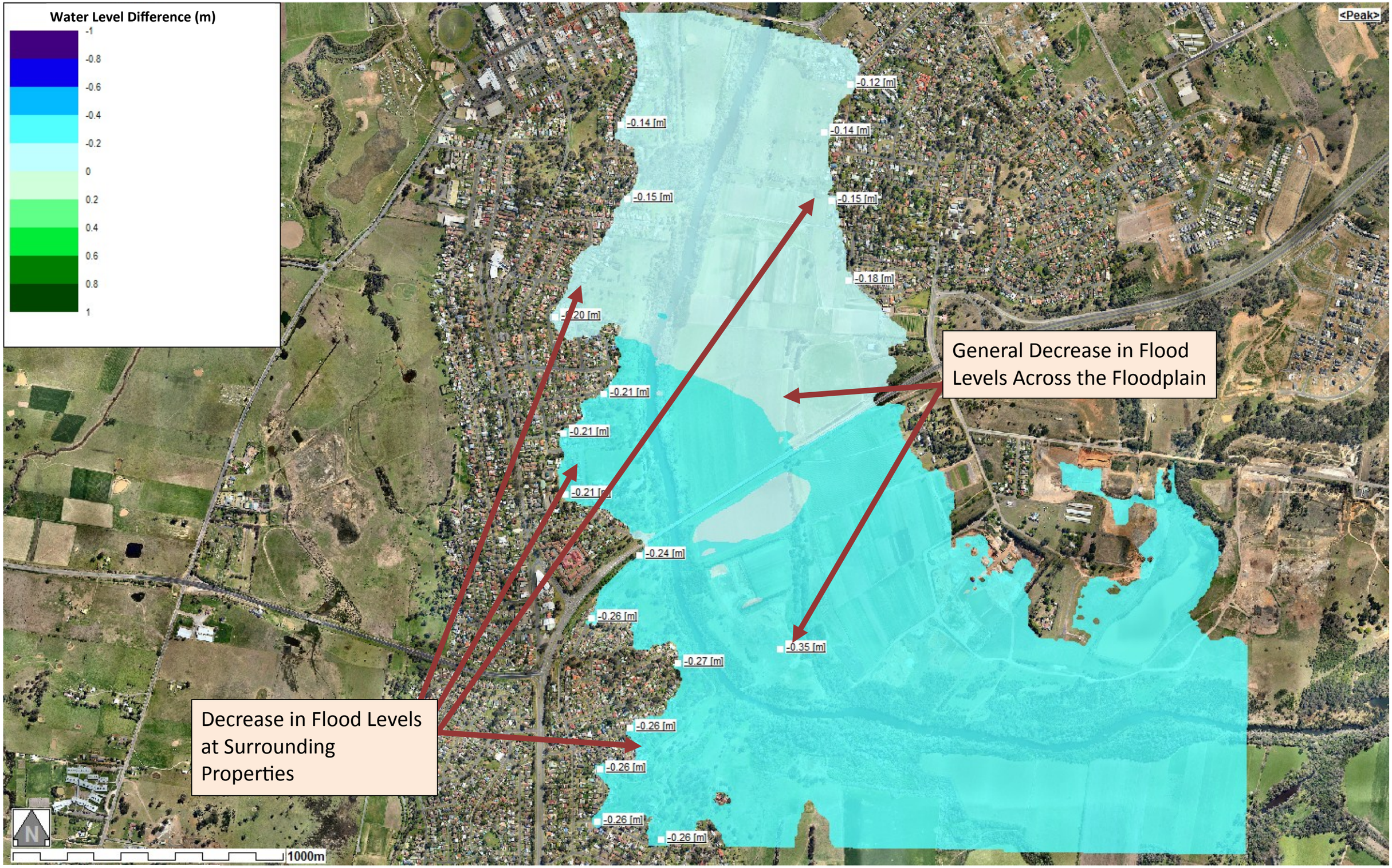


Figure 2 - 100 Year Flood Level Difference

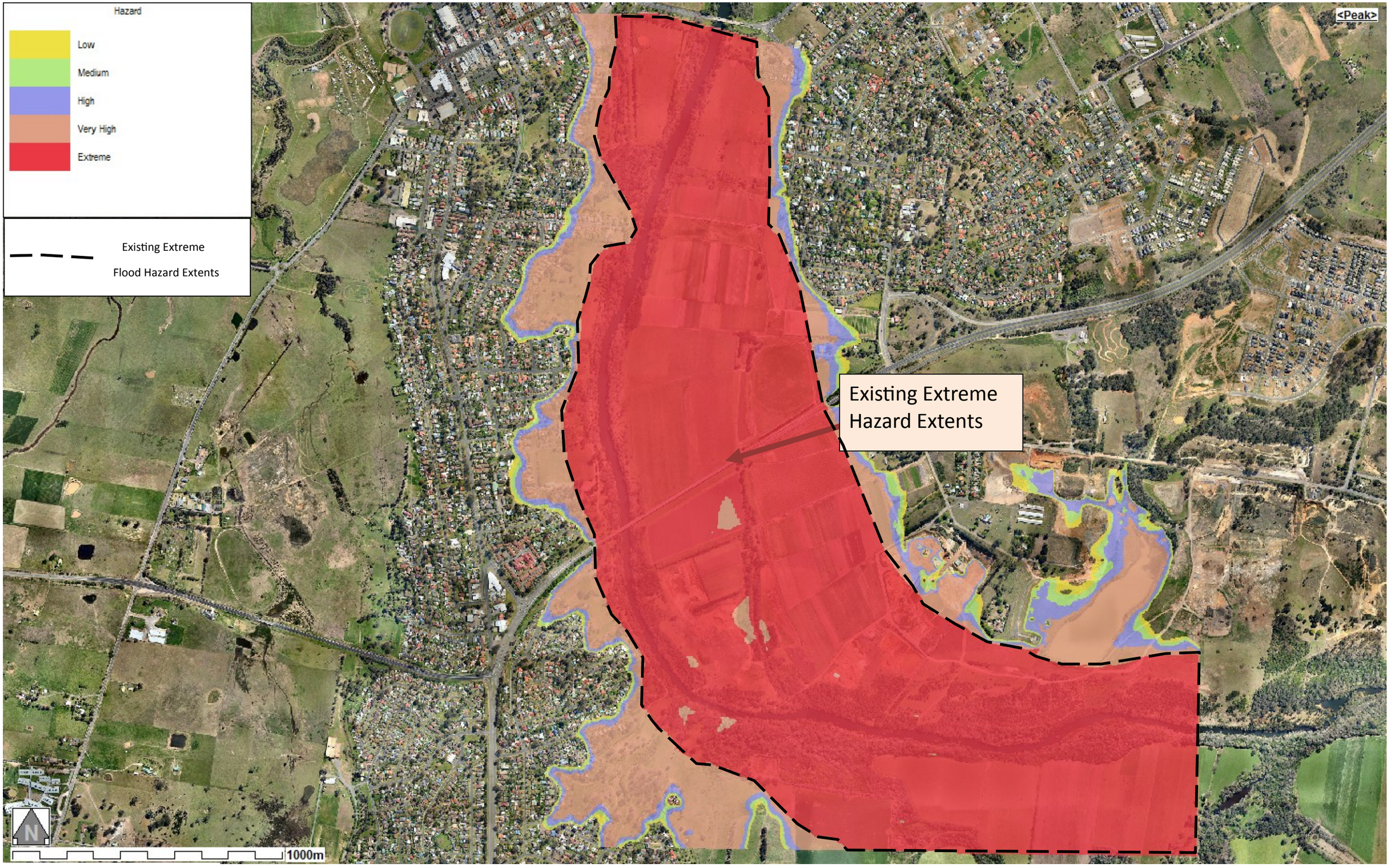


Figure 3 - 100 Year Existing Flood Hazard (Velocity x Depth)

Figure 4 - 100 Year Proposed Flood Hazard (Velocity x Depth)

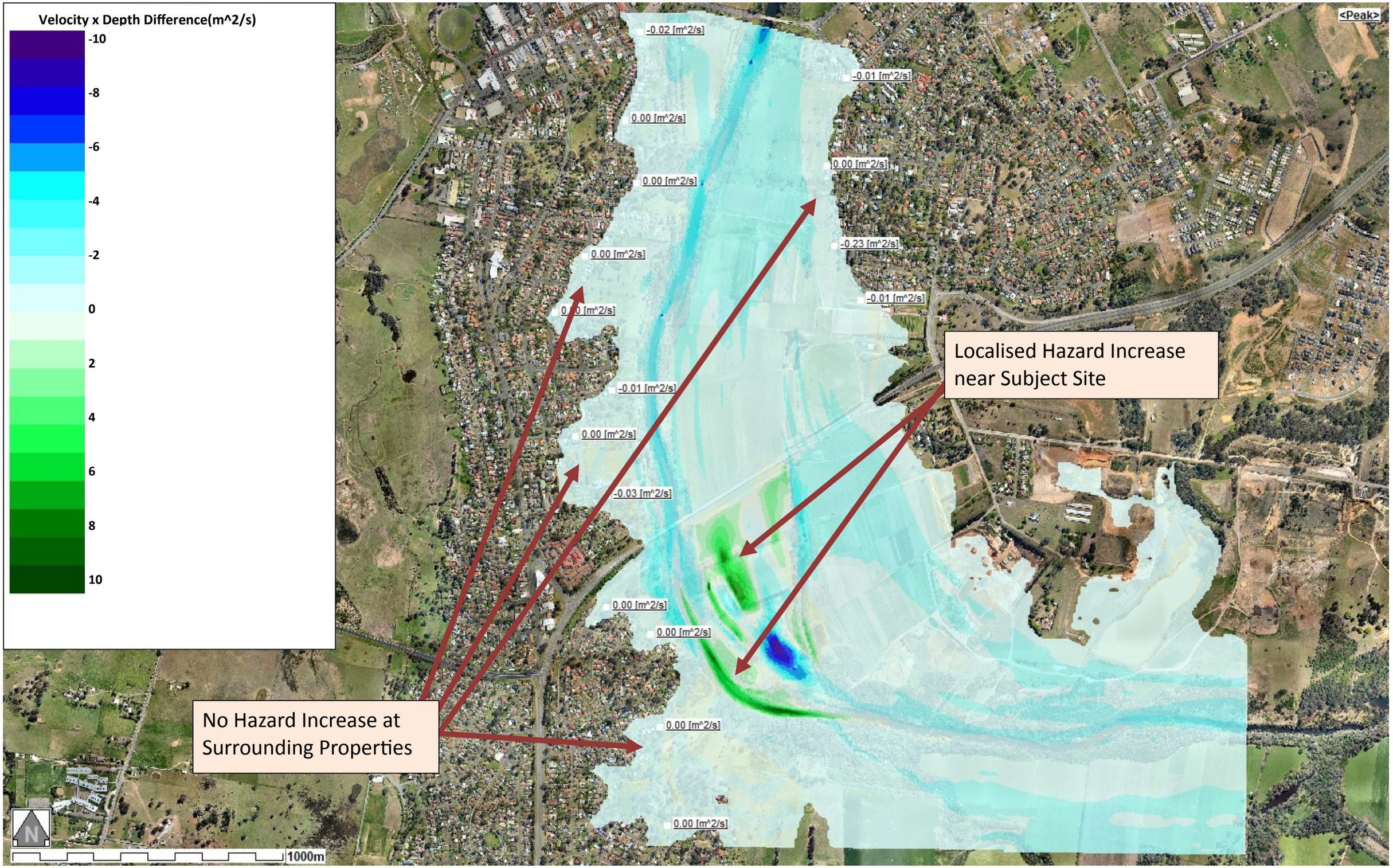


Figure 5 - 100 Year Flood Hazard (Velocity x Depth) Difference

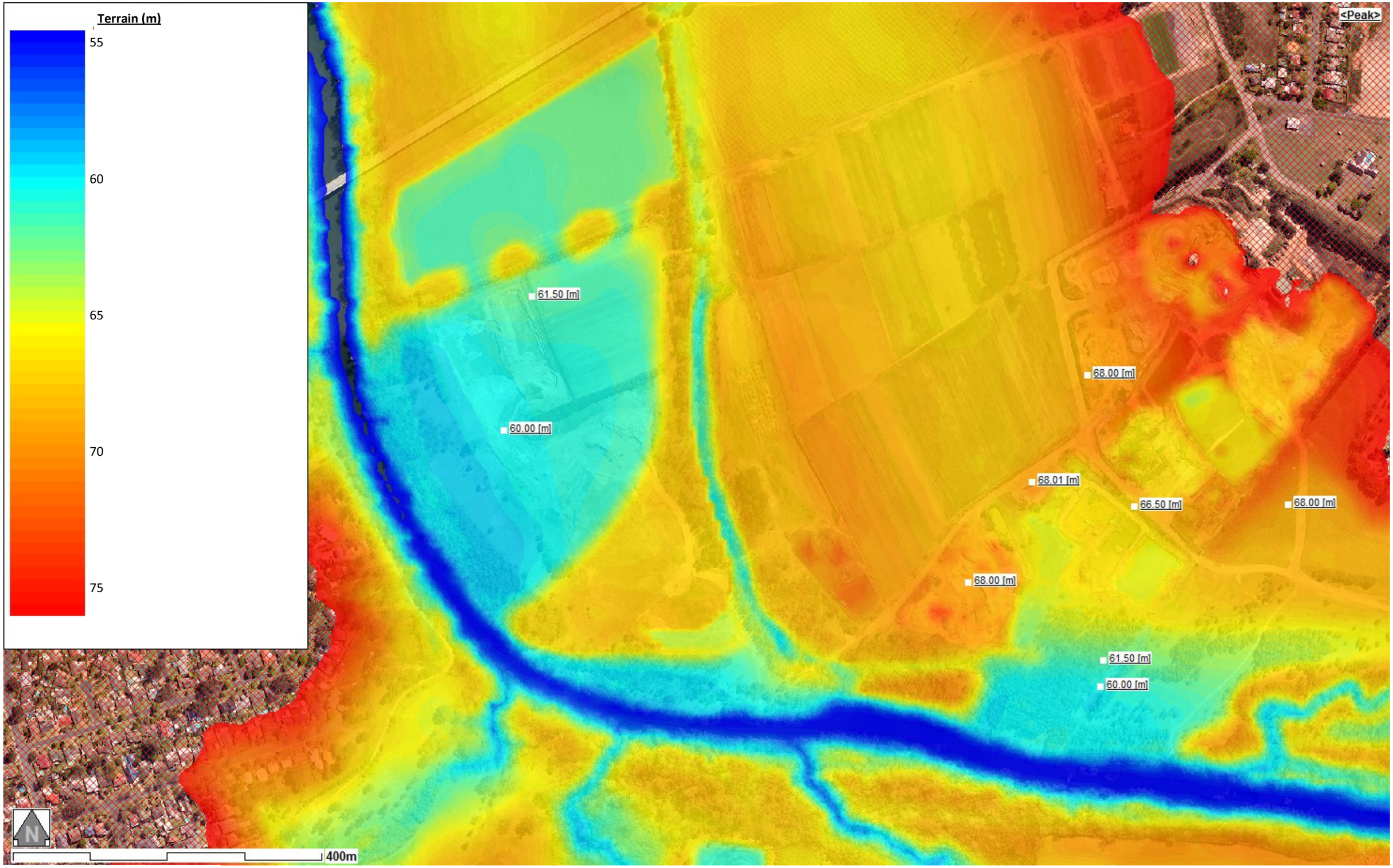


Figure 6 - Proposed Terrain Levels