Mooney Mooney & Peat Island Planning Proposal

Water Cycle Management Review

6 September 2016

Government Property NSW

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Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	05.08.2016	J. Taylor	C. Avis	C. Avis	DRAFT for review
B	26.08.2016	J. Taylor	C. Avis	C. Avis	Final Report
C	06.09.2016	J. Taylor	C. Avis	C. Avis	Final Report – Minor Amendments

Information class: Standard

Contents

1 Introduction

Mott MacDonald has been engaged to provide engineering services to support the Planning Proposal to rezone State Government owned land at Mooney Mooney and Peat Island (The Site).

1.1 Project Appreciation

A previous planning proposal was submitted to the Department of Planning and Environment (DPE) for consideration in 2014. As part of the proposal a Watercycle Review was undertaken by Brown Consulting. Comments from the review by DPE indicated that further consideration of flooding and riparian measures needed to be explored and addressed in the planning proposal. This study aims to address previous concerns and incorporate as part of the updated planning proposal.

1.2 Objectives of this Report

This report has been prepared in order to:

- Identify appropriate flood planning levels for The Site;
- Examine existing mainstream flooding conditions across The Site from the Hawkesbury River and provide recommendations for mitigation;
- Consider local flooding across The Site;
- Provide recommendations on a flood evacuation strategy addressing Peat Island and the causeway access;
- Review riparian requirements across The Site and provide input to the concept plan; and
- Consider a water cycle strategy for future development in relation to stormwater infrastructure.

2 The Site

The Site is situated on the north bank of the Hawkesbury River, adjacent to the Pacific Highway and is located within the Central Coast Council LGA. The Site location is shown in Figure 1.

The Site covers an area of 38ha and is currently made up of 17 existing lots. The Site is generally bound by the Popran National Park to the north and the Hawkesbury River to the south, east and west. It is currently zoned a mixture of RE1 Public Recreation and SP2 Special Infrastructure.

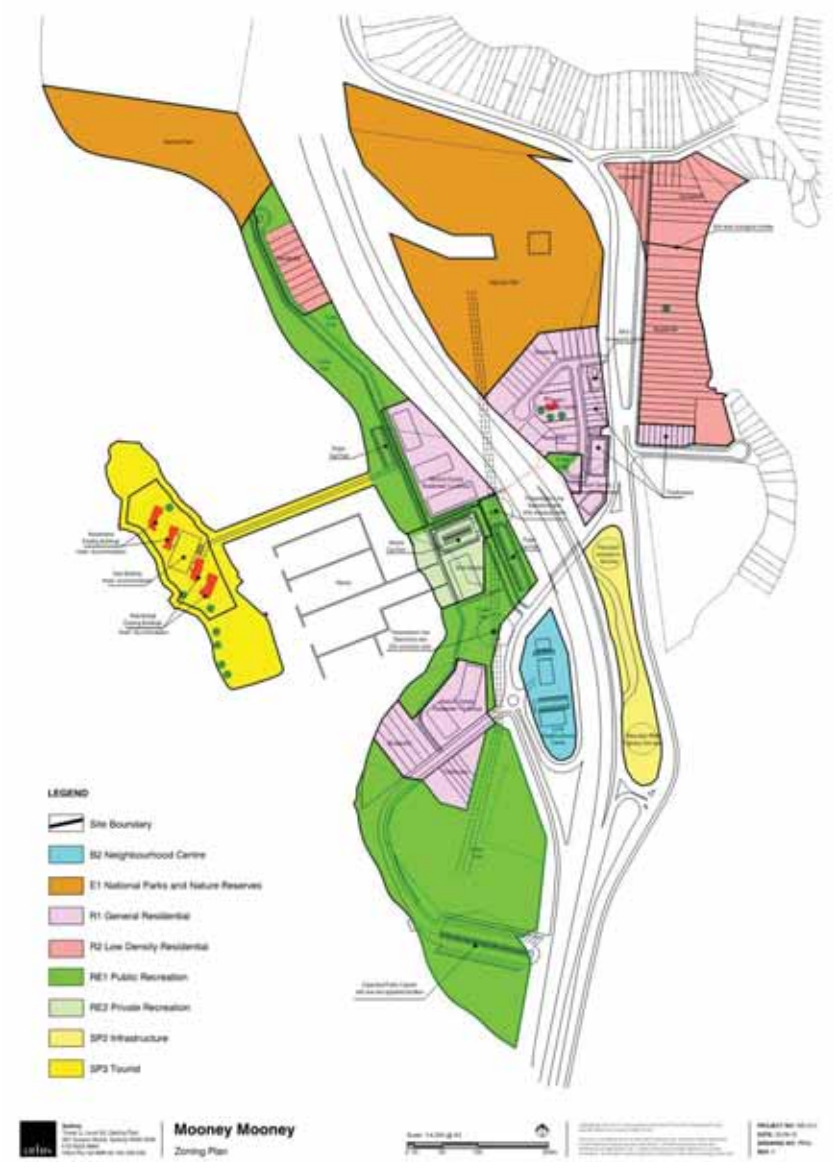
Figure 1: The Site

Source: Google Earth 2016

3 Proposed Rezoning

The proposed rezoning would provide a mix of community, residential and employment generating uses, as shown below in Figure 2. This report identifies potential issues associated with flooding, riparian measures and stormwater quantity and quality and consideration has been given to each in the concept plan.

Figure 2: Proposed Rezoning



Source: Urbis 2016

4 Reference Documents

Project reference documents considered for development of this report include:

- Lower Hawkesbury River Flood Study, Australian Water and Coastal Studies (1997);
- NSW Floodplain Development Manual, Department of Infrastructure, Planning and Natural Resources (2005);
- Floodplain Risk Management Guideline: Practical Consideration of Climate Change, Department of Environment and Climate Change (2007);
- Australian Rainfall and Runoff – Volume 1, Engineers Australia (2001);
- Guidelines for Riparian Corridors on Waterfront Land, NSW Office of Water (2012);

5 Flooding

5.1 Site Context

The Site lies on the Lower Hawkesbury River, approximately 15 kilometres from its outlet to the Pacific Ocean at Broken Bay. The size of the catchment contributing to flows in the river at this point comprises an area of approximately 22,000 square kilometres. To illustrate its scale, Figure 3 has been included which shows the extents of the Hawkesbury-Nepean catchment.

Figure 3: Regional Context

Source: NSW Government Department of Primary Industries: Water – Basins and Catchments

As can be seen, an area which stretches approximately 300km from the south beyond Goulburn, to the north in line with Newcastle and approximately 80km from the west beyond Katoomba to the east at Blacktown, contributes to flows in the river adjacent The Site.

5.2 Flood Planning

The *Lower Hawkesbury River Flood Study* by Australian Water and Coastal Studies (1997) provides the current flood planning guidance to applicable flood levels at The Site.

The report identifies flood levels for various storm events at key locations along the river, the most relevant to The Site being Brooklyn, approximately 2.5km downstream. Here, the following flood levels are observed as follows.

Table 1: Flood Levels at Brooklyn

Storm Event	Flood Level (AHD)
1% Annual Exceedance Probability (Existing)	RL 2.0m
1% Annual Exceedance Probability (Design)	RL 1.7m
Probable Maximum Flood (Design)	RL 3.3m

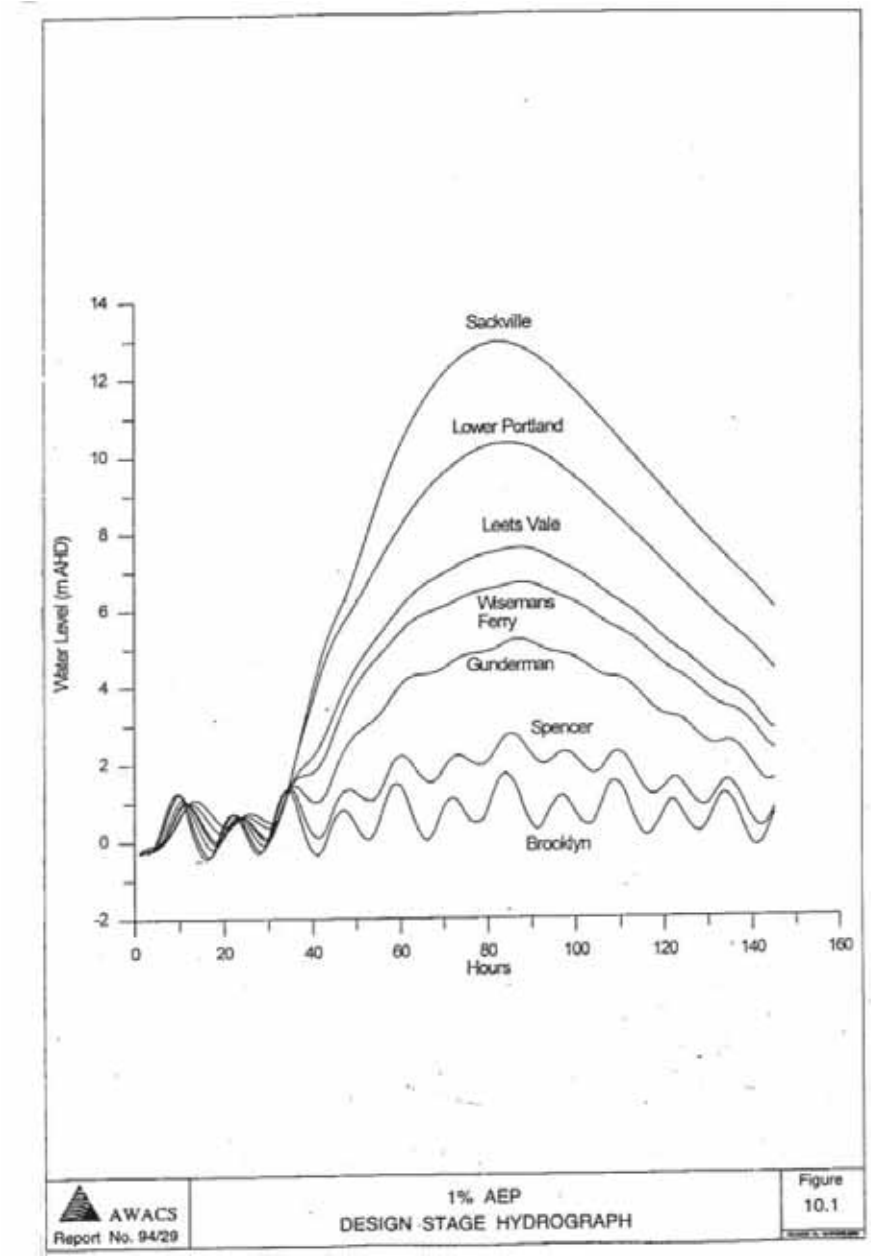
Source: Lower Hawkesbury River Flood Study, Australian Water and Coastal Studies (1997) – Figure 9.2 & Table 10.1

The results of the report demonstrate the reduced impact storm events have on the water level as flows approach the river mouth, where tidal influences dictate water levels. Figure 10.1 has been extracted from the flood study and is included on the following page as Figure 4. Based on the relative proximity of The Site to Brooklyn, it has been determined that similar flood levels would be expected at The Site. Therefore, this flood assessment has used the Brooklyn flood data.

5.2.1 Freeboard

In accordance with the NSW Flood Prone Land Policy, residential developments must be situated above the 100 year flood level with a 0.5m freeboard and commercial developments at the 100 year flood level. On this basis 0.5m should be added to the flood levels shown in Table 1 to determine the flood planning level.

Figure 4: Water Level Relative to Distance from Ocean – Design Stage Hydrograph (1% AEP)



Source: Lower Hawkesbury River Flood Study, Australian Water and Coastal Studies (1997) – Figure 10.1

5.2.2 Climate Change and Sea Level Rise

In accordance with the CCC's requirements an assessment has been made with regard to Climate Change and sea level rise. Councils planning maps show three scenarios, being a low, mid and high increase in sea level applied to the King Tide Average. The nearest map to The Site is at Patonga, approximately 13km downstream. Here, projected increases to sea level are tabulated below.

Table 2: Central Coast Council Sea Level Increase Scenarios

Scenario	Increase (m)
Low Level Rise	0.20
Mid-Level Rise	0.55
High Level Rise	0.90

Source: Central Coast Council: Gosford website – *Sea Level Rise Mapping*

The Bureau of Meteorology (BOM) provides the nearest tidal records at Sydney (Fort Denison), which have been used to estimate the sea level rise near The Site.

Table 3: Observed Tidal Records

	Average King Tide	Maximum Recorded King Tide
Sea Level (m AHD)	0.95	2.40

Source: Bureau of Meteorology website - *Monthly Sea levels for Fort Denison (Sydney) - 1914 to 2016*

Table 5.4: Tidal Sea Level Rise

Scenario	Average King Tide Rise (m AHD)	Max Recorded King Tide Rise (m AHD)
Low Level Rise	1.15	1.68
Mid-Level Rise	1.50	2.03
High Level Rise	1.85	2.38

5.2.3 Flood Planning Level

Consideration to the 100 year flood levels and climate change scenario tidal levels, the worst case has been adopted as the flood planning level for The Site. This being the highest recorded King Tide, high level climate change rise plus 0.5m freeboard as shown in the below table.

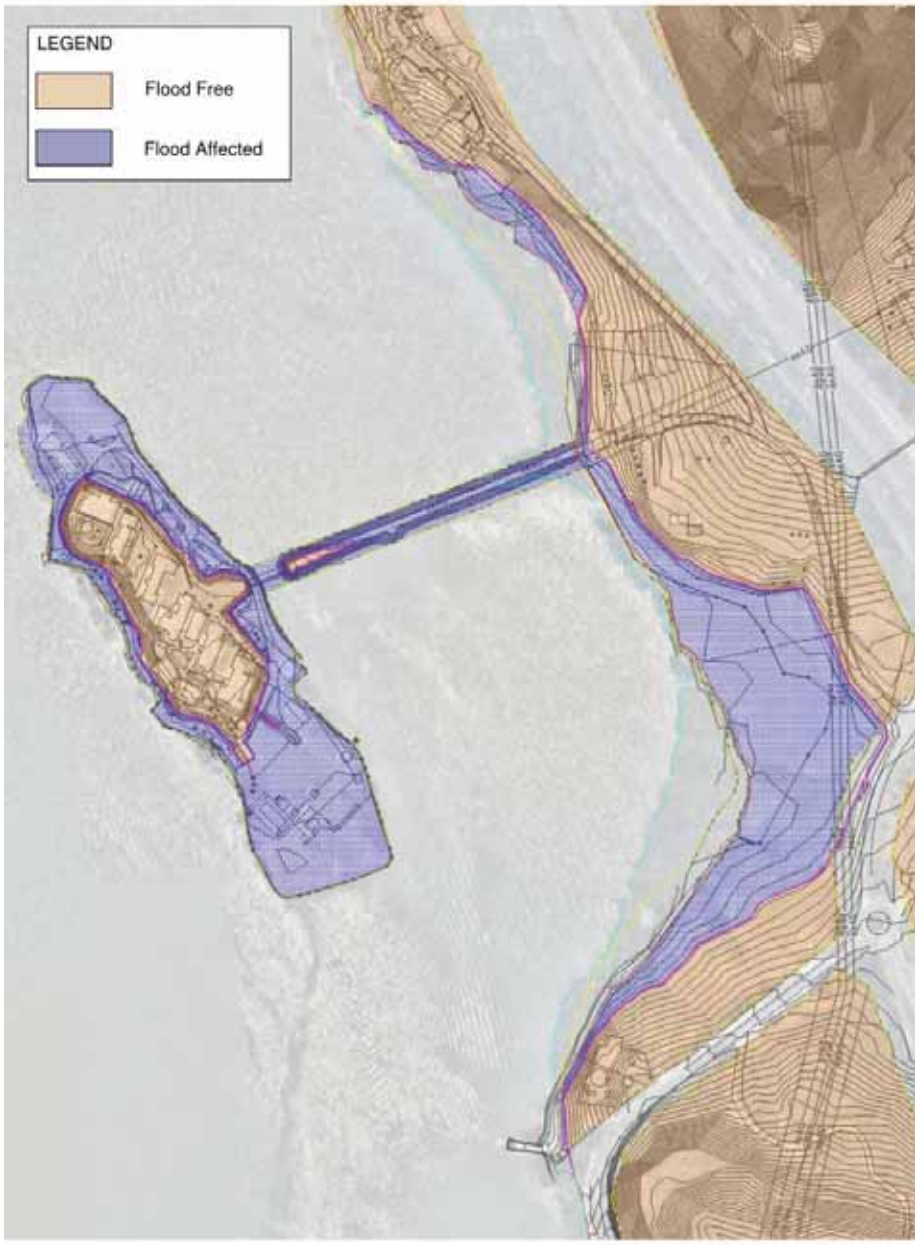
Table 5: Adopted Flood Planning Level

Scenario	Level (m AHD)
Max King Tide High Level Rise+ Freeboard	2.88

5.3 Flood Affectation

Whilst the majority of The Site is flood free, small portions of The Site (primarily Peat Island and two areas at Mooney Mooney in the centre and southern extent of The Site) are inundated in the 1% AEP storm event.

Figure 5: Flood Affected Land



Source: Background image: Nearmap

5.3.1 Alleviation Measures

In order to rationalise flood affectation across The Site, mitigation measures are proposed. It is proposed to raise the surface levels of the area on the mainland south of the Peat Island Causeway to at least the proposed minimum flood planning level. Due to the location and scale of the area proposed to be raised relative to the overall catchment (flood storage) and river width (flow conveyance area), changes to the flood characteristics are expected be negligible for the reasons outlined below, and illustrated on Figure 6.

Flow Conveyance

Due to the relative extent of earthworks (80m) compared to the width of the Hawkesbury River (850m) flood impacts are expected to be negligible. Further, the presence of the breakwater immediately upstream of the filling means that there is little flow conveyance associated with the areas of proposed filling.

Flood Storage

During a large storm event, flood waters infringe across The Site, likely as a result of backwater effects caused by flow constrictions beneath the motorway downstream. Increasing the surface level would not reduce the volume of water during the flood, but rather push them to other areas, potentially creating new areas of flood affectation.

The area of proposed fill is approximately 17,000m^2 (1.7ha) and has a maximum width of approximately 80m. It is proposed to be filled at varying depths up to a maximum approximately 1.5m. In relation to a flow width of approximately 850m (and an overall width under tidal influence of approximately 1,200m), the net impact from the loss of flood storage in the vicinity of The Site is less than 0.1% and considered negligible. Therefore, the raising of the identified land adjacent the Hawkesbury River (on the mainland, south of the Peat Island causeway) as outlined above is highly unlikely to have any adverse flooding impacts and is considered acceptable.

Figure 6: Flood Characteristics Across The Site

Source: Image: Google Earth 2016

5.4 Local Flooding

Localised flooding and existing overland flow paths across other areas of The Site are anticipated to be generally minor and would be analysed as part of a detailed design with mitigation measures incorporated in a Development Application.

The proposed filling works will not impede localised overland flow paths or drainage routes or affect other land in the vicinity of the site and is not inconsistent with the relevant policies, including the NSW Floodplain Development Manual.

5.5 Flood Evacuation

A flood evacuation strategy has been considered for The Site, refer Appendix A. As most areas of Mooney Mooney are above the PMF level, safe refuge can be reached by moving to higher ground as waters rise. Vehicles from Mooney Mooney can also leave The Site during a PMF event.

The sole access to Peat Island is via the existing Causeway from Mooney Mooney, which sits below the 1% AEP flood level. An evacuation strategy for the island will require detailed analysis; however a preliminary review of the flood study for the lower Hawkesbury River area shows that peak flood levels are experienced between 80 and 90 hours into the flood event. It is expected that this will enable sufficient warning time for safe evacuation from the island and will need to be coordinated with the SES in subsequent studies.

6 Riparian Corridors

6.1 NSW Office of Water Requirements

The NSW Office of Water guidelines were utilised to determine appropriate riparian setback areas for The Site. In accordance with the guidelines, 4th order watercourses require a total riparian corridor width of 40m on each side of the river channel. This setback comprises of a “core” setback of 20m from each “top of bank” in which new roads, structures, etc. are prohibited. The outer 20m of the riparian corridor may be varied in width and/or contain certain structures with the approval of the NSW Office of Water. Any encroachments into the outer 20m zone of the riparian corridor must be offset, such that the average width across the site is 40m.

6.2 Riparian Corridor Assessment

Both the western and eastern banks of Mooney Mooney adjoin tidal mudflats with extensive mangroves abutting the bank. After consultation with the Office of Water, it was agreed that the riparian setback of 40m would be established from the inner edge of the mangroves, rather than the top of bank, which would be the traditional boundary in the case of most creeks. The majority of developable area lies outside the setback area from the inner edge of mangroves, however there are some minor areas adjacent to the causeway and south of the causeway which falls within this zone. To compensate for the loss of these areas, a considerable amount of riparian offsetting has been provided in accordance with the requirements of the Office of Water. The riparian setback plan is shown in Appendix A.

Several existing structures lie within the riparian zones in the northern area to the west of the motorway and on Peat Island. As agreed with the Office of Water these areas were excluded from the riparian assessment as the revised concept plan does not propose to extend the development footprints closer to the river.

7 Water Cycle Management

7.1 Stormwater Quantity Management

While future development would generate more stormwater runoff due to an increased impervious area, the proximity to the river would allow near direct discharge and is not expected to adversely impact downstream properties, due to the regional context and tidal influence on the river. In addition, the relative scale of increased flows which would be expected from The Site in comparison to flows through the river is expected to be negligible.

Any future Development Application would need to consider Councils policy for stormwater conveyance to the nearest water body/ discharge point. As a number of new roads are proposed they will need to be designed to accommodate runoff to convey flows to the respective discharge points in the river in accordance with Council and Office of Water requirements.

7.2 Stormwater Quality Management

Stormwater runoff from developed areas is expected to contain increased contaminants such as gross pollutants, suspended solids and nutrients. As per CCC Development Control Plan (DCP), all new developments will be required to comply with the outlined stormwater quality targets. The objective of these targets is to reduce the total pollutant load when compared to untreated runoff from the developed impervious areas of The Site. The targets include:

- 80% reduction in suspended solids and gross pollutants; and
- 45% reduction in nutrients (including total phosphorus and total nitrogen).

In accordance with best practice, future developments should incorporate water sensitive urban design (WSUD), taking the full water cycle into account. Medium density residential and commercial developments could be expected to provide at source treatment, meaning runoff is treated on site prior to discharging to Councils network or the river. Low density residential development and auxiliary development (roads, parks etc.) could be accounted for on a community wide/ regional level.

Various treatment devices can be used as part of a treatment train to target the different levels of pollutants. These devises include but are not limited to:

- Vegetated swales;
- Permeable paving;
- Gross pollutant traps;
- Bioretention basins;
- Street trees; and
- Rainwater tanks.

Any future Development Application would need to consider Councils policies on Water Quality and demonstrate via modelling that they can achieve the required target removal rates.

8 Recommendations

8.1 Flooding

Flood Planning

After reviewing existing flood studies by others, a flood planning level which accommodates a climate change and sea level rise scenario has been deemed appropriate for The Site.

Flood Affectation

This assessment has also found that adopting the above flood planning level results in an area of The Site south of Peat Island Causeway requiring filling to enable development. The scale of change to flood characteristics is expected to be negligible in relation to the size of the river and contributing catchment. Should this area be filled it is expected to be appropriate for development and this is subsequently reflected in the concept plan.

Flood Evacuation

The existing levels of the Peat Island Causeway result in its inundation during the 100 year ARI storm event. While detailed consultation with the SES would be required at the Development Application stage, the time to peak of the storm is considerable at 80-90 hours. It is expected that this extended time would provide adequate warning to facilitate the early evacuation of the island. Areas of the mainland all have a safe path to refuge above during the PMF event.

8.2 Riparian

Riparian offsets have been applied in accordance with the Office of Waters policy on Riparian Corridors. The concept plan has been developed to remain outside of the maximum 40m setback. Some minor areas adjacent the Peat Island Causeway encroaches on the outer 20m, though offsetting has been applied to compensate for this lost land.

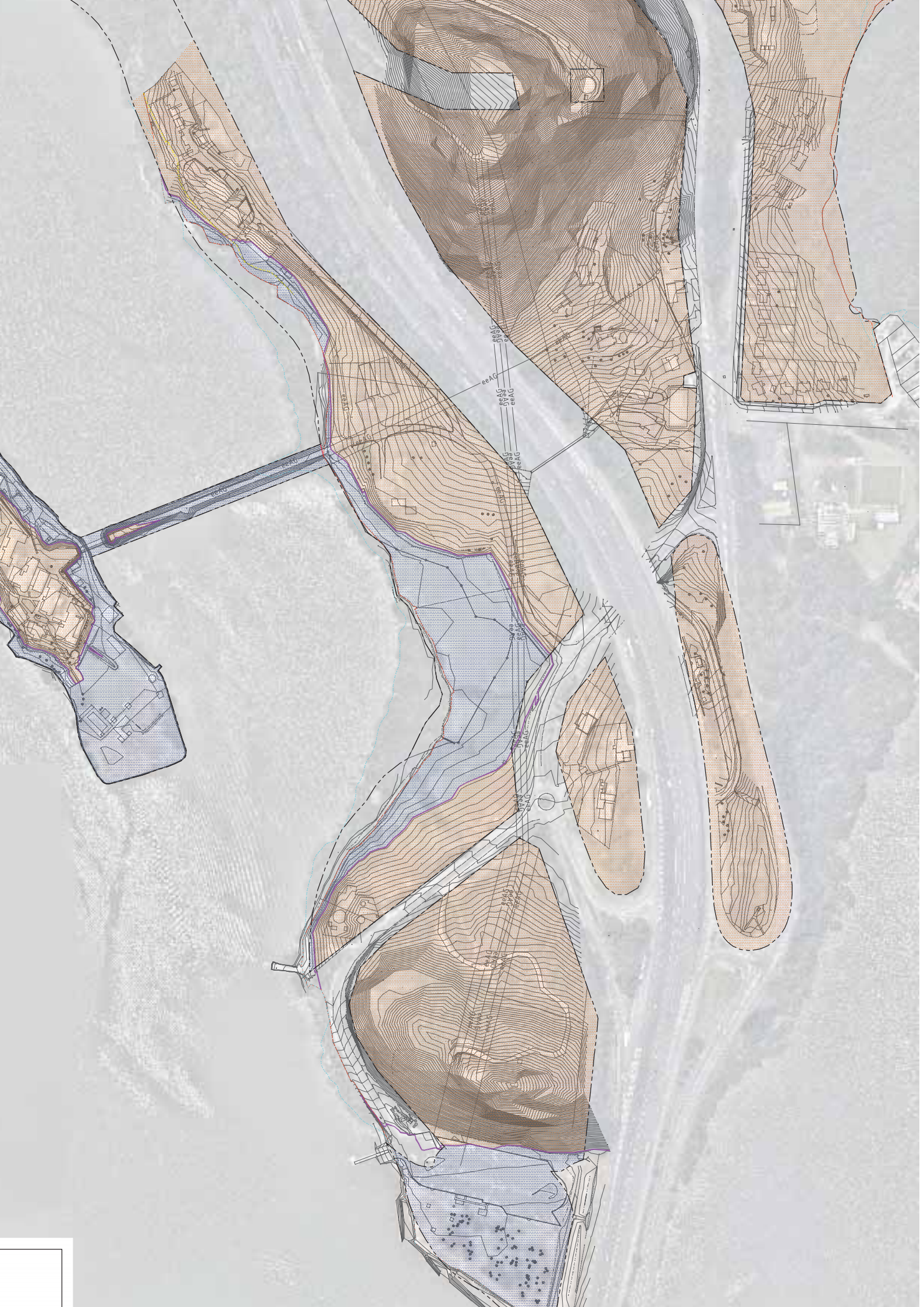
Existing development footprints have been excluded from the assessment along with Peat Island generally as a whole as this would deemed too restrictive to promote development.

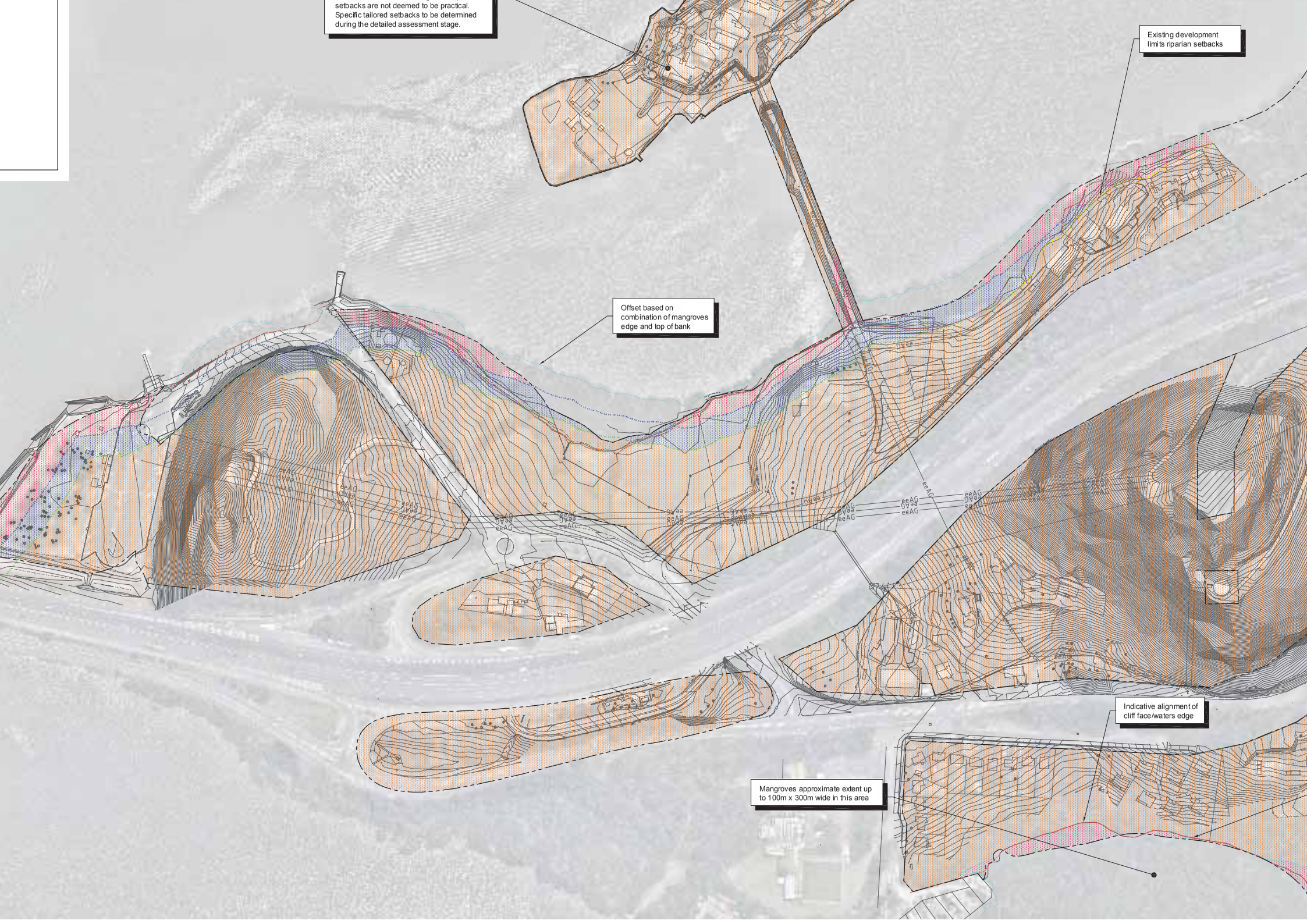
8.3 Water Cycle Management

Detailed analysis of the water cycle management across The Site would need to be undertaken at the Development Application stage to be appropriate for the relevant development. General guidelines, requirements and expectations have been provided within the report.

Appendices

A. Plans




setbacks are not deemed to be practical. Specific tailored setbacks to be determined during the detailed assessment stage.
Existing development limits riparian setbacks
Offset based on combination of mangroves edge and top of bank
Indicative alignment of cliff face/waters edge
Mangroves approximate extent up to 100m x 300m wide in this area