Lend Lease

# Hydrological Mitigation Report

PACIFIC HIGHWAY UPGRADE
OXLEY HIGHWAY TO KUNDABUNG

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# Glossary of terms and abbreviations

| Term/Abbreviation | Description |
|---|---|
| **mAHD** | Metres above Australian Height Datum |
| **ARI** | Average Recurrence Interval |
| **EA** | Pacific Highway Upgrade: Oxley Highway to Kempsey Environmental Assessment (RMS, 2011) |
| **GIS** | Geographic Information System |
| **OH2Ku** | Oxley Highway to Kundabung project |
| **Planning and Infrastructure Minister's Approval** | (MP 07_0090) Project approval granted by the (then) NSW Department of Planning and Infrastructure under Section 75J of the Environmental Planning and Assessment Act 1979, in 2012 (consolidated conditions of approval). |
| **PMHC** | Port Macquarie Hastings Council |
| **RMS** | Roads and Maritime Services |
| **SWTC** | Scope of Works and Technical Criteria |

# 1 Introduction

## 1.1 Project background

Lend Lease Engineering (The "Contractor") has been commissioned by the Roads and Maritime Services (RMS) to undertake the Detailed Design and Construction of the Pacific Highway Upgrade between the Oxley Highway Interchange and Kundabung. The Project involves upgrading the existing two-way Pacific Highway to a dual carriageway configuration, improving road safety, reducing highway congestion and providing a safer local road network.

The project comprises the construction of approximately 23km of new dual carriageway highway including four interchanges at Sancrox Road, Blackmans Point Road, Haydons Wharf Road and Yarrabee Road, major waterway crossings at Hastings River and Wilson River, and a crossing of the North Coast Rail Line. The project will connect to the existing Pacific Highway to the north of the Oxley Highway Interchange at Port Macquarie and to the Kundabung to Kempsey section of the Pacific Highway which is being upgraded to dual carriageway highway by RMS under a separate contract.

The project crosses a number of different watercourses including Fernbank Creek, Hastings River, Wilson River, Cooperabung Creek and Barrys Creek.

Floodplains across the project are associated with the Hastings and Wilson Rivers. In the Hastings River Floodplain, there are scattered rural residential properties with a concentration of rural dwellings located along Glen Ewan Road on the southern side of the river. Agriculture is the predominant land use within the floodplain, with the major form being grazing.

Similar to Hastings River, the Wilson River Floodplain is predominantly agricultural (grazing) and rural residential. Rural residential properties are scattered across the floodplain, but are concentrated in the village of Telegraph Point which straddles the Wilson River. The main retail and residential area of the village is located on the northern side of Wilson River, outside of the floodplain extent. However, properties to the south of Wilson River, particularly along Mooney Street also form part of the village.

## 1.2 Purpose of this report

As a condition of the Planning and Infrastructure Minister's Approval for the Pacific Highway Upgrade, Oxley Highway to Kempsey, RMS is required to prepare a Hydrological Mitigation Report. This is to identify any mitigation works required for properties in the Hastings and Wilson River Floodplain where adverse flooding impacts are predicted as a result of the project.

This report considers the existing flood conditions, identifies the modelling undertaken and assesses the predicted changes to flooding behaviour due to the project. Impacts to properties, access and infrastructure have been considered as a result of the changes to flooding behaviour from the project.

### 1.2.1 Planning and Infrastructure Minister's Approval

This report specifically addresses Conditions of Approval (CoA) B12 and B13 of the Planning and Infrastructure Minister's Approval for the project. These Conditions of Approval relate to hydrological and flooding impacts. Table 1 details the relevant conditions to comply with and identifies where in this document or in companion reports the compliance is demonstrated.

**Table 1 Planning and Infrastructure Minister's approval and Statement of Commitments**

| Reference | Condition | Reference |
|---|---|---|
| CoA B12 | The Proponent shall develop a Hydrological Mitigation Report for properties in the Hastings River and Wilson River Floodplain areas where flood impacts are predicted to increase as a result of the project. The Report shall be based on detailed floor level survey and associated assessment of potentially flood affected properties in those areas. The Report shall: | This report |
| | (a) identify properties in those areas likely to have an increased flooding impact and detail the predicted increased flooding impact; | Sections 3.1, 3.2 and 3.3 |
| | (b) identify mitigation measures to be implemented where increased flooding is predicted to adversely affect access, property or infrastructure; | Sections 4.1 and 4.2 |
| | (c) identify measures to be implemented to minimise scour and dissipate energy at locations where flood velocities are predicted to increase as a result of the project and cause localised soil erosion and/or pasture damage; | Section 4.3 |
| | (d) be developed in consultation with the relevant council, NSW State Emergency Service and directly-affected property owners; and | Section 4.5<br>Consultation to be undertaken with council andSES. |
| | (e) identify operational and maintenance responsibilities for items (a) to (c) inclusive. | Section 4.2.1 |
| | The Proponent shall not commence construction of the project on or within those areas likely to alter flood conditions until such time as works identified in the hydrological mitigation report have been completed, unless otherwise agreed by the Director General. | Noted. |
| CoA B13 | Based on the mitigation measures identified in CoA B12, the Proponent shall prepare a final schedule of feasible and reasonable flood mitigation measures proposed at each directly affected property in consultation with the property owner. The schedule shall be provided to the relevant property owner(s) prior to the implementation/construction of the mitigation works, unless otherwise agreed by the Director General. A copy of each schedule of flood mitigation measures shall be provided to the Department and the relevant council prior to the implementation/ construction of the mitigation measures on the property. | No mitigation measures have been identified for the project |

| Reference | Condition | Reference |
|---|---|---|
| CoA B14 | In the event that the Proponent and the relevant property owner cannot agree on feasible and reasonable flood mitigation measures to be applied to a property within one month of the first consultation on the measures (as required under CoA B13), the Proponent shall employ a suitably qualified and experienced independent hydrological engineer, who has been approved by the Director General, for the purposes of this condition prior to the commencement of construction on the Hastings River and Wilson River Floodplain areas affected by increased afflux from the project to advise and assist affected property owners in negotiating feasible and reasonable mitigation measures. | No mitigation measures have been identified for the project |
| CoA B15 | The Proponent shall provide assistance to the relevant council and / or NSW State Emergency Service, to prepare any new or necessary update (s) to the relevant plans and documents in relation to flooding, to reflect changes in flooding levels, flows and characteristics as a result of the project. | Not applicable as the project does not materially change the flooding levels, flows and characteristics and no plans or documents are required to be updated |

# 2 Flooding behaviour

This chapter provides a floodplain-wide discussion on existing flooding levels and depths and the predicted floodplain-wide changes in flooding behaviour as a result of the project.

## 2.1 Existing flooding behaviour

The following background information on both the Hastings and Wilson River Floodplain is obtained from the Oxley Highway to Kempsey EA based on the hydrological and flood modelling undertaken at that time.

### 2.1.1 Hastings River

The project is located entirely within the Hastings River catchment, which drains an area of around 3700 km$^2$ into the Pacific Ocean at Port Macquarie. The Wilson River is a major tributary of the Hastings River.

The Hastings River is a major watercourse in the Mid North Coast of NSW. It is tidally influenced at the existing highway crossing location and has a channel width of around 400 metres. The existing Pacific Highway crossing of the Hastings River is at the Dennis Bridge.

Fernbank Creek is located on the southern floodplain of the Hastings River and is hydraulically interconnected with the Hastings River. Fernbank Creek acts as a flood relief channel for the Hastings River, experiencing higher flow volumes during overbank flooding events of the Hastings River. The creek is around 65 metres wide. The predicted flood levels for the Hastings River at the existing highway crossing are provided in Table 2.

**Table 2 Predicted existing flood levels for the Hastings River at the existing highway crossing**

| Flood event | Predicted existing peak flood level (mAHD) |
|---|---|
| 1 in 5 year | 2.37 |
| 1 in 100 year | 3.81 |
| 1 in 200 year | 4.18 |
| 1 in 2,000 year | 5.50 |
| Extreme flood event | 6.97 |

*mAHD = metres above the Australian Height Datum.*

Existing flood depths across the Hastings River vary across the floodplain, with areas not affected, while other areas experiencing localised depths in excess of 2 metres. Flood depths experienced across the floodplain are shown in Appendix A (Figures A-1 to A-42).

The existing Pacific Highway, as it crosses the Hastings River Floodplain, provides an impediment to flow during flood conditions.

### 2.1.2 Wilson River

The Wilson River is a major watercourse. It is tidally influenced and has a channel width of about 300 metres set within a broad valley approximately 6 kilometres wide. The existing highway impedes flow across the southern floodplain of the Wilson River. The existing Pacific Highway Wilson River bridge and three smaller culvert openings along the southern embankment regulate flow to this common floodplain from the Wilson River.

Modelling indicates that the existing Pacific Highway crossing of the Wilson River remains flood free for all floods up to and including the 1 in 100 year flood event. The predicted flood levels for the Wilson River at the existing highway crossing are provided in Table 3.

**Table 3 Predicted existing peak flood levels for the Wilson River at the existing highway crossing**

| Flood event | Predicted peak flood level (mAHD) |
|---|---|
| 1 in 5 year | 2.70 |
| 1 in 100 year | 3.71 |
| 1 in 200 year | 4.10 |
| 1 in 2,000 year | 5.46 |
| Extreme flood event | 6.90 |

*mAHD = metres above Australian Height Datum*

Existing flood depths across the Wilson River vary across the floodplain, with areas not affected, while other areas experiencing localised depths in excess of 2 metres. Flood depths experienced across the floodplain are shown in Appendix A (Figures A-43 to A-51).

Flooding of the Wilson River is heavily influenced by flood events in the Hastings River. When the Hastings River is in flood, floodwaters back up into the Wilson River. This contributes to flooding across the Wilson River Floodplain.

## 2.2 Effects of the project works

The proposed Highway Upgrade crosses the Hastings River Floodplain approximately 300 metres upstream of the existing crossing. The proposed Highway Upgrade crosses the Wilson River Floodplain approximately 2.15 kilometres downstream of the existing crossing.

Flood modelling undertaken during detailed design identified the peak flood levels for the Hastings and Wilson Rivers. The predicted flood levels at the existing Pacific Highway bridge structures with the project in place for the 5, 100 and 2,000 year flood events in both floodplains are shown in Table 4 and 5 below. These locations have been chosen to provide a direct comparison to the predicted existing flood levels provided in Tables 1 and 2 above.

These tables show that there is no change to flood levels under the 1 in 2000 year flood event. For the 1 in 5 and 1 in 100 year flood events, there is only a change of 10 mm to flood levels upstream of the existing Pacific Highway. Across the Wilson River Floodplain, this is an increase in flood levels. For the Hastings River, as the existing crossing is downstream of the project, this is a reduction in flood levels.

**Table 4 Predicted proposed flood levels for the Hastings River at the existing highway crossing**

| Flood event | Predicted design peak flood level (mAHD) |
|---|---|
| 1 in 5 year | 2.36 |
| 1 in 100 year | 3.80 |
| 1 in 2,000 year | 5.50 |

**Table 5 Predicted proposed flood levels for the Wilson River at the existing highway crossing**

| Flood event | Predicted design peak flood level (mAHD) |
|---|---|
| 1 in 5 year | 2.71 |
| 1 in 100 year | 3.72 |
| 1 in 2,000 year | 5.46 |

Flood depth mapping and afflux mapping for the 100 year flood event across the modelled extent are shown in Appendix A.

# 3 Flood modelling assessment

This chapter provides a discussion to address B12 (a):

*(a) identify properties in those areas likely to have an increased flooding impact and detail the predicted increased flooding impact.*

## 3.1 Flood modelling methodology

During detailed design, further hydraulic modelling has been undertaken to further assess the hydraulic impacts of the project on the floodplain and properties.

### 3.1.1 Modelling set up and assumptions

The 2D model domain generated for simulation in RMA-2 is based on a variable finite elements mesh. The mesh detail has been developed to represent the topography, natural hydraulic features and catchment roughness. The mesh is finer local to the bridge and culvert structures to improve resolution.

The extent of the 2D domain was defined by digitising an area that included:

- All potential flow paths within the wider Hastings and Wilson River Floodplain area, including the main rivers and tributaries;
- All design features of existing roads and the project alignment including road formation, all earthworks and local road works; and
- Extending to the outlet of the Hastings River to the Pacific Ocean where tidal levels influence the extent of regional flooding.

The 2D mesh is unchanged from the RMS warranted version for the existing assessment while changes to the 2D mesh have been made locally within the project boundary to incorporate the proposed structures and earthworks. The project design assessed was the Substantial Detailed Design.

## 3.2 Property impact assessment

The approach taken for the property impact assessment for the project included:

- Step 1: identify the flood event where the afflux would have the greatest impact on the floodplain from the existing flood behaviour by reviewing the flooding impacts of the 5, 20, 50 and 100 year flood events against the existing flooding behaviour.
- Step 2: confirm all properties within the predicted afflux extents have been included and identify every structure that falls within that particular flood event to provide an individual property assessment of potential flooding impacts (refer to section 3.3 below).

### 3.2.1 Flood events reviewed

Flood modelling was undertaken as part of the detailed design to determine if flood impacts are predicted to increase as a result of the project from the existing flood behaviour. Flood events assessed were the 5, 20, 50 and 100 year flood events based on available hydrology and included assessment of structures within the floodplains (as identified in the Oxley Highway to Kundabung Flood Assessment Report - Hastings River and Wilson River Floodplain, January 2013.

To identify the flood event with the greatest flooding impact (ie Step 1 identified in Section 3.2), a review of the flood modelling was undertaken to identify the change in flood levels at each structure in the different flood events. The results of this assessment are provided in Table 6 and 7 below.

The same number of properties was assessed for all four flood events, 39 and 74 for the Hastings River and Wilson River Floodplain respectively. The change in flood level increases as the Average Recurrence Interval (ARI) increases (ie the 100 year events result in more structures being affected by greater changes in flood level). The exception to this is a small pocket of properties on the Wilson River Floodplain in the 5 year flood event, where impacts to three properties are in excess 0.02m.

**Table 6 Change in impacts within the Hastings River Floodplain**

| **Change in flood level** | **Total structures affected** | | | |
|---|---|---|---|---|
| | **5 year flood event** | **20 year flood event** | **50 year flood event** | **100 year flood event** |
| Less than or 0.00 m | 36 | 25 | 17 | 14 |
| < 0.01 m | 3 | 0 | 0 | 0 |
| 0.01 m – 0.02 m | 0 | 13 | 18 | 0 |
| 0.02 m – 0.03 m | 0 | 1 | 4 | 24 |
| 0.03 m – 0.04 m | 0 | 0 | 0 | 1 |
| **Total structures affected** | **39** | **39** | **39** | **39** |

**Table 7 Change in impacts across the Wilson River Floodplain**

| **Change in flood level** | **Total structures affected** | | | |
|---|---|---|---|---|
| | **5 year flood event** | **20 year flood event** | **50 year flood event** | **100 year flood event** |
| Less than or 0.00 m | 69 | 66 | 54 | 36 |
| < 0.01 m | 2 | 8 | 10 | 12 |
| 0.01 m – 0.02 m | 0 | 0 | 10 | 12 |
| 0.02 m – 0.03 m | 3 | 0 | 0 | 0 |
| **Total structures affected** | **74** | **74** | **74** | **74** |

#### 3.2.1.1. 5 year flood event

### Hastings River

The existing flood depths experienced on the floodplain range from between 0.01 m and 3 m on land, but depths within the Hastings River are in excess of 5 metres.

There are only three structures that would have an increased impact. Identification of the existing flood level at the structure, floor level and the afflux from the project are shown below.

**Table 8 Hastings River - Structures with increased impact - 5 Year Event**

| Asset ID | Existing flood level (mAHD) | Structure ground floor level (mAHD) | Afflux (m) |
|---|---|---|---|
| 20 | 2.451 | 1.56 | 0.009 |
| 21 | 2.456 | 2.03 | 0.008 |
| 29 | 2.541 | 2.39 | 0.004 |

The increase in flood level as a result of the project would be less than 0.01m. This increase in afflux is not considered to be a reportable impact (refer to Section 3.3.1). As such, flooding impacts from the project under a 5 year flood event do not represent an adverse impact. These structures are also already inundated under an existing 5 year flood event.

In addition, no additional structure would be newly inundated as a result of the project and no adverse impacts to the road network as roads are already flooded under the existing flood event (refer to section 3.3.1.4).

### Wilson River

The existing flood depths experienced on the floodplain range from between 0.01m and 3m on land, but depths within the Wilson River are in excess of 5 metres.

There are only five structures that would have an increased impact. Identification of the existing flood level at the structure and the afflux from the project are shown below.

**Table 9 Wilson River - Structures with increased impact - 1 in 5 Year Event**

| Asset ID | Existing flood level (mAHD) | Structure ground floor level (mAHD) | Afflux (m) |
|---|---|---|---|
| 49 | 2.475 | 2.23 | 0.022 |
| 51 | 2.520 | 2.18 | 0.017 |
| 52 | 2.503 | 2.24 | 0.020 |
| 54 | 2.508 | 2.26 | 0.019 |
| 57 | 2.507 | 1.7 | 0.020 |

These structures are already inundated under existing 5 year flood event, and the minor increase in flood levels as a result of the project would not represent an adverse impact.

In addition, no additional structure would be newly inundated as a result of the project and no adverse impacts to the road network as roads are already flooded under the existing flood event (refer to section 3.3.1.4).

#### 3.2.1.2. 20 year flood event

### Hastings River

The existing flood depths experienced on the floodplain range from between 0.01 m and 3 m on land, but depths in excess of 3m on isolated areas of Rawdon Island. Depths within the Hastings River are in excess of 4 metres.

There are fourteen structures that would have an increased impact. Identification of the existing flood level at the structure, floor level and the afflux from the project are shown below.

**Table 10 Hastings River - Structures with increased impact – 1 in 20 Year Event**

| Asset ID | Existing flood level (mAHD) | Structure ground floor level (mAHD) | Afflux (m) |
|---|---|---|---|
| 8 | 3.125 | 3.12 | 0.024 |
| 20 | 3.193 | 1.56 | 0.015 |
| 21 | 3.199 | 2.03 | 0.014 |
| 24 | 3.218 | 3.22 | 0.012 |
| 28 | 3.271 | 2.74 | 0.012 |
| 29 | 3.276 | 2.39 | 0.012 |
| 30 | 3.284 | 2.51 | 0.012 |
| 31 | 3.288 | 2.62 | 0.012 |
| 34 | 3.349 | 2.78 | 0.011 |
| 35 | 3.331 | 3.13 | 0.011 |
| 36 | 3.330 | 2.79 | 0.011 |
| 37 | 3.343 | 3.1 | 0.011 |
| 39 | 3.381 | 3.38 | 0.011 |
| 40 | 3.368 | 3.22 | 0.011 |

These structures are already inundated (bar one) under an existing 20 year flood event. The one structure, 24, based on the available information, would be newly inundated by the project. However, since this information was obtained, this structure appears to have been replaced and it is anticipated that the floor level would be higher than the available information due to the installation of a new concrete slab. It also appears that the area around the structure has been raised from the surrounding land, further increasing the floor level. This could result in the structure not being inundated by the project. However, even if the project does result in the estimated flooding of 0.012m, this would be a minor impact, particularly as the use of the structure is for agricultural equipment. As such, given the anticipated use of the structure and the durable concrete slab floor, this impact is not considered to be adverse.

As such, flooding impacts from the project under a 20 year flood event do not represent an adverse impact.

In addition, there are no adverse impacts to the road network as roads are already flooded under the existing flood event.

### Wilson River

The existing flood depths experienced on the floodplain range from between 0.01m and 3m on land, but depths within the Wilson River are in excess of 4 metres. There are eight structures that would have an increased impact. Identification of the existing flood level at the structure and the afflux from the project are shown below.

**Table 11 Wilson River - Structures with increased impact – 1 in 20 Year Event**

| Asset ID | Existing flood level (mAHD) | Structure ground floor level (mAHD) | Afflux (m) |
|---|---|---|---|
| 44 | 2.893 | 2.21 | 0.002 |
| 45 | 2.893 | 2.66 | 0.001 |
| 49 | 2.893 | 2.23 | 0.007 |
| 51 | 2.899 | 2.18 | 0.006 |
| 52 | 2.898 | 2.24 | 0.007 |
| 53 | 2.898 | 2.56 | 0.007 |
| 54 | 2.898 | 2.26 | 0.007 |
| 57 | 2.895 | 1.7 | 0.008 |

These structures are already inundated under an existing 20 year flood event. As such, the minor increase in afflux from the project under a 20 year flood event does not represent an adverse impact.

In addition, no additional structure would be newly inundated as a result of the project and no adverse impacts to the road network as roads are already flooded under the existing flood event.

#### 3.2.1.3. 50 year flood event

### Hastings River

The existing flood depths experienced on the floodplain range from between 0.01 m and 3 m on land, but depths in excess of 3m on isolated areas of Rawdon Island and north of Hastings River. Depths within the Hastings River are in excess of 4 metres.

There are 22 structures that would have an increased impact. Identification of the existing flood level at the structure, floor level and the afflux from the project are shown below.

**Table 12 Hastings River - Structures with increased impact – 1 in 50 Year Event**

| Asset ID | Existing flood level (mAHD) | Structure ground floor level (mAHD) | Afflux (m) |
|---|---|---|---|
| 8 | 3.590 | 3.12 | 0.028 |
| 9 | 3.621 | 3.24 | 0.018 |
| 15 | 3.623 | 3.09 | 0.020 |
| 16 | 3.619 | 3.2 | 0.019 |
| 17 | 3.618 | 3.49 | 0.017 |
| 20 | 3.648 | 1.56 | 0.020 |
| 21 | 3.654 | 2.03 | 0.020 |
| 23 | 3.682 | 3.5 | 0.019 |
| 24 | 3.680 | 3.22 | 0.019 |
| 25 | 3.681 | 3.39 | 0.019 |
| 28 | 3.732 | 2.74 | 0.018 |
| 29 | 3.737 | 2.39 | 0.017 |
| 30 | 3.746 | 2.51 | 0.017 |
| 31 | 3.751 | 2.62 | 0.017 |
| 33 | 3.786 | 3.97 | 0.017 |
| 34 | 3.825 | 2.78 | 0.016 |
| 35 | 3.810 | 3.13 | 0.016 |
| 36 | 3.810 | 2.79 | 0.016 |
| 37 | 3.822 | 3.1 | 0.016 |
| 38 | 3.863 | 3.57 | 0.015 |
| 39 | 3.859 | 3.38 | 0.015 |
| 40 | 3.847 | 3.22 | 0.016 |

These structures (bar one) are also already inundated under an existing 50 year flood event. As such, flooding impacts from the project under a 50 year flood event do not represent an adverse impact.

In addition, Structure 33 (shed) is not currently flooded and there are no additional structures that would be newly inundated as a result of the project. There would not be any adverse impacts to the road network as roads are already flooded under the existing flood event.

## Wilson River

The existing flood depths experienced on the floodplain range from between 0.01m and 3m on land, with areas near the Wilson River getting to depths of up to 4 m. Depths within the Wilson River are in excess of 4 metres.

There are 20 structures that would have an increased impact. Identification of the existing flood level at the structure and the afflux from the project are shown below.

**Table 13 Wilson River - Structures with increased impact – 1 in 50 Year Event**

| Asset ID | Existing flood level (mAHD) | Structure ground floor level (mAHD) | Afflux (m) |
|---|---|---|---|
| 41 | 3.300 | 3.07 | 0.002 |
| 42 | 3.300 | 2.29 | 0.001 |
| 43 | 3.300 | 1.75 | 0.001 |
| 44 | 3.301 | 2.21 | 0.002 |
| 45 | 3.301 | 2.66 | 0.002 |
| 46 | 3.301 | 2.21 | 0.001 |
| 47 | 3.299 | 2.97 | 0.010 |
| 48 | 3.300 | 3.25 | 0.010 |
| 49 | 3.302 | 2.23 | 0.010 |
| 50 | 3.302 | 2.94 | 0.010 |
| 51 | 3.305 | 2.18 | 0.009 |
| 52 | 3.305 | 2.24 | 0.010 |
| 53 | 3.305 | 2.56 | 0.010 |
| 54 | 3.305 | 2.26 | 0.010 |
| 57 | 3.301 | 1.7 | 0.011 |
| 66 | 3.310 | 3.15 | 0.010 |
| 70 | 3.626 | 3.1 | 0.003 |
| 71 | 3.638 | 3.22 | 0.001 |
| 96 | 3.315 | 3.32 | 0.008 |
| 97 | 3.315 | 2.96 | 0.014 |

These structures are already inundated (bar one- 96) under existing 50 year flood event. The minor increase in afflux from the project under a 50 year flood event does not represent an adverse impact.

It is noted that structure 96 (a garage) above, appears to be newly inundated as a result of the project. However, the increase in afflux is 0.008 m which, as being less than 0.01m, is not typically considered as a reportable impact (refer to section 3.3.1 for further details).

In addition, no adverse impacts would result to the road network as roads are already flooded under the existing flood event.

#### 3.2.1.4. 100 year flood event

### Hastings River

The existing flood depths experienced on the floodplain range from between 0.01 m and 4 m on land, but depths within the Hastings River are in excess of 4 metres.

There are 25 structures that would have an increased impact. Identification of the existing flood level at the structure, floor level and the afflux from the project are shown below.

**Table 14 Hastings River - Structures with increased impact – 1 in 100 Year Event**

| Asset ID | Existing flood level (mAHD) | Structure ground floor level (mAHD) | Afflux (m) |
|---|---|---|---|
| 8 | 4.004 | 3.12 | 0.030 |
| 9 | 4.029 | 3.24 | 0.023 |
| 11 | 4.029 | 3.97 | 0.029 |
| 13 | 4.026 | 3.97 | 0.031 |
| 15 | 4.031 | 3.09 | 0.024 |
| 16 | 4.027 | 3.2 | 0.023 |
| 17 | 4.027 | 3.49 | 0.023 |
| 20 | 4.060 | 1.56 | 0.025 |
| 21 | 4.066 | 2.03 | 0.025 |
| 23 | 4.101 | 3.5 | 0.024 |
| 24 | 4.099 | 3.22 | 0.024 |
| 25 | 4.100 | 3.39 | 0.024 |
| 28 | 4.152 | 2.74 | 0.023 |
| 29 | 4.156 | 2.39 | 0.023 |
| 30 | 4.168 | 2.51 | 0.023 |
| 31 | 4.174 | 2.62 | 0.023 |
| 32 | 4.197 | 3.97 | 0.022 |
| 33 | 4.208 | 3.6 | 0.022 |
| 34 | 4.247 | 2.78 | 0.021 |
| 35 | 4.237 | 3.13 | 0.021 |
| 36 | 4.237 | 2.79 | 0.021 |
| 37 | 4.247 | 3.1 | 0.021 |
| 38 | 4.283 | 3.57 | 0.020 |
| 39 | 4.282 | 3.38 | 0.020 |
| 40 | 4.271 | 3.22 | 0.020 |

These structures are already inundated under an existing 100 year flood event. The increase in afflux from the project under a 100 year flood event does not represent an adverse impact.

In addition, no additional structure would be newly inundated as a result of the project and no adverse impacts to the road network as roads are already flooded under the existing flood event.

### Wilson River

The existing flood depths experienced on the floodplain range from between 0.01m and 3m on land, with maximum depths of up to 4 m around small tributaries. Depths within the Wilson River are in excess of 4 metres.

There are 24 structures that would have an increased impact. Identification of the existing flood level at the structure and the afflux from the project are shown below.

**Table 15 Wilson River - Structures with increased impact – 1 in 100 Year Event**

| Asset ID | Existing flood level (mAHD) | Structure ground floor level (mAHD) | Afflux (m) |
|---|---|---|---|
| 41 | 3.682 | 3.07 | 0.002 |
| 42 | 3.682 | 2.29 | 0.002 |
| 43 | 3.682 | 1.75 | 0.002 |
| 44 | 3.682 | 2.21 | 0.003 |
| 45 | 3.682 | 2.66 | 0.003 |
| 46 | 3.682 | 2.21 | 0.002 |
| 47 | 3.682 | 2.97 | 0.012 |
| 48 | 3.682 | 3.25 | 0.013 |
| 49 | 3.684 | 2.23 | 0.013 |
| 50 | 3.684 | 2.94 | 0.013 |
| 51 | 3.686 | 2.18 | 0.012 |
| 52 | 3.686 | 2.24 | 0.012 |
| 53 | 3.686 | 2.56 | 0.012 |
| 54 | 3.686 | 2.26 | 0.012 |
| 57 | 3.684 | 1.7 | 0.014 |
| 58 | 3.689 | 3.53 | 0.013 |
| 63 | 3.685 | 3.56 | 0.014 |
| 66 | 3.690 | 3.15 | 0.013 |
| 68 | 3.991 | 3.7 | 0.004 |
| 70 | 3.961 | 3.1 | 0.004 |
| 71 | 3.971 | 3.22 | 0.002 |
| 73 | 3.980 | 3.9 | 0.001 |
| 96 | 3.717 | 3.32 | 0.017 |
| 97 | 3.717 | 2.96 | 0.017 |

These structures are already inundated under existing 100 year flood event. As such, the minor afflux as a result of the project under a 100 year flood event does not represent an adverse impact.

In addition, no additional structure would be newly inundated as a result of the project and no adverse impacts to the road network as roads are already flooded under the existing flood event.

#### 3.2.1.5. Summary of flood event to be used for specific property impact assessment

The review of the 5, 20, 50 and 100 year flood events and potential afflux impact on a selected group of structures identified in the warranted flood model provided by RMS. This data set provides an extensive representation of the structures across the afflux extent and provides a detailed indication of impacts across the floodplains. This review has identified that:

- No additional structures are inundated in any of the flood events as a result of the project (within the accuracy and tolerance of the model);
- The majority of the changes in flood events for more frequent events are less than 0.01 m which is not considered a reportable impact (refer Section 3.3.1). It is noted that there are three properties on the Wilson River Floodplain in the 5 year event that may be considered to not fit within the overall pattern of changes in flood levels. However, assessment in section 3.2.1.1 above shows that three properties are already inundated during an existing 5 year flood event and the project would not result in an adverse impact;
- The 100 year event results in the greatest change in flood levels for the greatest number of structures within the floodplains.

Detailed assessment of individual structures on the floodplains should be undertaken for the flood event that has the greatest impact. Based on the above points and the information in the above sections, the 100 year flood event is shown to result in the greatest potential impact as it would affect the greatest change in flood levels to the greatest number of structure. The detailed property impact assessment has been undertaken on the 100 year flood event.

## 3.3 Individual property assessments

This section provides the methodology and results of the individual property assessments (as per Step 2 of the methodology detailed in Section 3.2).

### 3.3.1 Assessment methodology

The identification of properties affected was undertaken as a desktop assessment, with appropriate field verification (including floor level surveys). ArcGIS software was used to overlay the flood modelling afflux results on top of property cadastre to determine those properties that intersect the increase in afflux. This list was then assessed as shown in Figure 1.

In determining whether there would be an adverse impact on a property, the individual property assessment considered:

- The existing 100 year flood depth;
- Increase in afflux from the project;
- Dwellings/ structures/ farm infrastructure (including livestock use) for the property;
- Floor level survey of dwelling or enclosed structures, where that structure is within the afflux extent of the project; and
- Access to the property.

Impacts to structures have considered whether it is currently inundated under flood conditions or whether it would be newly inundated from the project.

This assessment has used flood depths on the property and flood levels (mAHD) from the flood model to determine the level of impact. In particular, flood levels were used to assess whether a structure was already inundated above the floor level and the predicted level as a result of the project afflux.

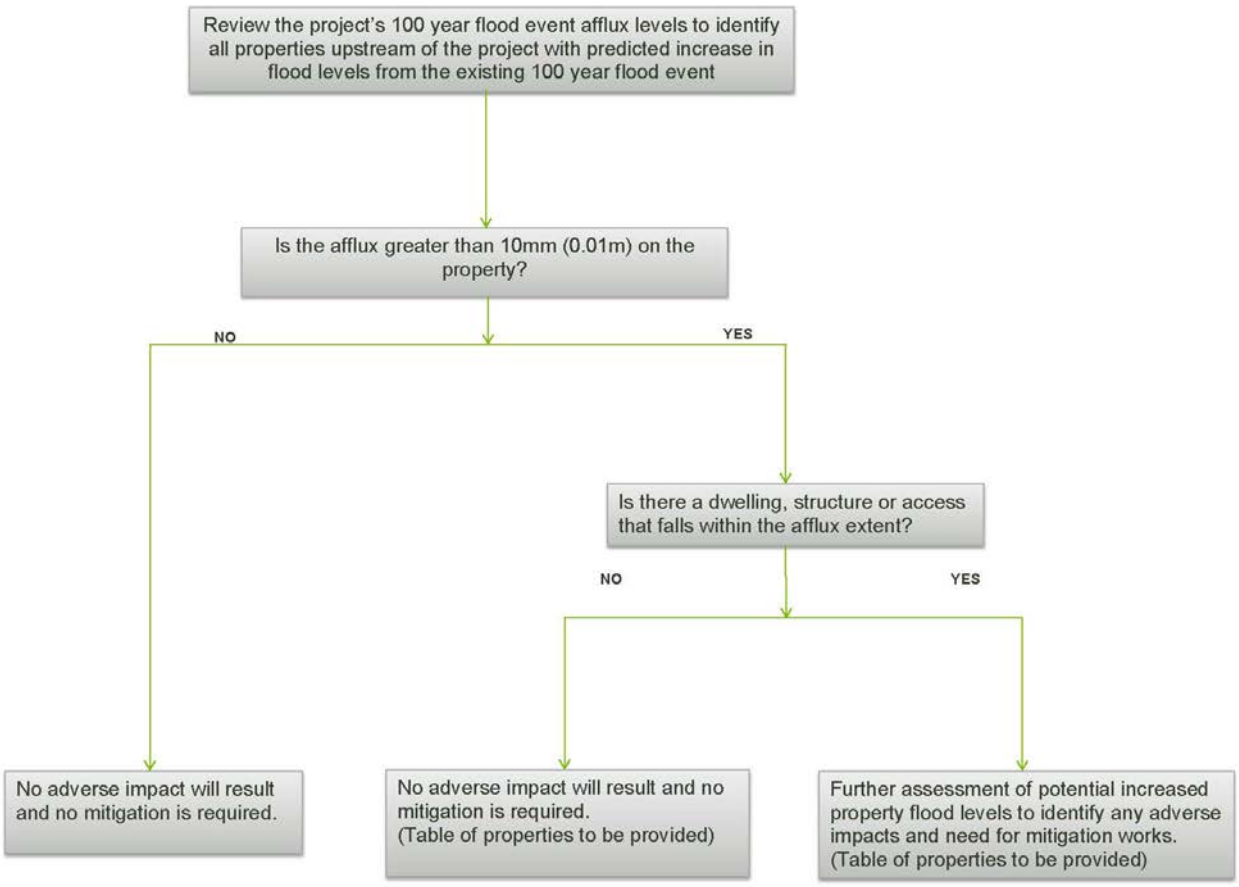


**Figure 1 Property impact assessment method**

The threshold used for further consideration of individual property impacts is 10mm (0.01m). This is based on Australian Rainfall and Runoff (P15/S1/009) (November'12), Section 8.5.1 Impact Assessment. This guidance identifies that modelling results less than 10mm are not reported as they are considered to be within the precision of the numerical model and data and therefore not a true reflection of flooding conditions.

In addition, during the assessment, a number of development applications were identified in the Hastings River Floodplain. These development applications have considered the existing flooding behaviour and (in the case of Birdon Marine West), the Oxley Highway to Kempsey project. These development applications are:

- Birdon Marine West. This rezoning application is on the Birdon Marine site located mostly to the east (and downstream) of the project. The application is with Port Macquarie-Hastings Council but has not yet been approved. The flood impacts assessment in the application states:

  *"The results of the flood modelling, which **assume that the new Pacific Highway upgrade is in place**, predict that increases in flood levels and velocities as a result of filling the land would be minor and generally occur within Lot 2."*

- Sancrox subdivision project. This rural residential subdivision is located on Sancrox Road and a Major Project Application has been approved by the Department of Planning and infrastructure (06_0212, approved 22 December 2010). The assessment identified that "*the potential building envelopes of all lots are located above the 1 in 100 year flood level*" and that "*all house site are capable of having 800mm freeboard and noted that there is flood free emergency access via the Oxley Highway to the west of the development*".

As the Birdon Marine west development has considered the changes to flooding behaviour by the project on the Hastings River Floodplain, these properties have not been considered as having structures within the afflux extent.

The Sancrox subdivision development has identified that the building envelope is outside of the 100 year flood extent. The project would not alter the extent of the 100 year flood extent, only increase flood depths within the flood extent by around 0.02 to 0.03 m. As such, no consideration has been given to the properties within the subdivision as no structures are present or should be built within the project afflux extent.

#### 3.3.1.1. Property impacts

Land use across the floodplains is predominantly agricultural, with some rural residential properties. Property impacts regarding rural residential properties mostly relates to the residence itself and any impacts to the residence and access. These are addressed in the individual property assessments.

### Agricultural land - cropping

Pasture survival or viability during flooding events are influenced by a number of factors including inundation velocity, duration and depth, water quality material deposition, pasture length, species, soil texture and even season/climate. The project can only minimise impacts to inundation duration and depth.

Existing flood levels across the Hastings River show that most agricultural land in proximity to the project are already inundated in all flood events (5, 20, 50, 100), with between 0.5 and 2m in depth for the 5 year ARI flood event up to 1 - 4m for a 100 year ARI flood event. On the Wilson River Floodplain, there is a similar scenario with flood levels for most of the land in proximity to the project ranging from 0.5 and 2m for a 5 year ARI flood event and up to 1.5 - 3m for a 100 year ARI flood event.

The project would only increase these flood levels by a maximum of 0.04 m for the Hastings River Floodplain and 0.02m on the Wilson River Floodplain (0.03 m for the 5 year ARI flood event). The project would not significantly alter either flood depths or time of inundation.

Existing flood durations across the Hastings and Wilson Rivers floodplains for the 100 year flood event are approximately 72 hours. The project would not increase the inundation duration on the Hastings River Floodplain, however, would slightly increase the duration on the Wilson River Floodplain of between 0 and 2 hours.

Current velocities at the (future) Hastings and Wilson River bridge locations are:

- Less than 1m/s for 5 year event up to 2m/s for a 100 year event at the Hastings River bridge location; and
- Less than 1m/s for 5 year event up to 1.7m/s for a 100 year event at the Hastings River bridge location.

Changes in velocity as a result of the project are minor, with increases in velocities limited to:

- Less than 0.01m/s for 5 year event up to 0.06m/s for a 100 year event at the Hastings River bridge location; and
- 0m/s for 5 year event up to 0.01m/s for a 100 year event at the Hastings River bridge location.

Erosion and scour is anticipated around the base of culverts and bridges across the floodplains, however, these impacts would be localised and within the project boundary. In order to avoid erosion and scour around these structures, scour protection is to be provided.

Based on this information, it is likely that current flood events impact on pasture survivability in the floodplains. The project would result in only minor changes to inundation velocity, duration and depth and would not have an adverse property impact.

### Agricultural land- stock

Increased flood levels may impact on the safety of stock. During a flood, farmers have different strategies depending on the flood size, if they have enough time to get to the stock etc. Farmers may:

- Evacuate their stock to high ground away from the property (this may be the side of a road or it may be another parcel of land they own that is flood free) prior to the peak of the flood,
- Leave their stock to find their own way to high ground or a stock mound. This is typically used if they are unable to get to the property during a flood or if they are away,
- Move the stock to a flood mound on the flood affected property.

If the stock remains on the flood affected lot during a flood they are typically moved to a dry paddock as soon as the flood has receded. This is because the flooded ground will be unsuitable for the cattle until it dries.

There are no identified travelling stock reserves within, or in the immediate vicinity of the project.

#### 3.3.1.2. Dwellings and structures

For the individual property assessments, a full review of properties and structures were undertaken. All properties within the 100 year afflux extent were identified via aerial photography and all structures on the property were catalogued (including those structures that were not within the afflux extent). This resulted in additional structures being identified than those in *Oxley Highway to Kundabung Flood Assessment Report - Hastings River and Wilson River Floodplain*, (January 2013) and provided a more robust and thorough schedule of structures to be included in the assessment.

Those structures within the afflux extent were subject to floor level survey to determine whether any impacts would result in inundation of the structure. Surveys were undertaken by RMS as part of the EA and were included in the EA Concept Design, and additional structures identified by this assessment as being affected have been surveyed by Lend Lease Engineering.

#### 3.3.1.3. Access

Impacts to access have considered whether the access is currently flooded to the point that the access road is impassable. The threshold for this has been obtained from Smith G and Cox R, Australian Rainfall and Runoff, Book IX, *Chapter 6 Safety Design Criteria -Draft, Engineers Australia*. This document identifies the upper tolerable depth limits for access- these are reproduced below:

- Upper tolerable depths within still or low velocity water:
  - ► small passenger vehicles: 0.3m
  - ► Large passenger vehicles: 0.4m
  - ► Large 4WD vehicles: 0.5m
- Upper tolerable depths within high velocity water ($3.0ms^{-1}$):
  - ► Small passenger vehicles: 0.1m
  - ► Large passenger vehicles: 0.15m
  - ► Large 4WD vehicles: 0.2m

Flood modelling has identified that floodwater velocities across the floodplain are considered to be low, and as such the tolerable depths for still or low velocity water are relevant to the project. The assessment has taken a conservative approach and assumed that access would be used by small passenger vehicle. As such, the depth for access impassability used in the assessment is 0.3m.

#### 3.3.1.4. Roads and infrastructure

Access out of the Hastings River Floodplain is via the main roads of:

- Existing Pacific Highway;
- Rawdon Island Road; and
- Glen Ewan Road.

Glen Ewan Road is cut under a 5 year flood event, with localised flooding depth of up to 3m making the road impassable. Rawdon Island Road also experiences localised flooding, with depths of up to 1m on Rawdon Island. These roads are also impacted by larger floods- Rawdon Island Road is mostly flooded with depths of around 1-3 m for a 100 year flood, however, the road remains flood free just north of the crossing of the southern arm of the Hastings River. Glen Ewan Road is also completed inundated in a 100 year flood with depths of around 2.5-3m. The existing Pacific Highway through the Hastings Floodplain has a flood immunity of slightly less than 100 year flood event (*Oxley Highway to Kempsey Environmental Assessment*, RMS, 2010).

Access out of the Wilson River Floodplain is via the main roads of:

- Existing Pacific Highway;
- Hacks Ferry Road; and
- Pembroke Road.

Pembroke Road is relatively flood free during a 5 year flood event. However, in an existing 100 year flood event, the road is impassable (to gain access east to Mooney Street) with flood depths of around 1.5-2 m. Access west along Pembroke Road near Farrawells Road remains flood free. In a 100 year flood event, Hacks Ferry Road is entirely flooded, with depths of around 1-3 m. It is only partially flooded in a 5 year flood event, however, localised flooding could make the road impassable (particularly east of the project). To the west of the project, Hacks Ferry Road connects to Mooney Street, which is impassable under an existing 5 year flood event, with depths of up to 3 m. The existing Pacific Highway crossing of the Wilson River has a flood immunity of up to and including the 100 year flood event (*Oxley Highway to Kempsey Environmental Assessment*, RMS, 2010).

The road network flood immunity and access during times of flood as identified above, would not be altered through the project, with increases:

- In a 5 year flood event of up to 0.01m on the Hastings River Floodplain and up to 0.03m on the Wilson River Floodplain.
- in a 100 year flood event of up to 0.02m on the Hastings River Floodplain and up to 0.03m on the Wilson River Floodplain.

As such, impacts to the road network have not been further addressed in this assessment.

Impacts to existing utilities as a result of changing flooding behaviour as a result of the project would be limited. This is due to:

Existing utilities located underground are not directly affected by increasing depth or velocity of floodwaters- as such, they have not been further addressed in this assessment; and

Existing above-ground utilities would adversely affected should velocities increase and exert lateral force on support poles. Changes in flood water velocities are only anticipated on the floodplain around new (river or floodplain) bridge structures. In most areas, there are no utilities located in close proximity to be affected by the increase in flood velocities. Utilities are located however, adjacaent to the rivers, along Glen Ewan and Hacks Ferry Road. At these locations, velocities are anticipated to change within the river channel, outside this channel, there would be minimal increases in velocity that would affect utilities. As such, these have not been further addressed in this assessment.

### 3.3.2 Property survey

A number of properties were identified as having structures subject to afflux. In order to confirm the impact of the project on these structures, floor level surveys of these structures were undertaken. This data has been used as part of the detailed design to confirm flooding impacts to properties.

The existing and proposed flood inundation extents are laid over the property boundaries in the GIS maps presented in Appendix A.

### 3.3.3 Results

By following the process described in Figure 1 it is shown that the project does not have an adverse impact on any property within the Hastings and Wilson River Floodplains.

Tables showing the individual property impact assessment are in Appendix B (Table 8 and Table 9 for the Hastings River Floodplain and Table 10 and Table 11 for the Wilson River Floodplain).

#### 3.3.3.1. Hastings River

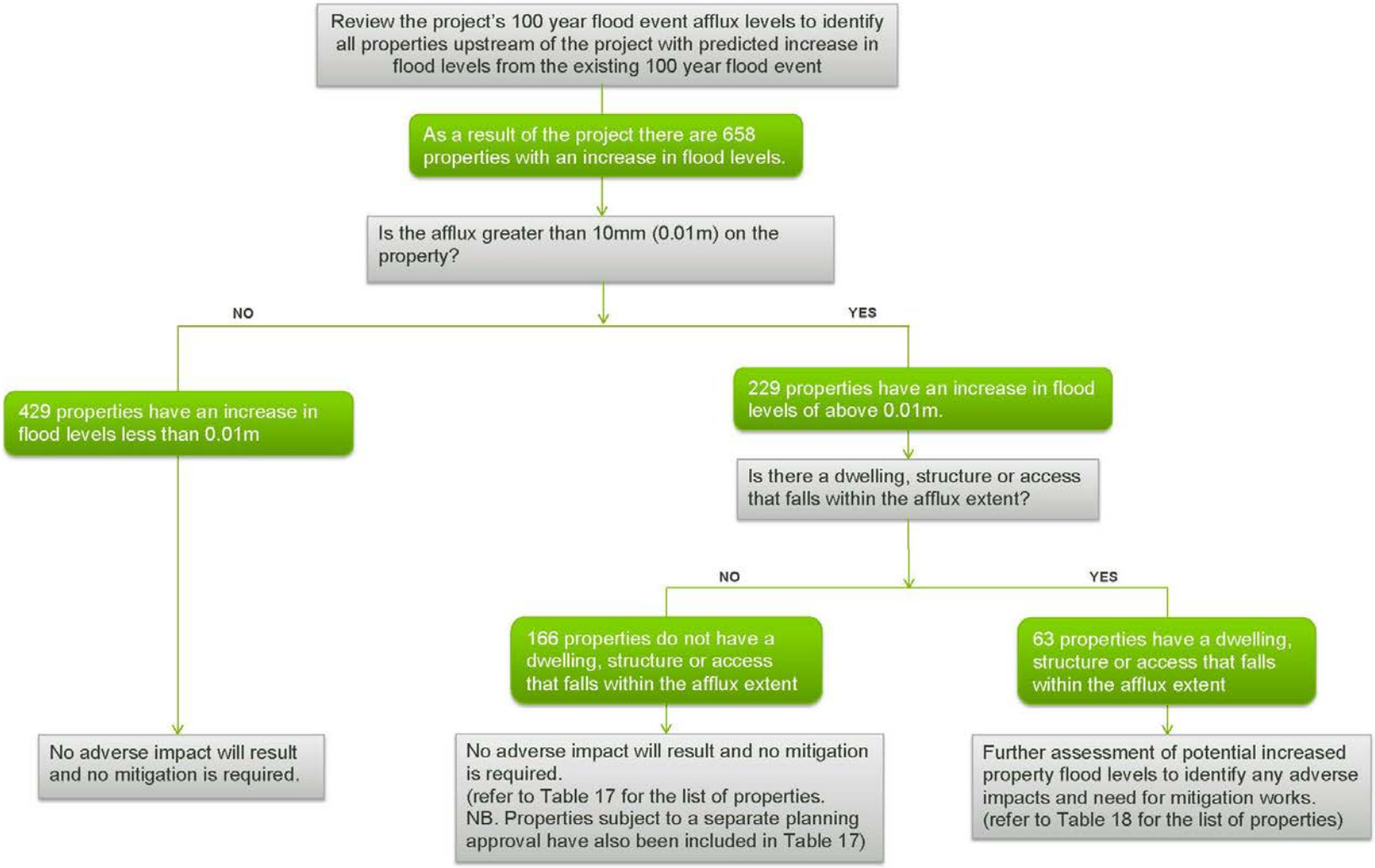


**Figure 2 Impacts on properties within the Hastings River Floodplain**

#### 3.3.3.2. Wilson River

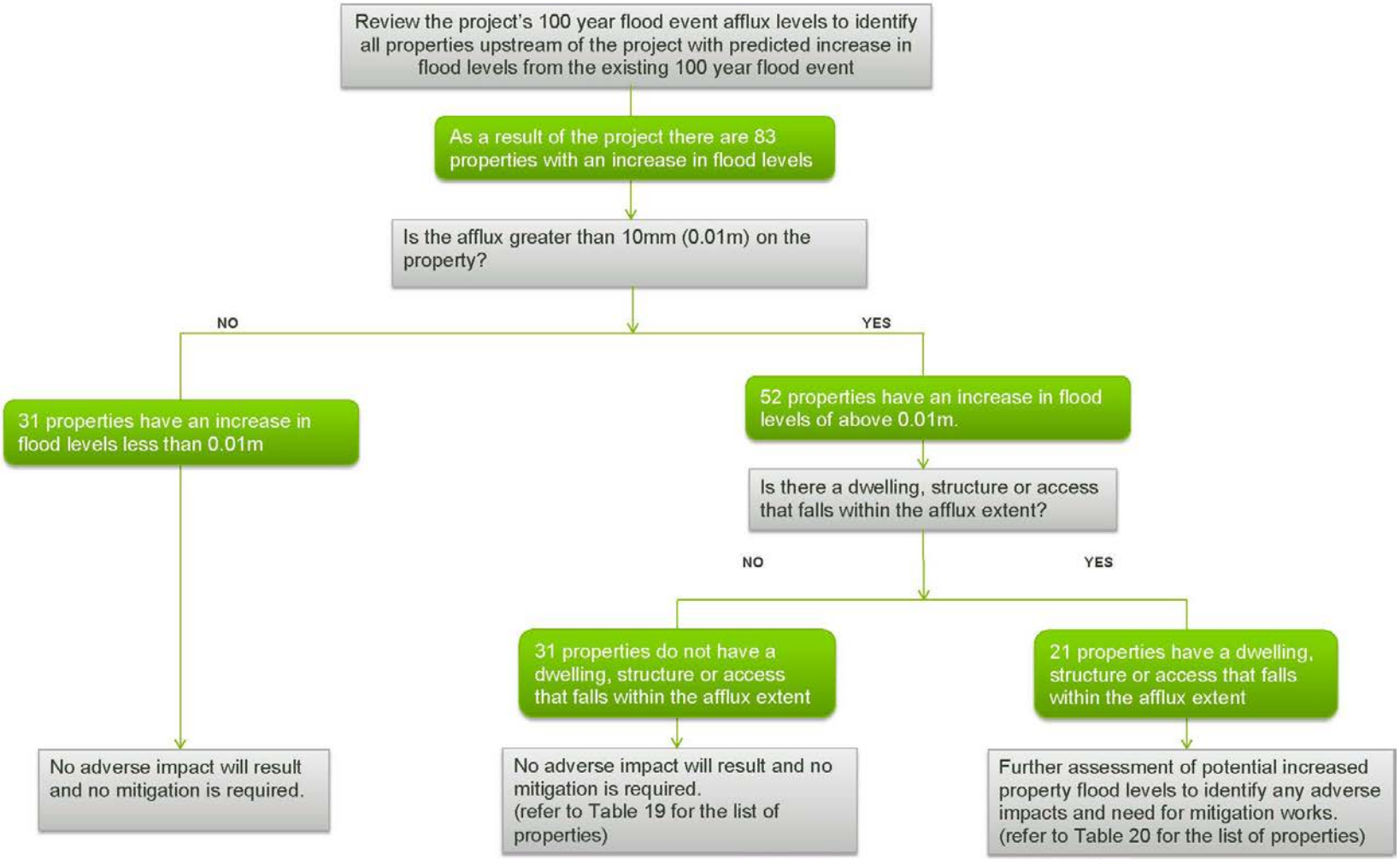


**Figure 3 Impacts on properties within the Wilson River Floodplain**

# 4 Mitigation measures

This chapter addresses the conditions B12 (b), (c), (d) and (e).

*(a) identify mitigation measures to be implemented where increased flooding is predicted to adversely affect access, property or infrastructure;*

*(b) identify measures to be implemented to minimise scour and dissipate energy at locations where flood velocities are predicted to increase as a result of the project and cause localised soil erosion and/or pasture damage;*

*(c) be developed in consultation with the relevant council, NSW State Emergency Service and directly-affected property owners; and*

*(d) identify operational and maintenance responsibilities for items (a) to (c) inclusive.*

## 4.1 Summary of impacts

The property impact assessment has shown that the project would not cause any adverse flooding impacts on dwellings, structures or accesses because:

- The project does not result in any structures being newly inundated (being consistent with the findings of the EA).
- Any increase in flood levels considered in isolation (including already inundated structures) is less than 0.05m. Previous hydrological assessments (including Pacific Highway projects) have shown that the relationship between flood level increase and flood damages indicate that an increase in flood levels of 0.05m would generally result in only minor increases to total average annual damages of affected communities (in the order of less than 5%).

In addition, it should be noted that all increases in flooding impact are within RMS' design criteria identified in the Scope of Works and Technical Criteria (SWTC).

These criteria are detailed in Clause 4.25 (a)(i) and 4.25 (a)(ii) of Appendix 4 of the SWTC and state:

(i) all waterway flood events in the Hastings River Floodplain up to and including the 1 in 100 year average recurrence interval (ARI) event do not:

a. affect additional residences to those identified in Table 12.13 of the document identified under condition A1.(b) of the Planning and Infrastructure Minister's Approvals;

b. cause an afflux greater than 0.040 metres at any existing residence; and

c. except as noted in sub-section (B) above, and except in the 1 in 5 year ARI event, cause an afflux greater than 0.050 metres at any other location outside the Site.

d. Except as noted in sub-section (B) above, cause an afflux greater than 0.080 metres at any other location outside the Site in the 1 in 5 year ARI event.

(ii) all waterway flood events in the Wilson River Floodplain up to and including the 1 in 100 year average recurrence interval (ARI) event do not:

a. affect additional residences to those identified in Table 12.18 of the document identified under condition A1.(b) of the Planning and Infrastructure Minister's Approvals;

b. cause an afflux greater than 0.020 metres at any other location outside the Site, except in the 1 in 5 year ARI event;

c. cause an afflux greater than 0.080 metres at any other location outside the Site in the 1 in 5 year ARI event.

d. result in a change in magnitude of the flow velocity upstream of the Site by greater than 0.6 m/s;

e. increase the peak flow velocity upstream of the Site to greater than 0.9 m/s;

f. increase the peak flow velocity downstream of the Site to greater than 1.1 m/s

All of the flood impacts predicted to occur as part of the project would fall within the above stated criteria.

It should be noted that the SWTC criteria was developed based on the hydrological assessment undertaken for the EA and the predicted flooding impacts resulting from the project. The concept design in the EA and the predicted impacts were approved by the Department of Planning and Infrastructure in November 2012.

## 4.2 Property, dwellings and structures mitigation measures

There are no adverse impacts predicted on properties, dwellings and structures. As such, no mitigation measures are required.

## 4.3 Access and infrastructure mitigation measures

A summary of the flood mitigation provided as part of the Oxley Highway to Kundabung project is provided in Table 16. These mitigation measures have been identified through being:

- Identified in the EA (and carried through detailed design) (ie. Cross drainage structures); or
- Foreshadowed in the EA and designed in detailed design based on further design and where relevant flood modelling (property and local road access, floodplain relief structures (part of cross drainage structures) and provision of scour protection.

**Table 16 Summary of flood mitigation measures**

| Reference | Mitigation |
|---|---|
| **HASTINGS RIVER FLOODPLAIN** | |
| Glen Ewan Road | East west connection, under the proposed Hastings River bridge. Project would be matching the existing flood immunity. |
| Existing Pacific Highway | To be retained as the service road. The existing flood immunity would be retained. |
| Internal property access under Fernbank Creek bridge | East west connection for property that spans the proposed highway. Flood immunity to be the same level as existing. |
| Access for property adjoining SB05 (floodplain relief structure) | Property access from existing highway for property that spans the proposed highway. The current internal access road RL is at the lowest point around 4.00 mAHD. As per SWTC Appendix 9.13 (d), the level of the new internal access road is 0.85 mAHD. This is a significant change to the flood immunity of the internal access road. However, a new property access from the existing highway is to be constructed on the western portion of the property. This property access will be located at a higher RL (4.0 metres compared to the existing property access at 2.0 metres). This access would improve the flood immunity and evacuation of the property. |
| Cross drainage structures (general) | Where affluxes are predicted to extend beyond the highway corridor, the proposed cross drainage structures provide equal or greater flow conveyance capacity than the Environment Assessment design. |
| Scour (general) | Industry standard rock mattresses provided at culvert inlets and outlets, and bridge abutments and piers. |
| **WILSON RIVER FLOODPLAIN** | |
| Hacks Ferry Road | East west connection, under the proposed Wilson River bridge. Project would be matching the existing flood immunity. |
| Existing Pacific Highway | To be retained as the service road. The existing flood immunity would be retained. This is generally 1 in 20, however, south of the Wilson River; the flood immunity becomes 1 in 100. |
| Internal property access (northern abutment of the Wilson River bridge) | This access is to be constructed at 5.0 mAHD, making this access road above the 1 in 100 year flood level. |
| Property access | From Hacks Ferry Road south to chainage 15 500 km. Property access would be constructed at ground level, except where a drainage culvert is required and would be raised. |
| Cross drainage structures (general) | Where affluxes are predicted to extend beyond the highway corridor, the proposed cross drainage structures provide equal or greater flow conveyance capacity than the Environment Assessment design |
| Scour (general) | Industry standard rock mattresses provided at culvert inlets and outlets, and bridge abutments and piers. |

### 4.3.1 Responsibility for maintenance

Where the works lie on RMS owned land (ie scour protection), RMS will be responsible for its maintenance. Works undertaken on local roads for construction will be maintained by the contractor for the duration of construction. Once construction is complete, the maintenance of the roads will become the responsibility of the local Council.

## 4.4 Scour protection measures

As part of detailed design flood modelling, changes in velocity were assessed as a result of the project. Velocity increases are confined locally to bridge structures with flood water plume velocities dissipating quickly as it moves away from the bridge structures.

In general, proposed changes in velocities surrounding the locations of the floodplain bridges are minor with the resultant flow velocity not considered to be erosive (the velocities across the floodplain remain at relatively low levels, being generally less than 1m/s). Flood velocities outside of the project boundary are not anticipated to result in localised soil erosion or pasture damage. However, under these floodplain bridges (ie within the project boundary), velocities will be higher and considered to be potentially erosive to exposed soil under the structures. This is due to the confined nature of the openings and increased flow velocities, with changes in velocity around the piers of the new structures creating potential scour. As the flood water exit the structure, the water would be unconfined and flow across the floodplain and would not maintain the higher velocity over large areas.

The changes in velocities downstream of the floodplain structures are detailed below:

- SB03 and SB05 (Hastings River Floodplain Bridges): increase in 0.48m/s and 0.39m/s for a 100 year flood event respectively
- SB06, SB07 and SB08 (Wilson River Floodplain Bridges): increase in 0.78m/s, 0.75m/s and 0.38m/s for a 100 year flood event respectively.

As mentioned above, these increases in velocities result in proposed velocities of generally less than 1m/s, which are low flows that are not considered to be erosive. Downstream of the bridges across the Hastings and Wilson Rivers (SB04 and SB09 respectively), have little to no change in velocities. Scour protection is provided at the above mentioned floodplain structures to minimise localised impacts and to dissipate energy where flow velocities will be increased.

In addition, localised scour protection is provided at culvert crossings beneath the proposed highway to minimise scour erosion at the entry and exits of these structures.

The assessment for scour protection considered structure type, relevant waterway channel depth and flow velocities. The results of the scour protection assessment estimated the maximum scour depths to determine the extent of scour protection required at each structure. Further details on the scour protection assessment are provided in Appendix C.

## 4.5 Consultation

Lend Lease Engineering has attempted to consult with Port Macquarie Hastings Council (as both the council and the provider of NSW State Emergency Services) regarding the findings of the report. A timeline of the consultation activities are detailed below:

**Table 17 LLE/PMHC consultation timeline**

| Date | Activity |
|---|---|
| Thursday 16 October | Email sent to Port Macquarie Hastings Council's Group Manager Transport & Stormwater Network, Duncan Clarke to advise him that consultation was required on the draft Hydrological Mitigation Report. No response was received to this email. |
| Tuesday 21 October 2014 | Repeated phone calls were made to Duncan Clarke's office and left messages explaining that we needed to talk to Council regarding the report |
| Thursday 23 October | Council reception called and asked to be transferred to Mr Clarke. Mr Clarke was not present and the receptionist indicated that she would ask Mr Clarke to return the call. |
| Friday 24 October | Repeated phone calls for Mr Clarke to indicate that no feedback had been received. |
| Monday 27 October | A printed copy of the report was personally delivered to Council's reception with a letter again seeking an opportunity to meet and obtain feedback. A response to this letter has not been received. |
| Thursday 6 November | An email was sent to Duncan Clarke seeking acknowledgement of the receipt of the report and feedback. |

To date, no feedback has been received from Council. Should Council provide feedback, this will be considered.

As there are no adverse impacts to the properties as identified in this report, individual discussions with directly affected property owners on increased flood impacts are not required. This approach has been discussed with and agreed to by the project Environmental Representative. However, this report would be uploaded onto the RMS website for information.

In regards to providing assistance to Council and the NSW State Emergency Services to update any plans (CoA B15), there are no plans to be updated. As this is not applicable, this has not been undertaken.

However, it should also be noted that separate to this report, discussions with property owners about property adjustments as a result of the project have been/ are being undertaken. As part of these discussions, internal property access requirements across the highway have been discussed, which has resulted in the development of accesses as identified in Table 16 above. There has been on-going consultation with the residents at the property under SB05 regarding property adjustments and the new access to the property, which is higher than the existing access (which is an illegal access just off the Hastings Bridge). Property adjustments and access at this property have been supported in principle by the property owner.

Discussions have also been had with Port Macquarie Hastings Council regarding construction use of local roads.

# 5 Conclusion

This report details the flood modelling undertaken by Lend Lease Engineering for works associated with the Oxley Highway to Kundabung Pacific Highway Upgrade. This report specifically addresses Minister's Conditions of Approval B12 and B13.

Seven hundred and forty one properties which were within the afflux extent of the project were considered in this assessment. Of these 741, further individual property assessment was undertaken at 84 properties across the two floodplains to identify whether any adverse impacts would occur on the property in terms of impacts to dwellings/ structures or access. In all cases, impacts were identified to be non-adverse. No new dwellings or structures would be inundated as a result of the project. Similarly, there would be no adverse impacts to access.

As there are no adverse impacts on structures, no property specific mitigation works are required.

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

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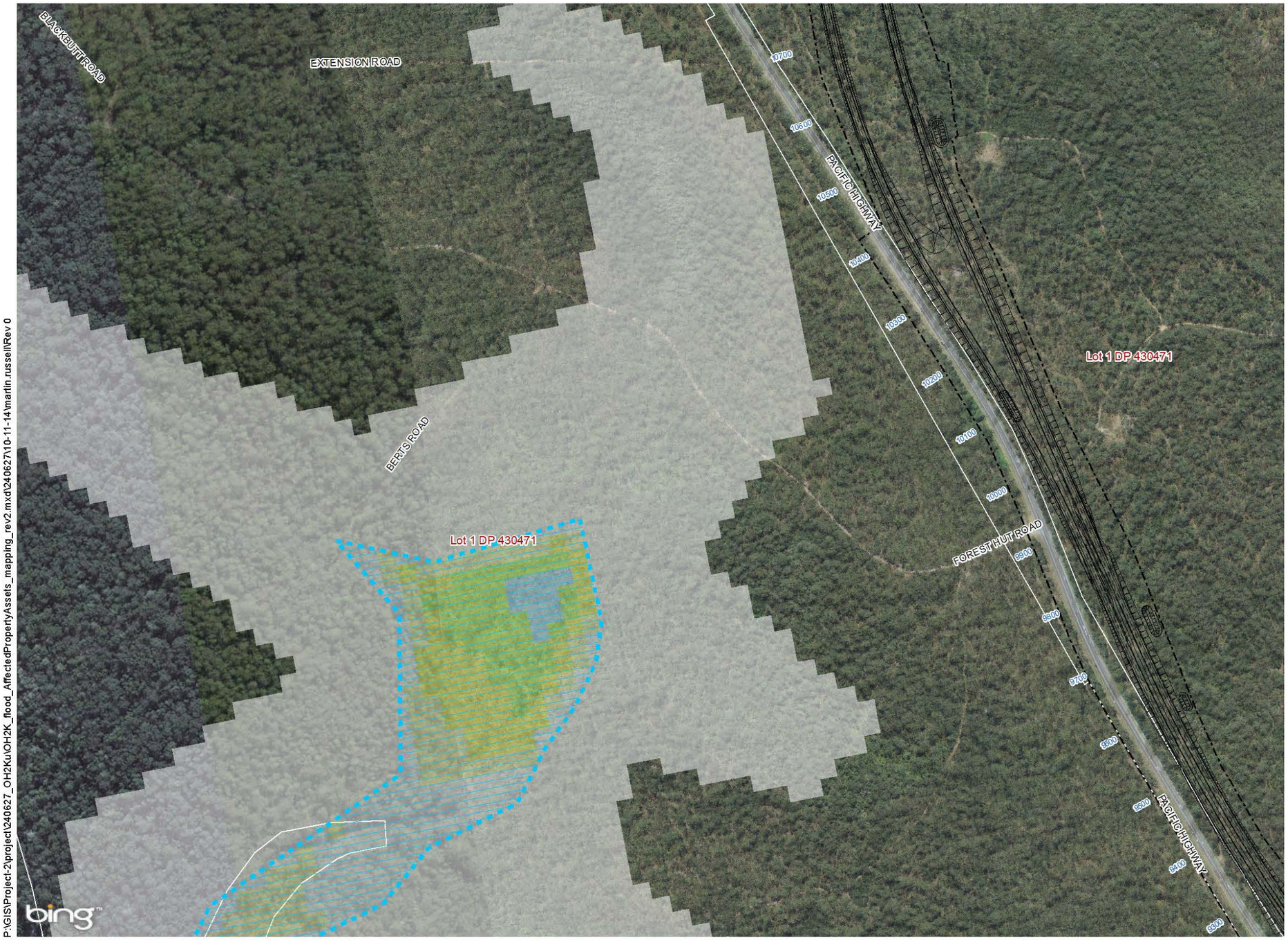
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-1 100 Year Flood Event Project Afflux Extent Map 1 of 51

Lend Lease

aupb JOINT VENTURE

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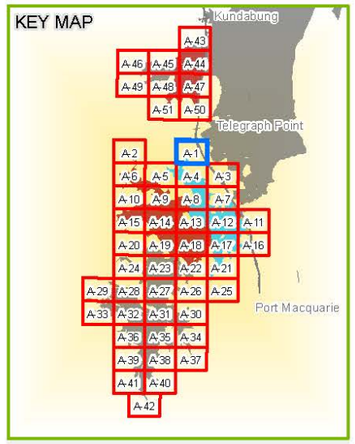



Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

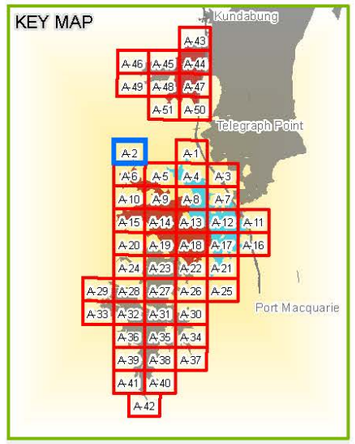
PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-1 (Map 1 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-2 100 Year Flood Event Project Afflux Extent Map 2 of 51


P:\GIS\Project-2\project\240627_OH2Ku\OH2K_flood_AffectedPropertyAssets_mapping_rev2.mxd\240627\10-11-14\martin.russell\Rev 0




Project boundary

Property assets

**100yr project afflux extent**

0.00-0.01m
0.01-0.02m
0.02-0.03m
0.03-0.04m
0.04-0.05m
> 0.05m

**Existing 100yr flood depths**

0 - 0.5m
0.5 - 1m
1 - 1.5m
1.5 - 2m
2 - 2.5m
2.5 - 3m
3 - 4m
4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

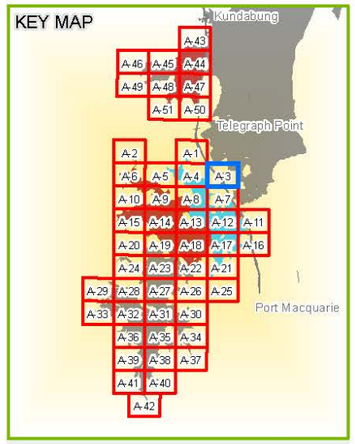
100 year flood event Project afflux extent A-2 (Map 2 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-3 100 Year Flood Event Project Afflux Extent Map 3 of 51


P:\GIS\Project-2\project\240627_OH2Ku\OH2K_flood_AffectedPropertyAssets_mapping_rev2.mxd\240627\10-11-14\martin.russell\Rev 0

KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

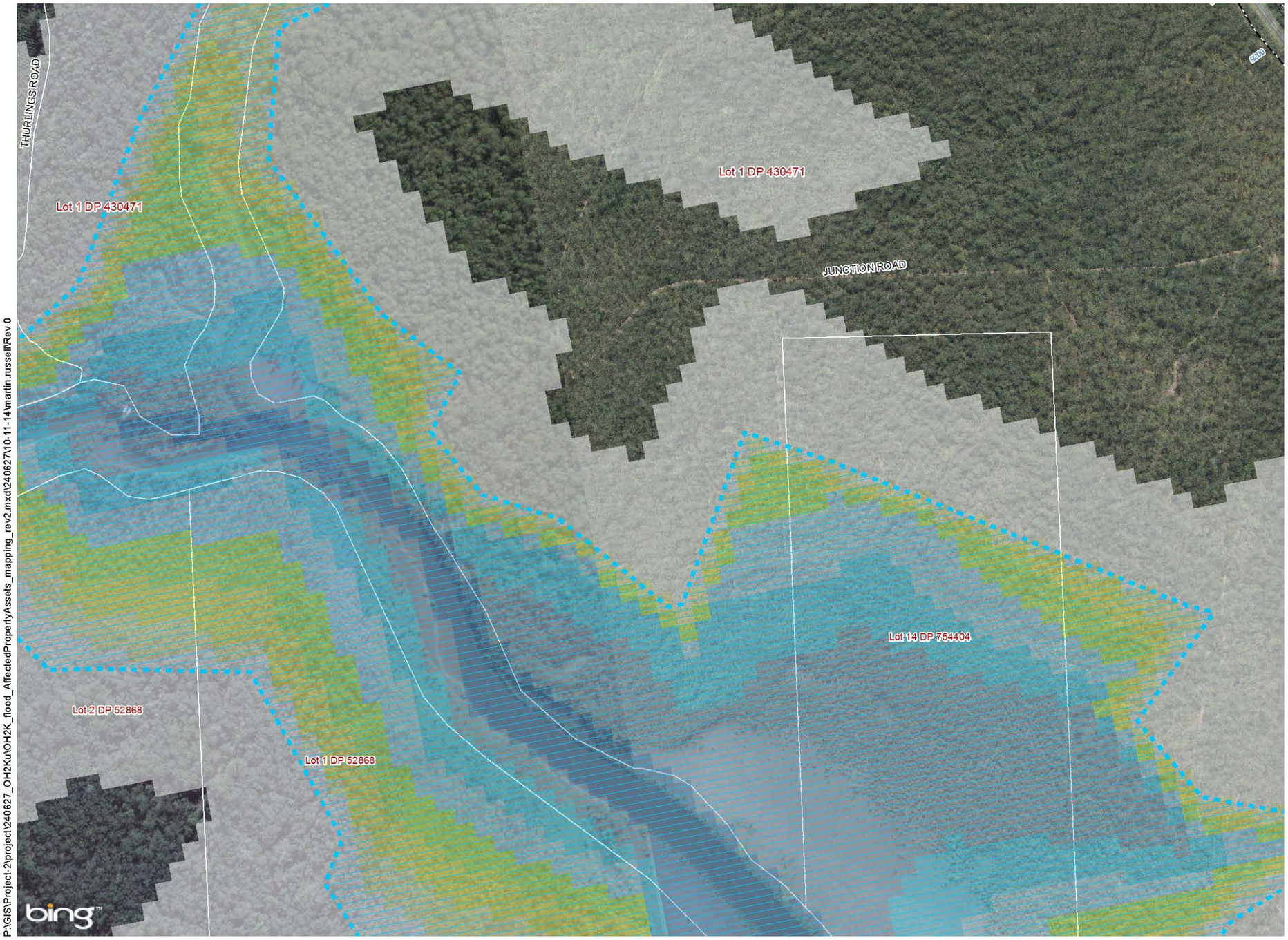
**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

# PACIFIC HIGHWAY UPGRADE OH2Ku HYDROLOGICAL MITIGATION REPORT

100 year flood event Project afflux extent A-3 (Map 3 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-4 100 Year Flood Event Project Afflux Extent Map 4 of 51

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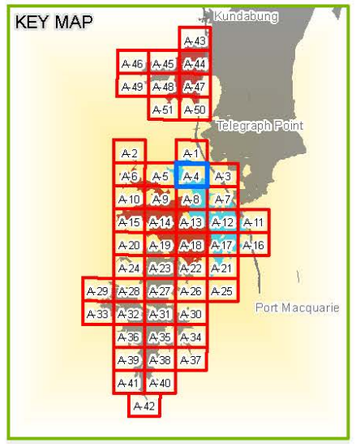
KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200m

**Date of Issue:** 10/11/2014
**Revision no:** 1

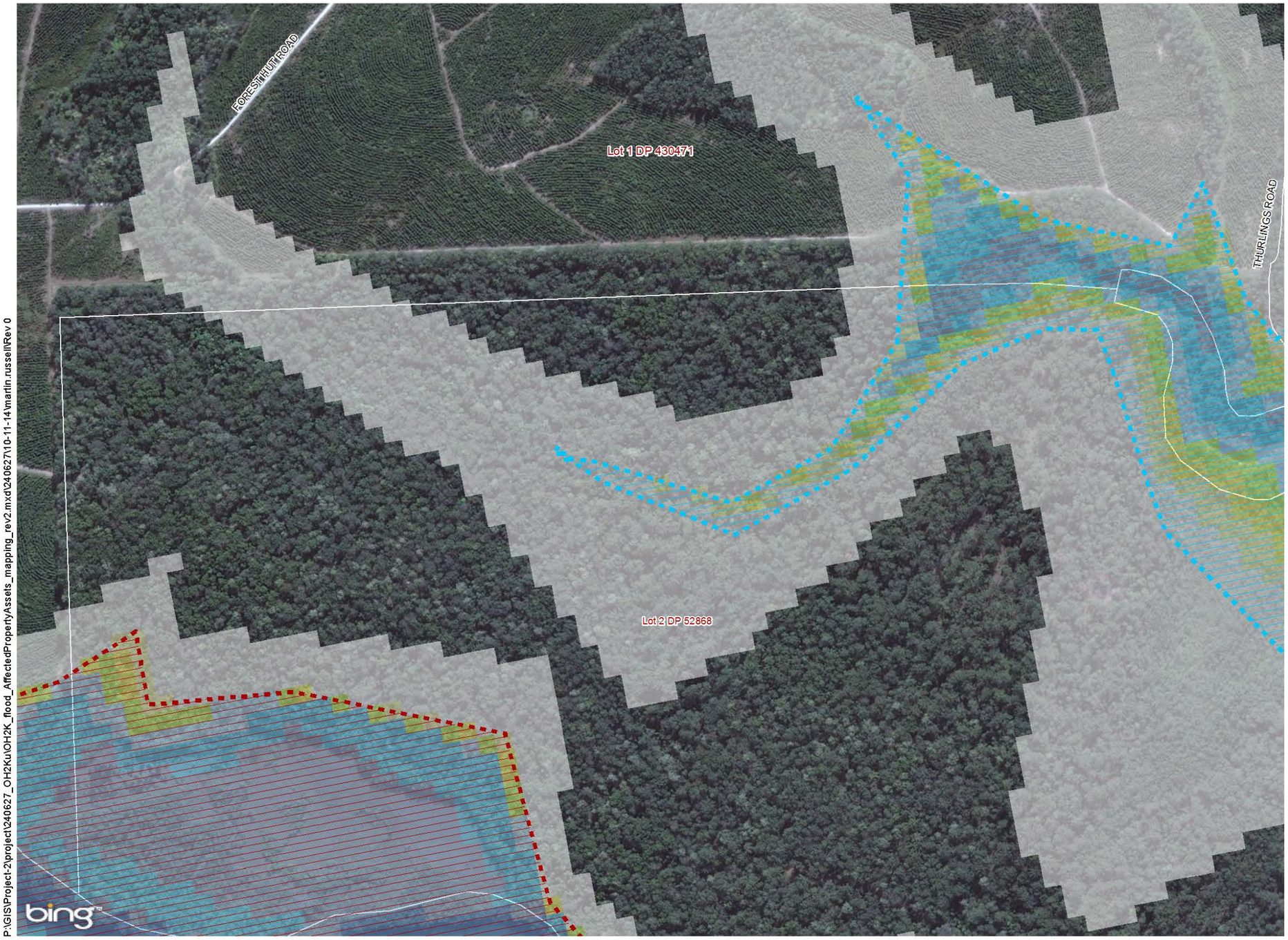
**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-4 (Map 4 of 51)

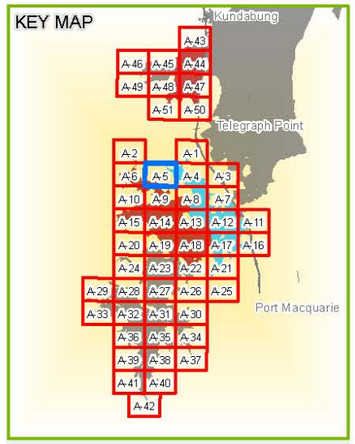
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-5 100 Year Flood Event Project Afflux Extent Map 5 of 51




P:\GIS\Project-2\project\240627_OH2Ku\OH2K_flood_AffectedPropertyAssets_mapping_rev2.mxd\240627\10-11-14\martin.russell\Rev 0

KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

0.00-0.01m
0.01-0.02m
0.02-0.03m
0.03-0.04m
0.04-0.05m
> 0.05m

**Existing 100yr flood depths**

0 - 0.5m
0.5 - 1m
1 - 1.5m
1.5 - 2m
2 - 2.5m
2.5 - 3m
3 - 4m
4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

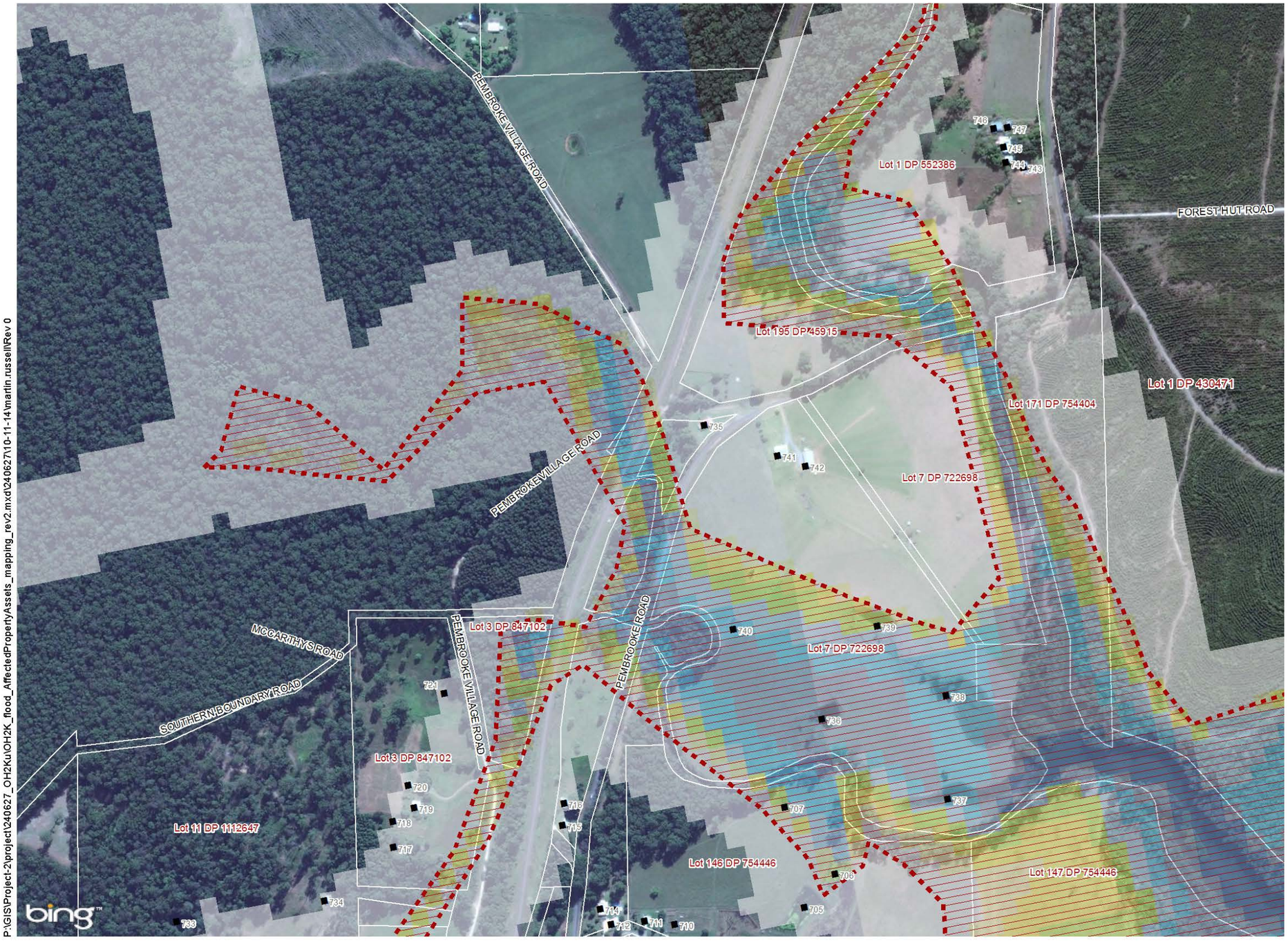
100 year flood event Project afflux extent A-5 (Map 5 of 51)

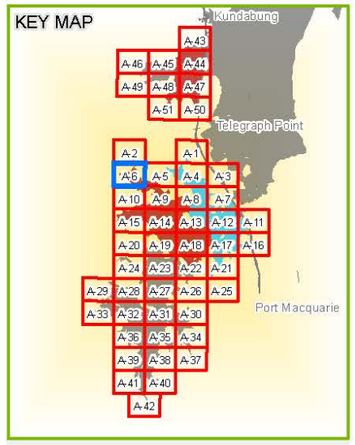
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-6 100 Year Flood Event Project Afflux Extent Map 6 of 51

Lend Lease

aupb JOINT VENTURE




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

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1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

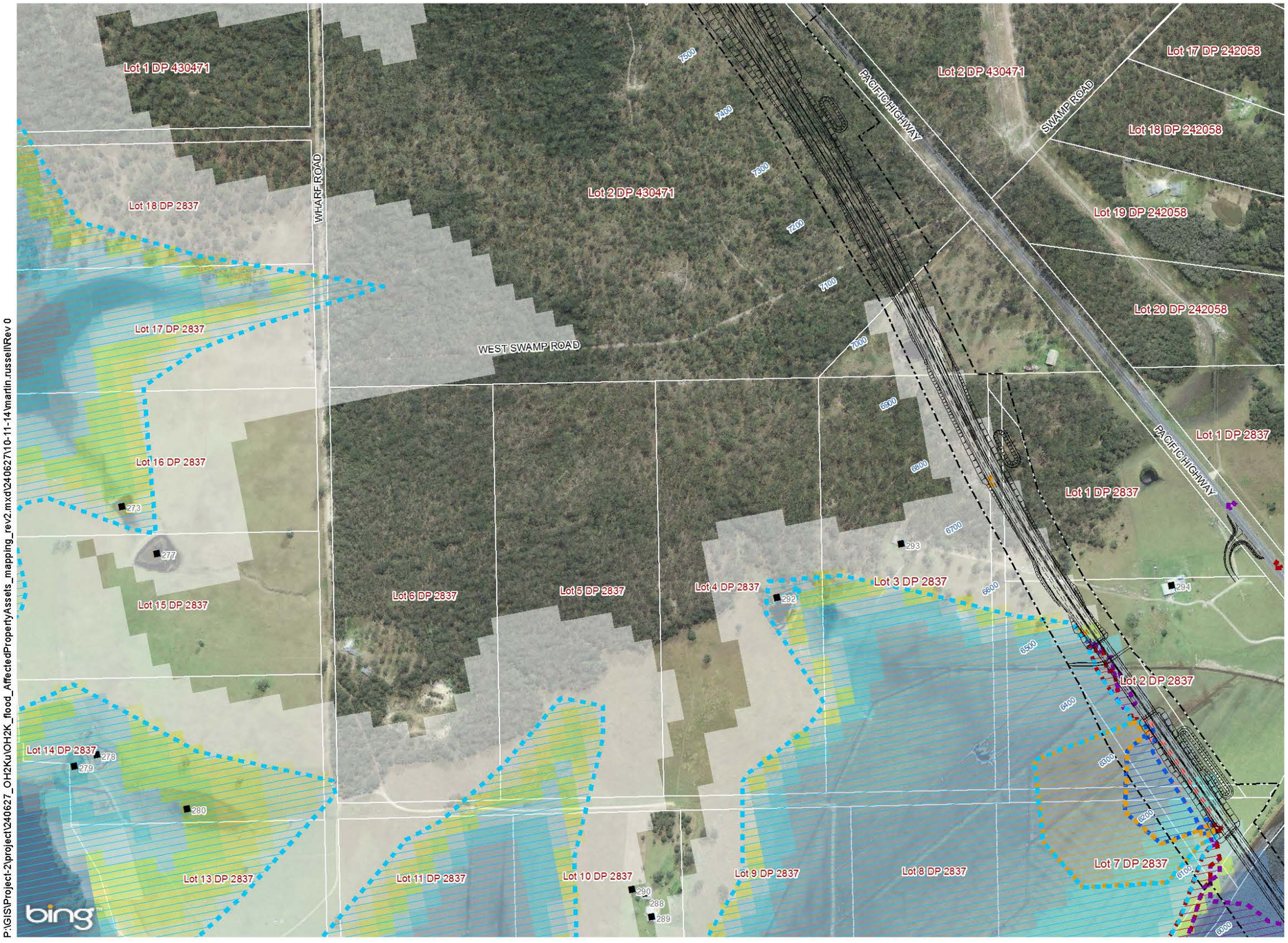
100 year flood event Project afflux extent A-6 (Map 6 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-7 100 Year Flood Event Project Afflux Extent Map 7 of 51

Lend Lease

aupb JOINT VENTURE

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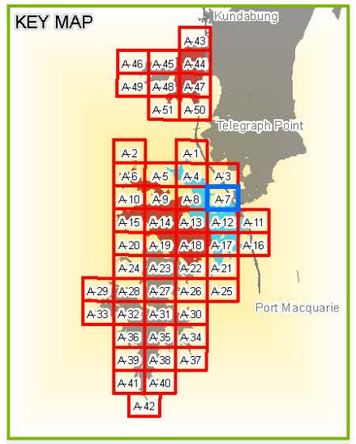
KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200m

**Date of Issue:** 10/11/2014
**Revision no:** 1

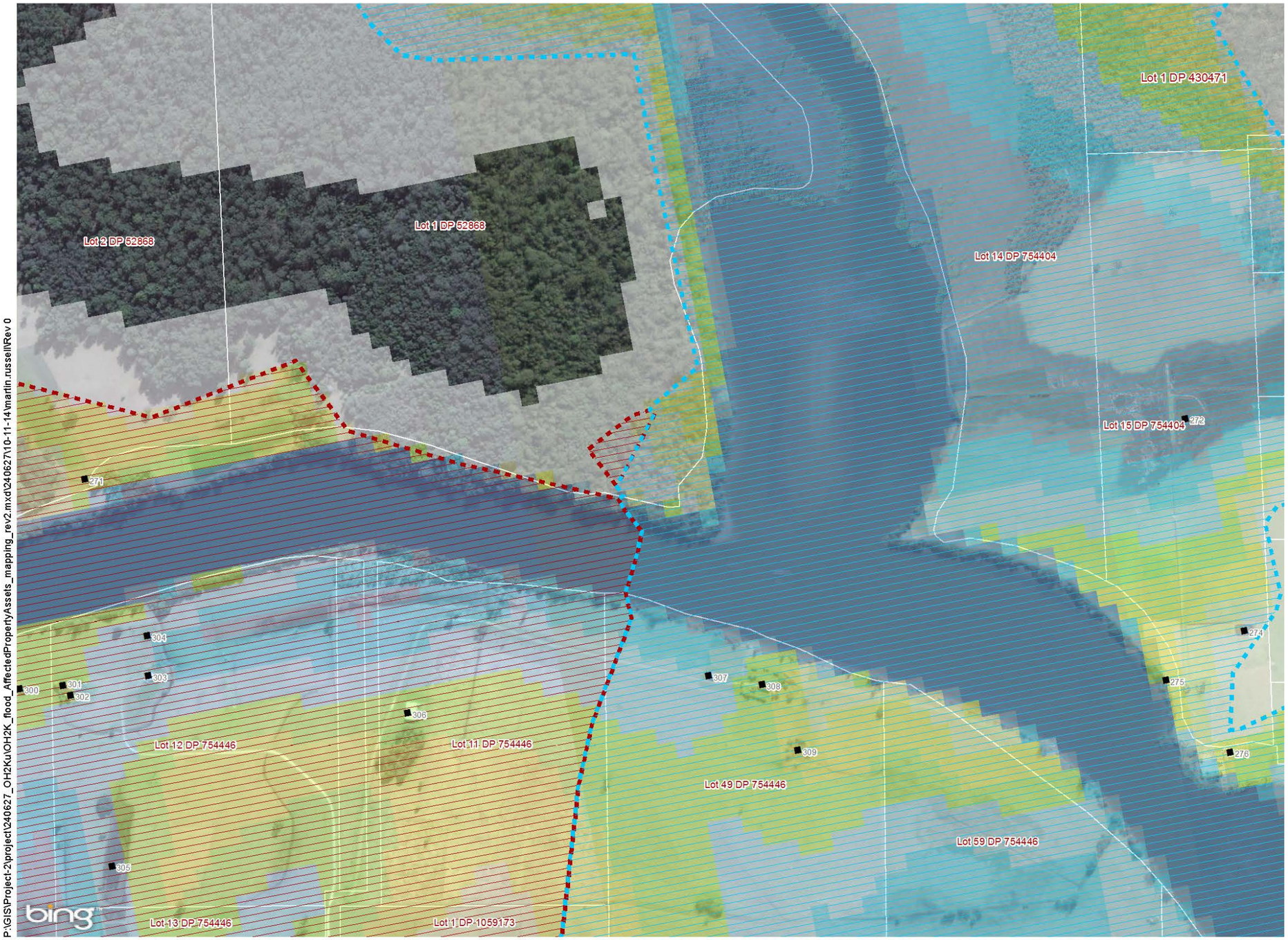
**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-7 (Map 7 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-8 100 Year Flood Event Project Afflux Extent Map 8 of 51

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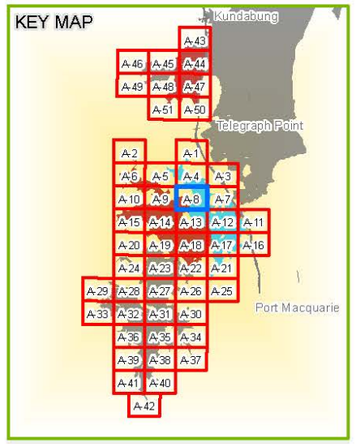
Lend Lease

aupb JOINT VENTURE




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

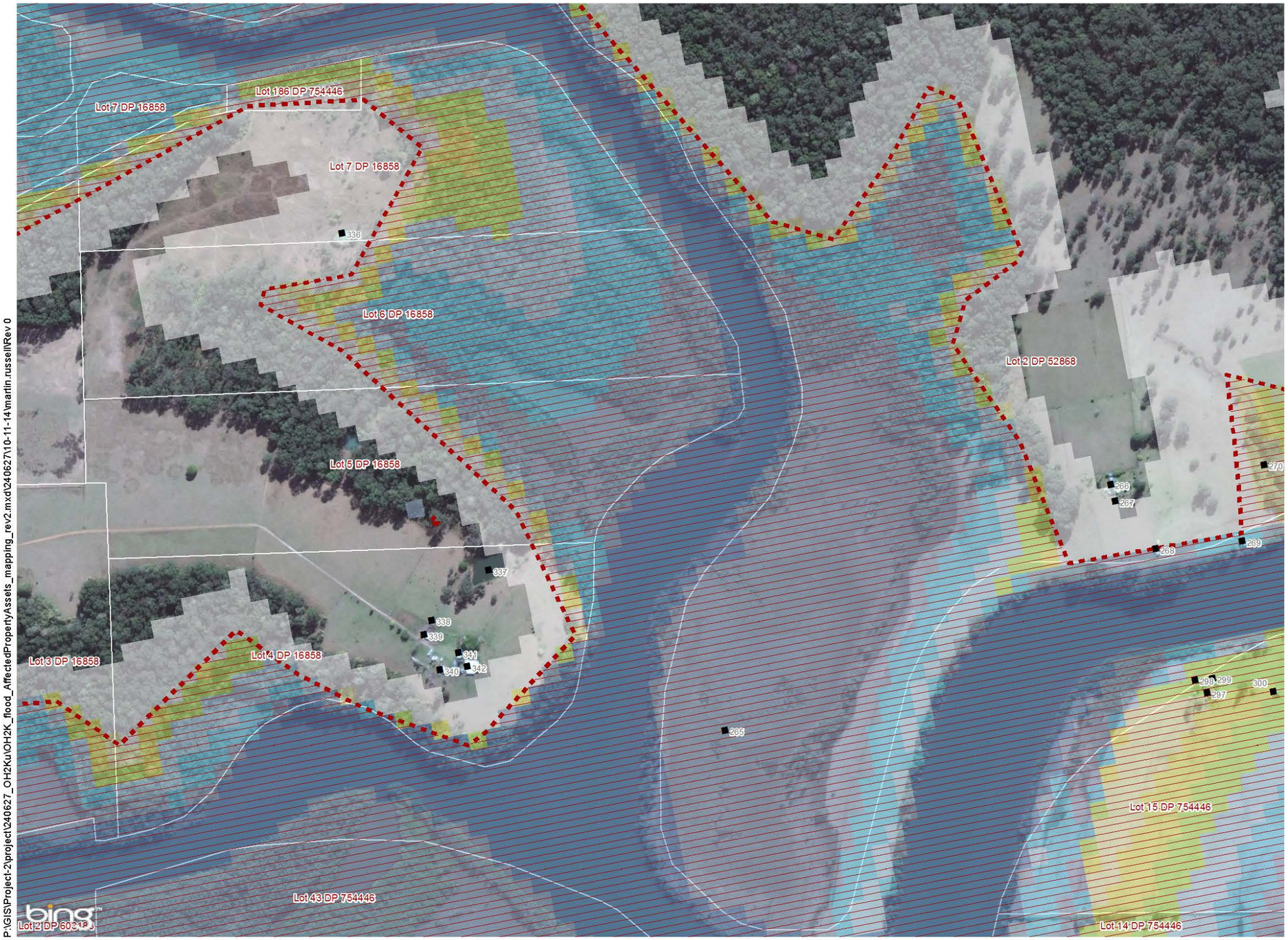
100 year flood event Project afflux extent A-8 (Map 8 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-9 100 Year Flood Event Project Afflux Extent Map 9 of 51

Lend Lease

aupb JOINT VENTURE

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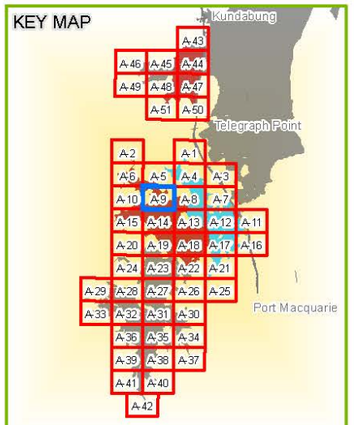
KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

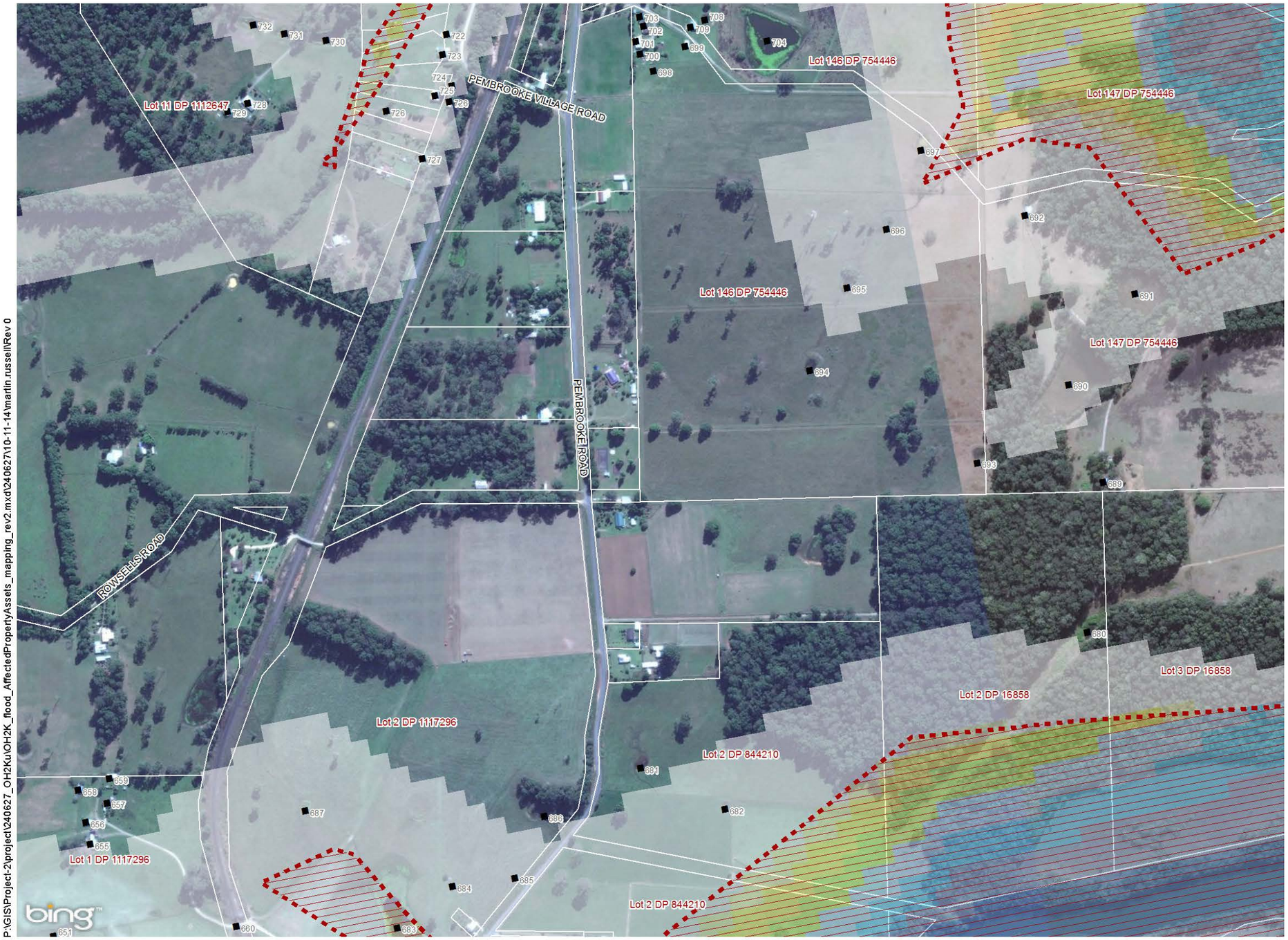
100 year flood event Project afflux extent A-9 (Map 9 of 51)

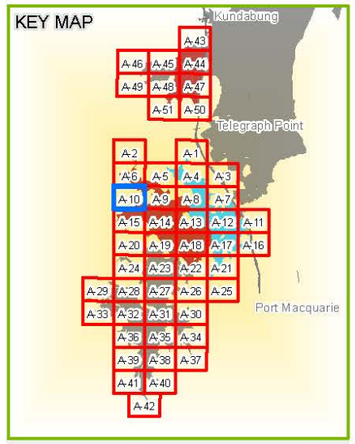
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-10 100 Year Flood Event Project Afflux Extent Map 10 of 51

Lend Lease

aupb JOINT VENTURE




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-10 (Map 10 of 51)

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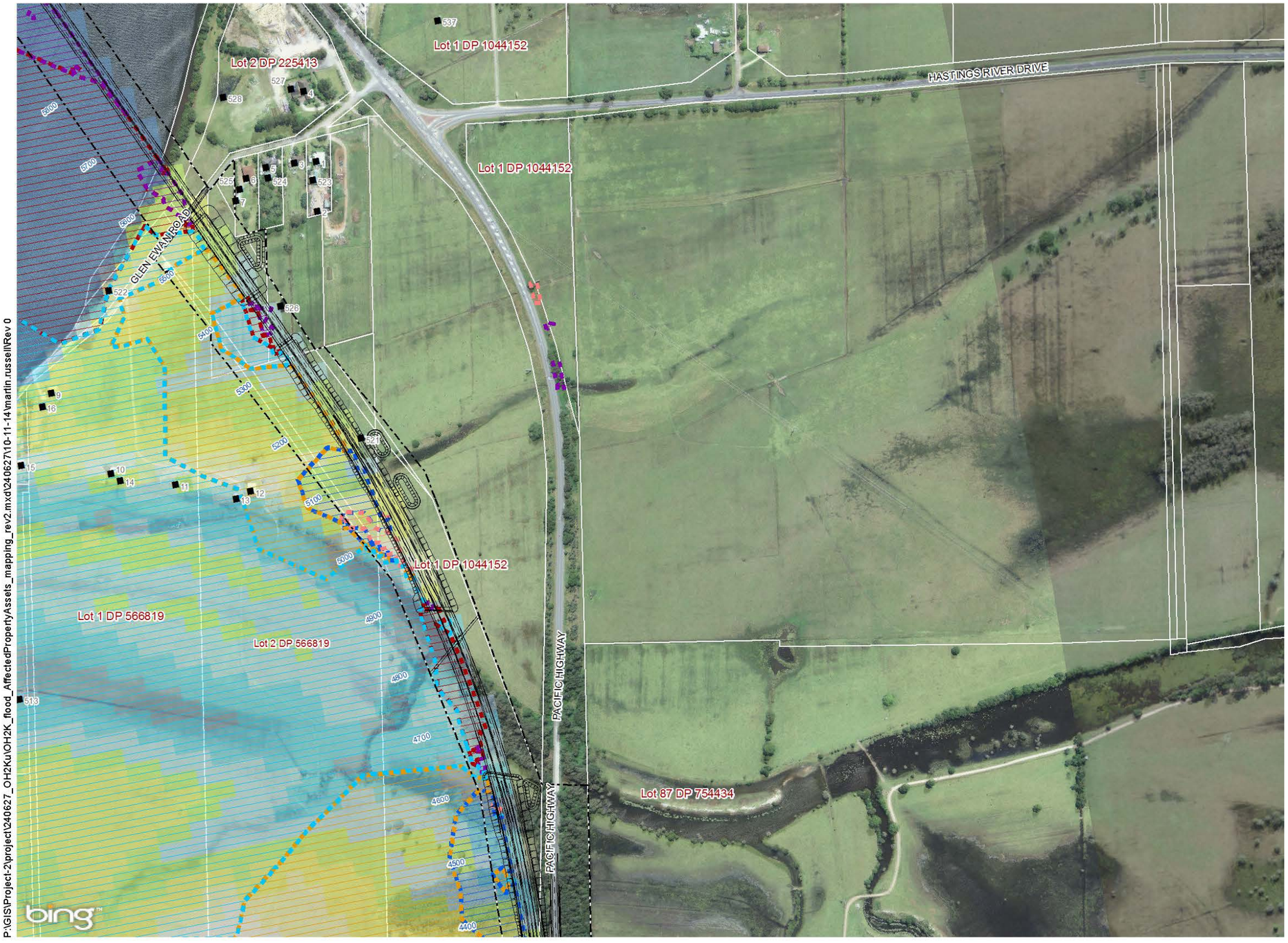
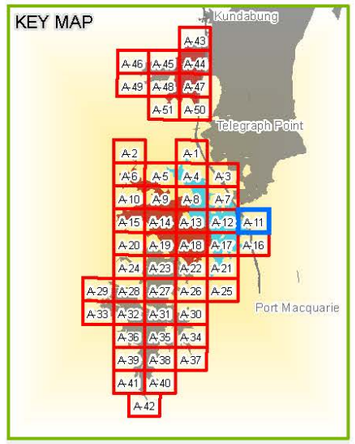
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-11 100 Year Flood Event Project Afflux Extent Map 11 of 51

Lend Lease

aupb JOINT VENTURE




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

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1:6,000

0 100 200m

**Date of Issue:** 10/11/2014
**Revision no:** 1

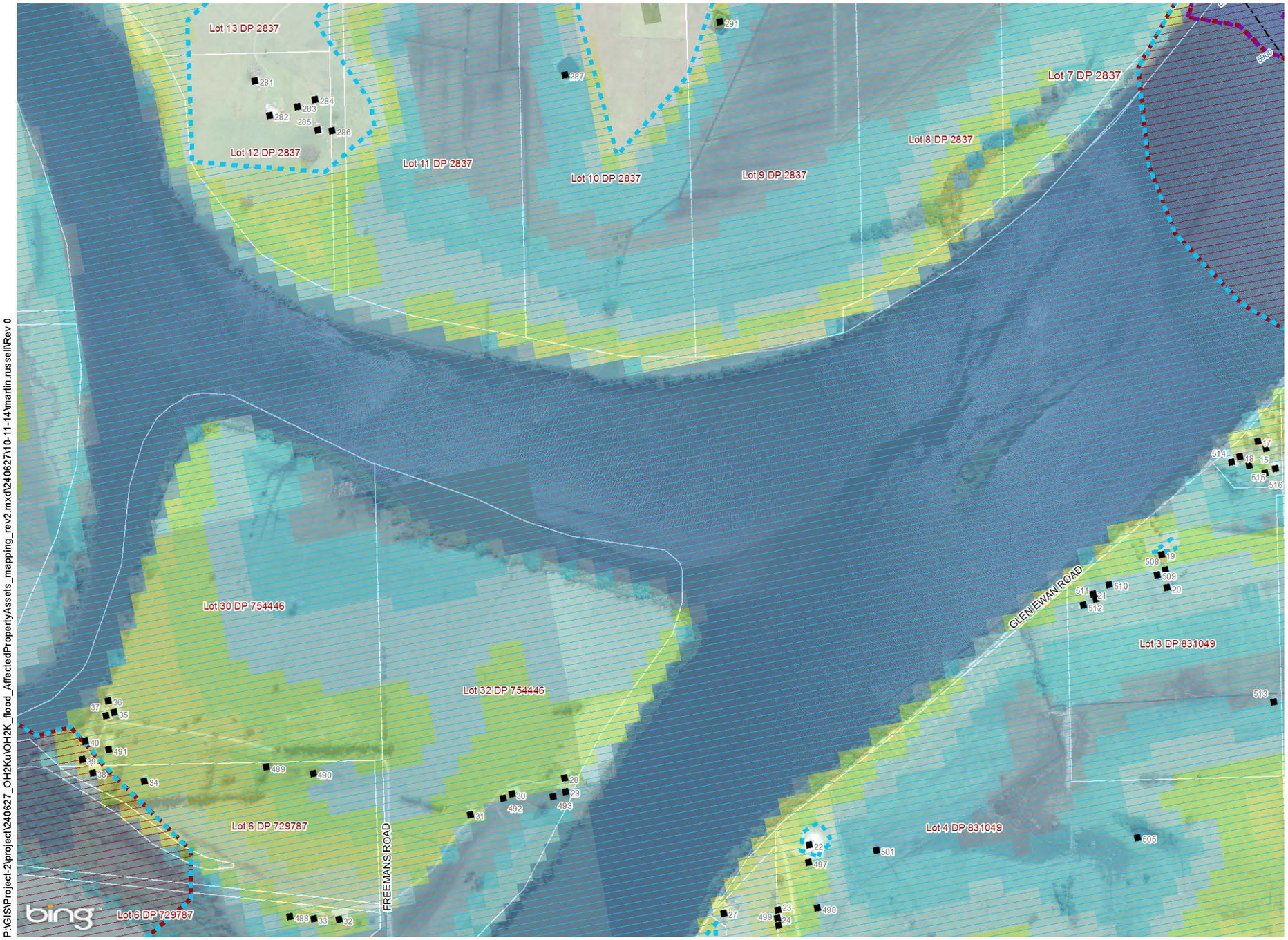
**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

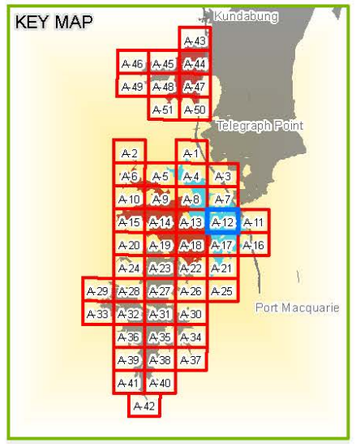
100 year flood event Project afflux extent A-11 (Map 11 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-12 100 Year Flood Event Project Afflux Extent Map 12 of 51




P:\GIS\Project-2\project\240627_OH2Ku\OH2K_flood_AffectedPropertyAssets_mapping_rev2.mxd\240627\10-11-14\martin.russell\Rev 0




- Project boundary
- Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

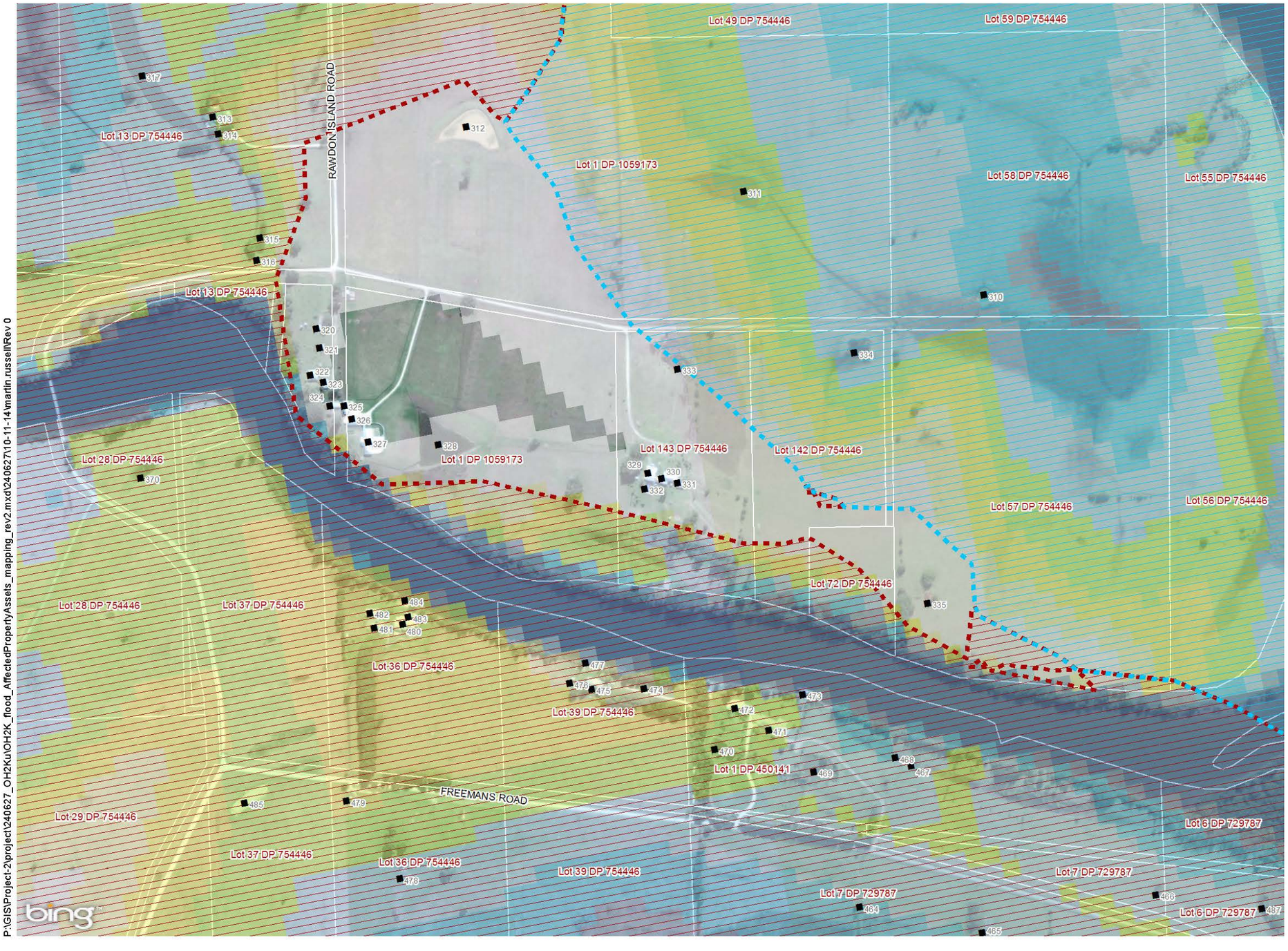
**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

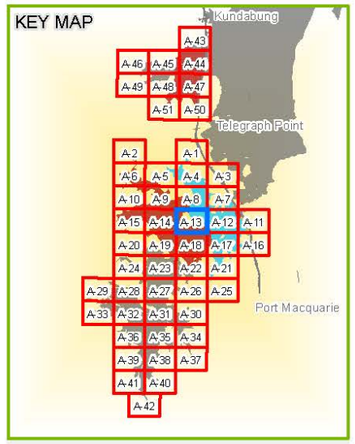
PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-12 (Map 12 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-13 100 Year Flood Event Project Afflux Extent Map 13 of 51




Project boundary
Property assets

**100yr project afflux extent**
- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**
- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

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1:6,000
0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

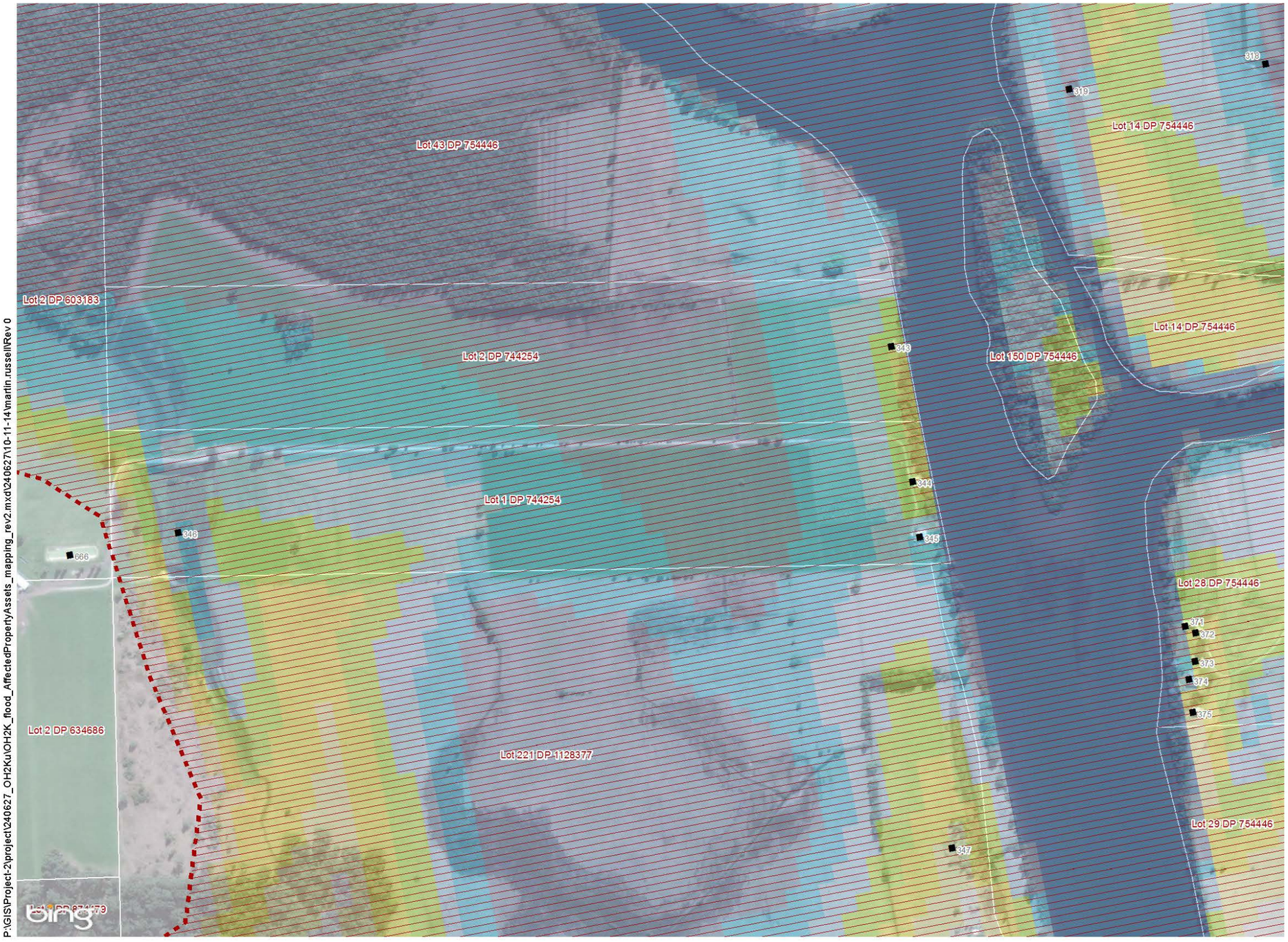
100 year flood event Project afflux extent A-13 (Map 13 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

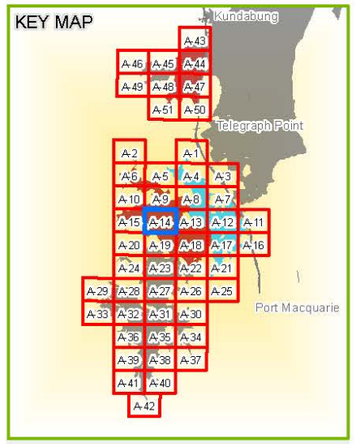
Figure A-14 100 Year Flood Event Project Afflux Extent Map 14 of 51

Lend Lease

aupb JOINT VENTURE




P:\GIS\Project-2\project\240627_OH2Ku\OH2K_flood_AffectedPropertyAssets_mapping_rev2.mxd\240627\10-11-14\martin.russell\Rev 0




- Project boundary
- Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

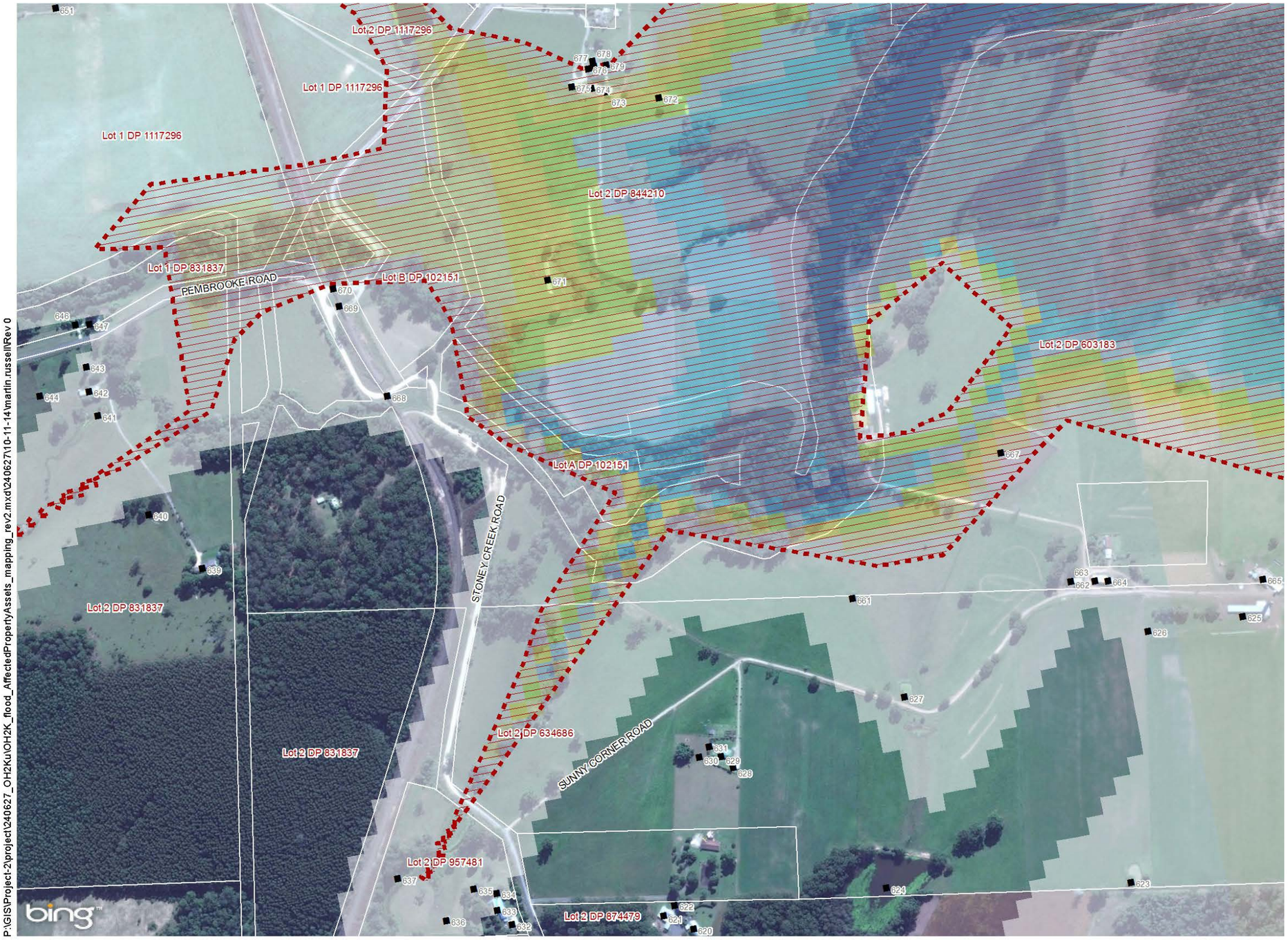
100 year flood event Project afflux extent A-14 (Map 14 of 51)

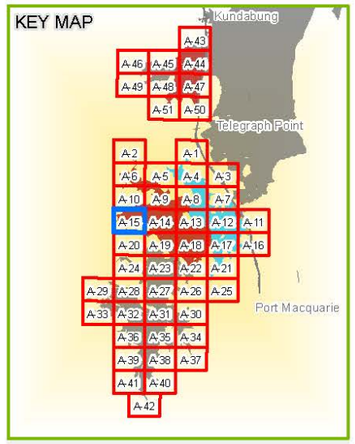
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-15 100 Year Flood Event Project Afflux Extent Map 15 of 51

Lend Lease

aupb JOINT VENTURE




Project boundary

Property assets

**100yr project afflux extent**

0.00-0.01m

0.01-0.02m

0.02-0.03m

0.03-0.04m

0.04-0.05m

> 0.05m

**Existing 100yr flood depths**

0 - 0.5m

0.5 - 1m

1 - 1.5m

1.5 - 2m

2 - 2.5m

2.5 - 3m

3 - 4m

4 - 5m+

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1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014

**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56

**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

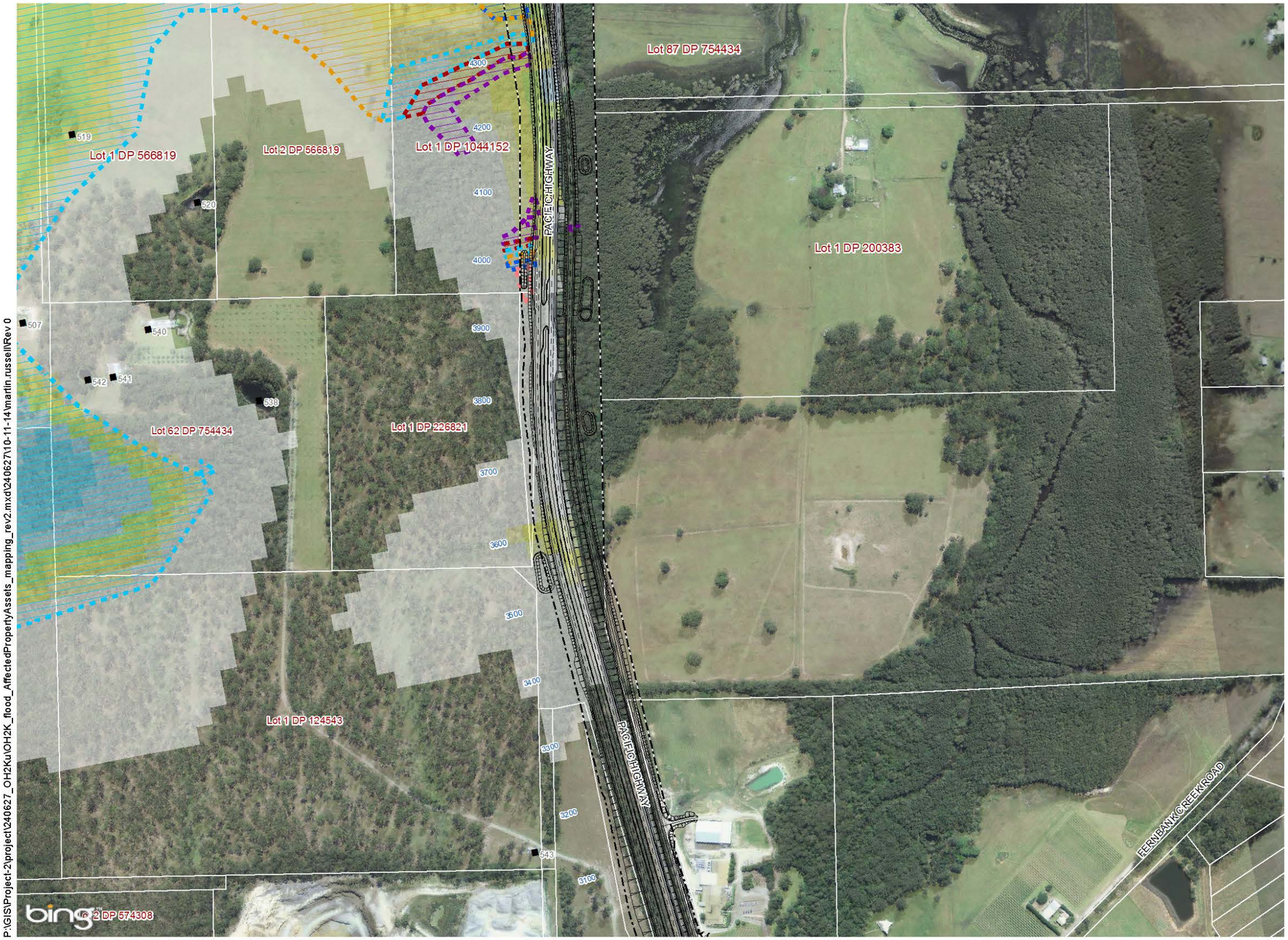
100 year flood event Project afflux extent A-15 (Map 15 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-16 100 Year Flood Event Project Afflux Extent Map 16 of 51

Lend Lease

aupb JOINT VENTURE

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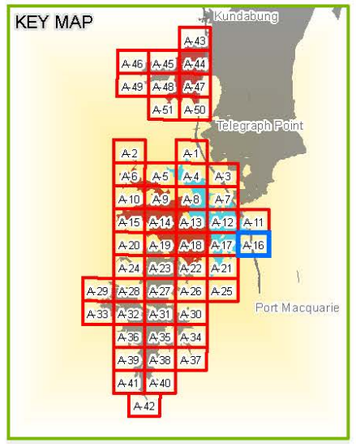
KEY MAP




- Project boundary
- Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

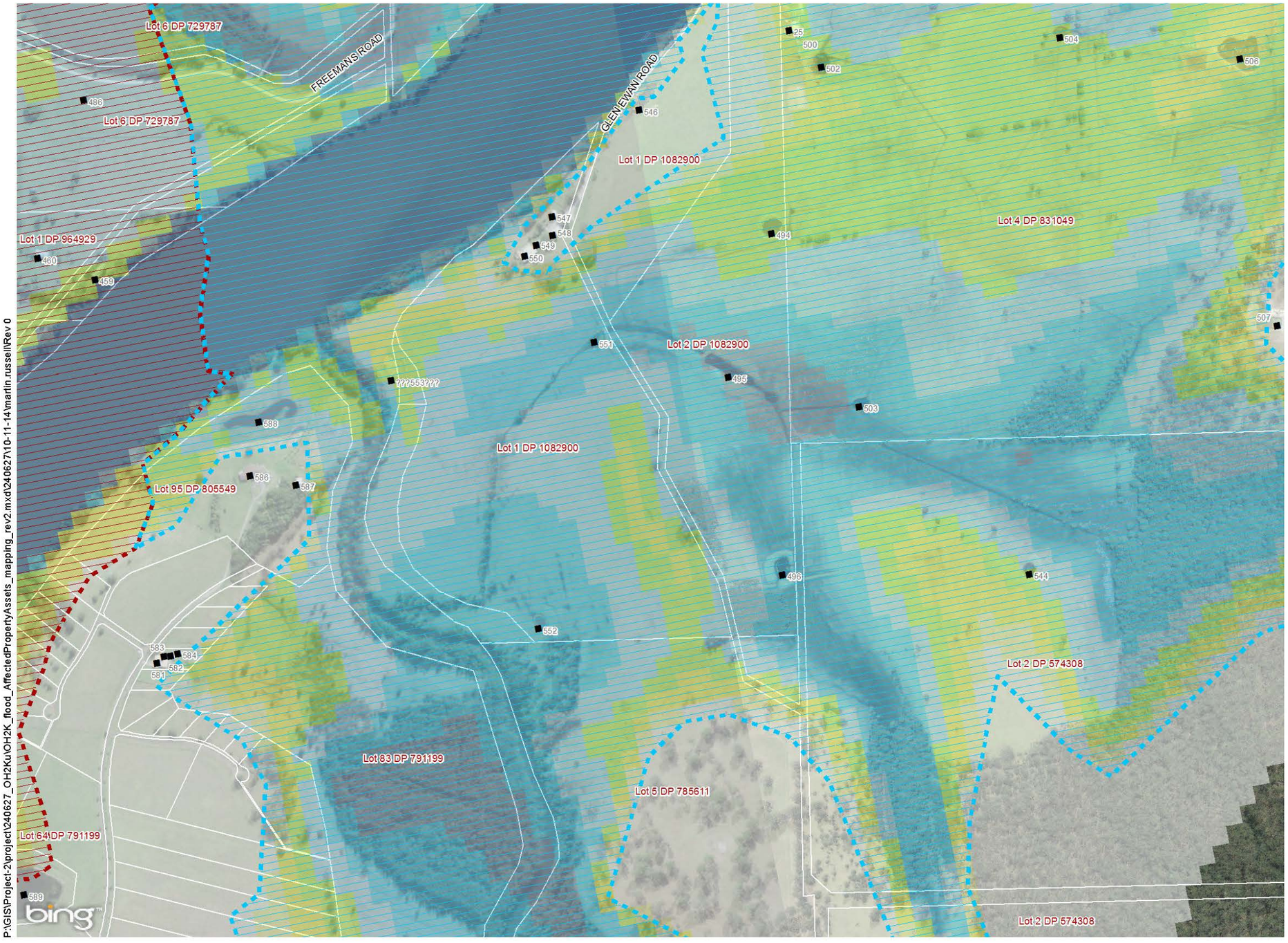
100 year flood event Project afflux extent A-16 (Map 16 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-17 100 Year Flood Event Project Afflux Extent Map 17 of 51

Lend Lease

aupb JOINT VENTURE

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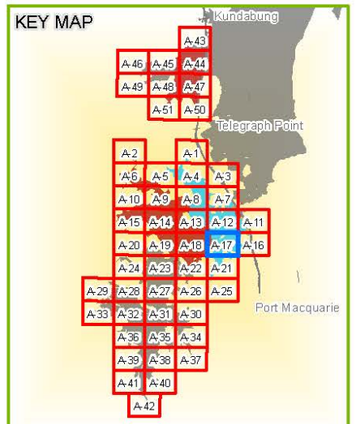
KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

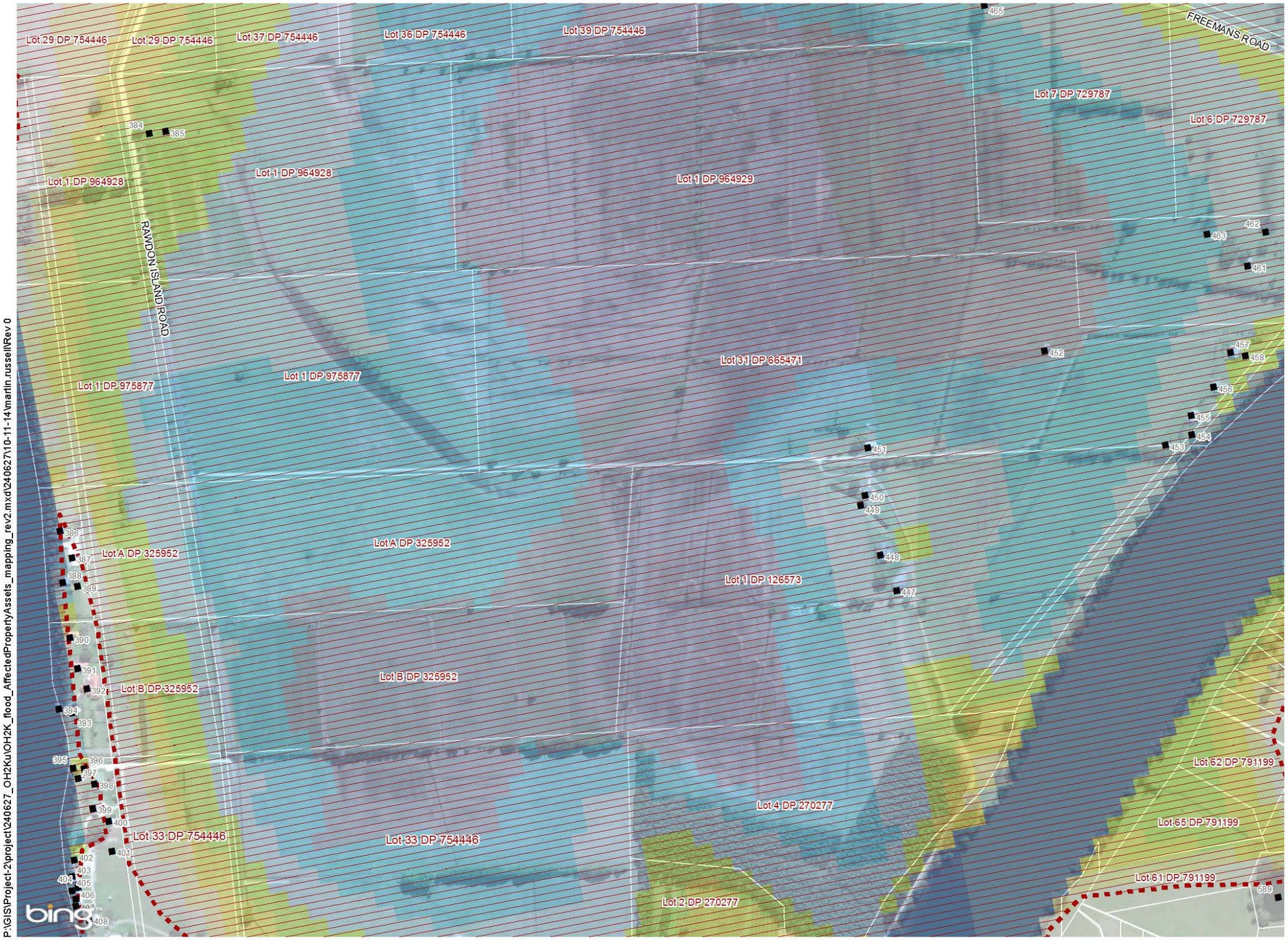
**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-17 (Map 17 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-18 100 Year Flood Event Project Afflux Extent Map 18 of 51

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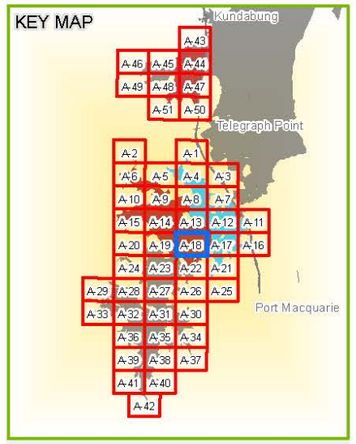
KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

# PACIFIC HIGHWAY UPGRADE OH2Ku HYDROLOGICAL MITIGATION REPORT

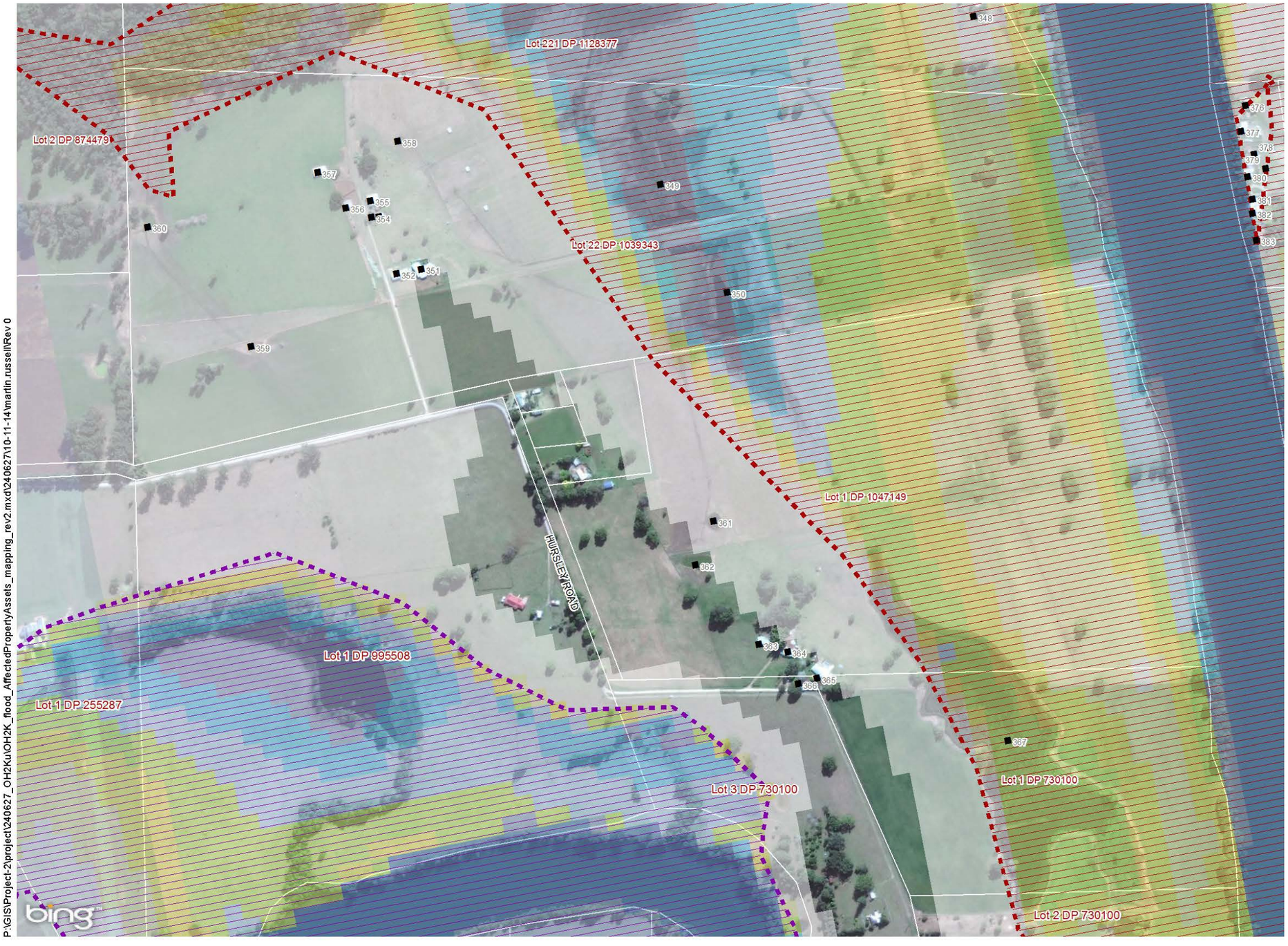
## 100 year flood event Project afflux extent A-18 (Map 18 of 51)

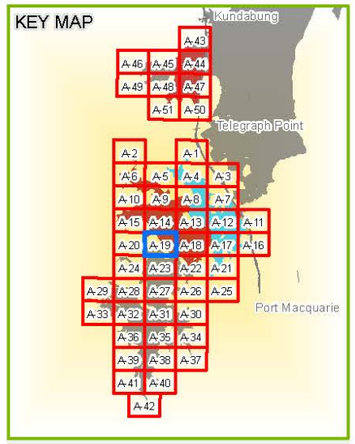
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-19 100 Year Flood Event Project Afflux Extent Map 19 of 51

Lend Lease

aupb JOINT VENTURE




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

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1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-19 (Map 19 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-20 100 Year Flood Event Project Afflux Extent Map 20 of 51


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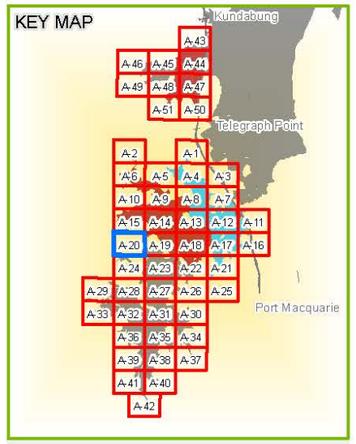
KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

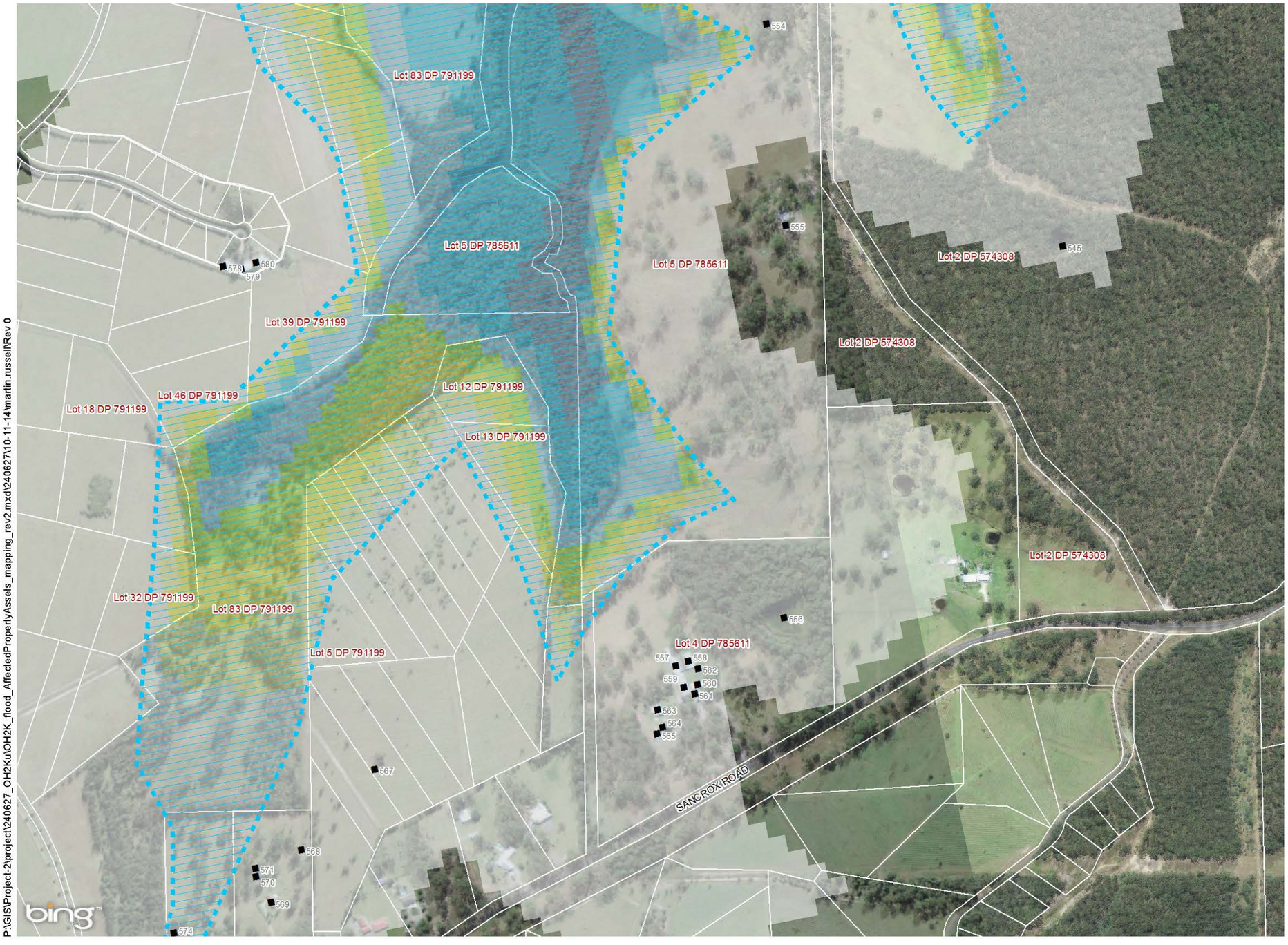
100 year flood event Project afflux extent A-20 (Map 20 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-21 100 Year Flood Event Project Afflux Extent Map 21 of 51

Lend Lease

aupb JOINT VENTURE

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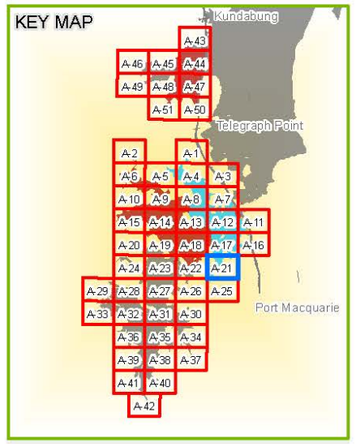
KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

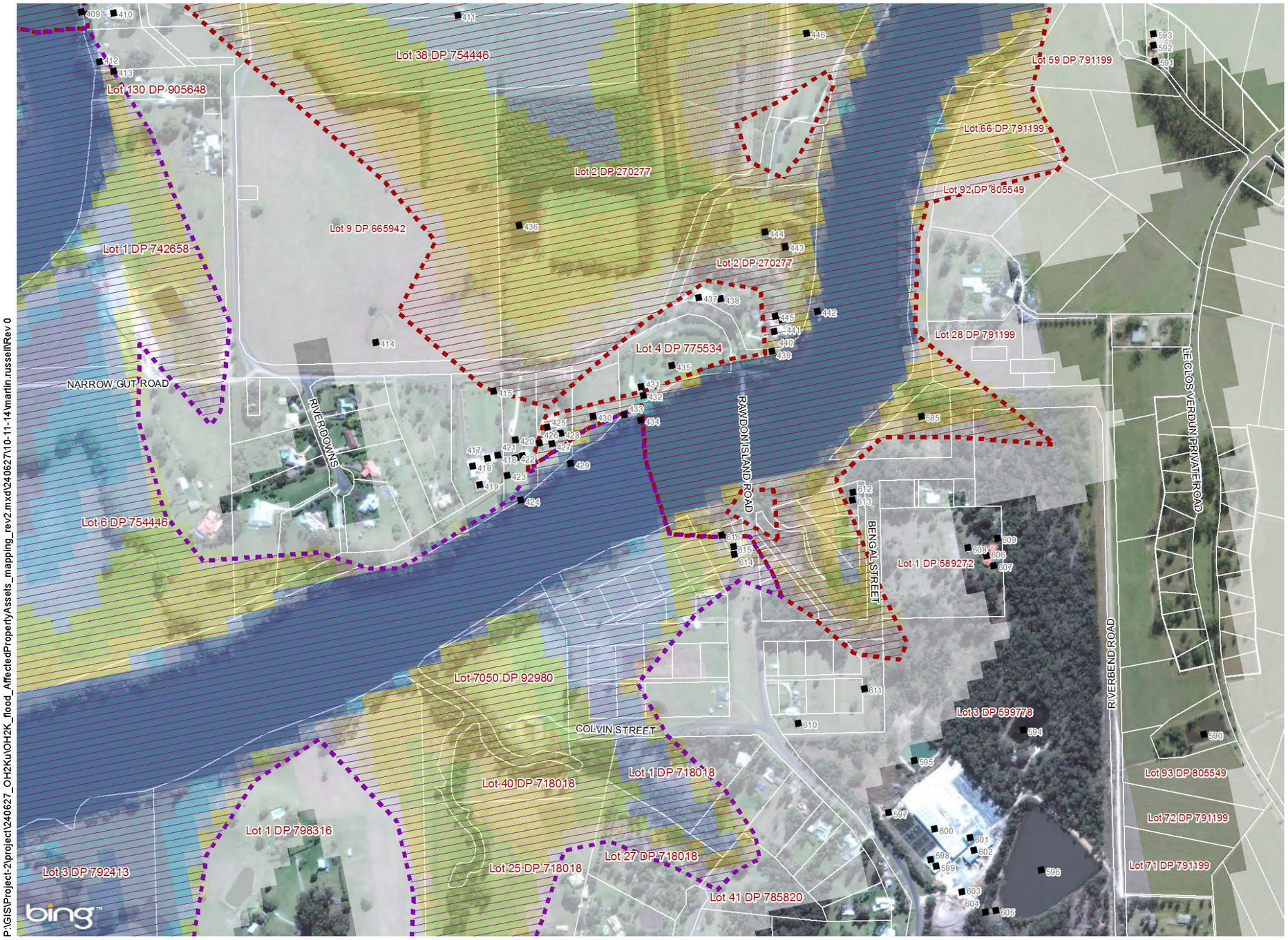
100 year flood event Project afflux extent A-21 (Map 21 of 51)

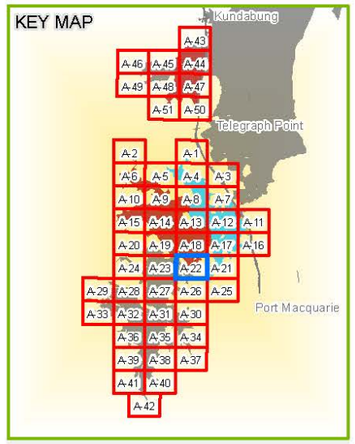
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-22 100 Year Flood Event Project Afflux Extent Map 22 of 51

Lend Lease

aupb JOINT VENTURE




Project boundary

Property assets

**100yr project afflux extent**

0.00-0.01m

0.01-0.02m

0.02-0.03m

0.03-0.04m

0.04-0.05m

> 0.05m

**Existing 100yr flood depths**

0 - 0.5m

0.5 - 1m

1 - 1.5m

1.5 - 2m

2 - 2.5m

2.5 - 3m

3 - 4m

4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-22 (Map 22 of 51)

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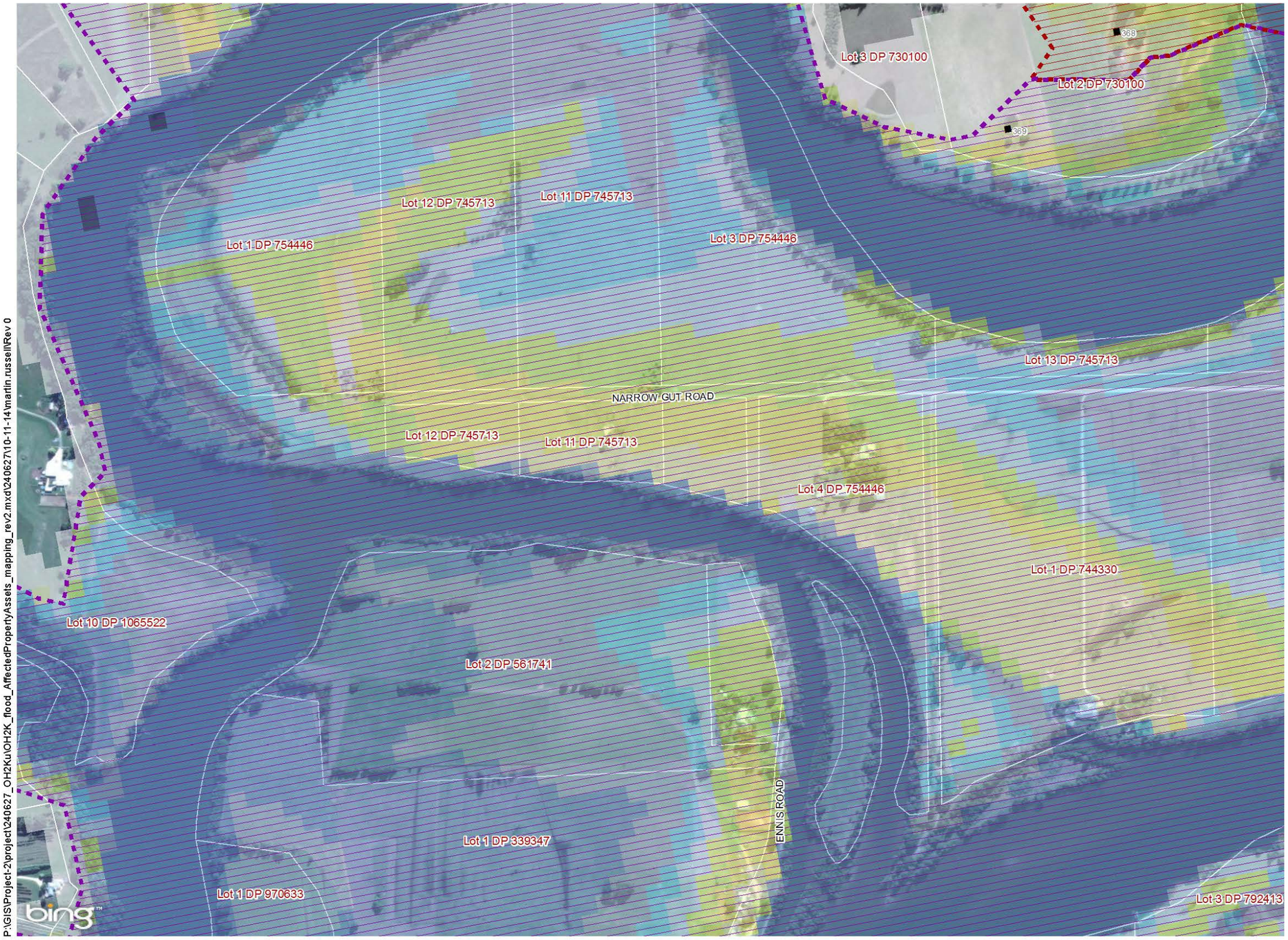
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-23 100 Year Flood Event Project Afflux Extent Map 23 of 51

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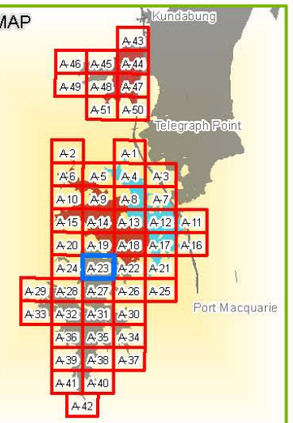
KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

# PACIFIC HIGHWAY UPGRADE OH2Ku HYDROLOGICAL MITIGATION REPORT

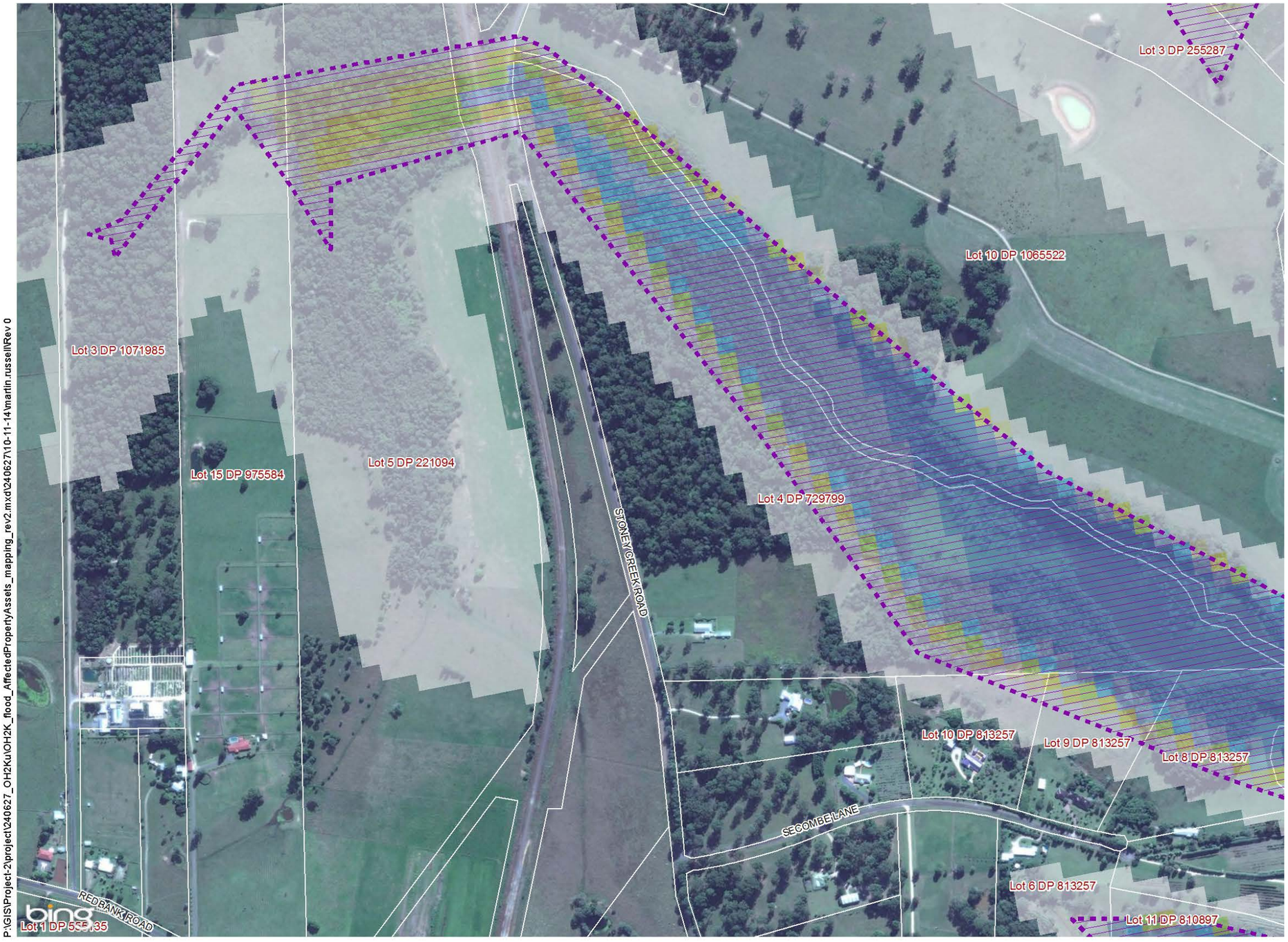
## 100 year flood event Project afflux extent A-23 (Map 23 of 51)

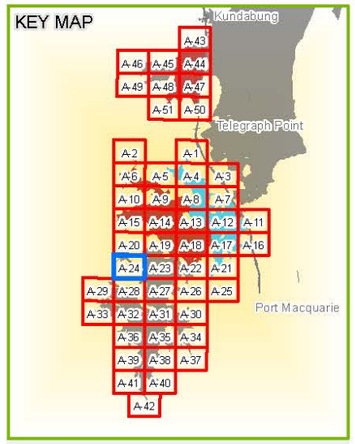
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-24 100 Year Flood Event Project Afflux Extent Map 24 of 51

Lend Lease

aupb JOINT VENTURE




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

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1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-24 (Map 24 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-25 100 Year Flood Event Project Afflux Extent Map 25 of 51


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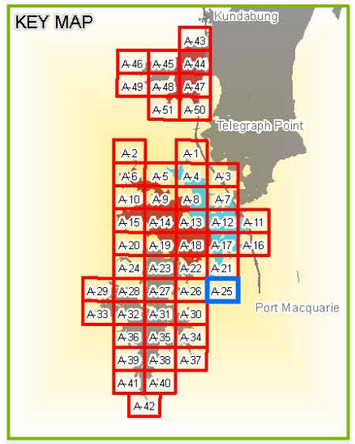
KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

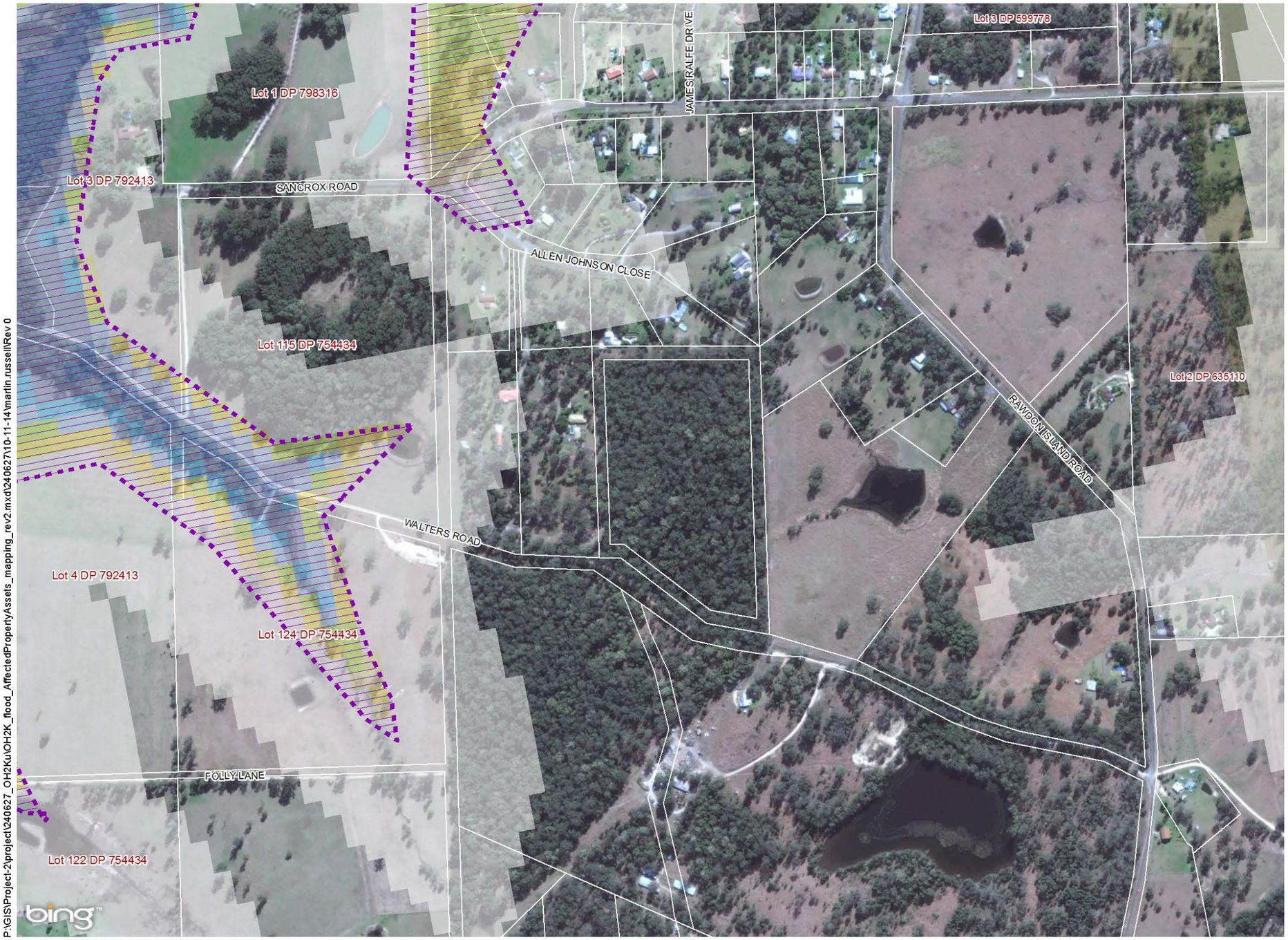
**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-25 (Map 25 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-26 100 Year Flood Event Project Afflux Extent Map 26 of 51

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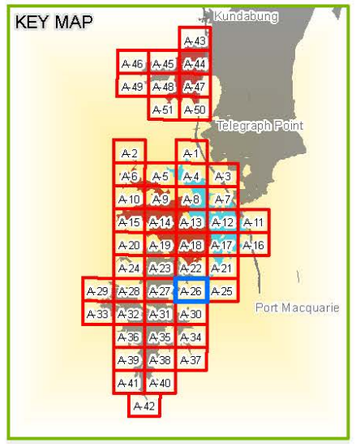
Lend Lease

aupb JOINT VENTURE

KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

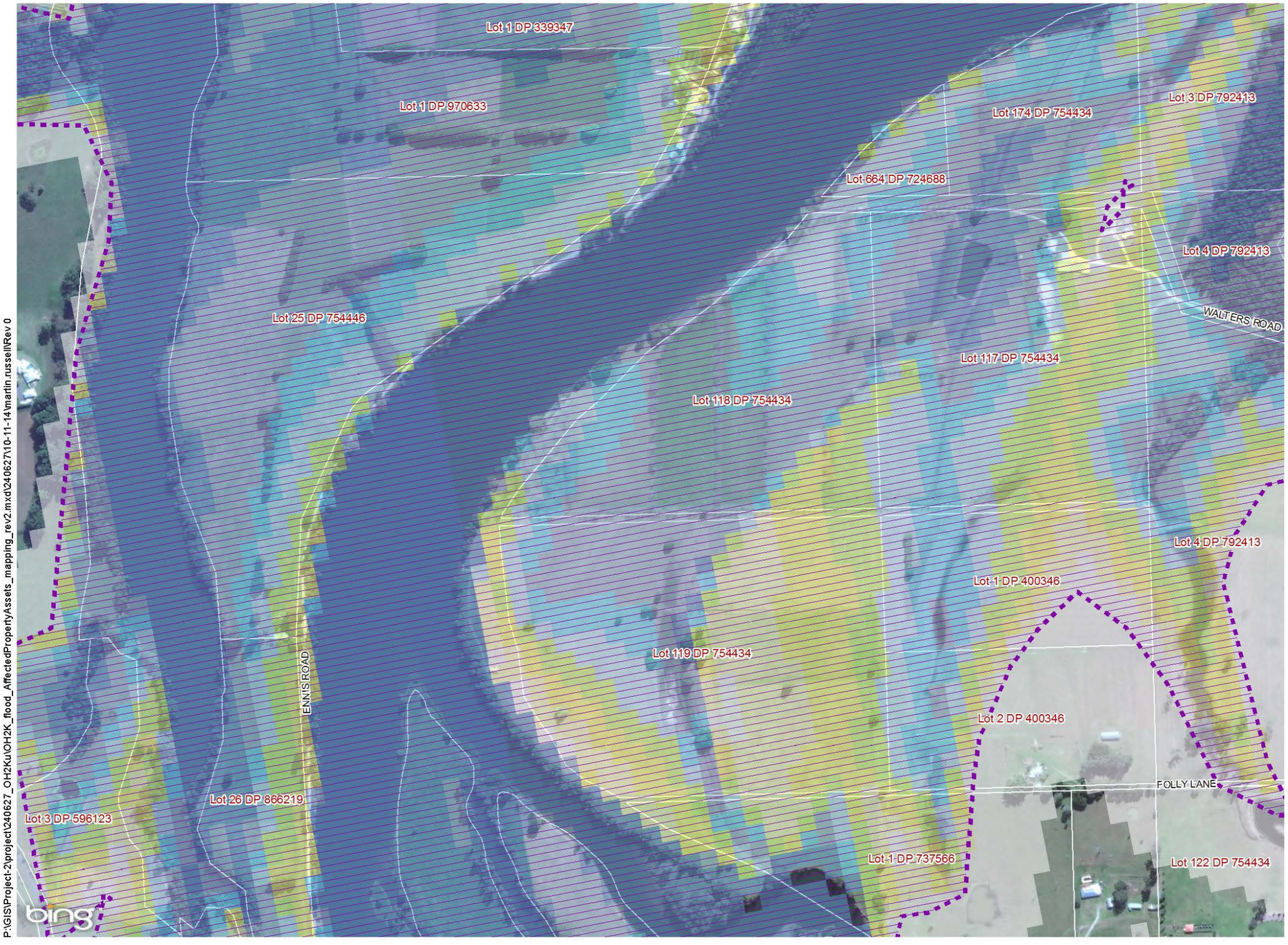
**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

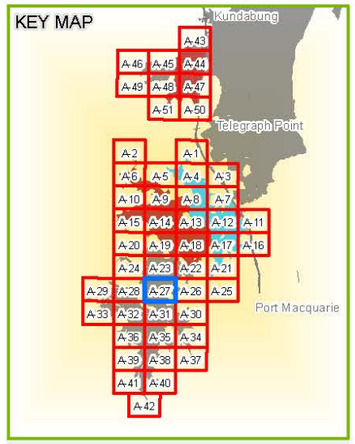
PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-26 (Map 26 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-27 100 Year Flood Event Project Afflux Extent Map 27 of 51




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

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1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014

**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56

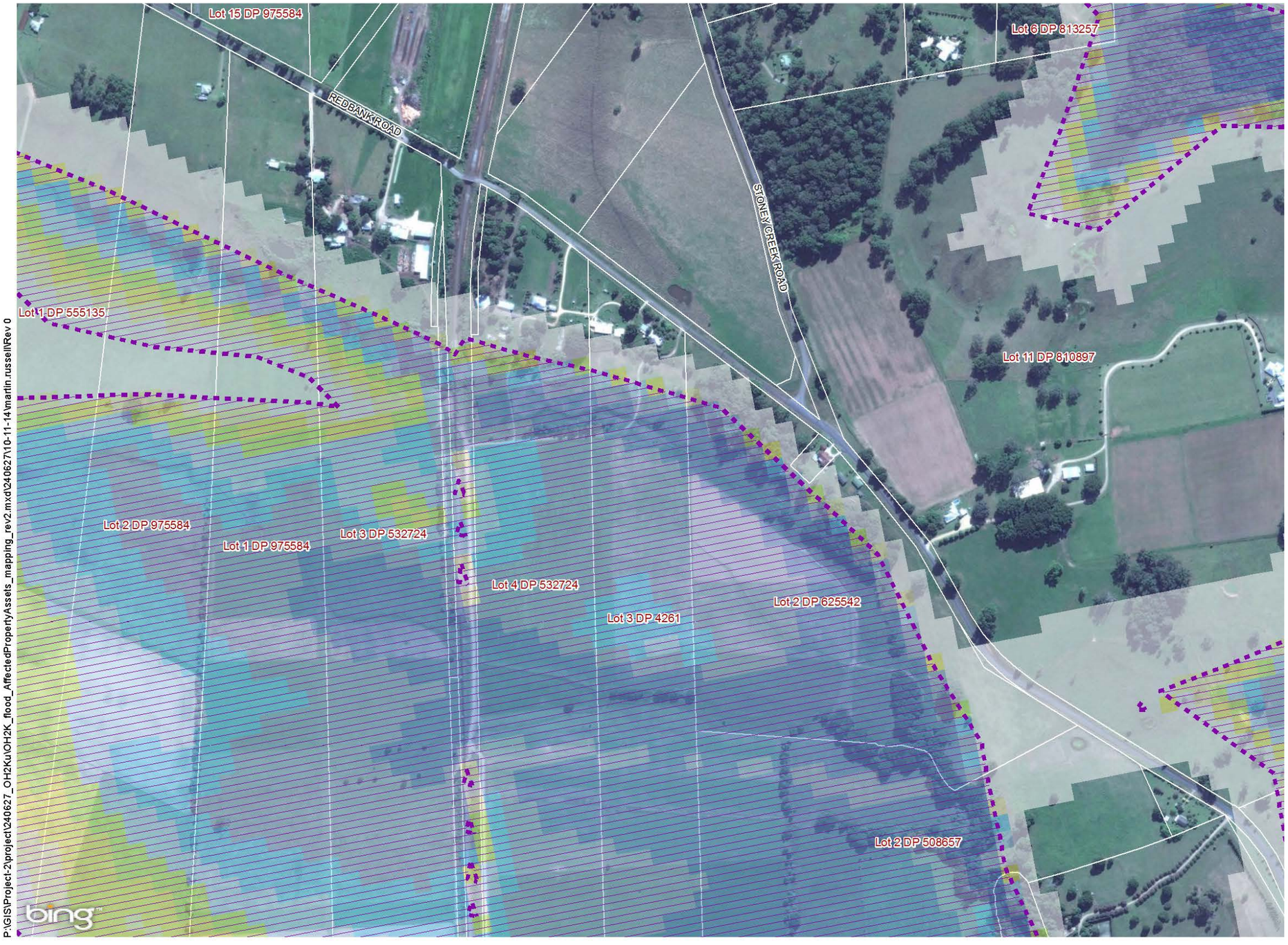
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-27 (Map 27 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-28 100 Year Flood Event Project Afflux Extent Map 28 of 51

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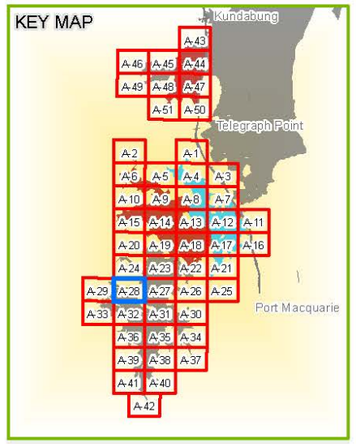



Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

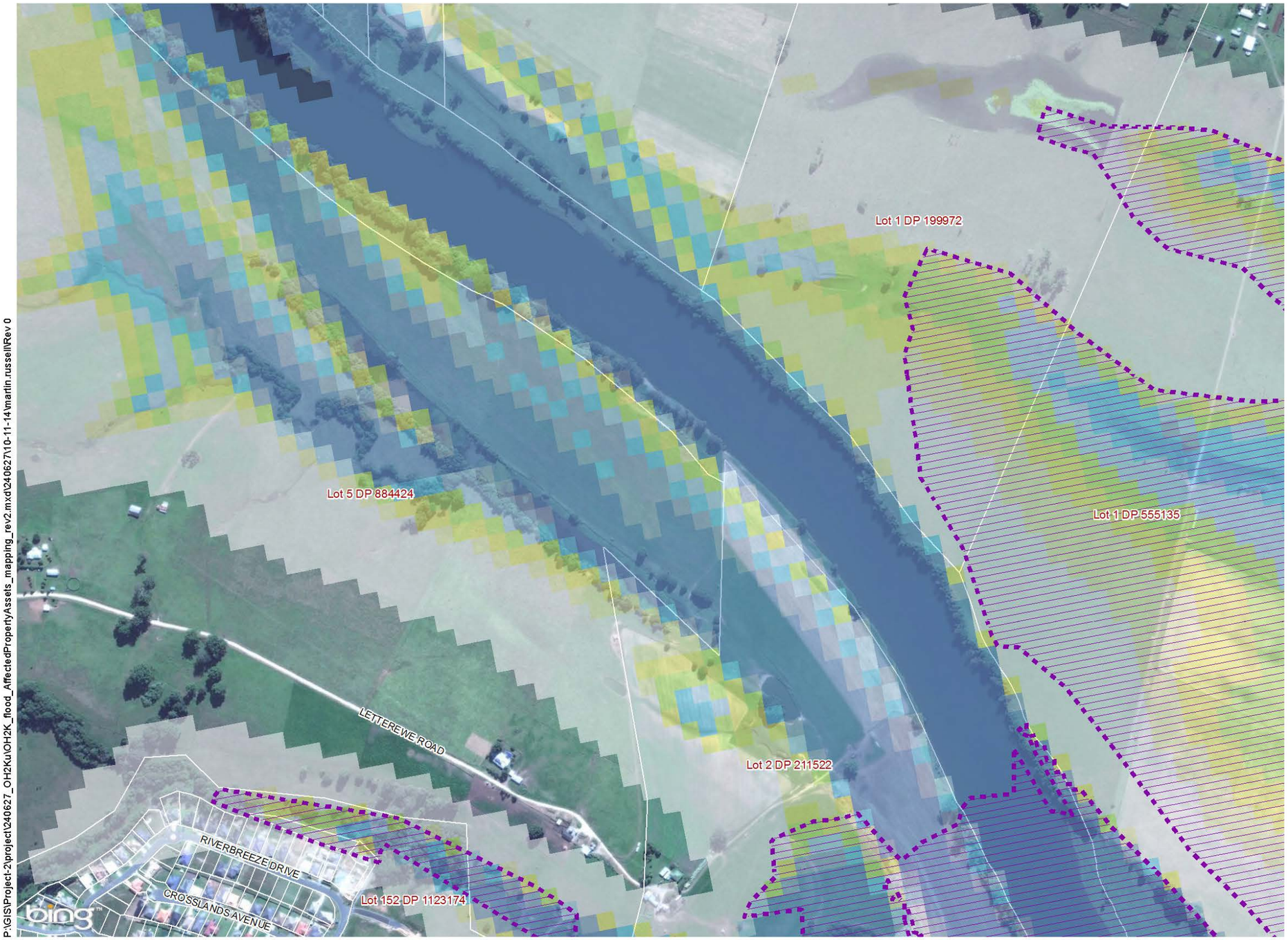
**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-28 (Map 28 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-29 100 Year Flood Event Project Afflux Extent Map 29 of 51

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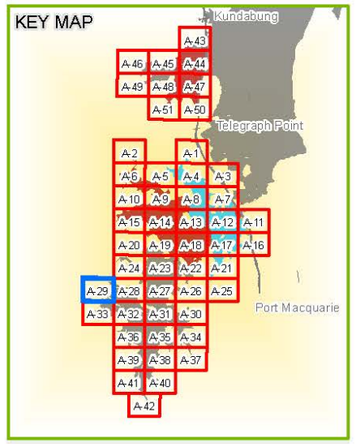



Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

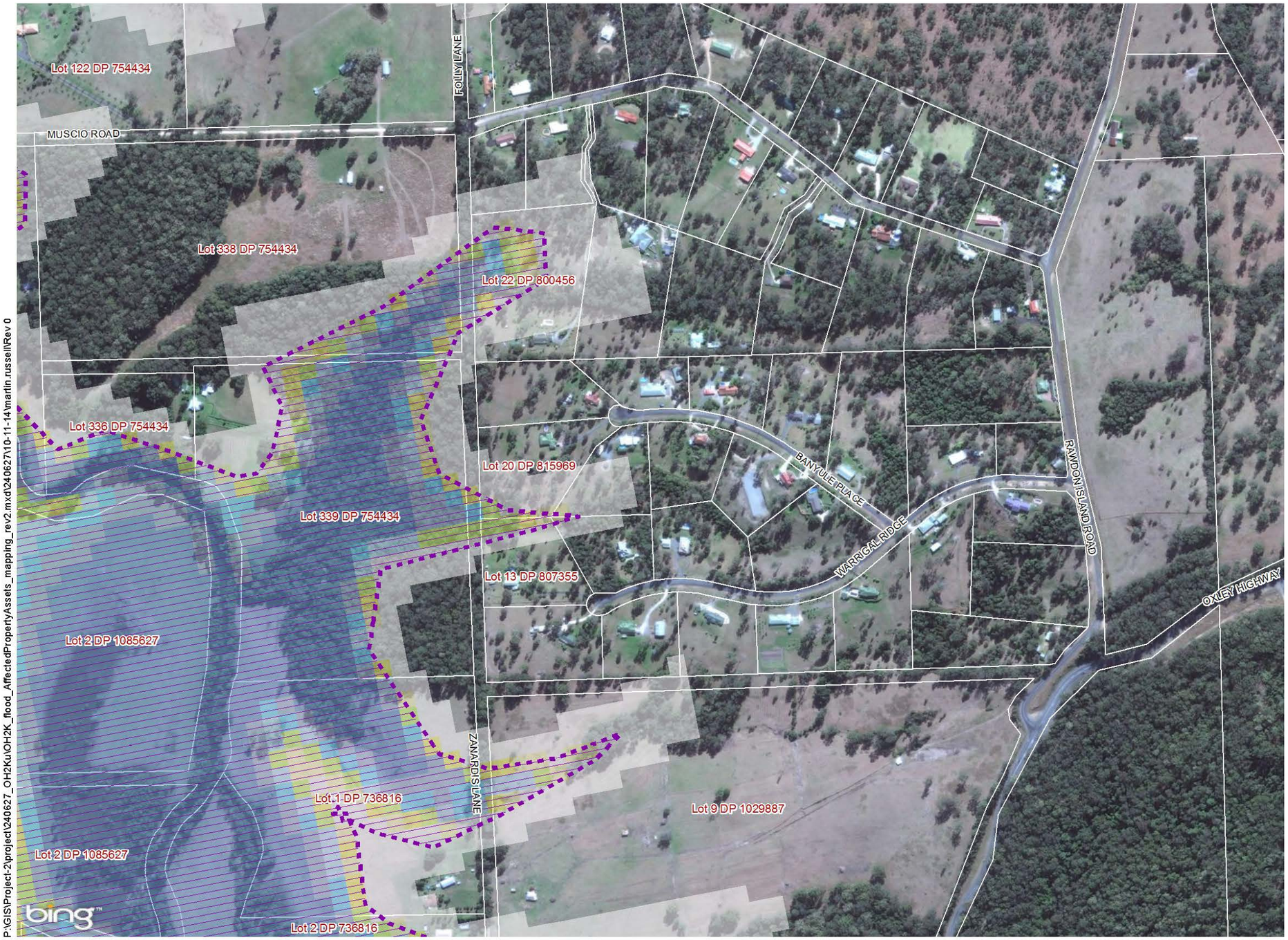
100 year flood event Project afflux extent A-29 (Map 29 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-30 100 Year Flood Event Project Afflux Extent Map 30 of 51

Lend Lease

aupb JOINT VENTURE

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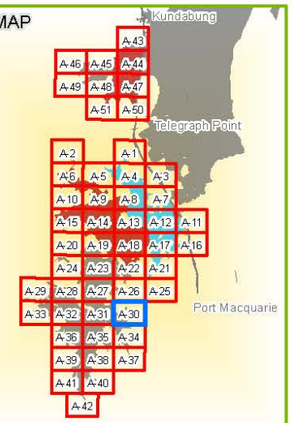
KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

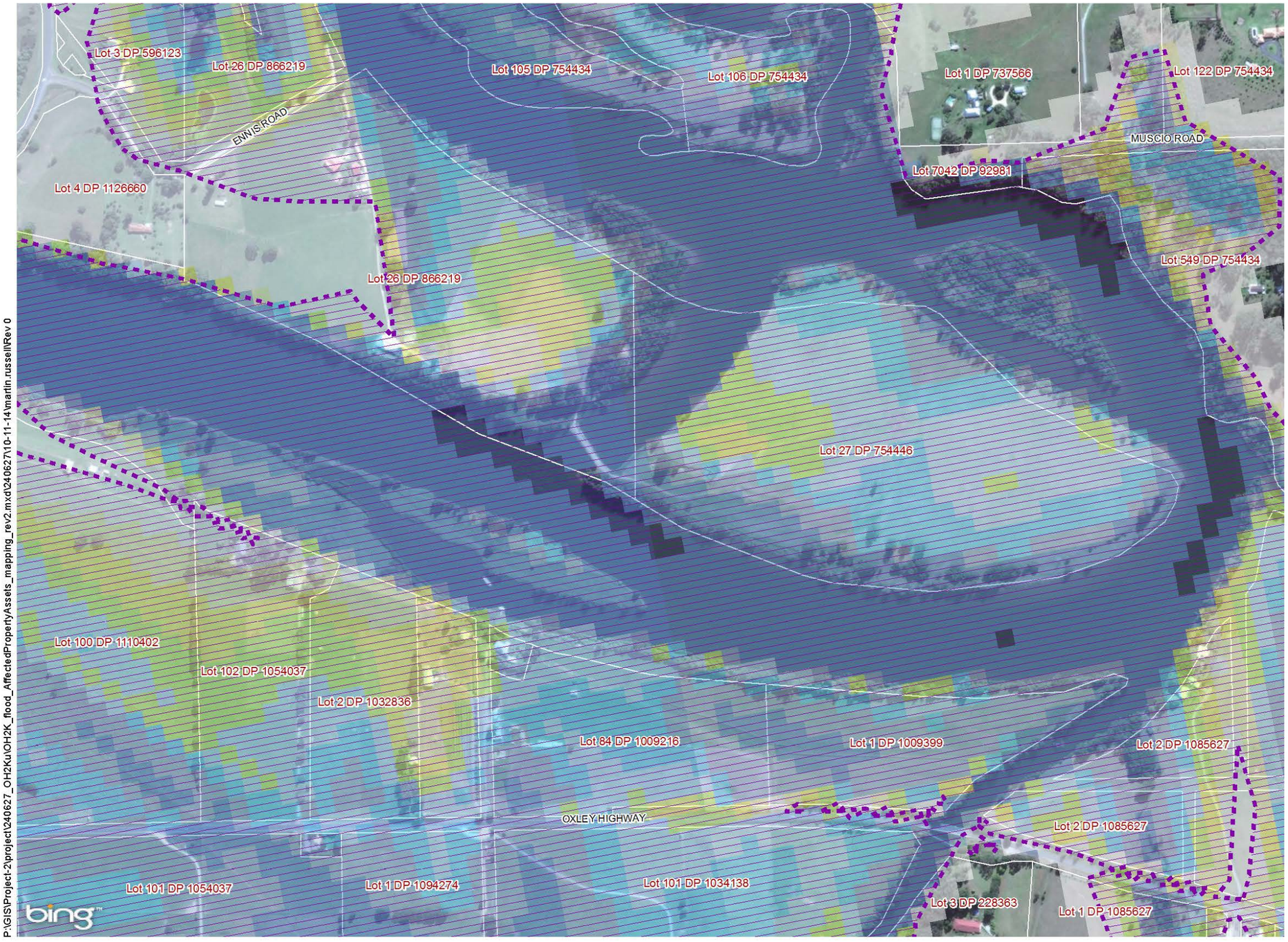
100 year flood event Project afflux extent A-30 (Map 30 of 51)

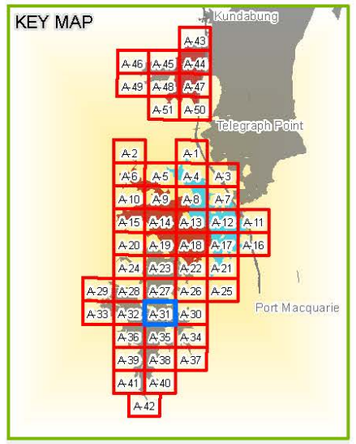
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-31 100 Year Flood Event Project Afflux Extent Map 31 of 51

Lend Lease

aupb JOINT VENTURE




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

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1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

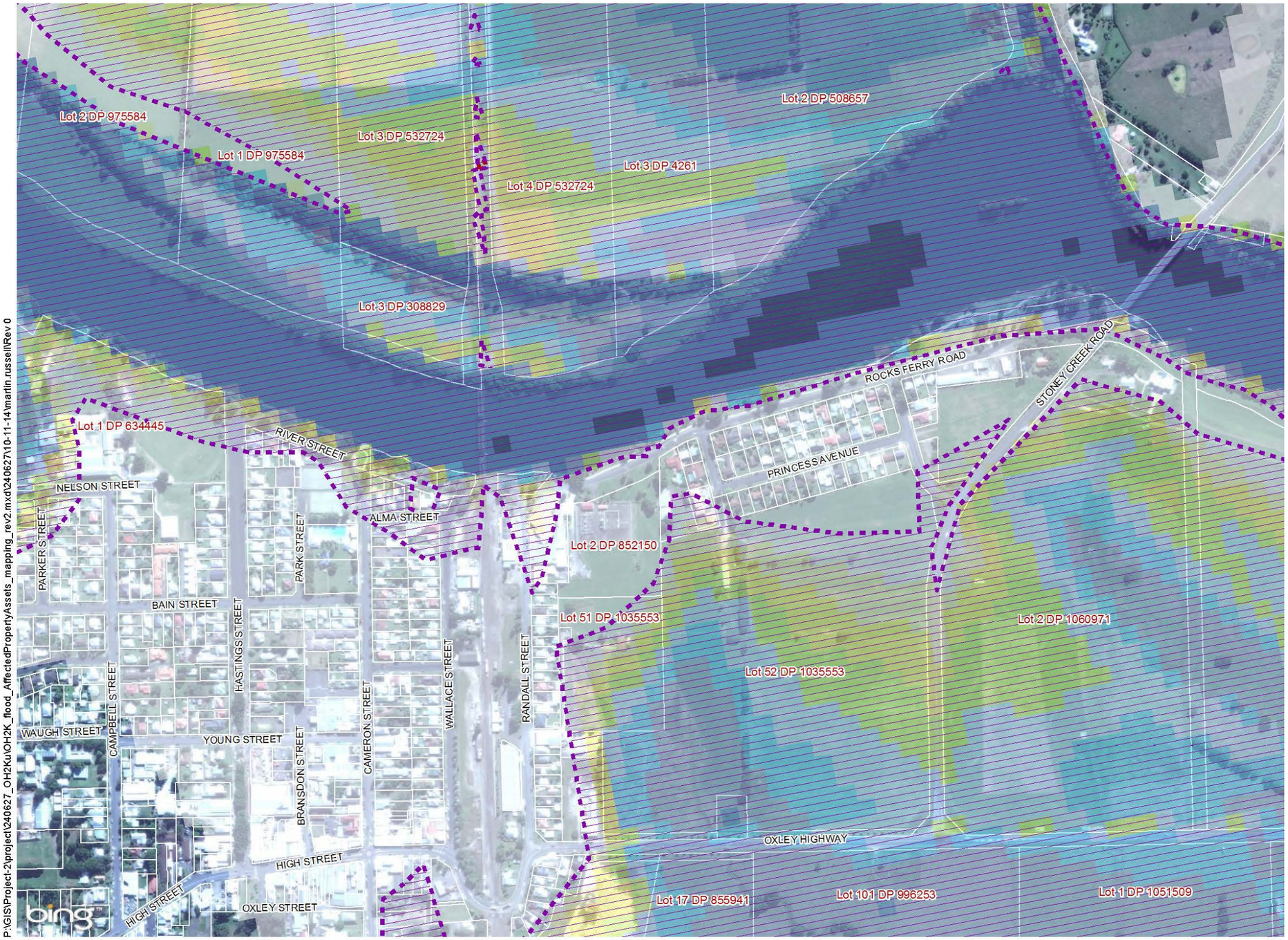
100 year flood event Project afflux extent A-31 (Map 31 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-32 100 Year Flood Event Project Afflux Extent Map 32 of 51

Lend Lease

aupb JOINT VENTURE

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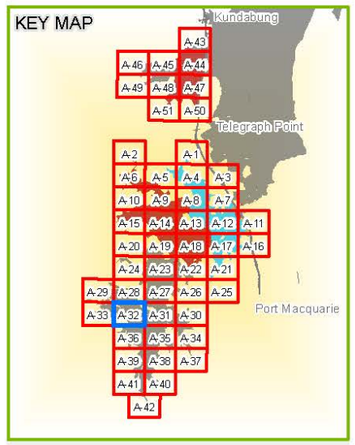
KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

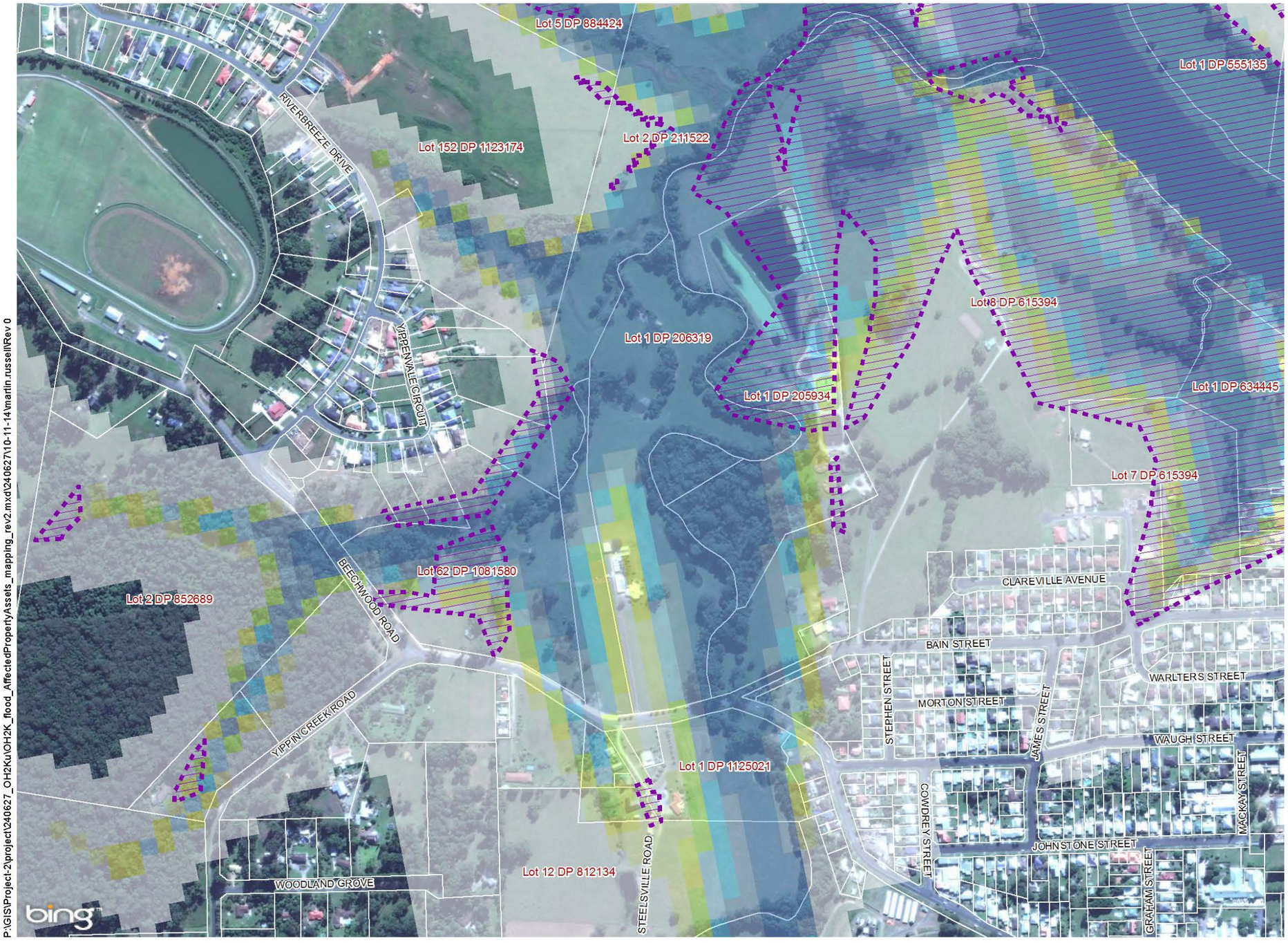
**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-32 (Map 32 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-33 100 Year Flood Event Project Afflux Extent Map 33 of 51






Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

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1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

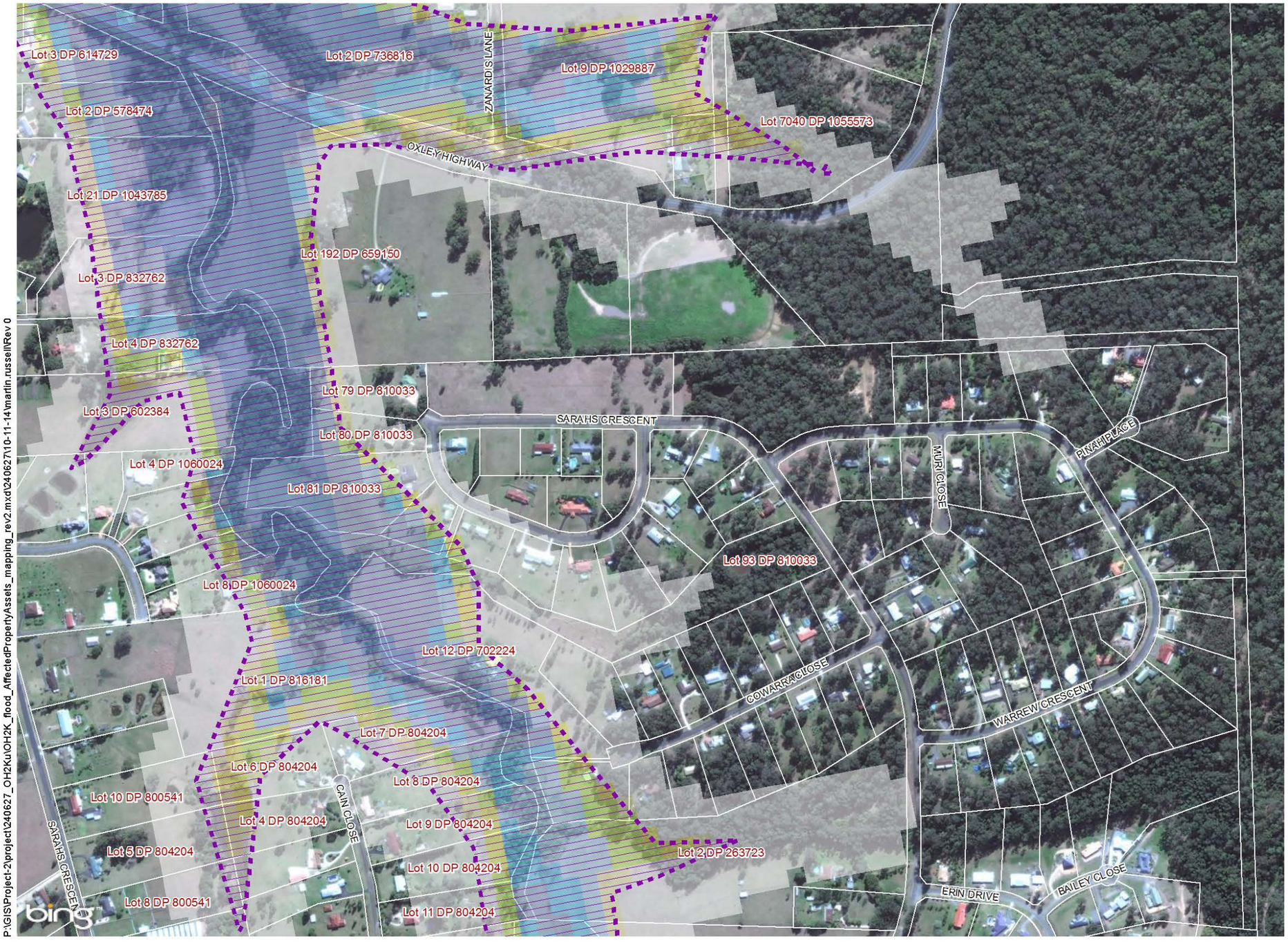
**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

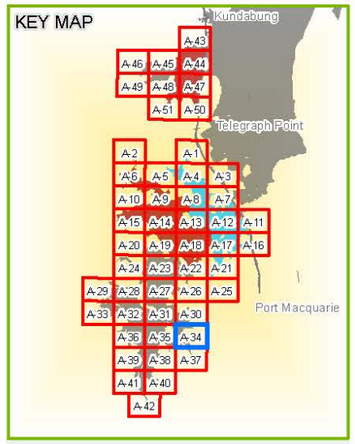
PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-33 (Map 33 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-34 100 Year Flood Event Project Afflux Extent Map 34 of 51




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-34 (Map 34 of 51)

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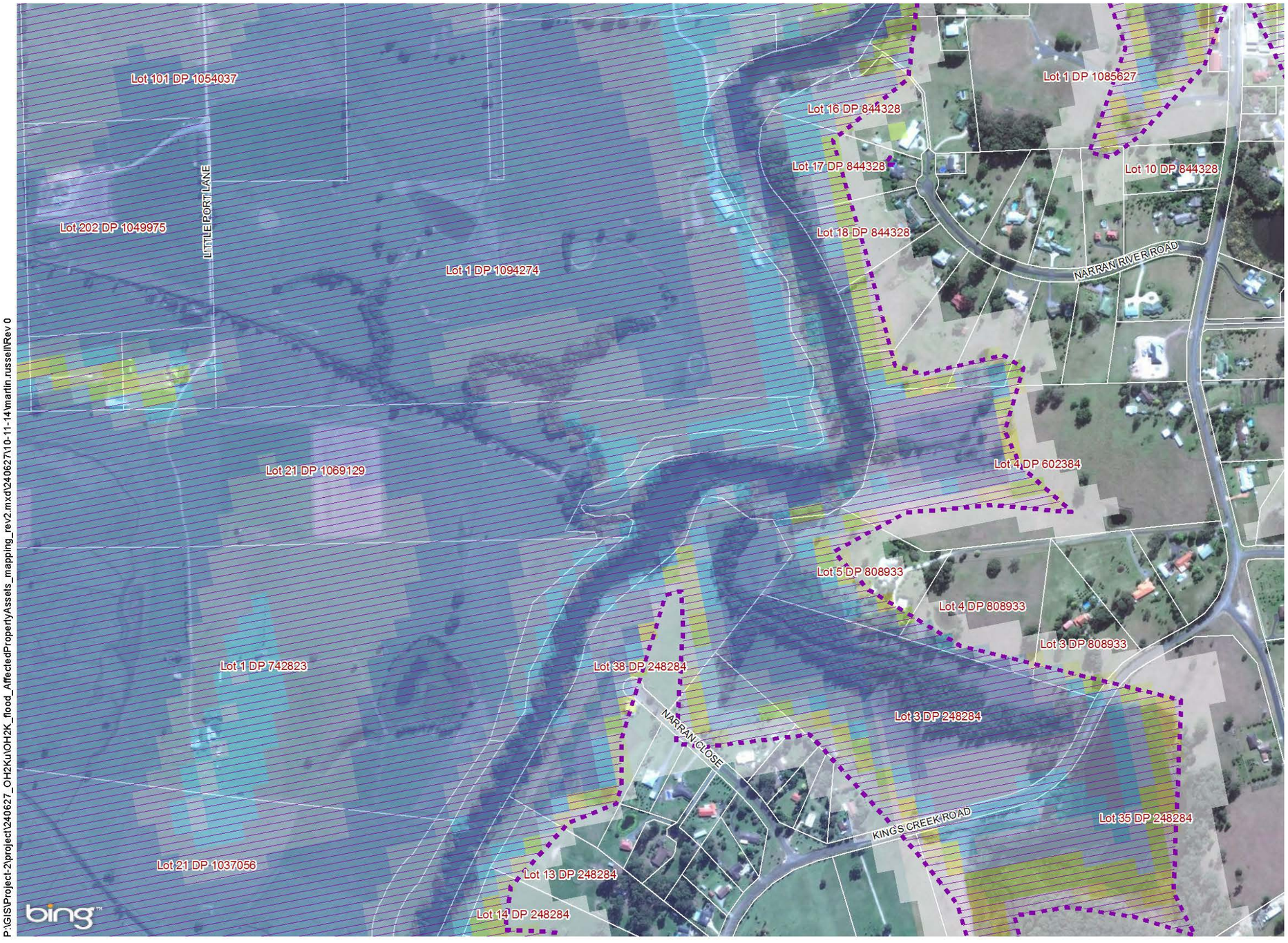
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-35 100 Year Flood Event Project Afflux Extent Map 35 of 51

Lend Lease

aupb JOINT VENTURE

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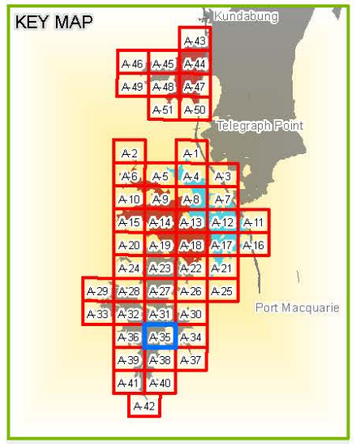



Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

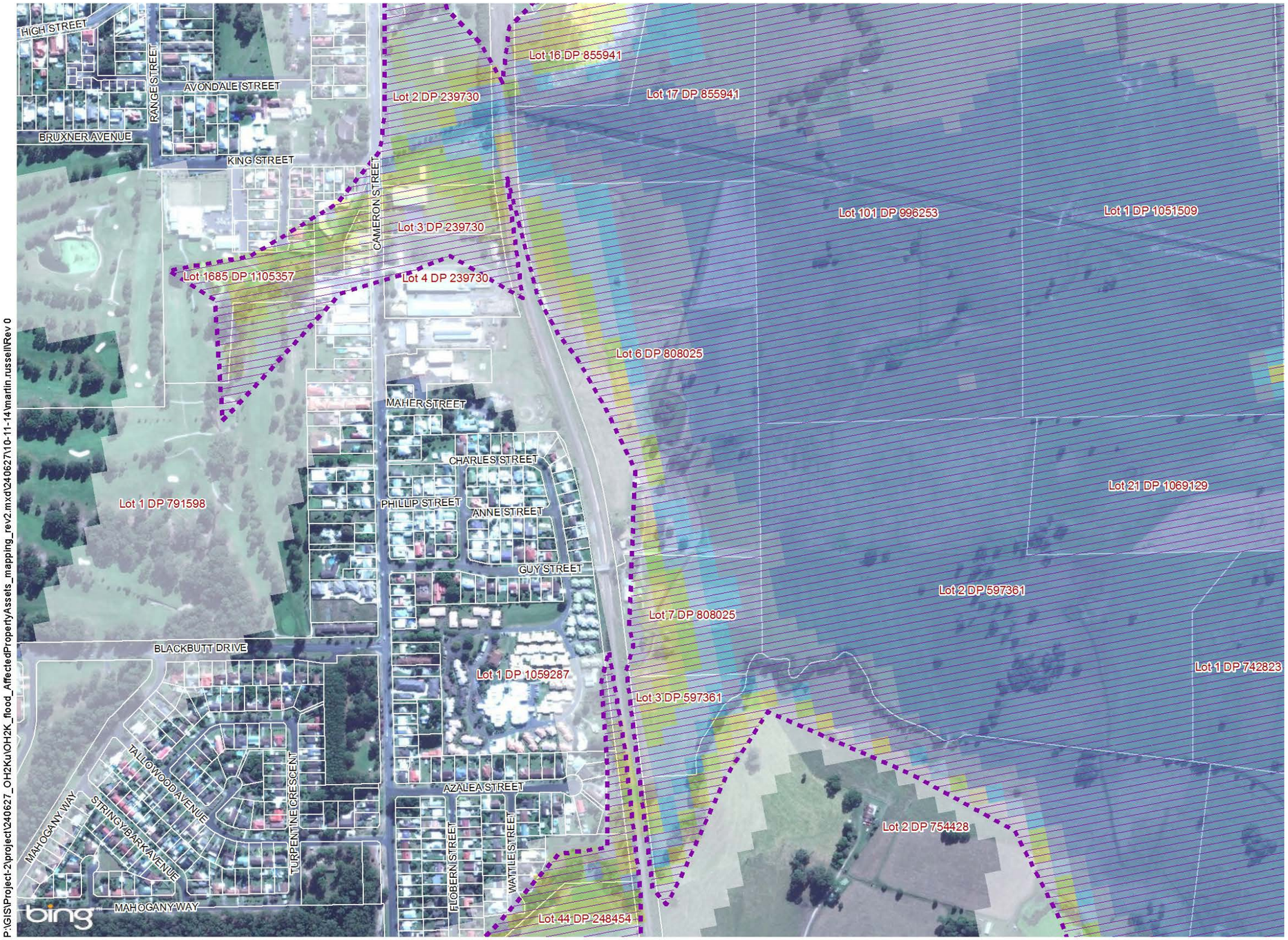
100 year flood event Project afflux extent A-35 (Map 35 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

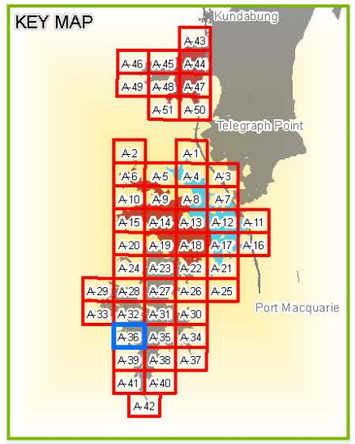
Figure A-36 100 Year Flood Event Project Afflux Extent Map 36 of 51

Lend Lease

aupb JOINT VENTURE




KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

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1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

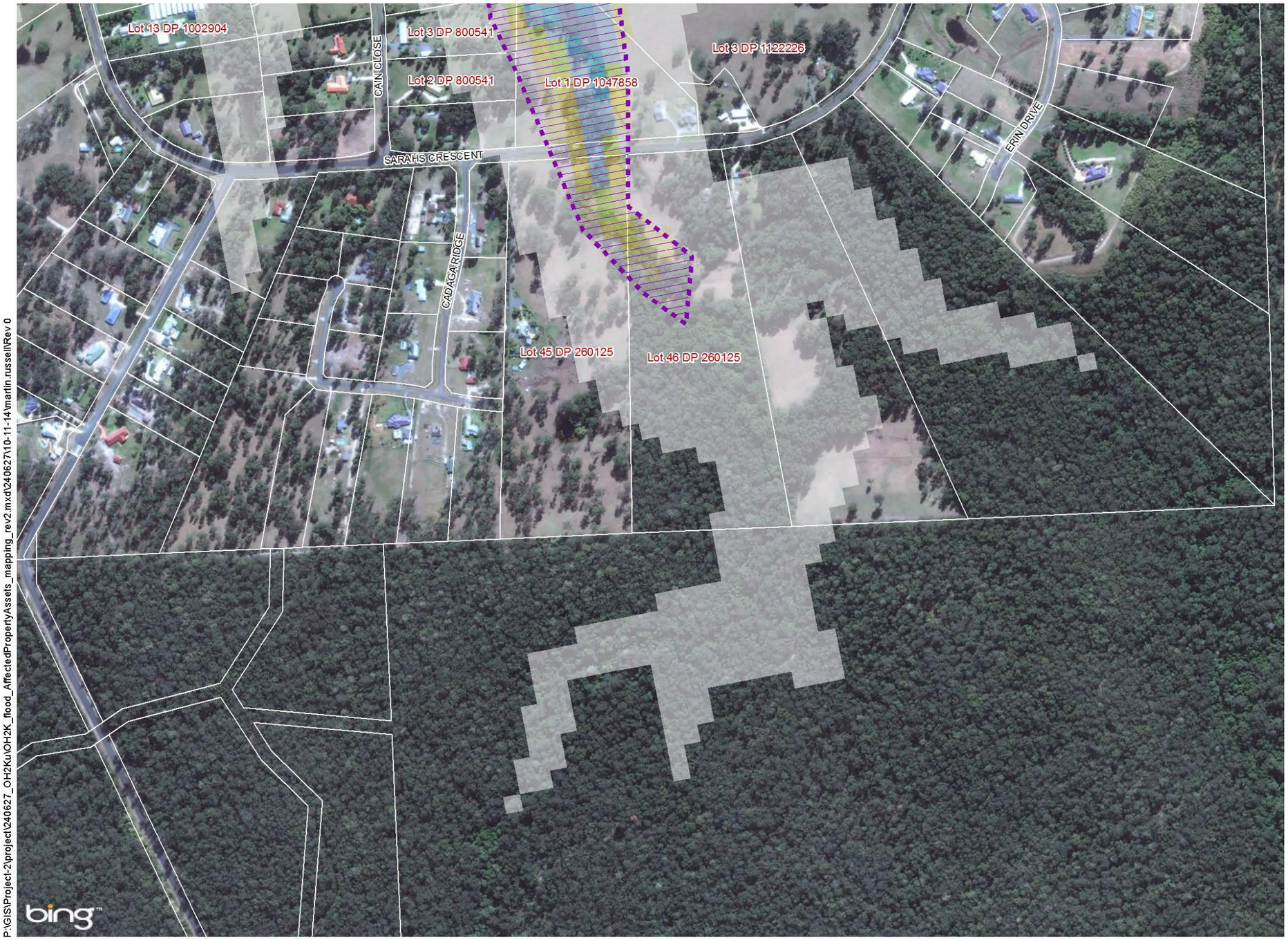
**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-36 (Map 36 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-37 100 Year Flood Event Project Afflux Extent Map 37 of 51

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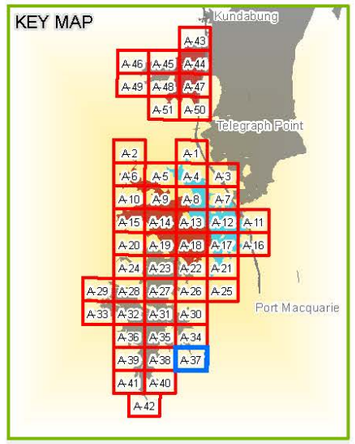



- Project boundary
- Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

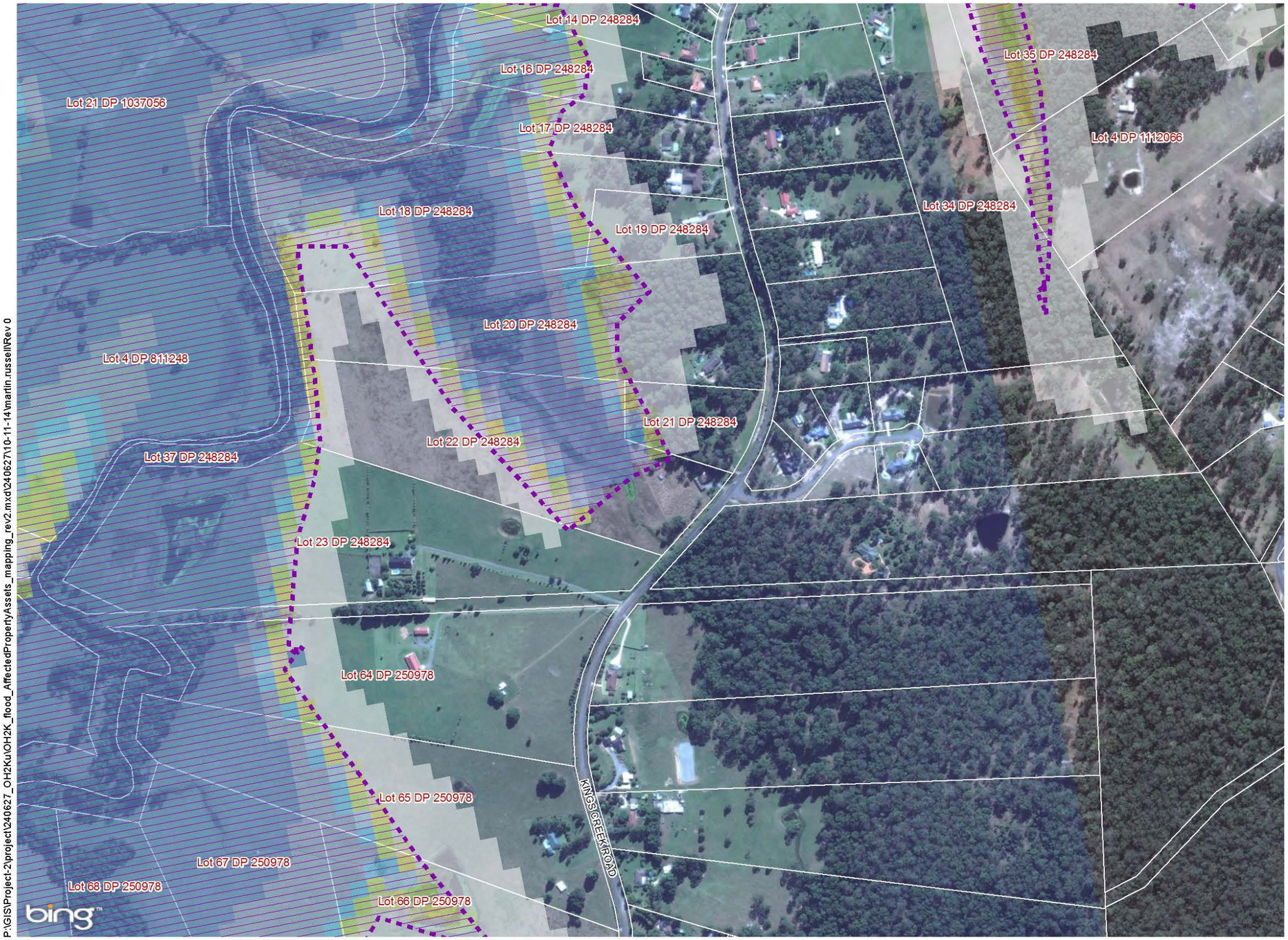
100 year flood event Project afflux extent A-37 (Map 37 of 51)

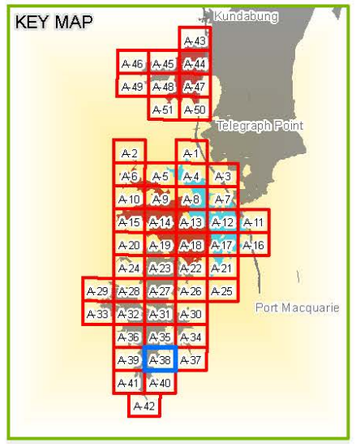
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-38 Year Flood Event Project Afflux Extent Map 38 of 51

Lend Lease

aupb JOINT VENTURE




Project boundary

Property assets

**100yr project afflux extent**

0.00-0.01m
0.01-0.02m
0.02-0.03m
0.03-0.04m
0.04-0.05m
> 0.05m

**Existing 100yr flood depths**

0 - 0.5m
0.5 - 1m
1 - 1.5m
1.5 - 2m
2 - 2.5m
2.5 - 3m
3 - 4m
4 - 5m+

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1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

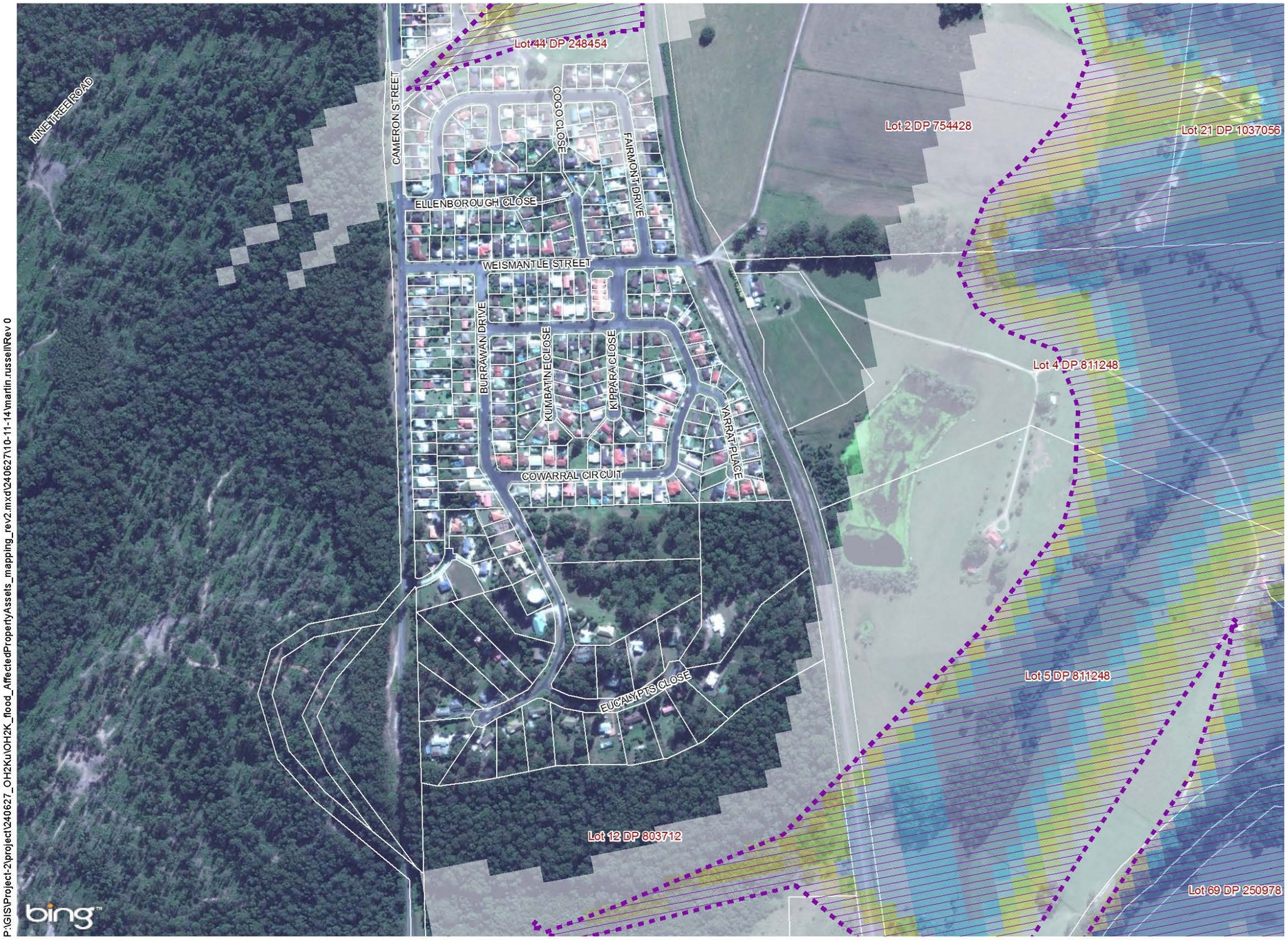
100 year flood event Project afflux extent A-38 (Map 38 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

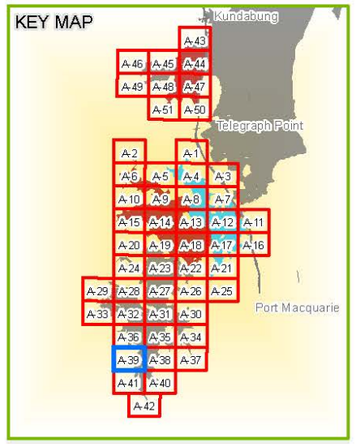
Figure A-39 100 Year Flood Event Project Afflux Extent Map 39 of 51

Lend Lease

aupb JOINT VENTURE




KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

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1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

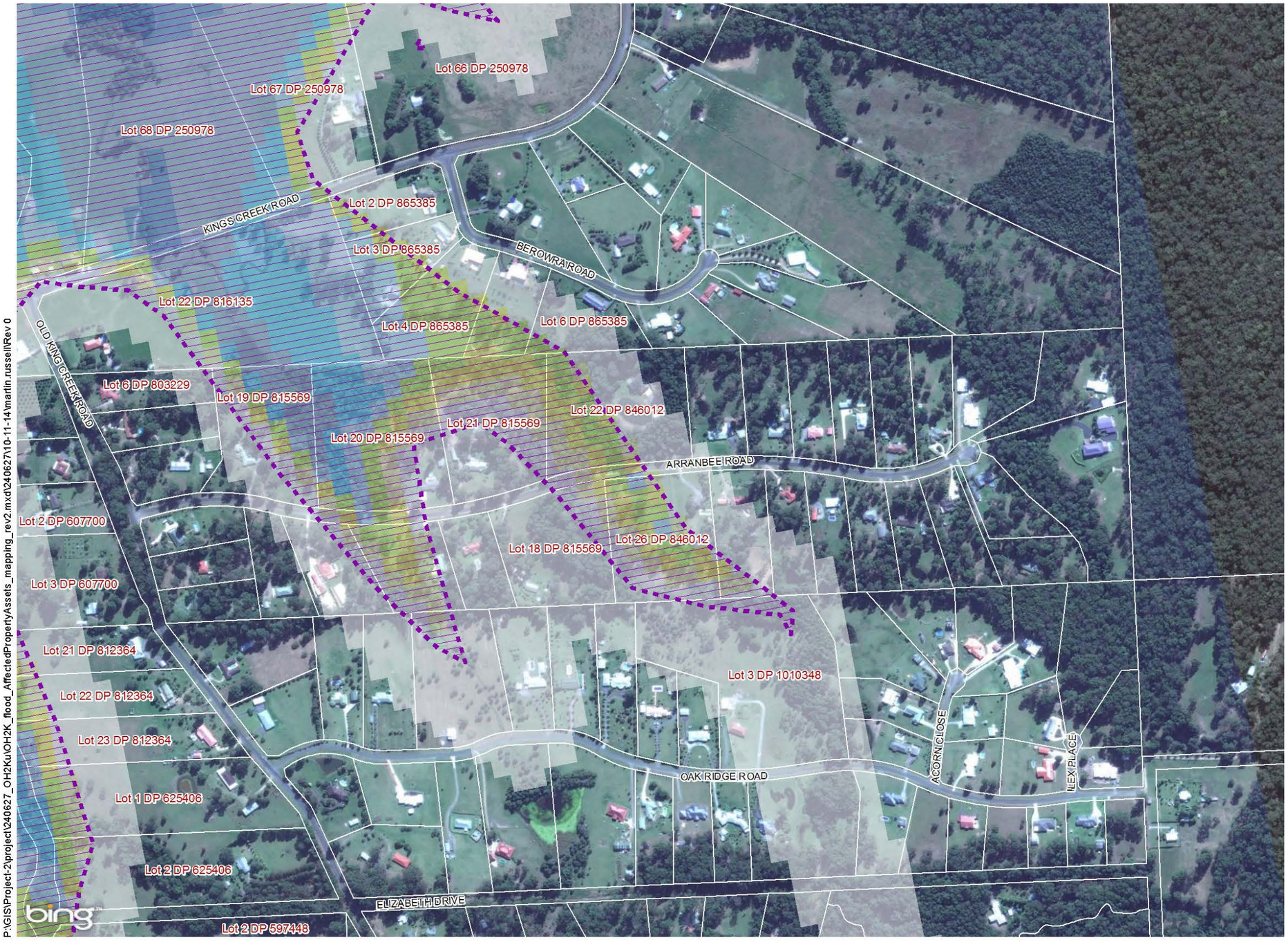
**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

# PACIFIC HIGHWAY UPGRADE OH2Ku HYDROLOGICAL MITIGATION REPORT

## 100 year flood event Project afflux extent A-39 (Map 39 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-40 100 Year Flood Event Project Afflux Extent Map 40 of 51

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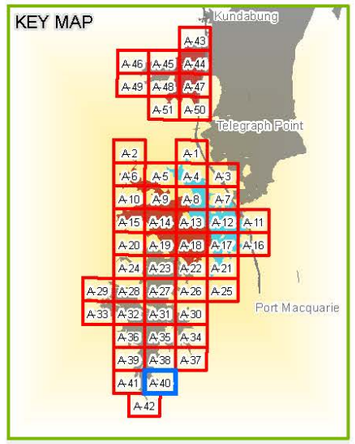



Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

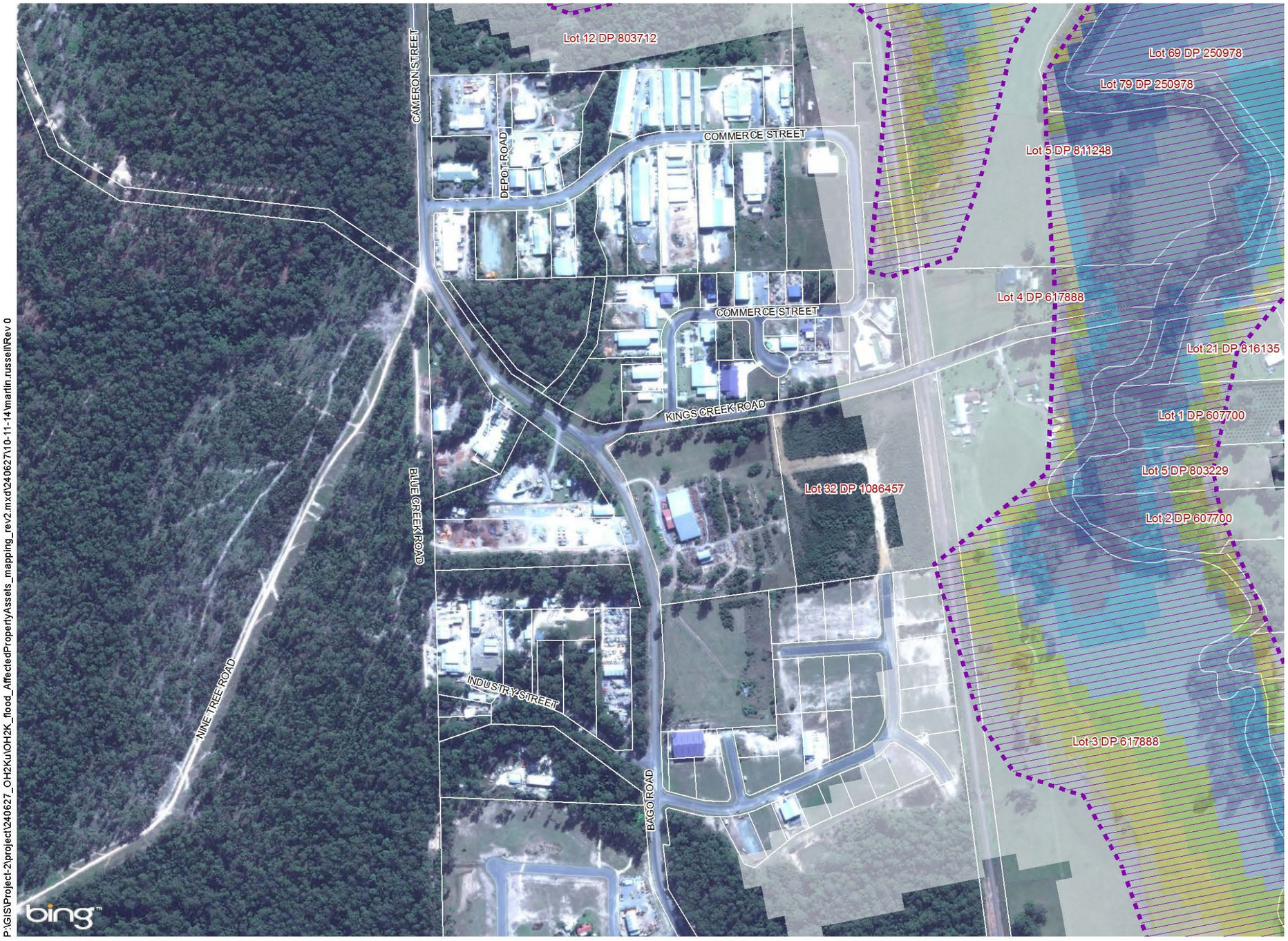
**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

# PACIFIC HIGHWAY UPGRADE OH2Ku HYDROLOGICAL MITIGATION REPORT

## 100 year flood event Project afflux extent A-40 (Map 40 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-41 100 Year Flood Event Project Afflux Extent Map 41 of 51

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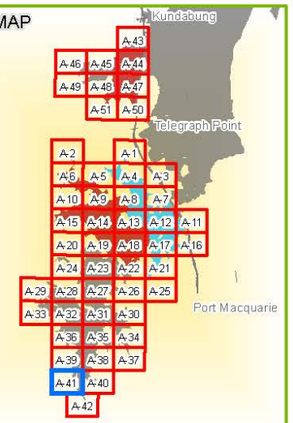
KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

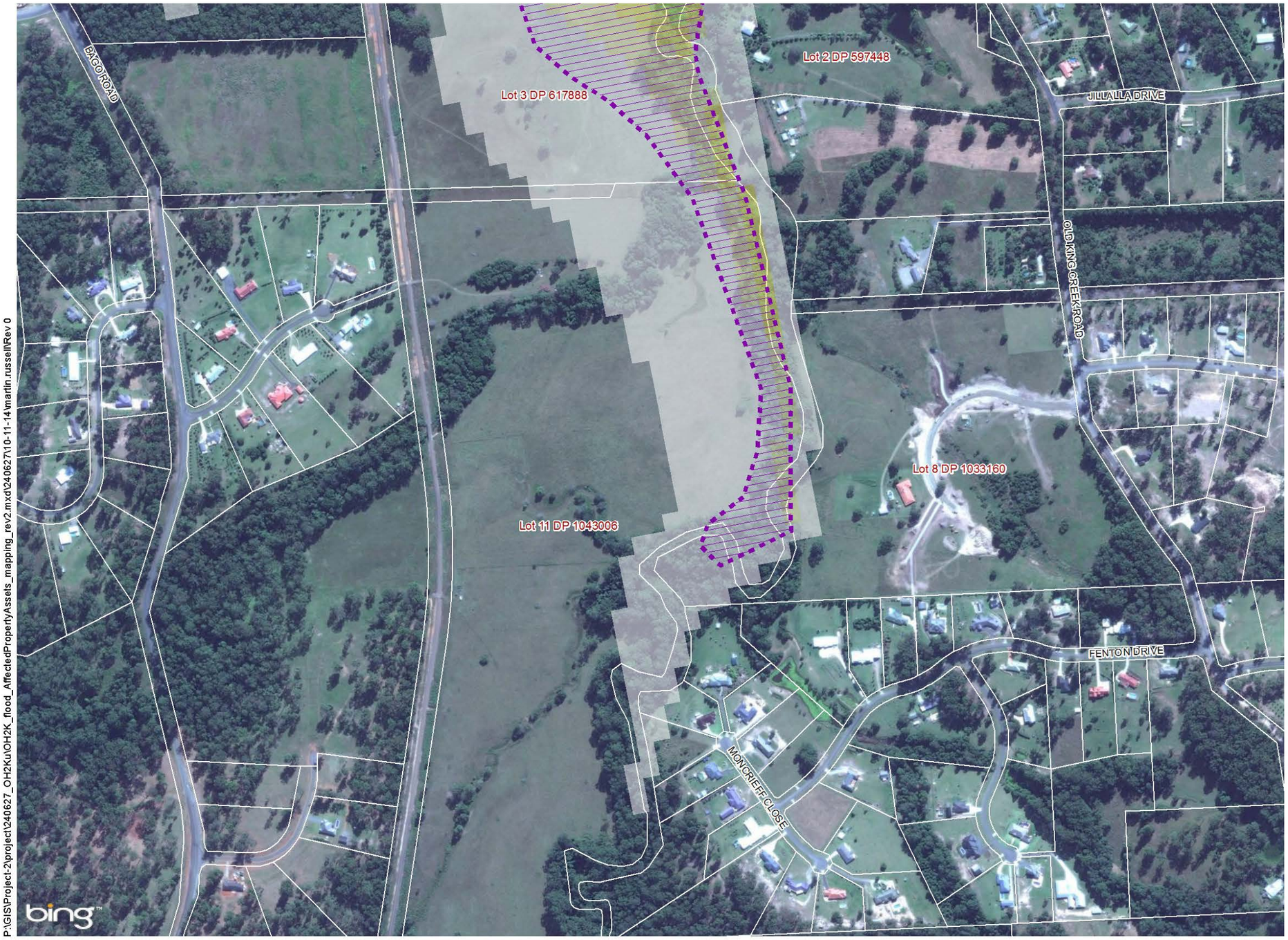
**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-41 (Map 41 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-42 100 Year Flood Event Project Afflux Extent Map 42 of 51

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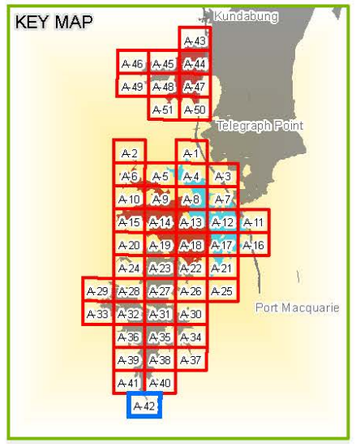



Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

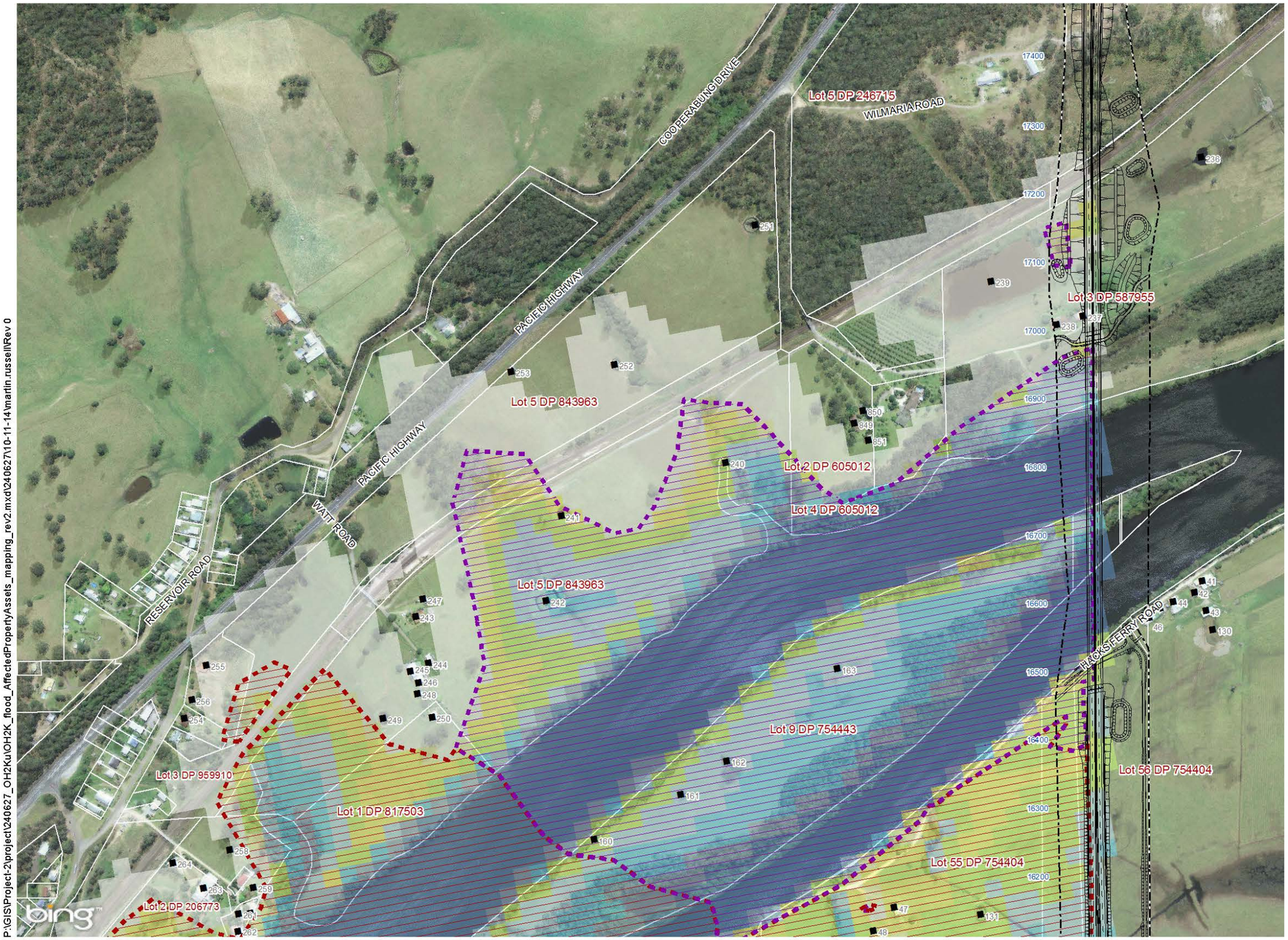
100 year flood event Project afflux extent A-42 (Map 42 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

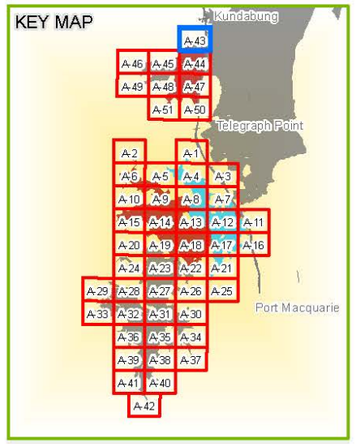
Figure A-43 100 Year Flood Event Project Afflux Extent Map 43 of 51

Lend Lease

aupb JOINT VENTURE




KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

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1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

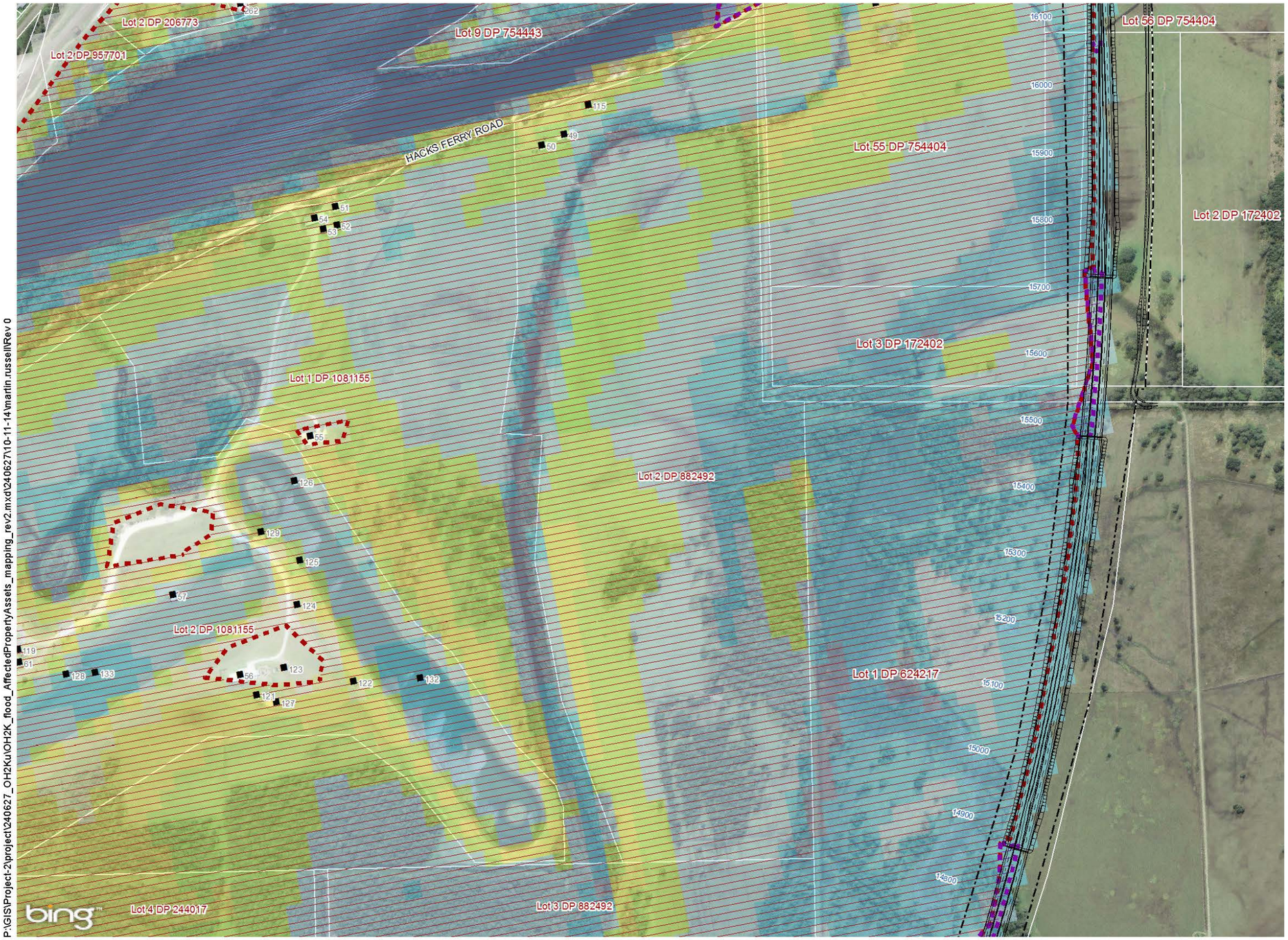
100 year flood event Project afflux extent A-43 (Map 43 of 51)

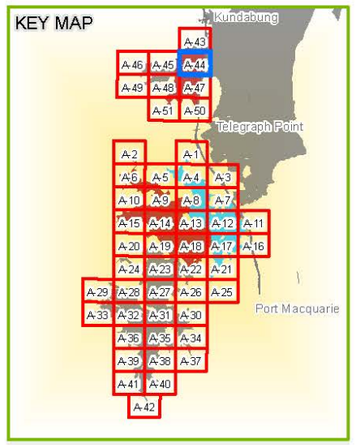
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-44 100 Year Flood Event Project Afflux Extent Map 44 of 51

Lend Lease

aupb JOINT VENTURE




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

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1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

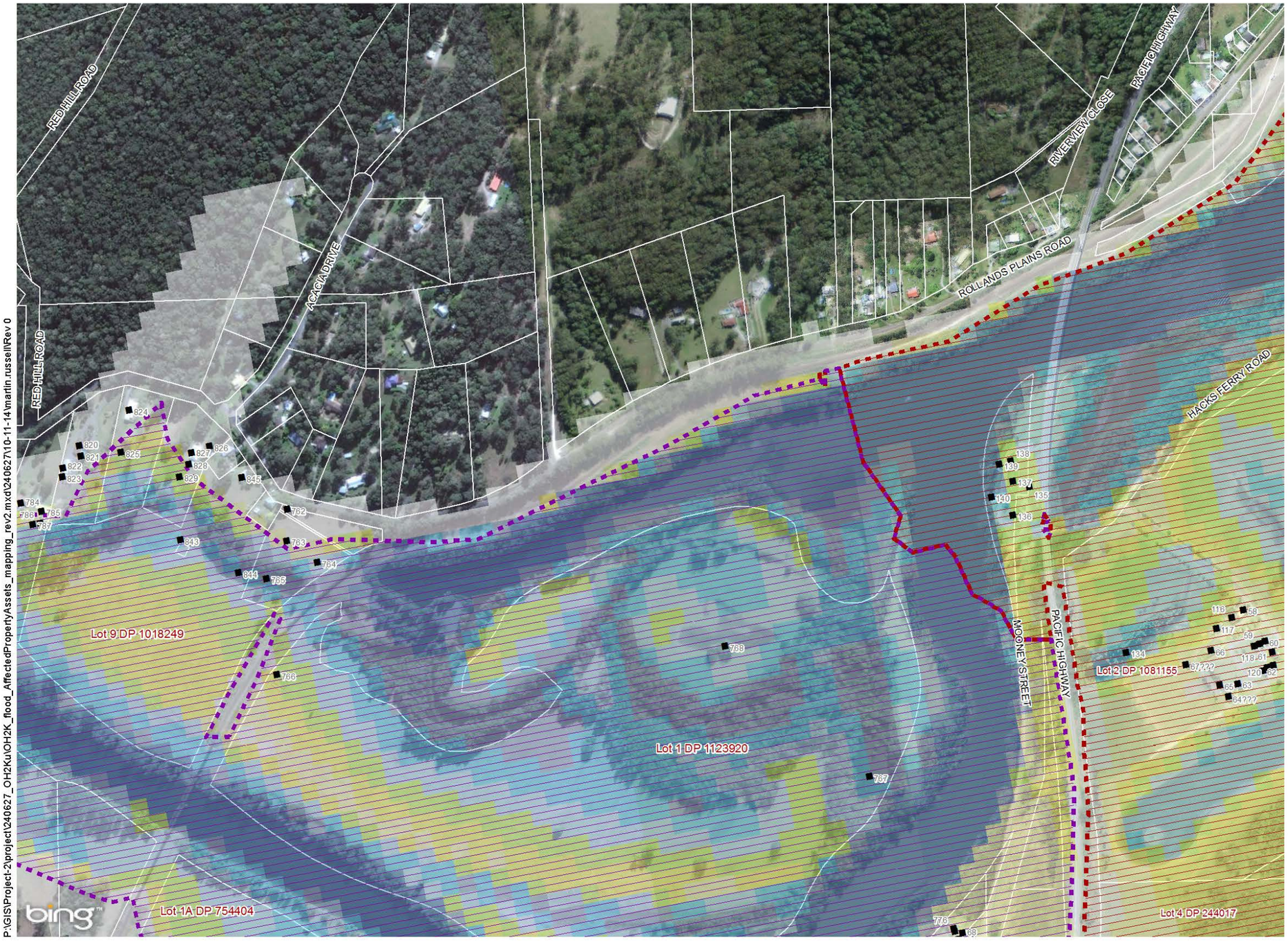
100 year flood event Project afflux extent A-44 (Map 44 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-45 100 Year Flood Event Project Afflux Extent Map 45 of 51

Lend Lease

aupb JOINT VENTURE

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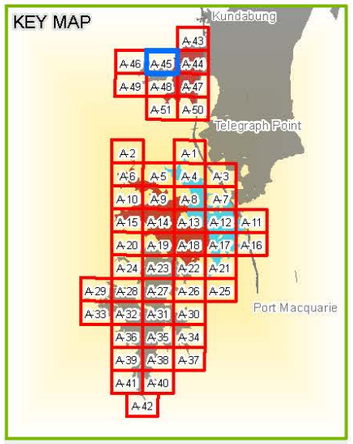
KEY MAP




- Project boundary
- Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

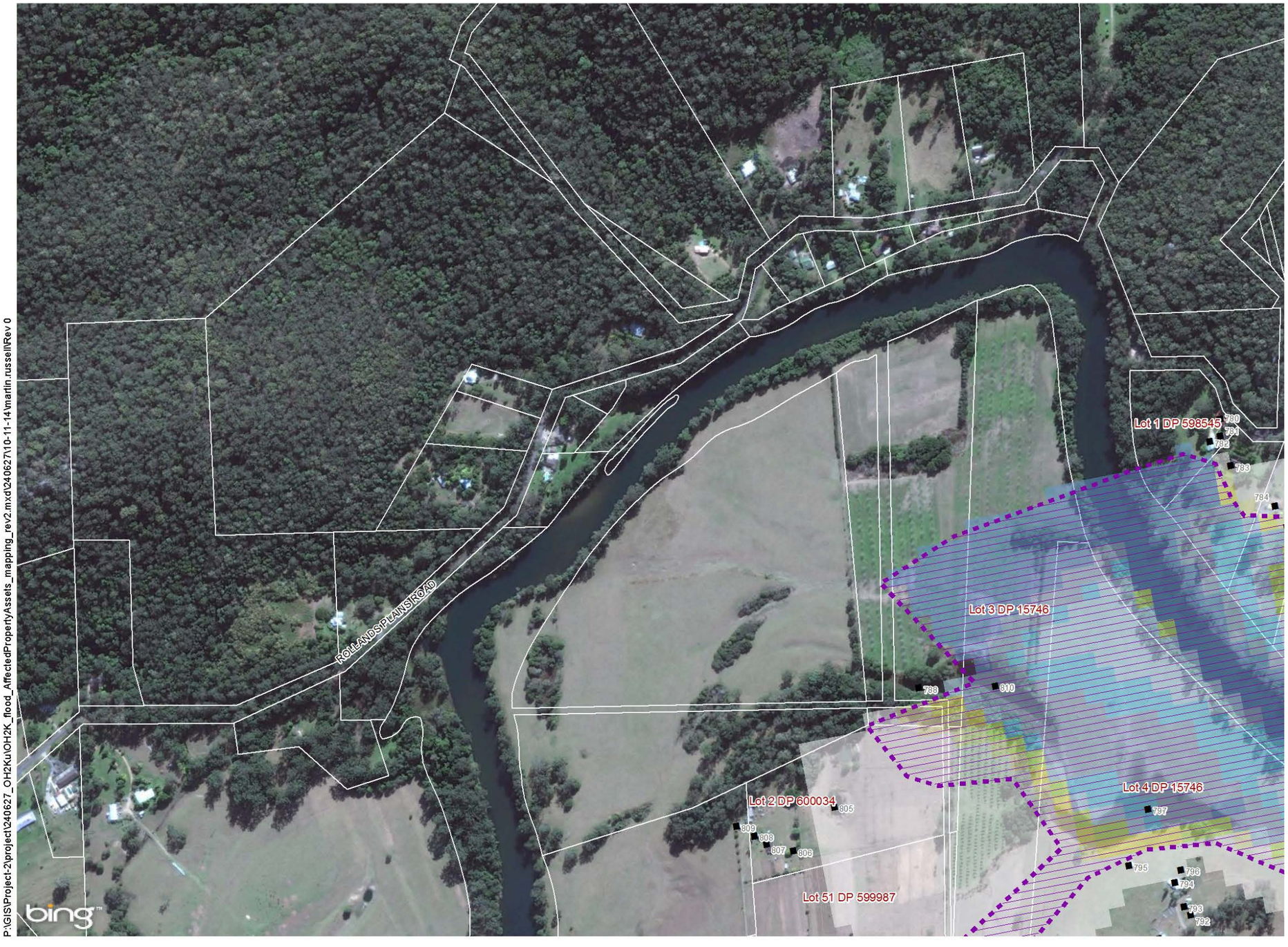
100 year flood event Project afflux extent A-45 (Map 45 of 51)

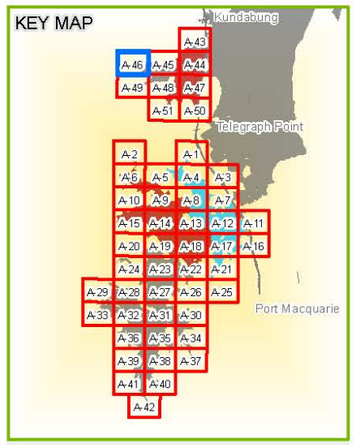
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-46 100 Year Flood Event Project Afflux Extent Map 46 of 51

Lend Lease

aupb JOINT VENTURE




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

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1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

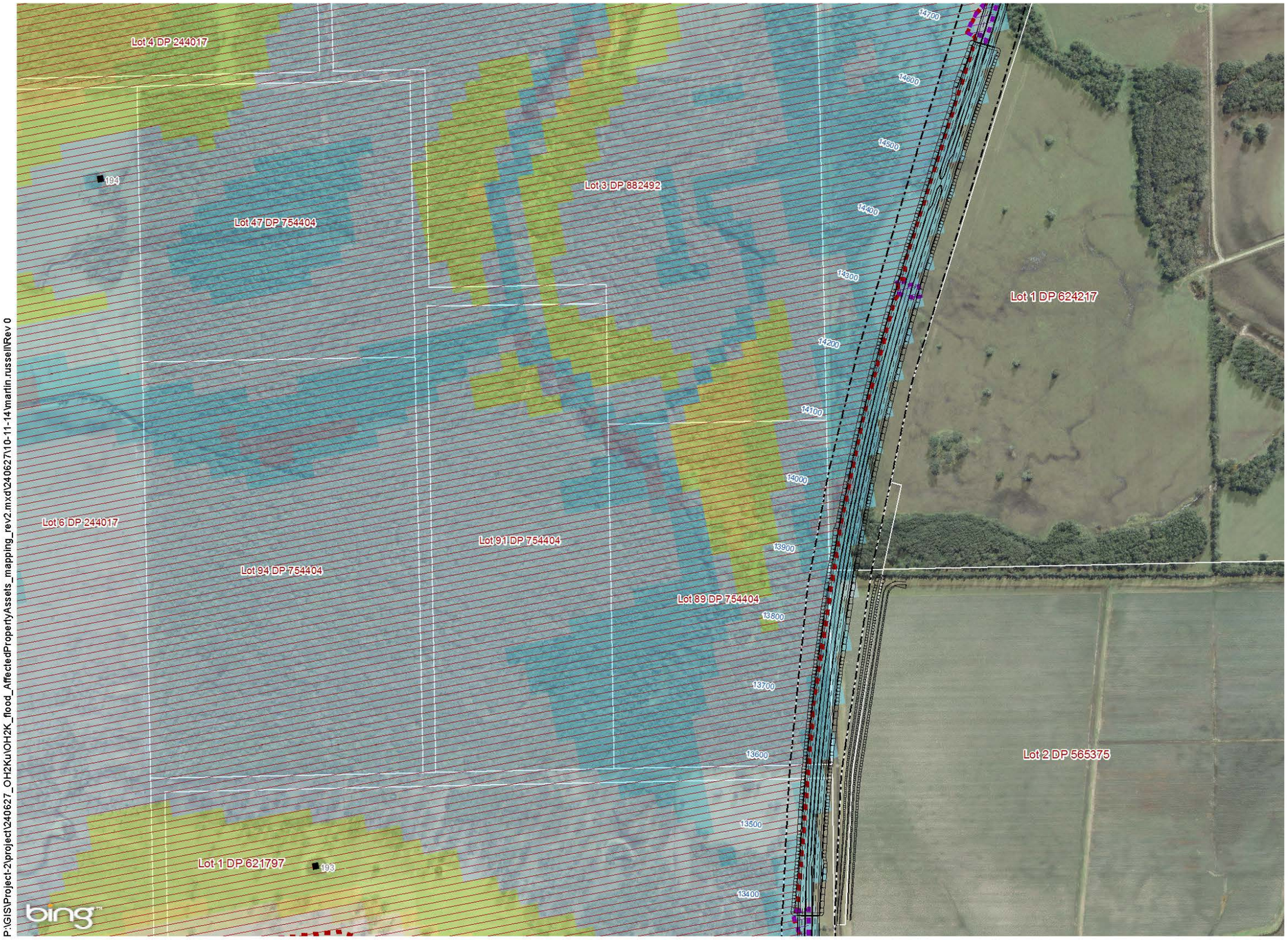
100 year flood event Project afflux extent A-46 (Map 46 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-47 100 Year Flood Event Project Afflux Extent Map 47 of 51

Lend Lease

aupb JOINT VENTURE

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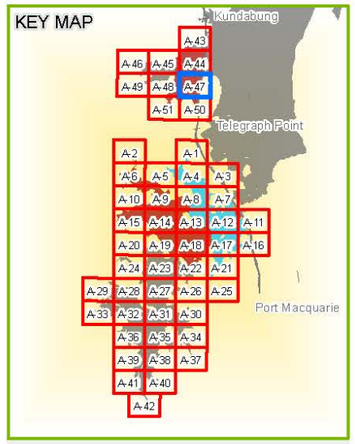



Project boundary

Property assets

**100yr project afflux extent**

0.00-0.01m

0.01-0.02m

0.02-0.03m

0.03-0.04m

0.04-0.05m

> 0.05m

**Existing 100yr flood depths**

0 - 0.5m

0.5 - 1m

1 - 1.5m

1.5 - 2m

2 - 2.5m

2.5 - 3m

3 - 4m

4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

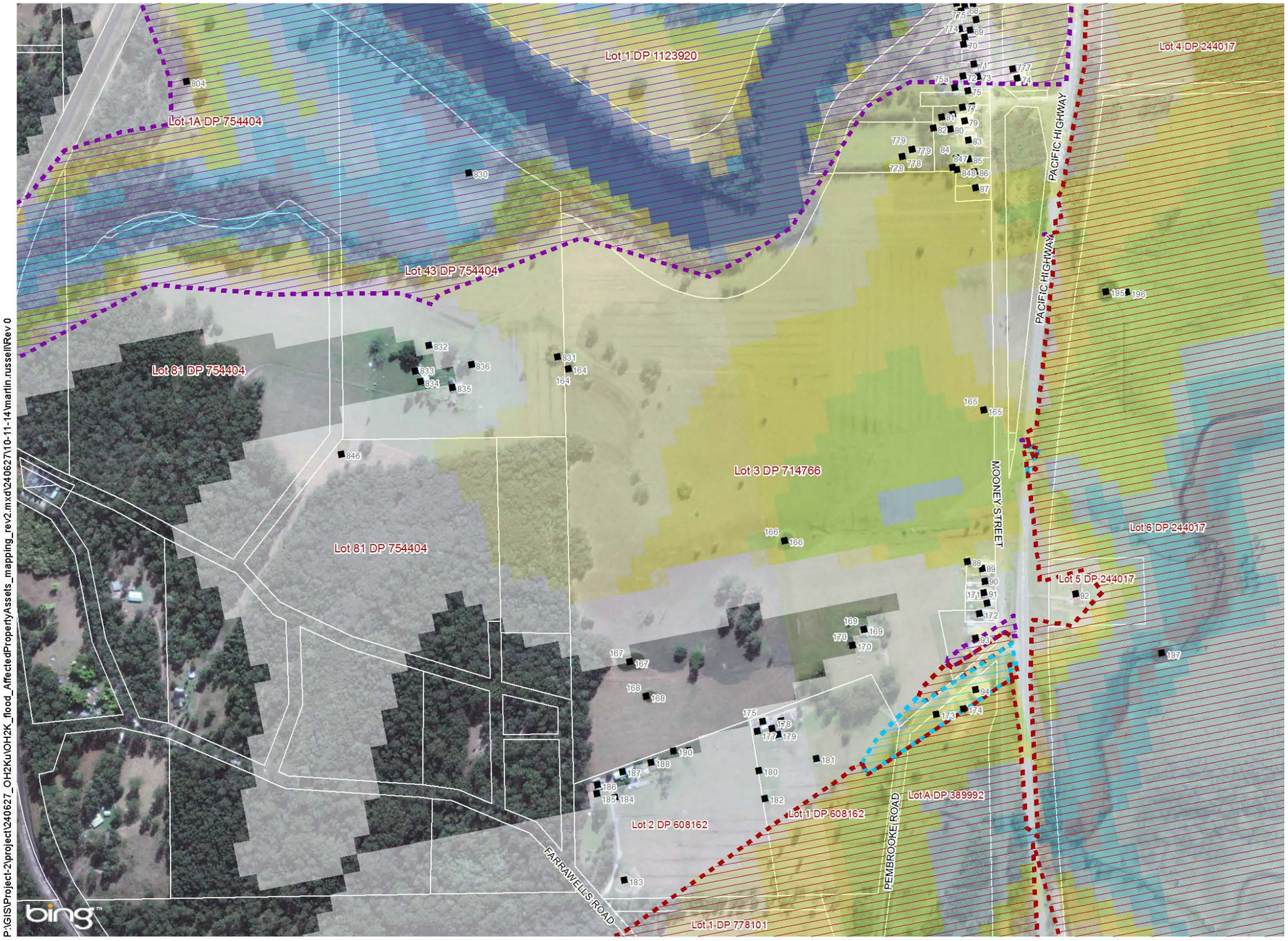
100 year flood event Project afflux extent A-47 (Map 47 of 51)

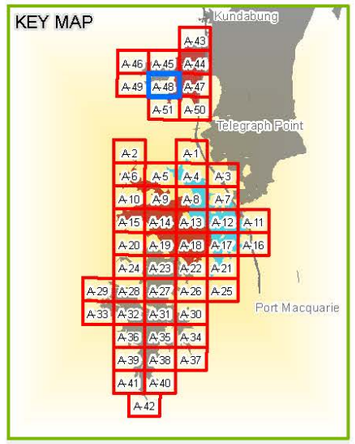
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-48 100 Year Flood Event Project Afflux Extent Map 48 of 51

Lend Lease

aupb JOINT VENTURE




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

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0 100 200 m

**Date of Issue:** 10/11/2014

**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56

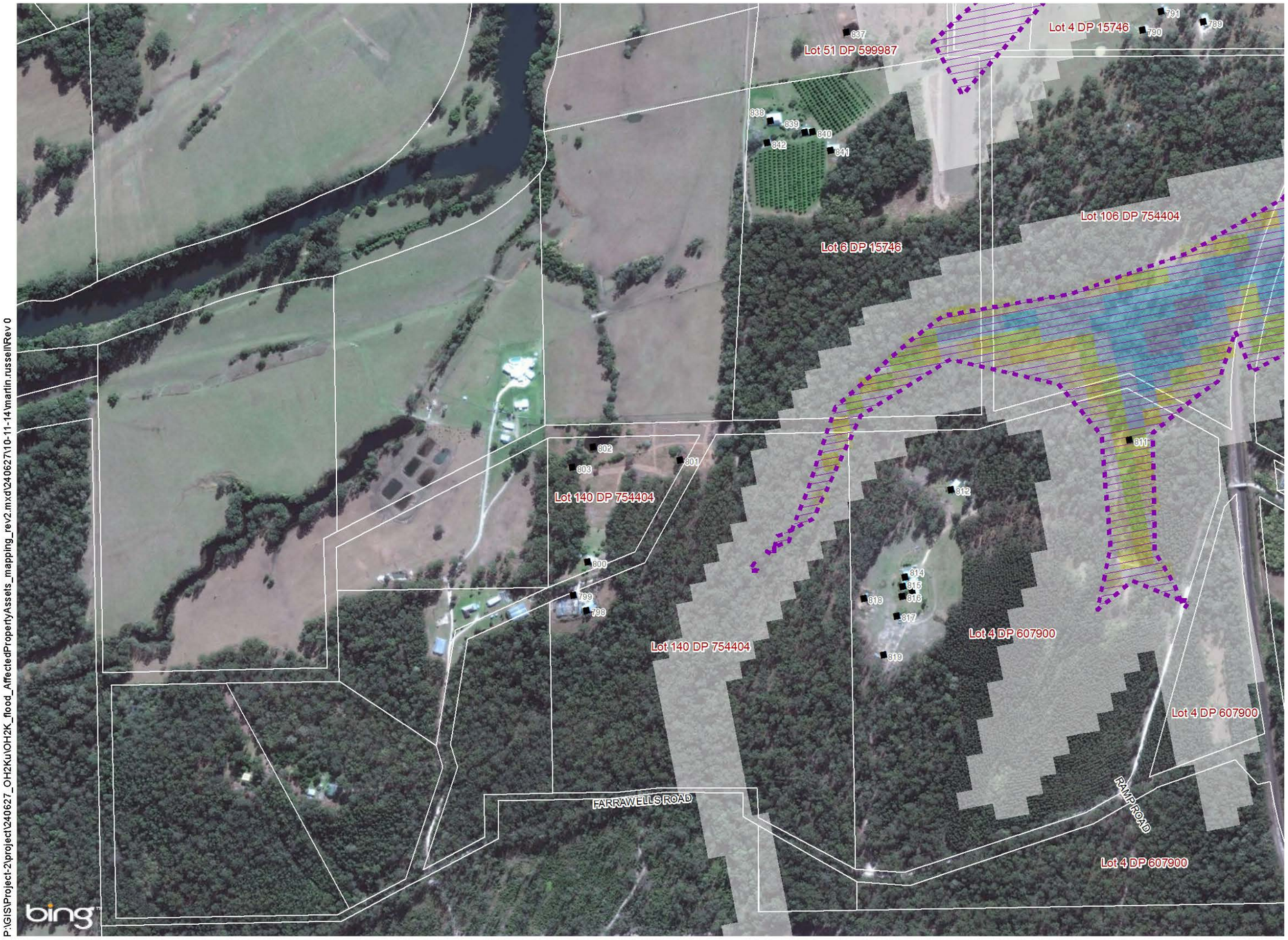
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-48 (Map 48 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-49 100 Year Flood Event Project Afflux Extent Map 49 of 51






Project boundary
Property assets

**100yr project afflux extent**
- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**
- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

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1:6,000
0 100 200 m

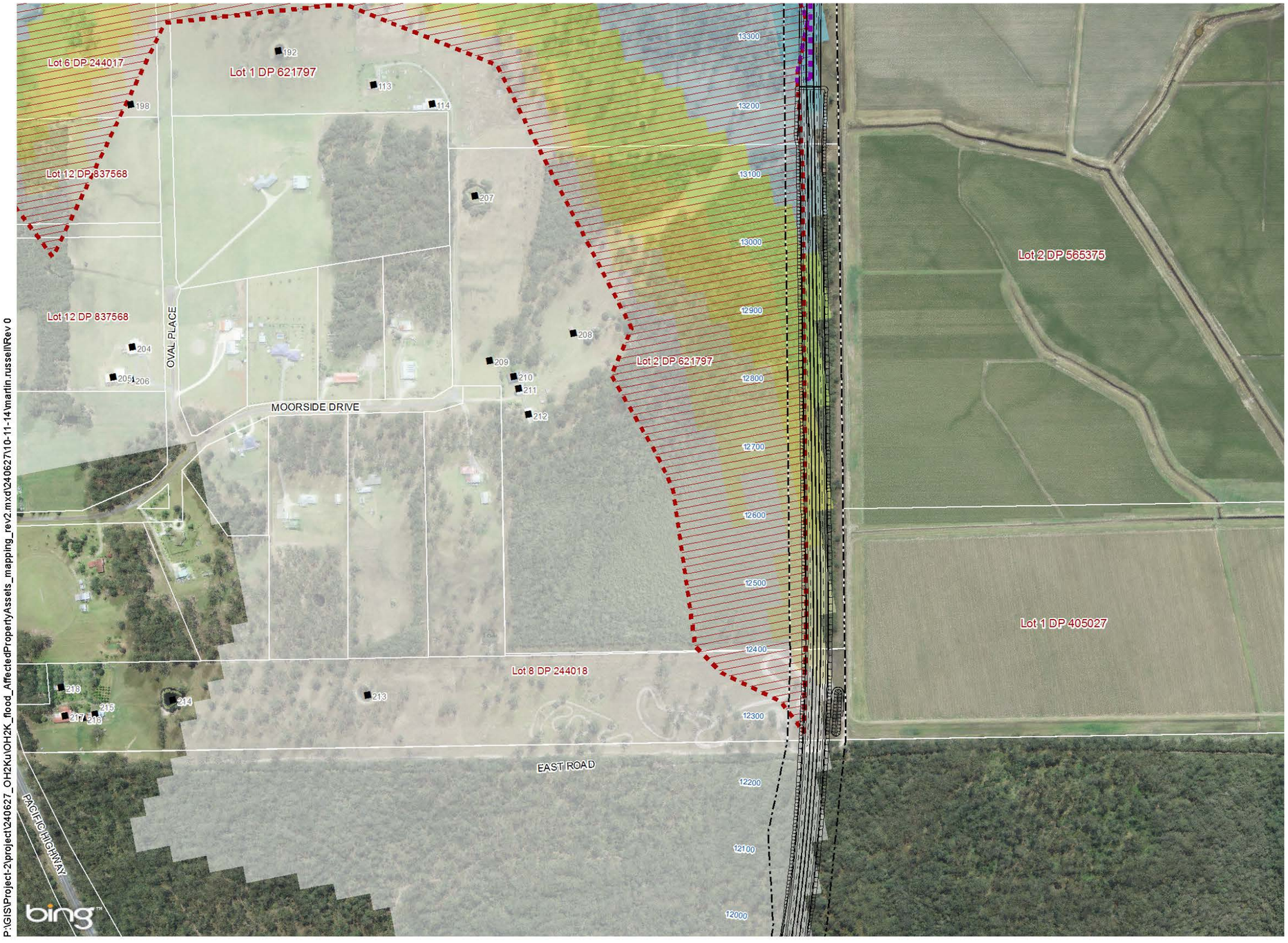
**Date of Issue:** 10/11/2014
**Revision no:** 1
**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-49 (Map 49 of 51)

# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-50 100 Year Flood Event Project Afflux Extent Map 50 of 51

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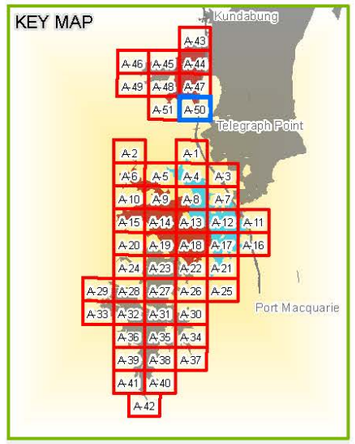
KEY MAP




Project boundary

Property assets

**100yr project afflux extent**

0.00-0.01m
0.01-0.02m
0.02-0.03m
0.03-0.04m
0.04-0.05m
> 0.05m

**Existing 100yr flood depths**

0 - 0.5m
0.5 - 1m
1 - 1.5m
1.5 - 2m
2 - 2.5m
2.5 - 3m
3 - 4m
4 - 5m+

1:6,000

0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

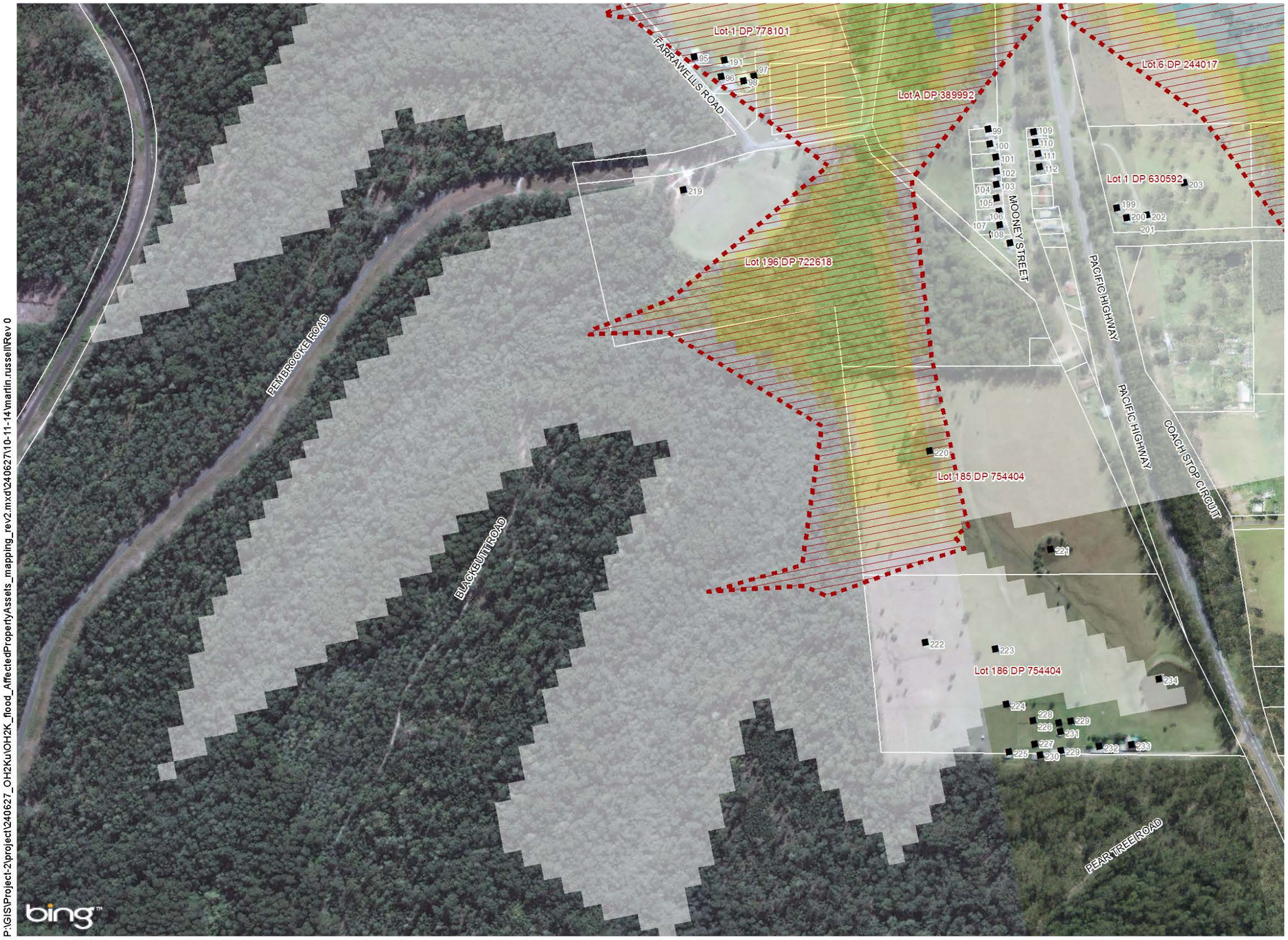
100 year flood event Project afflux extent A-50 (Map 50 of 51)

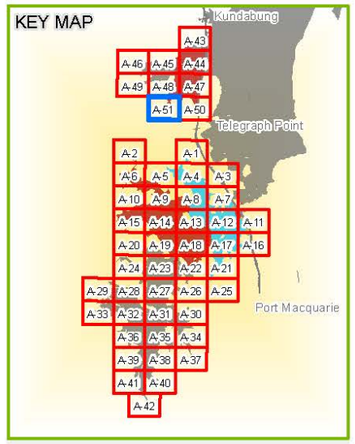
# Appendix A 100 Year Flood Event - OH2Ku Afflux Extents

Figure A-51 100 Year Flood Event Project Afflux Extent Map 51 of 51

Lend Lease

aupb JOINT VENTURE




Project boundary

Property assets

**100yr project afflux extent**

- 0.00-0.01m
- 0.01-0.02m
- 0.02-0.03m
- 0.03-0.04m
- 0.04-0.05m
- > 0.05m

**Existing 100yr flood depths**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2 - 2.5m
- 2.5 - 3m
- 3 - 4m
- 4 - 5m+

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0 100 200 m

**Date of Issue:** 10/11/2014
**Revision no:** 1

**Projection:** GDA 1994 MGA Zone 56
**Source:** RMS, AuPBJV, LPI, LLE, Bing Maps

PACIFIC HIGHWAY UPGRADE OH2Ku **HYDROLOGICAL MITIGATION REPORT**

100 year flood event Project afflux extent A-51 (Map 51 of 51)

# Appendix B Property impact assessment tables

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# Appendix B Property impact assessment tables

## Hastings River

**Table 18 Hastings River Floodplain properties with either no assets within the project afflux level or are subject to a separate development approval**

| Lot/DP | Number of assets on property[1] | | | | Comment |
|---|---|---|---|---|---|
| | Dwelling | Structure | Access | Other infrastructure | |
| Lot 1 DP 52868 | | | 1 | | No assets within the afflux extent |
| Lot 12 DP 2837 | 1 | 5 | | | No assets within the afflux extent |
| Lot 14 DP 754404 | | | 1 | | No assets within the afflux extent |
| Lot 143 DP 754446 | 1 | 3 | 1 | 1 | No assets within the afflux extent |
| Lot 15 DP 2837 | | | | 1 | No assets within the afflux extent |
| Lot 16 DP 2837 | | | 1 | 2 | No assets within the afflux extent |
| Lot 17 DP 2837 | | | 1 | 1 | No assets within the afflux extent |
| Lot 18 DP 2837 | | | | | No assets within the afflux extent |
| Lot 2 DP 430471 | | | | | Rawdon Nature Reserve- no assets within the afflux extent |
| Lot 5 DP 2837 | | | 1 | | No assets within the afflux extent |
| Lot 55 DP 754446 | | | 1 | | No assets within the afflux extent |
| Lot 56 DP 754446 | | | 1 | | No assets within the afflux extent |
| Lot 59 DP 754446 | | | 1 | | No assets within the afflux extent |
| Lot 8 DP 2837 | | | 1 | | No assets within the afflux extent |
| Lot 1 DP 1044152 | 2 | 7 | 1 | | No assets within the afflux extent |
| Lot 1 DP 124543 | | 1 | | | No assets within afflux extent |
| Lot 1 DP 226821 | | | | | Increase in flood level is contained within the road corridor. |
| Lot 1 DP 243130 | | | 1 | | Property acquired by RMS as part of project. |

[1] *This is the total number of assets on the property, not only those that fall within the afflux extent.*

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Comment |
|---|---|---|---|---|---|
| | Dwelling | Structure | Access | Other infrastructure | |
| Lot 10 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 11 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 12 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 13 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 18 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 2 DP 635110 | | 1 | | | No assets within the afflux extent. |
| Lot 21 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 3 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 30 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 32 DP 791199 | | | | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 33 DP 791199 | | | | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 39 DP 791199 | | 3 | | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 4 DP 243130 | 1 | | | 1 | Increase in flood afflux is within the project corridor only. |
| Lot 4 DP 785611 | | 9 | | 1 | No assets within the afflux extent |
| Lot 40 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Comment |
|---|---|---|---|---|---|
| | Dwelling | Structure | Access | Other infrastructure | |
| Lot 41 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 42 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 43 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 46 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 5 DP 625109 | 1 | 2 | | 1 | No assets within the afflux extent. |
| Lot 5 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 50 DP 791199 | | | NA | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 51 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 6 DP 625109 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 6 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 62 DP 754434 | | | | | Only about a quarter of property is flooded. Area flooded is timbered. Residence and access not affected. Rezoned as employment lands- DA approved.<br>No mitigation required. |
| Lot 7 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 7 0 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 71 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Comment |
|---|---|---|---|---|---|
| | Dwelling | Structure | Access | Other infrastructure | |
| Lot 72 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 74 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 75 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 77 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 78 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 79 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 8 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 80 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 83 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 9 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 90 DP 805549 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 91 DP 805549 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 94 DP 805549 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 95 DP 805549 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |

## Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Comment |
|---|---|---|---|---|---|
| | Dwelling | Structure | Access | Other infrastructure | |
| Lot 88 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 1 DP 1047149 | 1 | 3 | 1 | 2 | No asset within the afflux extent. |
| Lot 1 DP 1056587 | | | 1 | | No asset within the afflux extent. |
| Lot 1 DP 1070899 | | | | | No asset within the afflux extent |
| Lot 1 DP 1089005 | | | 1 | | No asset within the afflux extent |
| Lot 1 DP 1095567 | | | 1 | | No asset within the afflux extent |
| Lot 1 DP 1117296 | 1 | 5 | 1 | 7 | No asset within the afflux extent |
| Lot 1 DP 129137 | | | 1 | | Appears to be road easement only, no defined road.<br>Therefore no assets in the afflux extent. |
| Lot 1 DP 129486 | | | 1 | | No assets in the afflux extent |
| Lot 1 DP 129536 | | | 1 | | No assets in the afflux extent |
| Lot 1 DP 129590 | | | 1 | | No assets in the afflux extent |
| Lot 1 DP 225061 | | 1 | | | No assets in the afflux extent |
| Lot 1 DP 239898 | | | | | No assets in the afflux extent |
| Lot 1 DP 41430 | | | | 1 | No assets in the afflux extent |
| Lot 1 DP 455121 | 1 | 2 | 1 | | No assets within the afflux extent. |
| Lot 1 DP 47936 | | | 1 | | No assets within the afflux extent |
| Lot 1 DP 552386 | 1 | 4 | | | No assets within the afflux extent |
| Lot 1 DP 589272 | 1 | 3 | 1 | | No assets within the afflux extent |
| Lot 1 DP 722609 | | 1 | | | No assets within the afflux extent |
| Lot 1 DP 722614 | | | 1 | | No assets within the afflux extent |
| Lot 1 DP 730100 | | | | 1 | No assets within the afflux extent |
| Lot 1 DP 730998 | 1 | 3 | 1 | 1 | No assets within the afflux extent |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Comment |
|---|---|---|---|---|---|
| | Dwelling | Structure | Access | Other infrastructure | |
| Lot 1 DP 736946 | | | | | No assets within the afflux extent |
| Lot 1 DP 758892 (sect 15) | | | 1 | | No assets within the afflux extent |
| Lot 1 DP 831837 | | 3 | | | No assets within the afflux extent |
| Lot 1 DP 847102 | 1 | 2 | | | No assets within the afflux extent |
| Lot 1 DP 864975 | 1 | 7 | | 2 | No assets within the afflux extent |
| Lot 1 DP 975877 | | | | | No asset within the afflux extent. |
| Lot 14 DP 754446 | | | 1 | 2 | No assets within the afflux extent |
| Lot 146 DP 754446 | 1 | 8 | 1 | 10 | No assets within the afflux extent |
| Lot 147 DP 754446 | 1 | 1 | 1 | 2 | No assets within the afflux extent |
| Lot 150 DP 754446 | | | | | No assets within the afflux extent. |
| Lot 163 DP 754446 | | | 1 | | No assets within the afflux extent. |
| Lot 164 DP 754446 | | | 1 | | No assets within the afflux extent |
| Lot 165 DP 754446 | 1 | | | | No assets within the afflux extent |
| Lot 166 DP 754446 | | | | | No assets within the afflux extent |
| Lot 167 DP 754446 | | 1 | 1 | | No assets within the afflux extent |
| Lot 168 DP 754446 | | | | 1 | No assets within the afflux extent |
| Lot 169 DP 754446 | | 1 | | | No assets within the afflux extent |
| Lot 182 DP 754404 | | | 1 | | No assets within the afflux extent |
| Lot 186 DP 754446 | | | 1 | | No assets within the afflux extent |
| Lot 194 DP 45915 | | | 1 | | No assets within the afflux extent |
| Lot 195 DP 45915 | | | | | No assets within the afflux extent |
| Lot 2 DP 1089005 | | | 1 | | No assets within the afflux extent |
| Lot 2 DP 129486 | | | 1 | | No assets within the afflux extent |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Comment |
|---|---|---|---|---|---|
| | Dwelling | Structure | Access | Other infrastructure | |
| Lot 2 DP 129536 | | | 1 | | No assets within the afflux extent |
| Lot 2 DP 129590 | | | 1 | | No assets within the afflux extent |
| Lot 2 DP 16858 | | | | 1 | No assets within the afflux extent |
| Lot 2 DP 225413 | | | N/A | | Birdon Marine site. DA currently pending on this site. Flooding impacts from project has been considered. |
| Lot 2 DP 455121 | | | | | No assets within the afflux extent |
| Lot 2 DP 616884 | 1 | 3 | | | No assets within the afflux extent |
| Lot 2 DP 634686 | 1 | 5 | | 3 | No assets within the afflux extent |
| Lot 2 DP 730100 | | | 1 | 2 | No assets within the afflux extent |
| Lot 2 DP 736946 | | | 1 | | No assets within the afflux extent |
| Lot 2 DP 758892 | 1 | 1 | | | No assets within the afflux extent |
| Lot 2 DP 847102 | | 2 | | | No assets within the afflux extent |
| Lot 2 DP 874479 | 1 | 2 | | 3 | No assets within the afflux extent |
| Lot 2 DP 957481 | 1 | 4 | | 1 | No assets within the afflux extent |
| Lot 22 DP 1039343 | 1 | 6 | | 5 | No assets within the afflux extent. |
| Lot 221 DP 1128377 | | 2 | 1 | | No assets within the afflux extent |
| Lot 28 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 29 DP 754446 | | | 1 | | No assets within the afflux extent |
| Lot 3 DP 16858 | | | 1 | | No assets within the afflux extent |
| Lot 3 DP 270277 | | | | | No assets within the afflux extent |
| Lot 3 DP 43977 | | | 1 | | No assets within the afflux extent |
| Lot 3 DP 599778 | | 9 | | 3 | No assets within the afflux extent |
| Lot 3 DP 729787 | | | 1 | | No assets within the afflux extent |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Comment |
|---|---|---|---|---|---|
| | Dwelling | Structure | Access | Other infrastructure | |
| Lot 3 DP 736946 | | | 1 | | No assets within the afflux extent |
| Lot 3 DP 758892 | | | 1 | | No assets within the afflux extent |
| Lot 37 DP 754446 | | | | 1 | No assets within the afflux extent |
| Lot 38 DP 754446 | | 1 | 1 | 1 | No assets within the afflux extent |
| Lot 39 DP 754404 | | | 1 | | No assets within the afflux extent |
| Lot 4 DP 16858 | 1 | 4 | 1 | 1 | No assets within the afflux extent |
| Lot 4 DP 43977 | | | 1 | | No assets within the afflux extent |
| Lot 4 DP 270277 | | | 1 | 1 | No assets within the afflux extent |
| Lot 4 DP 729787 | | | 1 | | No assets within the afflux extent |
| Lot 4 DP 736946 | | | | | No assets within the afflux extent |
| Lot 4 DP 758892 | | | 1 | | No assets within the afflux extent |
| Lot 43 DP 754446 | | | | | No assets within the afflux extent |
| Lot 475 DP 754434 | | | | | No assets within the afflux extent |
| Lot 5 DP 16858 | | | 1 | | No assets within the afflux extent |
| Lot 5 DP 758892 | | | | | No assets within the afflux extent |
| Lot 53 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 59 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 6 DP 2837 | | | 1 | | No assets within the afflux extent |
| Lot 6 DP 16858 | | | 1 | | No assets within the afflux extent |
| Lot 60 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 61 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Comment |
|---|---|---|---|---|---|
| | Dwelling | Structure | Access | Other infrastructure | |
| Lot 62 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 63 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 64 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 65 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 66 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 68 DP 791199 | | | N/A | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 7 DP 16858 | | | | 1 | No assets within the afflux extent |
| Lot 7 DP 2837 | | | 1 | | No assets within the afflux extent |
| Lot 7078 DP 1095802 | | | | | No assets within the afflux extent |
| Lot 72 DP 754446 | | | 1 | | No assets within the afflux extent |
| Lot 8 DP 954540 | | 3 | 1 | | No assets within the afflux extent |
| Lot 87 DP 791199 | | | | N/A | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 9 DP 665942 | | | | 1 | No assets within the afflux extent |
| Lot 92 DP 805549 | | | | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot 93 DP 805549 | | | | | Property subject to separate planning approval (06_0212) with building envelope to be outside of the 100 year afflux extent. |
| Lot A DP 102151 | | | 1 | | No assets within the afflux extent |
| Lot B DP 102151 | | | 1 | | No assets within the afflux extent |

# Appendix B Property impact assessment tables

**Table 19 Hastings River Floodplain property impact assessment for 100 year flood event**

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 1 DP 430471 | | | (1) | | | | | | Cairncross State Forest/ Rawdon Nature Reserve.<br>State forest flooded along river edge. Some management (ie non public) trails cut. These trails are already cut in local areas by up to 2m, with afflux increases of up to 0.03m. These trails are already impassable under existing conditions and as such, the project would not result in adverse impacts.<br>No mitigation required. |
| Lot 2 DP 52868 | (1) | (4)<br>268<br>269 | (1) | (2) | 4.440<br>4.416 | 4.440<br>4.434 | 11.006<br>3.986 | 0.000<br>0.018 | Cairncross State Forest. Afflux in excess of 0.02m in forested areas.<br>One structure on the south of the property would be impacted by 0.018m afflux.<br>This structure is already inundated by a 100 year flood event.<br>No mitigation required. |

[1] *This is the total number of assets on the property, not only those that fall within the afflux extent.*

[2] *Properties highlighted in green are subject to receipt of floor level survey information to confirm outcomes of assessment.*

[3] *Numbers in brackets identify the number of structures or defined accesses on a property. Numbers not in brackets are the unique structure identifier given to structures (obtained from Oxley Highway to Kundabung Flood Assessment Report - Hastings River and Wilson River Floodplain, January 2013 and from desktop assessment).These assets are identified in the figures in Appendix A.*

## Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 1 DP 1059173 | (1) | (2) | (1) | (3) | | | | | The eastern half of property affected by afflux in excess of 0.02m – the only asset in the area is a dam. Note that the property is impacted by the existing 100 year flood event, with flood depths at the dam site between 1.5 and 2 metres.<br>No mitigation required. |
| Lot 1 DP 964929 | | (3)<br>459<br>460<br>461 | (1) | (2) | 1.852 (depth)<br>2.212 (depth)<br>2.322 (depth) | | -<br>-<br>- | 0.020<br>0.020<br>0.019 | The entire property already impacted by existing 100 year flood event, with depths between 1.9 and 3.4m. Existing flood depths at the structures on the property are between 1.85m and 2.32m. However, it appears that these structures could be on slightly elevated land. Afflux at these structures would be only 0.01-0.02m and it is unlikely that this would result in an adverse impact on the structure.<br>No mitigation required.<br>**Access was not granted to the property for floor level survey.* |
| Lot 10 DP 2837 | (1) | (2) | (1) | (1) | | | | | Three quarters of property inundated by up to 0.03m of afflux including a dam site. Dam site currently experiences food levels of approximately 2.5- 3m in a 100 year flood event.<br>Access from/to property has an increase of up to 0.03m of afflux however, under an existing 100 year flood event this access would be cut, with flood waters reaching up to 4m in some areas.<br>No mitigation required. |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 11 DP 2837 | | | (1) | | | | | | Three quarters of property inundated by up to 0.03m of afflux. No assets on the property. However, access from property has an increase of up to 0.03m of afflux, however, under an existing 100 year flood event, this access would be cut, with flood waters reaching up to 4m in some areas.<br>No mitigation required. |
| Lot 11 DP 754446 | | (1)<br>306 | (1) | | 4.357 | 4.376 | 3.159 | 0.019 | Residence impacted between 0.01-0.02m of afflux. Property is affected by current 100 year flood event with flood levels of approximately 1-2m. Structure on the property is inundated under existing 100 year flood event. Access also affected under existing 100 year flood event.<br>No mitigation required. |
| Lot 13 DP 2837 | | | (1) | | | | | | Access to neighbouring property dam affected by 0.02m of afflux. However property is currently inundated with up to 3m of water during an existing 100 year flood event.<br>No mitigation required. |
| Lot 14 DP 2837 | | | (1) | (4) | | | | | Dam and access to neighbouring property impacted. No other asset on site.<br>However property is currently inundated with up to 3m of water during an existing 100 year flood event.<br>No mitigation required. |

## Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 142 DP 754446 | | | (1) | (1) | | | | | More than half of the property impacted by 0.02m increase, including dam site. Property currently experiences flooding in a 100 year flood event, with flood levels up to 3m. Access to property also subject to up to 3m of flood waters under existing flood event- making the road impassable.<br>No mitigation required. |
| Lot 15 DP 754404 | (2)<br><br>276 | (1)<br>275 | (1) | (2) | <br>4.283<br>4.256 | <br>4.304<br>4.277 | <br>3.466<br>4.599 | <br>0.021<br>0.021 | Most of property affected by 0.02m in afflux. Farm structures and access to adjoining property affected.<br><br>One structure already inundated in an existing 100 year flood event. The dwelling is not currently impacted by an existing 100 year flood event and would not be inundated as a result of the project.<br>No mitigation required. |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 2 DP 2837 | (1) | | (1) | | | | | | Residence and access to property from existing highway are not affected by afflux from the project. Agricultural drains and lower lying land towards the Hastings River are already inundated during existing 100 year flood events with depths of up to 3.5m.<br>The highway will pass through the property via a bridge structure, with the property truncated in two. A new internal property access under new highway bridge will be constructed. It should be noted that this access is not designed to provide flood immunity (this could not be achieved as the access level was set to allow clearance for vehicle/ farm machinery under the bridge). This access road is in an area of 0.02m afflux, however this area under an existing flood, would experience flood depths of up to 3 m. While this access could not provide emergency access, it could still facilitate movement of people and stock prior to flood waters reaching that location.<br>There is higher land on both sides of the property that is not affected by afflux that could be used for stock during flood events or to move stock to higher land. This higher land to the west of the project has access via an access trail through the neighbouring property. The land to the east of the project has access out to the existing Pacific Highway via a newly constructed access with higher flood immunity than the current access.<br>Due to the availability of higher land and the multiple accesses on the property, no adverse impact would occur on the property.<br>No mitigation required |

## Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 3 DP 2837 | | (1) | (1) | (2) | | | | | Dam and agricultural drains on the property would experience an increase in up to 0.03m of afflux. Property is already flooded in an existing 100 year flood event, with flood depths of up to 3.5m on the property.<br>No mitigation required. |
| Lot 4 DP 2837 | | | (1) | (1) | | | | | Dam and agricultural drain inundated by up to 0.02m. These areas are already impacted by the existing 100 year flood event, with flood levels up to 0.7m.<br>No mitigation required. |
| Lot 49 DP 754446 | (1)<br><br>308 | (1)<br>307 | (1) | (1) | 4.298<br>4.296 | 4.318<br>4.316 | 4.182<br>5.069 | 0.020<br>0.020 | Entire property has an increased inundation of 0.02m.<br><br>Property adjacent to Hastings River with existing flood levels of between 1 and 2mStructure on property is already inundated in an existing 100 year flood event. The residence however, is built above the 100 year flood level, and is not inundated under an existing 100 year flood event. The project would not result in this dwelling being inundated.<br>No mitigation required |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 5 DP 729787 | | | (1) | | | | | | Easement includes property access. Property access currently experiences flooding in the existing 100 year flood event. Flood levels are approximately 0.5m. The project would increase flood levels by 0.02m. This would not result in the access becoming impassable (accesses become impassable at 0.3m[4]).<br>No mitigation required. |
| Lot 57 DP 754446 | | (1) | (1) | | | | | | Structure on property not inundated, majority of lot impacted. Local paper road access to property inundated by an afflux increase of up to 0.03m (however, this is currently impacted by 100 year flood event, with flood levels between 1.5 and 4m, which would make the road impassable in the existing flood event).<br>No mitigation required. |
| Lot 58 DP 754446 | | | (1) | (1) | | | | | Dam on property- entirely impacted by increase in 0.02m in inundation. Property already impacted in the 100 year flood event, with flood levels between 2 and 4m.<br>No mitigation required. |
| Lot 6 DP 729787 | (1)<br>32<br>38 | (5)<br><br><br>33<br>34 | (1) | (3) | <br>4.197<br>4.283<br>4.208<br>4.247 | 4.213<br>4.298<br>4.224<br>4.262 | 3.97<br>3.57<br>3.6<br>2.78 | 0.016<br>0.015<br>0.016<br>0.015 | Property would experience an increase of between 0.01 and 0.03m over the entire property. Property access also affected. Property is adjacent to the Hastings river, with structures already flooded in 100 year event.<br>No mitigation required. |

[4] *Obtained from Smith G and Cox R, Australian Rainfall and Runoff, Book IX, Chapter 6 Safety Design Criteria -Draft, Engineers Australia, December 2013, downloaded 17 September 2014.*

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 9 DP 2837 | | | (1) | (1) | | | | | Most of the property would have an increase in afflux of up to 0.03m, including an access and dam. However, the property is already inundated in an existing 100 year flood event, with flood levels up to 3.5m on the property.<br>No mitigation required. |
| Lot 1 DP 1082900 | (1) | (3) | (1) | (1) | | | | | Residences and other structures built on natural rise and are not within the afflux extent of the project.<br>Remainder of property affected by up to 0.03m of afflux including one dam structure. However this dam structure already experiences flood levels up to 2.8m in a 100 year flood event.<br>No mitigation required. |
| Lot 2 DP 1082900 | (1)<br>27 | | (1) | (3) | 4.148 | 4.165 | 4.72 | 0.017 | Entire property affected by increase in 0.03m. Residence is not inundated under existing 100 year ARI, the increase in afflux would not newly inundate this dwelling. Three dam sites would also experience increase in afflux from the project- however, these are currently inundated by the 100 year flood event, with flood levels between 1.5 and 3.5m.<br>No mitigation required. |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 1 DP 566819 | (2) | (12)<br>8<br>9<br>10<br>11<br>16 | (2) | (4) | <br>4.004<br>4.029<br>4.027<br>4.029<br>4.027 | <br>4.03<br>4.046<br>4.048<br>4.052<br>4.045 | <br>3.12<br>3.24<br>4.83<br>3.97<br>3.2 | <br>0.026<br>0.017<br>0.021<br>0.023<br>0.018 | Majority of property impacted by up to 0.03m increase. North eastern corner impacted by greater than 0.03m.<br>Structures already inundated by 100 year flood event, with the exception of structure 10- the increase in afflux from the project would not result in this structure being inundated.<br>Access to property is currently impacted by the 100 year flood event, with Glen Ewan Road experiencing depths of up to 2 m in a 100 year flood event.Some improvement works to Glen Ewan Road could improve access along Glen Ewan Road during floods.<br>No mitigation to the propertyrequired. |
| Lot 1 DP 740758 | (2)<br>17 | (4)<br><br>15 | (2) | | 4.027<br>4.031 | 4.044<br>4.05 | 3.49<br>3.09 | 0.017<br>0.019 | Property would be inundated by up to 0.03m of afflux. However, structures already inundated by 100 year flood event. No mitigation required. |
| Lot 2 DP 574308 | | | (1) | (2) | | | | | Dams and drainage lines impacted by up to 0.03m afflux. However, property experiences flooding under the existing 100 year flood event of up to 3m.<br>No mitigation required. |
| Lot 2 DP 566819 | (1) | (2)<br>12<br>13 | (1) | | 4.021<br>4.026 | 4.051<br>4.056 | 4.43<br>3.97 | 0.03<br>0.03 | Property upstream of the project would have up to 0.04m afflux. Two structures on property would experience increased afflux of up to 0.03m. One of these structures is already inundated during a 100 year flood event. The other structure is not inundated and the additional afflux from the project would not cause inundation.<br>No mitigation required. |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 2 DP 740758 | (1)<br>18 | (3) | (1) | | 4.038 | 4.055 | 4.52 | 0.017 | Entire property inundated by up to 0.02m increase. Residence not flooded in an existing 100 year ARI. The increase in afflux would also not cause inundation of this residence.<br>No mitigation required. |
| Lot 3 DP 831049 | (1)<br>19 | (8)<br><br>20<br>21 | (1) | | 4.06<br>4.06<br>4.066 | 4.083<br>4.078<br>4.084 | 4.51<br>1.56<br>2.03 | 0.023<br>0.018<br>0.018 | Entire property would be affected by up to 0.03m increase in afflux. Property already flooded in 100 year flood event with flood levels up to 4m, two structures are already inundated by existing 100 year flood event. The residence does not experience flooding under existing 100 year flood events, and increase in afflux as a result of the project would not inundate the residence.<br>No mitigation required. |
| Lot 30 DP 754446 | (1)<br>40 | (4)<br><br>39<br>37<br>35<br>36 | (1) | | 4.271<br>4.282<br>4.247<br>4.237<br>4.237 | 4.286<br>4.297<br>4.263<br>4.252<br>4.253 | 3.22<br>3.38<br>3.1<br>3.13<br>2.79 | 0.015<br>0.015<br>0.016<br>0.015<br>0.016 | Almost entire property affected by increase in afflux of 0.02m. Property already inundated under 100 year flood event with flood levels between 1 and 4m. Numerous structures on property that are already inundated under an existing 100 year flood event.<br>No mitigation required. |
| Lot 32 DP 754446 | (1)<br>29 | (5)<br><br>28<br>30<br>31 | (1) | | 4.156<br>4.152<br>4.168<br>4.174 | <br>4.173<br>4.169<br>4.185<br>4.191 | 2.39<br>2.74<br>2.51<br>2.62 | 0.017<br>0.017<br>0.017<br>0.017 | Almost entire property affected by increase in afflux of 0.02m. Property already inundated under 100 year flood event with flood levels between 1 and 3m. Numerous structures on property are already inundated under an existing 100 year flood event.<br>No mitigation required. |

## Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 4 DP 831049 | (1)<br>22 | (7)<br><br>23<br>24<br>25 | (1) | (7) | 0<br>4.101<br>4.099<br>4.1 | 0<br>4.118<br>4.116<br>4.117 | 5.46<br>3.5<br>3.22<br>3.39 | 0<br>0.017<br>0.017<br>0.017 | Almost entire property flooded, structure 22 is built up on a mound and would not have increased flooding from project. Other structures would be affected by up to 0.02m of afflux, however, all these structures area already inundated under an existing 100 year flood event.<br>No mitigation required. |
| Lot 5 DP 785611 | (1) | | | (1) | | | | | Access top property, residence and structure not impacted by the project afflux extent. Approximately half of property is currently flooded during existing 100 year flood events, with depths of up to 3 m. The flooded area would be subject to property afflux impacts, with afflux of up to 0.02m.<br>No mitigation required. |
| Lot 1 DP 126573 | (1)<br><br><br>450 | (2)<br>447<br>448 | (1) | (1) | <br>4.398<br>4.398<br>4.398 | <br>4.416<br>4.416<br>4.416 | <br>2.624<br>2.624<br>2.624 | <br>0.018<br>0.018<br>0.018 | Entire property covered in 0.01-0.02m. Already subject to existing flood depths from 1 to 3.5m. Structures located on property are predicted to be under 2.5m of water in the existing 100 year flood event.<br>Structures are already inundated under the existing 100 year flood event.<br>No mitigation required. |
| Lot 1 DP 270277 | | | (1) | | | | | | Property access road easement. 0.01m increase in afflux. Flooded by existing 100 year flood event, with depths of up to 1.5m. under existing conditions, access road would be impassable. No adverse impacts would occur from the project.<br>No mitigation required. |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 1 DP 450141 | (1)<br>471 | (2)<br><br>472 | (1) | (4)<br><br><br>473 | <br>4.378<br>4.382<br>4.374 | <br>4.396<br>4.400<br>4.392 | <br>5.181<br>3.832<br>1.469 | 0.018<br>0.018<br>0.018 | Entire property would experience a 0.01-0.02m increase in afflux. Property has existing flood depths of 1.5-3m during 100 year flood. Two structures (including a jetty) on the property are already inundated during an existing 100 year flood event. The dwelling is currently not inundated during an existing 100 year flood event. The afflux from the project would not cause this dwelling to be inundated.<br>No mitigation required. |
| Lot 1 DP 602376 | (1) | (4) | (1) | | | | | | Only part of the property (towards the Hastings River and access onto Rawdon Island Road) is currently impacted by flooding. These areas would be impacted by 0.01-0.02m of afflux. Structures on the property are not currently flooded and are not within the afflux extent of the project.<br>The access to the local road however, is currently flooded under existing 100 flood event and is under 0.2m of water. An increase in 0.017m would not adversely affect the access to the property, as an access would only become unpassable under 0.3 m of water.<br>No mitigation required. |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 1 DP 744254 | (1)<br><br>345 | (1)<br>344 | (1) | (1) | <br>4.498<br>4.498 | <br>4.514<br>4.514 | <br>2.976<br>5.018 | <br>0.016<br>0.016 | Entire property subject to an afflux increase of 0.01-0.02m. Property already entirely inundated during 100 year flood event- flood depths vary between 1 to 4 metres. One structure on the property is already inundated in a 100 year flood event. The dwelling is not inundated under an existing 100 year flood event and will not be inundated as a result of the project.<br>No mitigation required. |
| Lot 1 DP 964928 | (1)<br><br><br><br><br><br>381<br>382 | (8)<br>376<br>377<br>378<br>379<br>380<br><br><br>383 | (1) | | <br>4.517<br>4.521<br>4.528<br>4.508<br>4.531<br>4.532<br>4.533<br>4.560 | <br>4.532<br>4.536<br>4.543<br>4.523<br>4.546<br>4.547<br>4.548<br>4.574 | <br>5.014<br>4.381<br>4.091<br>3.56<br>4.363<br>4.247<br>4.215<br>3.489 | <br>0.015<br>0.015<br>0.015<br>0.015<br>0.015<br>0.015<br>0.015<br>0.014 | Almost entirely impacted by 0.01-0.02m in afflux. Property affected by existing flood levels, with depths of up to 3.5m. Structures on the property are mainly built on a high elevation that are close to the extent of afflux increase. However, three structures would be subject to an additional 0.014m from the existing flood depths (up to 0.5m). Five structures and two dwellings are already flooded during an existing 100 year flood event, the other structure is not inundated during the existing 100 year flood event. This structure will not be inundated as a result of the project.<br>No mitigation required. |
| Lot 11 DP 1112647 | (1) | (2) | | (4) | | | | | Access into property affected by 0.01-0.02m increase in afflux. However, under existing 100 year flood event, this access is under 1m of water. This increase in flood level would not result in an adverse impact.<br>No mitigation required. |

## Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 12 DP 754446 | (1)<br>301 | (3)<br><br>302<br>303<br>304 | (1) | (1) | <br>4.413<br>4.415<br>4.405<br>4.403 | <br>4.431<br>4.433<br>4.423<br>4.421 | <br>3.41<br>2.282<br>2.594<br>3.115 | <br>0.018<br>0.018<br>0.018<br>0.018 | Entire property would experience increase in afflux of between 0.01-0.02m. Property currently experiences flood depths of 2-4m. Residence and structures would experience flood depths of around 2-2.5m. All structures and dwelling are subject to inundation in an existing 100 year flood event.<br>No mitigation required. |
| Lot 13 DP 754446 | (2)<br>313 | (6)<br><br>314 | (1) | (2) | <br>4.451<br>4.449 | <br>4.468<br>4.466 | <br>5.807<br>5.068 | <br>0.017<br>0.017 | Residence is within the extent of afflux increase. Residence would experience an increase of around 0.01-0.02m. It is currently flooded in the existing 100 year flood event with depths of around 1.5-2.5m. Neither dwelling or structure on the property within the afflux extent is currently inundated under an 100 year flood event. These structures would not be inundated as a result of the project.<br>No mitigation required. |
| Lot 15 DP 754446 | (1)<br>297 | (3)<br><br>298<br>299<br>300 | (1) | | <br>4.429<br>4.431<br>4.429<br>4.422 | <br>4.446<br>4.448<br>4.446<br>4.440 | <br>3.735<br>3.275<br>2.8<br>3.158 | <br>0.017<br>0.017<br>0.017<br>0.018 | Entire property to experience increases of 0.01-0.02m in afflux. Property currently affected by 100 year flood event, with flood depths of up to 4m. All dwellings and structures within the afflux extent are inundated under an existing 100 year flood event.<br>No mitigation required. |
| Lot 171 DP 754404 | | | Partial | | | | | | Access to adjoining property would be impacted by 0.016m increase in afflux. This increase in flood water would not result in an adverse impact, as the access road currently experiences 100 year flood levels of around 0.6m- which would make the access road impassable. |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 2 DP 1117296 | | (3) | | (2) | | | | | A large dam is within the afflux extent. This dam is under 0.12m of flood water under existing 100 year flood event. The increase in 0.01-0.02m would not result in an adverse impact, as the only asset affected is the dam on the property.<br>No mitigation required. |
| Lot 2 DP 270277 | (1)<br><br><br><br>440 | (6)<br>437<br>438<br>439<br><br>441<br>445 | (1) | (3) | <br>4.416<br>4.413<br>4.573<br>4.483<br>4.411<br>4.374 | <br>4.433<br>4.430<br>4.587<br>4.499<br>4.428<br>4.391 | <br>4.307<br>4.508<br>4.748<br>7.37<br>4.15<br>4.348 | <br>0.017<br>0.017<br>0.014<br>0.016<br>0.017<br>0.017 | Property would be almost entirely impacted by an increase in 0.01 -0.02m in afflux. Property is currently affected by 100 year flood event across most of the site. One dwelling and two structures 438 and 439 are not inundated by existing 100 year flood events and would not be inundated as a result of the project. Another three structures are already impacted by the 100 year flood event.<br>No mitigation required. |
| Lot 2 DP 602376 | (1)<br>425 | (4)<br><br>426<br>427<br>428 | (1) | | <br>4.621<br>4.838<br>4.838<br>4.965 | <br>4.635<br>4.850<br>4.849<br>4.977 | <br>5.558<br>4.7<br>4.919<br>6.076 | <br>0.014<br>0.012<br>0.011<br>0.012 | Most of the property would be impacted by an increase in afflux of 0.01-0.02m. The dwelling and one structure is not inundated under an existing 100 year flood event. These structrures would not be inundated as a result of the project. Two additional structures are already subject to inundation from existing 100 year flood event.<br>No mitigation required. |
| Lot 2 DP 603183 | | (4) | (1) | (3) | | | | | Dam site under approximately 3m of water for the existing 100 year flood event. Project would increase flood levels by around 0.01-0.02m. This would not result in an adverse impact.<br>No mitigation required. |

## Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 2 DP 744254 | | (1)<br>343 | | | 4.495 | 4.511 | 3.607 | 0.016 | Property is currently impacted by the 100 year flood event, with flood depths of 1-4m. Structure on the property is currently inundated under existing 100 year flood event.<br>No mitigation required. |
| Lot 2 DP 831837 | (1) | (3) | (1) | (3) | | | | | Property access would be impacted, no other structrues fall within the afflux extent of the project. The access is currently under 0.06m of flood waters under a 100 year flood event. The project would result in an increase in afflux of 0.016m. The access would still be passable and no adverse impact would result.<br>No mitigation required. |
| Lot 2 DP 844210 | (1) | (8)<br>671<br>672<br>673<br>674<br>675<br>676<br>677<br>678<br>679 | (1) | (2) | <br>4.493<br>4.493<br>4.493<br>4.493<br>4.493<br>4.493<br>4.493<br>4.493<br>4.493 | <br>4.509<br>4.509<br>4.509<br>4.509<br>4.509<br>4.509<br>4.509<br>4.509<br>4.509 | <br>3.367<br>3.994<br>4.589<br>4.776<br>4.653<br>5.131<br>5.025<br>4.557<br>4.831 | <br>0.016<br>0.016<br>0.016<br>0.016<br>0.016<br>0.016<br>0.016<br>0.016<br>0.016 | Property already affected by existing 100 year flood event- with depths of up to 4m. Structures on the property are in an area of 0.7m deep flood water. Afflux increases are predicted of up to 0.016m. Two structures are currently inundated by existing 100 year flood events. Another seven structures are not inundated during 100 year flood events and will not be inundated as a result of the project.<br>No mitigation required. |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 28 DP 754446 | (1)<br>371<br>372<br>373<br><br>375 | (4)<br><br><br><br>374 | (1) | (1) | <br>4.483<br>4.475<br>4.475<br>4.481<br>4.480 | <br>4.499<br>4.491<br>4.491<br>4.497<br>4.496 | <br>3.256<br>3.052<br>3.07<br>4.784<br>4.065 | <br>0.016<br>0.016<br>0.016<br>0.016<br>0.016 | Property already affected by existing 100 year flood event- with depths between 1-2.5m.<br>Afflux increases are predicted of up to 0.01-0.02m. All structures are inundated as a result of existing 100 year flood event. The dwelling is not inundated by an existing 100 year flood event, and would not be inundated as a result of the project.<br>No mitigation required. |
| Lot 3 DP 602376 | (1)<br>430 | | | | 4.904 | 4.916 | 5.782 | 0.012 | Most of the property impacted by afflux increases of between 0.01 and 0.02m. Majority of the property is impacted by the existing 100 year flood extent with depths of up to 6m across a small area adjacent to the Hastings River. However the dwelling on the property would not be subject to inundation as a result of the project.<br>No mitigation required. |
| Lot 3 DP 847102 | (1) | (2) | (1) | (2) | | | | | The property access currently experiences flooding in 100 year flood event of up to 1.5m. No other structures on the property fall within the project afflux extent. Property access would be impacted by 0.016m of afflux785611. No adverse impact would result.<br>No mitigation required. |

## Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 31 DP 665471 | (1) | (6) | (1) | | | | | | Entire property would be subject to increase in afflux of around 0.01-0.02m. property is affected by existing 100 year flood event, with depths of up to 4m. All dwellings and structures are inundated in an existing 100 year flood event.<br>No mitigation required. |
| | | 451 | | | 4.394 | 4.412 | 2.841 | 0.018 | |
| | | 452 | | | 4.381 | 4.399 | 1.143 | 0.018 | |
| | | 453 | | | 4.374 | 4.392 | 2.25 | 0.018 | |
| | | 454 | | | 4.363 | 4.382 | 2.251 | 0.019 | |
| | 455 | | | | 4.364 | 4.383 | 2.361 | 0.019 | |
| | | 456 | | | 4.359 | 4.378 | 2.413 | 0.019 | |
| | 457 | | | | 4.352 | 4.371 | 2.4 | 0.019 | |
| | | 458 | | | 4.343 | 4.362 | 2.376 | 0.019 | |
| Lot 33 DP 754446 | (2) | (15) | (1) | | | | | | Property is already impacted by the existing 100 year flood event, with depths of up to 4m. Water depths of less than 0.5 m are experienced at the structures on the site. The property is predicted as having an increase of 0.01-0.02m across the majority of the property. All of the structures (with the exception of 400) within the afflux extent are not inundated by an existing 100 year flood event and would not be inundated as a result of the project. Structure 400 is not inundated in an existing 100 year flood event and would not be newly inundated as a result of the project afflux.<br>No mitigation required. |
| | 395 | | | | 4.654 | 4.666 | 5.272 | 0.012 | |
| | 396 | | | | 4.654 | 4.654 | 5.127 | 0.000 | |
| | 397 | | | | 4.629 | 4.642 | 4.892 | 0.013 | |
| | 398 | | | | 4.527 | 4.542 | 5.342 | 0.015 | |
| | 399 | | | | 4.552 | 4.567 | 4.899 | 0.015 | |
| | 400 | | | | 4.450 | 4.466 | 4.377 | 0.016 | |
| | 402 | | | | 4.608 | 4.621 | 4.918 | 0.013 | |
| | 403 | | | | 4.653 | 4.665 | 5.264 | 0.012 | |
| | 404 | | | | 4.639 | 4.651 | 5.281 | 0.012 | |
| | 405 | | | | 4.663 | 4.675 | 5.35 | 0.012 | |
| | 406 | | | | 4.675 | 4.687 | 5.391 | 0.012 | |
| | 407 | | | | 4.675 | 4.687 | 6.085 | 0.012 | |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 36 DP 754446 | (1)<br>480 | (6)<br><br>481<br>482<br>483<br>484 | (1) | | <br>4.417<br>4.421<br>4.422<br>4.417<br>4.418 | <br>4.435<br>4.438<br>4.439<br>4.435<br>4.435 | <br>5.49<br>3.792<br>3.476<br>5.38<br>1.576 | <br>0.018<br>0.017<br>0.017<br>0.018<br>0.017 | Property is already impacted by the existing 100 year flood event, with depths of up to 4m. Water depths of 1-1.5m are experienced at the structures on the site. The property is predicted as having an increase of 0.01-0.02m across the entire property. The dwelling and one structure 483, on the property is not subject to inundation under the existing 100 year flood event and the project would not result in these structures being inundated. All other structures within the afflux extent are inundated in an existing 100 year flood event.<br>No mitigation required. |
| Lot 39 DP 754446 | (1)<br>475 | (3)<br><br>476<br>477 | (1) | | <br>4.397<br>4.398<br>4.397 | <br>4.415<br>4.416<br>4.415 | <br>5.386<br>3.245<br>1.042 | <br>0.018<br>0.018<br>0.018 | Property is already impacted by the existing 100 year flood event, with depths of up to 4m. The property is predicted as having an increase of 0.01-0.02m across the entire property. The dwelling and one other structure are not inundated under an existing 100 year flood event and would not be inundated as a result of the project. One structure is already inundated under the existing 100 year flood event.<br>No mitigation required. |

## Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot 4 DP 775534 | (1)<br>431 | (4)<br><br>433<br>434 | (1) | | <br>0.012 (depth)<br>0.048 (depth)<br>2.747 (depth) | | <br>-<br>-<br>- | <br>0.011<br>0.012<br>0.010 | Property is partially inundated by the existing 100 year flood event. Flood levels are up to 2.5m. The residence current experiences depth of 0.012m, with another structure on the property experiencing depths of up to 0.048. A jetty on the Hastings River experiences depths of up to 2.747m. The project would increase depths by around 0.010m. The jetty (structure 434) would already be inundated under an existing 100 year flood event. The residence, from Google Maps Street View appears to have a raised ground level and it is not anticipated that the increase in afflux would inundate this structure.<br>No mitigation required.<br>**Access was not granted to the property for floor level survey.* |
| Lot 7 DP 722698 | | (2) | (1) | (5) | | | | | There are a few dams within the afflux extent (up to 0.02m). The increase in afflux extent is contained to areas that are currently flooded by a 100 year flood event. Existing flood depths are between 0.5-4m. |
| Lot 7 DP 729787 | | (1)<br><br>465 | (1) | (1)<br>464 | <br>4.378<br>4.361 | <br>4.396<br>4.380 | <br>1.356<br>2.301 | <br>0.018<br>0.019 | Property is already fully inundated during a 100 year flood event. One structure (shed) and water tank are on the property. There would be an increase in up to 0.02m of afflux. Both structures are currently inundated under an existing 100 year flood event.<br>No mitigation required. |

# Appendix B Property impact assessment tables

| Lot/DP | Number of assets on property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | Assessment discussion[2] |
| Lot A DP 325952 | (1)<br>387 | (3)<br><br>388<br><br>386 | | | <br>-0.00 (depth)<br>2.23 (depth)<br>0.00(depth) | | <br>-<br><br>-<br><br>- | <br>0.016<br><br>0.013<br><br>0.013 | Property is partially inundated by the existing 100 year flood event. Flood depths are up to 6m near the river (including near the back edge of the residence) but rapidly decrease away from the river. The residence and structure 386 are on land that is not currently flooded under an existing 100 year flood event. Structure 388 is on land that is currently flooded (flood depths predicted at 2.2m, with the ground floor level appearing to be around 0.5m above ground) in an existing flood level. Potential increases in afflux across the property are around 0.013m. By visual inspection, it appears that the residence is raised above ground level (by around 1.2m to 1.8m) and would not be inundated by the 0.013 m of afflux. Structure 386 (shed/garage) may be partially impacted by the afflux, however, the area around the structure (and residence 387) is around 1m above existing 100 year flood levels, an increase in flood levels of 0.0013m would not result in inundation of the structure. No mitigation required<br>**Access was not granted to the property for floor level survey.* |
| Lot B DP 325952 | (1) | (4)<br>390<br>391<br>393<br>394 | | | <br>4.617<br>4.630<br>4.673<br>4.666 | <br>4.630<br>4.643<br>4.685<br>4.678 | <br>4.973<br>4.927<br>5.064<br>1.059 | <br>0.013<br>0.013<br>0.012<br>0.012 | Property is partially inundated by the existing 100 year flood event. Flood levels are up to 4m. The project could increase flooding in this area by 0.01-0.02m. A jetty is already affected by the existing 100 year flood event, however, three additional structures are not inundated by the existing 100 year flood event and will not be inundated as a result of the project.<br>No mitigation required. |

# Appendix B Property impact assessment tables

## Wilson River

**Table 20 Wilson River Floodplain properties with no assets within the project afflux level**

| Property | Number of assets on property[1] | | | |
|---|---|---|---|---|
| | Dwelling | Structure | Access | Other infrastructure (dam/pumps) |
| Lot 1 DP 329191 | | | 1 | |
| Lot 1 DP 604843 | 1 | | 1 | |
| Lot 1 DP 624217 | 1 | 10 | 1 | 8 |
| Lot 1 DP 630592 | | 4 | 1 | 1 |
| Lot 1 DP 817503 | 1 | | 1 | |
| Lot 1 DP 822665 | | | 1 | |
| Lot 1 DP 929470 | | | 1 | |
| Lot 12 DP 837568 | 1 | 2 | 1 | |
| Lot 133 DP 754404 | | | 1 | |
| Lot 134 DP 754404 | | | 1 | |
| Lot 135 DP 754404 | | | 1 | |
| Lot 136 DP 754404 | | | 1 | |
| Lot 137 DP 754404 | | | 1 | |
| Lot 138 DP 754404 | | | 1 | |
| Lot 139 DP 754404 | | | 1 | |
| Lot 186 DP 754404 | 2 | 9 | | 2 |
| Lot 2 DP 604843 | 1 | 1 | 1 | |
| Lot 2 DP 608162 | 1 | 6 | 1 | 1 |
| Lot 2 DP 621797 | 2 | 3 | 1 | 1 |
| Lot 2 DP 957701 | | | 1 | |
| Lot 3 DP 882492 | | | 1 | |
| Lot 3 DP 172402 | | | 1 | |
| Lot 47 DP 754404 | | | 1 | |
| Lot 5 DP 843963 | 1 | 7 | | 5 |
| Lot 56 DP 754404 | 1 | 5 | 1 | 1 |
| Lot 8 DP 244017 | | | 1 | |
| Lot 8 DP 244018 | 1 | 3 | 1 | 2 |
| Lot 89 DP 754404 | | | 1 | |
| Lot 9 DP 754443 | | 1 | | 3 |
| Lot 91 DP 754404 | | | 1 | |
| Lot 94 DP 754404 | | | 1 | |

[1] *This is the total number of assets on the property, not only those that fall within the afflux extent.*

# Appendix B Property impact assessment tables

**Table 21 Wilson River Floodplain property impact assessment for 100 year flood event**

| Property | Number of assets on the property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | Assessment discussion[2] |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | |
| Lot 1 DP 1081155 | (2)<br>51<br><br><br><br>55 | (2)<br><br>52<br>53<br>54 | (1) | | 3.686<br>3.686<br>3.686<br>3.686<br>0 | 3.7<br>3.7<br>3.7<br>3.7<br>0 | 2.18<br>2.24<br>2.56<br>2.26<br>4.71 | 0.014<br>0.014<br>0.014<br>0.014<br>0 | Property currently experiences flooding in a 100 year flood event with flood depths up to 2.5m.<br>Most structures are already inundated by the existing 100 year flood event.<br>The dwelling 55 that is not inundated in a 100 year flood event would not be affected by the afflux from the project.<br>No mitigation required. |
| Lot 1 DP 621797 | (1) | (1) | (1) | (3)<br>193 | | | | | Two structures on the site are not impacted by the project afflux extent.<br>There is one dam site (193) is within the afflux extent of the project. Existing flood depths for the 100 year flood event is between 1 and 2m at this site. The dam would be subject to 0.001 and 0.002m of afflux. No adverse impact would result.<br>No mitigation required. |

[1] *This is the total number of assets on the property, not only those that fall within the afflux extent.*

[2] *Properties highlighted in green are subject to receipt of floor level survey information to confirm outcomes of assessment.*

[3] *Numbers in brackets identify the number of structures or defined accesses on a property. Numbers not in brackets are the unique structure identifier given to structures (obtained from Oxley Highway to Kundabung Flood Assessment Report - Hasting River and Wilson River Floodplain, January 2013 and from desktop assessment). These assets are identified in the figures in Appendix A*

## Appendix B Property impact assessment tables

| Property | Number of assets on the property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | Assessment discussion[2] |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | |
| Lot 1 DP 778101 | (1)<br>95 | (1) | (1) | | 3.717 | 3.736 | 4.25 | 0.019 | Entire property would be impacted by up to 0.02m. Dwelling would be subject to 0.019m of afflux. However, it will not be inundated from this afflux.<br>No mitigation required. |
| Lot 132 DP 754404 | (1)<br>98 | (2)<br><br>96<br>97 | (1) | | 3.717<br>3.717<br>3.717 | 3.736<br>3.736<br>3.736 | 4.36<br>3.32<br>2.96 | 0.019<br>0.019<br>0.019 | Most of the project would be affected by up to 0.02m of afflux. Structures on the property are in areas that experience 0.4-1m flood depths during existing 100 year flood event. Two of these structures are already inundated during these events. The residence is not inundated under the existing 100 year flood event and the afflux increase would not inundate the residence.<br>No mitigation required. |
| Lot 185 DP 754404 | | | (1) | (2) | | | | | Property would be partially affected by up to 0.02m. One dam site is within this area. This dam site is currently inundated under an existing 100 year flood event with flood depths of approximately 0.5m.<br>No mitigation required. |
| Lot 196 DP 722618 | | (1) | (1) | | | | | | This property consists of a local playing field. The playing field would be impacted with up to 0.02m of afflux. This area of increased afflux is already impacted by up to 1.2m deep flood waters under the existing 100 year flood event.<br>There would not be an adverse impact from the increase in afflux.<br>No mitigation required. |

# Appendix B Property impact assessment tables

| Property | Number of assets on the property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | Assessment discussion[2] |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | |
| Lot 2 DP 206773 | | (2) | (1) | | | | | | This property has a vehicular access down to a jetty in Wilson River that falls within an area of increased afflux of up to 0.02m. This access is already inundated under a 100 year flood event, with flood depths of 1.1 to 2.2m, making the access impassable. The increase in afflux would not result in an adverse impact.<br>No mitigation required. |
| Lot 2 DP 1081155 | (16)<br>56<br>58<br>59<br>60<br>61<br>62<br>63<br>64<br>65<br>66 | (7)<br><br><br><br><br><br><br><br><br><br>57 | (1) | (6) | <br>0<br>3.689<br>3.688<br>3.688<br>3.684<br>3.684<br>3.685<br>3.684<br>3.686<br>3.69<br>3.684 | <br>0<br>3.703<br>3.702<br>3.702<br>3.7<br>3.7<br>3.7<br>3.7<br>3.701<br>3.704<br>3.699 | <br>4.91<br>3.53<br>3.91<br>3.91<br>4.02<br>4.03<br>3.56<br>4.05<br>4.03<br>3.15<br>1.7 | <br>0<br>0.015<br>0.014<br>0.014<br>0.016<br>0.016<br>0.015<br>0.016<br>0.015<br>0.014<br>0.015 | Other than a couple of isolated portions on the property, the majority of the property is subject to flooding from the existing 100 year flood event with flood depths between 0.3m and 3m.<br>Access to the site is already inundated by over 2 metres on a section of access under an existing 100 year flood event, making it impassable.<br>There are seven dwellings that are not inundated under an existing 100 year flood event. Increases in afflux across the property from the project would not result in any additional dwellings being inundated. Three dwellings and one structure (a jetty) are already inundated under an existing 100 year flood event.<br>No mitigation required. |

## Appendix B Property impact assessment tables

| Property | Number of assets on the property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | Assessment discussion[2] |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | |
| Lot 2 DP 874263 | | (4) | (1) | (2) | | | | | This property is the Log Wharf Reserve rest area. This property is adjacent to the Wilson River and is situated alongside the existing Pacific Highway Wilson River bridge. It is currently inundated during existing 100 year flood event, with flood depths of up to 4m in some areas of the site. The afflux increase across the property is up to 0.015m.<br>Access to the site by Pacific Highway travelers is cut with Mooney Street becoming impassable under existing 100 year flood events. Access from the east of the highway along Hacks Ferry Road is also cut under existing 100 year flood events, with flood depths on the road in excess of 1m<br>No mitigation required. |
| Lot 2 DP 882492 | (1)<br>50 | (2)<br><br>49 | (1) | | <br>3.684<br>3.684 | <br>3.698<br>3.697 | <br>2.23<br>2.94 | <br>0.014<br>0.013 | The property would be subject to increased afflux of up to 0.02m. The property is entirely inundated during existing 100 year flood events with flood depths on the property between 1 and 3m.<br>The two structures on the site are already inundated under an existing 100 year flood event.<br>No mitigation required. |
| Lot 3 DP 959910 | | | (1) | | | | | | Property is ARTC land. Increases in afflux of up to 0.03m would be experienced on the property. However, the main asset on the property is the North Coast Rail line. The rail line at this location has been built up and is not inundated under an existing 100 year flood event. It would also not be subject to inundation as a result of the project.<br>No mitigation required. |

# Appendix B Property impact assessment tables

| Property | Number of assets on the property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | Assessment discussion[2] |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | |
| Lot 31 DP 876534 | | (3)<br>257 | | | 3.690 | 3.706 | 8.221 | 0.016 | Half the property is inundated by flooding under the existing 100 year flood event. There are no assets on this section of the property. The area which would experience an increase in afflux is mostly cleared of assets with the exception of a farm shed. This farm shed is not currently flooded in a 100 year flood event, with flood levels over 1m lower than the property ground level. The afflux increase of 0.016m at one corner of the structure, would still not inundate the structure.<br>No mitigation required. |
| Lot 32 DP 876534 | (1) | (2)<br>260<br>262 | (1) | | 3.690<br>3.691 | 3.701<br>3.702 | 5.83<br>5.291 | 0.011<br>0.011 | Majority of property is situated outside of the floodplain, however there is a residence situated on the southern extent of the property, that is not flooded in an existing 100 year flood event, however would be subject to the afflux increase. This dwelling and another structure are partially within the afflux extent. However, these structures will not be inundated as a result of the project.<br>No mitigation required. |
| Lot 4 DP 244017 | | (1) | (1) | | | | | | This property would be impacted by an increase in afflux of up to 0.02m. There is stock infrastructure on the property that would be subject to the increase.<br>The property is currently fully inundated during an existing 100 year flood event. The cleared area of the site that would be used to hold stock currently experiences flooding depth of up to 1m. The increase of up to 0.02m would not result in an adverse impact.<br>No mitigation required. |

# Appendix B Property impact assessment tables

| Property | Number of assets on the property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | Assessment discussion[2] |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | |
| Lot 5 DP 244017 | (1) | | | | | | | | The property is partially inundated under an existing 100 year flood event. The area of afflux increase covers more than half of the property, including a stock shed and enclosure. This stock shed is generally not inundated during an existing 100 year flood, with flood levels around 0.08m below the property ground level. An increase in 0.016m of afflux would not flood the stock shed or enclosure.<br>No mitigation required. |
| Lot 5 DP 714766 | | (1)<br>93 | (1) | | 3.780 | 3.793 | 4.628 | 0.013 | Property is a commercial property that is currently inundated in a 100 year flood event, with flood depths up to 0.7m on the property. The project would include flood depths by around 0.01m. Increase in flood depths will not result in inundation of the structure.<br>No mitigation required. |
| Lot 55 DP 754404 | (1)<br>47 | (1)<br><br>48 | (1) | (1) | 3.682<br>3.682 | 3.695<br>3.682 | 2.97<br>3.25 | 0.013<br>0.013 | The property is currently fully inundated under an existing 100 year flood event with flood depths on the property between 1 and 3m.<br>The two structures on the site are already inundated under an existing 100 year flood event. The increase in afflux would not create an adverse impact.<br>No mitigation required. |

# Appendix B Property impact assessment tables

| Property | Number of assets on the property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | Assessment discussion[2] |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | |
| Lot 6 DP 244017 | | (1) | (1) | (4)<br>194<br>195<br>196<br>197 | | | | | The majority of the property would be impacted by the increase in afflux of up to 0.02m. There are four dam sites on the property (two of which appear to have naturally developed from the creek running through the property) which would be impacted. However, these dam sites are already inundated under an existing 100 year flood event, with flood depths of between 1.5 and 3m. A shed on the south east corner of the property is outside of the afflux extent.No mitigation required. |
| Lot 1 DP 608162 | (1) | (7) | (1)<br>Drive | | 3.691 | 3.721 | 3.454 | 0.03 | Property access would be impacted by the afflux increase. The local road immediately outside the property is inundated with over 1m of water under existing 100 year flood event, making it impassable. The project would increase afflux at this location up to 0.03m<br>No mitigation required. |
| Lot 3 DP 714766 | (1) | (2) | (1)<br>Drive | (4) | 3.691 | 3.721 | 4.252 | 0.03 | Property access would be impacted by the afflux increase. The local road immediately outside the property is inundated with over 1m of water under existing 100 year flood event, making it impassable. The project would increase afflux at this location up to 0.03m<br>No mitigation required. |

# Appendix B Property impact assessment tables

| Property | Number of assets on the property[1] | | | | Property Impact Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dwelling/structure analysis | | | | Assessment discussion[2] |
| | Dwelling[3] | Structure | Access | Other infrastructure (dam/pumps) | Existing flood level (mAHD) | Proposed flood level (mAHD) | Floor level survey (mAHD) | Increase in flood levels (mAHD) | |
| Lot A DP 389992 | | (3)<br>94 | (1) | | 3.72 | 3.739 | 4.3 | 0.019 | The site is a commercial/ industrial site. The property is inundated during the existing 100 year flood event, with flood depths of up to 2.6m on the property. There is one structure on the property that is currently not inundated by an existing 100 year flood event. The increase in afflux of up to 0.02m would not result in inundation of the structure.<br>No mitigation required. |

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# Appendix C Scour Protection results

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# Appendix C Scour Protection results

## Modelling results

This Appendix details the modelling results to quantify and size the scour protection at the bridge structures located within the Hastings and Wilson River bridges.

## Scour assessment and protection design modelling

Additional modelling was undertaken to confirm flood velocities and to consider the possible need for scour protection at relevant structures. The following documents and methodology have been used in the modelling:

- 'Evaluating Scour at Bridges', Hydraulic Engineering Circular No. 18, U.S. Department of Transportation – Federal Highway Administration, April 2001 (4th edition).
- Constriction scour has been estimated using the Laursen's Equation.
- Pier scour has been estimated using the CSU Equation.
- Surcharge scour (where it occurs) has been estimated using the Arneson Equation.
- The HEC-18 standard pier calculation method has been used.
- The sizing of scour protection at watercourse crossing structures has been determined using design spreadsheets based on guidance within the AUSTROADS (1994) Waterway Design Guide and 'Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance'-Third Edition, Hydraulic Engineering Circular No. 23, U.S. Department of Transportation – Federal Highway Administration, April 2001 (4th edition).

Three mechanisms of bridge scour have been evaluated:

- Constriction Scour – applies generally across the bed under the bridge and arises from the constriction and acceleration of flow as it passes into and through the bridge opening.
- Local Pier Scour – occurs as a result of eddies which develop around the piers.
- Abutment Scour – occurs as a result of eddies and flow acceleration around the bridge abutments.

Bridge abutment scour protection has been designed to the 50 year ARI event.

Total scour depths have been assessed for the 2000 year ARI event. These depths will inform the structural design of the bridge sub-structures.

# Appendix C Scour Protection results

## SB04 - Hastings River Bridge

The scour assessment parameters used in the scour assessment at the Hastings River Bridge location have been provided in Table 22.

**Table 22 Hastings River Bridge scour assessment parameters**

| Parameter | Value |
|---|---|
| Contraction Scour Type | Live-bed scour |
| D50 (equivalent particle size) | 0.30 mm |
| Bridge Deck Surcharged (ARI) | >2000 year ARI event |

Relevant channel depth and velocity results from the flood modelling for the scour assessment are provided in Table 23 and predicted scour depths for the different scour types are provided in Table 24.

**Table 23 Hastings River Bridge scour assessment flow depths and velocities**

| Parameter | 2000 year ARI event | 100 year ARI event |
|---|---|---|
| Average flow depth (m) | 7.71 | 6.14 |
| Average velocity (m/s) | 1.92 | 1.39 |

**Table 24 Hastings River Bridge predicted scour depth estimates**

| Contraction Scour Depth (m) | | Maximum Pier Scour Depth (m)* | | Surcharge Scour Depth (m) | | Maximum Abutment Scour Depth (m)* | | Maximum Total Scour Depth at Pier (Pier + Surcharge + Contraction) (m)* | |
|---|---|---|---|---|---|---|---|---|---|
| 2000 year ARI | 100 year ARI | 2000 year ARI | 100 year ARI | 2000 year ARI | 100 year ARI | 2000 year ARI | 100 year ARI | 2000 year ARI | 100 year ARI |
| 0.86 | 0.35 | 4.95 | 4.23 | N/A | N/A | 8.93 | 5.06** | 5.81 | 4.57 |

* *- Only Maximum depths tabulated.*

** *- Abutment scour zero as a result of 100yr ARI rip rap counter measures.*

# Appendix C Scour Protection results

## SB09 - Wilson River Bridge

The scour assessment parameters used in the scour assessment at the Wilson River Bridge location have been provided in Table 25.

**Table 25 Wilson River Bridge scour assessment parameters**

| Parameter | Value |
|---|---|
| Contraction Scour Type | Live-bed scour |
| D50 (equivalent particle size) | 0.32 mm |
| Bridge Deck Surcharged (ARI) | >2000 year ARI event |

Relevant channel depth and velocity results from the flood modelling for the scour assessment are provided in Table 26 and predicted scour depths for the different scour types are provided in Table 27.

**Table 26 Wilson River Bridge scour assessment flow depths and velocities**

| Parameter | 2000 year ARI event | 100 year ARI event |
|---|---|---|
| Average flow depth (m) | 3.93 | 3.11 |
| Average velocity (m/s) | 1.29 | 0.92 |

**Table 27 Wilson River Bridge predicted scour depth estimates**

| Contraction Scour Depth (m) | | Maximum Pier Scour Depth (m)* | | Surcharge Scour Depth (m) | | Maximum Abutment Scour Depth (m)* | | Maximum Total Scour Depth at Pier (Pier + Surcharge + Contraction) (m)* | |
|---|---|---|---|---|---|---|---|---|---|
| 2000 year ARI | 100 year ARI | 2000 year ARI | 100 year ARI | 2000 year ARI | 100 year ARI | 2000 year ARI | 100 year ARI | 2000 year ARI | 100 year ARI |
| 1.23 | 0.21 | 4.42 | 3.71 | N/A | N/A | 5.10 | 3.51** | 5.65 | 3.92 |

* *- Only Maximum depths tabulated.*

** *- Abutment scour zero as a result of 100yr ARI rip rap counter measures.*

# Appendix C Scour Protection results

## Hastings River Floodplain Bridges (SB03 and SB05)

The scour assessment parameters used in the scour assessment at the Hastings River Floodplain Bridges have been provided in Table 28 adopted for all locations.

**Table 28 Hastings River Floodplain bridges scour assessment parameters**

| Parameter | Value |
|---|---|
| Contraction Scour Type | Clear-water scour |
| D50 (equivalent particle size) | SB03 – 0.30 mm, SB05 – 0.32 mm |
| Bridge Deck Surcharged (ARI) | SB03 – > 2000 year ARI, SB05 – > 100 year ARI |

Relevant channel depth and velocity results from the flood modelling for the scour assessment are provided in Table 29 and predicted scour depths for the different scour types are provided in Table 30.

**Table 29 Hastings River Floodplain bridges scour assessment flow depths and velocities**

| Floodplain Bridge | Parameter | 2000 year ARI event | 100 year ARI event |
|---|---|---|---|
| SB03<br>Bridge over Hastings River Floodplain 15.4km north of Port Macquarie | Average flow depth (m) | 3.36 | 1.76 |
| | Average velocity (m/s) | 1.95 | 0.72 |
| SB05<br>Bridge over Hastings River Floodplain 16.4km north of Port Macquarie | Average flow depth (m) | 4.38 | 2.86 |
| | Average velocity (m/s) | 1.04 | 0.87 |

**Table 30 Hastings River Floodplain bridges predicted scour depth estimates**

| Floodplain Bridge | Contraction Scour Depth (m) | | Maximum Pier Scour Depth (m)* | | Surcharge Scour Depth (m) | | Maximum Abutment Scour Depth (m)* | | Maximum Total Scour Depth at Pier (Pier + Surcharge + Contraction) (m)* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2000 year ARI | 100 year ARI | 2000 year ARI | 100 year ARI | 2000 year ARI | 100 year ARI | 2000 year ARI | 100 year ARI | 2000 year ARI | 100 year ARI |
| SB03<br>Bridge over Hastings River Floodplain 15.4km north of Port Macquarie | 6.61 | 0.97 | 2.64 | 1.54 | N/A | N/A | 9.25 | 2.51** | 9.25 | 2.51 |
| SB05<br>Bridge over Hastings River Floodplain 16.4km north of Port Macquarie | 3.28 | 1.69 | 2.66 | 2.36 | 0.46 | N/A | 8.49 | 6.19** | 6.40 | 4.06 |

* *- Only Maximum depths tabulated.*

** *- Abutment scour zero as a result of 100yr ARI rip rap counter measures.*

# Appendix C Scour Protection results

## Wilson River Floodplain Bridges (SB06, SB07 and SB08)

The scour assessment parameters used in the scour assessment at the Wilson River Floodplain Bridges have been provided in Table 31 adopted for all locations.

**Table 31 Wilson River Floodplain bridges scour assessment parameters**

| Parameter | Value |
|---|---|
| Contraction Scour Type | Clear-water scour |
| D50 (equivalent particle size) | SB06 – 0.40 mm, SB07 – 0.45 mm, SB08 – 0.39 mm |
| Bridge Deck Surcharged (ARI) | SB06, SB07, SB08 – 100 & 2000 year ARI events |

Relevant channel depth and velocity results from the flood modelling for the scour assessment are provided in Table 32and predicted scour depths for the different scour types are provided in Table 33.

**Table 32 Wilson River Floodplain bridges scour assessment flow depths and velocities**

| Floodplain Bridge | Parameter | 2000 year ARI event | 100 year ARI event |
|---|---|---|---|
| SB06 Twin Bridges over Wilson River Floodplain 23.3km north of Port Macquarie | Average flow depth (m) | 2.45 | 1.52 |
| | Average velocity (m/s) | 1.52 | 1.02 |
| SB07 Twin Bridges over Wilson River Floodplain 24.8km north of Port Macquarie | Average flow depth (m) | 2.45 | 1.48 |
| | Average velocity (m/s) | 1.43 | 1.09 |
| SB08 Twin Bridges over Wilson River Floodplain 25.6km north of Port Macquarie | Average flow depth (m) | 2.43 | 1.58 |
| | Average velocity (m/s) | 1.20 | 0.81 |

**Table 33 Wilson River Floodplain bridges predicted scour depth estimates**

| Floodplain Bridge | Contraction Scour Depth (m) | | Maximum Pier Scour Depth (m)* | | Surcharge Scour Depth (m) | | Maximum Abutment Scour Depth (m)* | | Maximum Total Scour Depth at Pier (Pier + Surcharge + Contraction) (m)* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2000 year ARI | 100 year ARI | 2000 year ARI | 100 year ARI | 2000 year ARI | 100 year ARI | 2000 year ARI | 100 year ARI | 2000 year ARI | 100 year ARI |
| SB06 Twin Bridges over Wilson River Floodplain 23.3km north of Port Macquarie | 3.45 | 1.32 | 2.57 | 2.56 | 0.43 | 0.75 | 6.45 | 4.63** | 6.45 | 4.63 |
| SB07 Twin Bridges over Wilson River Floodplain at 24.8km north of Port Macquarie | 2.86 | 1.33 | 2.67 | 2.77 | 0.32 | 0.67 | 5.85 | 4.77** | 5.85 | 4.77 |
| SB08 Twin Bridges over Wilson River Floodplain 25.6km north of Port Macquarie | 2.35 | 0.80 | 2.41 | 2.40 | 0.17 | 0.63 | 4.36 | 3.12** | 4.94 | 3.84 |

* *- Only Maximum depths tabulated.*

** *- Abutment scour zero as a result of 100yr ARI rip rap counter measures.*

# Appendix C Scour Protection results

## Floodplain embankment protection

The presence of the proposed highway embankment alters the flow paths across the Hastings and Wilson floodplains. As such flood waters must now flow parallel to the embankment before discharging through the river and floodplain bridge openings.

Flow velocities upstream and downstream of the floodplain embankments do not exceed 1.4m/s and the potential for erosion of the grassed embankments is low. It is therefore proposed that no rock protection be provided in the floodplain with the exception of those areas local to bridge openings and culverts that are designed and detailed in the respective Bridge Design Lots.

## Scour rock sizing

The sizing of scour protection at watercourse crossing structures has been determined based on guidance within the 'Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance'-Third Edition, Hydraulic Engineering Circular No. 23, U.S. Department of Transportation – Federal Highway Administration, April 2009 (3rd edition) (HEC-23). Rock rip rap will be sized and provided at the bridge structures as follows:

### Abutment (Spill-through)

Abutment scour protection will be provided to the predicted contraction scour depth (plus pier scour depth if piers are close to the abutments) for the 100 year ARI flood event. Rock rip rap sizing will be based on the velocity at the abutment and the density of the rock material used.

### Pier

Pier scour protection will be provided to the area surrounding the pier to the predicted contraction scour depth for the 50 year ARI event. Rock rip rap sizing will be based on the velocity at the abutment and the density of the rock material used.

Attention to the rock rip rap protection detailing will be made for the land piers located in close proximity to the main channel to avoid any scour extents becoming linked to the main channel thereby widening the waterway unless protected. This is consistent with advice from Fisheries as part of the ERG consultation process where the issue of piers located close to or in the waterway was identified and guidance provided.

# Appendix C Scour Protection results

A preliminary scour rock size based on the maximum velocity and guidance within HEC-23 is provided in Table 34.

**Table 34 Preliminary Scour Rock Sizing**

| Design Bridge Name | Maximum Velocity Abutment (100yr) m/s | Maximum Velocity Pier (50yr) m/s | Abutment Scour Protection Rock Size D50 (m) | Abutment Scour Protection Thickness (m) | Pier Scour Protection Rock Size D50 (m) | Pier Scour Protection Thickness (m) |
|---|---|---|---|---|---|---|
| Hastings River Floodplain Bridge (SB03) | 0.72 | 0.65 | 0.3 | 0.6 | 0.15 | 0.45 |
| Hastings River (SB04) | 1.39 | 1.56 | 0.3 | 0.6 | 0.15 | 0.45 |
| Hastings River Floodplain Bridge (SB05) | 0.87 | 0.80 | 0.3 | 0.6 | 0.15 | 0.45 |
| Wilson River Floodplain Bridge (SB06) | 1.02 | 1.08 | 0.3 | 0.6 | 0.15 | 0.45 |
| Wilson River Floodplain Bridge (SB07) | 1.37 | 1.23 | 0.3 | 0.6 | 0.15 | 0.45 |
| Wilson River Floodplain Bridge (SB08) | 0.81 | 0.84 | 0.3 | 0.6 | 0.15 | 0.45 |
| Wilson River (SB09) | 0.92 | 1.37 | 0.3 | 0.6 | 0.15 | 0.45 |

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