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15 February 2021

Basec Engineering
20 Bridge Street
Lismore
NSW 2480

Attention: Peter Jones

**RE: FLOOD IMPACT ASSESSMENT FOR UPGRADE WORKS OF WYRALLAH ROAD,
BUCKENDOON**

Dear Peter,

BMT has completed the flood impact assessment for the proposed overlay works on Wyrallah Road along the Richmond River, Buckendoon. This letter contains a summary of the work undertaken to determine whether the proposed works would have an impact on local flood behaviour.

Site and Proposed Upgrade Description

Lismore City Council propose to upgrade approximately 700m length of Wyrallah Road, including the intersections at Buckendoon School Lane (approx. 150m) and Oakland Road (approx. 35m) (the site). The site is located on the north east bank of the Richmond River. The surrounding area is predominantly agricultural. Existing road crown levels vary from approximately 3.1m AHD to 4.1m AHD based on the survey provided. Refer to Figure 1 for the approximate location of the proposed works.



Figure 1 Location of works (red line)

Scope of Works

BMT has previously developed the Richmond River Modular TUFLOW model of the Richmond River floodplain from Kyogle to Casino and downstream to Ballina. The extent and resolution (60m grid cells) of the existing model is sufficient to complete this assessment.

The following tasks have been undertaken for this assessment:

- Update the existing Richmond River Modular TUFLOW model to include available site survey (7073 wyrallah buckendoon survey model.dwg, provided 7/12/20).
- Simulate the updated existing case model for the 5% and 1% AEP event critical storm durations. Since the works of the site is located within the Mid Richmond basin, the 36, 48 and 72 hour durations have been used for the impact assessment. The 72 hour duration resulted in the highest peak flood levels at the site for both the 5% and 1% AEP.
- Update the TUFLOW model to represent two works scenarios:
 - Scenario 1: the proposed works scenario (7073 WYRALLAH ROAD BUCKENDOON FOR FLOOD MDOELLING design concept.dwg, provided 30/10/20), and
 - Scenario 2: an additional works scenario where a section of road elevations are increased further from the above.
- Simulate the developed case models for the 5% and 1% AEP event critical storm duration.
- Prepare a short letter and flood impact maps for the 5% and 1% AEP events to show the potential difference in flood levels and flood extents.

Methodology

The length of upgrades of Wyrallah Road along the Richmond River bank are represented by seven model grid cells. The lowest section between approximately chainages 280-640m is represented by four model grid cells. The minimum overtopping elevation of each model cell was determined in each scenario and used to enforce the bank elevations for that cell. This is considered to represent a worst-case overtopping flood extent by the Richmond River in the floodplain area to the north east of the Wyrallah Road works.

The proposed works Scenario 1 generally lowers the existing road levels along the bank section of Wyrallah Road. Scenario 2 additionally increases the elevations in the cells that represent chainages 280-490m to above the adjacent Richmond River flood levels.

Flood Modelling Results

5% AEP Event

The peak 5% AEP flood level along the works area varies between 3.9m and 3.7m AHD. For the existing case conditions, the Richmond River flood level exceeds the minimum overtopping elevation in the model cell that represents the northern section of bank of the Wyrallah Road works (approximately chainage 280-410m). The flood waters inundate an area behind Wyrallah Road, towards Buckendoon School Lane, and flow northward across the floodplain. The house at the corner of Wyrallah Road and Buckendoon School Lane remains flood free.

In the proposed works Scenario 1, impacts are observed due to the lowering of the road levels in the cell that represents chainage 410-490 as per Construction Site Plan No. 7073-002 - Sheet 6 & 7 (provided 2/12/20), which results in a new section of Wyrallah Road being overtopped and inundating new areas. Although other sections of the works are also lowered (chainages 490-640m), the elevations remain above the adjacent Richmond River flood levels, and so do not contribute to impacts. Impacts of up to 300mm occur. Refer to Figure 1 for mapping showing the extent of the 5% AEP flooding impacts for the proposed works Scenario 1.

In Scenario 2, the elevations of the section of works that overtopped in Scenario 1 (chainages 280-490m) were increased to above the 5% AEP Richmond River flood levels (of 3.811m and 3.806m in the two cells that represent these chainages). The elevations of the cells that represent chainages 490-640 were not altered, as they did not overtop in Scenario 1. As expected, the increased road levels prevent any additional overtopping of the Wyrallah Road works, and also prevent the inundation that occurred in the existing case. Refer to Figure 3 for mapping showing the extent of the 5% AEP flooding impacts for the additional works Scenario 2.

1% AEP Event

During the 1% AEP flood event, Wyrallah Road in the works area is completely overtopped, and the adjacent floodplain is completely inundated. The peak flood level is 4.3m - 4.4m AHD for the existing case. The proposed road upgrade has an insignificant effect on the peak flood levels during the 1% AEP event for both works scenarios, as shown in Figure 2 and Figure 4.

Limitations

The following limitations are provided in relation to the Wyrallah Road flood impact assessment:

- The Richmond River Modular Flood model has been used for this assessment, which has a course grid size (60m). However, due to only gradual changes in the road elevation along its length (i.e. little variation across each 60m grid cell), it is not expected that the grid resolution will have a significant influence on flood impacts, and the current model is considered fit-for-purpose.
- No minor transverse drainage culverts are incorporated in the model due to their minimal function during the events considered.

Conclusion

The proposed works result in flood level impacts less than $\pm 10\text{mm}$ during a 1% AEP event.

During a 5% AEP event, impacts were observed in Scenario 1 up to 300mm, and new areas inundated. The major factor affecting these levels are the introduction of new break out area between chainage 410-490m where road levels are lowered in the proposed works compared to the existing case. The impacts occur over a localised area immediately to the north east of Wyrallah Road. Scenario 2 shows that should the design road elevations between chainage 280-490m be raised above the adjacent Richmond River 5% AEP flood levels, then no overtopping of the bank at the Wyrallah Road works will occur, and impacts will be negligible.

Should you require any additional information or wish to discuss the contents of this letter, please do not hesitate to contact the undersigned on 07 3831 6744.

Yours Faithfully

A handwritten signature in blue ink, appearing to be 'B. Caddis', is positioned above the printed name.

Ben Caddis
Principal Flood Engineer
BMT

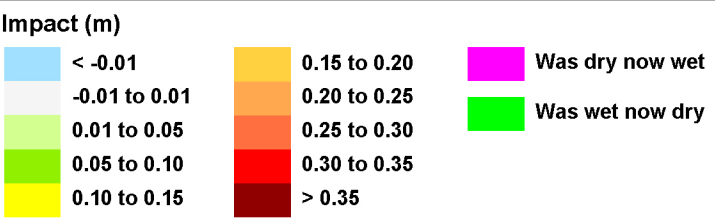


LEGEND

— Proposed Road Overlay

□ Cadastral Boundaries

Satellite image:
Google Earth Jul/Aug/Sep 2020
Image © 2020 CNES / Airbus
Image © 2020 Maxar Technologies



Title:
5% AEP Peak Flood Level Impacts for the Proposed Overlay Works on Wyrallah Road (Scenario 1)


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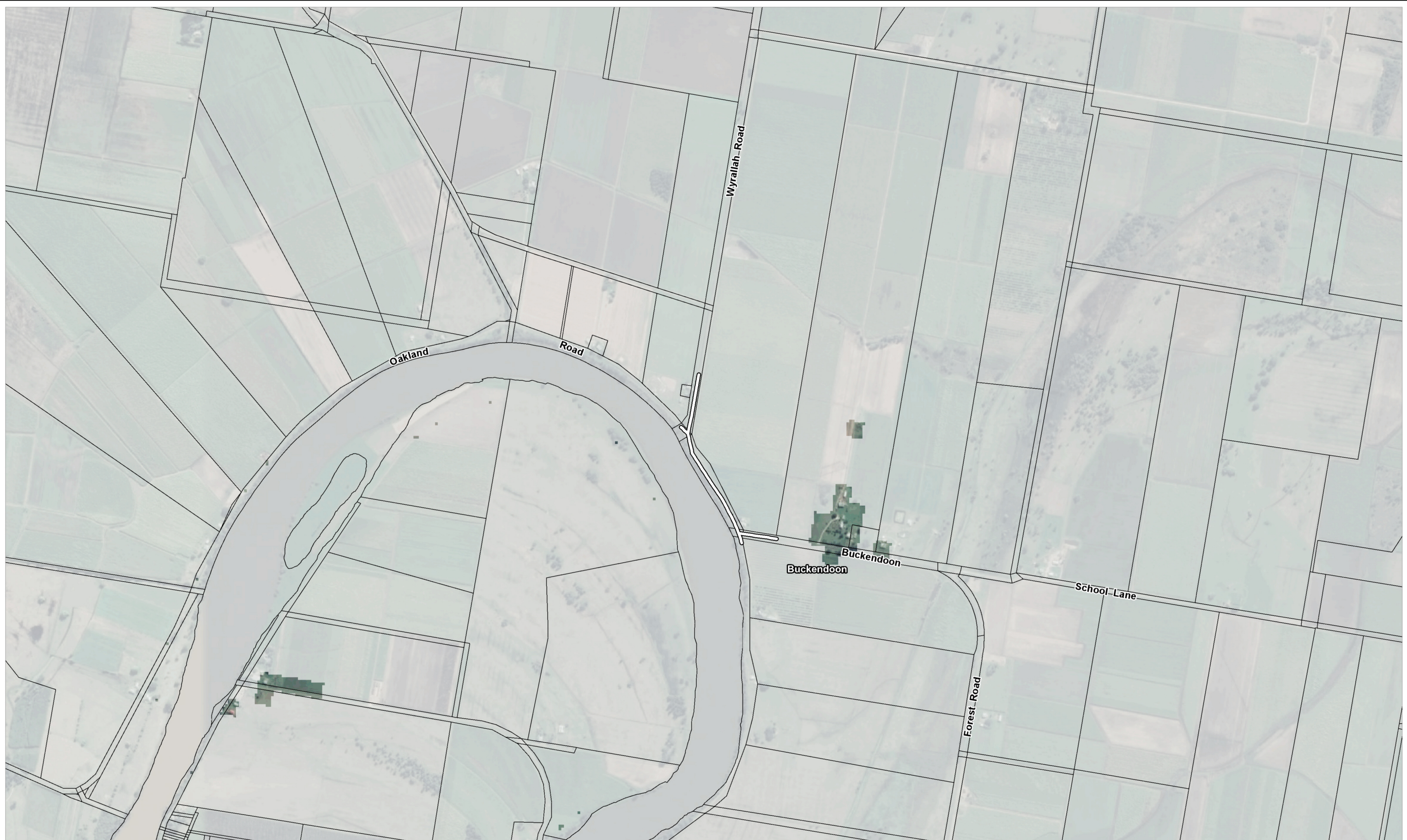
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N 0 400 800 Metres

Figure:
1

Rev:
A

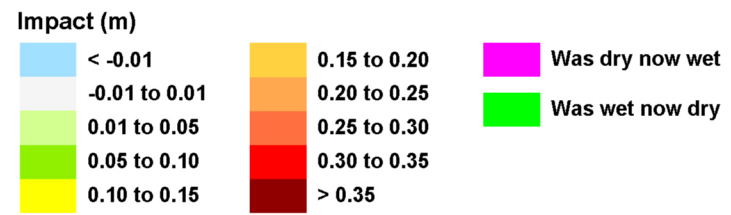

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Proposed Road Overlay
Cadastral Boundaries

Satellite image:
Google Earth Jul/Aug/Sep 2020
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Title:
1% AEP Peak Flood Level Impacts for the Proposed Overlay Works on Wyrallah Road (Scenario 1)


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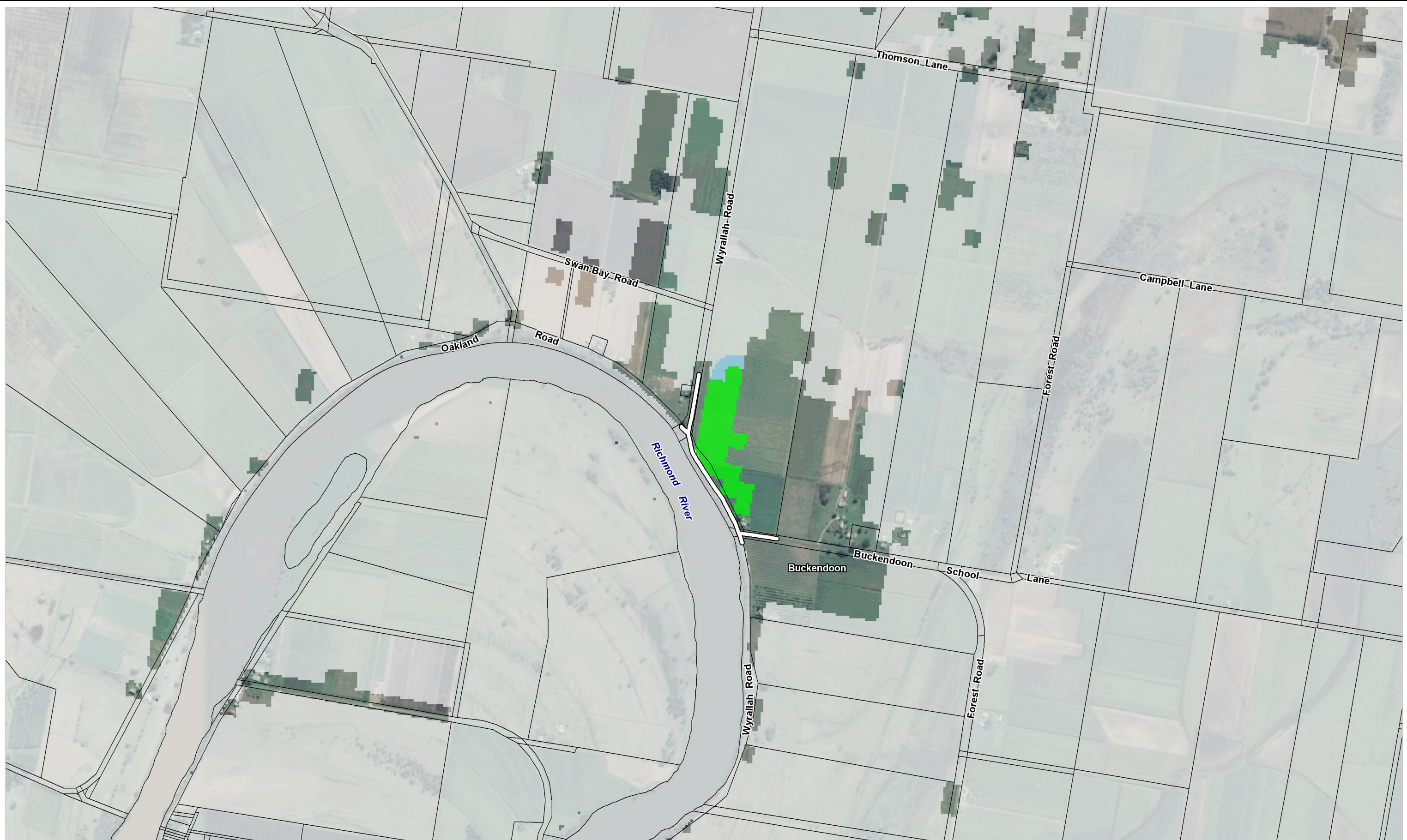
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N 0 400 800 Metres

Figure:
2

Rev:
A


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- Proposed Road Overlay
- Cadastral Boundaries

Satellite image:
Google Earth Jul/Aug/Sep 2020
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Impact (m)

< -0.01	0.15 to 0.20	Was dry now wet
-0.01 to 0.01	0.20 to 0.25	Was wet now dry
0.01 to 0.05	0.25 to 0.30	
0.05 to 0.10	0.30 to 0.35	
0.10 to 0.15	> 0.35	

Title:
**5% AEP Peak Flood Level Impacts for the
Proposed Overlay Works on Wyrallah Road (Scenario 2)**

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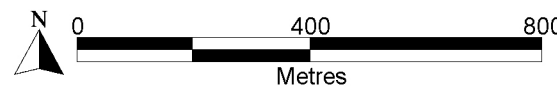
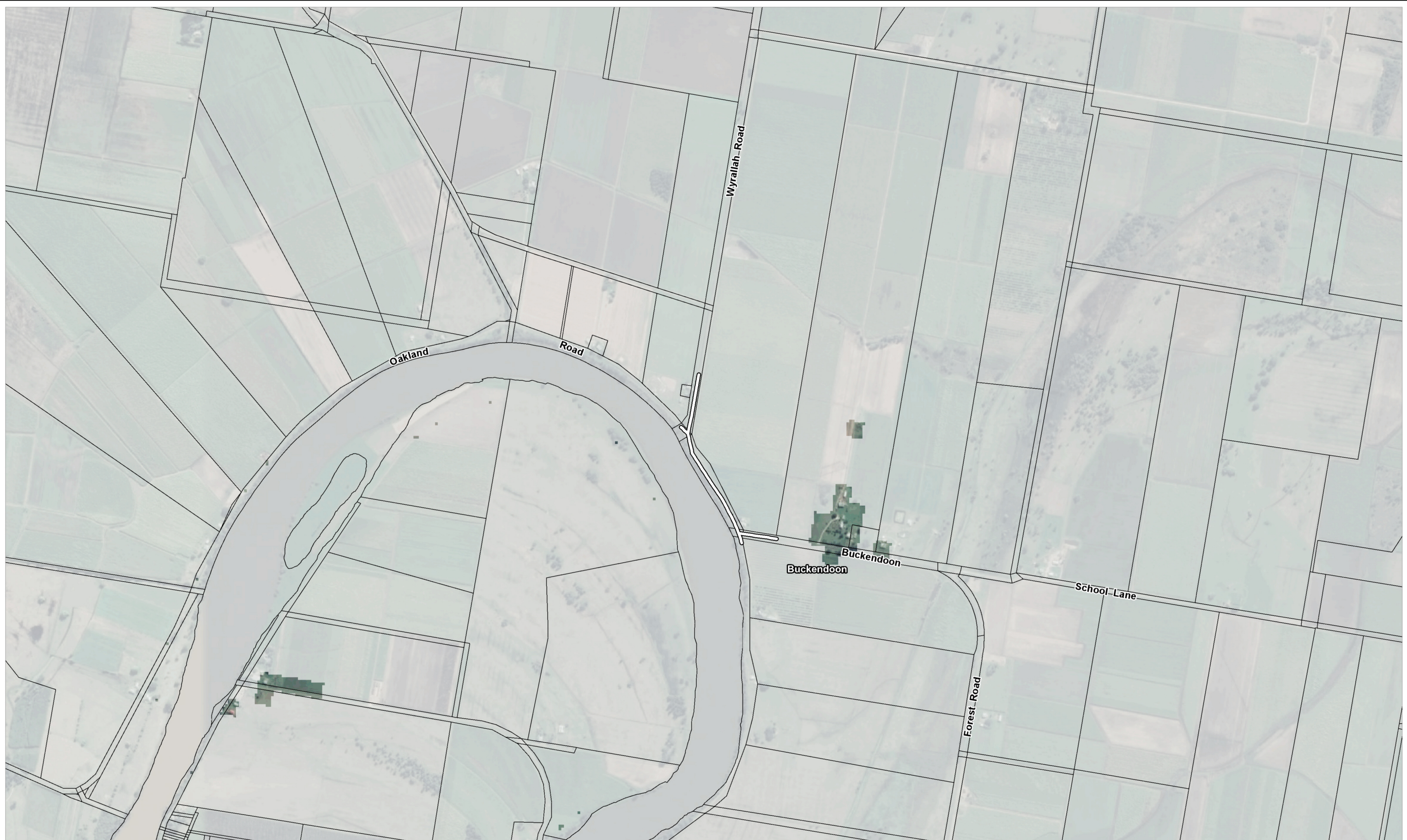


Figure:
3

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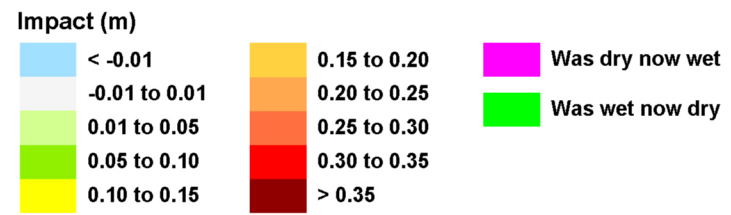
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— Proposed Road Overlay
— Cadastral Boundaries

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Title:
1% AEP Peak Flood Level Impacts for the Proposed Overlay Works on Wyrallah Road (Scenario 2)


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Figure:
4

Rev:
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