Flooding Behaviour - Mooroopna ODP

Report Prepared For

City of Greater Shepparton

Report LJ5470 / RM2125
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REPORT STATUS

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TABLE OF CONTENTS

LIST OF FIGURES

1. INTRODUCTION

The Mooroopna Outline Development Plan (ODP) covers a large area to the north west of Mooroopna, as shown in figure 1.1. In 2005 the City of Greater Shepparton (CoGS) commissioned Cardno Lawson Treloar to undertake hydraulic modelling to assess the impact of developing the ODP area on flood flows and levels on adjacent properties.

This report includes the scope of work, background information for the area and the study, details of the hydraulic modelling undertaken and recommendations and conclusions. The report will be used by Maunsell Australia in an analysis for the Mooroopna ODP.

2. SCOPE OF WORK

This project had the following scope of work:

1. Re-establish the hydraulic model representing the existing conditions for the study area;
2. Determine the impact of the proposed Mooroopna ODP development on flood flows and levels at surrounding properties;
3. Determine mitigation measures required to reduce the impact of the development on flood flows and levels at surrounding properties; and
4. Produce a report showing the results of the investigation.

3. BACKGROUND

The City of Shepparton is situated in Northern Victoria, approximately 180 km directly north of Melbourne. It is at the centre of the Goulburn Valley, at the confluence of three major watercourses, the Goulburn River, Broken River and Seven Creeks. The area is extremely flat and, consequently, when flooding occurs, a large portion of the study area can be inundated.

The townships of Shepparton and Mooroopna have been subject to numerous floods since European development, with the largest floods on record occurring in 1916, 1939, 1974 and 1993. Following the 1993 floods, the Shepparton-Mooroopna Flood Study (SKM, 2002) was commissioned. Cardno Lawson Treloar (previously Lawson and Treloar) were engaged to create a hydraulic model of the Shepparton area as part of this flood study.

Since the hydraulic model was created, it has been used to assess the hydraulic impact of a number of developments proposed for the Shepparton-Mooroopna area.

The Mooroopna ODP covers a large area to the north west of Mooroopna. The aim of this investigation was to assess the total impact of development of the ODP area, rather than the incremental impact of small portions of development, on flood behaviour in the area.

4. HYDRAULIC MODELLING

4.1 Existing Conditions

In 2005 the hydraulic model used for the Shepparton Flood Study was updated to the SOBEK modelling system and the topography updated to include all recent developments (CLT, 2006, Report LJ5470 / RM2106).

There are three main flooding mechanisms in the Shepparton-Mooroopna area:

- Local rain;
- Goulburn River flooding
- Broken River & Seven Creeks flooding.

Investigations into flooding on the Mooroopna ODP site showed that the dominant flooding mechanism is flooding from Goulburn River dominant events.

Figure 3.1 shows the maximum predicted water surface elevation for the 100 year Average Recurrence Interval (ARI) Goulburn dominant event. Figure 3.2 shows the maximum predicted water depths for the 100 year ARI Goulburn dominant event, with figure 3.3 showing an enlargement of the ODP area. These results have been used as the existing conditions for this investigation.

4.2 ODP

To represent the ODP development area in the hydraulic model, the grid cells within the area to be developed were raised above the 100 year ARI flood level. This is shown in figure 3.4.

The maximum water-surface elevations resulting from the 100-year ARI event were compared to those produced for the existing conditions. This showed that by developing the ODP area, water levels on properties to the east of the ODP would increase significantly. As this effect is unacceptable, mitigation options were investigated to minimise the impact the ODP would have on flood flows and levels in the surrounding areas.

Numerous mitigation options were considered and assessed using the hydraulic model. The combination of mitigation options presented in this report is considered to be the most practical option and results in minimal off-site impact.

The mitigation options consist of a series of on and off-site works. These mitigation options have been developed in consultation with the following organisations:

- City of Greater Shepparton;
- Goulburn Broken Catchment Management Authority;
- Maunsell Australia; and
- Earth Tech.

Earth Tech have undertaken the design of a number of existing developments adjacent to the Mooroopna ODP, and are working for groups that own land within the ODP area. Earth Tech are proposing to do some of the mitigation works proposed in this investigation as part of other developments. These works are within the floodplain as shown in figure 3.5.

The floodway areas have been modified to represent the concept used by Earth Tech in the Heathmont Estate. This concept involves reshaping the floodway areas to allow for additional storage of water.

Figure 3.6 shows the extent of works designed by Earth Tech and the extent of works to be undertaken as part of the Mooroopna ODP. The proposed invert levels for the floodways are also shown on figure 3.6. The material extracted from these areas may be used as fill for the developable areas. It is possible that these floodway areas may be used for water quality treatment. Any such works in these areas will need to be investigated to ensure no adverse impact on flood flows.

The following additional mitigation works are proposed for this area. Figure 3.5 shows the location of these. Please note that all these mitigation works are required to be constructed for the impact of the proposed development to be reduced.

A series of roads (labelled B-N on figure 3.7).
These roads have been designed to convey floodwater through the development from east to west. These have been modelled as 25 m wide reserves. Following negotiations, the Goulburn Broken Catchment Management Authority have allowed a flood depth of 0.5 m in these roads. The exact location and configuration of these roads may change during design. If the final design is different to that presented in this report, additional analysis may be required.

Figure 3.8 shows the predicted flows for the all roads and floodways. These flows may be used to determine the size required. Please note that some of the roads are shown with zero flow in this figure. These roads have very low flow rates and are needed for storage area.

In addition to these roads, there is one road proposed for the northern section of the development, as shown in figure 3.5.

The North-South Road (shown on figure 3.7).
This road is proposed to be used as a floodway during extreme events. The road location shown is indicative, and may be changed if necessary. If the location of this road is changed significantly, additional investigation may be required.

The North-South Road runs from the northern to southern edge of the developments. This road will involve two bridges to cross the floodways. The location of the southern bridge is shown in figure 3.7. The location of the northern bridge has not been finalised at this stage. Investigations have shown

that this 'spur' is used for storage of flood water only and is not a flow path. The structure at this location should be sized to maintain the flood storage area and allow for local drainage.

North-South floodway (shown on figure 3.7).
This floodway has been designed to allow space for one house block between the existing eastern edge of the development and the floodway. It is envisaged that this floodway be incorporated into a road reserve. The floodway may be used for local drainage and water quality treatment in addition to conveying the 100 year ARI flow. The reserve (road and floodway) is expected to be approximately 50 m wide.

Boundary Road (shown on figure 3.7).
The southern section of the Mooroopna ODP has been designed with a 'Boundary Road' around most of the developable area. This Boundary Road begins on the western edge of the development at Road M, and follows the floodway through to the North-South Road. This road has been designed to be inundated (to a maximum depth of 0.5 m) in the 100 year ARI flood event, with no obstructions to flow between the road and the floodway.

Swale drains on existing roads.
Additional swale drains should be incorporated into existing roads to the east of the Mooroopna ODP. These are required to convey additional flow around the development site. The invert levels for these drains are shown on figure 3.7. Actual configuration of these drains will depend on the existing conditions in these locations. Additional investigation may be required if the specified levels cannot be achieved.

4.2.1 Results

The maximum predicted water depths and maximum water surface elevations from the developed conditions model (including mitigation options) are shown in figures 3.9 and 3.10 respectively.

The mitigation options proposed for the Mooroopna development have successfully prevented an increase in flood levels at most properties adjacent to the development. Figure 3.11 shows the predicted difference in water surface elevation due to the Mooroopna ODP. In the areas shown as being green and blue, a decrease in water levels is predicted. Yellow and orange areas indicate that the model is predicting an increase in water levels, due to the development.

This figure shows that there are some changes in water levels predicted in the areas adjacent to the Mooroopna ODP, with the majority of the impacts being a decrease in flood levels. Some minor increases in the road reserves to the east of the development, and increases of up to 5 cm in the area to the north-west of the development are also predicted.

5. CONCLUSIONS AND RECOMMENDATIONS

The information in this report will be provided to Maunsell Australia to assist in the preparation of the full Mooroopna ODP investigation.

The design presented in this report is conceptual only. It is recommended that the final design be tested within the hydraulic model to ensure that the impacts on surrounding properties are as predicted.

6. REFERENCES

CLT, 2006. *"Flood Model Update – Shepparton-Mooroopna Area"*. Report LJ5470 / RM2106 Ver 0.2 DRAFT, January 2006 prepared by Cardno Lawson Treloar for City of Greater Shepparton.

Sinclair Knight Merz, 2002. *"Shepparton Mooroopna Floodplain Management Study"*. Report prepared by Sinclair Knight Merz and Lawson & Treloar for the Greater Shepparton City Council, October 2002.

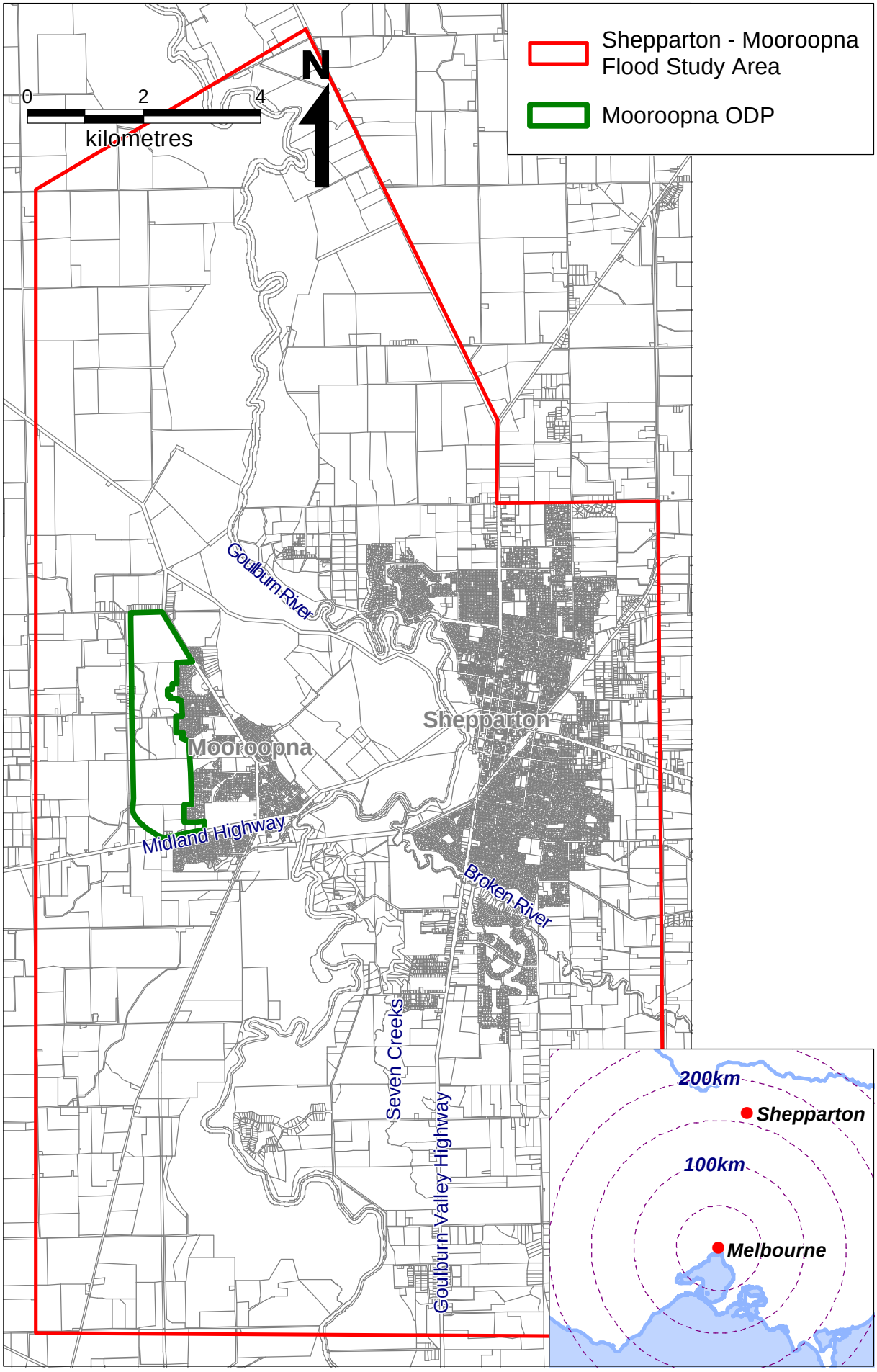

Figure 1.1 - Locality and Study Area

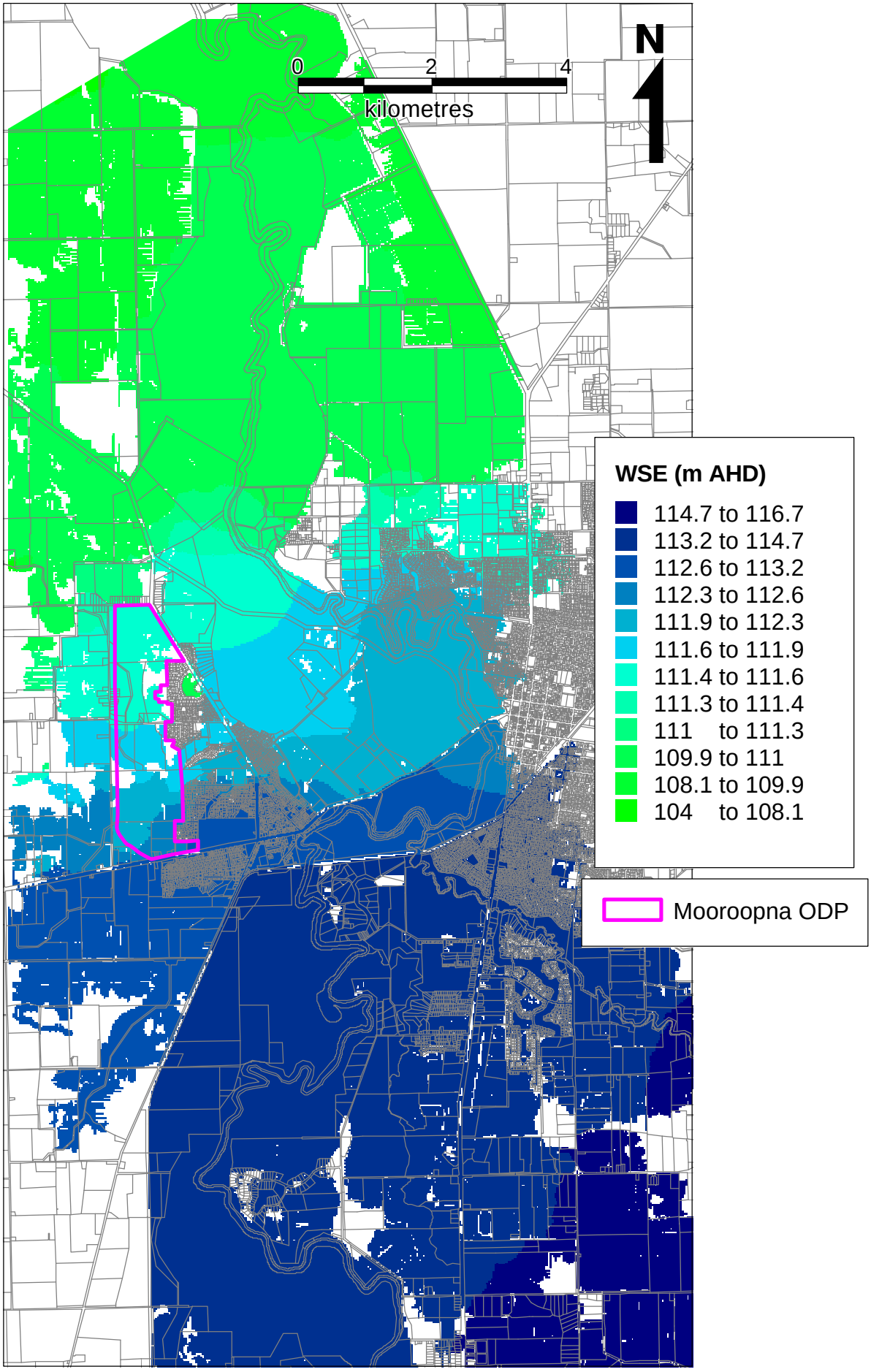

Figure 3.1 - Existing Conditions, 100 Year ARI Maximum Water Surface Elevation, Goulburn River Dominant Event

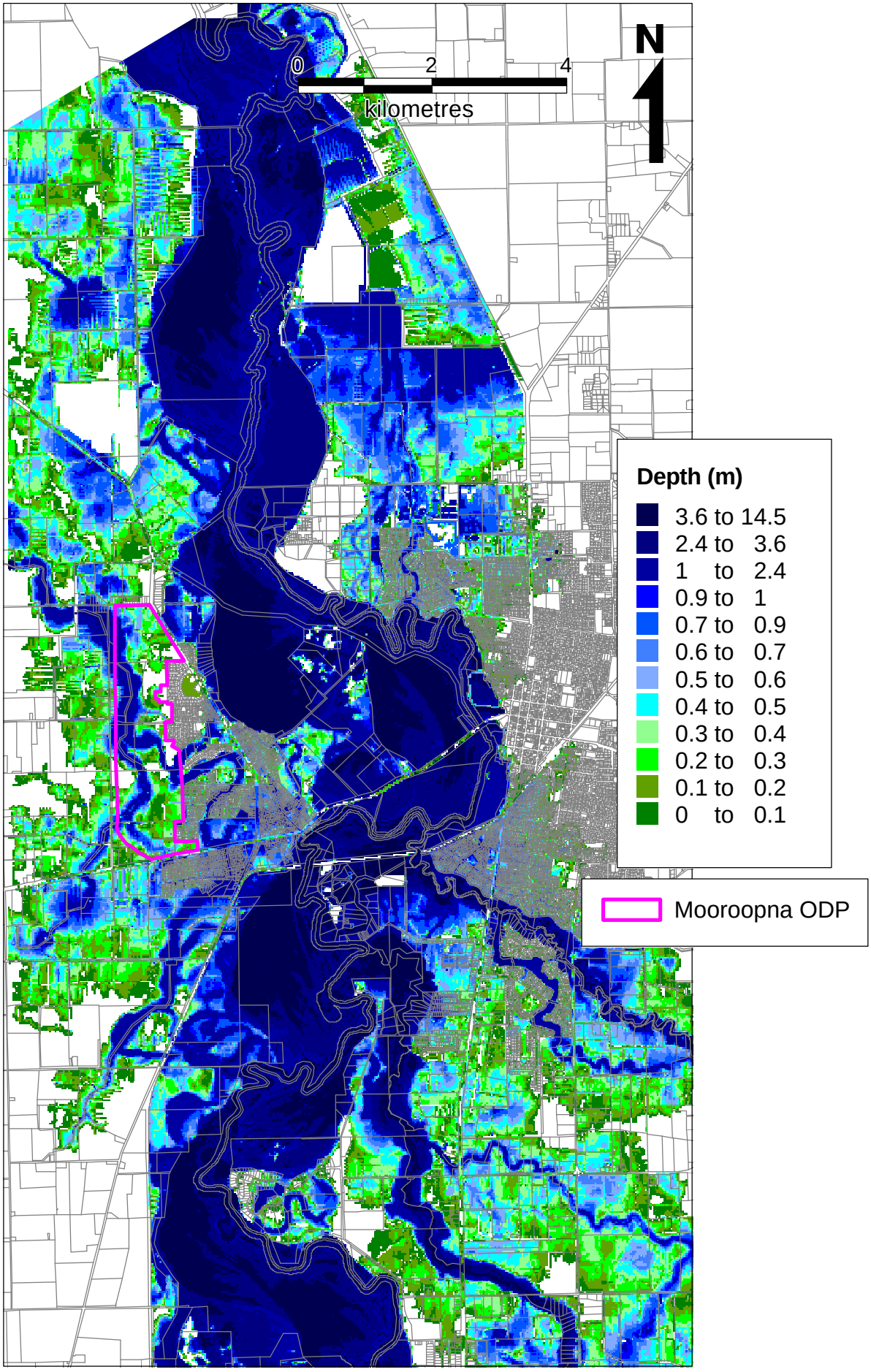

Figure 3.2 - Existing Conditions, 100 Year ARI Maximum Water Depth, Goulburn River Dominant Event

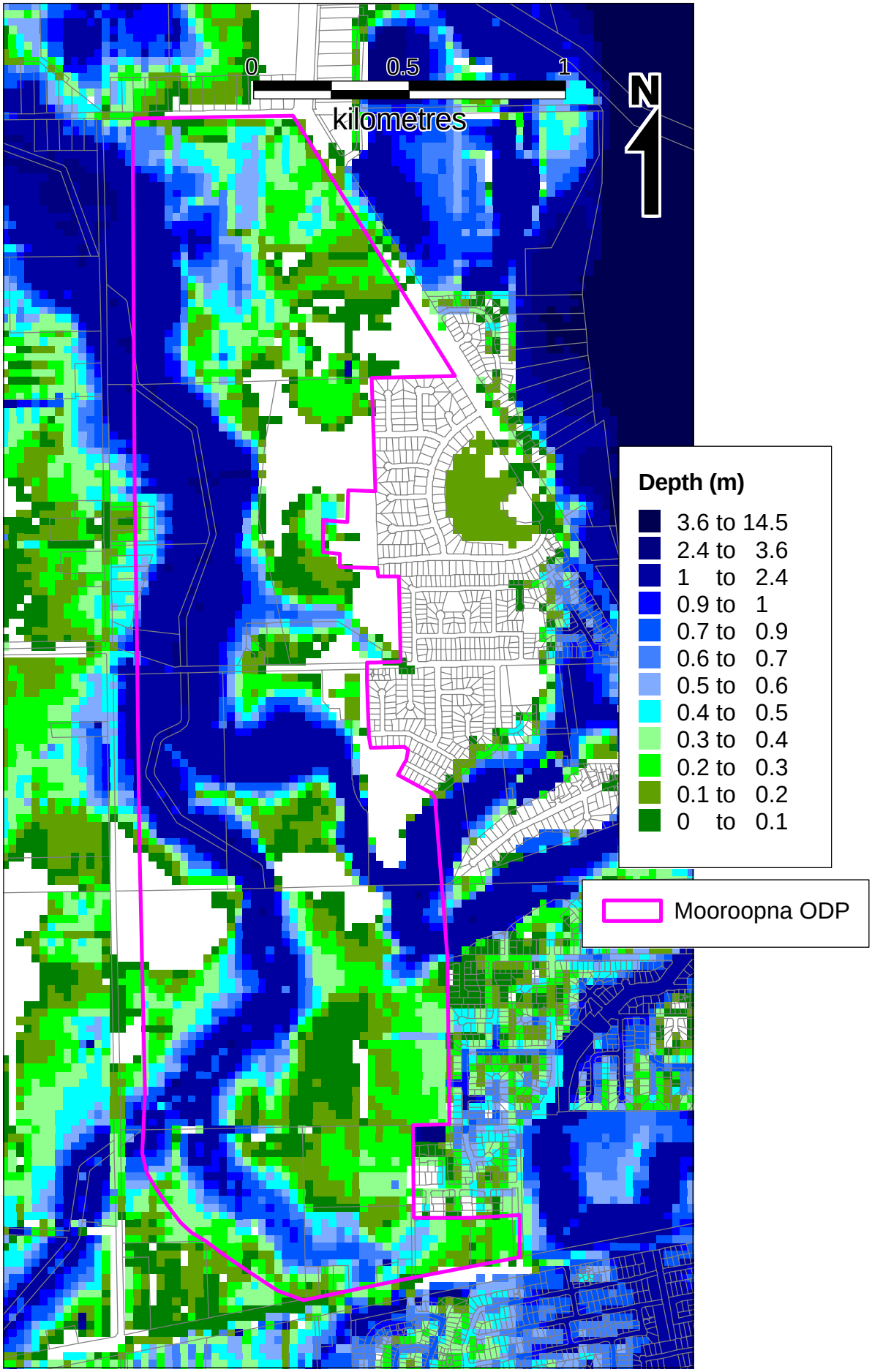

Figure 3.3 - Existing Conditions, 100 Year ARI Maximum Water Surface Elevation, Goulburn River Dominant Event for Mooroopna ODP Area

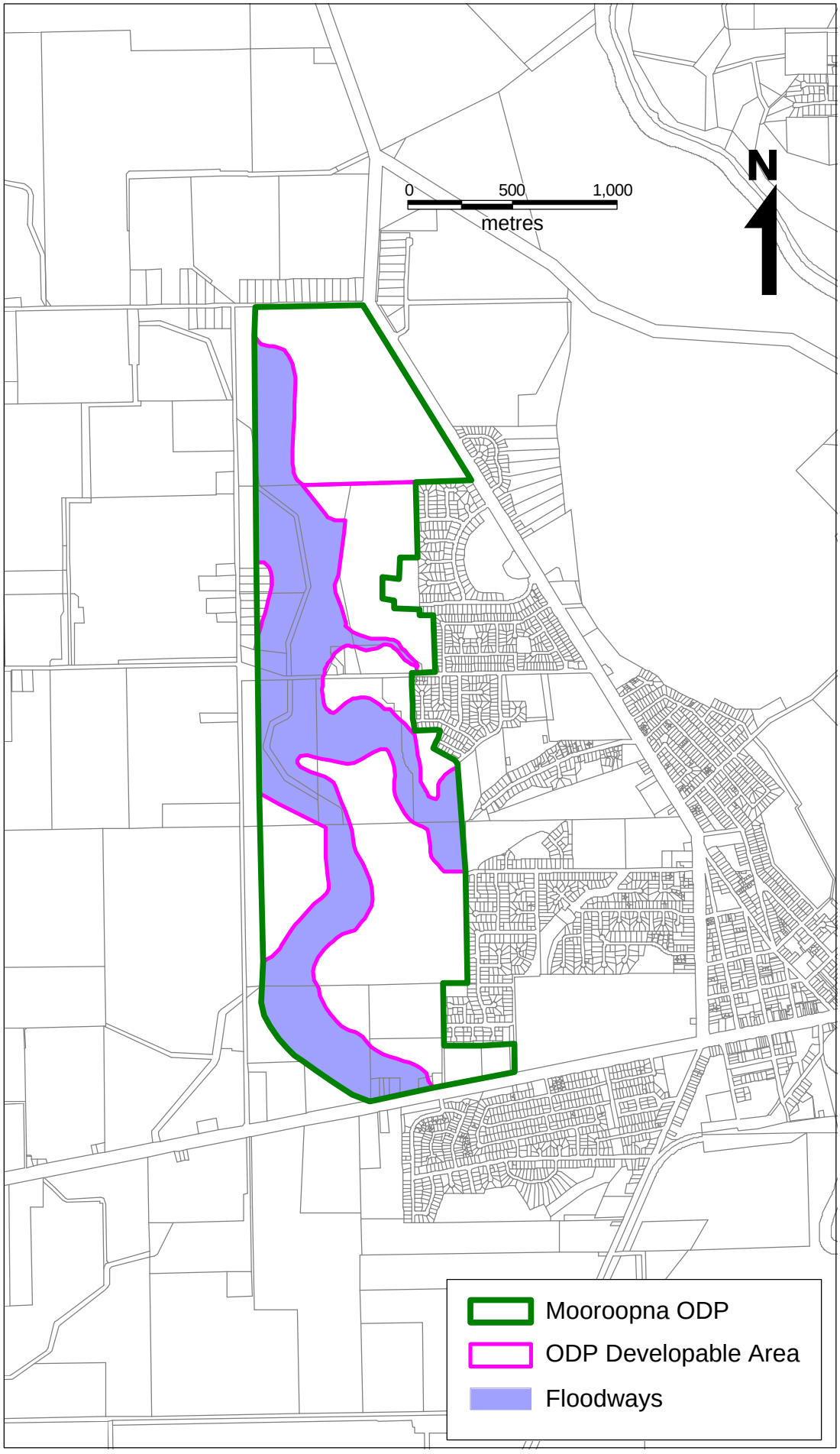

Figure 3.4 - Mooroopna ODP Outline

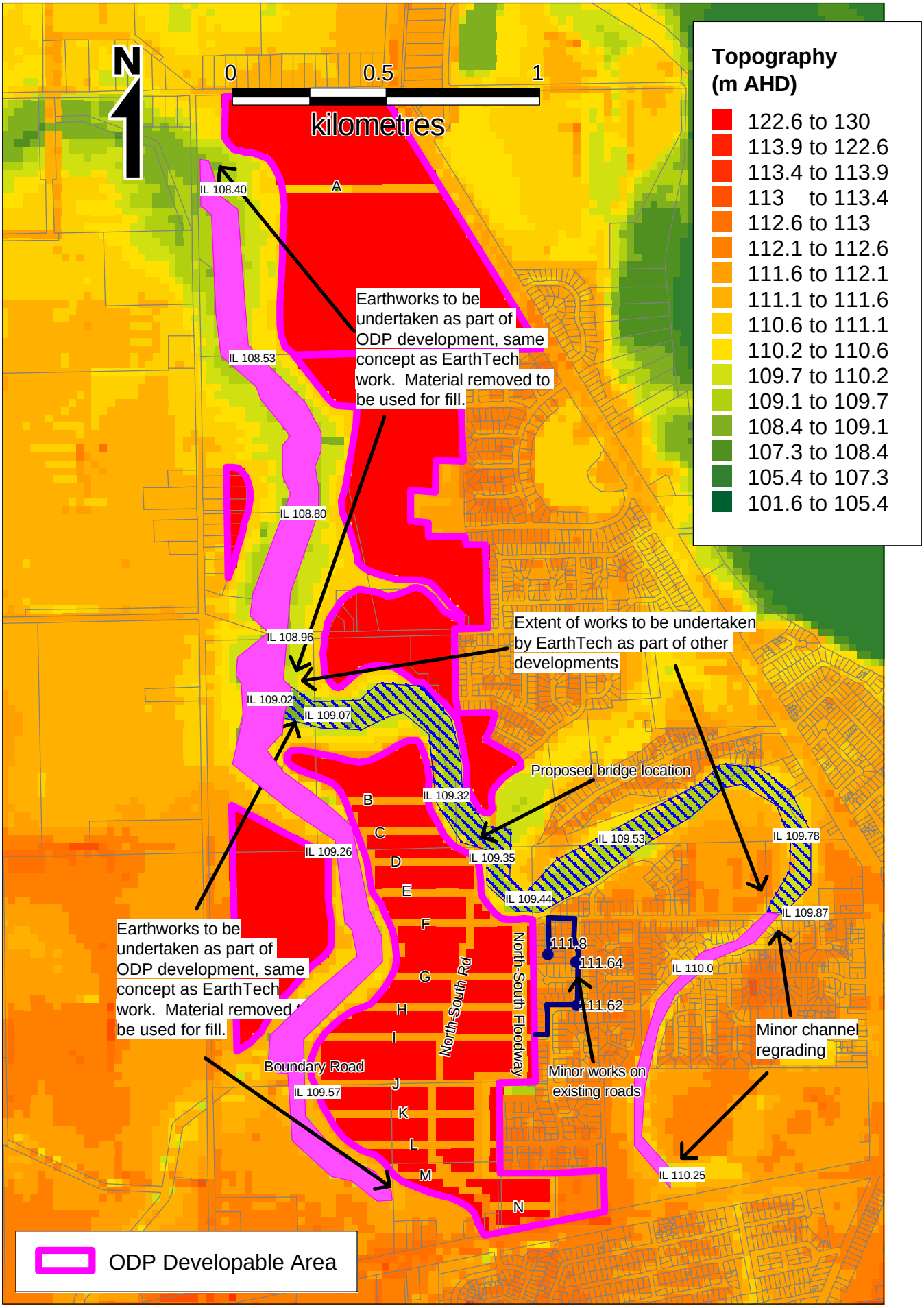

Figure 3.5 - Mooroopna ODP Features

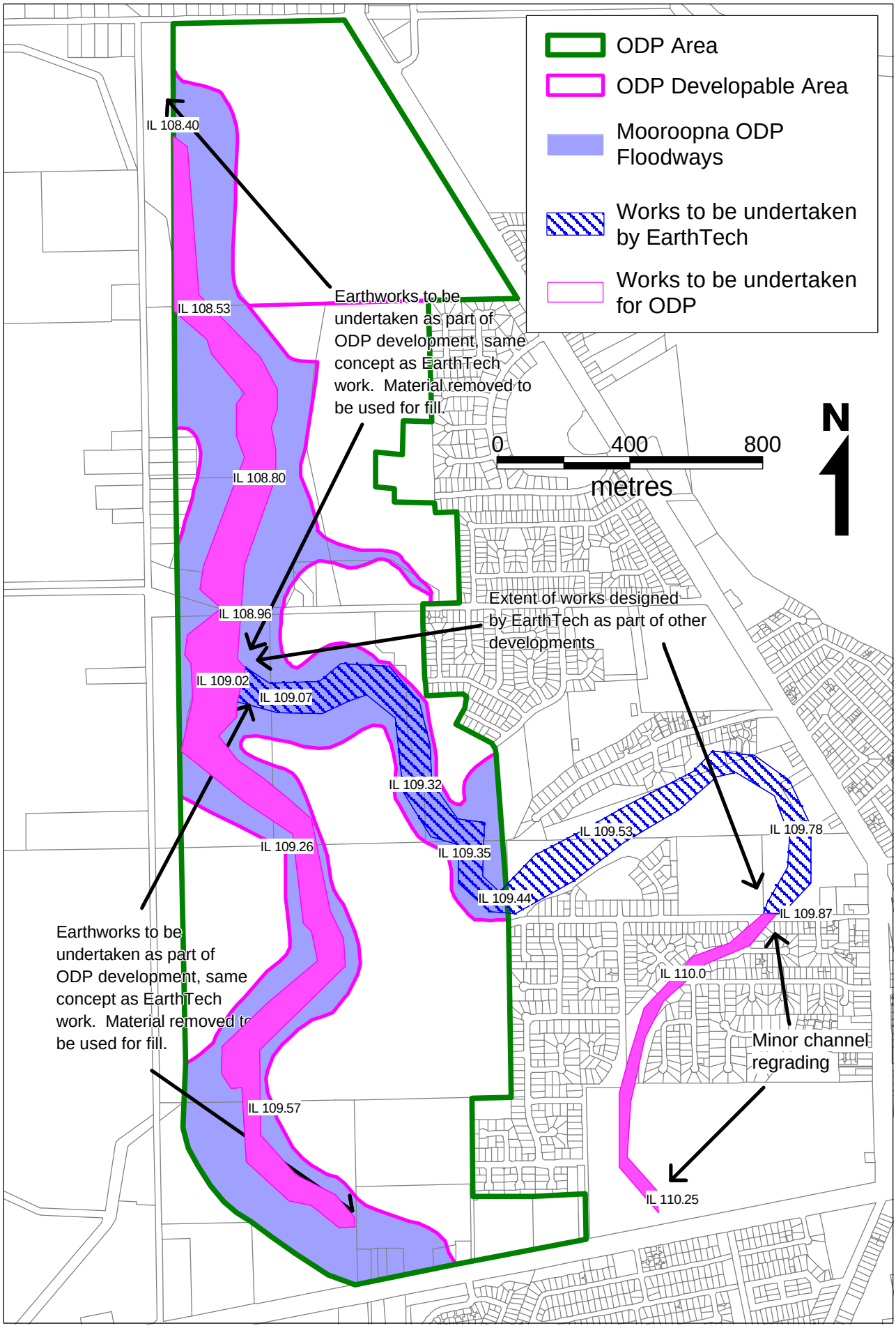

Figure 3.6 - Mooroopna ODP Proposed Floodway Works

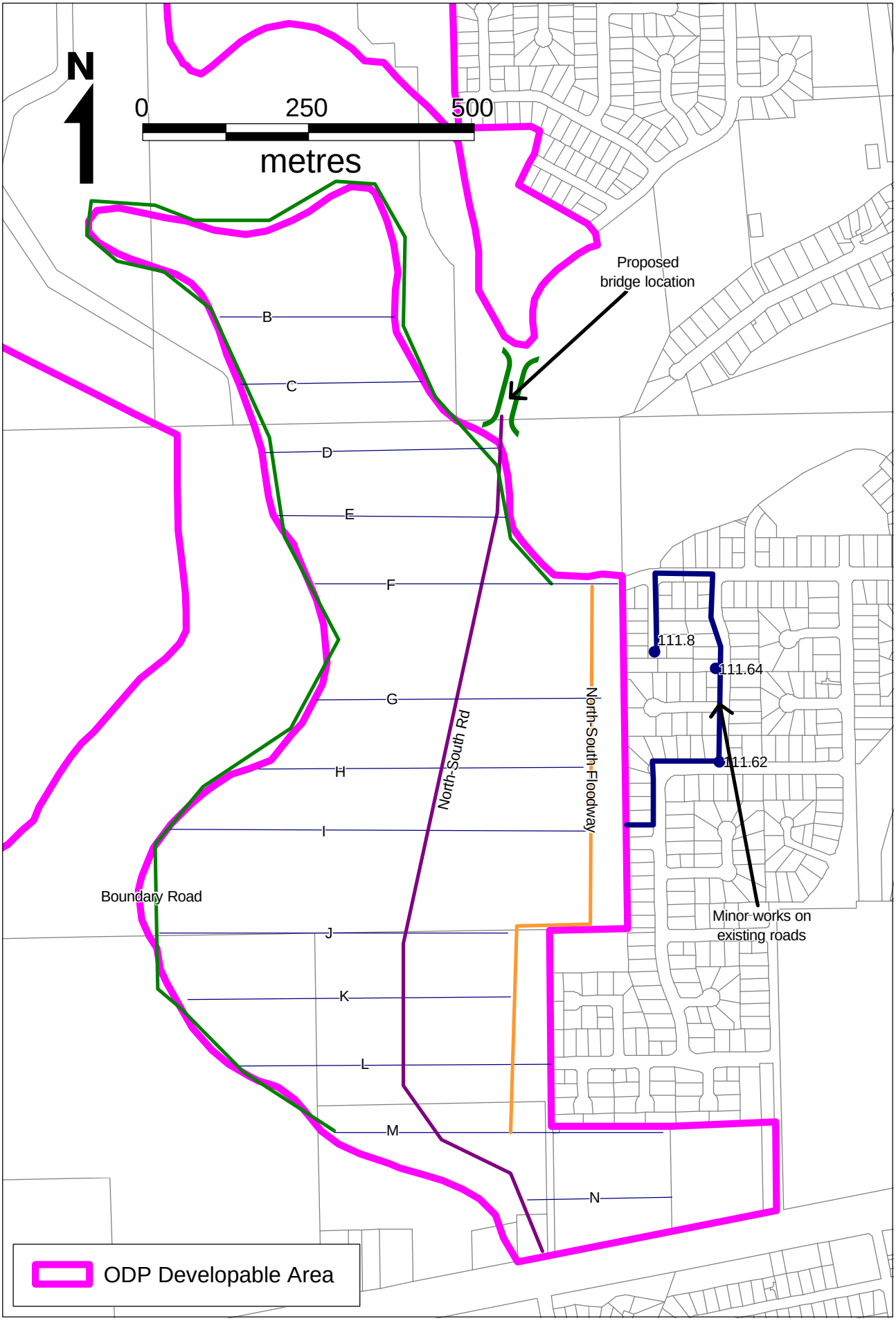

Figure 3.7 - Mooroopna ODP Proposed Roads and Floodways

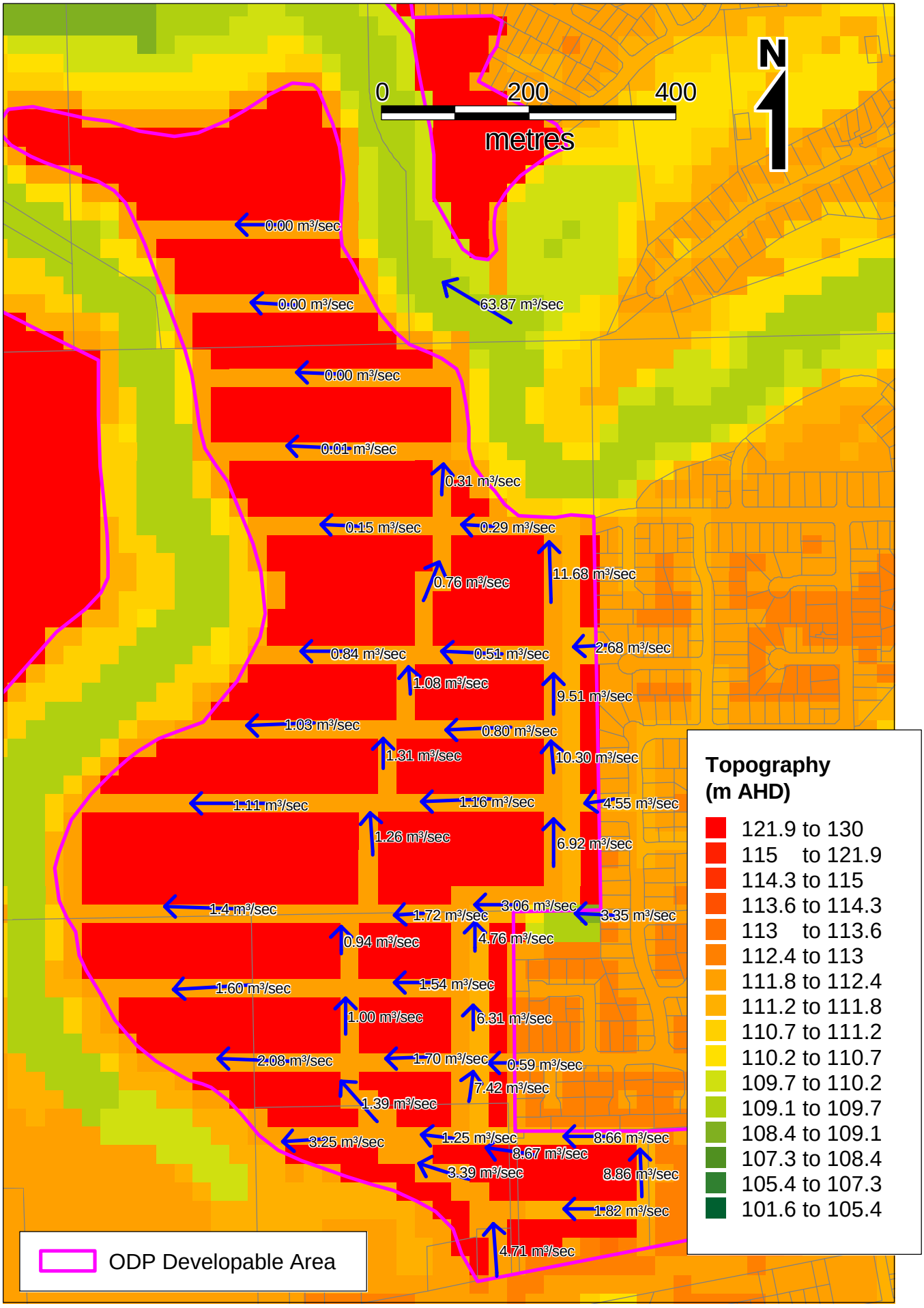

Figure 3.8 - Mooroopna ODP, Modelled Flows on Proposed Roads

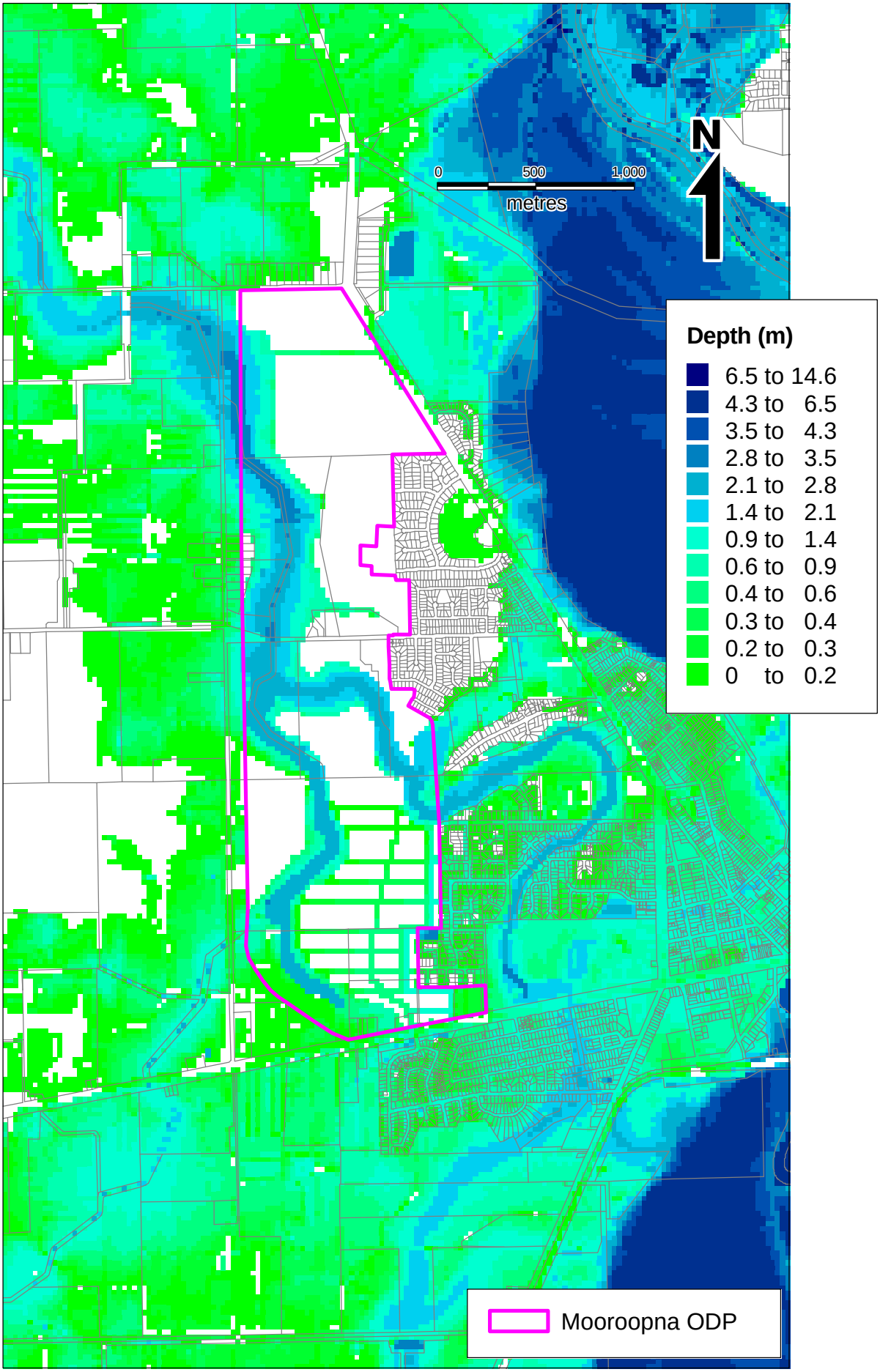

Figure 3.9 - Predicted Maximum Water Depths, 100 Year ARI Goulburn River Dominant Event with Mooroopna ODP & Mitigation Works in Place

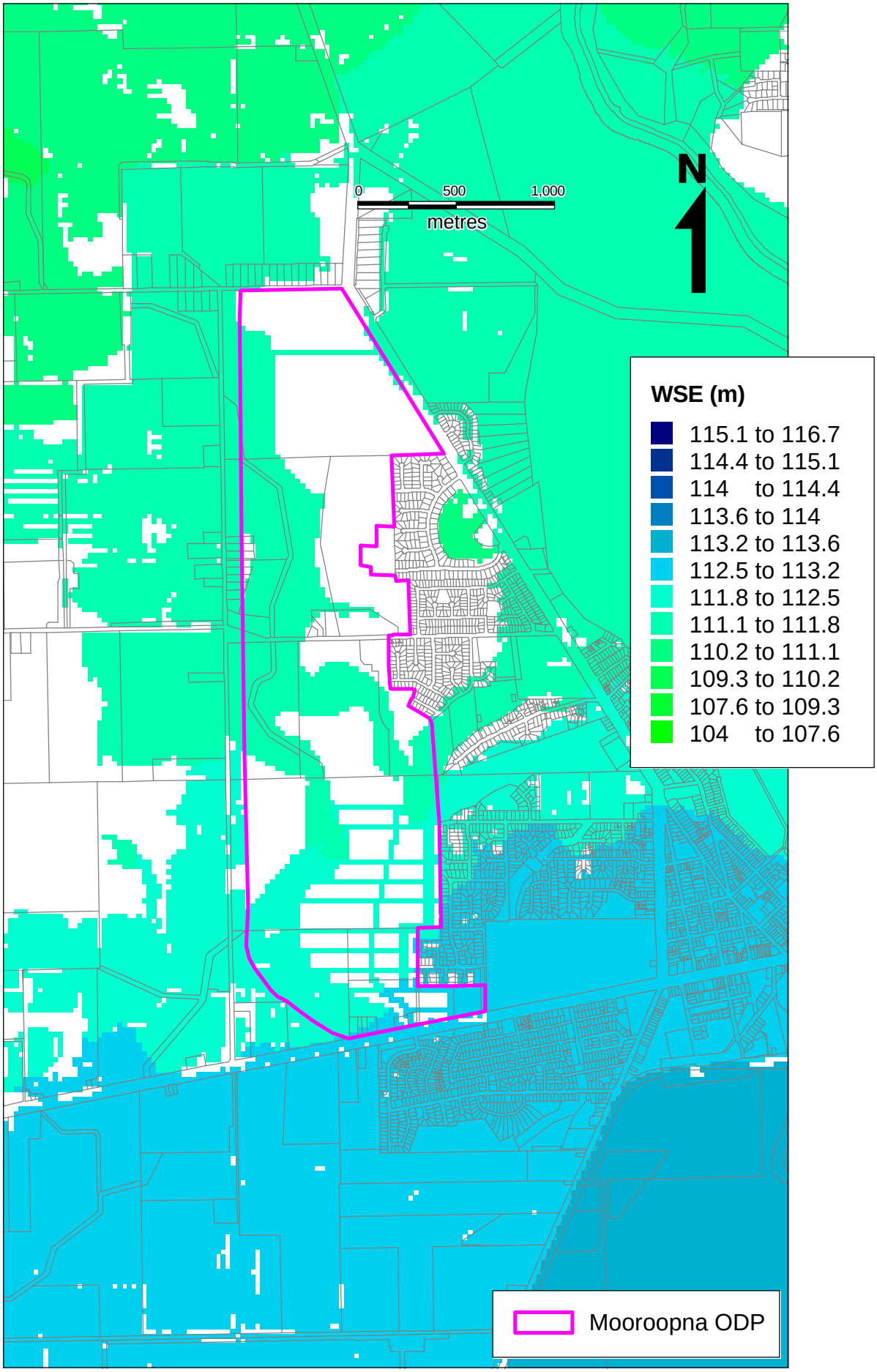

Figure 3.10 - Predicted Maximum Water Surface Elevation, 100 Year ARI Goulburn River Dominant Event with Mooroopna ODP & Mitigation Works in Place

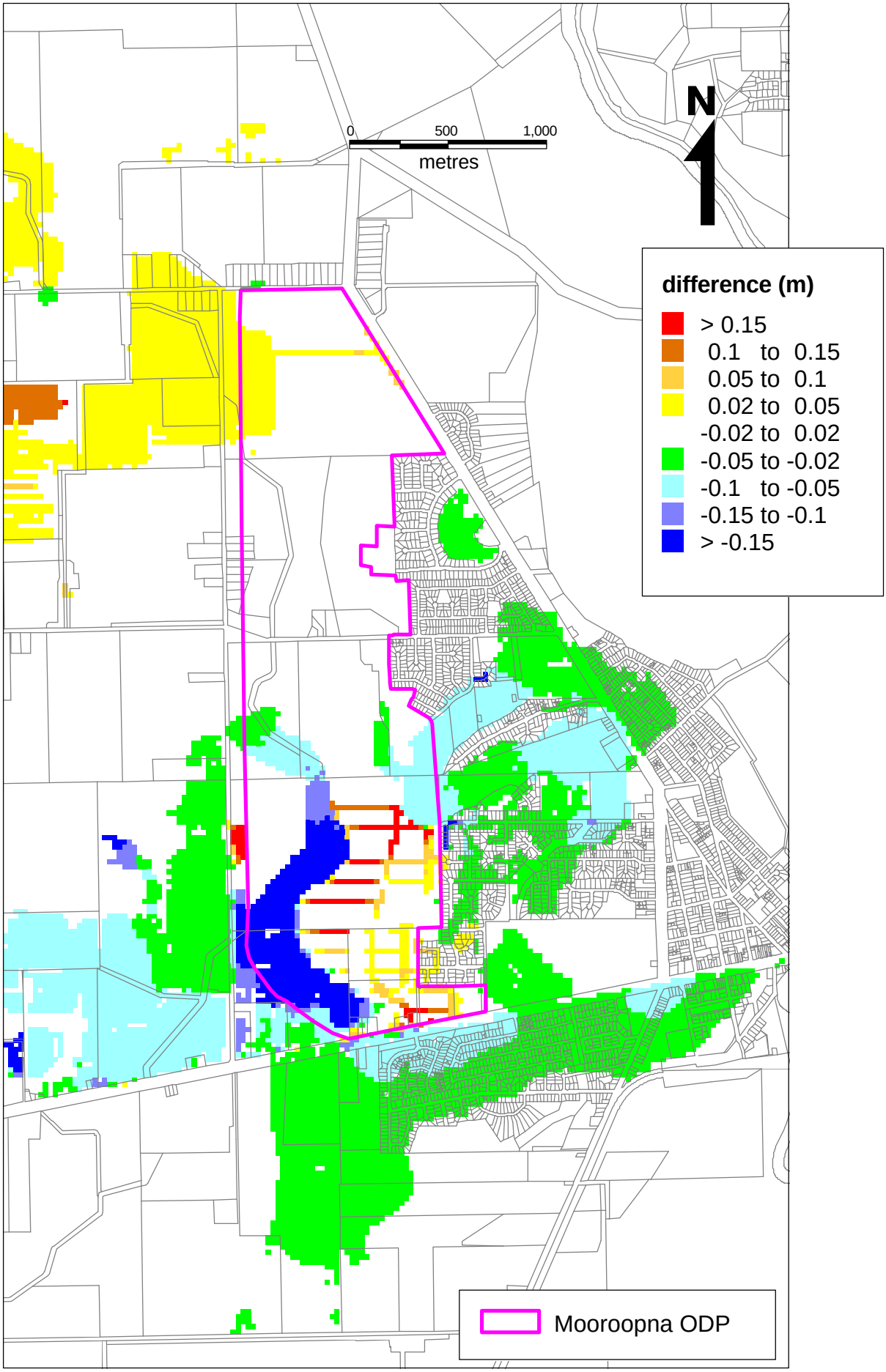

Figure 3.11 - Predicted Change in Water Levels Due to Mooroopna ODP & Mitigation Works (100 Year ARI Goulburn River Dominant Event)