

**ITEM 11 - ATTACHMENT 1 PLANNING PROPOSAL - 251 ADELAIDE STREET  
RAYMOND TERRACE.**

**ATTACHMENT 10 – Review of Bushfire Constraints prepared by Newcastle  
Bushfire Consulting (2016)**

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Couch Family Trust T/A  
Newcastle Bushfire Consulting

5 Chartley Street,  
Warners Bay NSW 2282  
Ph: 02 40230149

28th April, 2016

Phoenix Builders  
C/- de Witt Consulting  
PO Box 850  
Charlestown NSW 2290

**RE: REVIEW OF BUSHFIRE CONSTRAINTS 251 ADELAIDE STREET, RAYMOND TERRACE**

Dear Sir or Madam,

Following my site visit at the above property I offer the below advice on Bushfire Planning Constraints:

1. In reviewing the site I have focused on the north-west corner of the site (north of the power line) as requested and the surrounding bushland.
2. The nearest bushland threat to the south is considered forest.
3. The vegetation to the north of the site is a small area of remnant vegetation on council parkland. It would be recommended to discuss with council the management of this very small area of vegetation or managing vegetation located south of the powerline easement where within 100 metres of the vegetation. It will become a non-threat if the above can occur.
4. The below asset protection zones and bushfire attack levels are measured from the southern forest vegetation. There is a varying slope within the bushland so I have measured a buffer for the differing slope transects:

**Level Slope in Forest**

- a. Minimum Subdivision distance for forest – 20 metres (this is relevant for rezoning). Important note – Many councils require subdivision to BAL-29 which would be a minimum 25 metres.
- b. BAL-40 - 19 to 25 metres
- c. BAL-29 - 25 to 34 metres
- d. BAL-19 - 35 to 47 metres
- e. BAL-12.5 - 48 to 99 metres

**0 to 5 degree downslope in Forest**

- a. Minimum Subdivision distance for forest – 25 metres (this is relevant for rezoning). Important note – Many councils require subdivision to BAL-29 which would be a minimum 32 metres.
- b. BAL-40 - 24 to 31 metres
- c. BAL-29 - 32 to 42 metres
- d. BAL-19 - 43 to 56 metres
- e. BAL-12.5 - 57 to 99 metres

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Note: The above minimum rezoning asset protection zones have been illustrated in the attached site constraints map. If the vegetation south of the powerline easement was cleared then the asset protection zone would be moved respectively.

5. Planning Principles for Rezoning to Residential Land in Bush Fire Prone Areas
  - a. Provision of a perimeter road with two way access which delineates the extent of the intended development;
  - b. Provision, at the urban bushland interface, for the establishment of adequate asset protection zones for future housing;
  - c. Specifying minimum residential lot depths to accommodate asset protection zones for lots on perimeter roads;
  - d. Minimising the perimeter of the area of land, interfacing the hazard, which may be developed;
  - e. Introduction of controls which avoid placing inappropriate developments in hazardous areas; and
  - f. Introduction of controls on the placement of combustible materials in asset protection zones.
6. Water supply - The future hydrant supply should be designed in accordance with AS2419.1 however this would be addressed at subdivision stage.
7. Electrical and gas supplies will be located underground require no further conditions. This would be addressed at subdivision stage.
8. At the commencement of building works and in perpetuity the entire property shall be managed as an inner protection area (IPA) as outlined within section 4.1.3 and Appendix 5 of Planning for Bush Fire Protection 2006 and the NSW Rural Fire Service's document Standards for asset protection zones.

If you have any questions regarding the above I am available for comment on 0423 923284 or 02 40230149.

Yours Sincerely  
Phillip Couch

Phillip Couch GFireE  
Bach Info Science  
Grad Dip Design for Bushfire Prone Areas  
FPAA BPAD – Level 3 Certificate Number BPD-PA-16132  
Director Newcastle Bushfire Consulting



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**ITEM 11 - ATTACHMENT 1 PLANNING PROPOSAL - 251 ADELAIDE STREET  
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**ATTACHMENT 11 – Aboriginal Cultural Heritage Due Diligence Assessment  
(2016)**

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**INSITE HERITAGE**  
PTY LTD

PO Box 98  
Wangi Wangi NSW 2267  
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P 0249755818

**Aboriginal Cultural Heritage Due Diligence Assessment  
251 Adelaide Ave  
Raymond Terrace, NSW**

Prepared For  
DeWitt Consulting

June 2016

**ITEM 11 - ATTACHMENT 1      PLANNING PROPOSAL - 251 ADELAIDE STREET  
RAYMOND TERRACE.****Introduction**

Insite Heritage Pty Ltd were commissioned by DeWitt Consulting on behalf of Phoenix Builders to provide an Aboriginal Cultural Heritage Assessment of potential impact on Aboriginal Cultural Heritage by the proposed rezoning of the site to allow for the establishment of residential and villa allotments.

The property, 251 Adelaide St Raymond Terrace (Lot 232 DP 593512), is a former quarry site. The north western portion of the lot is the subject of the proposed rezoning. The area of the rezoning proposal is approximately 7ha of the total approximately 43 ha block. The area of development relative to the total Lot is shown in Figure 1.

An AHIMS search for the study located two isolated finds located to the south of the site associated with road upgrades. An inspection of the study area was carried out with a representative of Worimi Local Aboriginal Land Council (LALC) on the 15<sup>th</sup> May 2016. No Aboriginal objects, or areas of potential archaeological deposit, were located. The survey was done in the northern section of the site and subsequently the study area was enlarged. An additional survey was not considered necessary as the additional area contained the quarry infrastructure and areas of low lying ground with dense vegetation. The initial survey results were extrapolated over the remainder of the site.

The history of quarrying on the site has reduced the archaeological potential of the site significantly. The site has been used for quarrying purposes since 1974 and this was reflected in the poorly developed soil profile on the site. The site is not considered to have archaeological potential.

The cultural heritage values assessment will be provided by the Worimi LALC and included in this report upon receipt.



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RAYMOND TERRACE.****1. Introduction**

DeWitt Consulting have been commissioned to prepare a rezoning application on behalf of Pheonix Builders. The rezoning of 251 Adelaide Ave Raymond Terrace, will be determined by Port Stephens Shire Council. Currently zoned RU2 (rural) the rezoning would allow the development of medium density housing. This assessment is intended to identify any potential impacts as a result of the rezoning, on Aboriginal cultural heritage and to provide recommendations regarding mitigation measures.

**2. Environmental Landscape**

The site is identified as flood prone land, and two tributaries to Windeyers Creek passed through the area prior to the impact of mining. Historically the site has been used for quarrying since the mid-1960's while information on the title of the land shows quarrying since at least 1974<sup>1</sup> the void acts as a storage area for flood waters from the Hunter River that then drains in to Windeyer Creek. The area of the rezoning has been historically quarried since the mid 1960's and is now revegetated predominately with Radiata Pine and remnant Swamp Oak forest.

The flora and fauna assessment identified a paucity of hollow bearing trees which is consistent with the size of the trees observed in the site inspection. In general the trees on site did not appear to be of sufficient age for Aboriginal modification and no evidence of cultural modification was observed. The 2004 Google Earth image clearly shows the straight line character of the planted Radiata in the north west portion of the site (Figure 2).



Figure 2 The subject area 2004 - Google Earth

The soil landscape map for the area also shows the area as disturbed (Figure 3). The soil landscape is Shoal Bay - Aeolian Pleistocene sand sheets with slope gradients generally <5% but on slopes of rolling dunes up to 15%, with local relieve generally <5m<sup>2</sup>. This particular soil landscape can be

<sup>1</sup> 2011 ERM 251 Adelaide Street Raymond Terrace, Ecological Due Diligence and BioBanking Assessment. Report to Rocla Quarry Products (p14)

<sup>2</sup> Murphy, C.L 1995 Soil Landscapes of the Port Stephens 1:100,000 Sheet. Published Soil Conservation Service of NSW,



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archaeologically sensitive but the scale of disturbance at this site indicates that little archaeological value is likely to remain. The scale of disturbance can also in Figure 4 (Google Earth 2007).

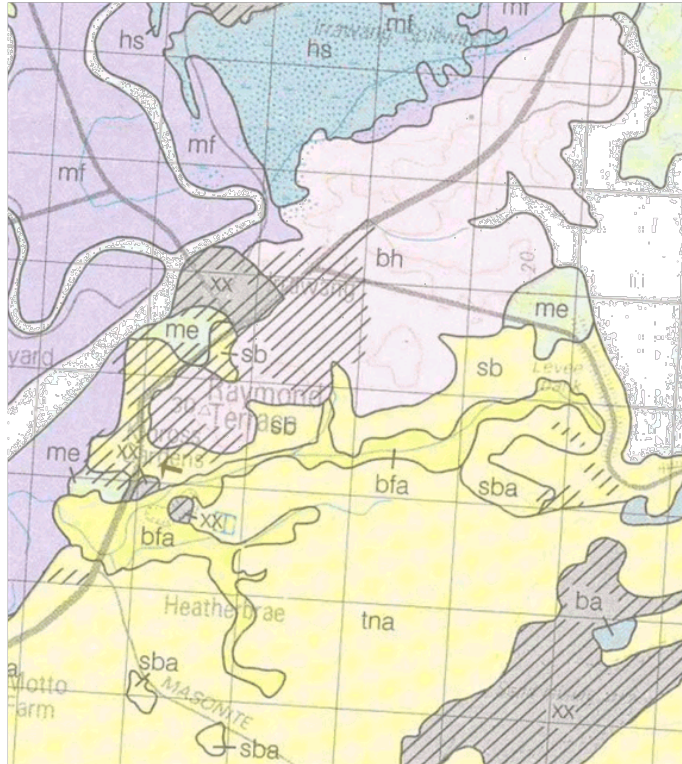


Figure 3 Soil landscape map placing the study area in a disturbed area

The southern boundary of the proposed rezoning area is bounded by the Grahamstown drain, an artificial drain constructed to take over flows upstream (Figure 4).

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Figure 4 The subject site circa 2007 (Google Earth) – note the Grahamstown drain at the base of the area.

### 3. Archaeological Context

A search of the Aboriginal Heritage Information Management System (AHIMS) was undertaken with a 200m buffer in order to identify any previously recorded Aboriginal archaeological sites which may be impacted by the proposed works.

The search located two sites south of the site (refer Appendix A). The sites 38-4-0238 and 38-4-0320. The sites were located in the course of the Raymond Terrace Bypass archaeological assessment in 1990. 38-4-0320 comprised 7 artefacts located in two concentrations in disturbed areas. A total of 7 artefacts were recorded made from silcrete and indurated mudstone. Six of the artefacts were flakes and the other a large core. The sites are located 40m from Windeyers Creek on intact creek terraces. 38-4-0238 comprises 14 artefacts of a variety of raw material located 5m from Windeyers Creek on a terrace.

The subject area has been subject to the excavation of a large void that would have incorporated the two arms of Windeyers Creek and the associated terraces. The Grahamstown drain has also been excavated on the southern boundary of the proposed rezoning to relieve flooding. At the time of closure the site support a floating dredge, sand wash, mooring and pontoons, office/weighbridge and staff amenities and earthmoving operations. The historical infrastructure associated with the mining of the site from the mid 1960's is not known. There is negligible potential for creek terrace to remain on the site.

The bio-banking assessment of the site prepared by ERM reviewed historical photographs of the site and found that the site had been quarried since the mid-1960s. The review found that "the north-west of the site, which has the highest potential for redevelopment to residential use .... was



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historically quarried and now appears vegetated"<sup>3</sup>. A site visit found that there is evidence of disturbance with a steep un-natural cut along the northern boundary and a similarly steep western margin possibly due to fill under Adelaide proposed rezoning is located on the margins of a sand quarry site. The tree cover is generally introduced (Radiata Pine) with a some remnant Swamp Oak Floodplain Forest.



**Plate 1 The north- west corner of the site view east**

There are two sites recorded on AHIMS to the south of the study area. The two sites are open sites located on the terrace of Windeyers Creek. There are no other archaeological records relevant to the study area.

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<sup>3</sup> (ibid) Page 15

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**Figure 5 AHIMS locations relative to the study area – area in red was surveyed**

The desktop assessment did not locate any Aboriginal objects. The site was inspected with Richard Kime of Worimi Local Aboriginal Land Council, on the 17<sup>th</sup> of May 2016. The inspection focused on the area marked in red (Figure 4) as this was the initial rezoning proposal area. The area has been extended to that shown in Figure 1. Additional survey was not considered necessary given the disturbance on the site, and the results of the survey extrapolated over the additional area.

No archaeological objects or areas of potential archaeological deposit.

It was noted that the soil profile appeared poorly developed unlike the top of slope in the adjacent park. The northern margins of the site with a slope of approximately 45% is clearly not natural or consistent with the soil landscape description of typical slopes (Plate 1). In addition the trees within the study area appeared to be no more than approx. 30 years old, which is consistent with the ERM assessment of sandmining in the area in the 1960's – 1970's (Plates 2&3).



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**Plate 2** The brown A horizon of the sandy soil in the park to the north of the study area.



**Plate 3** the soil beneath pine needles, note the poorly developed humic layer

Archaeological visibility was provided by the powerline transect across the block (Plate 4). The easement provided 20% archaeological visibility (260m x 5m of easement inspected) providing 260 sqm of archaeological visibility (Plate 5). No cultural heritage objects were located.

As shown in Plates 1, 3 & 4, surface visibility was very limited by a deep cover of pine needles. Three areas of exposure within the forested areas of the site provided by exposures (total of 5 x 10m with 10% archaeological visibility) totalling 5 sqm of effective exposure (Plate 6). A total of 265 sqm of the 1.8ha included in the survey area provided the opportunity to locate heritage objects. There is no potential for modified trees given the younger age of the trees and the introduction of radiate pine.



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Plate 4 The approx 45 degree slope - northern margin



Plate 5 View west across the southern end of the study area along the powerline easement



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Plate 6 Surface visibility in an exposure mid section of the site



Plate 7 Typical surface visibility

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**Plate 8** Access track to the WWTP on the northern boundary of the study area

### **Cultural Heritage Impact Assessment**

Based upon the historic landuse assessment (ERM 2011), and the site inspection the study area has been highly impacted by at least 40 years of sandmining. The potential for items of Aboriginal heritage to remain in- situ is very low.

### **Recommendations**

There were sufficient sample areas of surface visibility at the time of inspection to determine that the subject area has been substantially disturbed. The soil profile was observed to be poorly developed which is consistent with a history of sandmining. Whilst overall the surface visibility was low due to the ground cover of pine needles, there were no objects found in those areas that did present the opportunity for objects to be located.

There are no constraints to the rezoning, given that the likelihood of sites of significance remaining within the study area being low.

### **References**

*Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales.* NSW Office of Environment & Heritage 2010.

ERM    2011    251 Adelaide Street Raymond Terrace, Ecological Due Diligence and BioBanking Assessment. Report to Rocla Quarry Products (p14)

Murphy, C.L 1995 Soil Landscapes of the Port Stephens 1:100,000 Sheet. Published Soil Conservation Service of NSW,

Yours sincerely

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**Insite Heritage Pty Ltd**

Angela Besant  
Senior Archaeologist  
Insite Heritage Pty Ltd

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Appendix A– AHIMS Search



## ORDINARY COUNCIL - 25 JULY 2017 - ATTACHMENTS

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Office of  
Environment  
& Heritage

#### AHIMS Web Services (AWS)

##### Extensive search - Site list report

Your Ref/PO Number : dewitt raymond terrace

Client Service ID : 223135

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-4-0238	RT 3;	AGD	56	381900	6372150	Open site	Valid	Artefact : -	Open Camp Site	1916,1983,219 9,102116
	<u>Contact</u>									
		<u>Recorders</u>	Doctor.Jo McDonald,Elizabeth Rich					<u>Permits</u>		
38-4-0320	RT 5;	AGD	56	382220	6372230	Open site	Valid	Artefact : -	Open Camp Site	1983,102116
	<u>Contact</u>	<u>Recorders</u>	Doctor.Jo McDonald					<u>Permits</u>		

Report generated by AHIMS Web Service on 29/04/2016 for Angela Besant for the following area at Lot : 232, DP:DP593512 with a Buffer of 200 meters. Additional Info : to inform and impact assessment. Number of Aboriginal sites and Aboriginal objects found is 2

This information is not guaranteed to be free from error omission. Office of Environment and Heritage (NSW) and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

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**Appendix B Worimi LALC report**

(to be included after review)

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ATTACHMENT 12 - Flood Assessment prepared by BMT WBM (2017)

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BMT WBM Pty Ltd  
126 Belford Street  
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PO Box 266  
Broadmeadow NSW 2292

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ABN 54 010 830 421

[www.bmtwbm.com.au](http://www.bmtwbm.com.au)

Our Ref: DJL- L.N20202.005.docx

28 March 2017

Pheonix Builders Pty Ltd  
PO Box 342  
Earlwood NSW 2206

Attention: Chris Xistouris

Dear Chris,

**RE: FLOOD ASSESMENT 251 ADELAIDE ST, RAYMOND TERRACE**

This letter report provides a review of the existing flood conditions and identifies risks associated with flooding which may pose constraints on the potential for development of the disused quarry site at 251 Adelaide St, Raymond Terrace. The assessment updates previous reporting investigating different potential development footprints.

**Background**

The disused quarry site at 251 Adelaide St, Raymond Terrace is located on the low-lying floodplain of Windeyers Creek, just upstream of the Hunter River. The site is positioned just south of the Raymond Terrace township and is bounded by the elevated road embankments of Adelaide Street and the Pacific Highway. A sewage treatment plant adjacent to the site is raised well above the floodplain.

Windeyers Creek is characterised by wide, low-lying swamp areas where ground levels are typically 1.0-1.5m AHD. Within the site boundary, the creek separates into two branches. The northern creek branch has been realigned into a well-defined channel running along the north and west boundaries of the site. Across the remaining site, elevations are generally below 2.5m AHD, with the exception of the north western corner of the block which is raised to around 3.0m AHD. The site boundary and local topography of the area is presented in Figure 1.

The site is subject to two flooding mechanisms:

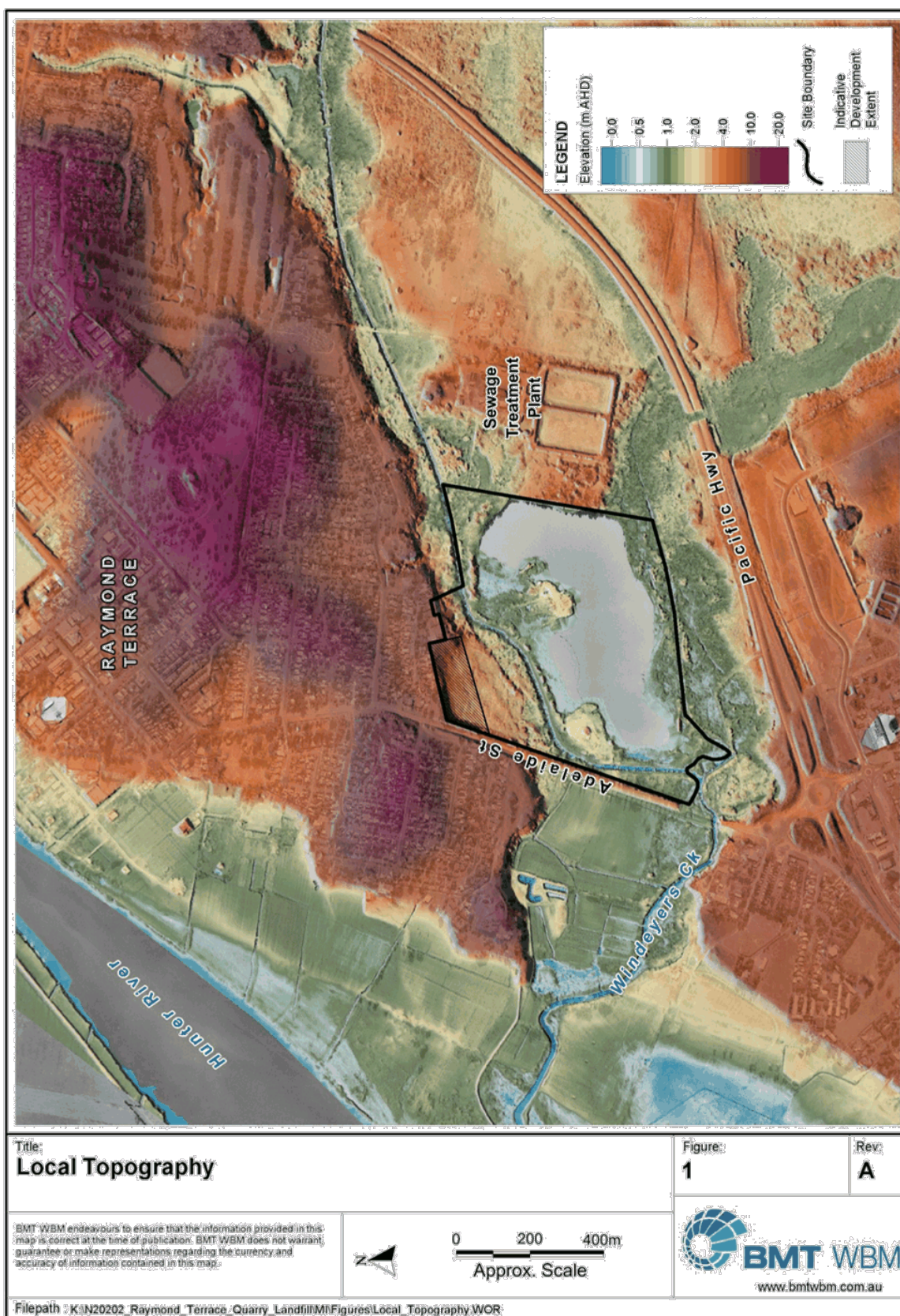
- Backwater inundation from the wider Hunter River system; and
- Local flooding of Windeyers Creek catchment.

The site is located within the low-lying floodplain area bounded by Adelaide Street and the Pacific Highway, and provides major storage area for flooding of both Windeyers Creek and the Hunter River. There are two major flood flow paths either side of the disused quarry, being the main Windeyers Creek channel running around the north and west perimeter of the quarry lake and a secondary tributary channel along the southern perimeter. A levee is constructed along the Hunter River floodplain offering some protection from elevated water levels associated with Hunter River flood events. The proposed development at the site will be concentrated to the north-western corner, as indicated on Figure 1.

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**A part of BMT in Energy and Environment**

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**Model Development**

The flooding constraints applicable to the site have been defined through computer modelling of typical flood behaviour. Modelling was completed for the 1% AEP event (100yr ARI), which is typically used to define flood planning levels. The lower Hunter River model (developed by BMT WBM on behalf of Port Stephens Council) defines Hunter River design flood conditions and was utilised for this assessment.

To simulate local catchment flooding of Windeyers Creek, separate hydrologic and hydraulic models were developed.

An XP-RAFTS hydrological model was developed to simulate the rate at which rainfall runs off the catchment. The amount of rainfall runoff and the attenuation of the flood wave as it travels down the catchment are dependent on:

- The catchment slope, area, vegetation and other characteristics;
- Variations in the distribution, intensity and amount of rainfall; and
- The antecedent conditions (dryness/wetness) of the catchment.

Catchment properties were determined from the high resolution (2m grid size) Digital Elevation Model (DEM) derived from LiDAR data and aerial photography. Rainfall intensity-frequency-duration values and temporal patterns were adopted in accordance with the standard procedures outlined in AR&R (2001). An initial loss of 20mm and a continuing loss of 2.5mm/hr were adopted for this study and are within the limits recommended by AR&R for a catchment in eastern NSW.

In developing the hydraulic model, BMT WBM has applied the fully 2D software modelling package TUFLOW. The 2D model has distinct advantages over 1D and quasi-2D models in applying the full 2D unsteady flow equations. This approach is necessary to model the complex interaction between rivers, creeks and floodplains and converging and diverging of flows through structures.

As the study area is relatively small, a high resolution model cell size (5m) was adopted, providing for an accurate representation of flow distribution over the floodplain. Key hydraulic control structures including the Pacific Highway and Adelaide Street bridges were represented as layered flow constrictions where the flow impediment influence of the abutments, piers and bridge deck is modelled. Culverts within the study area (under the Pacific Highway and through the Hunter River levee) were also included within the 2D domain as 1D structures.

**Existing Flood Conditions**

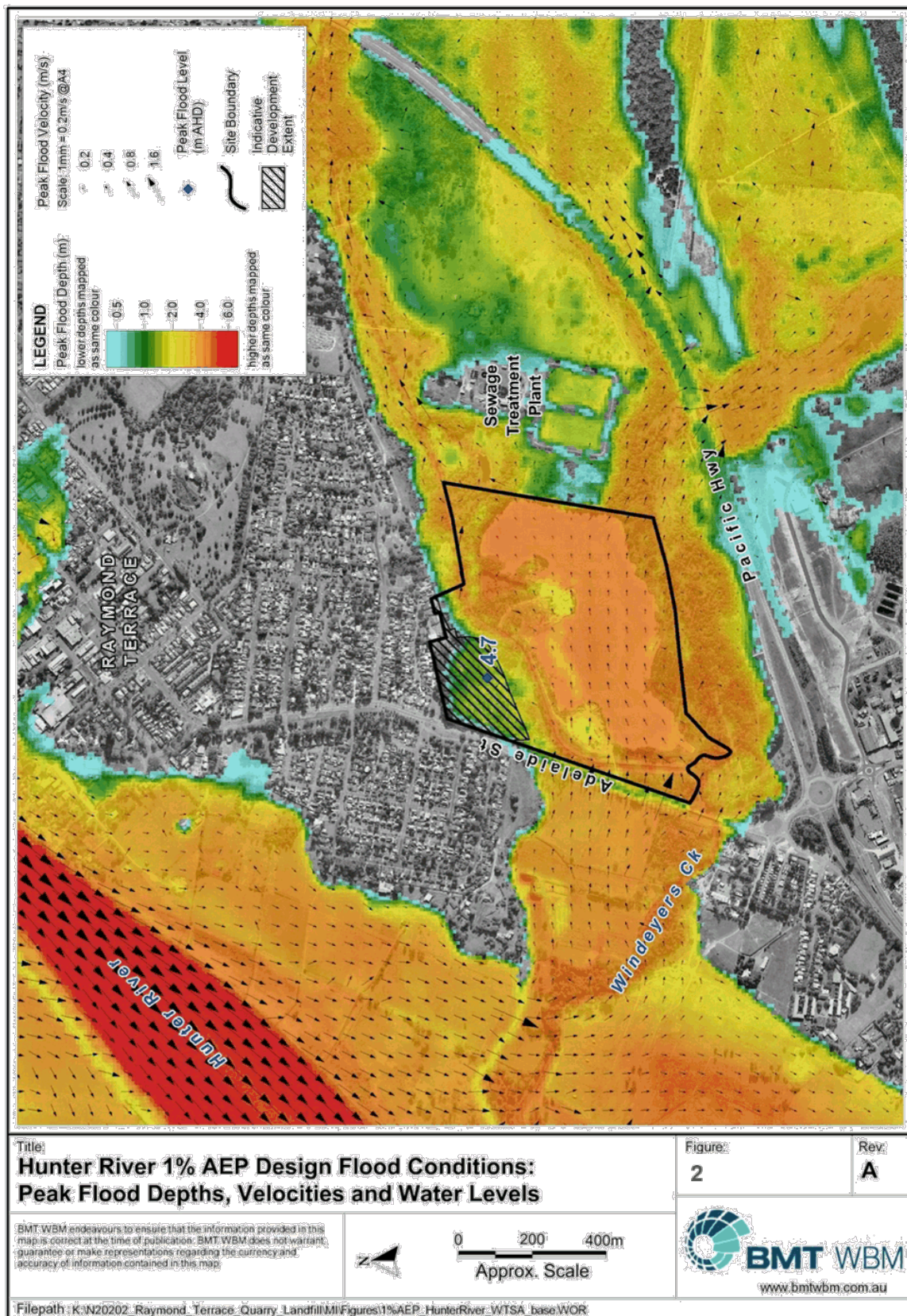
The inundation extents for 1% AEP flooding events including peak flood depths and velocities in the vicinity of the site are shown in Figure 2 and Figure 3 for Hunter River and Windeyers Creek flooding respectively.

The relative impacts at the site of local flooding of Windeyers Creek are far outweighed by mainstream Hunter River flooding. For the 1% AEP Hunter River flood event, there is extensive overtopping of the levee protection system, with large scale inundation extending upstream into the Windeyers Creek floodplain.

Being the dominant mechanism in terms of peak flood levels, the Hunter River flooding condition would be adopted in the derivation of flood planning levels (FPLs).

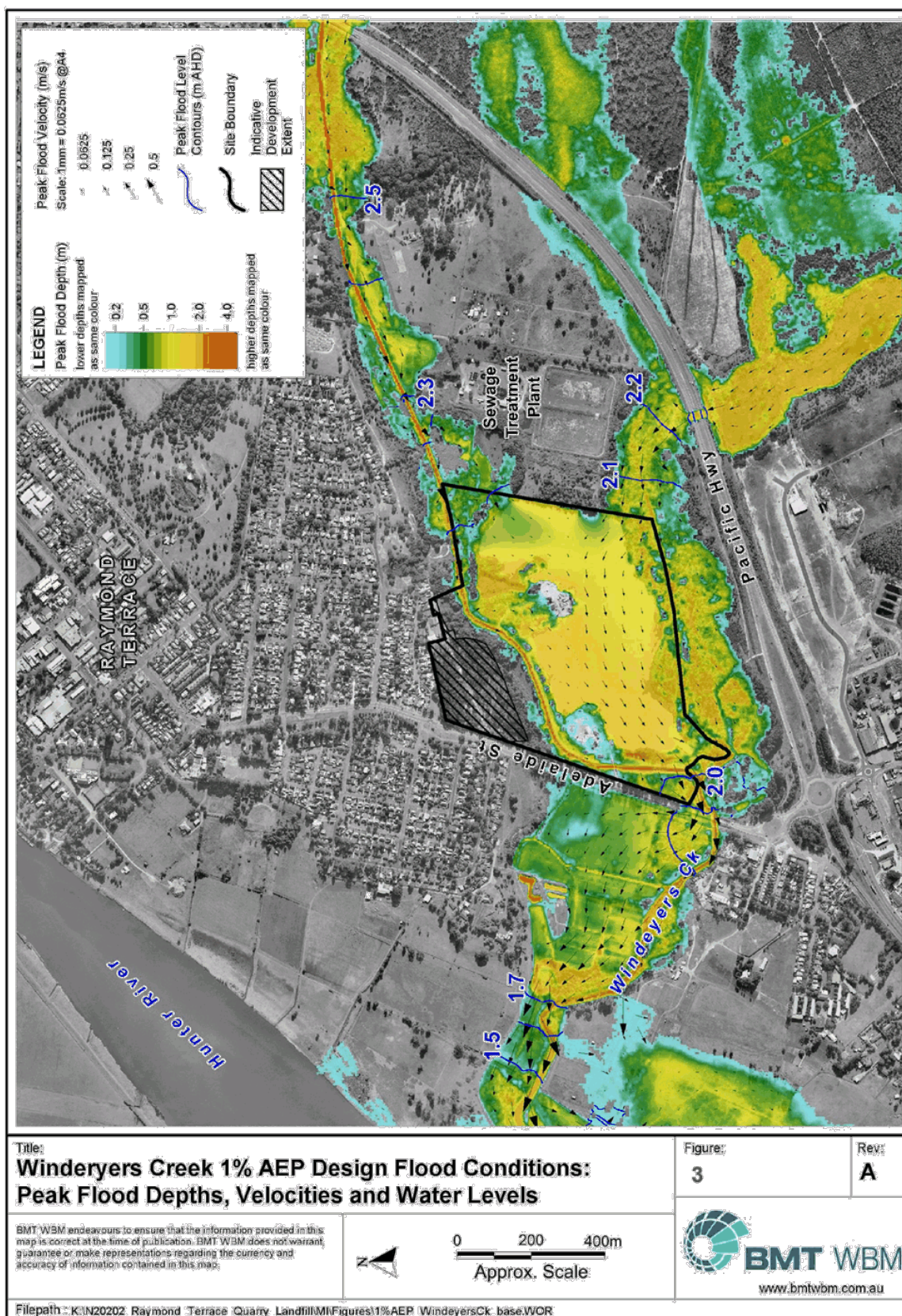
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Existing design flood conditions for each flooding mechanism are detailed below.

Hunter River Flooding

Design flood conditions were developed for the Lower Hunter and Williams River System in the Williamstown / Salt Ash Flood Study Review (BMT WBM, 2012). Following on from the flood study, the Williamstown / Salt Ash Floodplain Risk Management Study (BMT WBM, 2017) was completed. The study involved further updates and refinement to modelling and provides the most recent definition of design flood conditions at the site.

The 1% AEP design conditions for Hunter River flooding were derived from adopting the following boundary conditions:

- Hunter River flow at Raymond Terrace, just downstream of the confluence with the Williams River. The Williams River inflow components were scaled to produce a peak flood level for the 1% AEP of ~4.8m AHD – consistent with the Flood Frequency Analysis for Raymond Terrace.
- Water level time series at the downstream boundaries of Newcastle Harbour and Tilligerry Creek. The time series are representative of 50% AEP design conditions.
- Local catchment inflows into the Hunter River, including the Windeyers Creek catchment, derived from 10% AEP design rainfall conditions. A 48 hour duration design storm was adopted as it was found to be the critical event for the catchment.

A water level time series along the Hunter River was extracted from the Williamstown / Salt Ash model and was applied at the boundary of the local model developed for this study. The finer cell resolution adopted in this study (5m grid compared to 40m grid in the former study) provided the necessary detail to compare development impacts as a result of filling the site.

For the 1% AEP flooding condition, inundation across the floodplain is extensive. Both the levee protection system and Adelaide Street are significantly overtopped. The storage area is filled and floodwaters breach over sections of the Pacific Highway. Typical depths across the site are within the order of 3.0-4.0m (refer to Figure 2), with the peak water level at approximately 4.7m AHD. The broader low-lying floodplain of Windeyers Creek provides for an extensive storage area of Hunter River derived floodwater. The elevated road embankments of both Adelaide Street and the Pacific Highway provide some level of control, however, extensive overtopping of both roads are expected at the 1% AEP Hunter River flood magnitude.

The main flow path traverses through the centre of the site across the lake, as indicated by the velocity vectors shown on Figure 2.

Local Catchment Flooding of Windeyers Creek

In order to gain a full appreciation of catchment derived flooding conditions, the local Windeyers Creek model was run without influence from Hunter River tailwater conditions. Past studies including the Williamstown / Salt Ash Flood Study adopted a tailwater condition of ~1.2m AHD which is representative of the 50% AEP (2yr ARI) Hunter River water level. During coincident flooding events of the Hunter River and Windeyers Creek, the levee system offers significant protection against backwater inundation from Hunter River water levels up to around 2.0m AHD. Accordingly, the simulated flood conditions shown in Figure 3 are largely derived from the local Windeyers Creek catchment.

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The Adelaide St road embankment acts as a major control for Windeyers Creek flooding with flow confined to the existing bridge opening (i.e. no local overtopping of Adelaide St). The resulting flood levels at the proposed development site are influenced by the backwater from the Adelaide St bridge. Upstream of the development site, the elevated Pacific Highway embankment also provides for a significant hydraulic control, particularly on the southern tributary of Windeyers Creek.

The extent of overbank inundation within the site boundary is generally maintained within the disused quarry lake area between the two Windeyers Creek branches, to the west of the elevated sewage treatment plant. Typical depths across the site are within the order of 0.5-1.5m, with the peak water level at 2.1m AHD. Velocity of floodwaters are generally less than 0.3m/s, with higher velocities (up to 1m/s) contained within the realigned Windeyers Creek channel along the northern boundary of the site. Due to the poorly defined nature of the southern creek branch, the main flood path along the southern boundary of the site is less distinct. Modelled floodwaters spill out of the natural creek channel onto the disused quarry area. The preferential flow path across the lake is indicated on Figure 3.

There is notable attenuation of floodwaters over the wider catchment due to the flat topography and remnant sand dunes. The local hydraulic model was developed by applying inflow boundary conditions derived from the XP-RAFTS hydrological model at selected locations. Due to the flooding behaviour of the wider floodplain, the inflows derived from the XP-RAFTS model are expected to be slightly higher than what would realistically occur as some attenuation outside the model domain is not explicitly accounted for. The results found in this study are conservative and would represent the maximum peak flood level likely across the site. Previous model results from the Williamstown Salt Ash Flood Study (WBM Oceanics, 2004) indicated that 1% AEP flooding of Windeyers Creek resulted in peak flood levels at the site of 1.9m AHD. Therefore, it is appropriate to assume that peak flood conditions in the order of 1.9-2.1m AHD should be expected at the site for the 1% AEP event.

### Development Potential

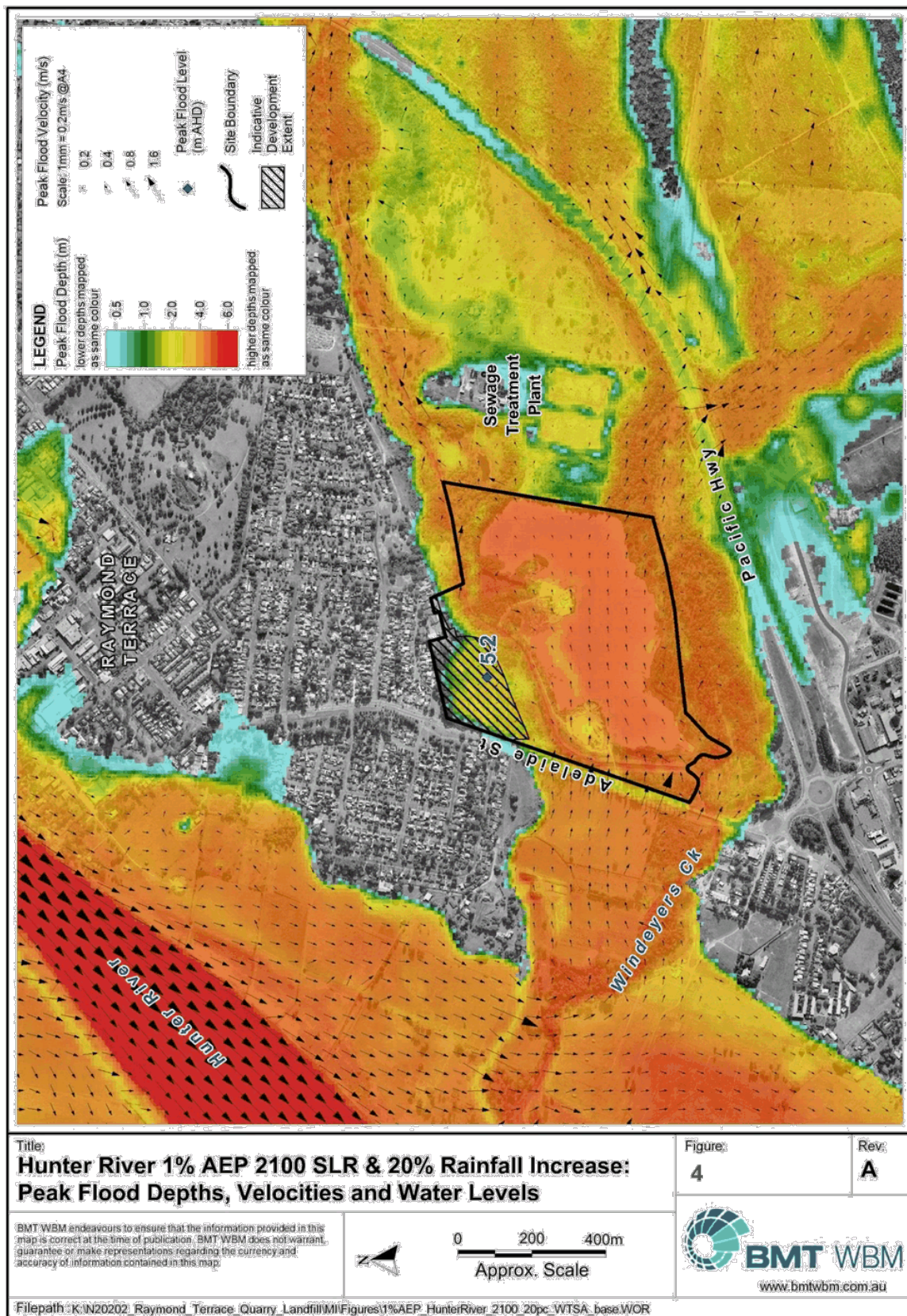
In considering the impact of flood conditions on potential development, the Hunter River conditions will drive the required flood planning level (FPL). The Williamstown / Salt Ash FRMS (BMT WBM, 2017) was in part prepared to inform Council of the likely changes in flood behaviour within the study area that may arise through future climate change conditions, particularly in relation to flood planning levels. Following completion of the study, Council has adopted the 1% AEP Hunter River design event including a 0.9m sea level rise allowance and 20% increase in flow (indicative 2100 planning horizon) to define flood planning levels. A similar 20% increase in design rainfall intensity is applied to the local Windeyer's Creek catchment.

The peak flood inundation extents and depths for the 1% AEP flood planning event for Hunter River and Windeyers Creek flooding are shown in Figure 4 and Figure 5 respectively.

A summary of the simulated peak water levels for existing and flood planning conditions (2100 planning horizon) is shown in Table 1. At the site, the peak flood level for the appropriate flood planning event is 5.2m AHD. An additional allowance for freeboard is required for certain types of development. For residential development, a freeboard of 0.5m is typically required. This would provide for a FPL of 5.7m AHD for habitable floor levels at the site.

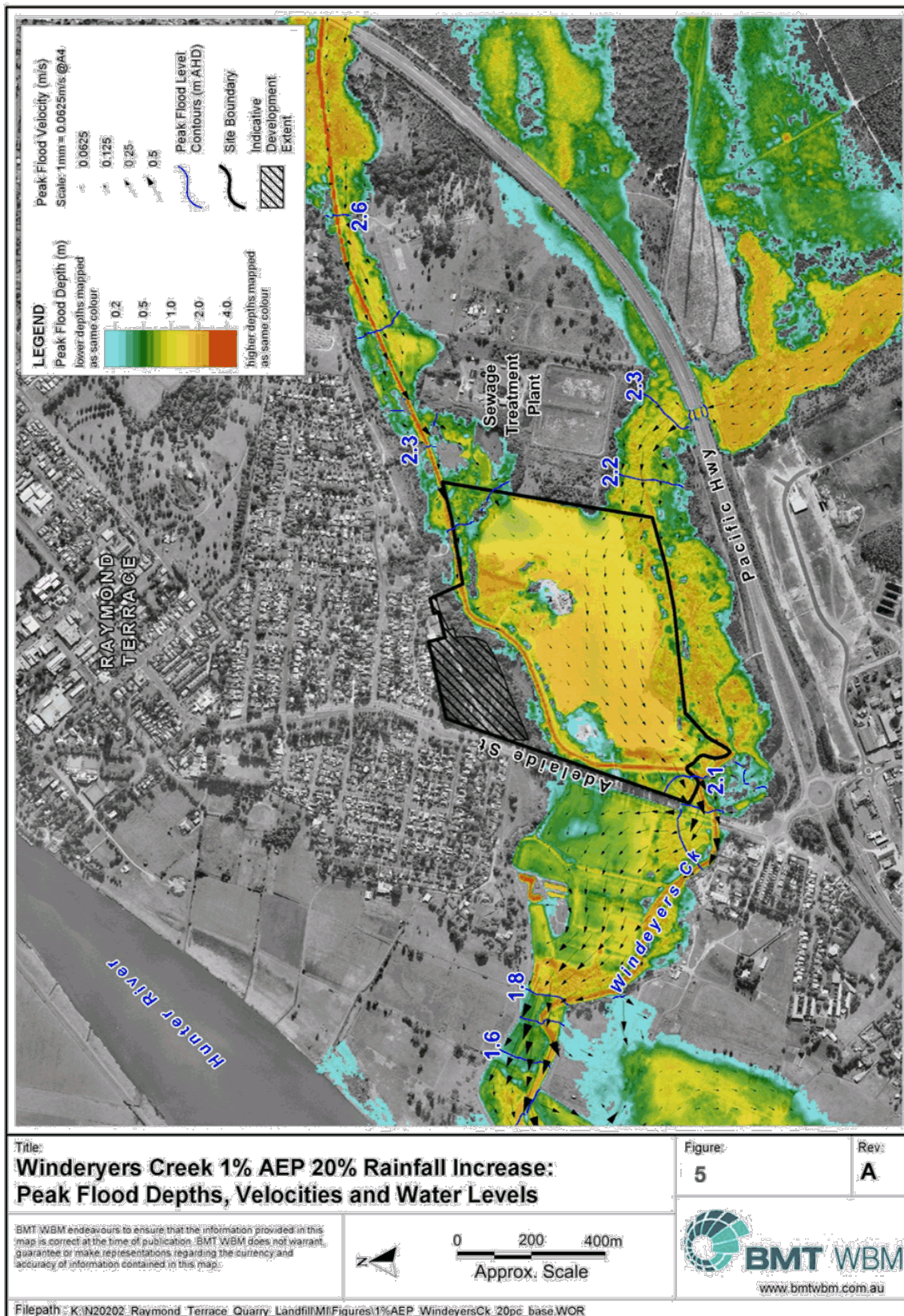
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**Table 1 Peak Flood Levels at 251 Adelaide St, Raymond Terrace**

Flooding Mechanism	Peak flood level (m AHD)
Hunter River 1% AEP (BMT WBM, 2017)	4.7
Hunter River 1% AEP 2100 planning horizon w/ 0.9m SLR and 20% increase in flow (BMT WBM, 2017)	5.2
Windeyers Creek 1% AEP	2.1
Windeyers Creek 1% AEP 2100 planning horizon with 20% increase rainfall	2.2

As the majority of the site is elevated below 2.5m AHD, an extensive amount of fill would be required to provide flood immunity to the 1% AEP flood level and is indicative of the severity of flooding affecting the area and suggests that stringent controls would apply to any proposed development in this location. Preliminary investigation into flood constraints at the site indicated that filling of a large, central portion of the site was not viable due to potential for changes to existing flood conditions through:

- Redistribution of flow arising from works on the floodplain;
- Concentrated discharges and subsequent impact on downstream areas; and
- Increase in flood levels through impedance of overland flow paths and loss of temporary flood storage.

As a consequence of the preliminary investigation, this current study is focused on filling the north-western portion of the site only. The assessment will assume the parcel of land indicated as having development potential to above the peak 1% AEP flood level. This represents the exclusion of all existing flood storage within the fill footprint.

It should be noted that the proposed development extent is outside of the 1% AEP Windeyers Creek flood inundation extent (refer to Figure 5). Therefore, impacts will be assessed for Hunter River derived flooding only. This assessment is focused on identifying the opportunity for development based on the flooding constraints and potential flood impacts. The assessment has not considered other design constraints such as environmental constraints, construction practicalities, planning approvals etc.

## Flood Impact Assessment

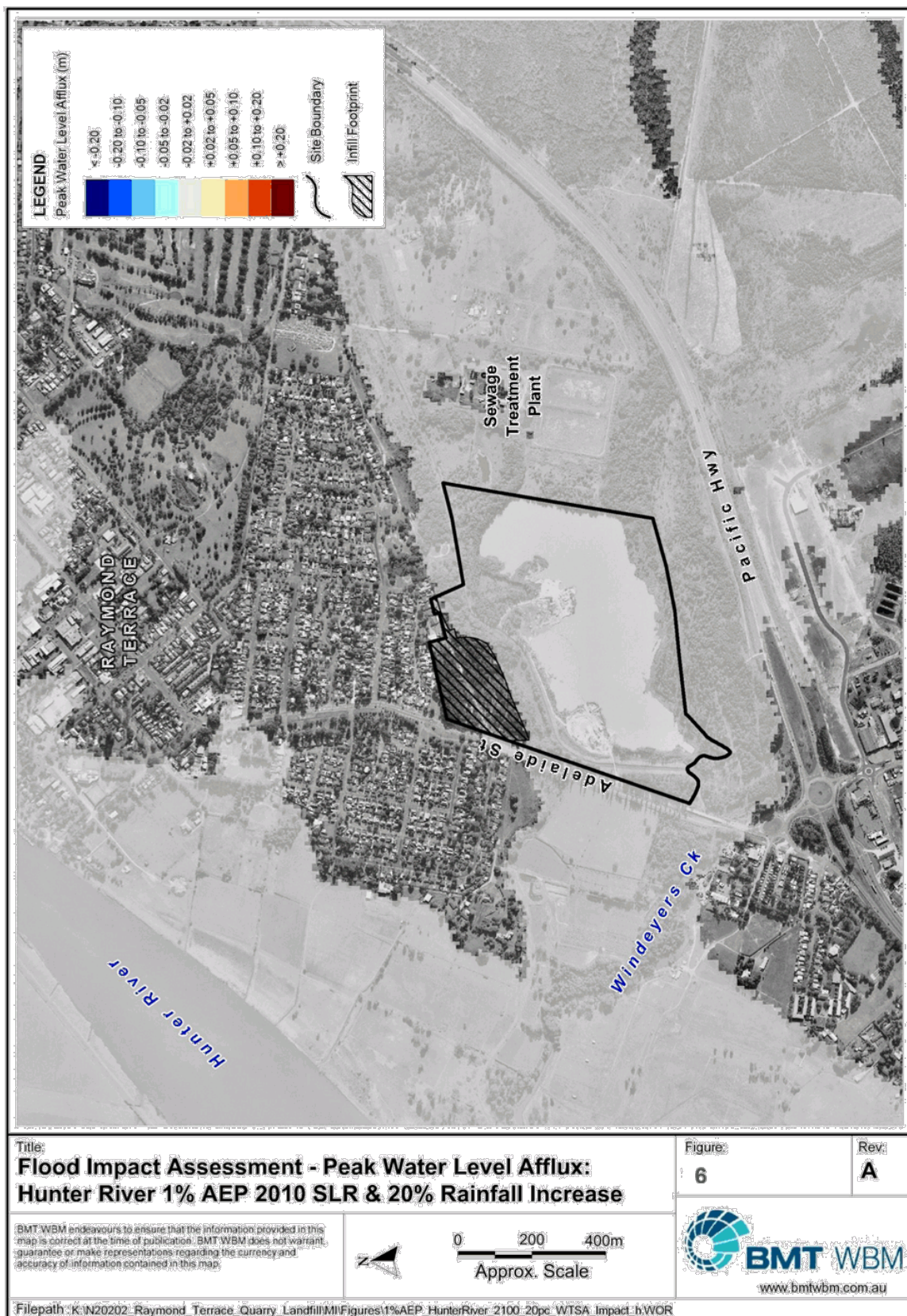
The proposed development layout is included in Appendix A for reference. Within the model the development footprint area, ground levels have been raised above the adopted FPL for habitable dwellings (i.e. 5.7m AHD).

The simulated change in peak flood level and peak flood velocity for the proposed fill footprint is shown in Figure 6 and Figure 7 respectively. In both instances, there are no significant impacts on existing flood water level and velocity distributions for the proposed fill footprint.

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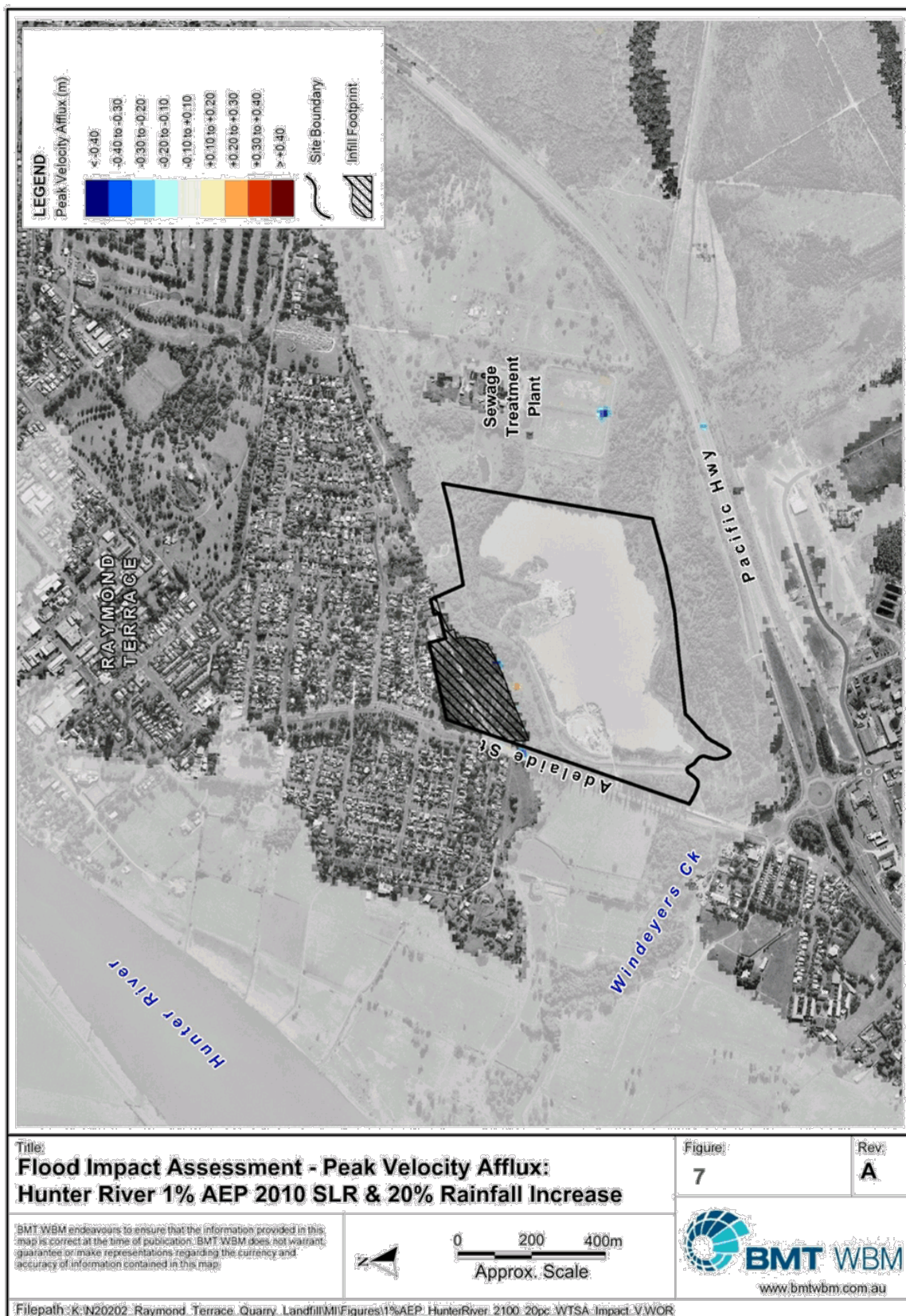


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The proposed development area is located on the fringe of the 1% AEP Hunter River flood inundation extent, where velocities are minor (less than 0.1m/s) and depths are typically in the order of 1-2m. Residential development located to the north-west of the site on the opposite side of Adelaide Street (Wahroonga Street and Parkway Avenue area) is elevated well above the floodplain and offers protection to the proposed development area from Hunter River flooding. As such, the results of the flood impact assessment show that there will be negligible impact to existing 1% AEP design flood conditions at the site as a result of filling the north-western corner out of the floodplain. Increases in peak flood levels and velocities are less than 5mm and 0.05m/s. respectively.

The flood impact assessment has only considered the proposed fill footprint for the proposed dwellings (raised to the FPL). At this stage of the development design, there is no detail of the proposed access road that runs from Adelaide Street through to the development lots. The access road traverses the flood inundation area under both Hunter River and Windeyers Creek flood conditions (refer to Figure 4 and 5). The road elevations and cross drainage provisions will need to be designed to meet the objectives for access road flood immunity and minimising potential adverse impacts through elevated road profiles.

#### Other Considerations

In assessing the development potential site there are a number of other considerations with respect to flooding including:

- Risks to life considered for flood events up to the PMF;
- Flood warning; and
- Emergency response and flood access.

Whilst these aspects have not been considered in detail to date, the following comments are offered. The Hunter River flooding is noted as the dominant flooding mechanism and far exceeds the Windeyers Creek flooding in terms of severity. Accordingly, the design standards for any proposed development on the site is based on peak Hunter River flood levels. With regards the other design considerations noted above, it is important to note that flooding of the wider Hunter / Williams River system has a very long warning time (likely to be days), with flood waters rising slowly as a result of the large contributing catchment area. Accordingly, it is envisaged that existing formal flood warning and emergency procedures for the Hunter River would serve proposed development at the site for flood events in excess of the 1% AEP design standard.

I trust the above provides a suitable description of the opportunity and constraints for development at the subject site. Please feel free to contact the undersigned to discuss further as required.

Yours Faithfully  
**BMT WBM**

**Darren Lyons**  
Water & Environment Manager – Newcastle

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References:

BMT WBM (2012) Williamtown / Salt Ash Flood Study Review, prepared for Port Stephens Council

BMT WBM (2017) Williamtown-Salt Ash Floodplain Risk Management Study and Plan (in preparation),  
prepared for Port Stephens Council

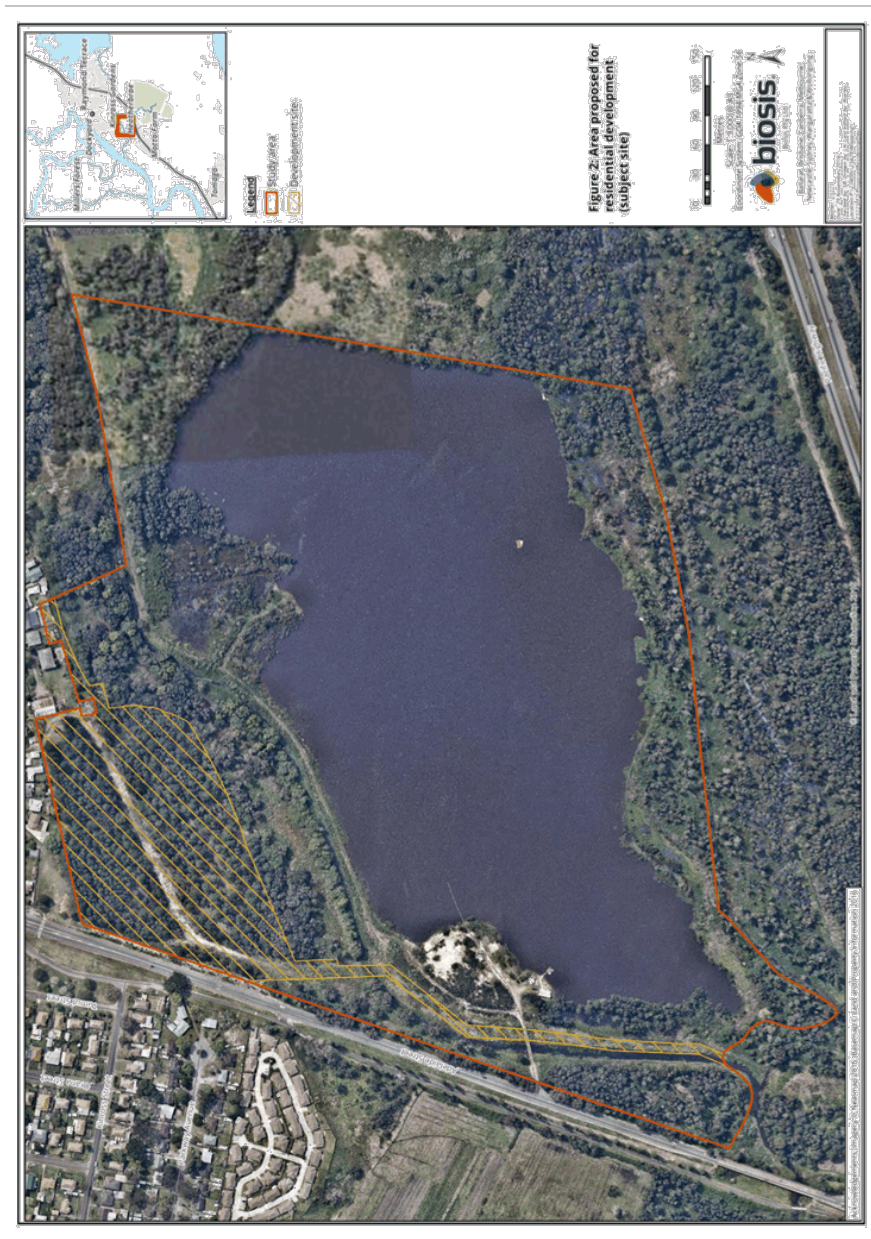
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Appendix A – Proposed Development Layout



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