Hydrodynamic Modelling of SDL Sites

MALLEE CMA

Nyah Forest – Final Report

24 January 2017

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1. Introduction

1.1 Background

The Murray Darling Basin Plan has set legal limits on the amount of surface water and groundwater that can be extracted from the Basin for consumptive use. The sustainable diversion limits (SDLs) for surface water are set at a 2,750 GL/y reduction on current extraction levels. For groundwater, there is an SDL of 3,334 GL/y set on groundwater extraction across the basin. The Basin Plan also includes a mechanism for the adjustment of these SDLs where an equivalent environmental outcome can be achieved with less water.

Typically these SDL adjustment projects involve the installation of environmental infrastructure (works and measures) on a floodplain to enable inundation events using smaller quantities of water than would typically be needed without intervention. These works and measures are designed to allow for the replication of the volume and duration of natural floods to achieve environmental benefits using significantly less water than a comparable natural flooding event.

The Mallee CMA has identified a number of locations where SDL offset works and measures are expected to significantly enhance the existing watering regime. The Nyah Forest is one of these sites, and has been subject to a preliminary options assessment and concept design for watering works (Mallee CMA, 2013). The works proposed for the Nyah Forest consist of:

- Regulating structure consisting of a pair of concrete box culverts at the downstream end of Parnee Malloo Creek
- Smaller structure allowing a release of flows onto a floodplain area outside the inundation area
- Approximately 1.3 km of levees to contain the water within the proposed inundation area.

This report presents results of modelling of the impacts of the proposed works.

The next stages of the SDL offsets project include development of business cases to justify funding for the proposed capital works. Detailed design will also be undertaken for the proposed works and measures. The outcomes from this hydraulic modelling study will form a key input to those stages of work.

1.2 Hydraulic Model

Jacobs was commissioned by the Mallee CMA in May 2014 to develop a hydraulic model of the Nyah Forest floodplain and Parnee Malloo Creek (Figure 1 and Figure 2) to simulate the existing conditions and effect of proposed SDL infrastructure. Parnee Malloo Creek is an anabranch of the River Murray to the south of Piangil in north west Victoria. It meanders for approximately 15 km before re-joining the Murray.

A previous report by Alluvium (Alluvium, 2013) identified potential modifications to the floodplain in Nyah Forest. The purpose of these potential structures is to contain environmental water delivered to the area, retain flood water that enters the area and enable return from the River Murray. The overall aim of this project is to model the potential of these structures to increase flooding of the Nyah Forest floodplain in order to achieve proposed environmental and hydrological requirements.

As part of the same project, Jacobs was also to build a model of the Vinifera Forest floodplain, approximately 8km southeast. To enable significant time and cost savings, the Nyah and Vinifera Forest floodplains were represented in one model, which approximately covers the extent shown in Figure 1.

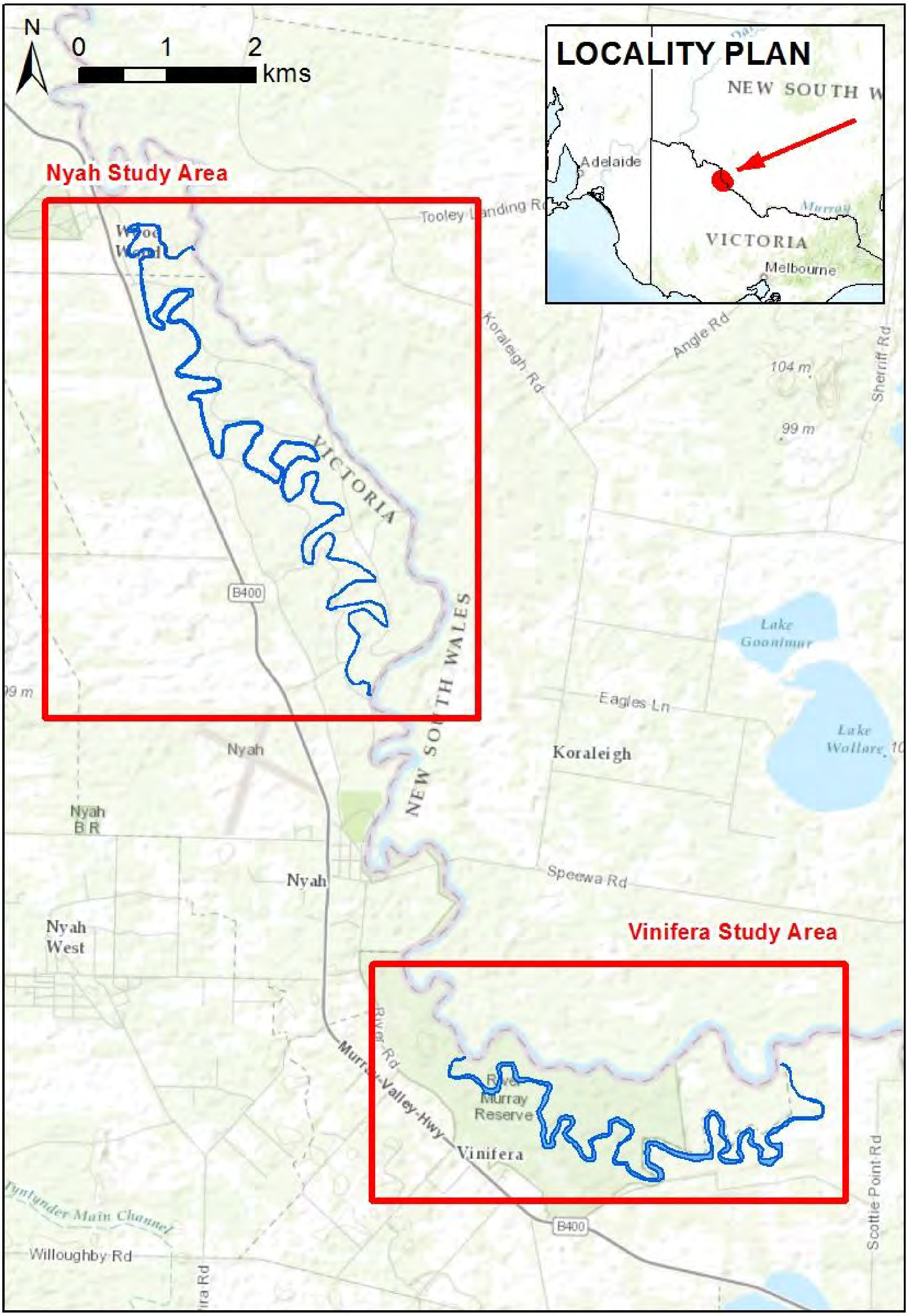


Figure 1 Study areas for the Nyah and-Vinifera Forests

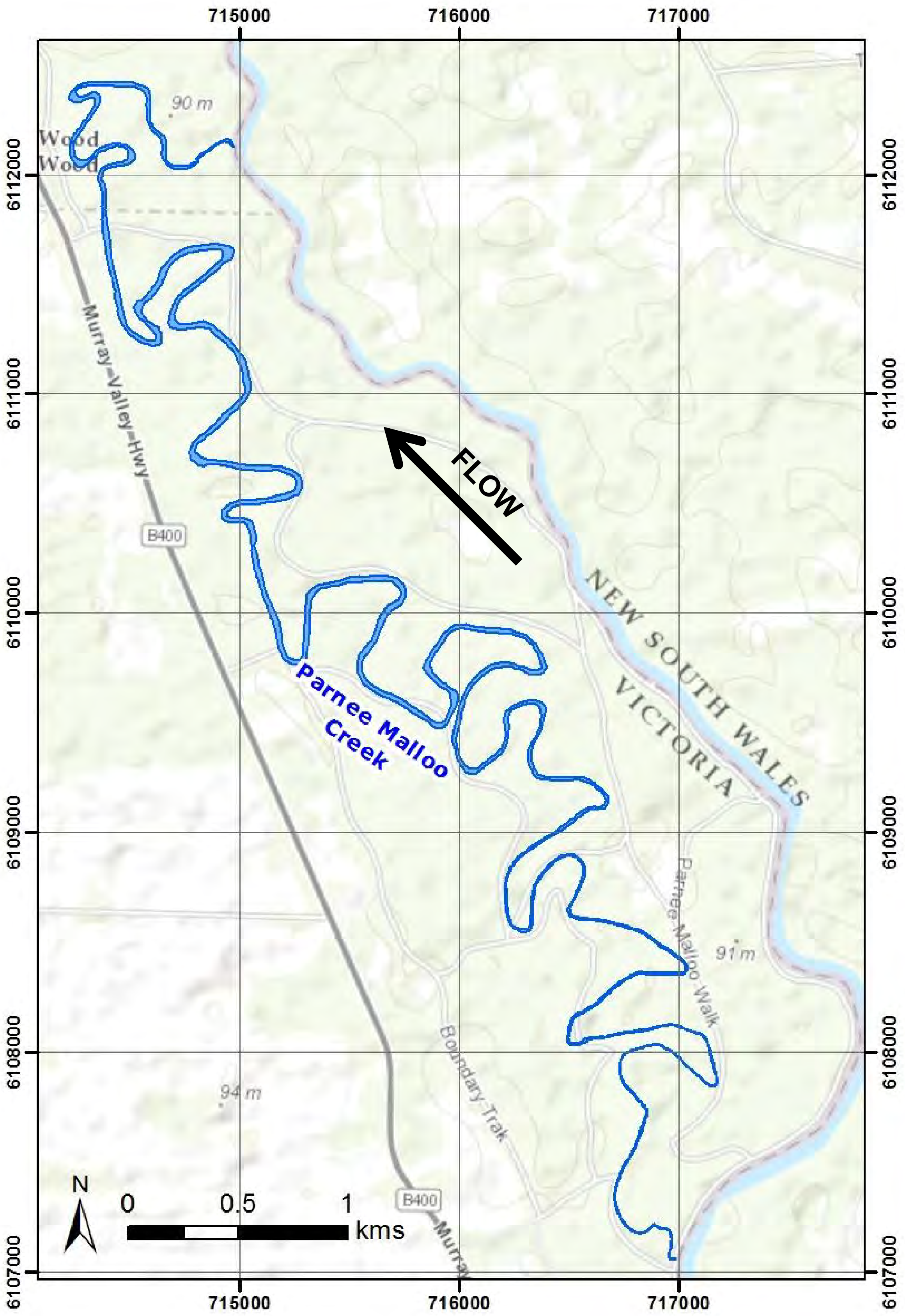


Figure 2 Nyah Forest study area showing Parnee Malloo Creek

2. Model Development

2.1 LIDAR Review

The first stage of the model development was a brief review of the LIDAR for the area, which was provided by the Mallee CMA. Two LIDAR datasets were provided as 1m GIS raster files that covered approximately the same area, one of which was from approximately 2001, and the other of which was from 2010. Both datasets appeared to be of reasonable accuracy, although significant banding was apparent when the two sets were numerically subtracted from each other.

Mallee CMA indicated that the banding was present from the 2001 dataset, and that the 2010 dataset should be used exclusively as it is more accurate and more recent. Metadata was provided solely for the 2010 dataset, with key information as follows:

- Spatial Consultant – Fugro Spatial Solutions
- Acquisition Period – 19 May 2010 to 18 October 2010
- Horizontal Datum / Vertical Datum / Projection – GDA94 / AHD / MGA54
- Horizontal Accuracy – 67% of points ± 0.19m
- Vertical Accuracy – 100% of points ± 0.20m
- Average Point Spacing – 0.45m

The topography of the Nyah area is generally fairly flat and regular in nature, without any significant hills or ridges. The study area is bounded by the River Murray in the east and an embankment that leads to the Murray Valley Highway in the west, and covers approximately 10 km^2. The vast majority of the area bounded by the River Murray channel running through the northern part of Nyah Forest is relatively lightly forested.

The width of the River Murray ranges from approximately 50 m to approximately 80 m between the inlet and outlet of the channel that runs through the Nyah Forest floodplain. The majority of the Parnee Malloo Creek is less than approximately 30m in width.

2.2 Model Schematisation

The model was built using DHI's MIKE software package, with a 1D/2D coupled model approach. The model was constructed using the following information supplied by the Mallee CMA:

- LiDAR survey – used to generate a grid of surface elevation which forms the topographic basis of the model;
- Aerial imagery – used to define a roughness map based on land use, and to better define hydraulic features where site photos were not available; and
- Site photos – used to define hydraulic features.

It is important to note that the collection and use of ground based topographic survey for the purposes of modelling was not within the scope of the project. Consequently, elevations of low flow channels, existing structures and levee banks are generally only accurate to within the LiDAR tolerances stated above.

Further analysis of the LIDAR was undertaken to determine the best approach to the two-dimensional (2D) modelling. A number of grid sizes were trialled, with rough models run to ascertain run times and the validity of the selected grid size. Ultimately it was determined that a 7m grid would adequately resolve the important hydraulic features of the wider floodplain, while keeping run times manageable. This 7m grid was resampled from the 1m LiDAR provided by the Mallee CMA.

Figure 3 shows a section through Parnee Malloo Creek, located towards the upstream end of the channel. A rule of thumb stated by DHI is that channels modelled by a 2D grid should be at least 5 grid cells wide. Figure 3 shows that the channel is only one to two cells wide, consequently it was determined that it needed to be modelled as a one-dimensional (1D) branch, with lateral links to the 2D grid. This 1D MIKE11 branch was generated by excavating cross sections from the 1m LiDAR, thus providing greater resolution than the 7m resampled grid. This resulted in an increase to run times, but was necessary to adequately represent conveyance in the channel. Relevant hydraulic structures were input as MIKE11 structures. The configuration of these structures was assumed from aerial imagery, LIDAR and site photos where available.

As the LIDAR picked up the surface of the water in the River Murray, the channel had to be manually excavated in the model grid to account for this. No significant survey information was available for the River Murray channel at this location, though there were cross sections and river bathymetry data available at points further upstream and downstream. Using this information, it was estimated that there was approximately 2m of water in the Murray at the time the LIDAR was flown, and the channel cells were lowered accordingly.

This approach is approximate, and would need to be refined for future more detailed analysis when ground based survey of the River Murray channel may be available. On top of the estimated depth of water being approximate, this approach also results in a rectangular channel. While it is possible to reasonably model conveyance using this method, the distribution of velocity and depth across the channel section will not be entirely realistic.

Parnee Malloo Creek also had water in it at the time the LIDAR was flown, and the cross sections in the MIKE11 model needed to be similarly excavated. This standing water was due to a weir towards the downstream end of the creek. The cross sections in the MIKE11 branch were excavated to an invert calculated by linearly interpolating from the invert at the upstream end of the branch, to the invert just downstream of the weir. Similarly to the excavation of the River Murray channel, this resulted in a rectangular, rather than natural base to the channel.

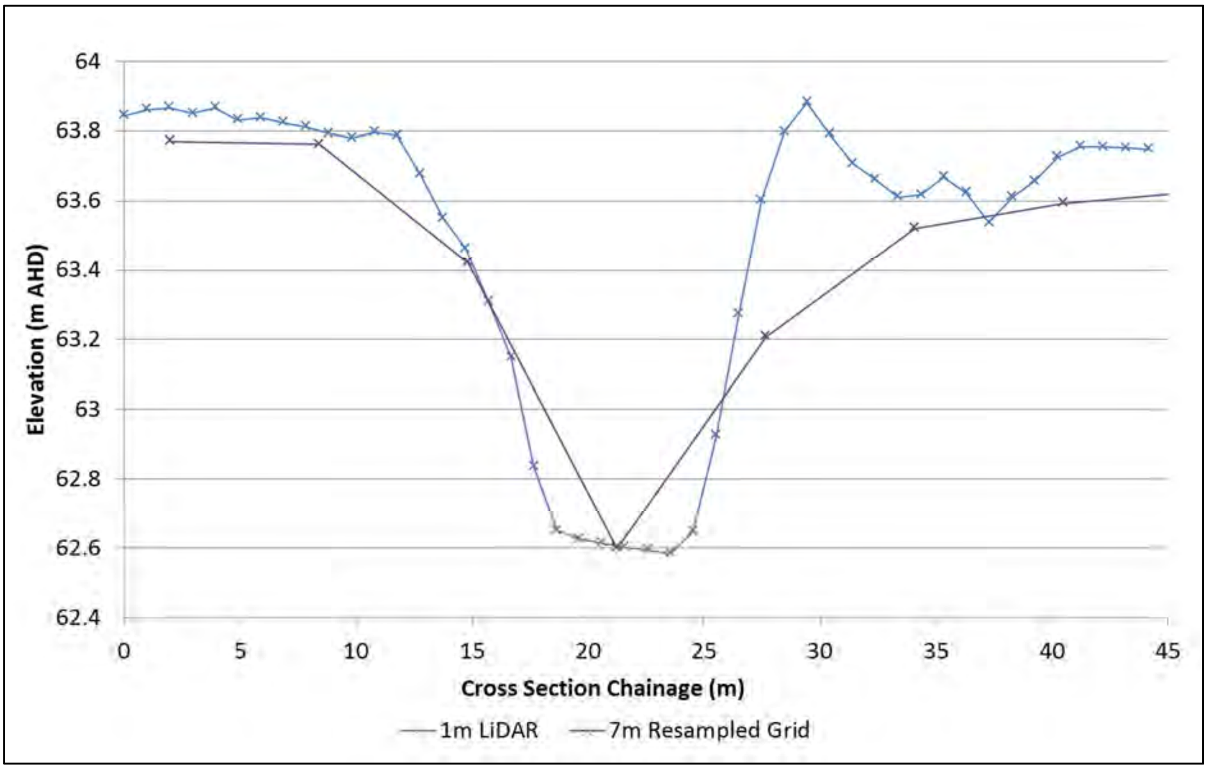


Figure 3 Comparison between 1m and 7m grid for a typical section through the Parnee Malloo Creek

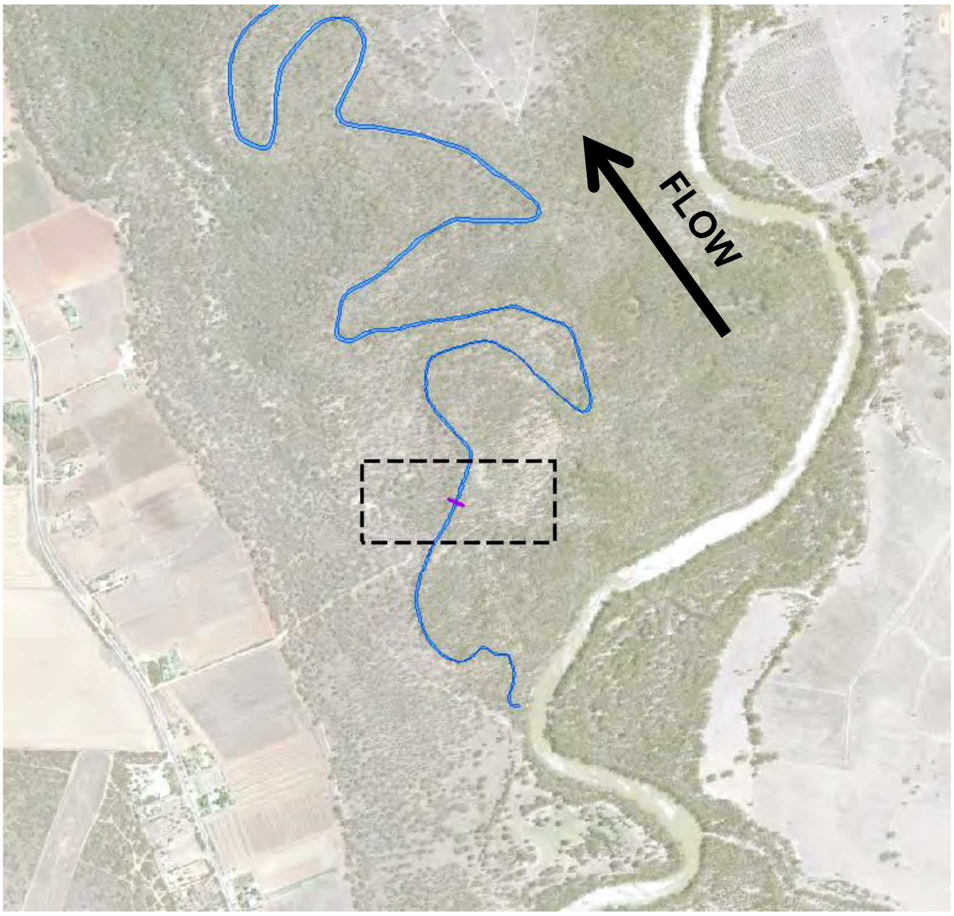


Figure 4 Location of cross section represented in Figure 3 (upper Parnee Malloo Creek, refer Figure 2)

A Manning's n roughness map was digitised based on aerial imagery and LIDAR. The following roughness values were adopted:

- River/creek channels – 0.03
- Pasture/cleared areas – 0.05
- Lightly forested areas – 0.06
- Densely forested areas – 0.1

The values adopted were generally at the higher end of the range typically adopted for a 1D model. This is in line with the suggested approach by DHI for MIKE 2D models. In a 1D model, the roughness acts upon the entire wetted perimeter of the cross-section, including the bed and banks (ie side walls) of the channel. In a 2D model, the roughness applies solely to the bottom of the water column on each grid cell. Thus there is an effective decrease in roughness as no friction losses are applied to the channel bank (side wall). The higher values are adopted to account for side wall losses in the channel not calculated in the 2D model.

There are two boundaries in the model; an inflow boundary to south and an outflow boundary to the north. The steady state flows discussed subsequently were input through southern boundary while the northern outflow boundary was set as a rating curve (Figure 5). This rating curve was developed based on the results of early trial model runs and an assessment of various River Murray flow rates, levels and slopes. Slopes from the hydraulic model were compared with the slope of the water surface captured when the LiDAR was flown to provide confidence that the rating curve was appropriate.

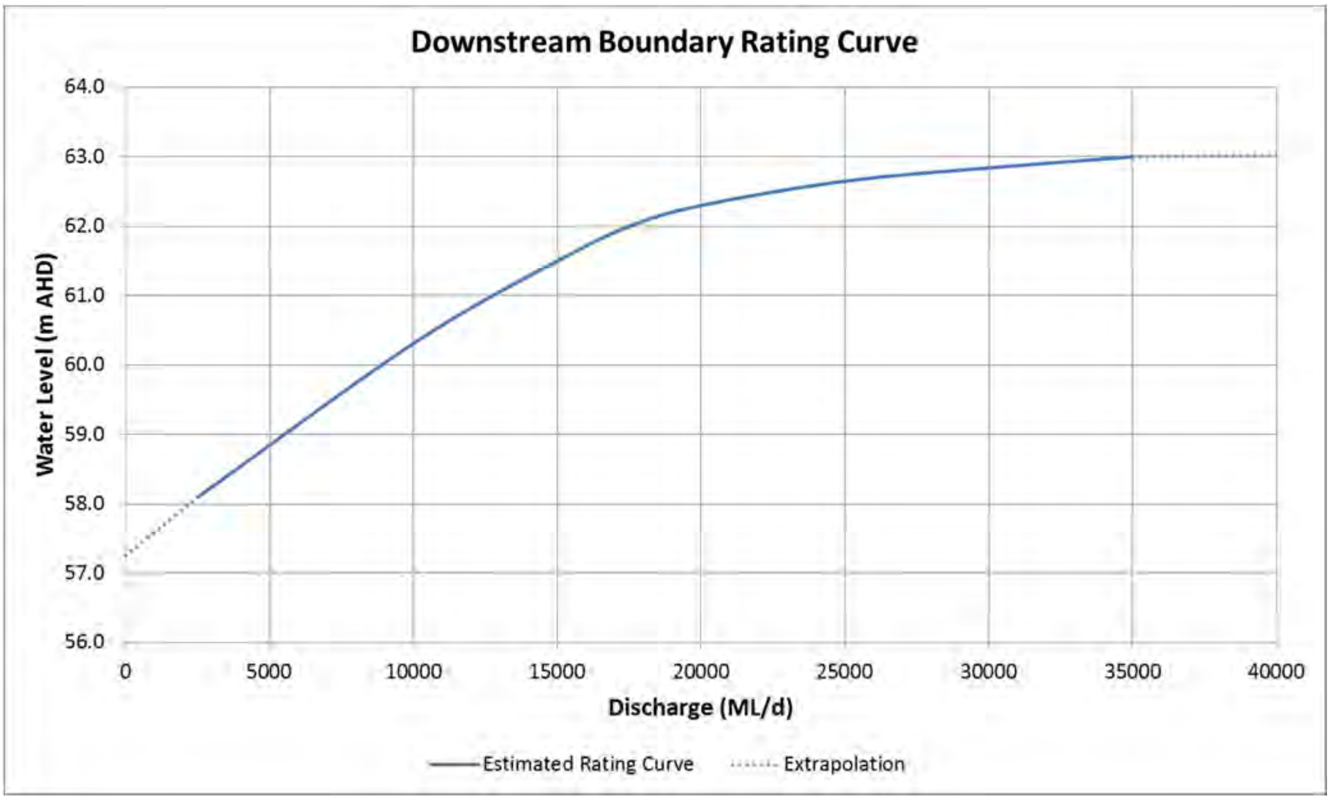


Figure 5 Nyah Vinifera Model Downstream Boundary Rating Curve

2.3 Modelling Scenarios

Modelling was undertaken of five distinct physical conditions as follows:

- Existing Conditions - floodplain modelled in its current state, including all existing (but not proposed) hydraulic structures of significance.
- Natural Conditions – existing conditions with significant existing man-made hydraulic features (eg culverts, levees) removed in order to model conditions prior to human intervention.
- Proposed Works Conditions – Existing conditions model with proposed SDL works, with all regulators/gates open.
- Water Retained by Proposed Works – simulation of the water retained by the proposed SDL works once the River Murray flow recedes to in-channel levels.
- Maximum Inundation Achieved by Proposed Works – Proposed works with the upstream culvert open and downstream regulator closed, allowing the floodplain to fill to the water level at the upstream culvert.

For the existing conditions model, all relevant existing hydraulic structures were included in the model, based on information obtained from site photos, aerial imagery and LIDAR. The schematic for this model is shown in Figure 6. At the time the existing conditions model flow scenarios were run, the two pipes at the upper and lower ends of the Parnee Malloo channel were estimated as 600mm diameter pipes. It was subsequently determined that these were closer to 1200 and 900mm diameter pipes at the upstream and downstream ends respectively. This underestimation of pipe size will have some impact on the lower flow scenarios run, but its effect will be drowned out at higher flow scenarios where the embankment is overtopped. This affects only the existing conditions model as all structures were removed for the natural conditions model and the structures were updated for the proposed works scenario.

The locations of modelled structures for the existing conditions model are shown in Figure 6, with photos shown in Figure 7 to Figure 10. To account for the significant amount of debris likely to obstruct the modelled culverts during flood events, relatively high roughnesses and head loss factors were applied (0.025 and 1) for both entry and exit. Culverts were input as MIKE11 structures and levees were stamped into the MIKE21 grid. Culvert inverts and weir sill levels were estimated based on site photos and LiDAR.

The natural conditions model was based on the existing conditions model (Figure 6), with all structures and major levees/roads removed. The aim was to best represent the landform as it was prior to any human intervention. While the model will approximate these conditions, there are a number of assumptions implicit in this, given no historical survey information was available for the project.

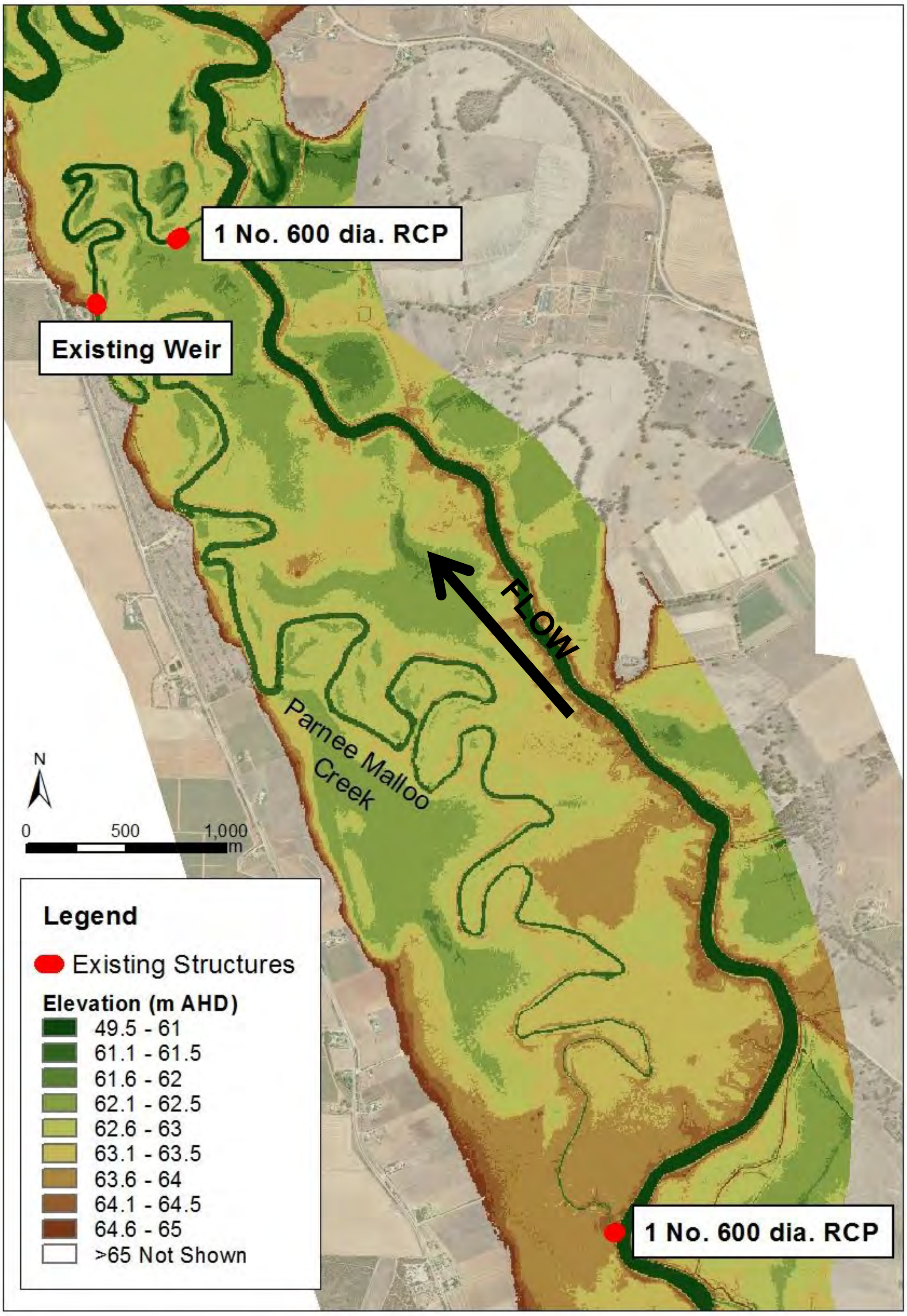


Figure 6 Nyah Forest (Figure 1) Modelled Area - Existing Conditions Model

Figure 7 Culvert at upstream entrance to Nyah Channel

Figure 8 Nyah channel weir

Figure 9 Culvert at Downstream End of Parnee Malloo Channel

Figure 10 Parnee Malloo Creek Downstream Confluence with River Murray

The proposed works model was based on design information provided by another Jacobs' project team working on the proposed works concept design. This information was current at the 26th of September, 2014. The layout and configuration of these works is shown in Table 1, Figure 11 and Figure 12. The design is based on the following:

- Regulators have been sized to minimise the impact on the existing flow regime when open, by maintaining current waterway areas;
- The levee is to have constant crest elevation of 63.5 m AHD, which is designed to retain a water level of 63.2 m AHD with 300mm freeboard;
- There are a number of strengthened overflow sills at an elevation of 63.3 m AHD, which are designed to pass larger floods before the entire levee is overtopped.

The proposed works run aims to examine the impact the works have on flood extents. All gates and regulators were open as would be the strategy during a major riverine flooding event.

Table 1 Nyah Proposed Regulators and Culverts

Structure	Type	No.	Size (mm)
N1a	Regulator	3	1800x1200
N1b	Regulator	3	1800x1200
N2	Regulator	2	1800x2700
		6	1800x2400
N5	Culvert / Gate	1	1200 dia.

The "Water Retained" models were schematised as follows:

- The steady state water level from the Proposed Works run was used as the initial conditions;
- Regulator and culvert gates were closed to prevent flow from entering or leaving the floodplain; and
- A nominal in-channel flow of 5,000 ML/d was run in the River Murray.

Given the same nominal flow was run in the River Murray, for the lower flows where water doesn't break out of the banks, the flood depth plots are identical (Appendix E).

The "Max Inundation" models were schematised to simulate the maximum possible inundation of the floodplain for each flow scenario. This meant opening the upstream gate and closing the downstream regulators. This scenario allowed the floodplain to fill to the level of Parnee Malloo Creek at the upstream gate or the crest of the downstream regulator, whichever was lower.

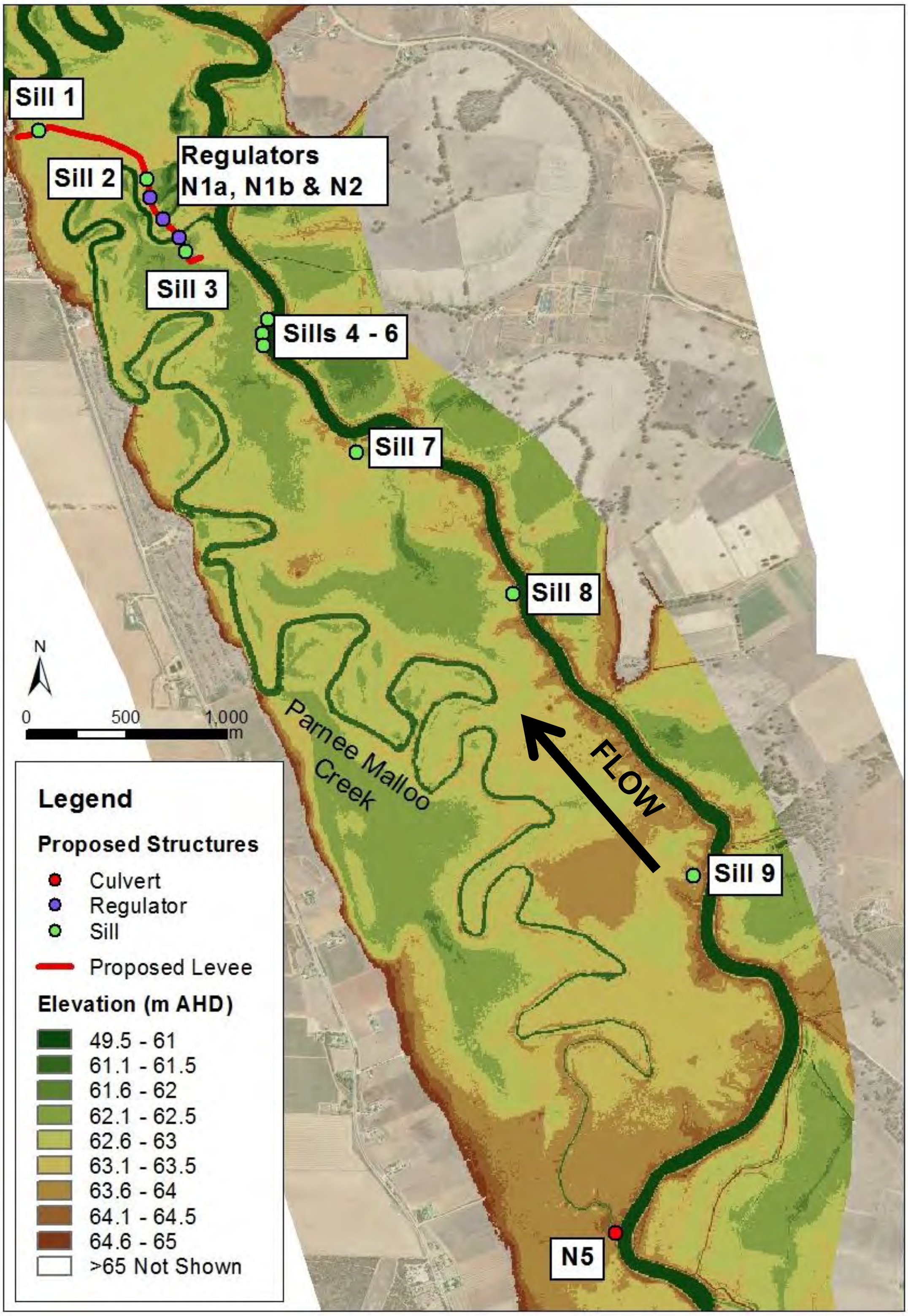


Figure 11 Nyah Forest Floodplain Proposed Structures and Levees

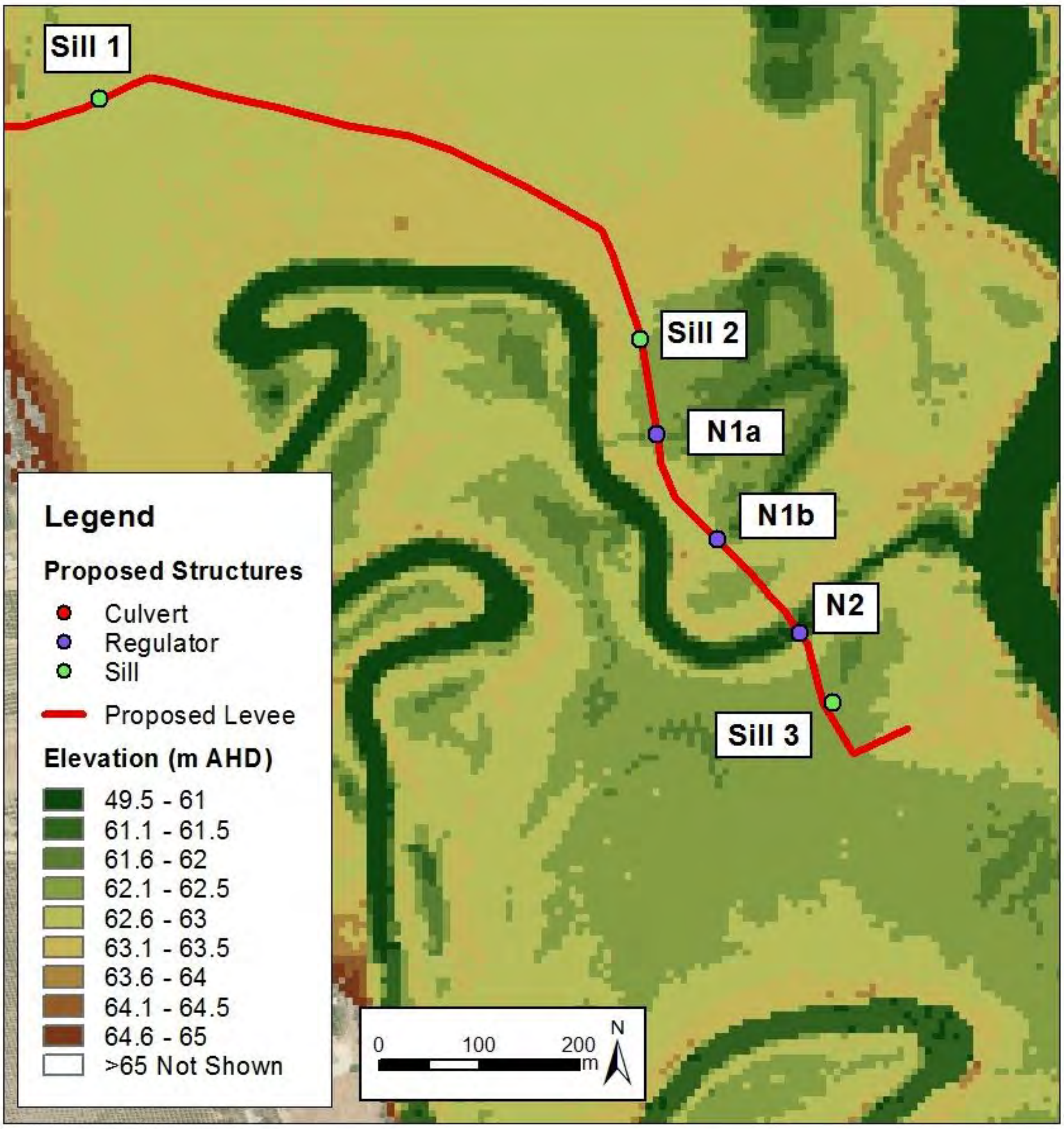


Figure 12 Nyah Forest Floodplain Proposed Structures and Levees – Northern Area Detail

2.4 Flow Scenarios

One of the key outcomes from this project was an understanding of the extent of peak inundation and retained water for a range of River Murray flow events. Some consideration was therefore given to the range and type of flow scenarios to be simulated. In conjunction with Mallee CMA, it was determined that a steady-state modelling approach would be a suitable means of simulating peak inundation events for this site. Steady-state modelling means that the upstream model boundary is configured with a constant inflow, representing a sustained flow rate in the River Murray. The model was then allowed to run for a sufficient time for water levels across the floodplain to reach equilibrium under these inflow conditions.

One of the key advantages of steady-state modelling is that it simplifies the consideration of which events to model, as there is no need to account for the variability of real or synthetic hydrographs. It also decreases the total amount of required modelling time, as reaching equilibrium conditions is generally achieved more quickly than the amount of time required to simulate a full River Murray flood (typically 1-2 months or more in duration). This then enabled the project's tight deadlines to be met.

The main disadvantage is that steady-state conditions do not account for the volume of water inherent in real flood events – the basic assumption is that volume is infinite. This is an important consideration in some situations, for example when water is flowing some distance down an effluent channel to a confined lake, however it's likely not to significantly impact results in cases where water simply spills from the river into a relatively narrow floodplain.

Given that the Nyah floodplain more resembles the latter case, steady-state modelling was adopted with confidence that it would provide a suitable level of accuracy.

Running the model to steady state conditions negates the need to consider the effect of the antecedent conditions of large off-stream storages such as the Poon Boon Lakes system on the NSW side of the Murray. However, it is noted that if the model is to be run in the future with real or design event hydrographs, this will require more detailed consideration.

Mallee CMA provided the steady state flows to be run as outlined in Table 2.

Table 2 Flow Scenarios Run

Flow (ML/day)
2,500
5,000
7,500
10,000
12,500
15,000
17,500
20,000
22,500
25,000
27,500
30,000
32,500
35,000

2.5 Calibration

There was minimal calibration information available to verify the hydraulic models. The only information provided by the Mallee CMA for the Nyah Forest floodplain was satellite imagery of flood events, RiMFIM and anecdotal evidence. CSIRO's RiMFIM (River Murray Floodplain Inundation Model) inundation models were developed in GIS using remote sensing and hydrological modelling. Floodplain inundation extents were detected from satellite imagery for a range of flows and interpolated to model flood growth patterns (Overton, 2006)

2.5.1 Satellite Imagery Calibration

Of the satellite imagery provided by the Mallee CMA for model calibration, imagery from the dates listed in Table 3 was utilised. Additional imagery was provided but was discounted due to poorly defined flood extents or duplication of similar sized events. Plots showing the satellite imagery compared with modelled flood extents are shown in Appendix C.

Table 3 Satellite Imagery Dates and Flows

Date	Swan Hill (Gauge 409204) Flow (ML/d)
9/2/11	28,350
2/6/11	14,620

For the June 2011 event (14,620 ML/d), the satellite image appears to show water in Parnee Malloo Creek. However, the imagery is not clear enough to be able to adequately define the extent of the inundated area. For the larger February 2011 event (28,350 ML/d) it appears that the majority of the Nyah Forest floodplain is inundated, which is suggested by the hydraulic model. It is noted however that it is fairly difficult to define the true extent of the flood from the satellite imagery. Consequently this method of calibration is approximate only.

On the NSW side of the Murray, the hydraulic model appears to over-predict flood extents when compared to the satellite imagery. This is may be explained by the fact that this region of the model is not as detailed as Nyah Forest (the area of interest) and structures/levees were not specifically input to the model due to the time constraints of the project. The assessment was made that there isn't significant overbank conveyance parallel to the direction of the floodplain on the NSW side of the River Murray.

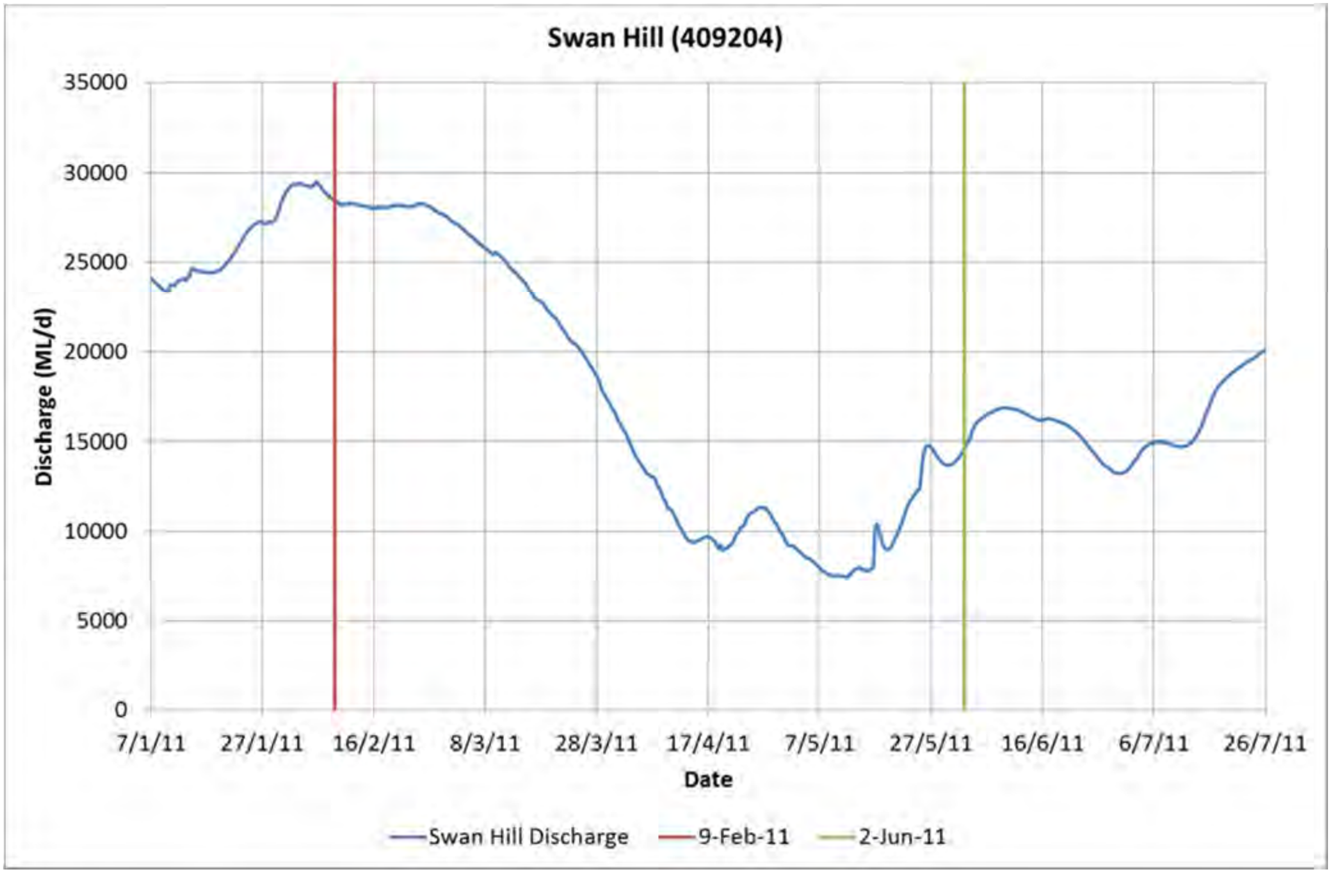


Figure 13 Satellite Imagery Calibration Events - Swan Hill Gauge

2.5.2 RiMFIM Calibration

Analysis of the RiMFIM modelled flood extents indicates that the approach is reasonably coarse and is primarily useful for larger flood events, particularly where there is significant connectivity between the River Murray and the floodplain. In the case of Nyah Forest, RiMFIM appears to significantly under-predict flood extents when compared with satellite imagery and modelled extents, particularly for the range of events modelled for this project. The same two events compared with satellite imagery above are compared with RiMFIM predictions in Appendix C.

It appears that the primary reason for this under-prediction is the representation of tipping points into the Nyah Forest in the RiMFIM method. For example, anecdotal (Malcolm Thompson, MCMA 2014, pers comm) and modelled evidence suggests that water enters the Parnee Malloo Creek from the River Murray at a Murray flow of around 15,000 ML/d, whereas RiMFIM suggests over 35,000 ML/d.

Given the above analysis, RiMFIM is not considered useful for calibration of this model.

2.6 Analysis

Flood depth plots from the hydraulic model can be found in Appendix A to Appendix F for each of the discharges modelled. For the Existing Conditions model, water from the River Murray breaks into Parnee Malloo Creek at a flow of approximately 12,500 ML/d. For flows of 25,000 ML/d and above large areas of the floodplain are inundated, suggesting that positive outcomes may be achieved by the proposed regulators.

Peak water levels at several locations shown in Figure 14 were extracted for each flow scenario and are presented in Table 4 to Table 8. These locations were selected to give reasonable coverage of the River Murray and the Nyah Forest floodplain. Tables showing afflux between the following scenarios are included:

- Existing Conditions relative to Natural Conditions (Table 9);
- Proposed Works relative to Existing Conditions (Table 10); and
- Maximum Inundation relative to Existing Conditions (Table 11).

Generally the difference in water levels between the natural and existing condition models is negligible for both the River Murray and Nyah Forest floodplain. This would suggest that the existing structures on Parnee Malloo Creek are not significantly impeding flow for the steady state events. This may partially be due to the relatively flat topography, allowing the floodplain to fill once a flow enters an area. However it is reemphasised that the size of these structures in the model is slightly incorrect, and this may be affecting the results.

It is noted that the most significant afflux between the natural and existing models occurs for the 20,000 ML/d event, where water is just beginning to flood areas on the Nyah Forest floodplain. This is to be expected, as for lower flows, small structures such as those present in the Parnee Malloo channel will have a greater effect before they are drowned out by bigger flood events.

The Maximum Inundation runs (Table 11 and Appendix F) show that inundation of the floodplain can be modestly increased with lower flows than for the existing conditions. The design inundation level (63.20 m AHD) is achieved at the downstream regulator for 20,000 ML/d as compared with 22,500 ML/d for the natural conditions model. The regulators do not have a more significant impact in this scenario due to the relatively flat topography.

It is important to note that for the Maximum Inundation runs, it could take a significant amount of time for the floodplain to fill, particularly for lower flows where only a small amount of flow is entering Parnee Malloo Creek from the River Murray. For the 20,000 ML/d run, it took approximately three weeks of “real time” for the floodplain to fill. Operation of the regulators will require further consideration of this given that “real” (rather than steady state) River Murray flows may significantly affect inundation of the floodplain.

The aim of the Proposed Works run was to ensure that the works would not have a significantly adverse impact on flooding during large events when the regulators would be left open. Comparing the levels to the existing conditions (Table 10) suggests the proposed works (while open) will modestly increase flood levels on the Nyah Forest floodplain for mid-range flows, but will be drowned out for higher flows. No significant adverse effects have been identified.

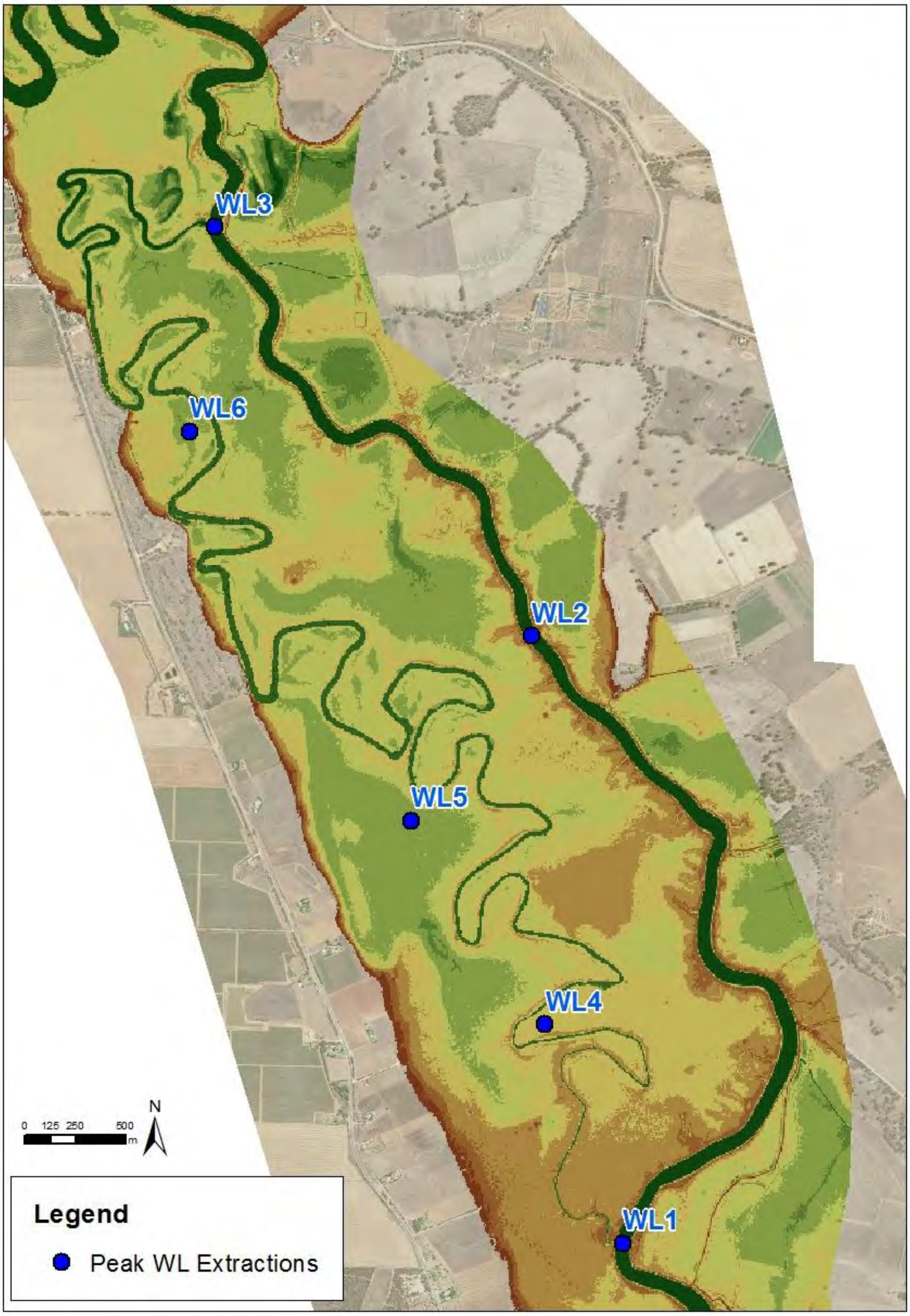


Figure 14 Nyah extracted water level locations

Table 4 Extracted Peak Water Levels - Natural Conditions

Flow (ML/day)	WL1 (m AHD)	WL2 (m AHD)	WL3 (m AHD)	WL4 (m AHD)	WL5 (m AHD)	WL6 (m AHD)
2,500	59.60	59.10	58.62			
5,000	60.57	60.09	59.53			
7,500	61.29	60.80	60.22			
10,000	61.96	61.46	60.90			
12,500	62.55	62.04	61.48			
15,000	63.11	62.59	62.06			
17,500	63.62	63.09	62.57			
20,000	63.97	63.44	62.89	63.35	63.05	62.95
22,500	64.16	63.65	63.14	63.59	63.39	63.25
25,000	64.27	63.79	63.30	63.69	63.58	63.43
27,500	64.33	63.87	63.39	63.79	63.70	63.54
30,000	64.38	63.92	63.47	63.89	63.80	63.63
32,500	64.42	63.98	63.56	64.00	63.92	63.72
35,000	64.46	64.03	63.64	64.11	64.02	63.81

Table 5 Extracted Peak Water Levels - Existing Conditions

Flow (ML/day)	WL1 (m AHD)	WL2 (m AHD)	WL3 (m AHD)	WL4 (m AHD)	WL5 (m AHD)	WL6 (m AHD)
2,500	59.60	59.10	58.61			
5,000	60.57	60.09	59.53			
7,500	61.28	60.79	60.22			
10,000	61.95	61.45	60.90			
12,500	62.56	62.04	61.48			
15,000	63.11	62.59	62.05			
17,500	63.62	63.09	62.55		62.79	62.80
20,000	64.00	63.46	62.91	63.30	63.13	63.09
22,500	64.15	63.64	63.12	63.55	63.37	63.25
25,000	64.26	63.77	63.27	63.67	63.55	63.42
27,500	64.33	63.86	63.37	63.78	63.70	63.55
30,000	64.37	63.91	63.45	63.89	63.81	63.64
32,500	64.42	63.97	63.54	64.00	63.92	63.73
35,000	64.45	64.02	63.62	64.11	64.03	63.81

Table 6 Extracted Peak Water Levels - Proposed Works

Flow (ML/day)	WL1 (m AHD)	WL2 (m AHD)	WL3 (m AHD)	WL4 (m AHD)	WL5 (m AHD)	WL6 (m AHD)
2,500	59.60	59.10	58.61			
5,000	60.57	60.09	59.53			
7,500	61.28	60.79	60.22			
10,000	61.95	61.45	60.90			
12,500	62.56	62.04	61.48			
15,000	63.12	62.60	62.06		62.93	62.94
17,500	63.63	63.10	62.56		63.01	63.00
20,000	64.02	63.48	62.95	63.31	63.16	63.14
22,500	64.15	63.65	63.13	63.56	63.40	63.29
25,000	64.27	63.79	63.31	63.69	63.60	63.48
27,500	64.34	63.88	63.41	63.81	63.74	63.61
30,000	64.38	63.94	63.49	63.92	63.86	63.70
32,500	64.42	63.99	63.58	64.04	63.97	63.78
35,000	64.46	64.04	63.66	64.13	64.06	63.85

Table 7 Extracted Peak Water Levels - Water Retained

Flow (ML/day)	WL1 (m AHD)	WL2 (m AHD)	WL3 (m AHD)	WL4 (m AHD)	WL5 (m AHD)	WL6 (m AHD)
2,500	60.57	60.09	59.53			
5,000	60.57	60.09	59.53			
7,500	60.57	60.09	59.53			
10,000	60.57	60.09	59.53			
12,500	60.57	60.09	59.53			
15,000	60.57	60.09	59.53		62.89	62.86
17,500	60.57	60.09	59.53		62.88	62.86
20,000	60.57	60.09	59.53		62.95	62.91
22,500	60.57	60.09	59.53	63.31	63.31	63.31
25,000	60.57	60.09	59.53	63.31	63.31	63.31
27,500	60.57	60.09	59.53	63.31	63.31	63.31
30,000	60.57	60.09	59.53	63.31	63.31	63.31
32,500	60.57	60.09	59.53	63.31	63.31	63.31
35,000	60.57	60.09	59.53	63.31	63.31	63.31

Table 8 Extracted Peak Water Levels – Maximum Inundation

Flow (ML/day)	WL1 (m AHD)	WL2 (m AHD)	WL3 (m AHD)	WL4 (m AHD)	WL5 (m AHD)	WL6 (m AHD)
2,500	59.60	59.10	58.61			
5,000	60.57	60.09	59.53			
7,500	61.28	60.79	60.22			
10,000	61.95	61.45	60.90			
12,500	62.57	62.05	61.49			
15,000	63.11	62.59	62.05		62.95	62.94
17,500	63.59	63.05	62.51		63.11	63.11
20,000	63.95	63.41	62.88	63.38	63.33	63.33
22,500	64.15	63.63	63.11	63.58	63.47	63.41
25,000	64.27	63.79	63.29	63.70	63.62	63.53
27,500	64.34	63.88	63.40	63.82	63.75	63.63
30,000	64.38	63.94	63.48	63.93	63.86	63.71
32,500	64.42	63.99	63.57	64.04	63.97	63.79
35,000	64.46	64.04	63.65	64.14	64.06	63.85

Table 9 Afflux due to Existing Conditions (relative to Natural Conditions)

Flow (ML/day)	WL1 (m)	WL2 (m)	WL3 (m)	WL4 (m)	WL5 (m)	WL6 (m)
2,500	0.00	0.00	0.00			
5,000	0.00	0.00	0.00			
7,500	0.00	0.00	0.00			
10,000	-0.01	-0.01	0.00			
12,500	0.01	0.01	0.01			
15,000	0.01	0.00	0.00			
17,500	0.01	0.00	-0.02		0	0
20,000	0.03	0.03	0.02	-0.05	0.07	0.14
22,500	-0.01	-0.02	-0.02	-0.03	-0.03	0.00
25,000	-0.01	-0.02	-0.03	-0.03	-0.03	-0.02
27,500	0.00	-0.01	-0.02	-0.02	0.00	0.00
30,000	0.00	-0.01	-0.02	0.00	0.01	0.01
32,500	0.00	-0.01	-0.02	0.00	0.01	0.01
35,000	0.00	-0.01	-0.02	0.00	0.01	0.00

Table 10 Afflux due to Proposed Works (relative to Existing Conditions)

Flow (ML/day)	WL1 (m)	WL2 (m)	WL3 (m)	WL4 (m)	WL5 (m)	WL6 (m)
2,500	0.00	0.00	0.00			
5,000	0.00	0.00	0.00			
7,500	0.00	0.00	0.00			
10,000	0.00	0.00	0.00			
12,500	0.00	0.00	0.00			
15,000	0.01	0.01	0.01			
17,500	0.00	0.01	0.02		0.22	0.20
20,000	0.02	0.02	0.04	0.01	0.03	0.05
22,500	0.00	0.01	0.01	0.01	0.03	0.04
25,000	0.01	0.03	0.04	0.02	0.05	0.06
27,500	0.01	0.02	0.04	0.03	0.04	0.06
30,000	0.01	0.02	0.04	0.04	0.04	0.06
32,500	0.01	0.02	0.04	0.04	0.04	0.06
35,000	0.00	0.02	0.03	0.03	0.03	0.04

Table 11 Afflux for Maximum Inundation Run (relative to Existing Conditions)

Flow (ML/day)	WL1 (m)	WL2 (m)	WL3 (m)	WL4 (m)	WL5 (m)	WL6 (m)
2,500	0.00	0.00	0.00			
5,000	0.00	0.00	0.00			
7,500	0.00	0.00	0.00			
10,000	0.00	0.00	0.00			
12,500	0.00	0.00	0.01			
15,000	0.00	0.00	0.00			
17,500	-0.04	-0.03	-0.04		0.32	0.31
20,000	-0.05	-0.05	-0.03	0.07	0.21	0.24
22,500	0.00	0.00	-0.01	0.03	0.10	0.16
25,000	0.01	0.02	0.03	0.03	0.07	0.11
27,500	0.01	0.02	0.02	0.04	0.06	0.08
30,000	0.01	0.02	0.03	0.04	0.05	0.07
32,500	0.01	0.02	0.03	0.04	0.05	0.06
35,000	0.00	0.02	0.02	0.03	0.03	0.04

2.7 MDBA Tables

Statistics were generated from the modelling for input into the MDBA's BIGMOD water resource model for both the Proposed Works and Water Retained model runs (Table 12 and Table 13). Figure 15 contains a schematic of the BIGMOD model for the Nyah Forest floodplain, for which the following information was extracted:

- Steady state flow into/out of the floodplain;
- Water surface elevation on the upstream side of the downstream regulator;
- Inundation area; and
- Inundation volume.

These statistics were calculated for the area of the floodplain shown in Figure 16, which represents the Nyah Forest floodplain.

Table 12 MDBA BIGMOD Model Statistics – Proposed Works Scenario

Murray Flow (ML/d)	Steady State Floodplain Flow (ML/d)	Water Level US of Downstream Regulator (m AHD)	Surface Area (ha)	Volume (ML)
2500	-	-	-	-
5000	-	-	-	-
7500	-	-	-	-
10000	-	-	-	-
12500	1	61.5	3	36
15000	163	62.4	203	852
17500	191	62.7	345	1700
20000	294	62.9	422	2090
22500	1445	63.3	616	3940
25000	2450	63.4	674	5110
27500	3456	63.5	701	5990
30000	5387	63.6	713	6700
32500	6507	63.7	720	7420
35000	8885	63.7	724	8000

Table 13 MDBA BIGMOD Model Statistics – Retained Water Scenario

Murray Flow (ML/d)	Water Level US of DS Regulator (m AHD)	Surface Area (ha)	Volume (ML)
2500	-	-	-
5000	-	-	-
7500	-	-	-
10000	-	-	-
12500	61.4	3	34
15000	62.5	203	858
17500	62.7	313	1350
20000	62.9	385	1710
22500	63.3	558	3390
25000	63.3	572	3410
27500	63.3	581	3420
30000	63.3	581	3420
32500	63.3	582	3410
35000	63.3	582	3410

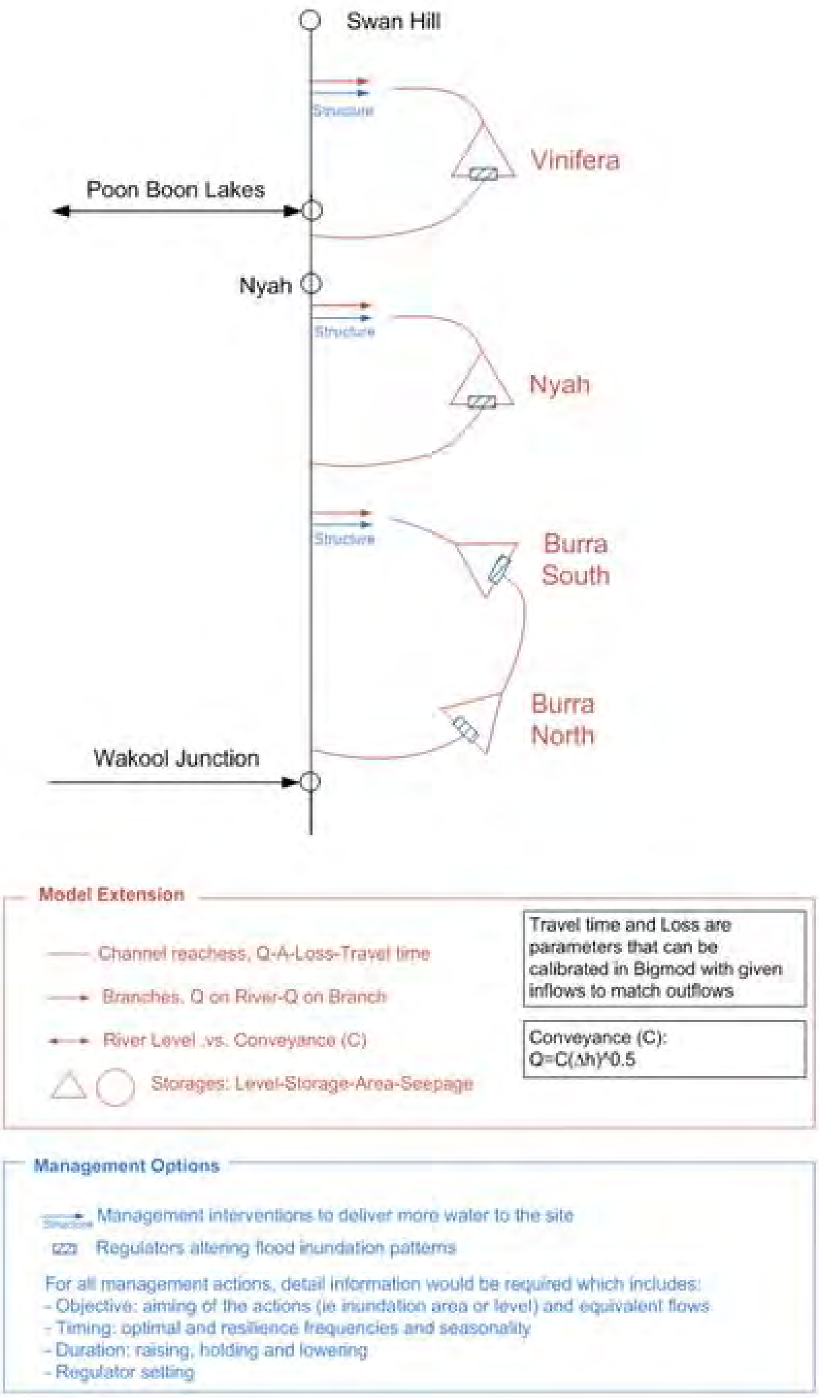


Figure 15 BIGMOD Model Schematic

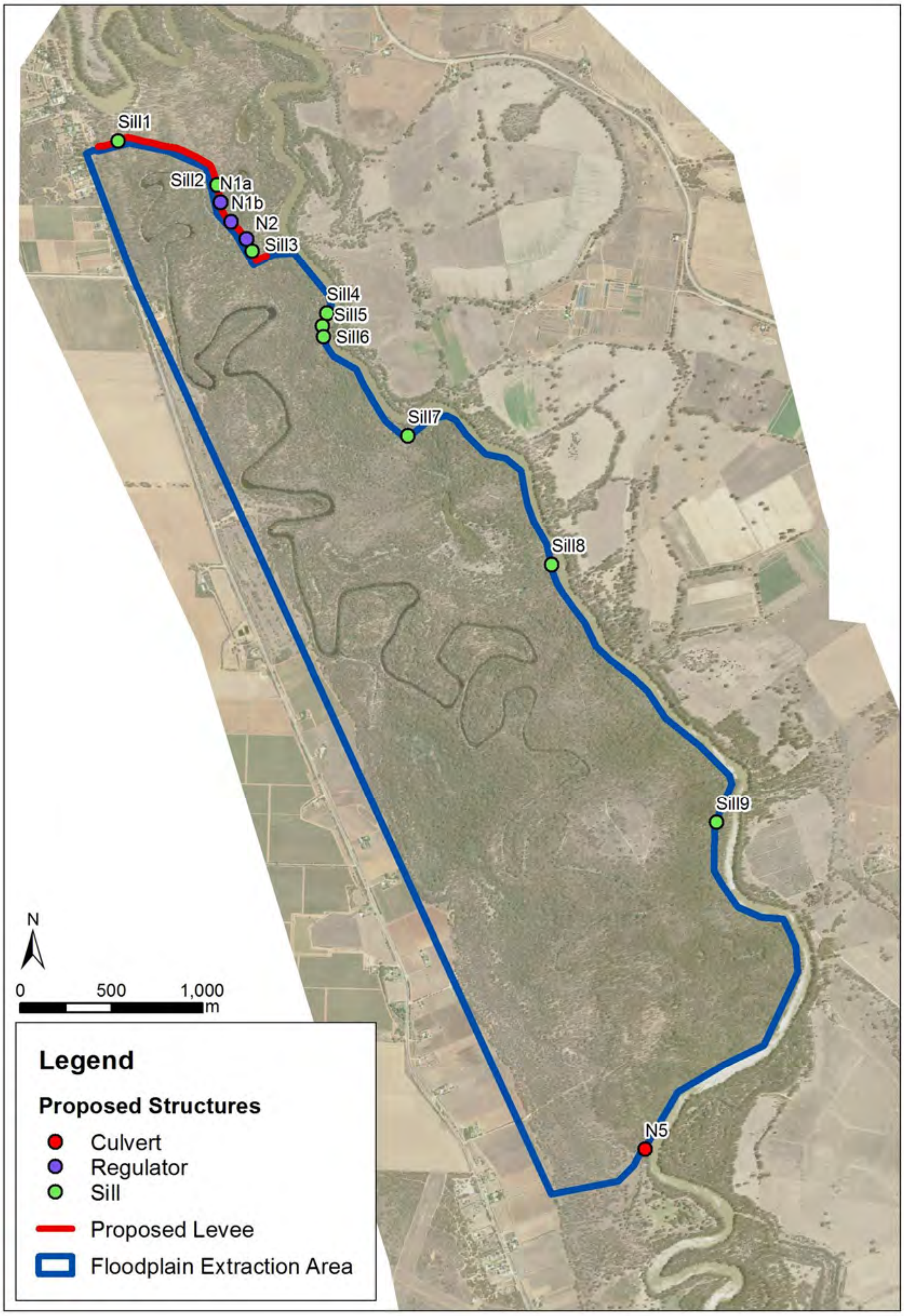


Figure 16 Nyah Forest Floodplain Extraction Area

2.8 Conclusions and Recommendations

The model development and calibration stages of this project have revealed a number of valuable and important conclusions, including:

- The LiDAR data adopted for this project is fit for purpose, however the accuracy of the modelling and reliability of the conclusions could be enhanced through collection of additional survey data. This includes cross-sections of the River Murray, field survey of critical levels in and around the floodplain and survey of key existing structures.
- The overall modelling approach is sufficiently detailed to simulate the key hydraulic processes in the channels and floodplains of the study area, including exchanges of flows between the River Murray, Parnee Malloo Creek and movement of flow on the floodplain. In particular, the model grid size adopted and location and spacing of one-dimensional cross-sections has allowed the critical features to be modelled as accurately as the available data allows.
- Available calibration data is limited, with the most reliable information is anecdotal evidence on River Murray flows at which breakouts occur into the floodplain. The model results are consistent with this information.
- Adoption of a series of steady-state flow scenarios for design modelling has produced a useful database of results that can be used to determine a range of critical hydraulic features of the study area and also to provide information on how water moves through the study area under a range of physical conditions.

The modelling results have also revealed some key hydraulic features of the floodplain. For the Existing Conditions model:

- Water from the River Murray enters Parnee Malloo Creek at a River Murray peak flow rate of approximately 12,500 ML/d.
- Water from the River Murray spills onto the Nyah floodplain at a River Murray peak flow rate of approximately 25,000 ML/d.
- The majority of the floodplain is inundated at a Murray River flow rate of approximately 30,000 ML/d.

Modelling of the proposed regulators and levee banks has also revealed that:

- During high flow events the restriction created by the proposed works increases flood levels on the Nyah Forest floodplain, inundating a larger extent than under existing conditions.
- For the Maximum Inundation runs, the target inundation level is achieved under a River Murray flow of 20,000 ML/d. This level of flooding is equivalent to 22,500 ML/d flow in the River Murray for the Natural Conditions model.

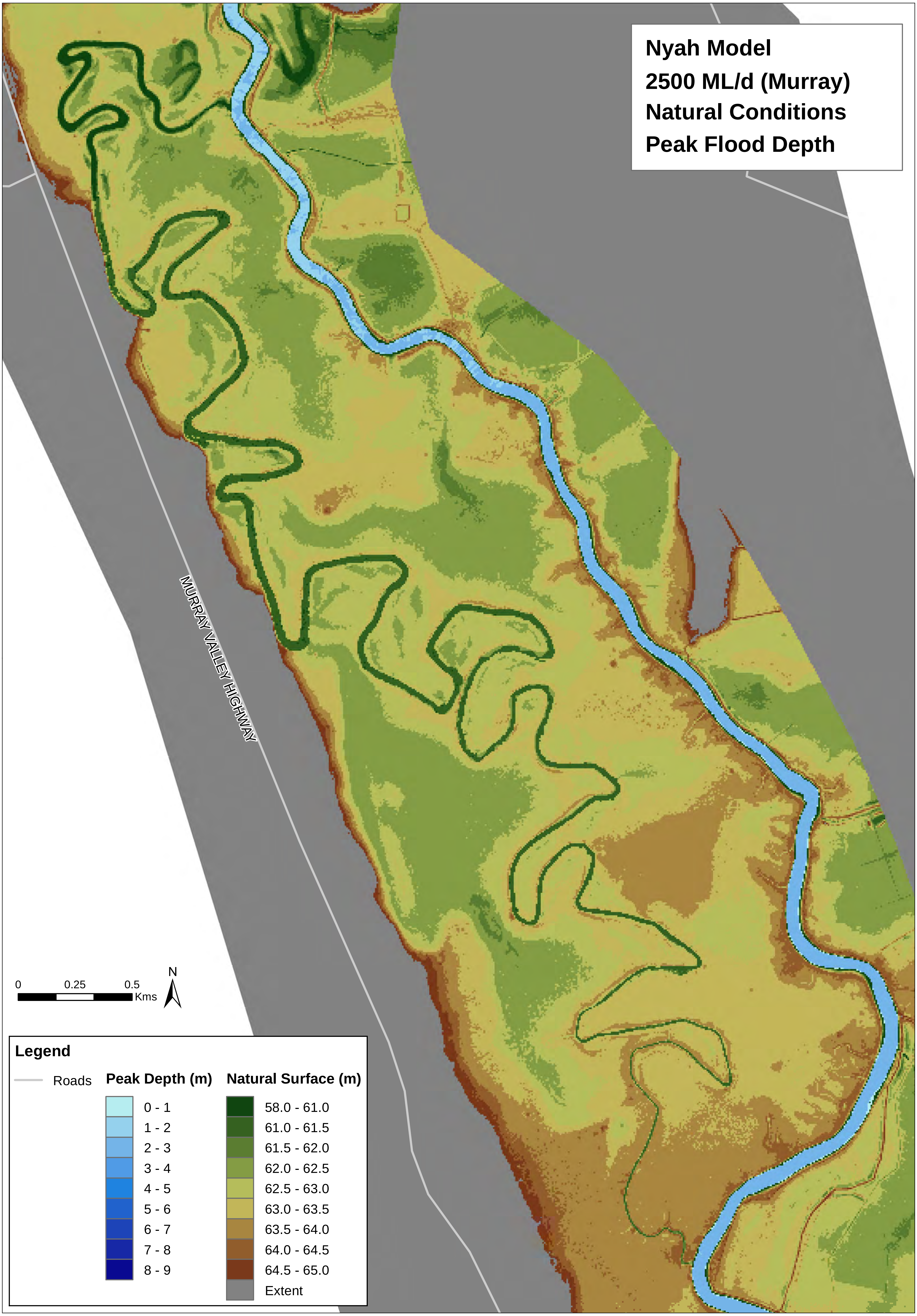
In addition, the modelling results have been used to derive a number of flow and volume relationships which can be used within a water resources model to better understand the benefits associated with long-term operation of these structures.

3. References

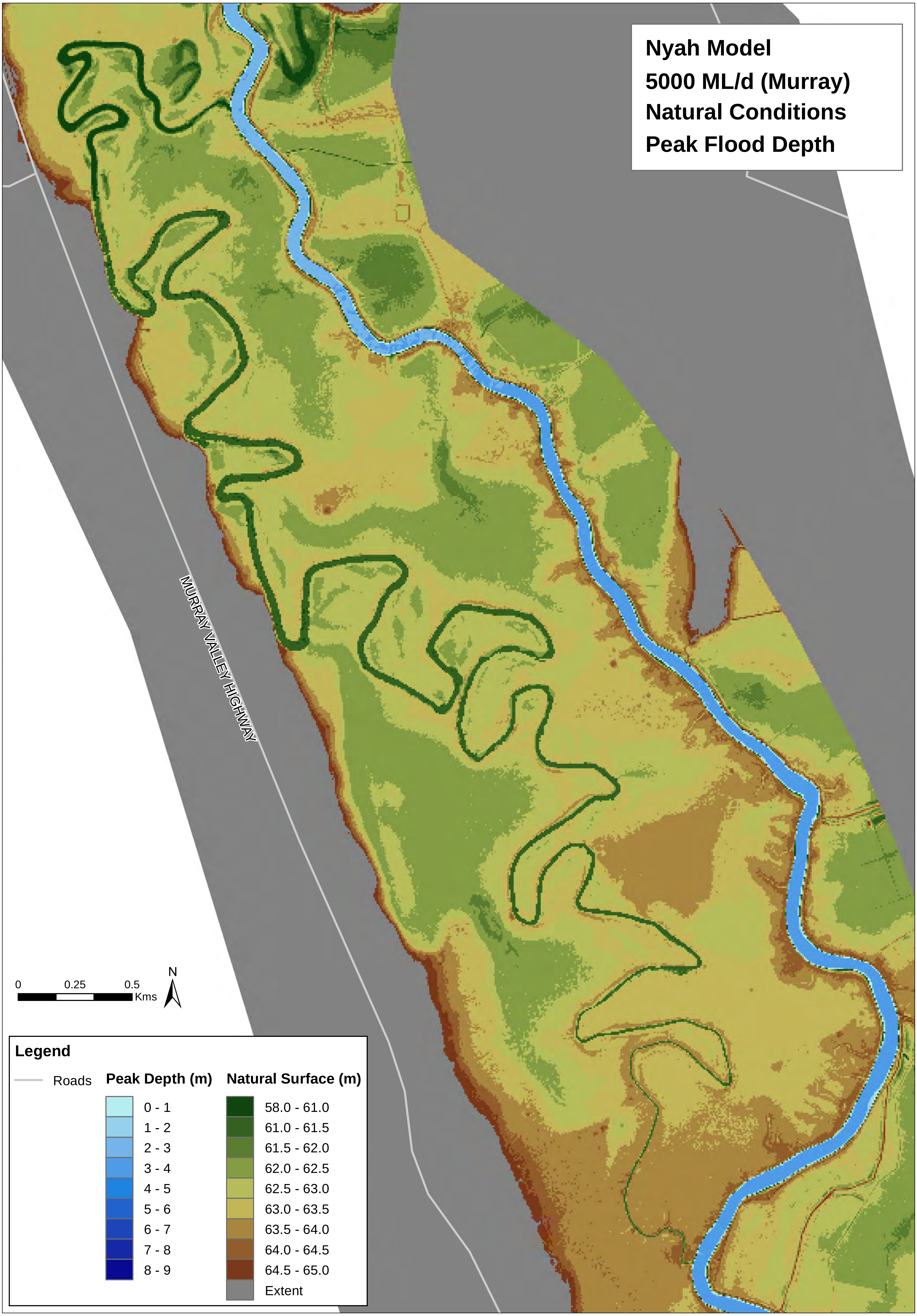
Alluvium (2013), *Nyah Park Water Management Options Project*. Report produced May 2013 for Mallee CMA.

Overton (2006), *The River Murray Floodplain Inundation Model (RiM-FIM),* Report produced 2006 for CSIRO.

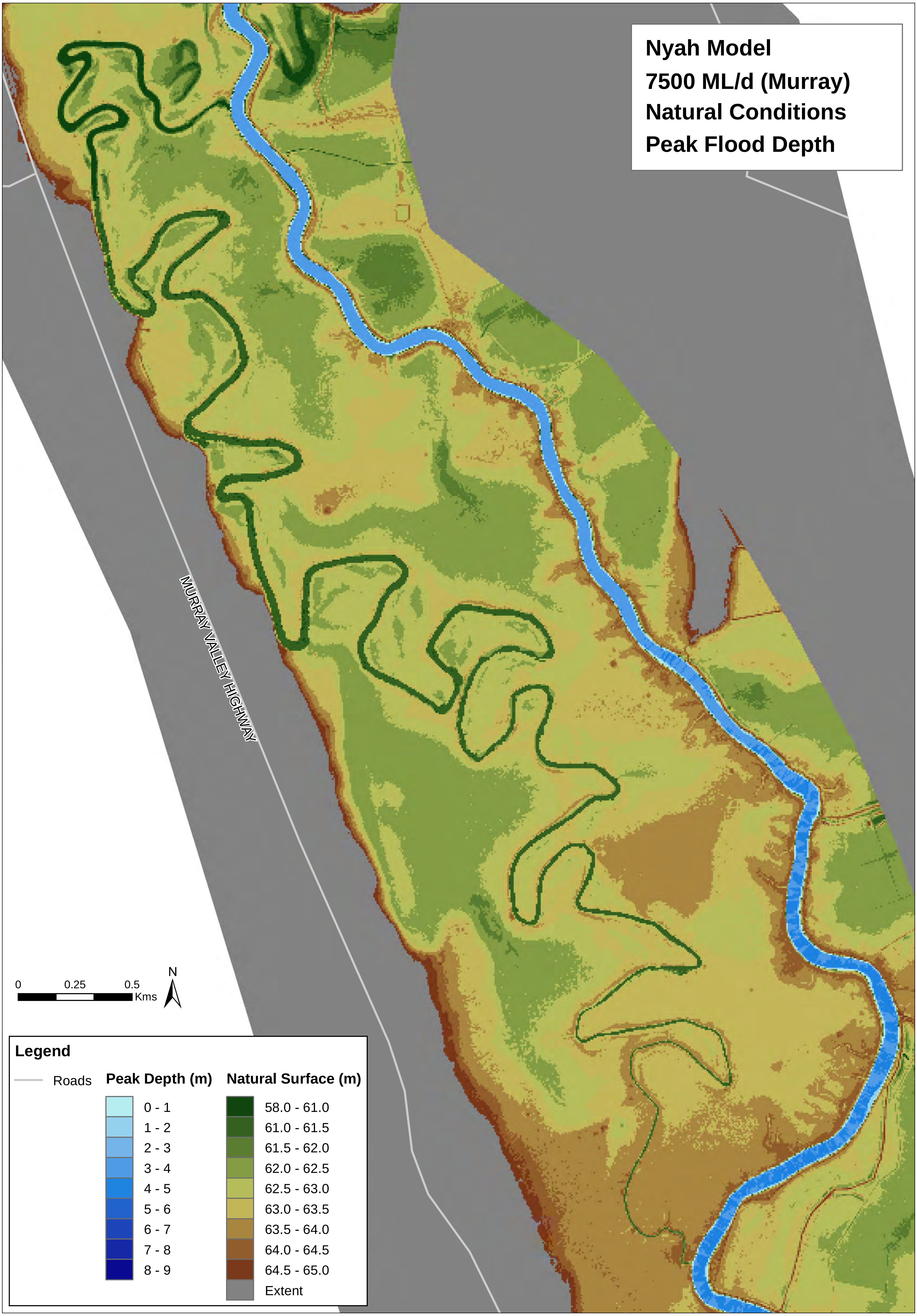
Appendix A. Natural Conditions Peak Depth Plots

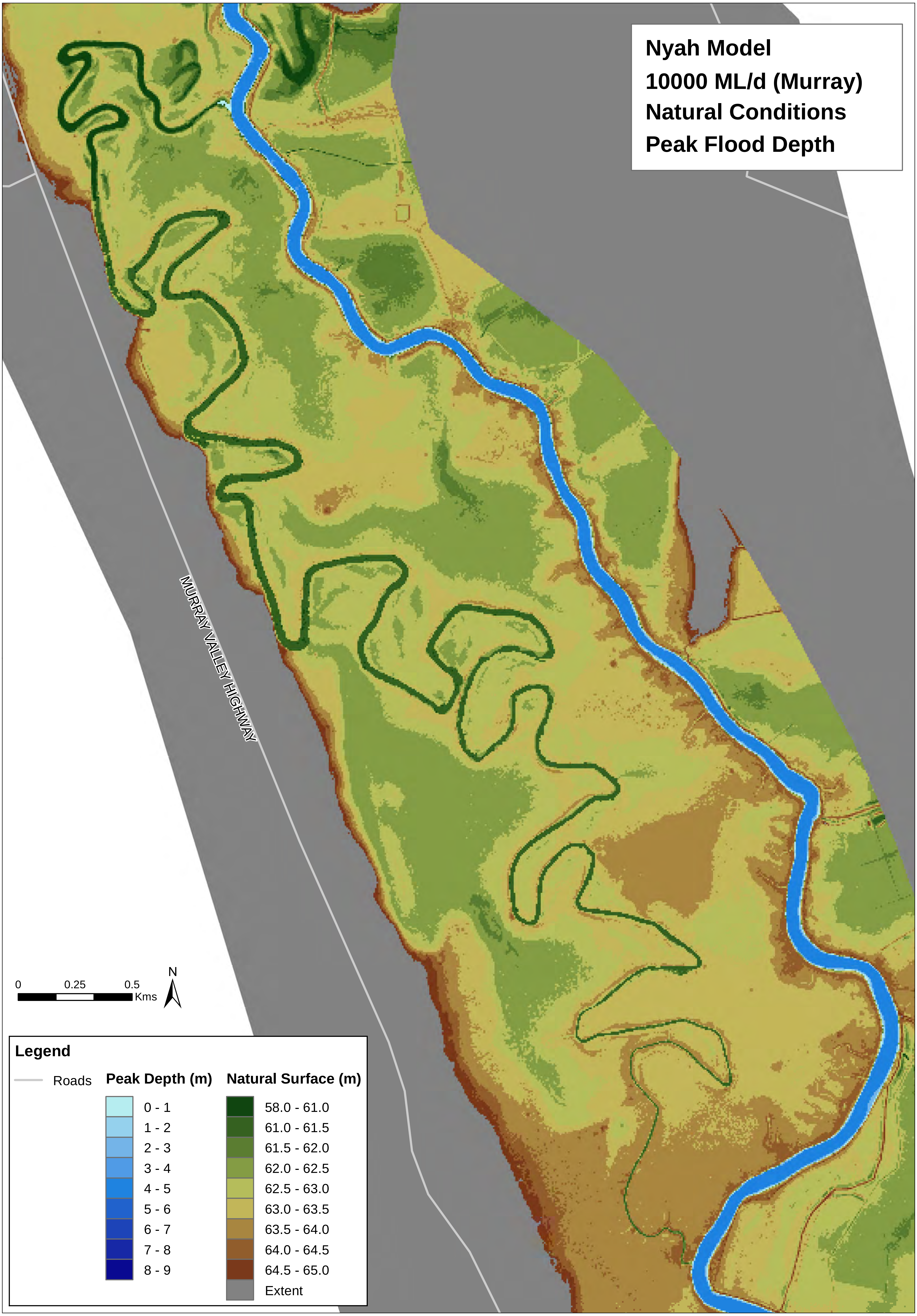


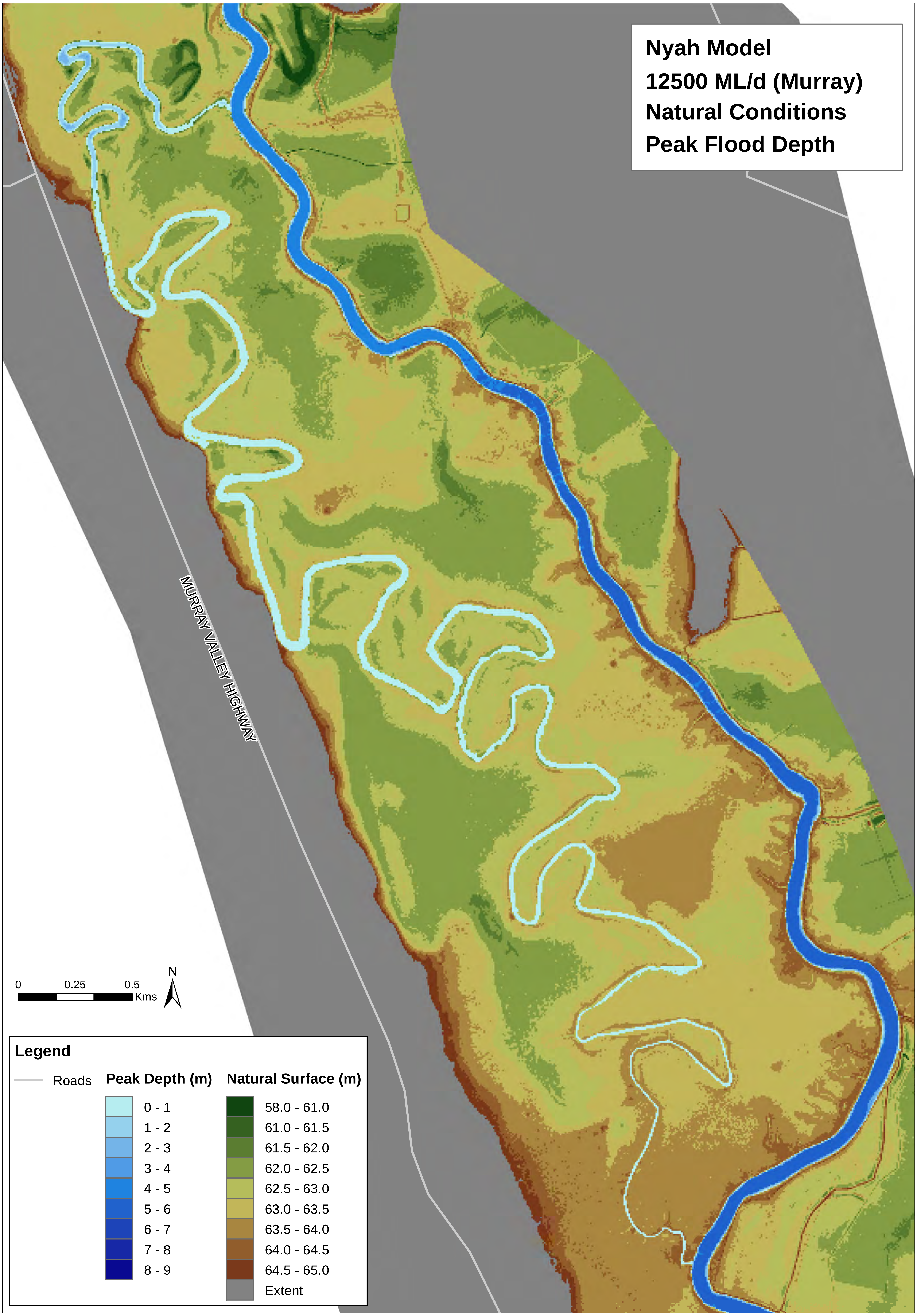
Nyah Model
2500 ML/d (Murray)
Natural Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
Natural Surface (m)
58.0 - 61.0
61.0 - 61.5
61.5 - 62.0
62.0 - 62.5
62.5 - 63.0
63.0 - 63.5
63.5 - 64.0
64.0 - 64.5
64.5 - 65.0
Extent



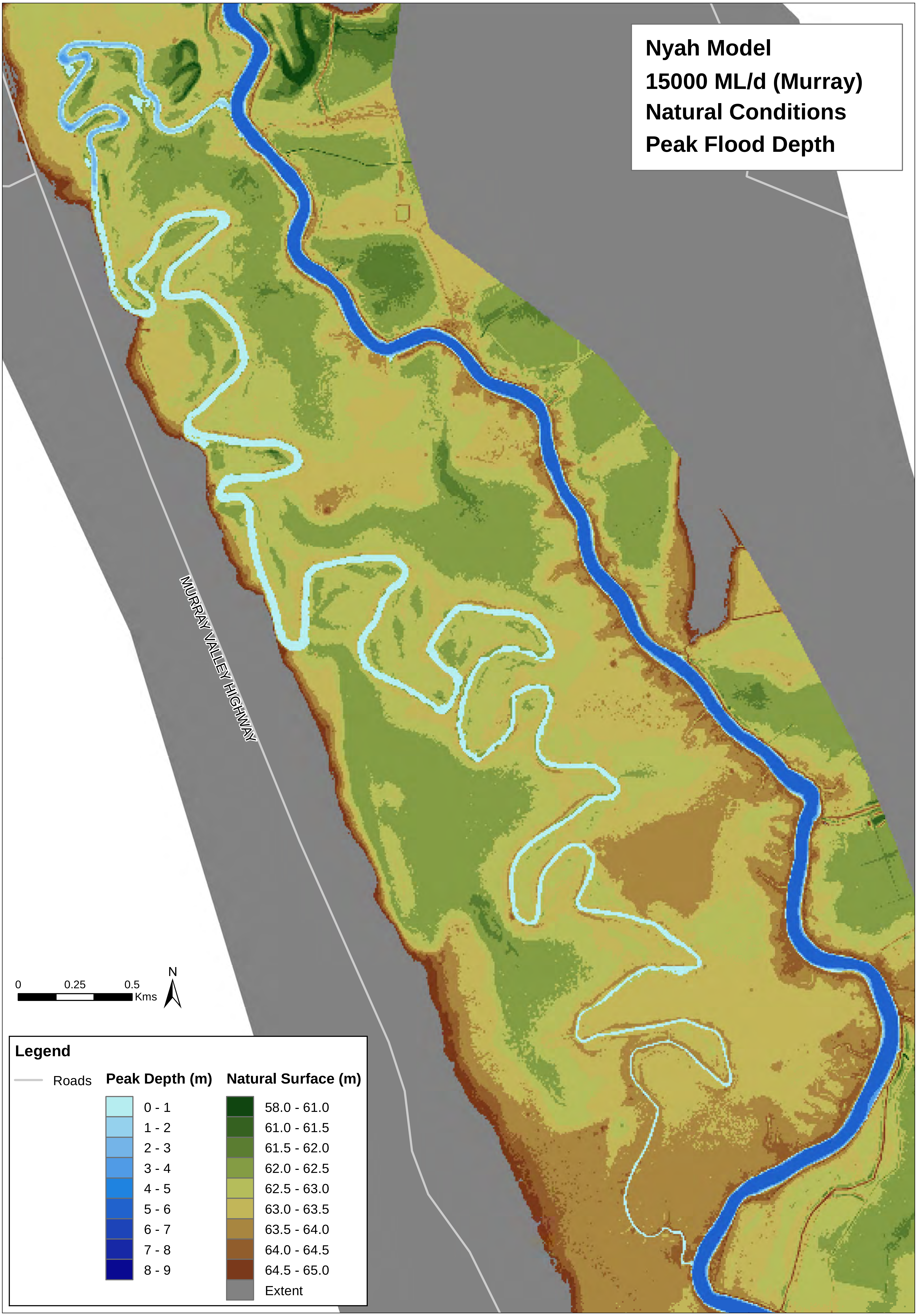
Nyah Model
5000 ML/d (Murray)
Natural Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
Natural Surface (m)
58.0 - 61.0
61.0 - 61.5
61.5 - 62.0
62.0 - 62.5
62.5 - 63.0
63.0 - 63.5
63.5 - 64.0
64.0 - 64.5
64.5 - 65.0
Extent


Nyah Model
7500 ML/d (Murray)
Natural Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
Natural Surface (m)
58.0 - 61.0
61.0 - 61.5
61.5 - 62.0
62.0 - 62.5
62.5 - 63.0
63.0 - 63.5
63.5 - 64.0
64.0 - 64.5
64.5 - 65.0
Extent

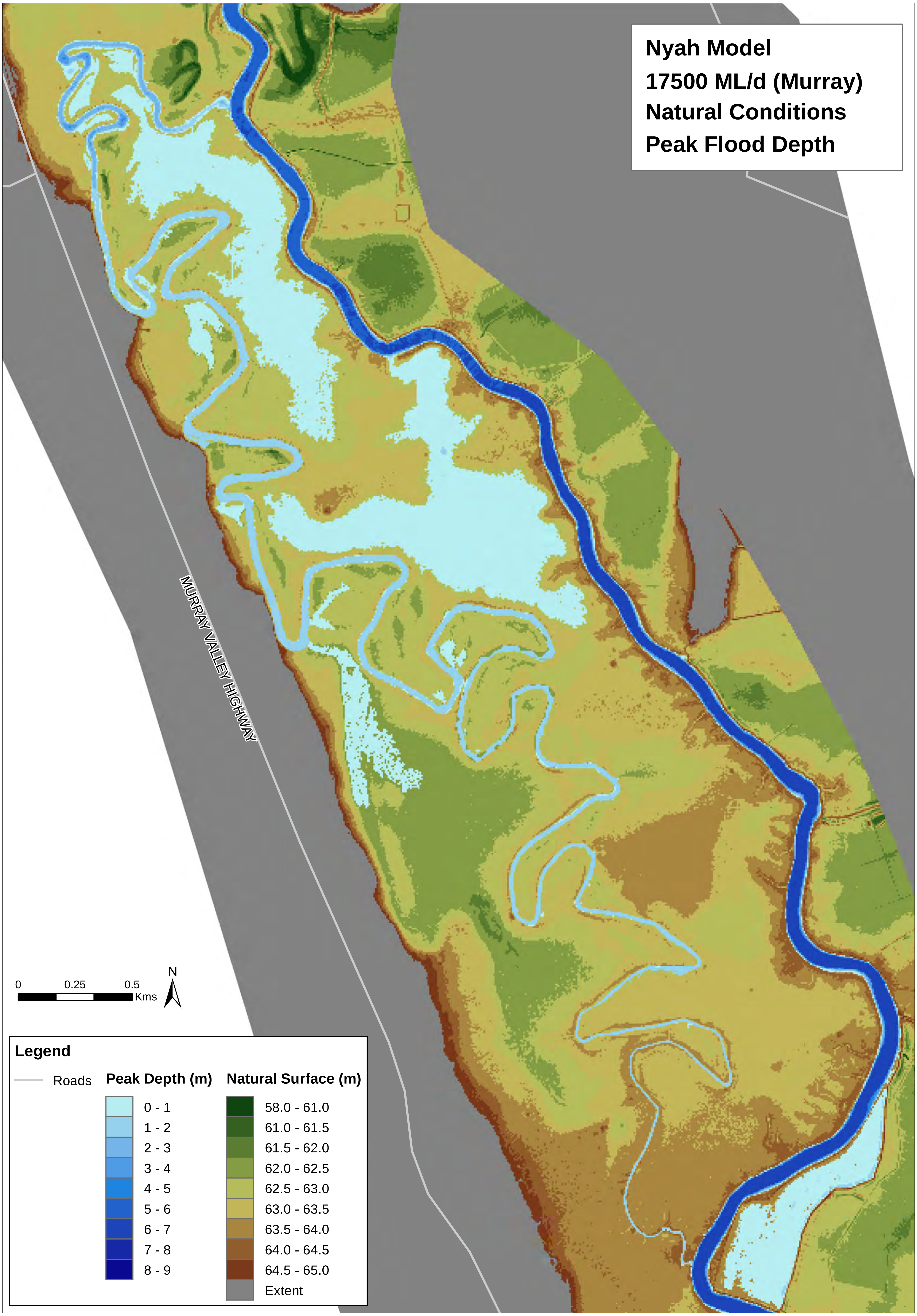

Nyah Model
10000 ML/d (Murray)
Natural Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
Natural Surface (m)
58.0 - 61.0
61.0 - 61.5
61.5 - 62.0
62.0 - 62.5
62.5 - 63.0
63.0 - 63.5
63.5 - 64.0
64.0 - 64.5
64.5 - 65.0
Extent



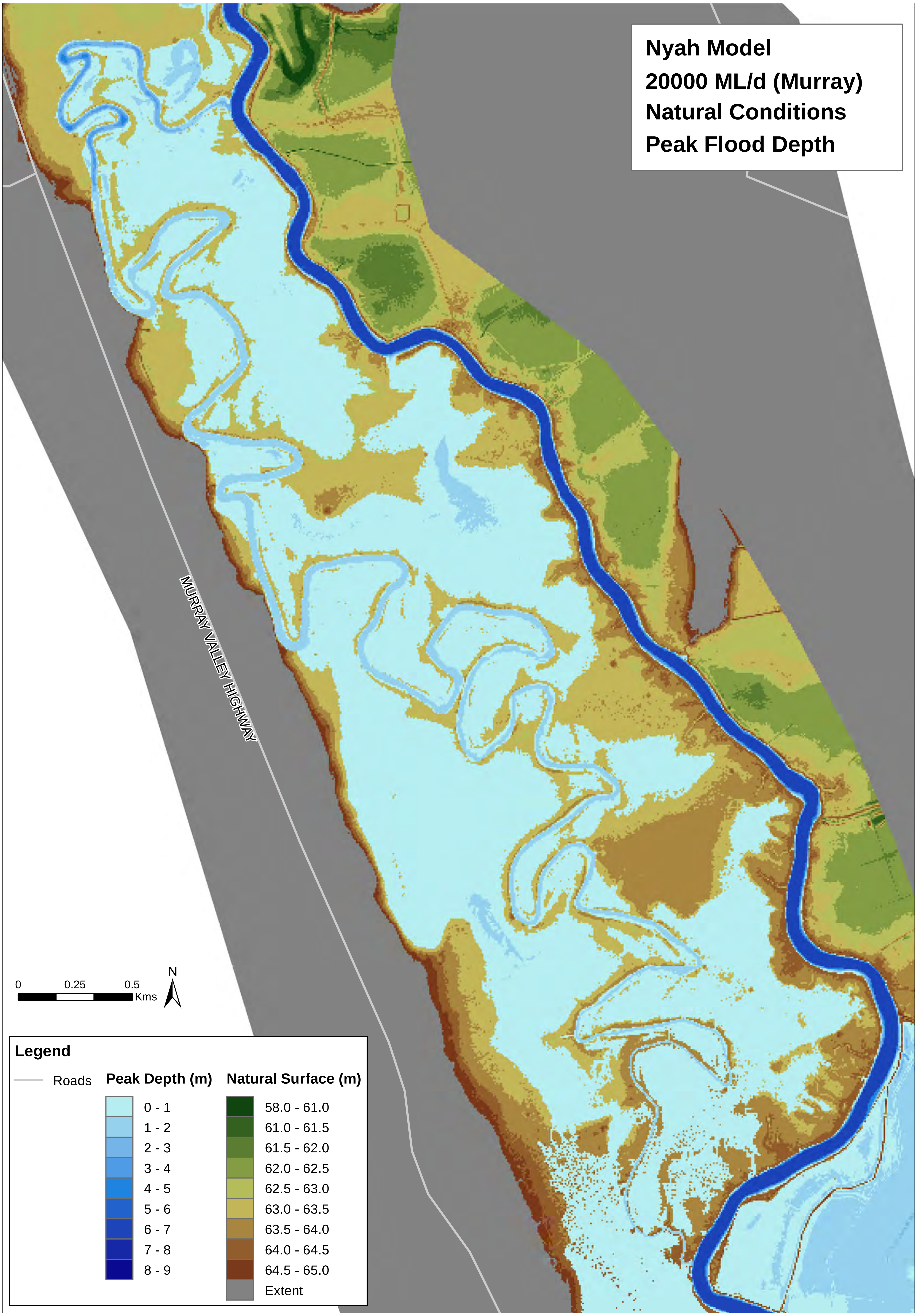
Nyah Model
12500 ML/d (Murray)
Natural Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
Natural Surface (m)
58.0 - 61.0
61.0 - 61.5
61.5 - 62.0
62.0 - 62.5
62.5 - 63.0
63.0 - 63.5
63.5 - 64.0
64.0 - 64.5
64.5 - 65.0
Extent



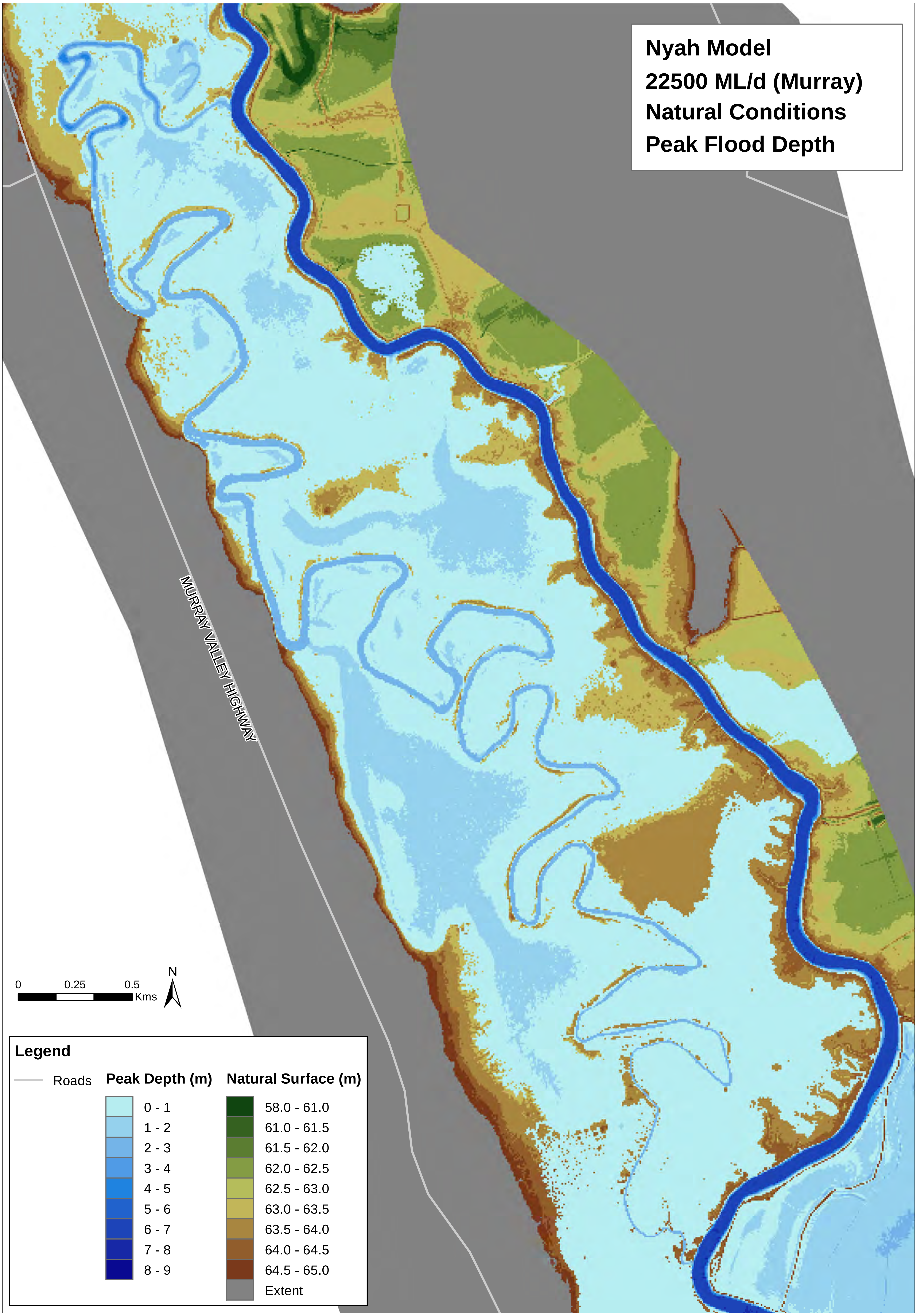
Nyah Model
15000 ML/d (Murray)
Natural Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
Natural Surface (m)
58.0 - 61.0
61.0 - 61.5
61.5 - 62.0
62.0 - 62.5
62.5 - 63.0
63.0 - 63.5
63.5 - 64.0
64.0 - 64.5
64.5 - 65.0
Extent

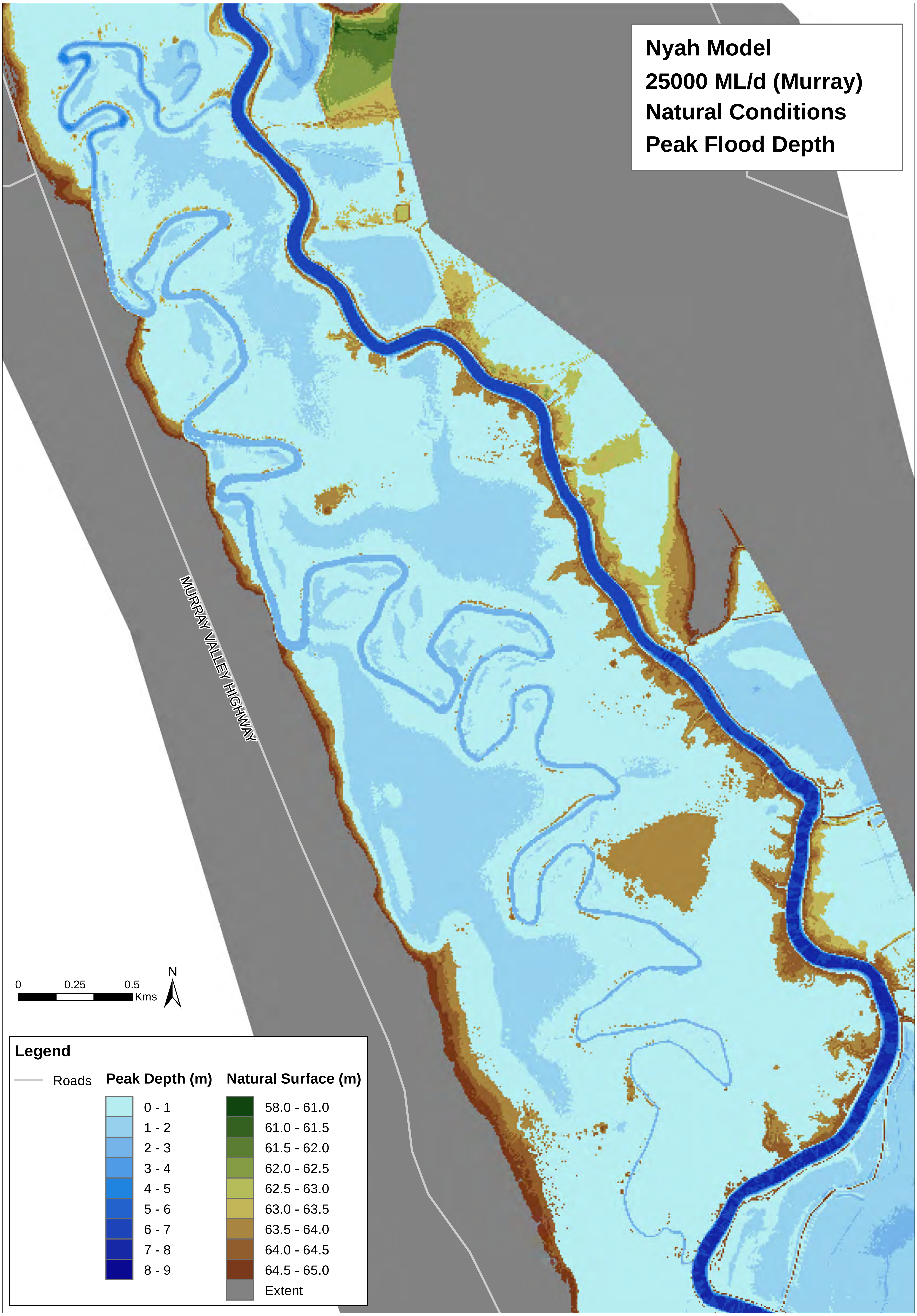


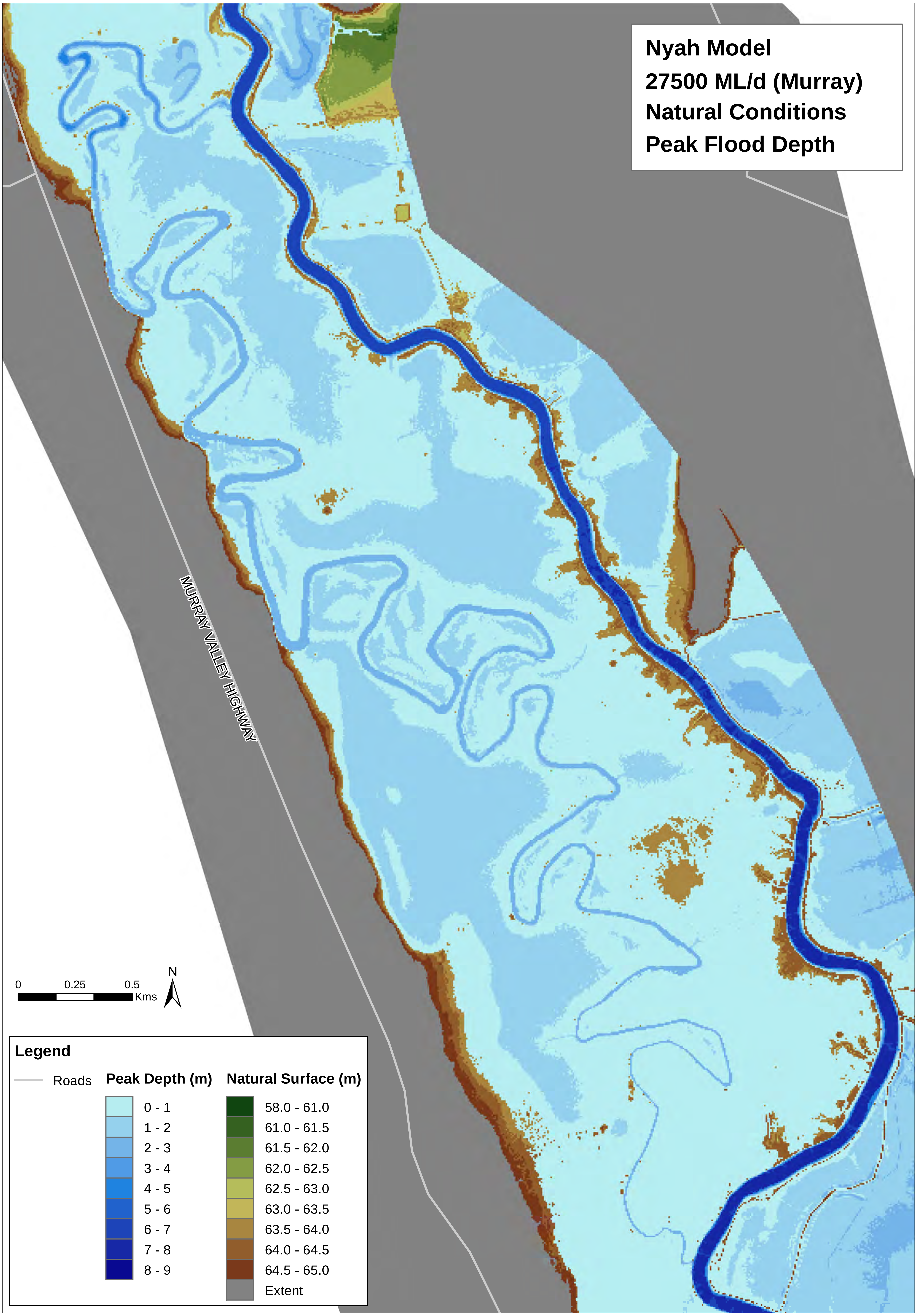
Nyah Model
17500 ML/d (Murray)
Natural Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
Natural Surface (m)
58.0 - 61.0
61.0 - 61.5
61.5 - 62.0
62.0 - 62.5
62.5 - 63.0
63.0 - 63.5
63.5 - 64.0
64.0 - 64.5
64.5 - 65.0
Extent



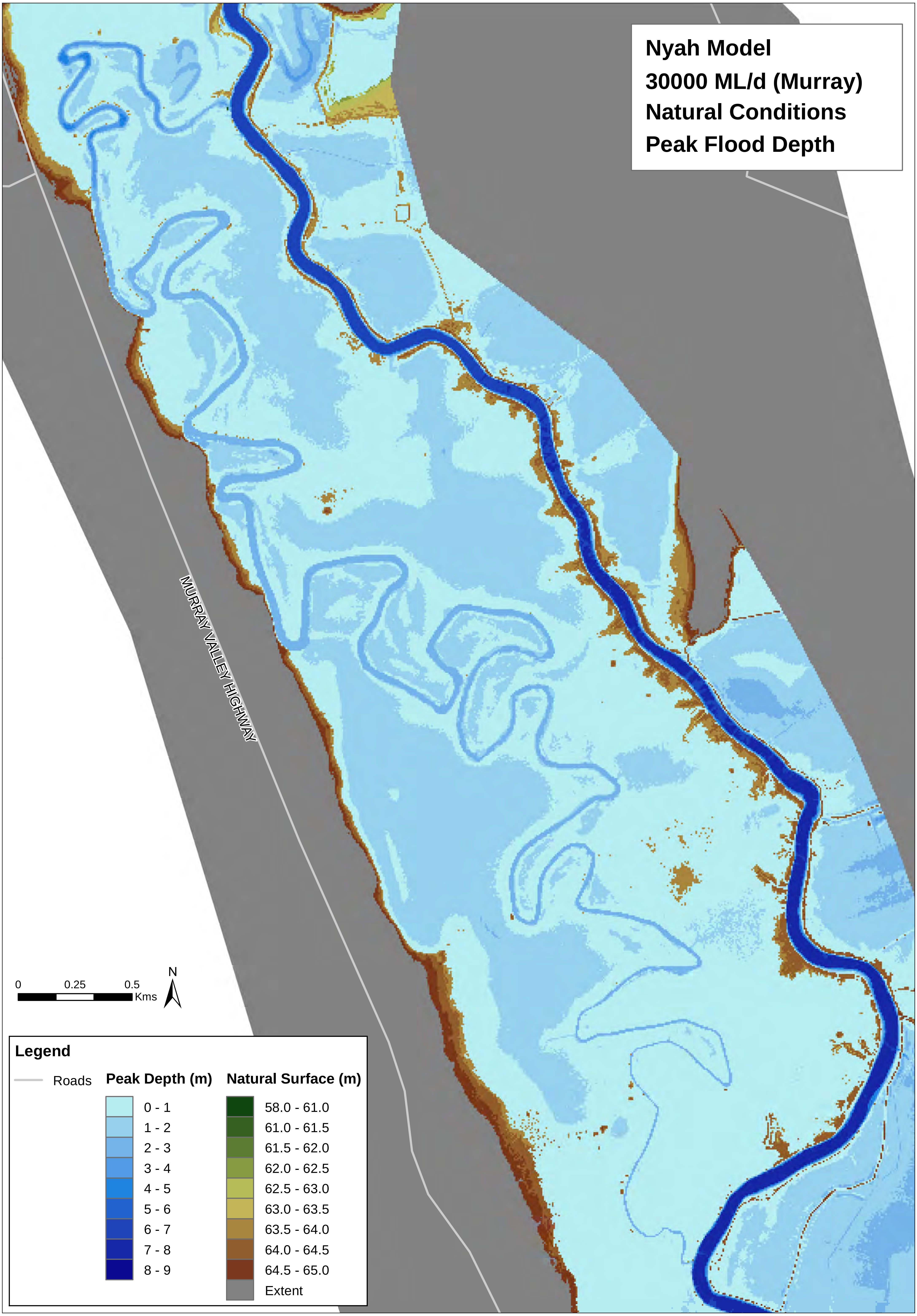
Nyah Model
20000 ML/d (Murray)
Natural Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
Natural Surface (m)
58.0 - 61.0
61.0 - 61.5
61.5 - 62.0
62.0 - 62.5
62.5 - 63.0
63.0 - 63.5
63.5 - 64.0
64.0 - 64.5
64.5 - 65.0
Extent

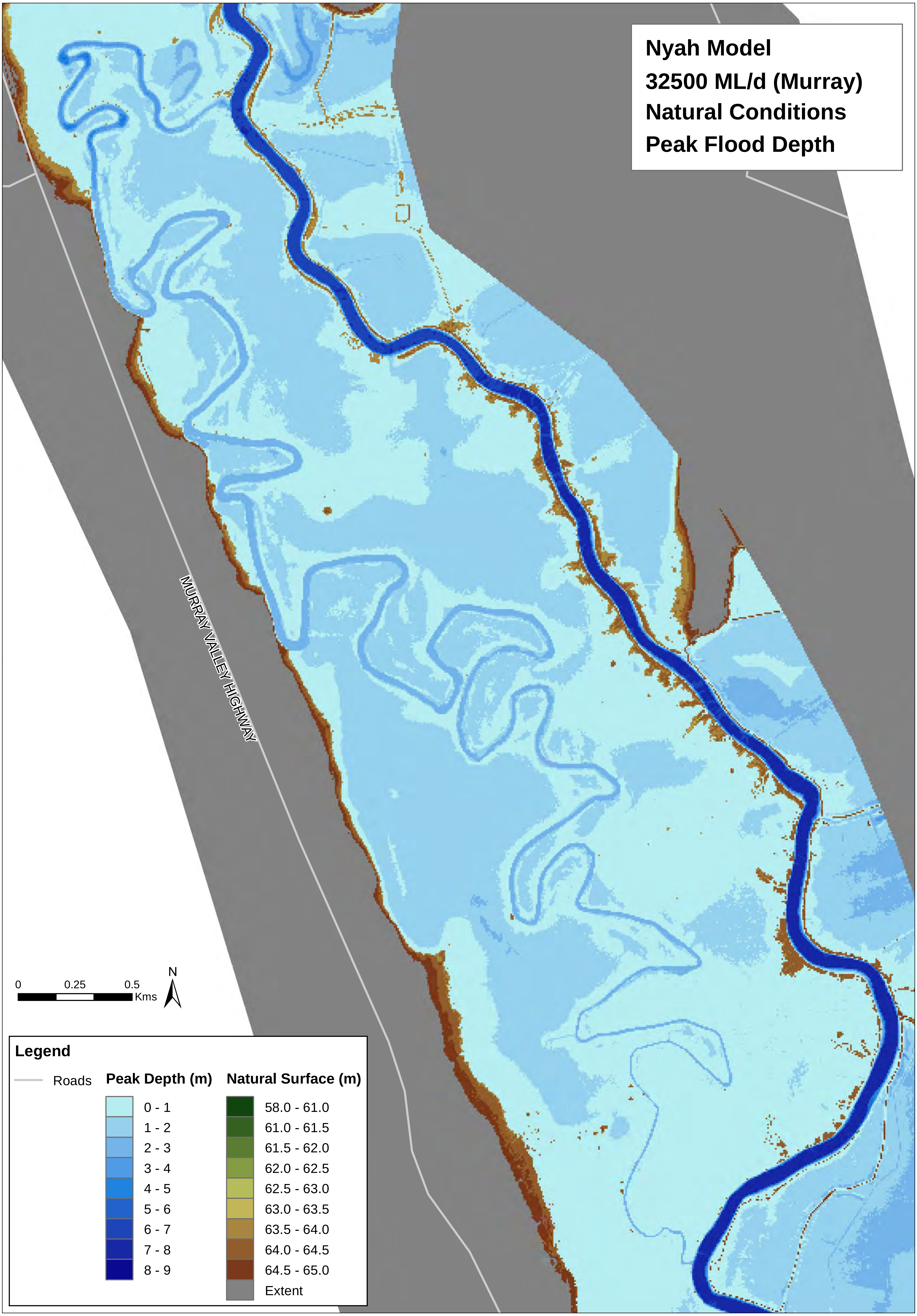

Nyah Model
22500 ML/d (Murray)
Natural Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
Natural Surface (m)
58.0 - 61.0
61.0 - 61.5
61.5 - 62.0
62.0 - 62.5
62.5 - 63.0
63.0 - 63.5
63.5 - 64.0
64.0 - 64.5
64.5 - 65.0
Extent

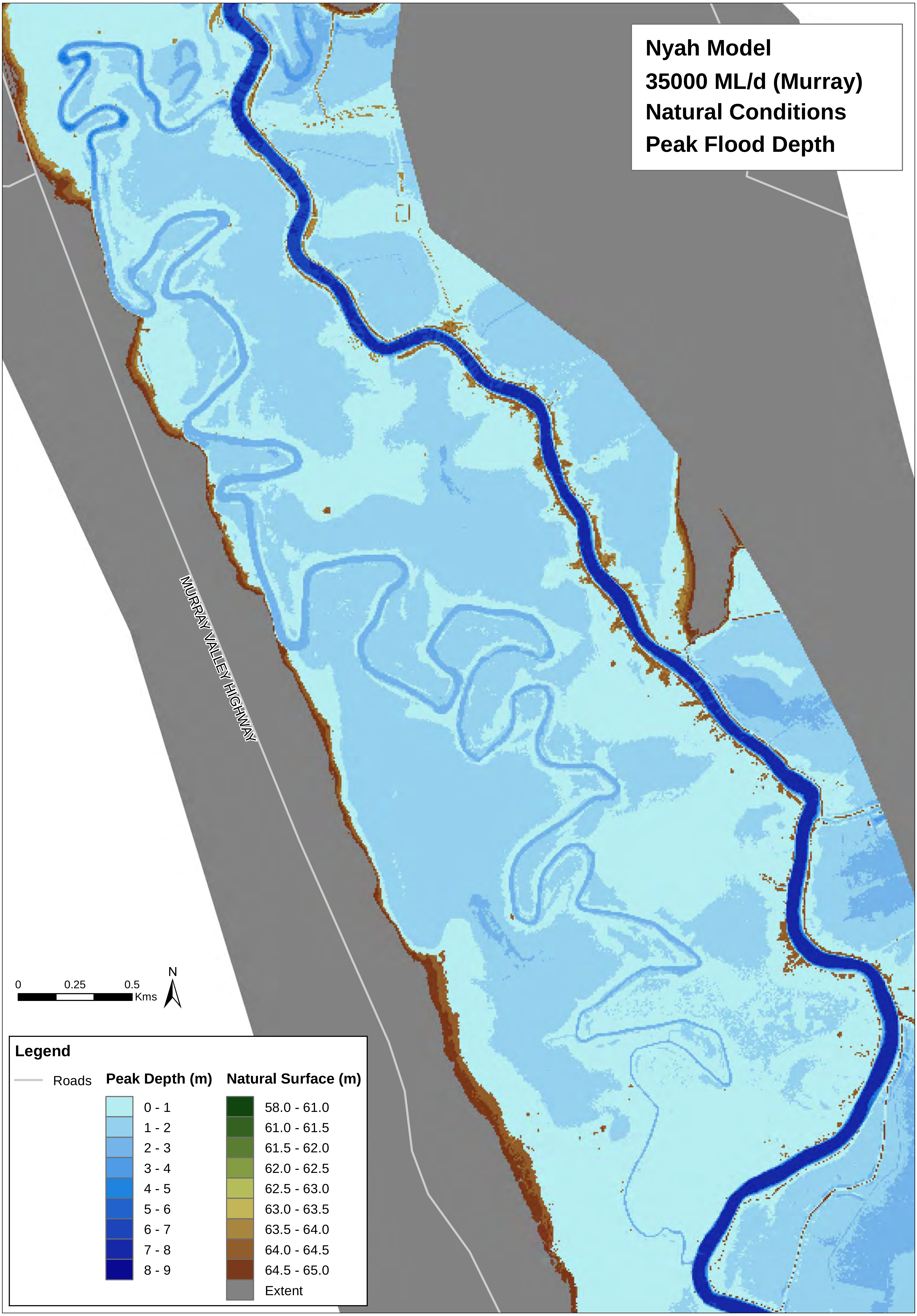

Nyah Model
25000 ML/d (Murray)
Natural Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
Natural Surface (m)
58.0 - 61.0
61.0 - 61.5
61.5 - 62.0
62.0 - 62.5
62.5 - 63.0
63.0 - 63.5
63.5 - 64.0
64.0 - 64.5
64.5 - 65.0
Extent



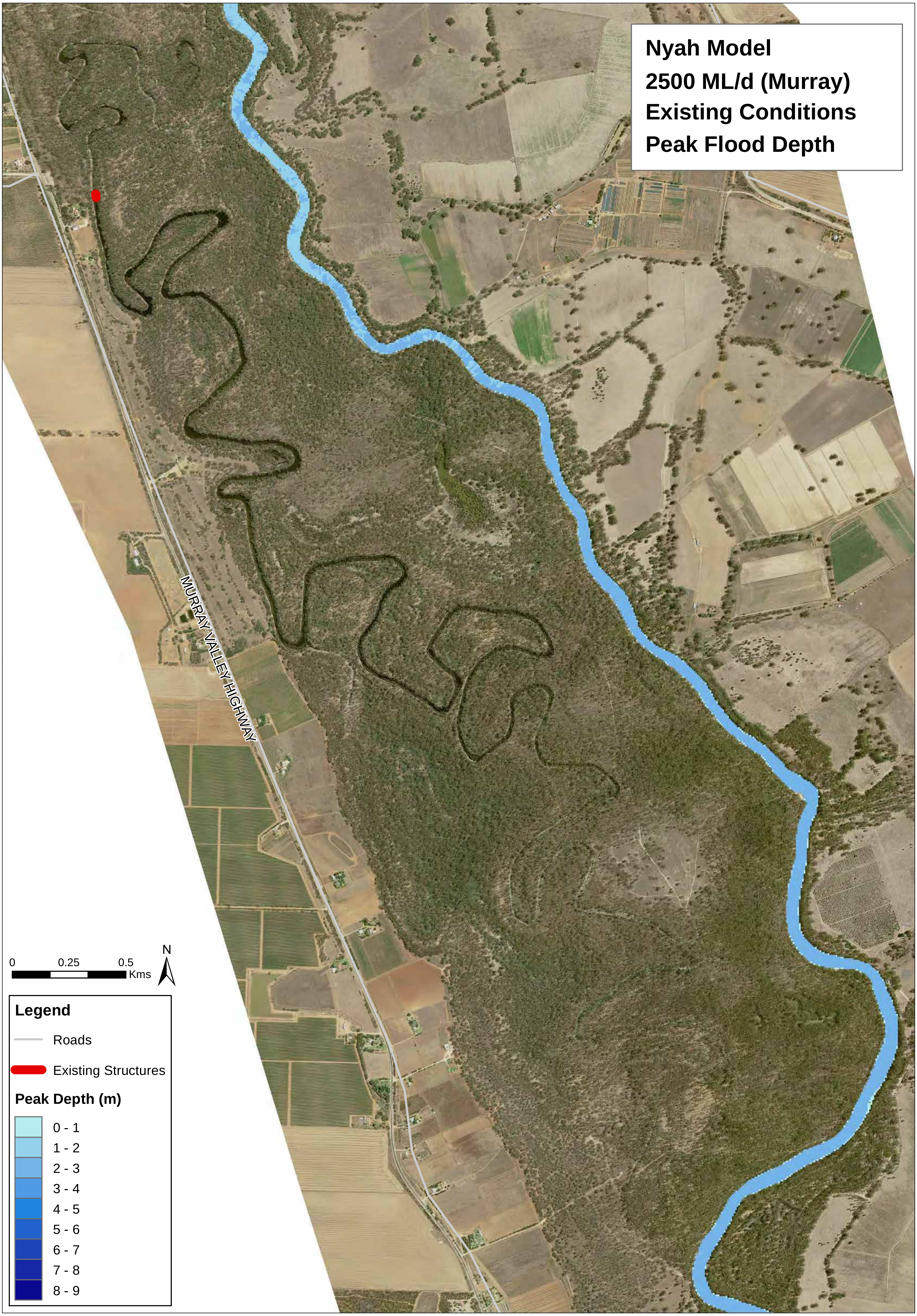
Nyah Model
27500 ML/d (Murray)
Natural Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
Natural Surface (m)
58.0 - 61.0
61.0 - 61.5
61.5 - 62.0
62.0 - 62.5
62.5 - 63.0
63.0 - 63.5
63.5 - 64.0
64.0 - 64.5
64.5 - 65.0
Extent

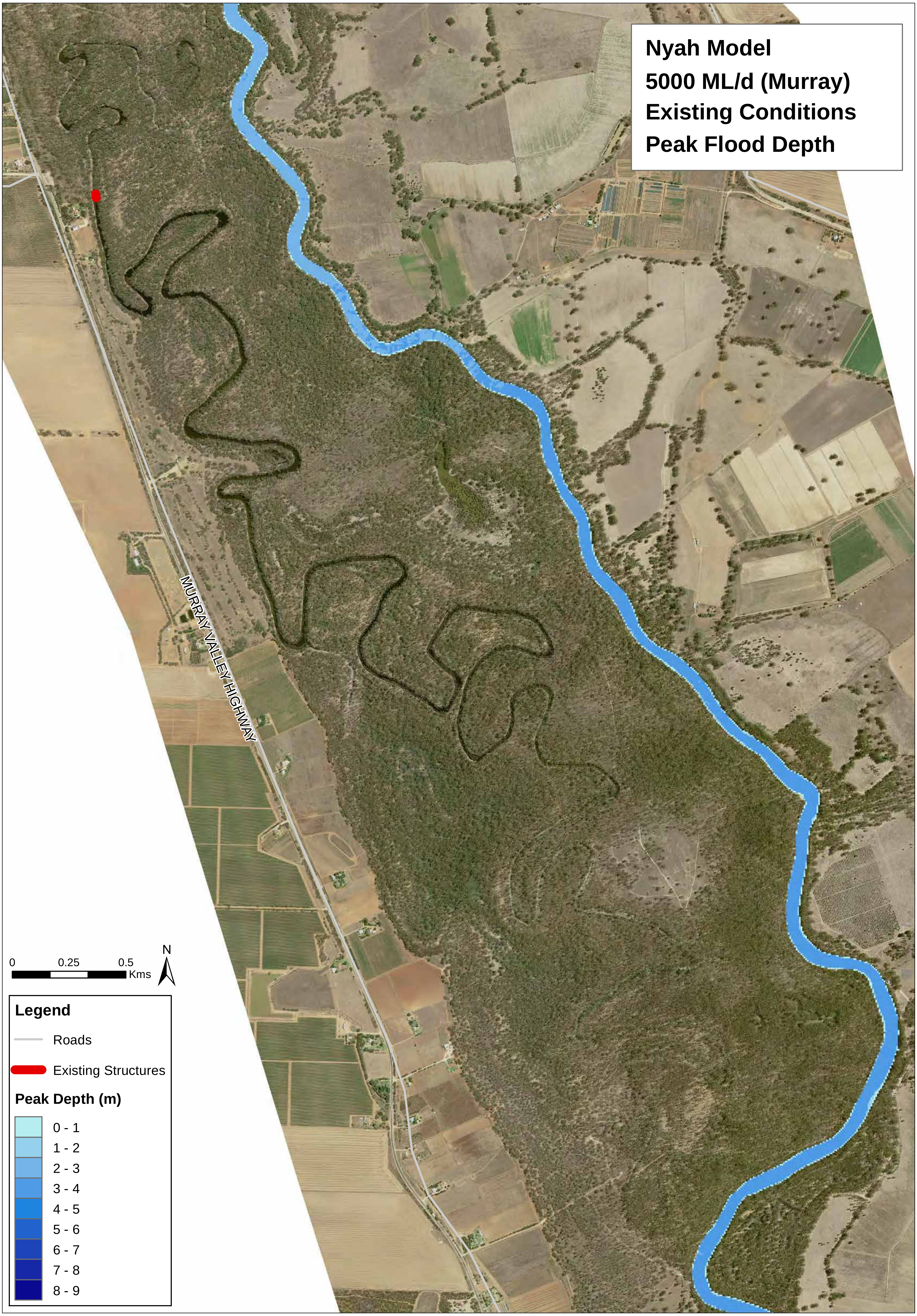

Nyah Model
30000 ML/d (Murray)
Natural Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
Natural Surface (m)
58.0 - 61.0
61.0 - 61.5
61.5 - 62.0
62.0 - 62.5
62.5 - 63.0
63.0 - 63.5
63.5 - 64.0
64.0 - 64.5
64.5 - 65.0
Extent


Nyah Model
32500 ML/d (Murray)
Natural Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
Natural Surface (m)
58.0 - 61.0
61.0 - 61.5
61.5 - 62.0
62.0 - 62.5
62.5 - 63.0
63.0 - 63.5
63.5 - 64.0
64.0 - 64.5
64.5 - 65.0
Extent

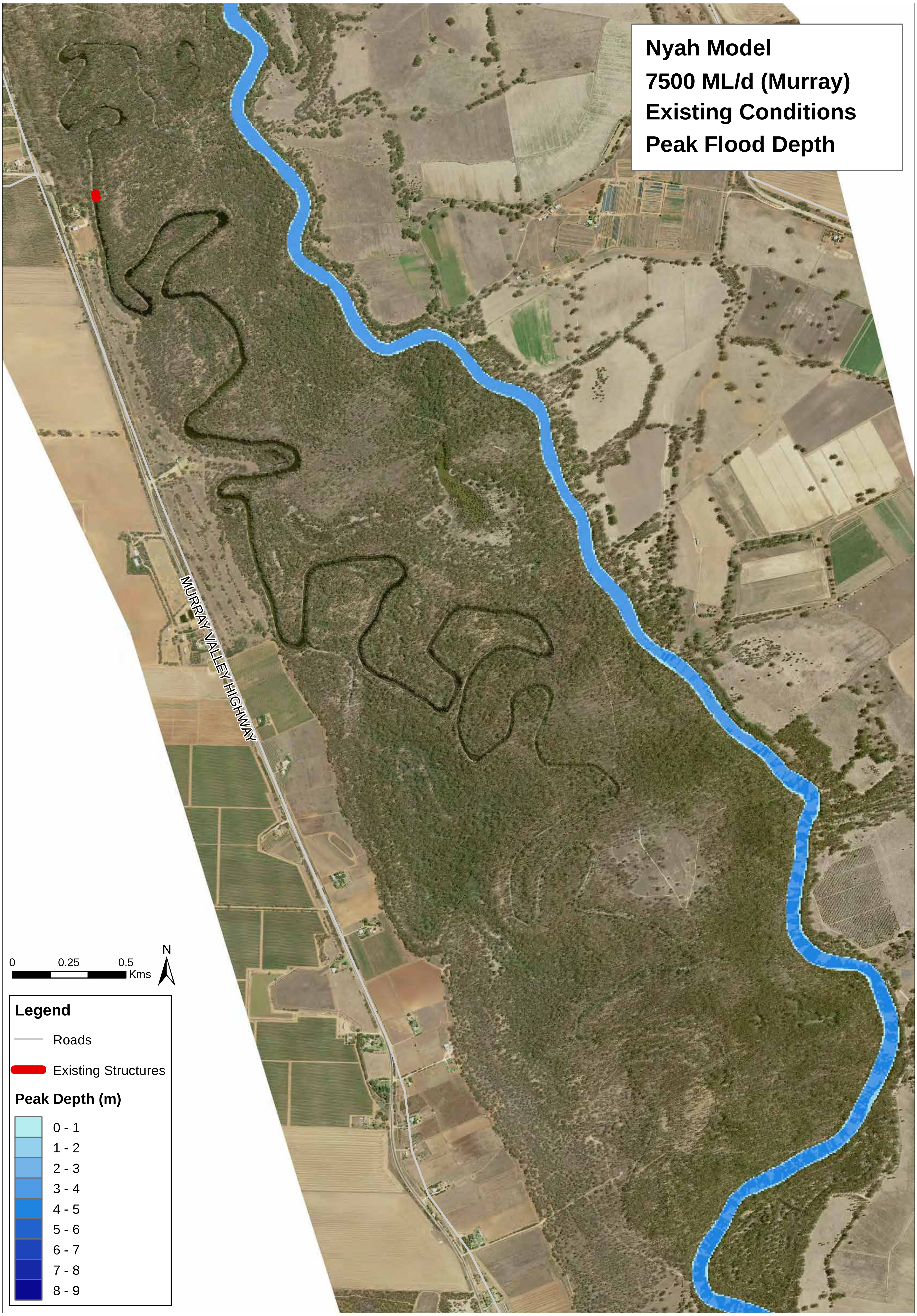

Nyah Model
35000 ML/d (Murray)
Natural Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
Natural Surface (m)
58.0 - 61.0
61.0 - 61.5
61.5 - 62.0
62.0 - 62.5
62.5 - 63.0
63.0 - 63.5
63.5 - 64.0
64.0 - 64.5
64.5 - 65.0
Extent

Appendix B. Existing Conditions Peak Depth Plots

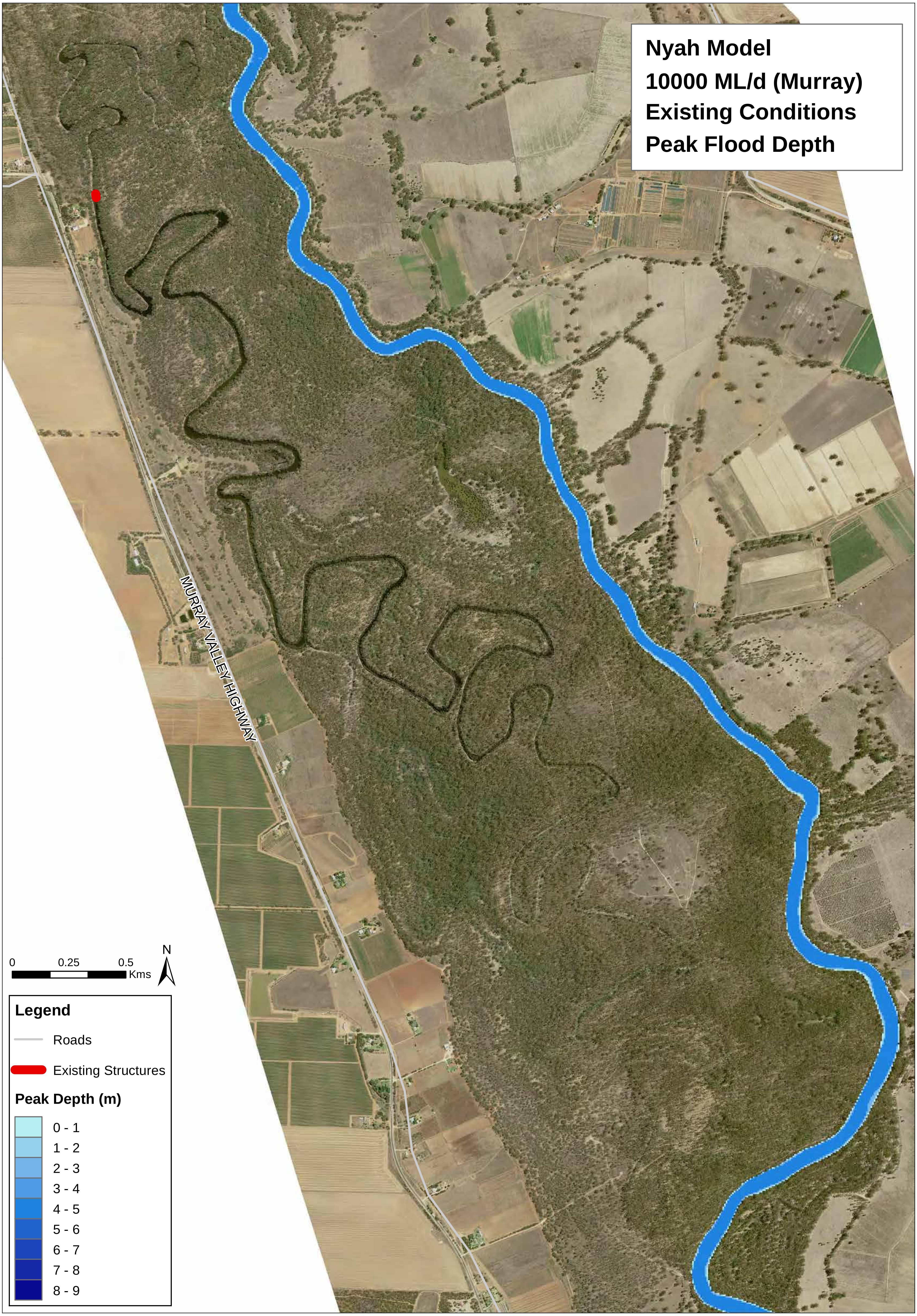

Nyah Model
2500 ML/d (Murray)
Existing Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

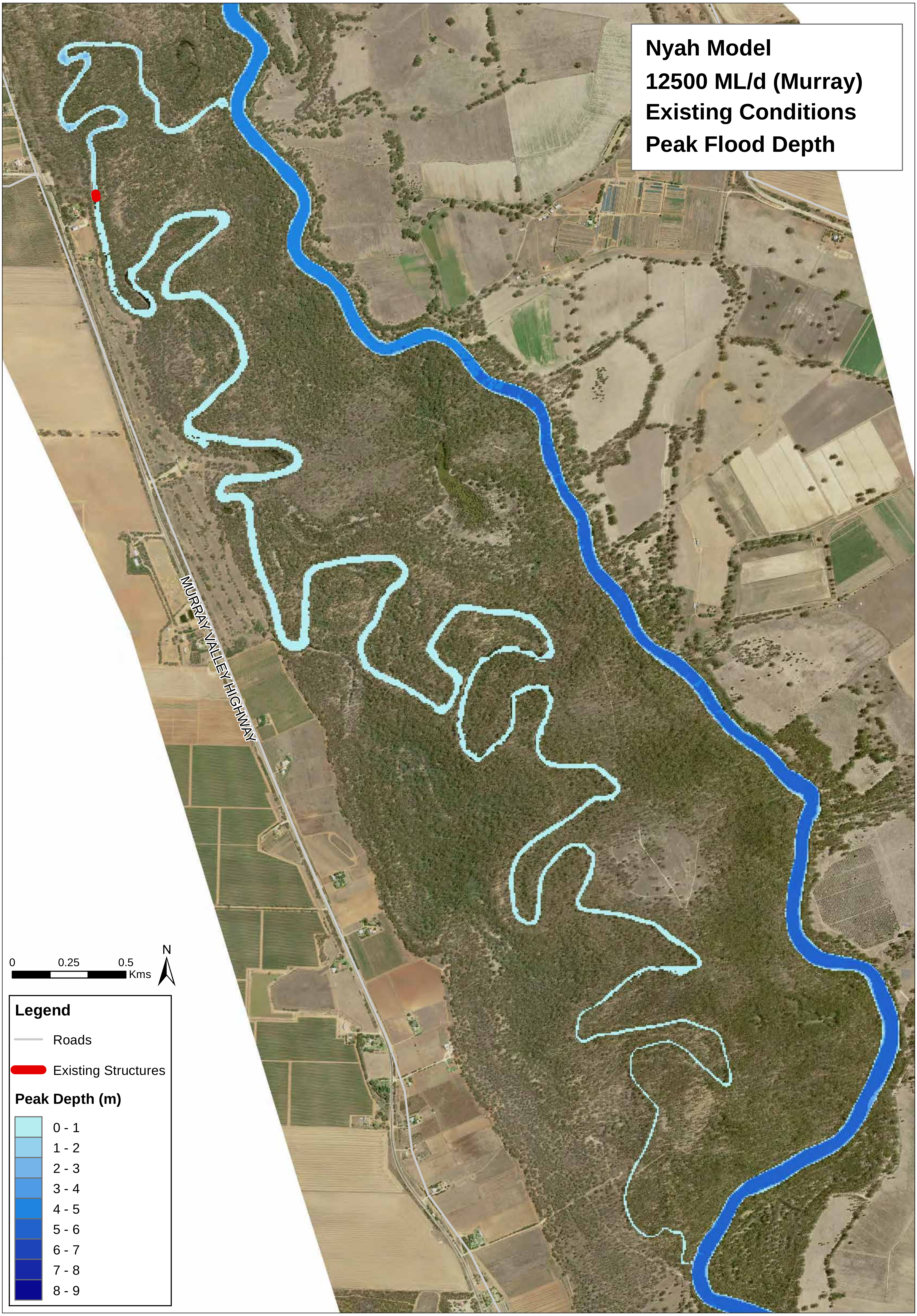


Nyah Model
5000 ML/d (Murray)
Existing Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

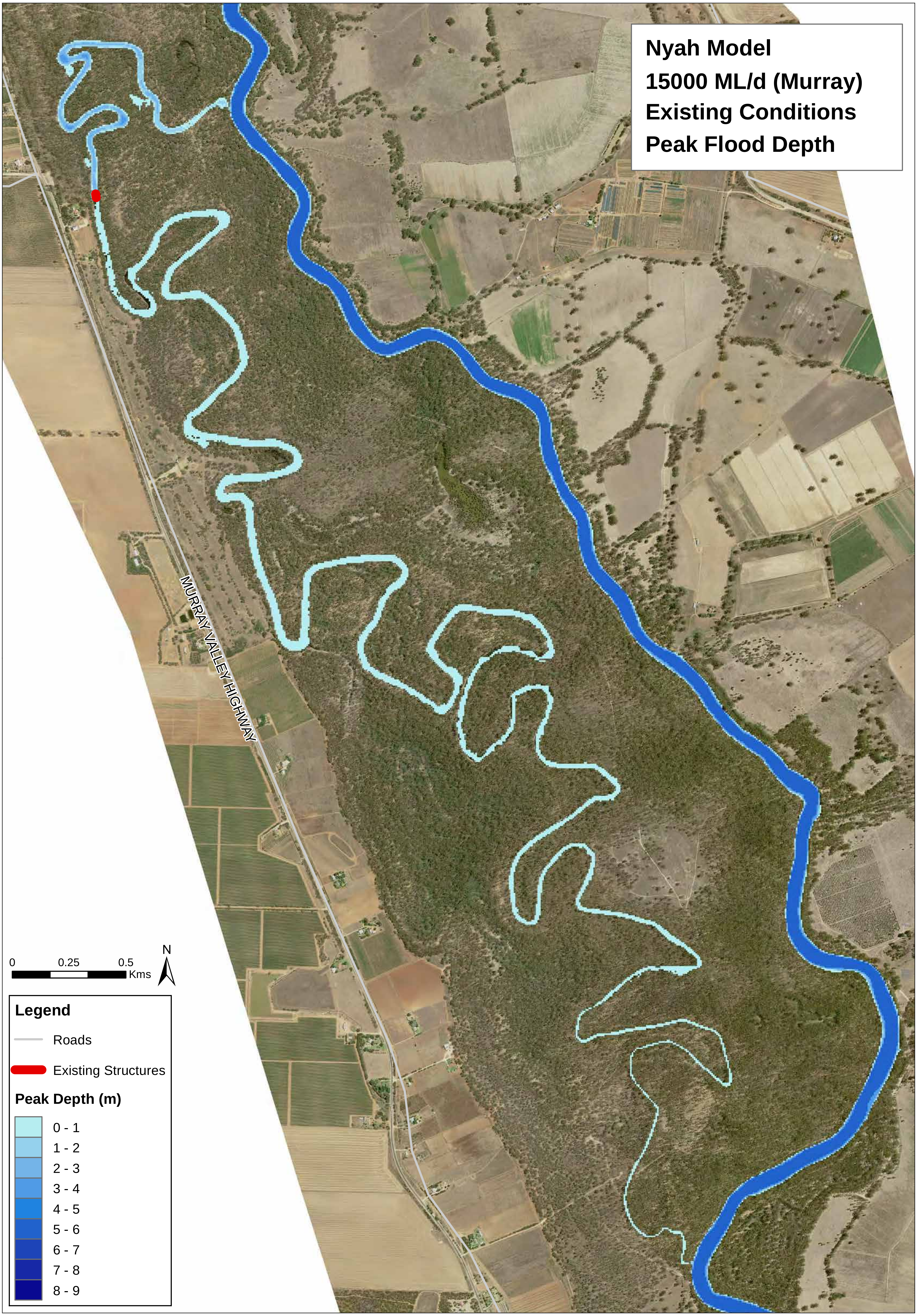


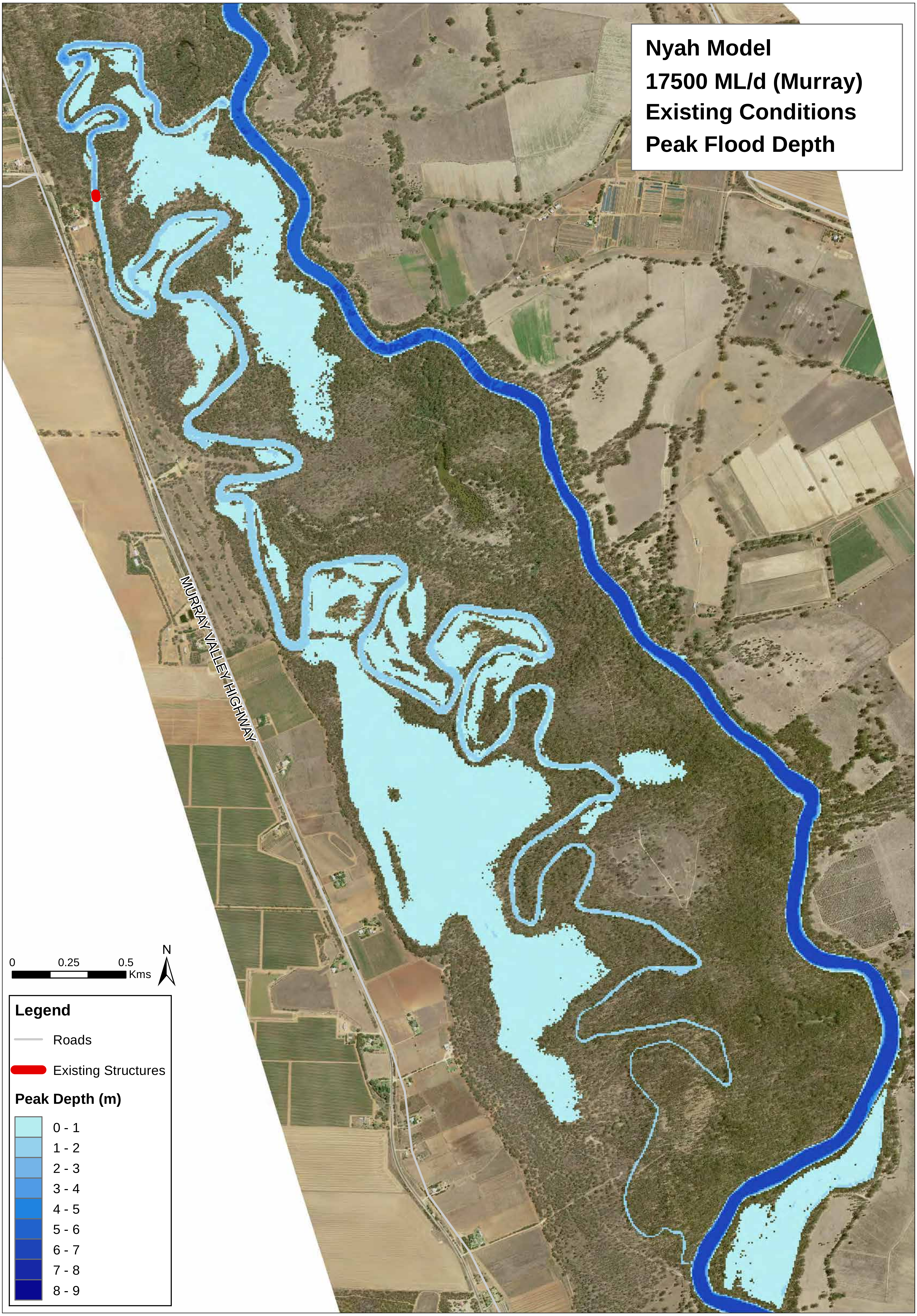
Nyah Model
7500 ML/d (Murray)
Existing Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9


Nyah Model
10000 ML/d (Murray)
Existing Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
N
0
0.25
0.5
Kms
Legend
Roads
Existing Structures
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

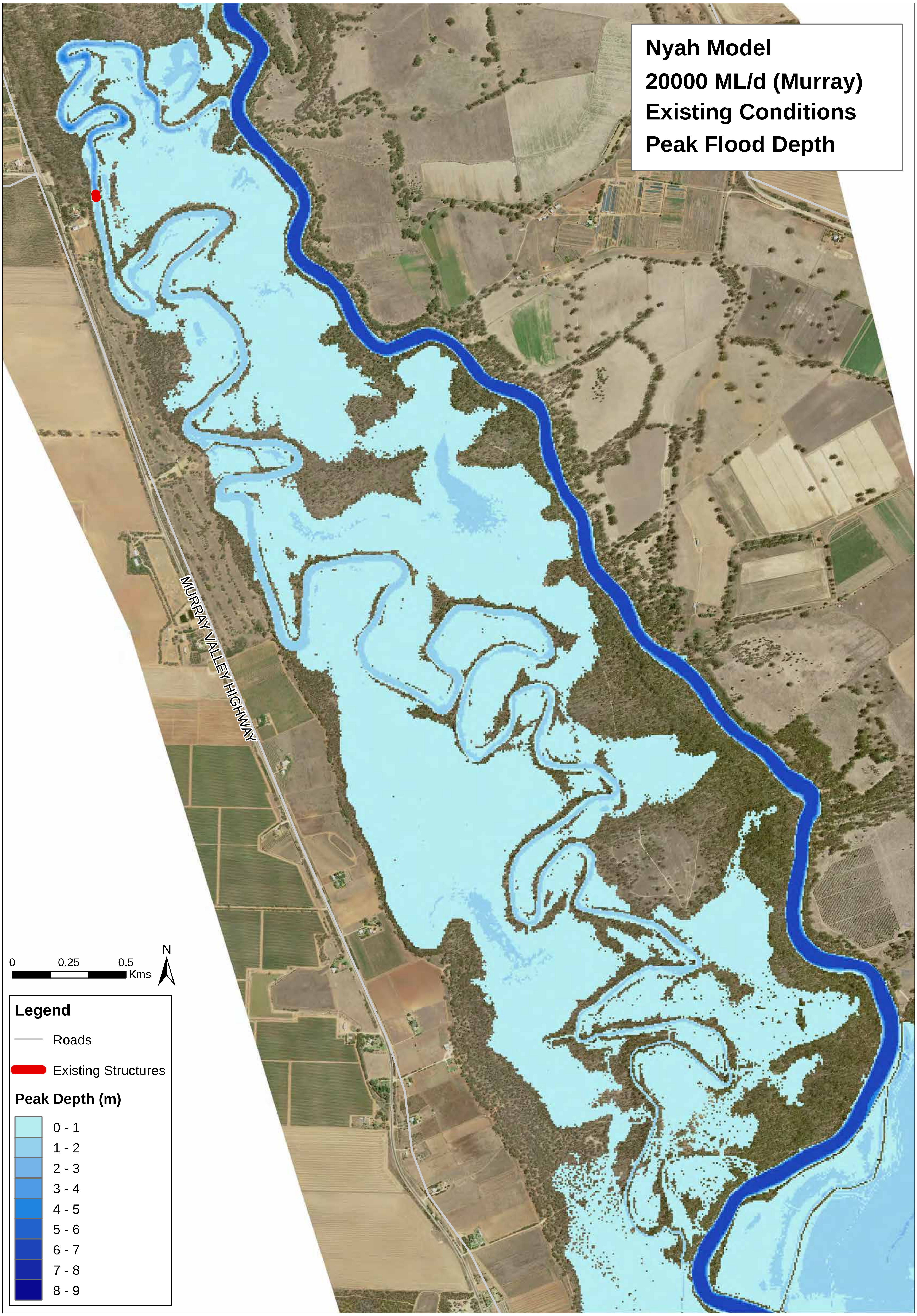


Nyah Model
12500 ML/d (Murray)
Existing Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

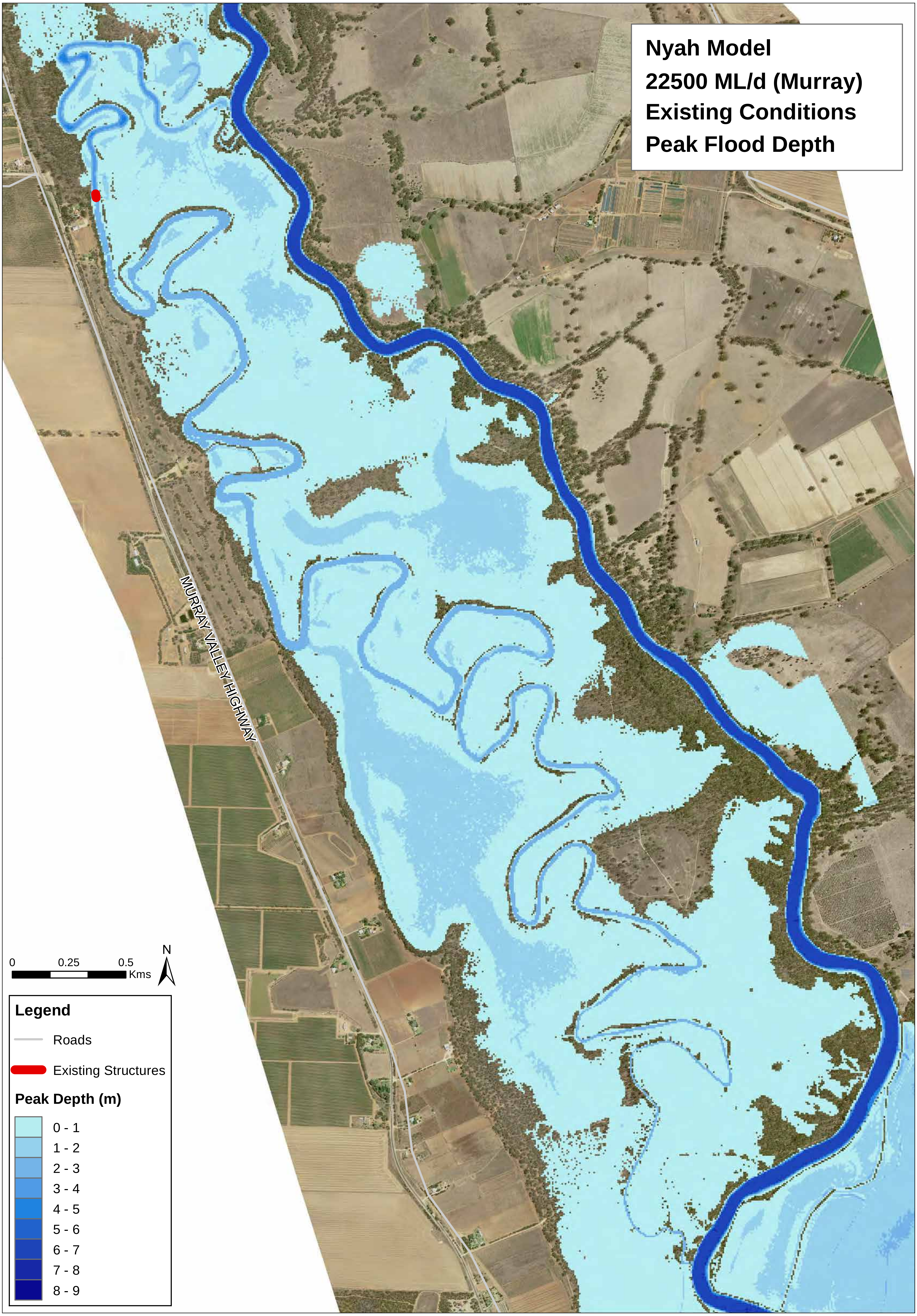

Nyah Model
15000 ML/d (Murray)
Existing Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9



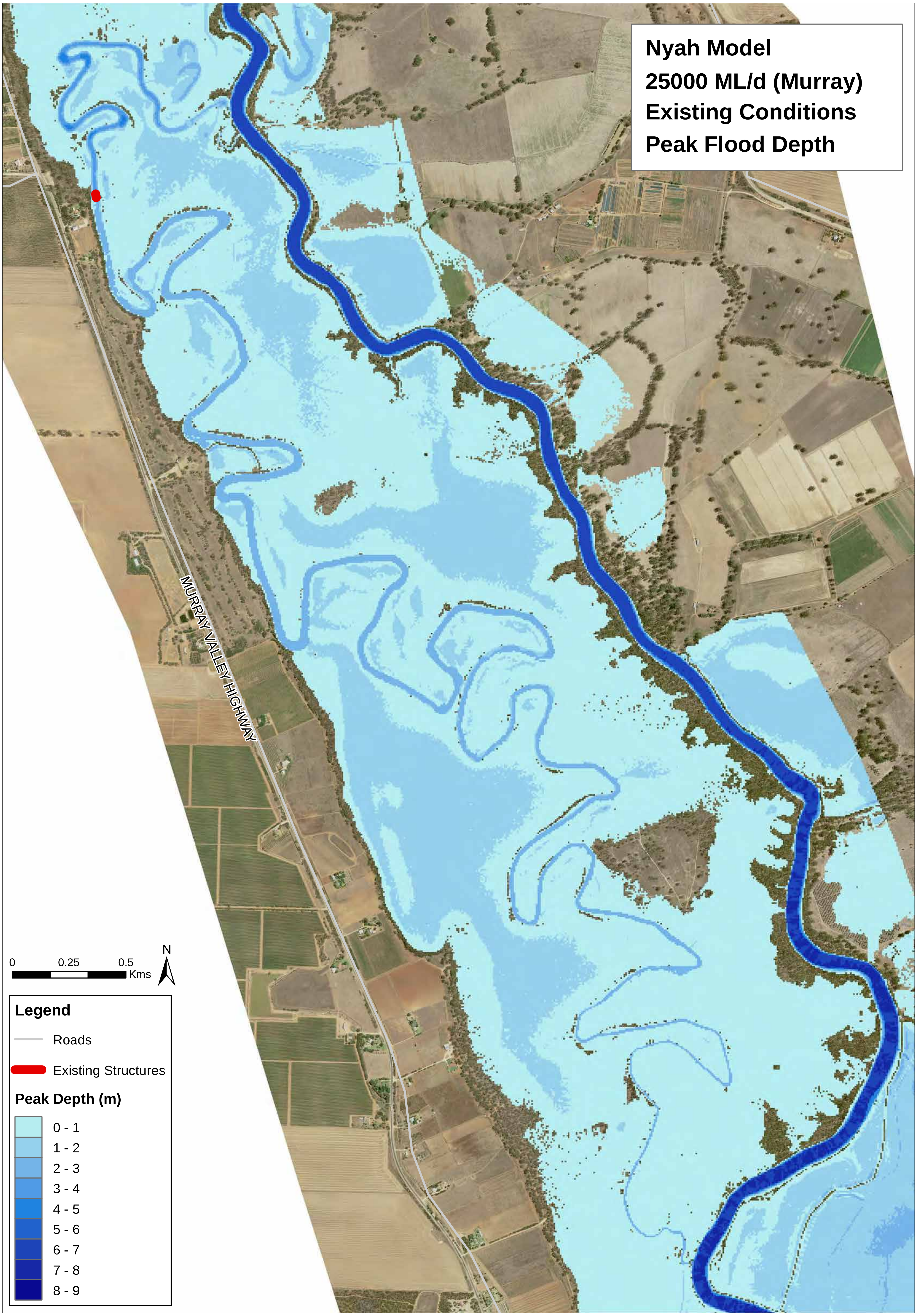
Nyah Model
17500 ML/d (Murray)
Existing Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

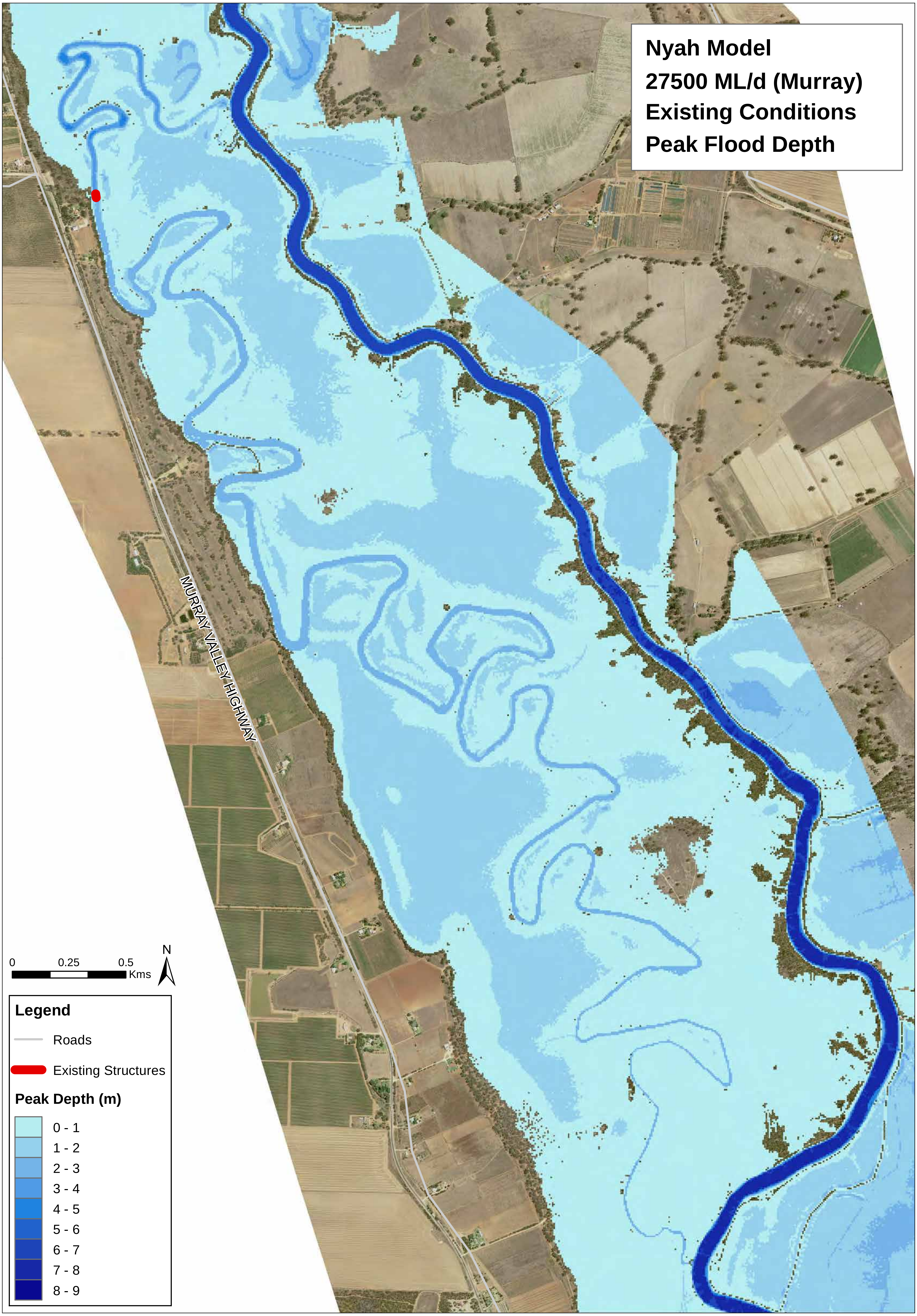


Nyah Model
20000 ML/d (Murray)
Existing Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

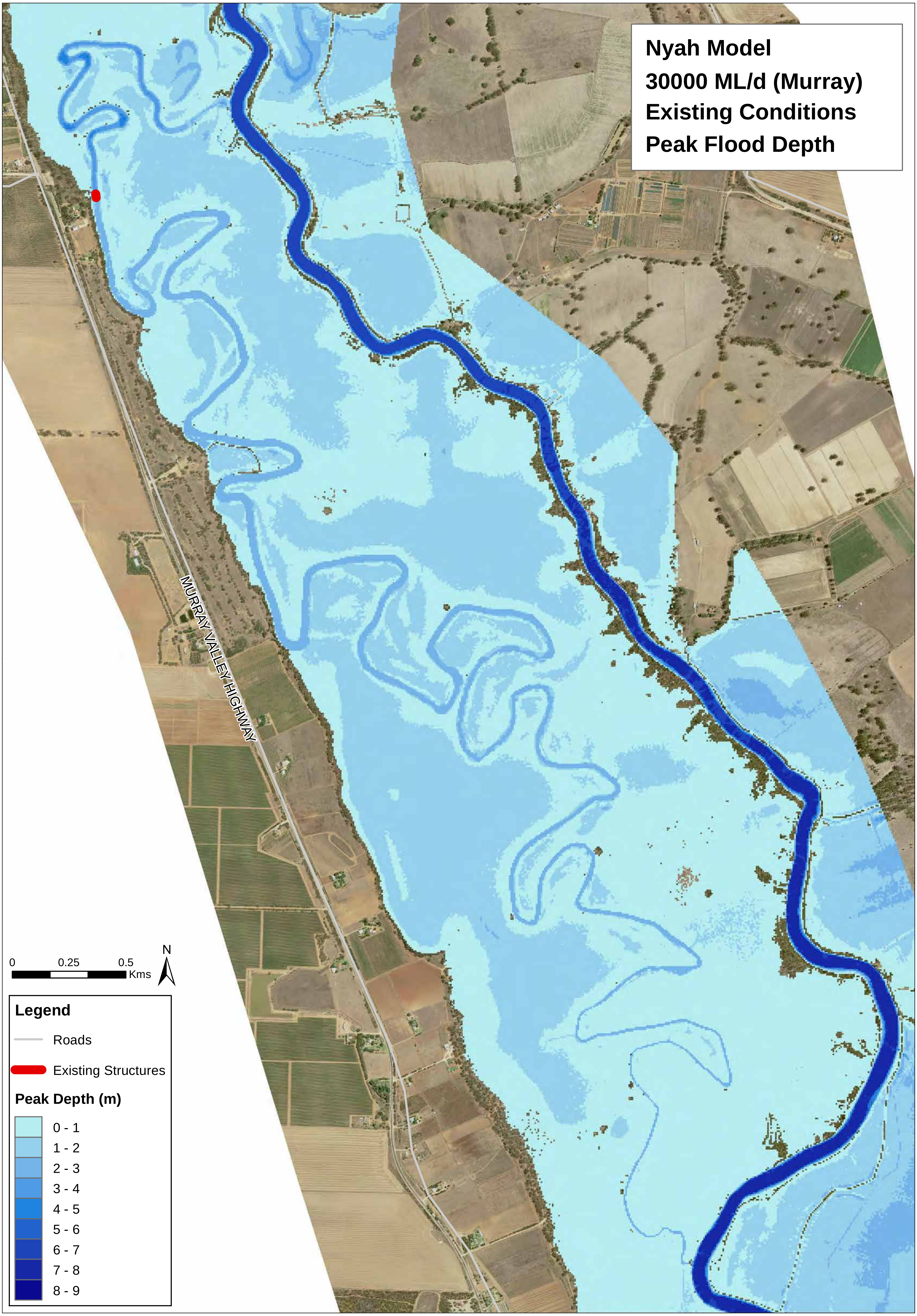


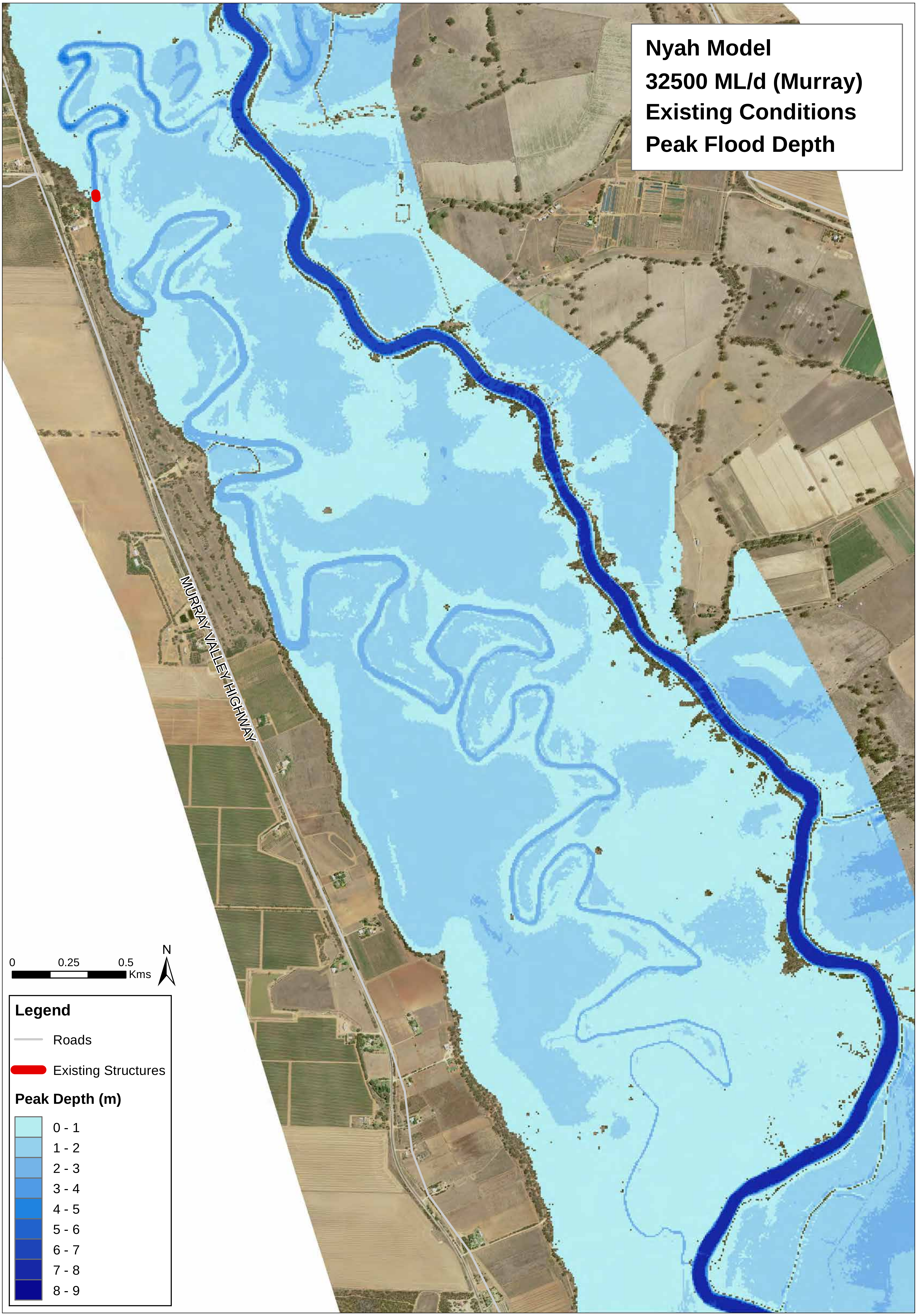
Nyah Model
22500 ML/d (Murray)
Existing Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9


Nyah Model
25000 ML/d (Murray)
Existing Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

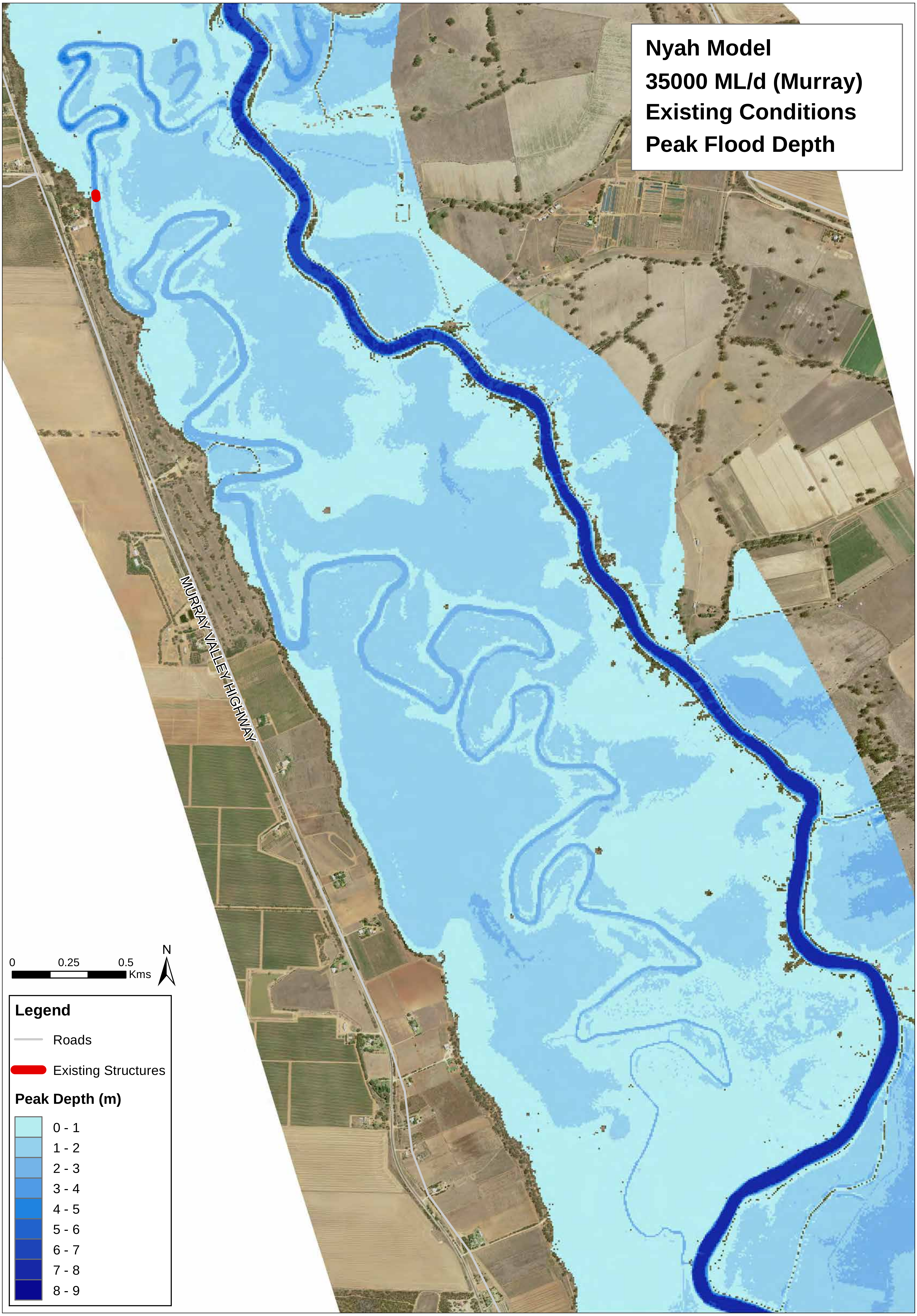


Nyah Model
27500 ML/d (Murray)
Existing Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9


Nyah Model
30000 ML/d (Murray)
Existing Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

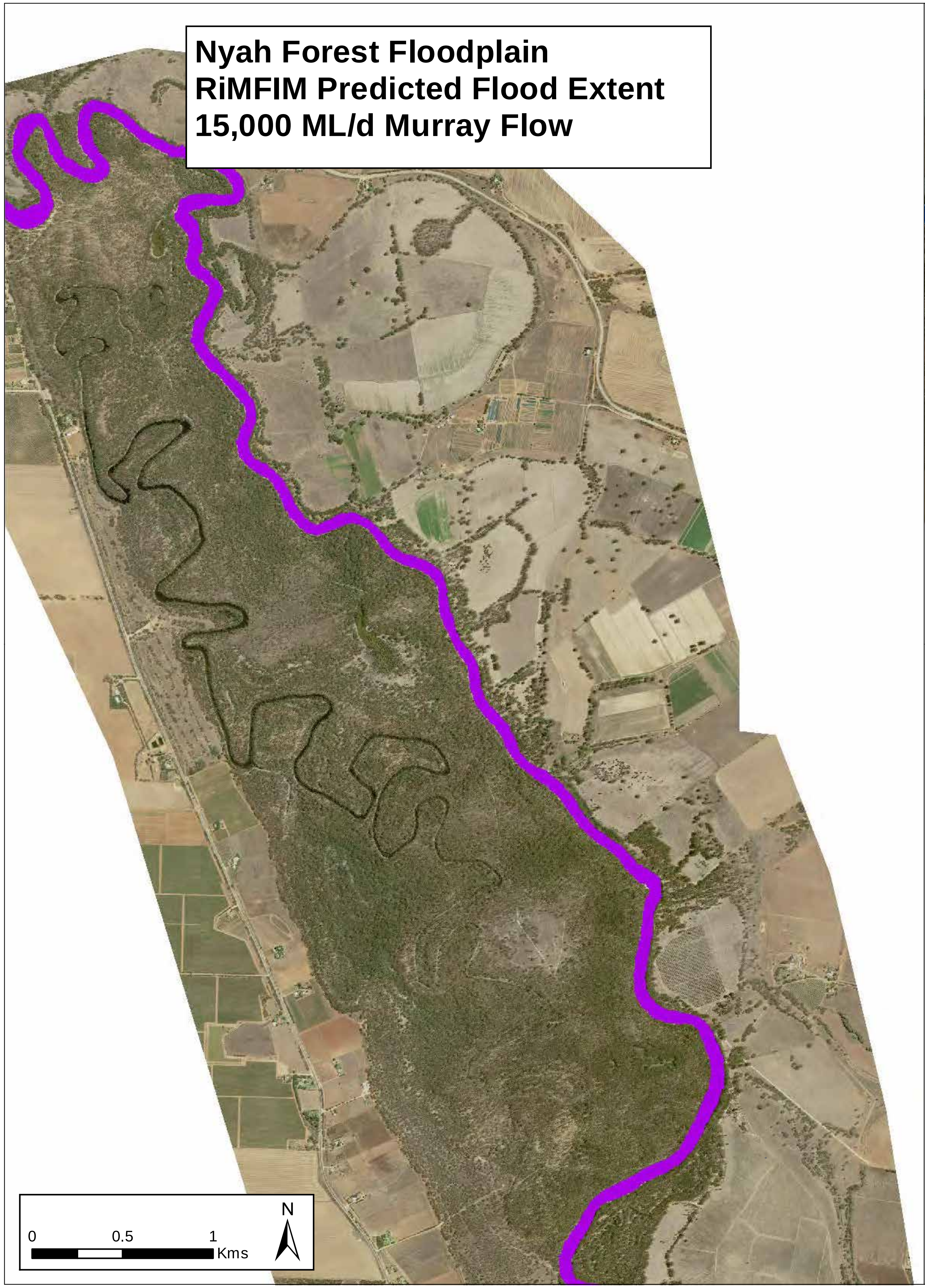


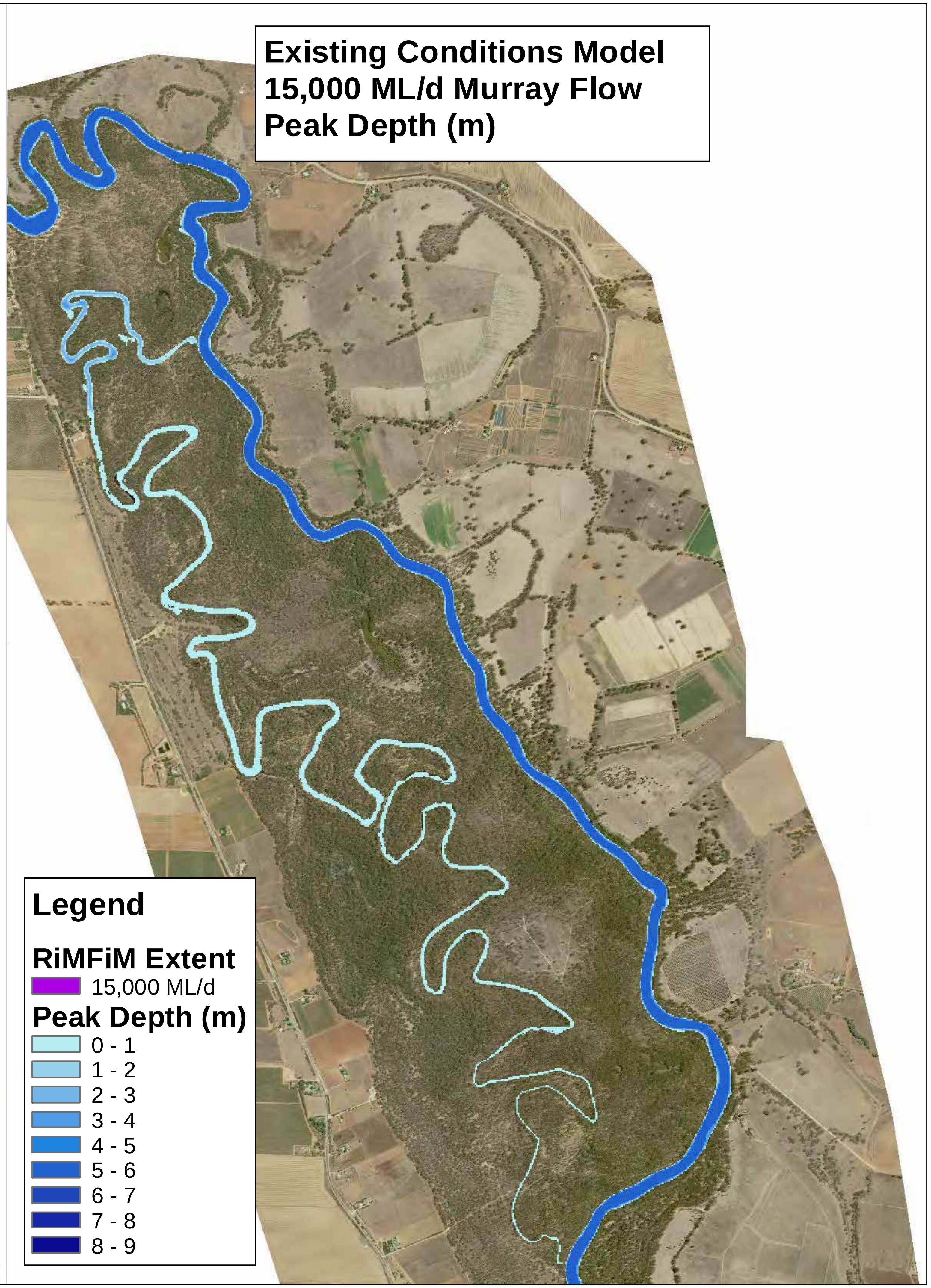
Nyah Model
32500 ML/d (Murray)
Existing Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

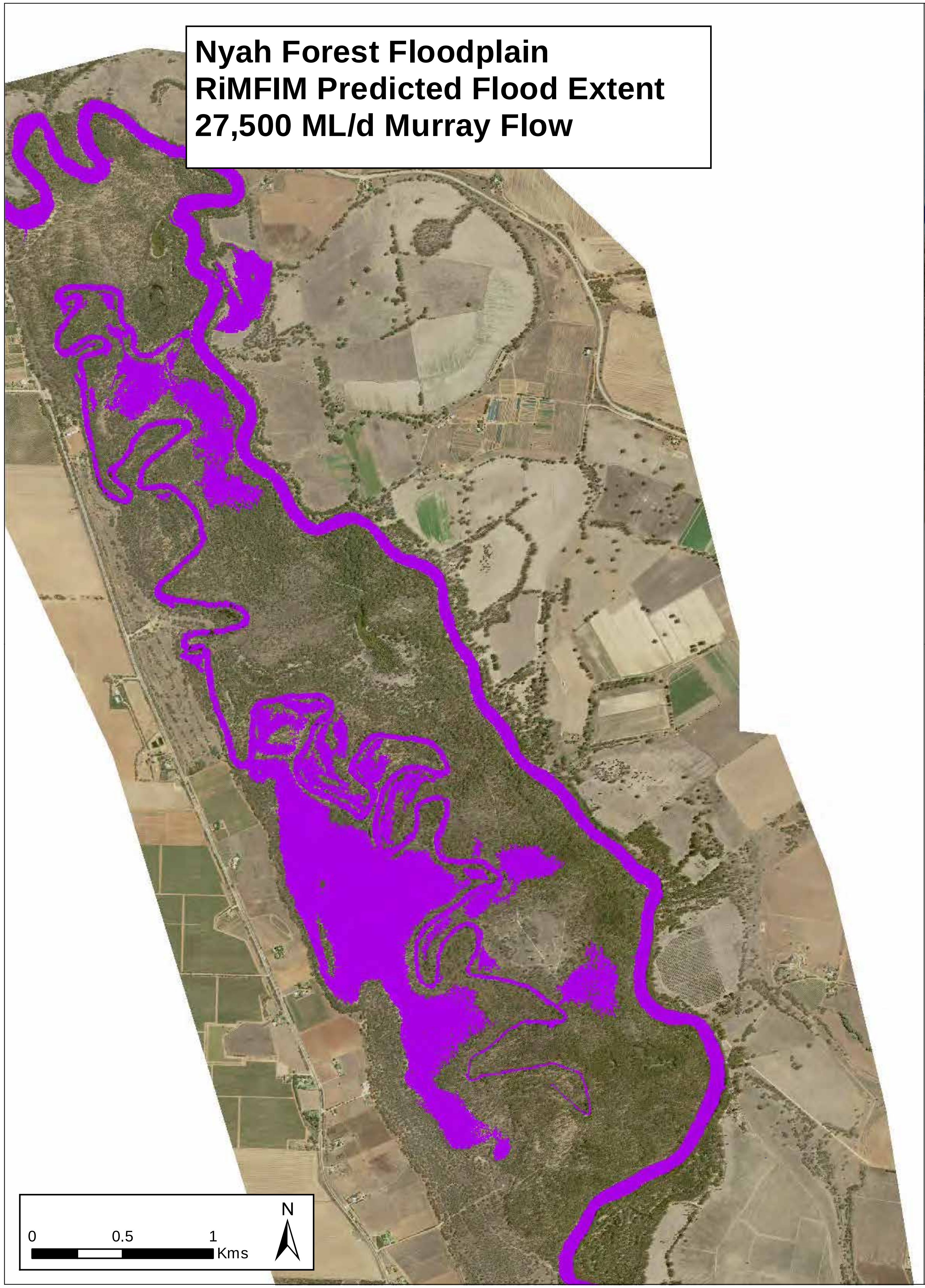


Nyah Model
35000 ML/d (Murray)
Existing Conditions
Peak Flood Depth
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

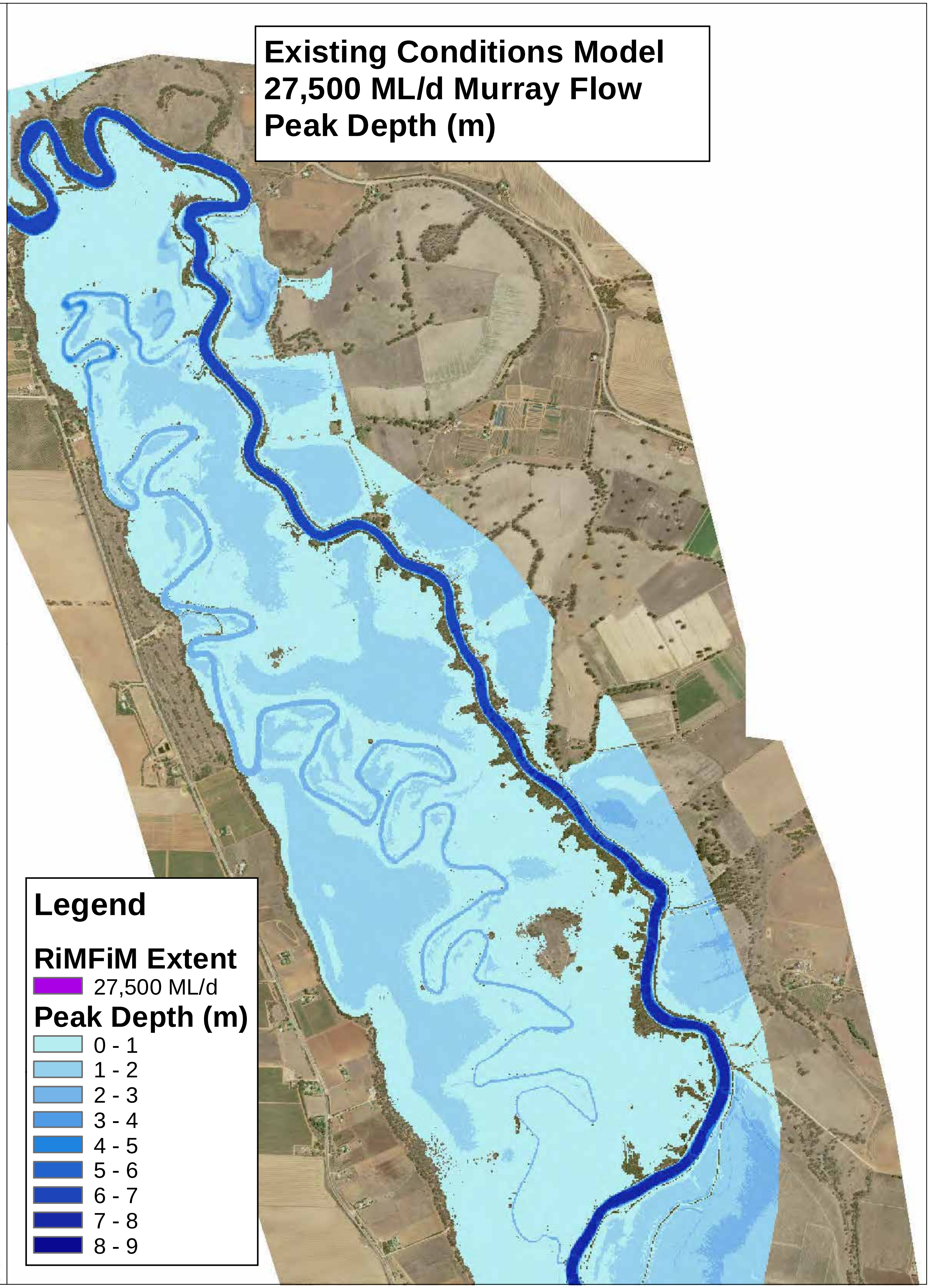
Appendix C. Calibration Plots


Nyah Forest Floodplain
RiMFIM Predicted Flood Extent
15,000 ML/d Murray Flow
0
0.5
1
Kms
N


Existing Conditions Model
15,000 ML/d Murray Flow
Peak Depth (m)
Legend
RiMFiM Extent
15,000 ML/d
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

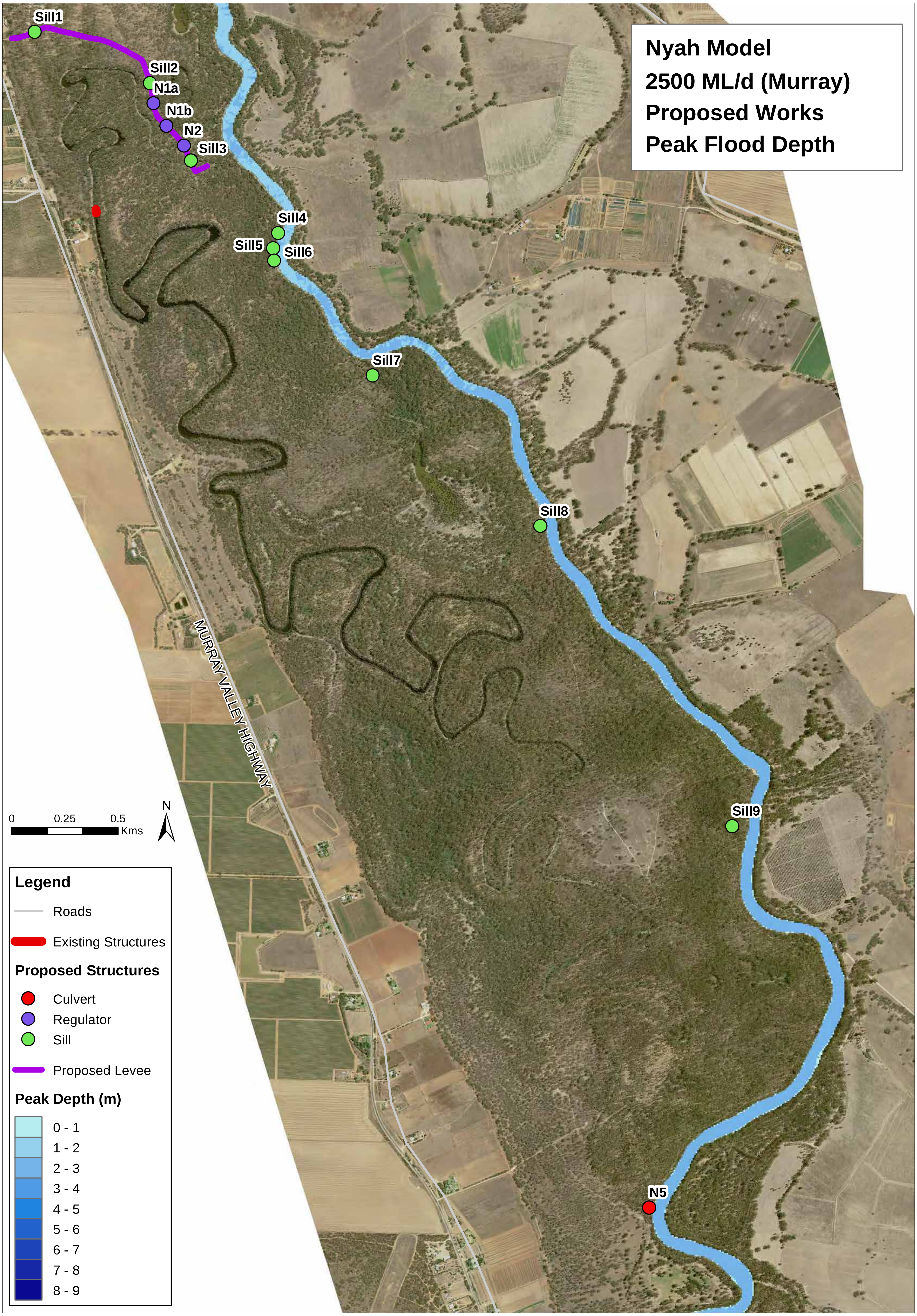


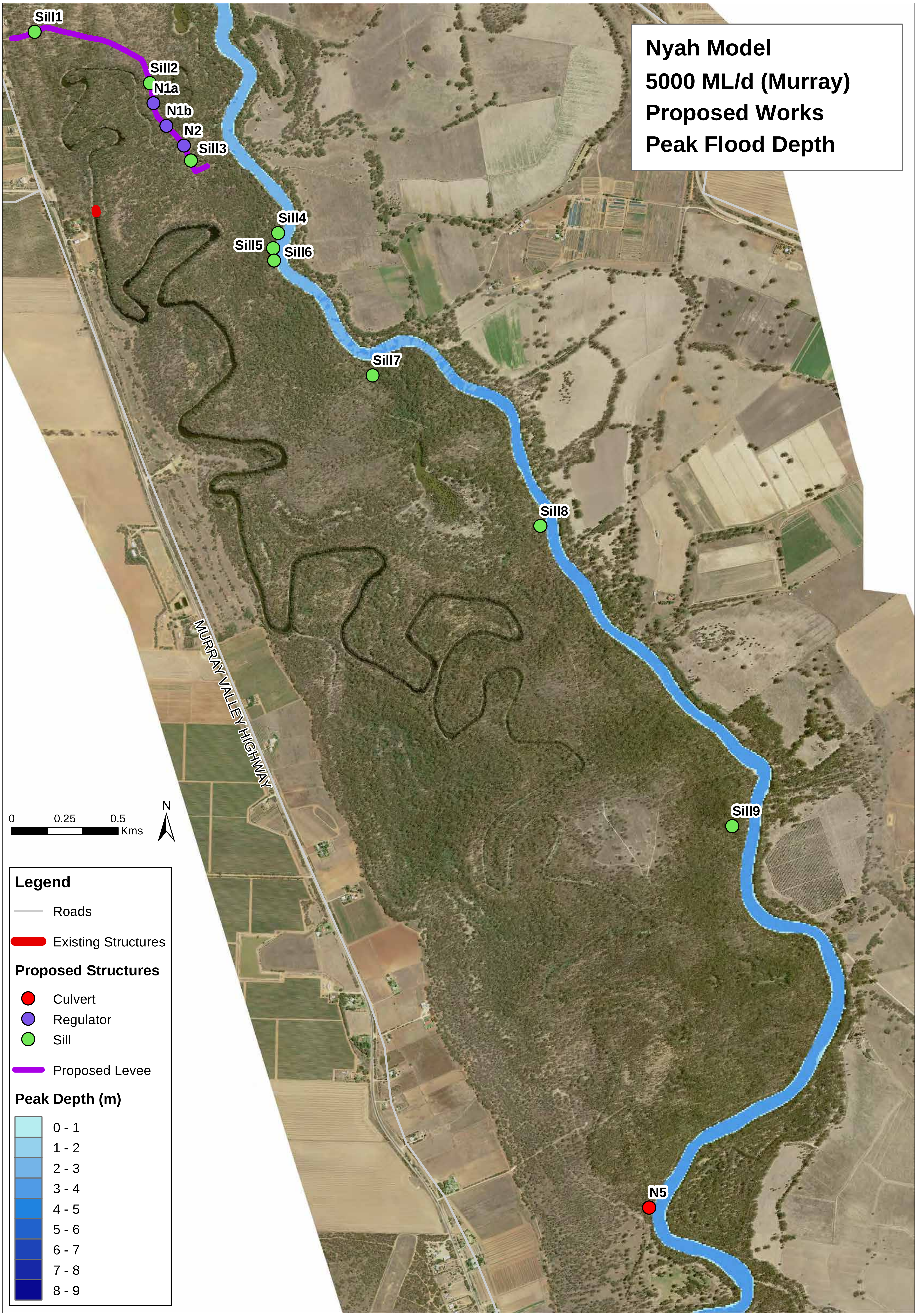
Nyah Forest Floodplain
RiMFIM Predicted Flood Extent
27,500 ML/d Murray Flow
0
0.5
1
Kms
N



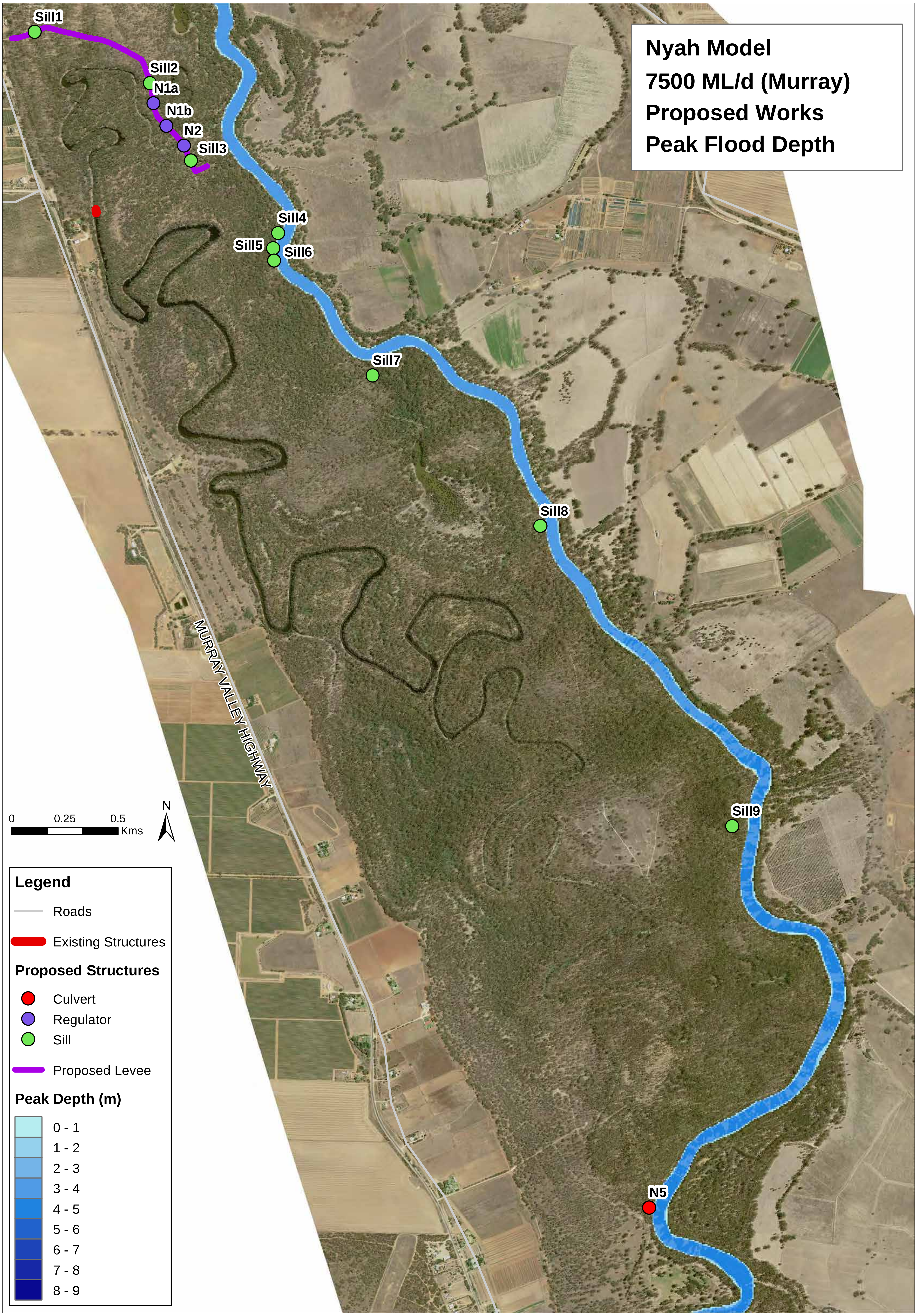
Existing Conditions Model
27,500 ML/d Murray Flow
Peak Depth (m)
Legend
RiMFiM Extent
27,500 ML/d
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

Appendix D. Proposed Works Peak Depth Plots

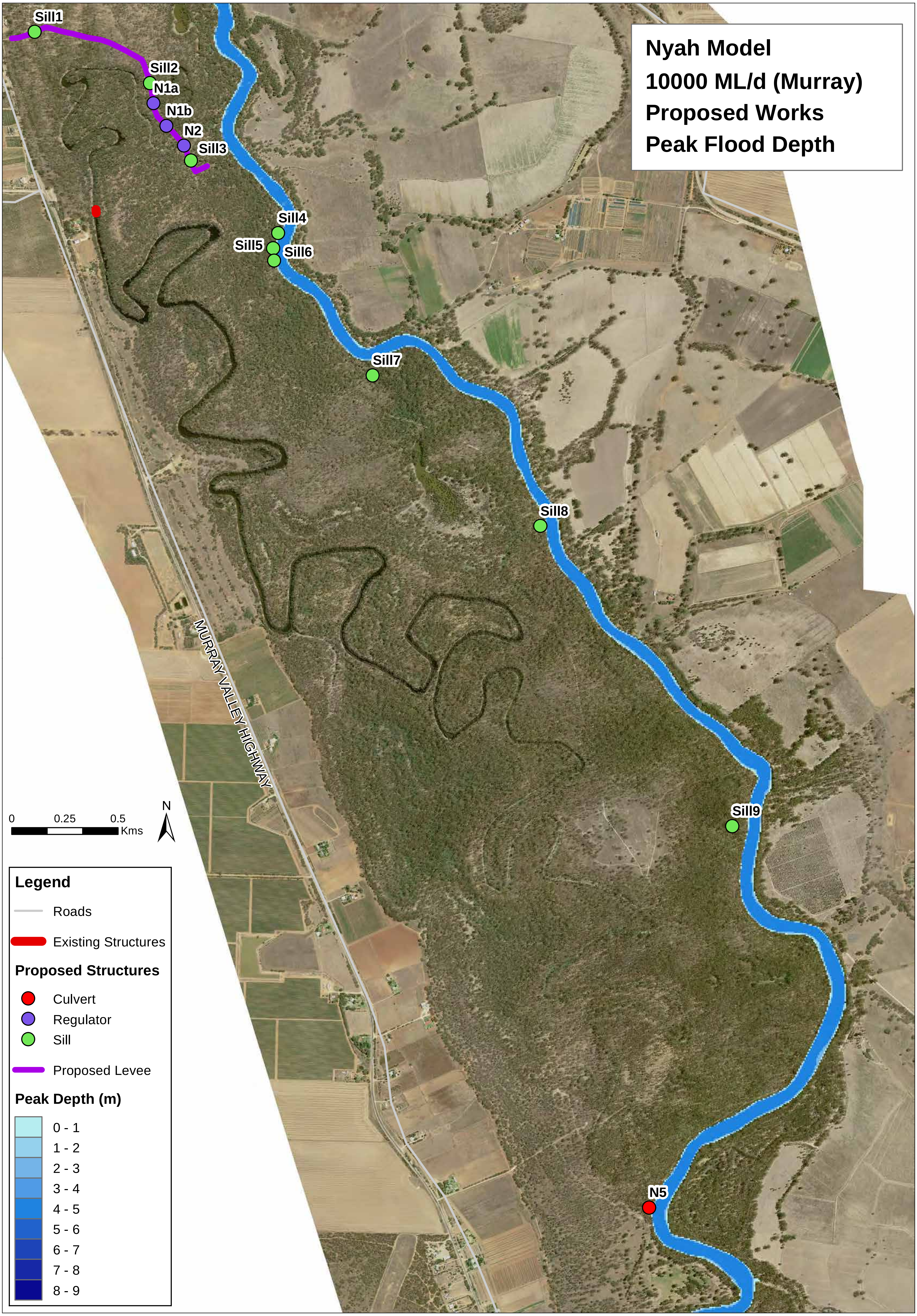

Nyah Model
2500 ML/d (Murray)
Proposed Works
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9



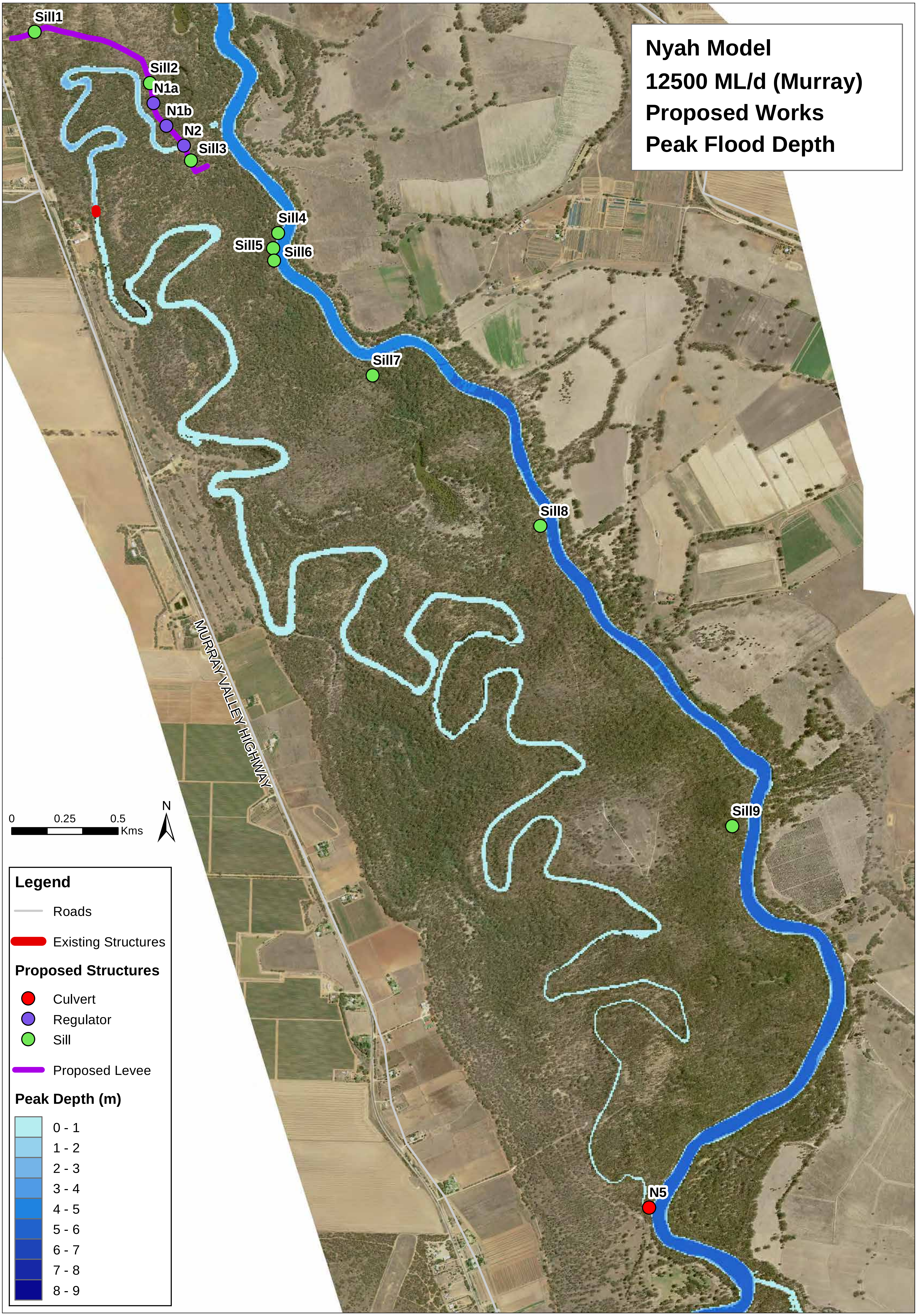
Nyah Model
5000 ML/d (Murray)
Proposed Works
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9



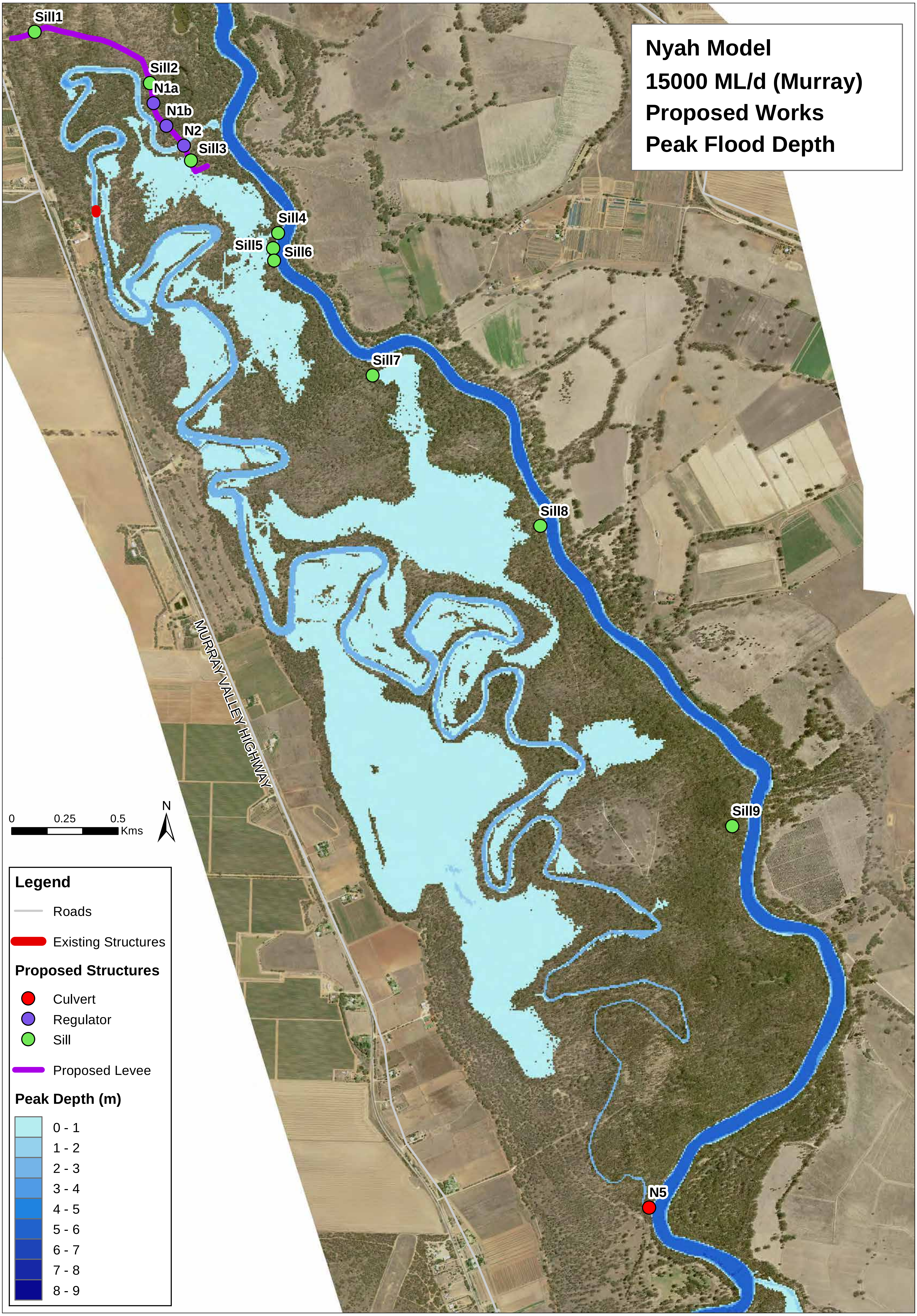
Nyah Model
7500 ML/d (Murray)
Proposed Works
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

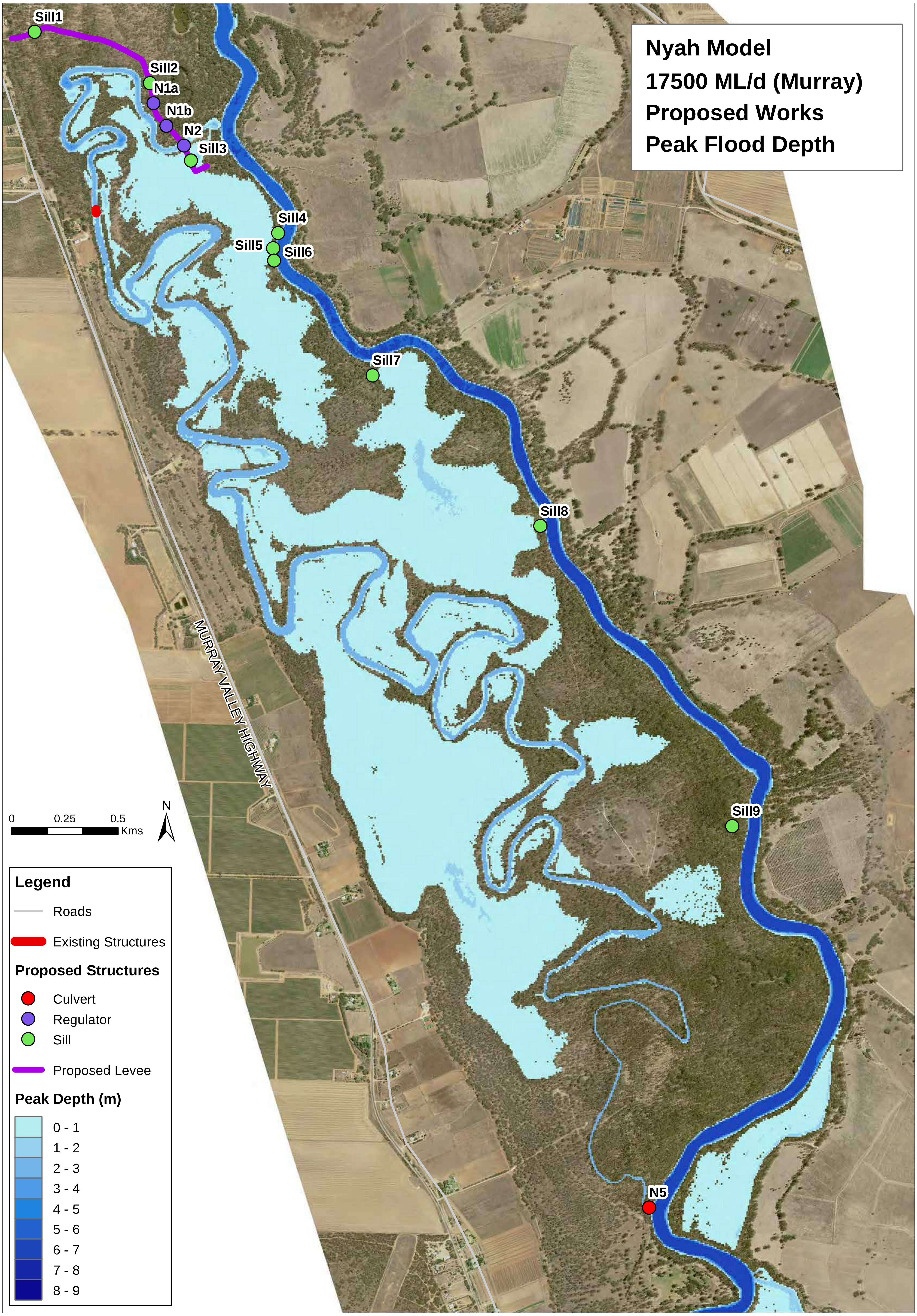


Nyah Model
10000 ML/d (Murray)
Proposed Works
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

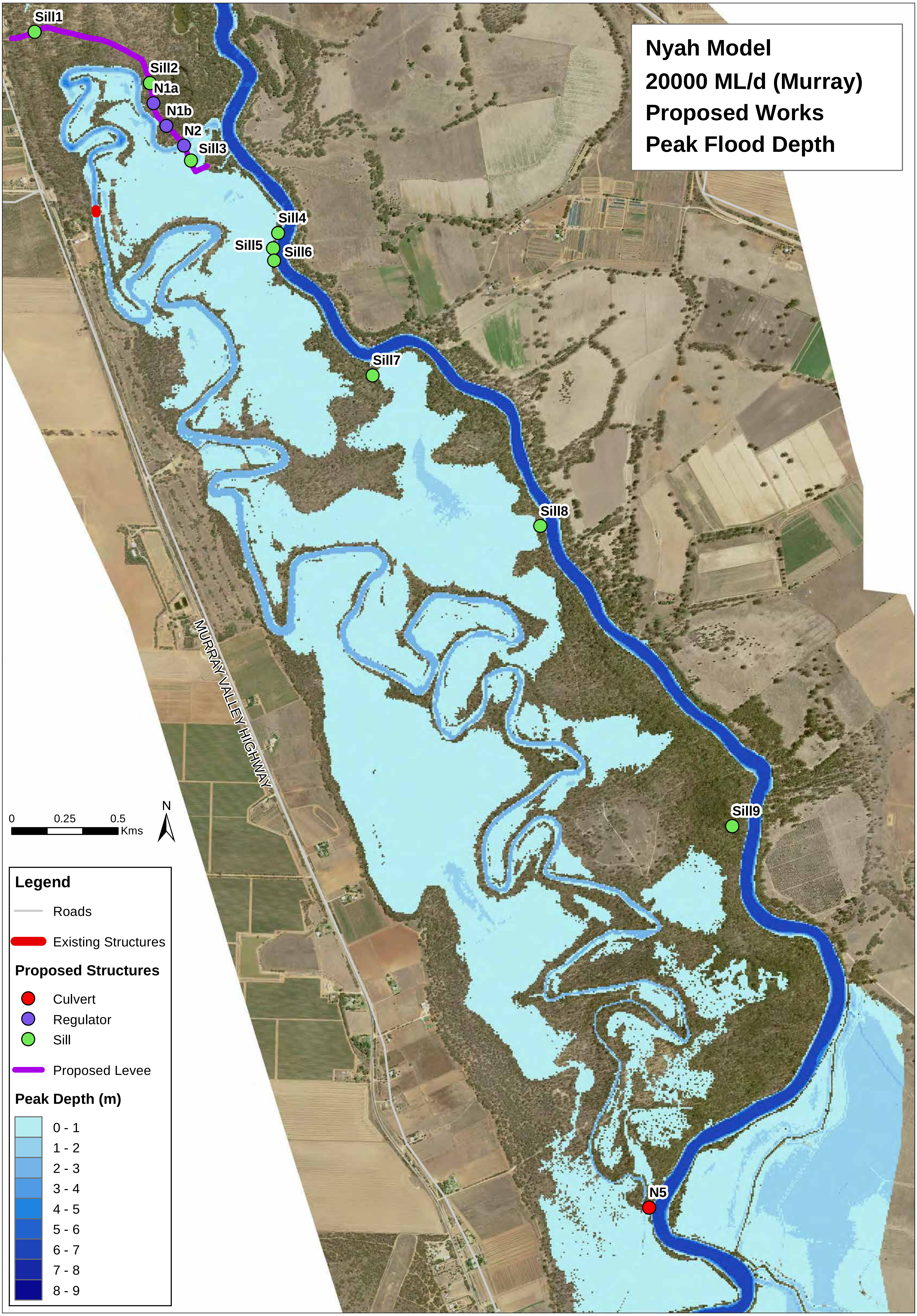


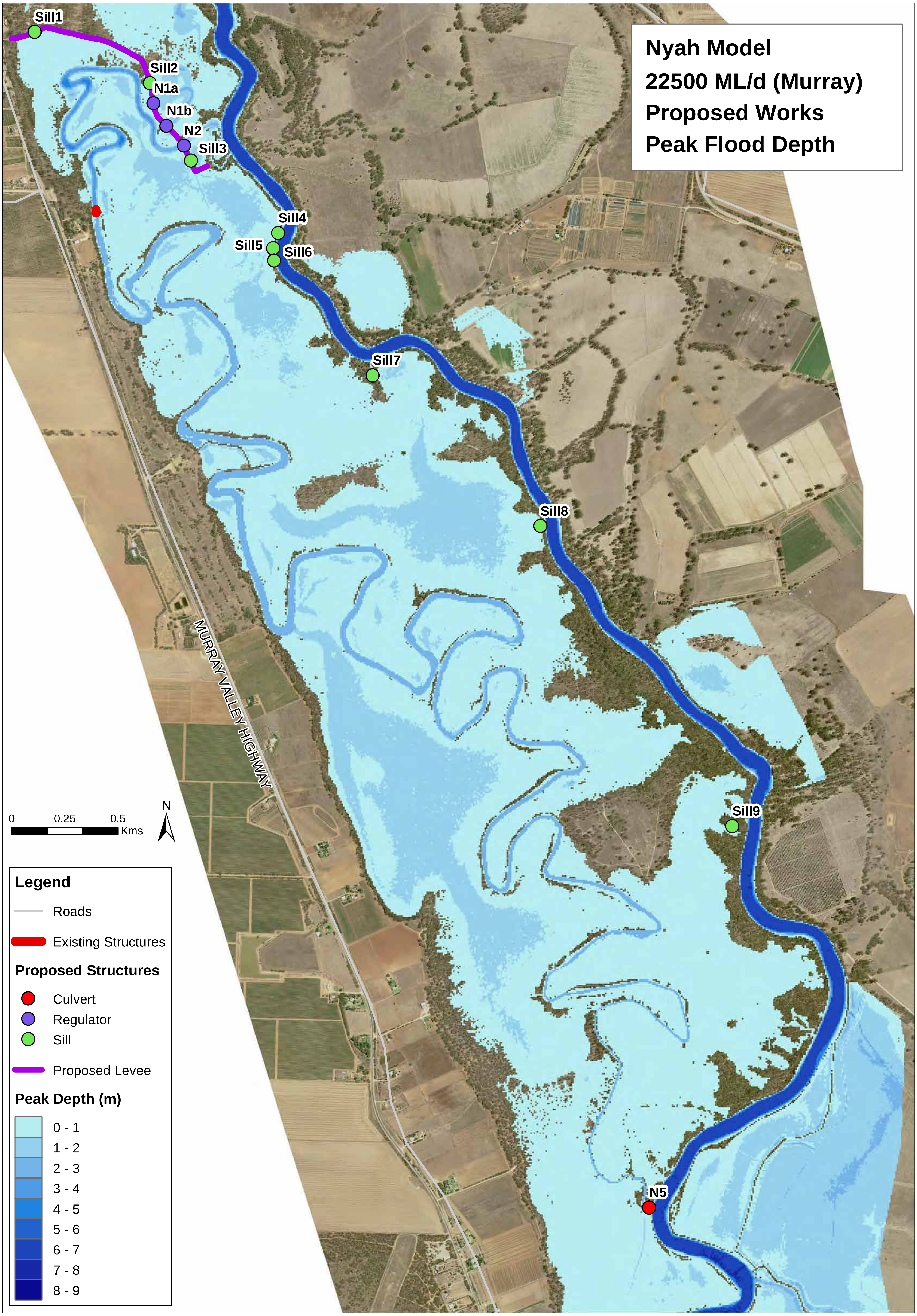
Nyah Model
12500 ML/d (Murray)
Proposed Works
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9


Nyah Model
15000 ML/d (Murray)
Proposed Works
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

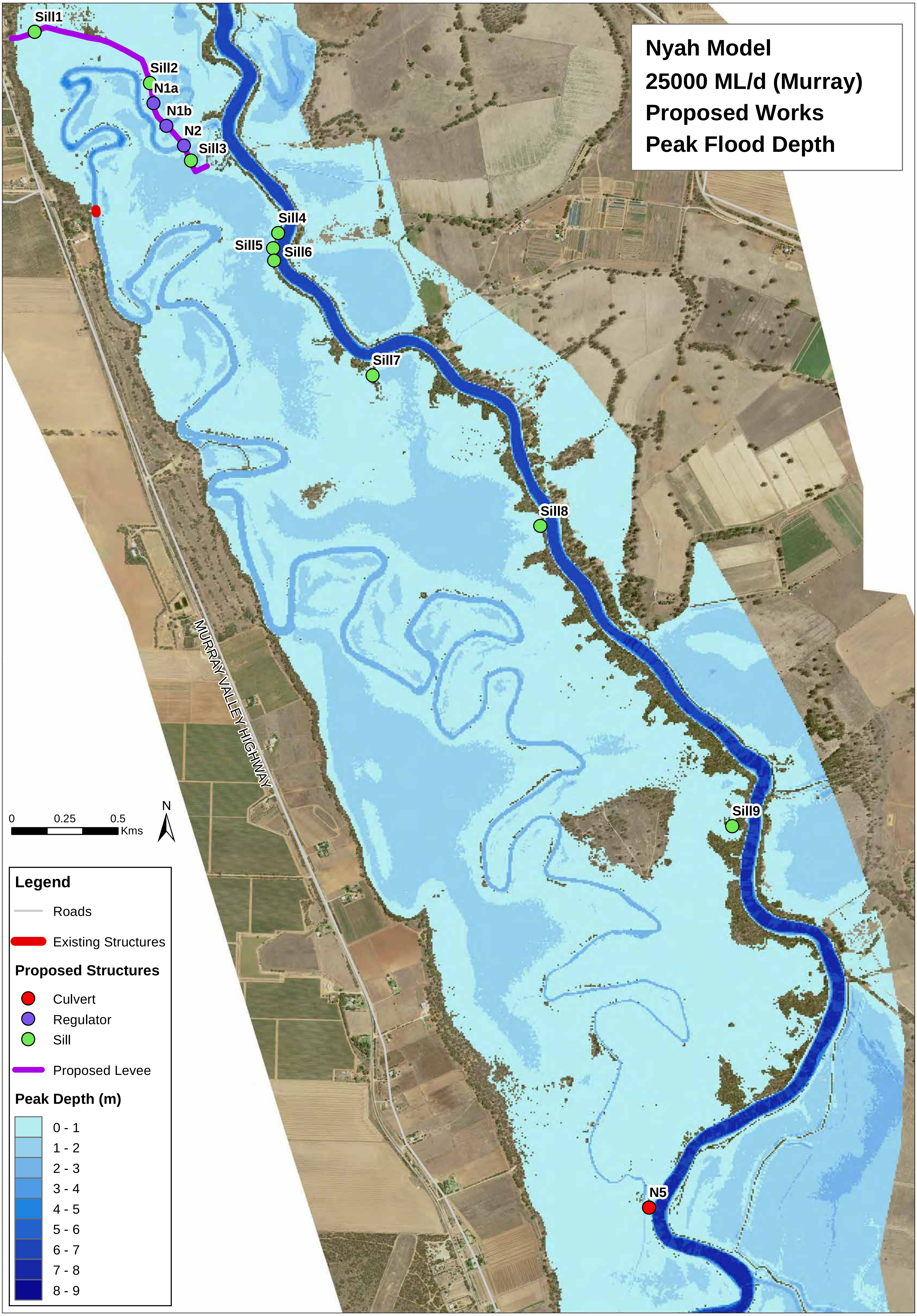


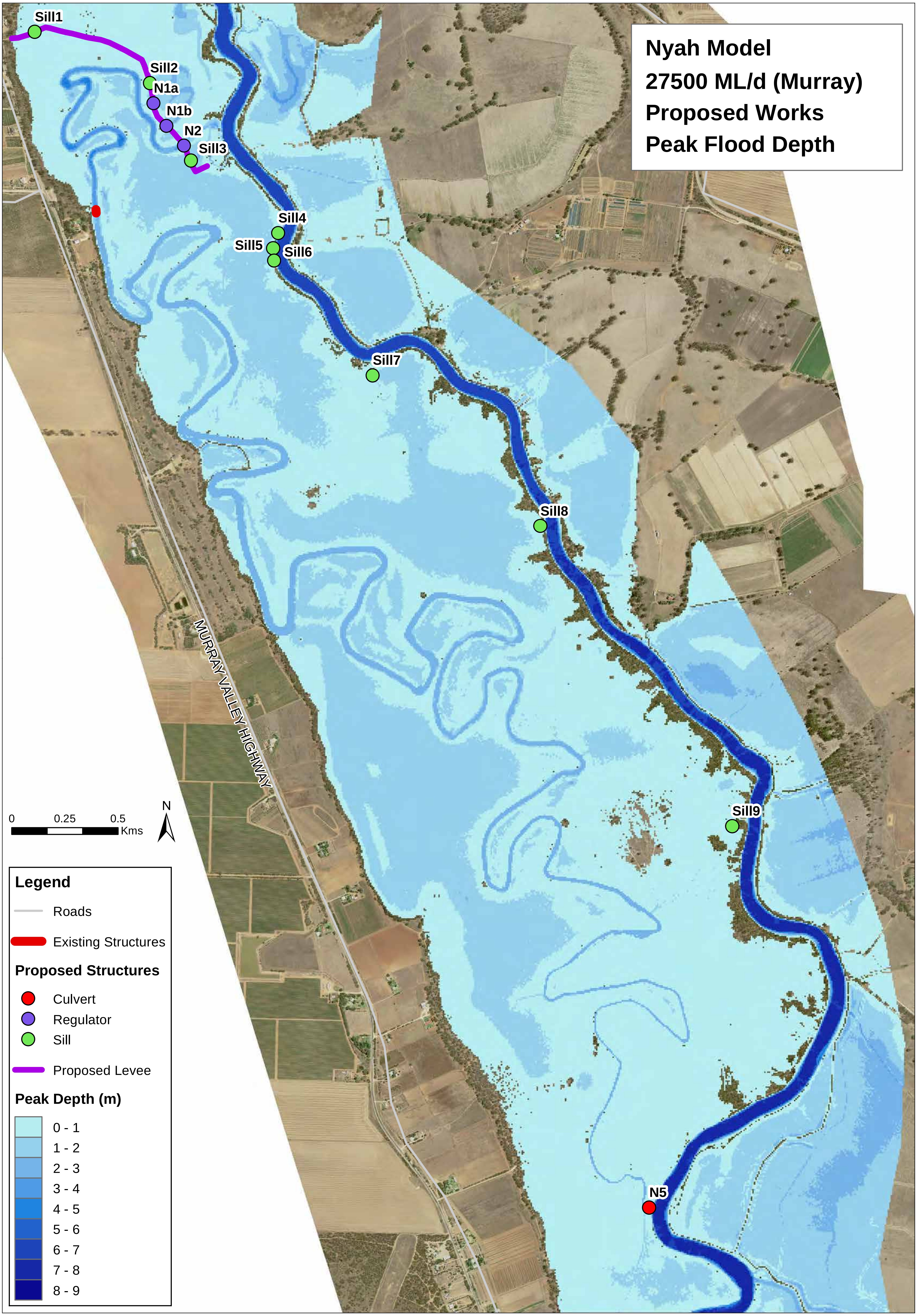
Nyah Model
17500 ML/d (Murray)
Proposed Works
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

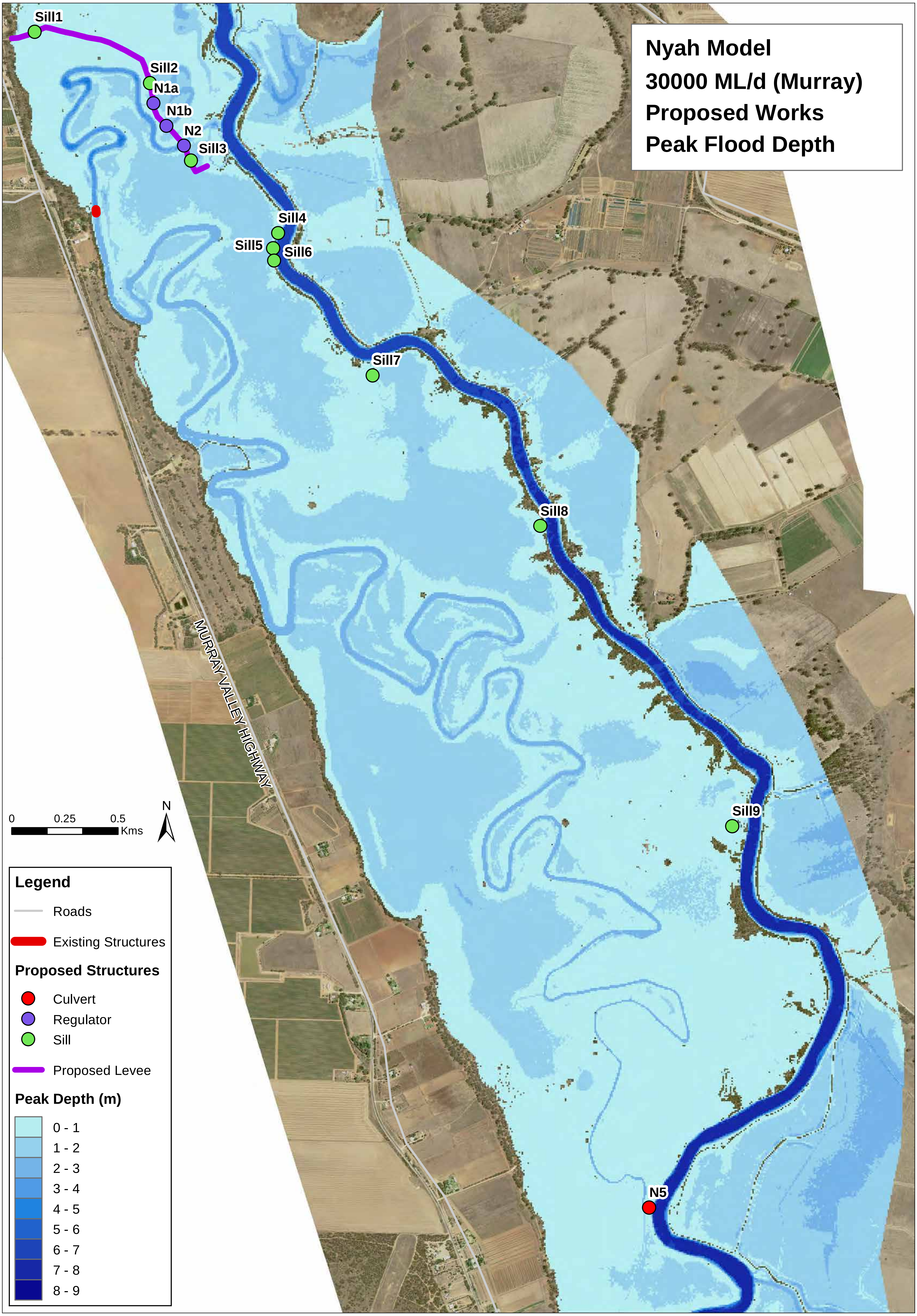

Nyah Model
20000 ML/d (Murray)
Proposed Works
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9



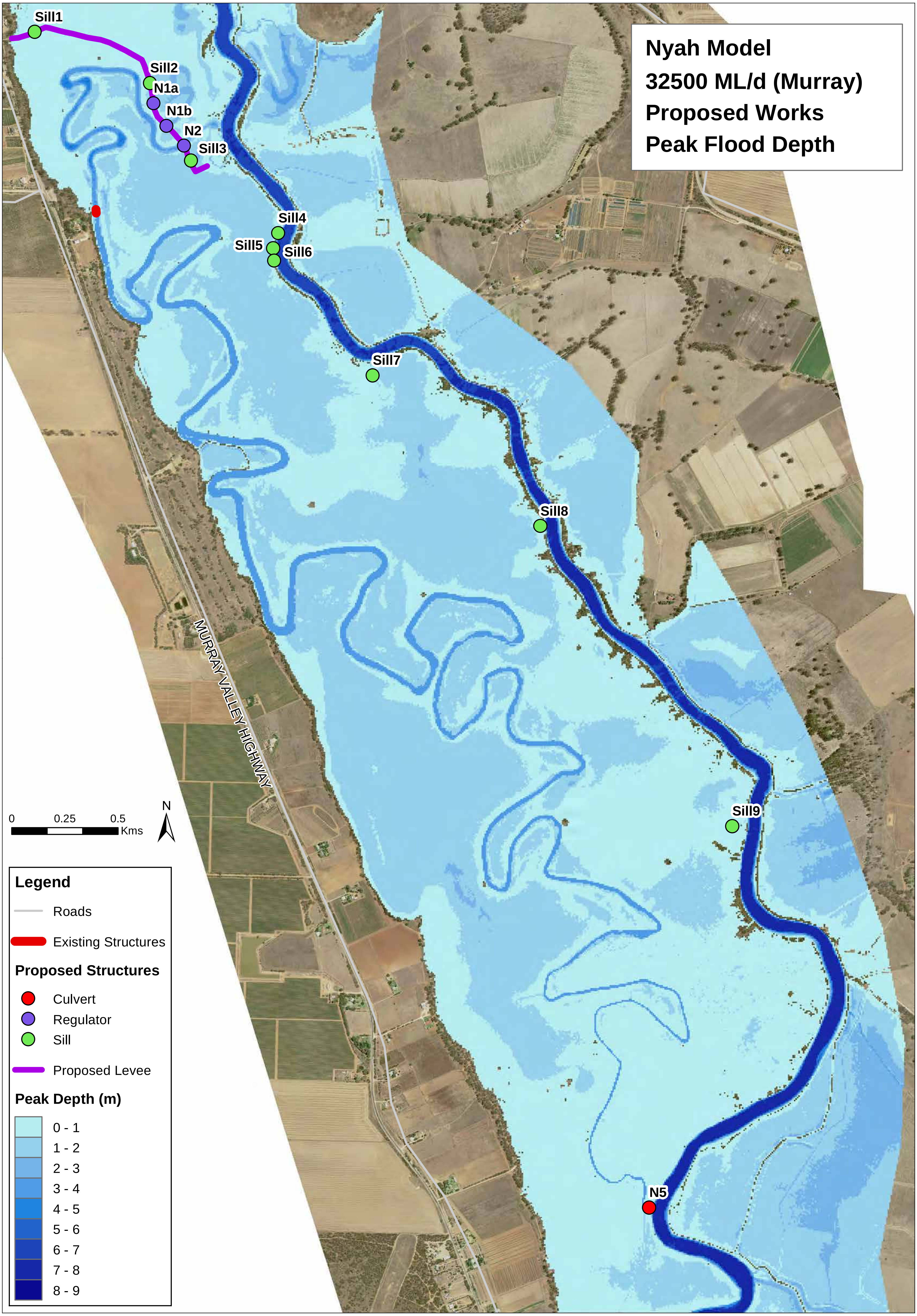
Nyah Model
22500 ML/d (Murray)
Proposed Works
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

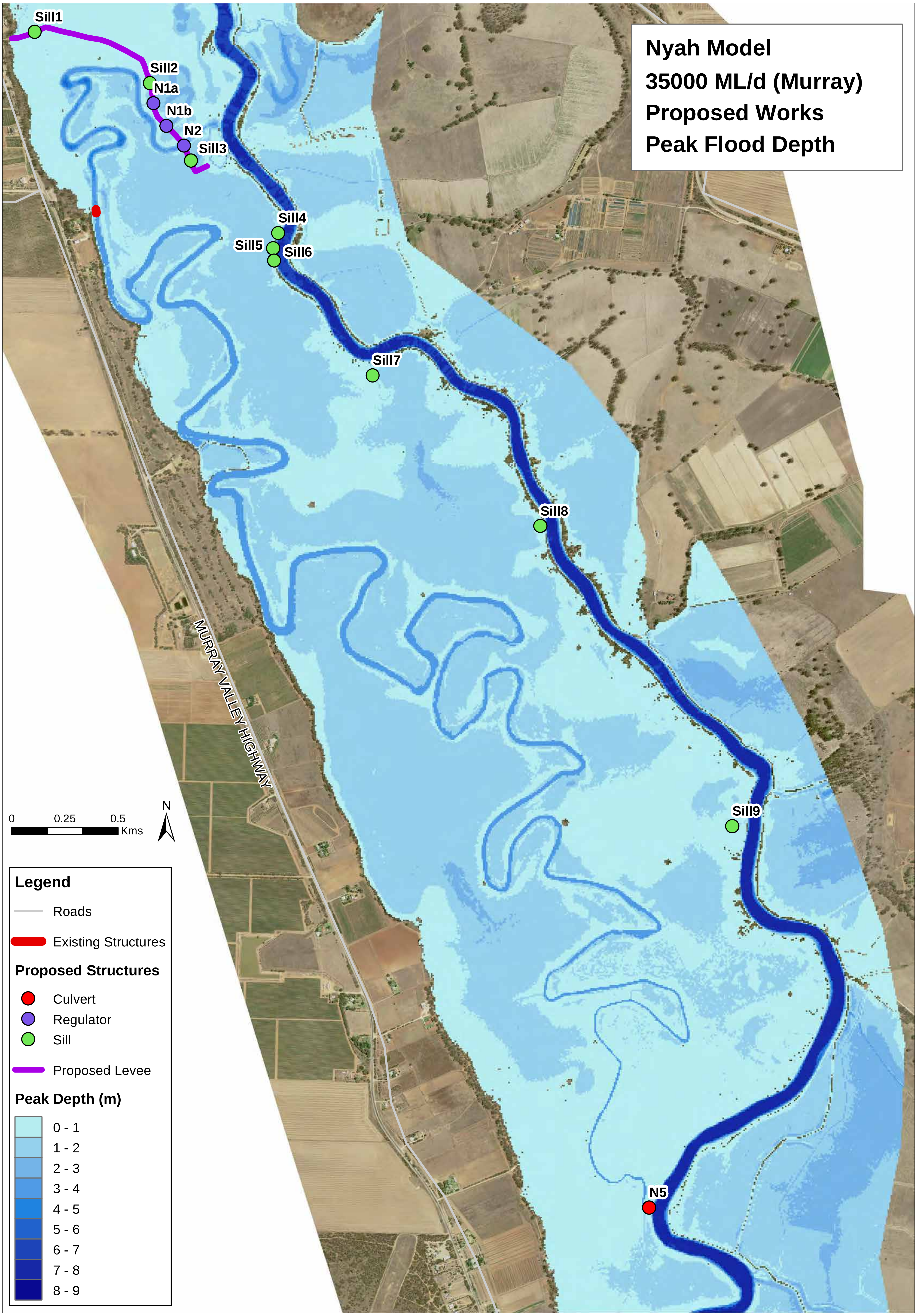

Nyah Model
25000 ML/d (Murray)
Proposed Works
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9


Nyah Model
27500 ML/d (Murray)
Proposed Works
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

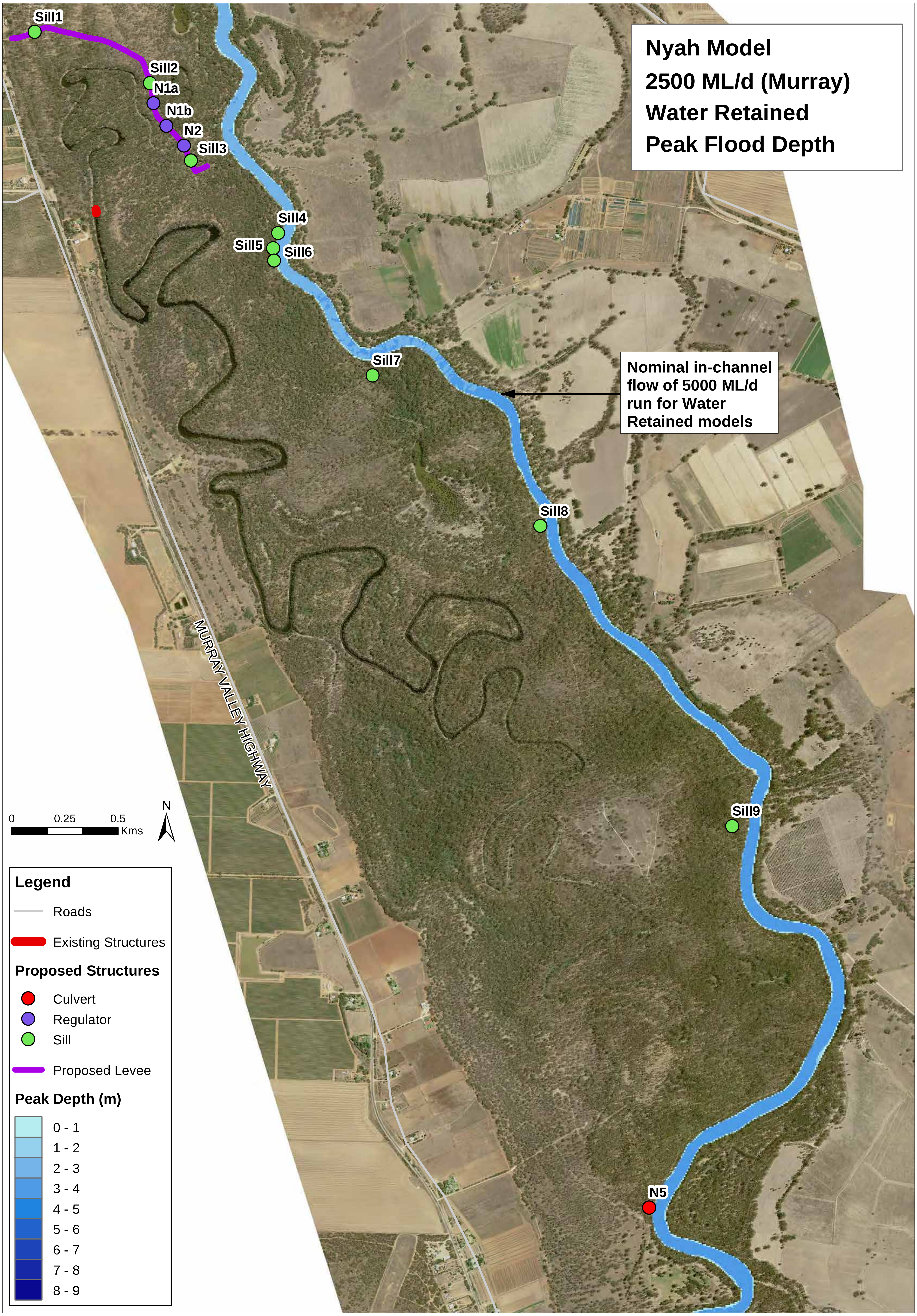


Nyah Model
30000 ML/d (Murray)
Proposed Works
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

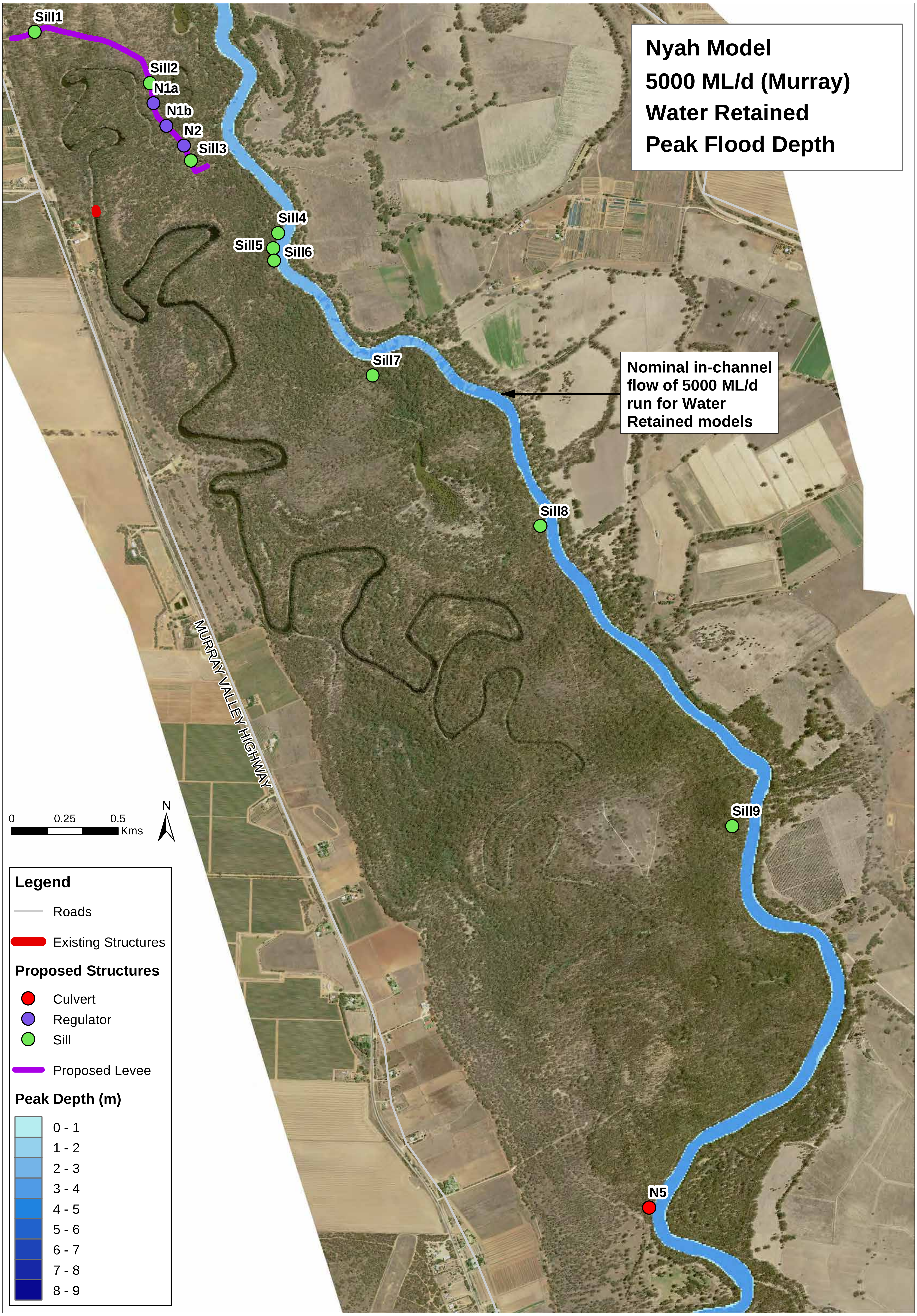

Nyah Model
32500 ML/d (Murray)
Proposed Works
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

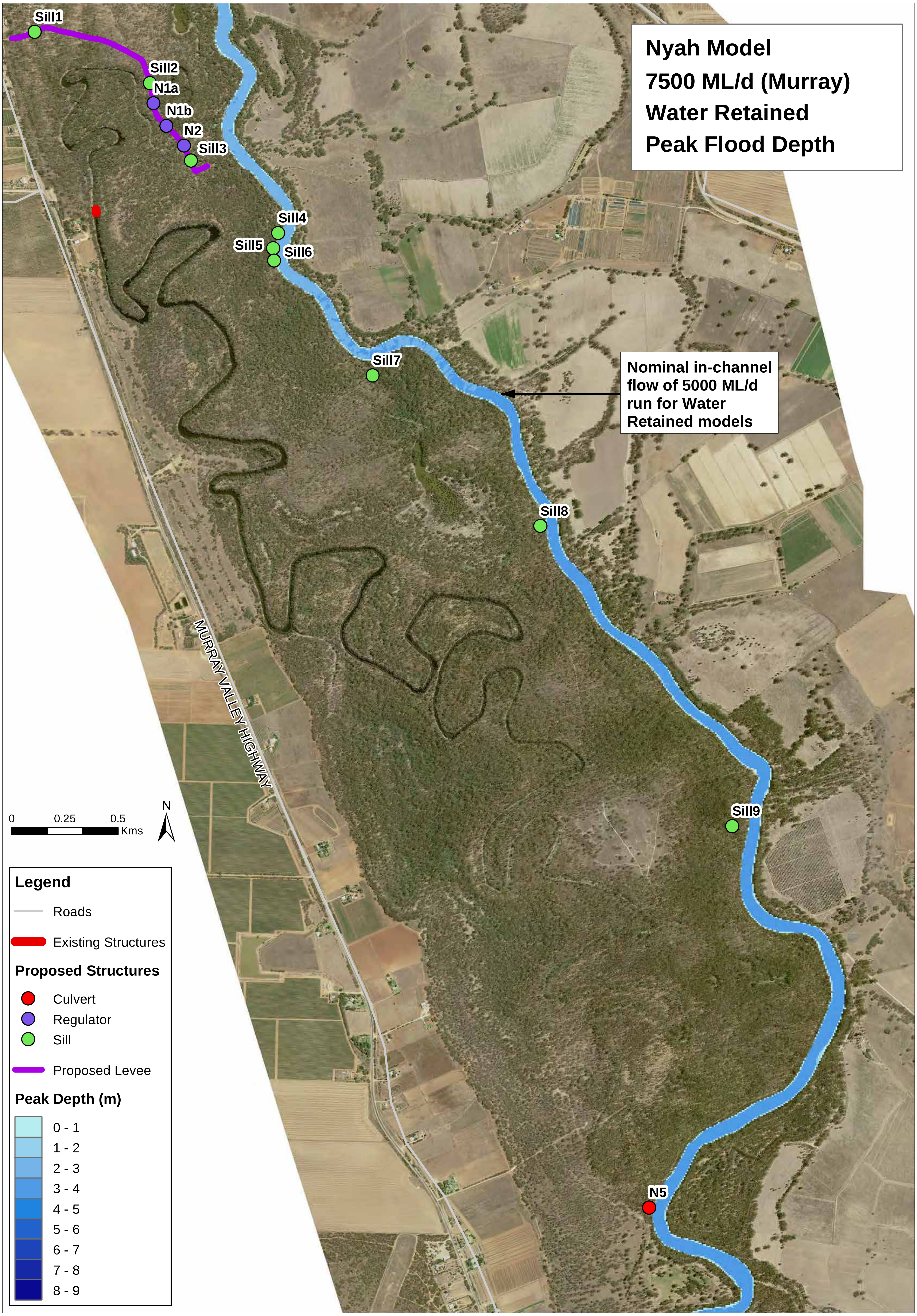

Nyah Model
35000 ML/d (Murray)
Proposed Works
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

Appendix E. Water Retained Peak Depth Plots

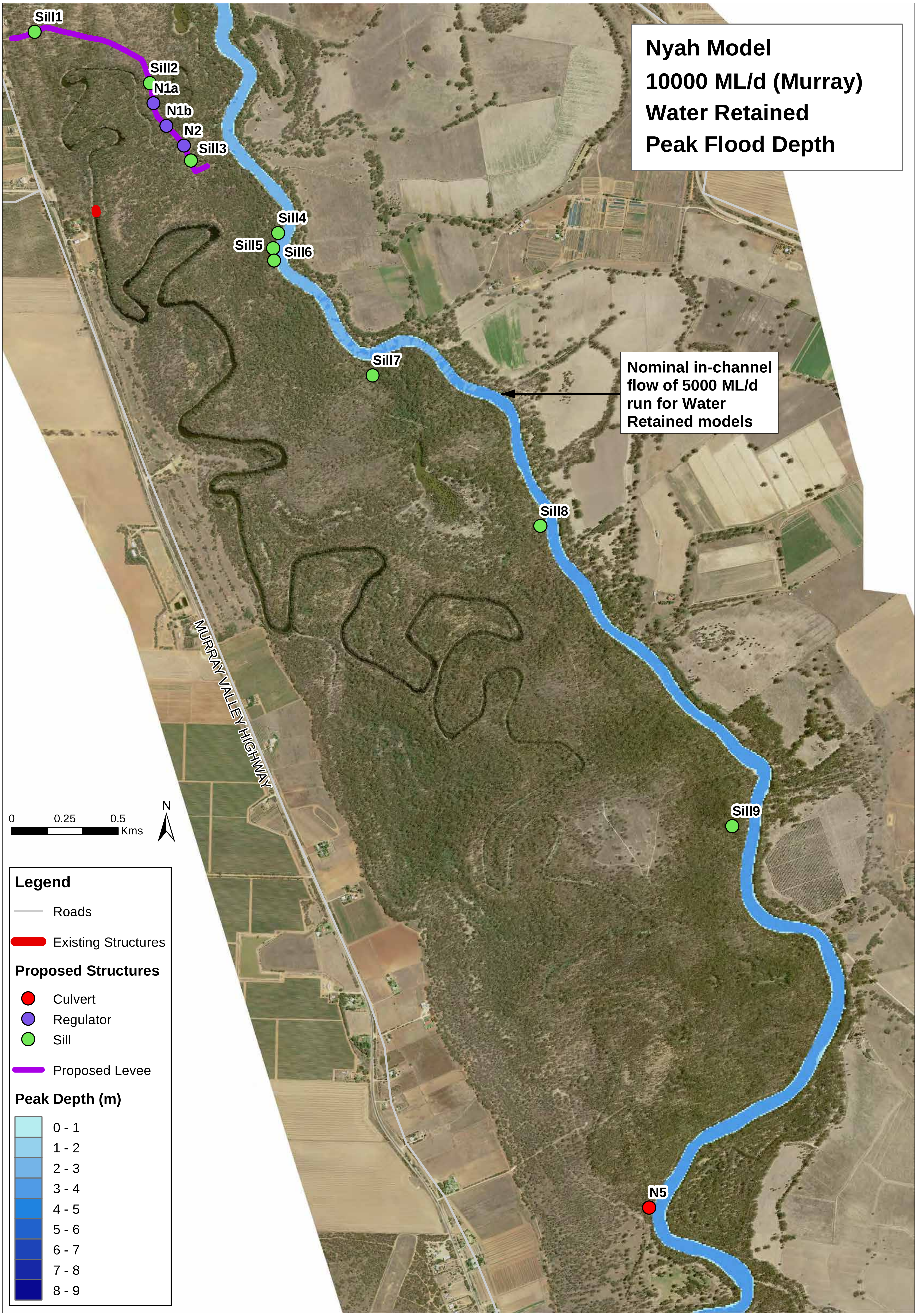


Nyah Model
2500 ML/d (Murray)
Water Retained
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
Nominal in-channel flow of 5000 ML/d run for Water Retained models
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

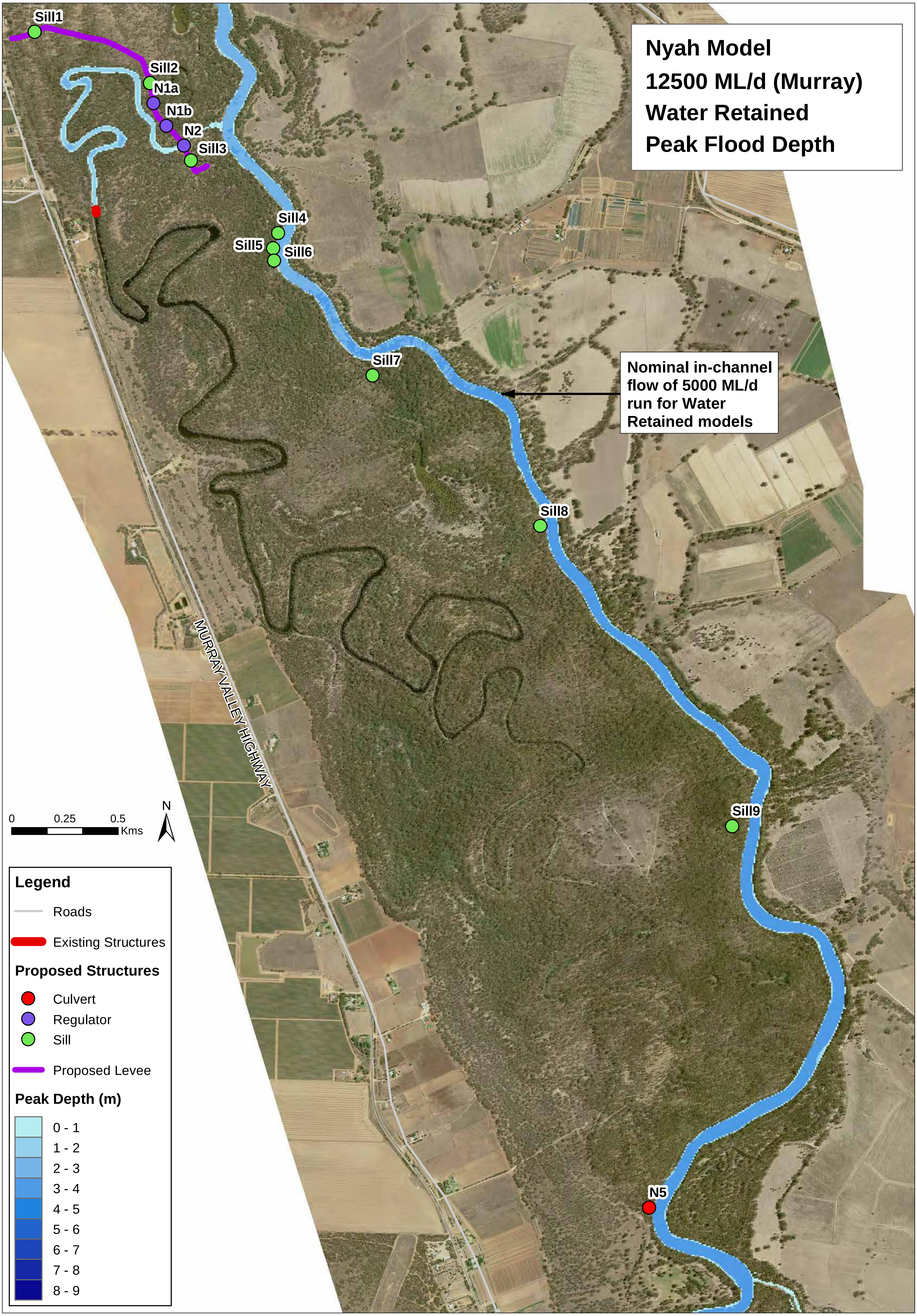

Nyah Model
5000 ML/d (Murray)
Water Retained
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Nominal in-channel flow of 5000 ML/d run for Water Retained models
Sill8
MURRAY VALLEY HIGHWAY
Sill9
N5
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9



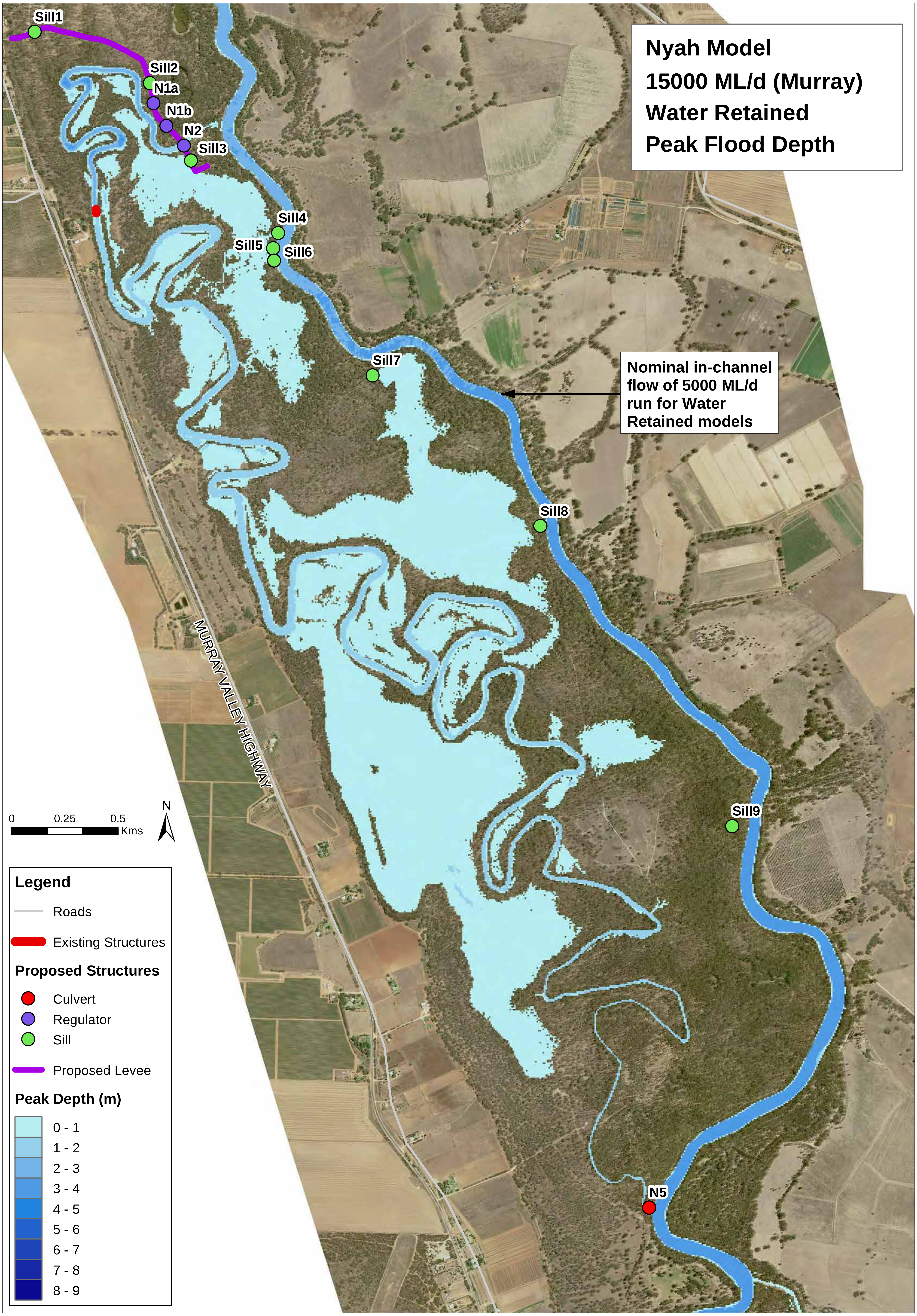
Nyah Model
7500 ML/d (Murray)
Water Retained
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
Nominal in-channel flow of 5000 ML/d run for Water Retained models
MURRAY VALLEY HIGHWAY
0 0.25 0.5 Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9



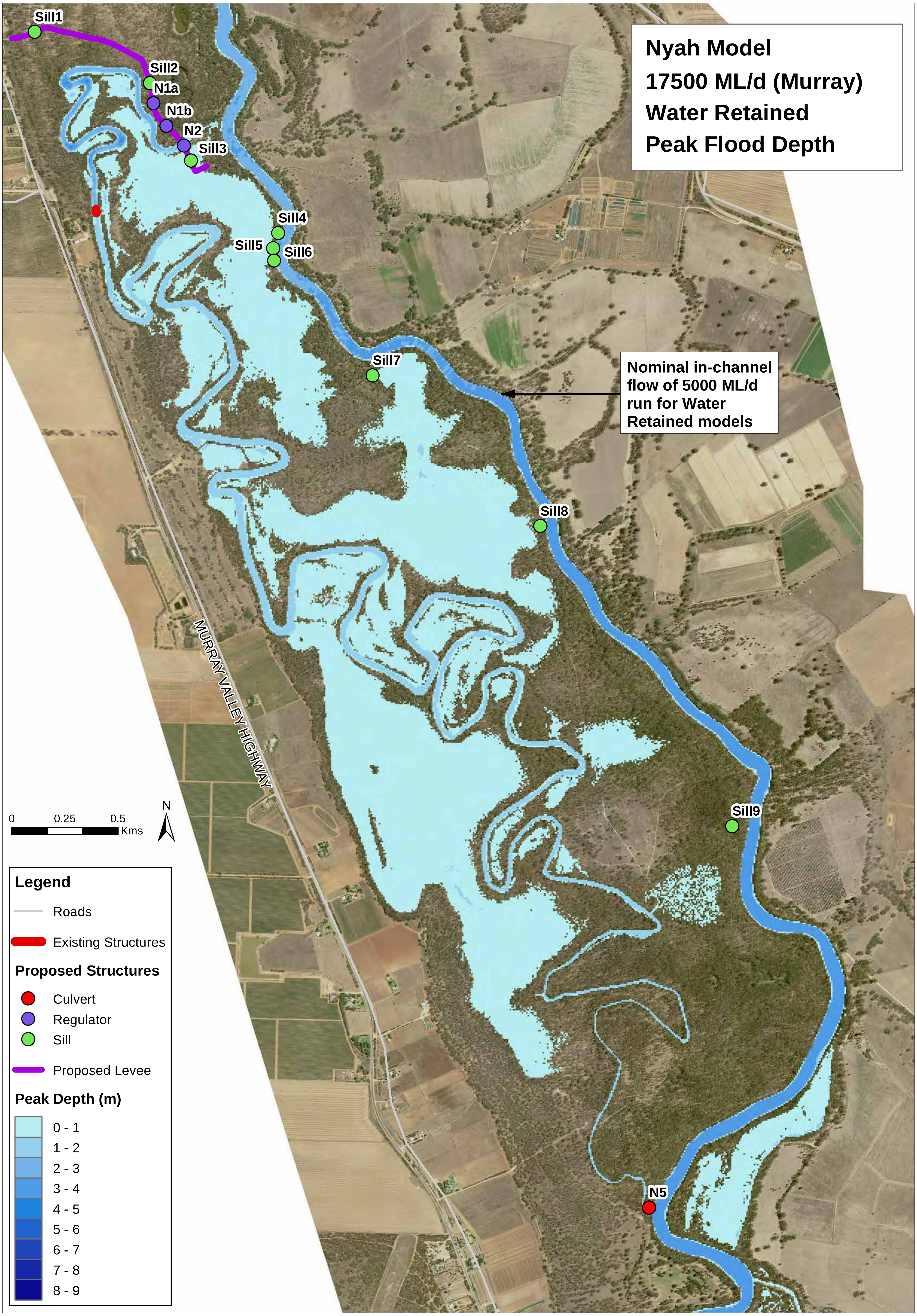
Nyah Model
10000 ML/d (Murray)
Water Retained
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
Nominal in-channel flow of 5000 ML/d run for Water Retained models
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9



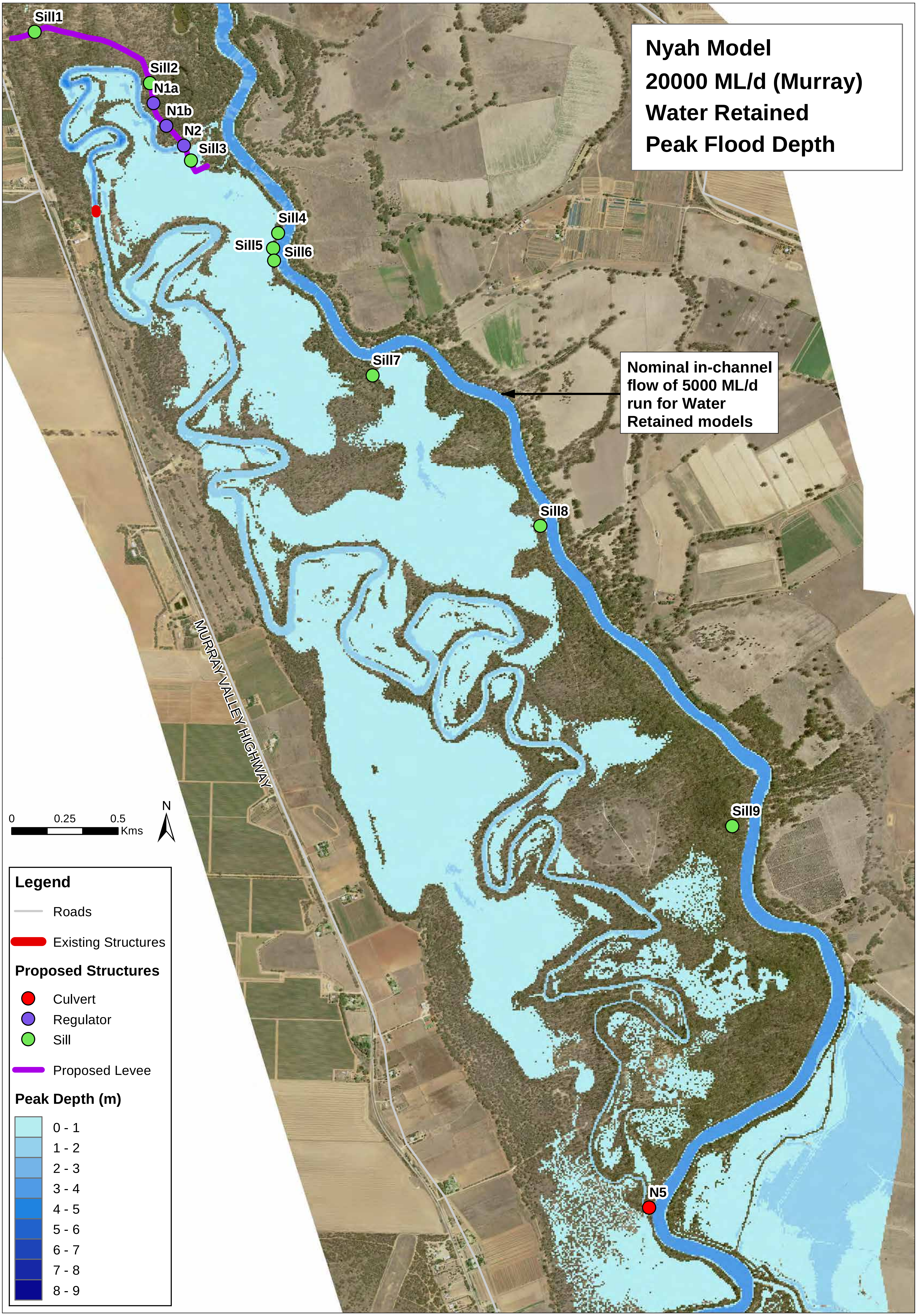
Nyah Model
12500 ML/d (Murray)
Water Retained
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Nominal in-channel flow of 5000 ML/d run for Water Retained models
Sill8
MURRAY VALLEY HIGHWAY
Sill9
N5
0 0.25 0.5 Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

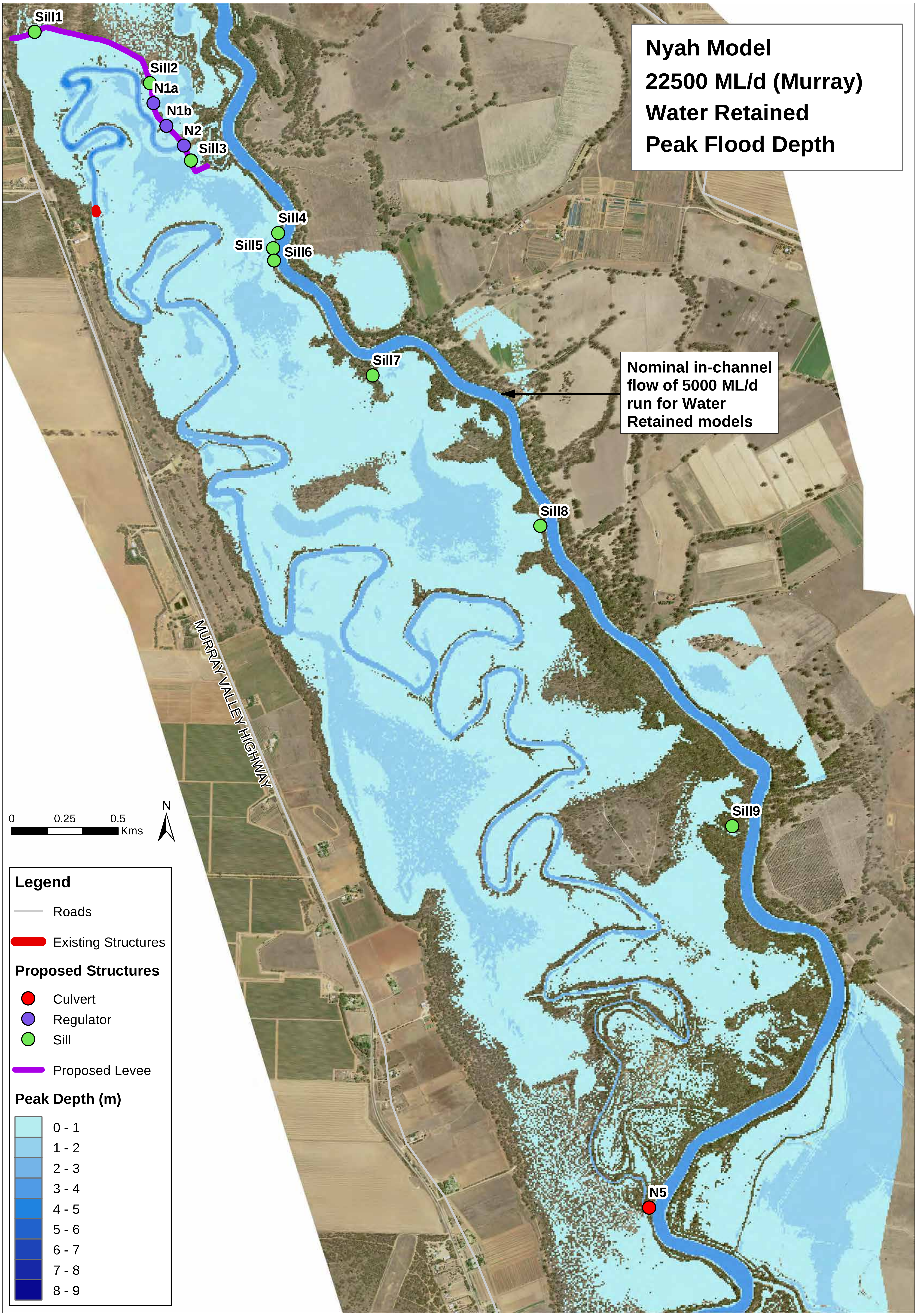


Nyah Model
15000 ML/d (Murray)
Water Retained
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
Nominal in-channel flow of 5000 ML/d run for Water Retained models
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

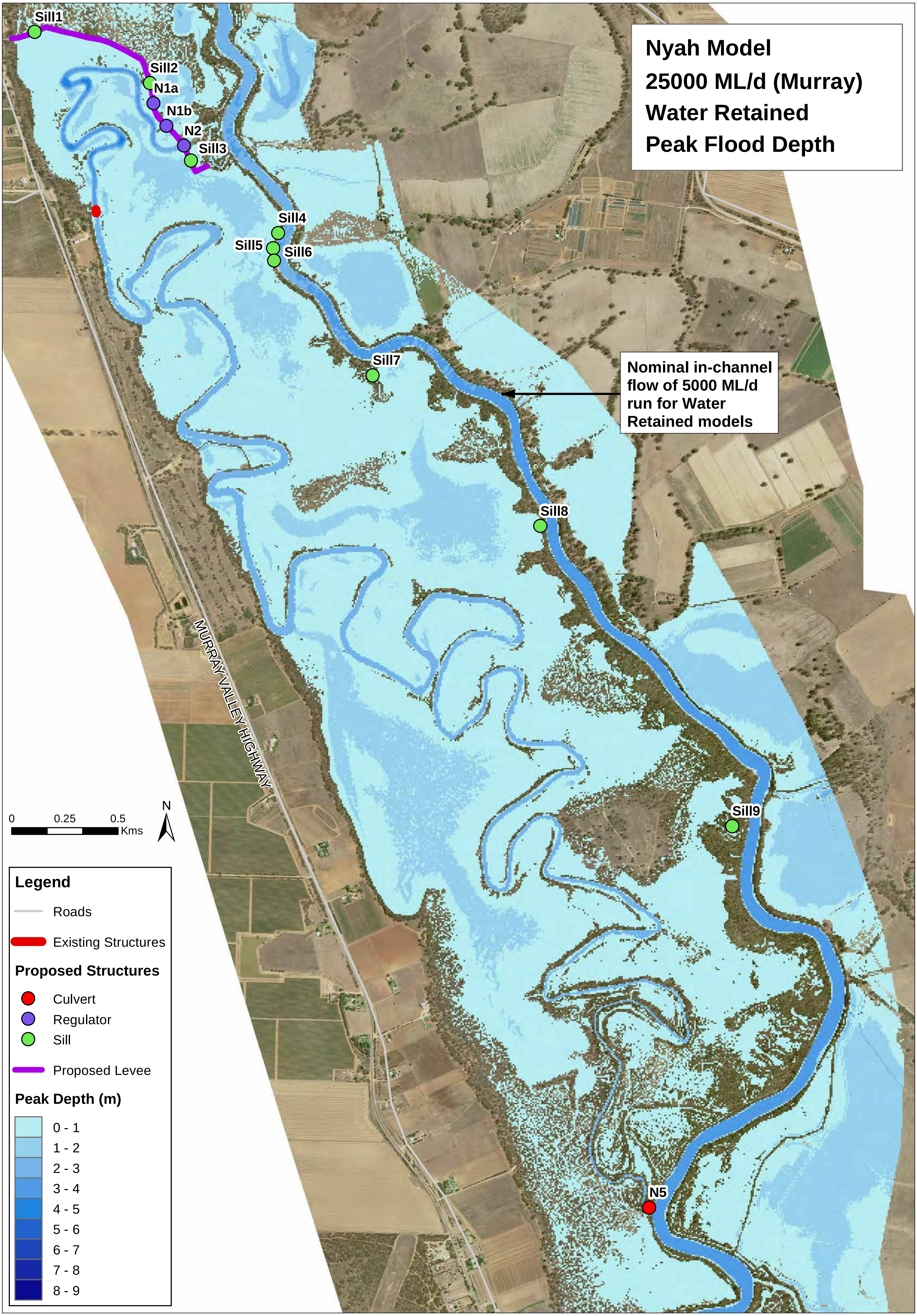


Nyah Model
17500 ML/d (Murray)
Water Retained
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
Nominal in-channel flow of 5000 ML/d run for Water Retained models
MURRAY VALLEY HIGHWAY
0 0.25 0.5 Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

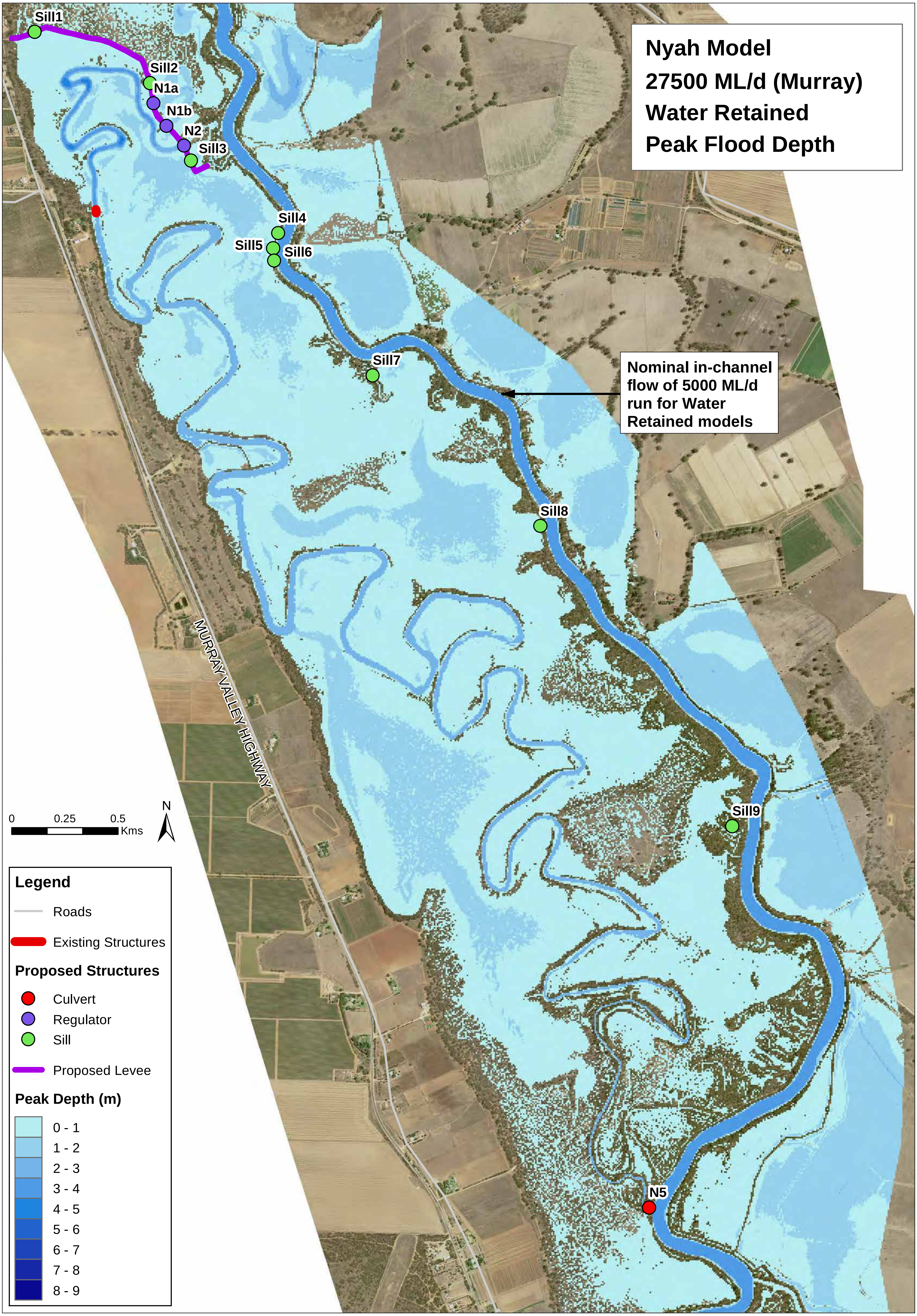

Nyah Model
20000 ML/d (Murray)
Water Retained
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
Nominal in-channel flow of 5000 ML/d run for Water Retained models
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9



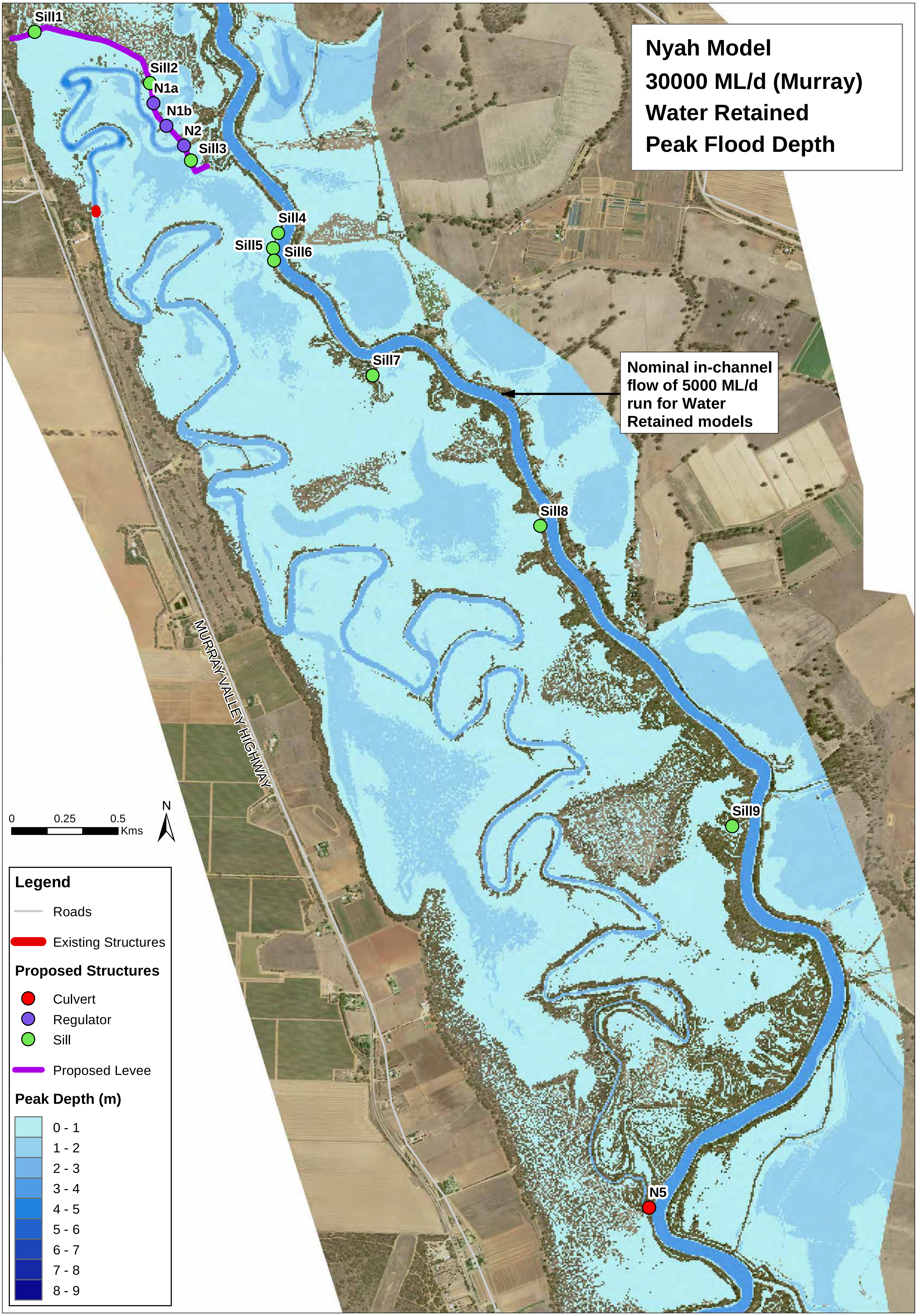
Nyah Model
22500 ML/d (Murray)
Water Retained
Peak Flood Depth
Nominal in-channel flow of 5000 ML/d run for Water Retained models
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0 0.25 0.5 Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

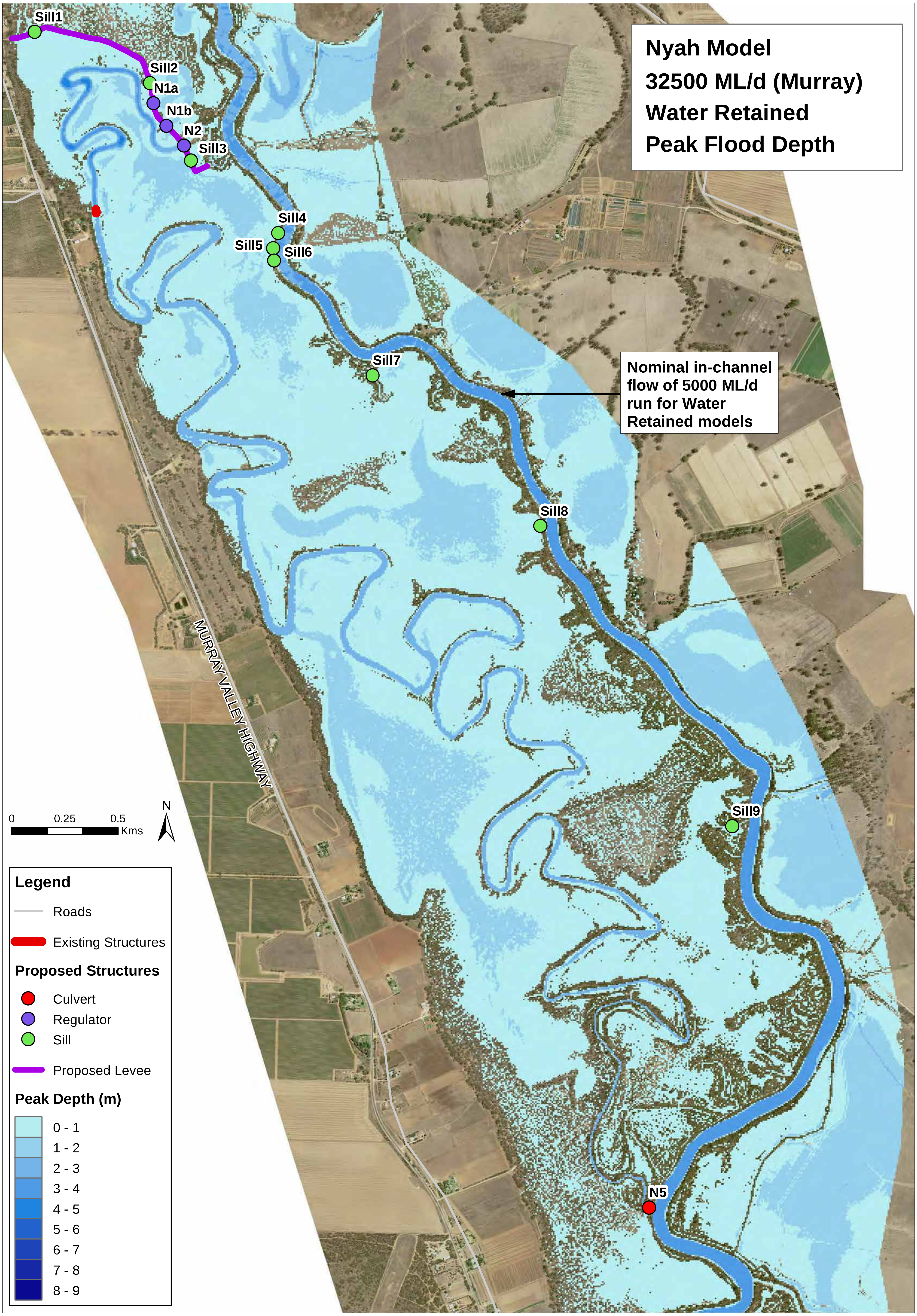


Nyah Model
25000 ML/d (Murray)
Water Retained
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
Nominal in-channel flow of 5000 ML/d run for Water Retained models
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

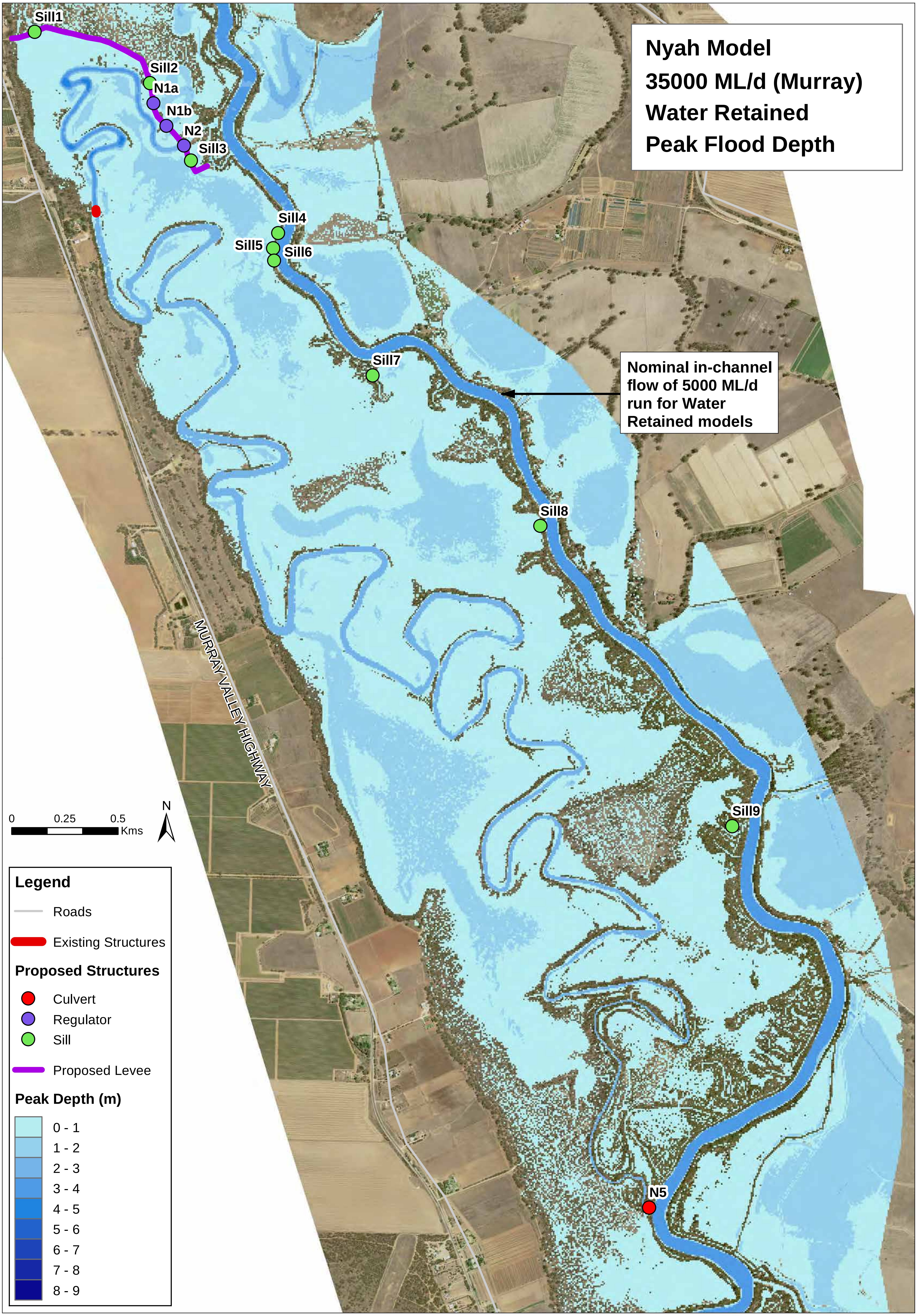


Nyah Model
27500 ML/d (Murray)
Water Retained
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
Nominal in-channel flow of 5000 ML/d run for Water Retained models
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9


Nyah Model
30000 ML/d (Murray)
Water Retained
Peak Flood Depth
Nominal in-channel flow of 5000 ML/d run for Water Retained models
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

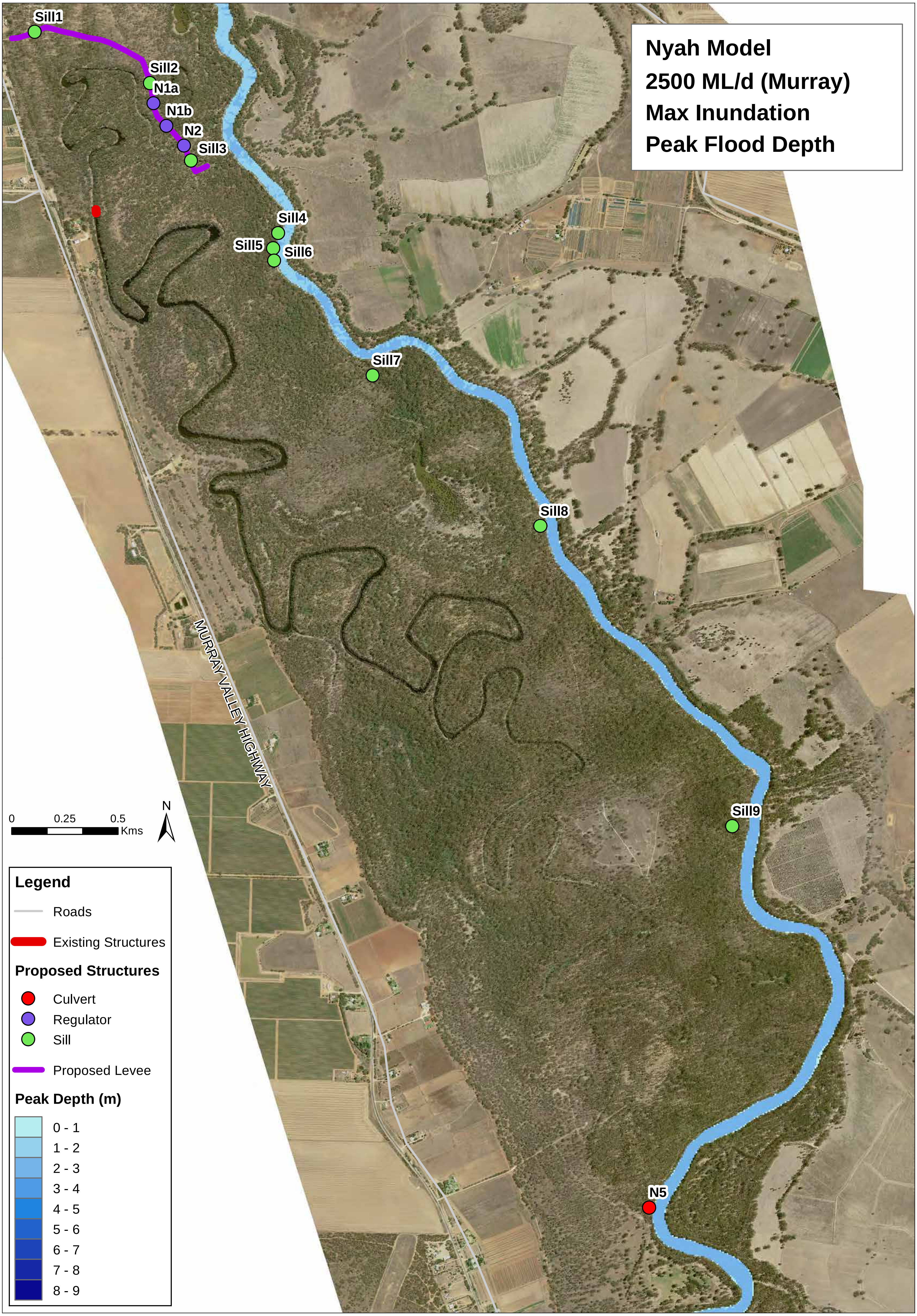


Nyah Model
32500 ML/d (Murray)
Water Retained
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
Nominal in-channel flow of 5000 ML/d run for Water Retained models
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

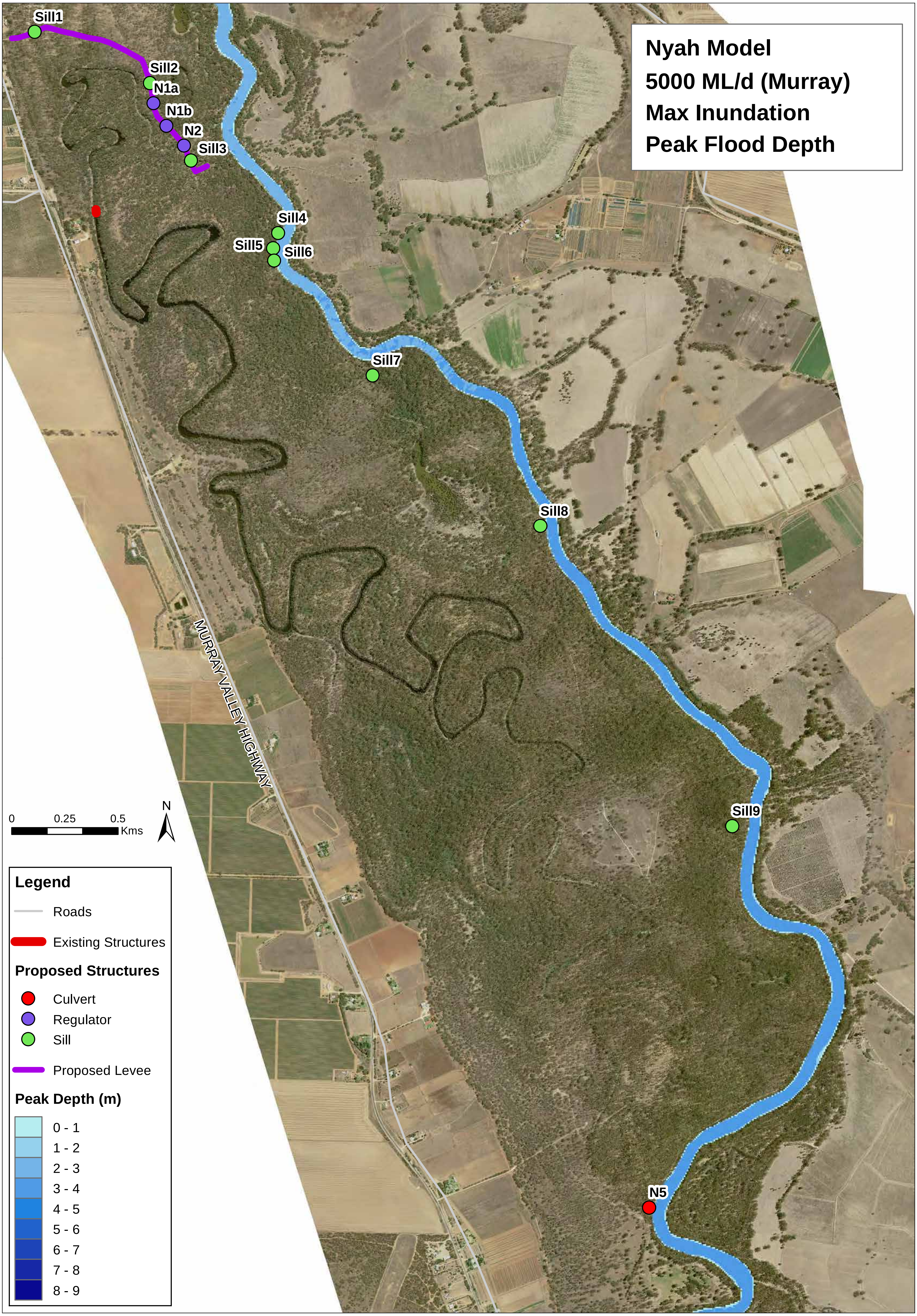


Nyah Model
35000 ML/d (Murray)
Water Retained
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
Nominal in-channel flow of 5000 ML/d run for Water Retained models
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

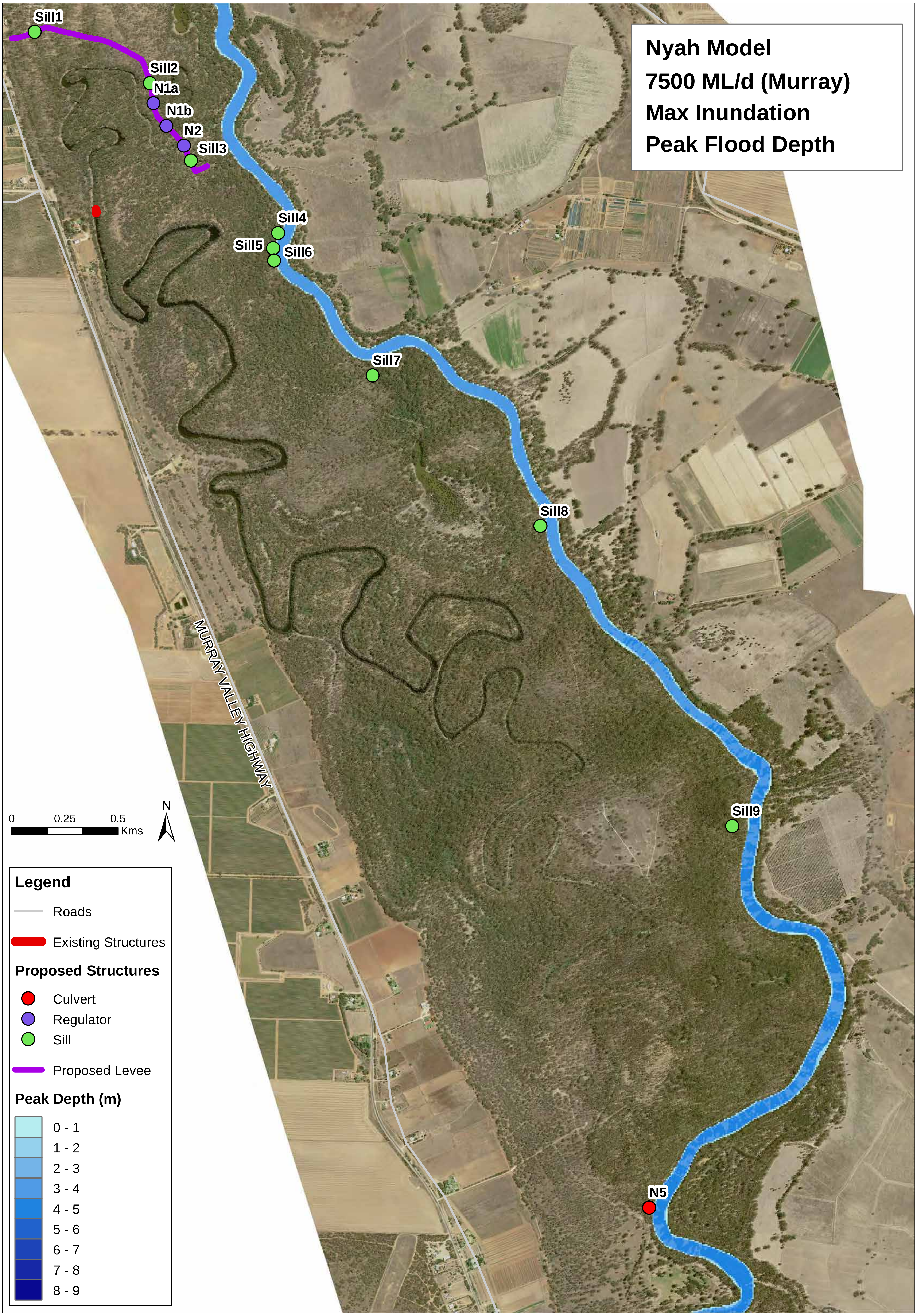
Appendix F. Maximum Inundation Peak Depth Plots



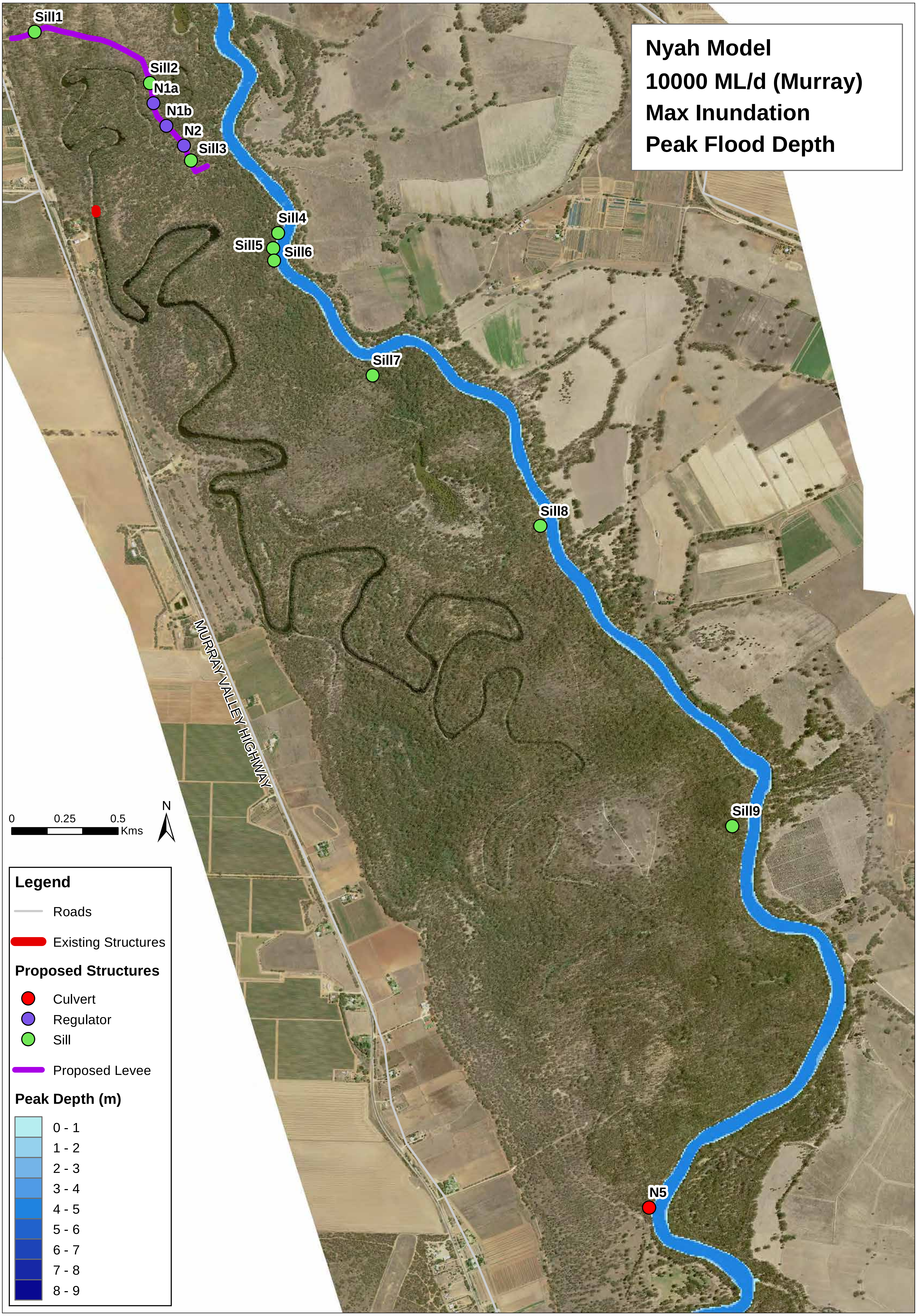
Nyah Model
2500 ML/d (Murray)
Max Inundation
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9



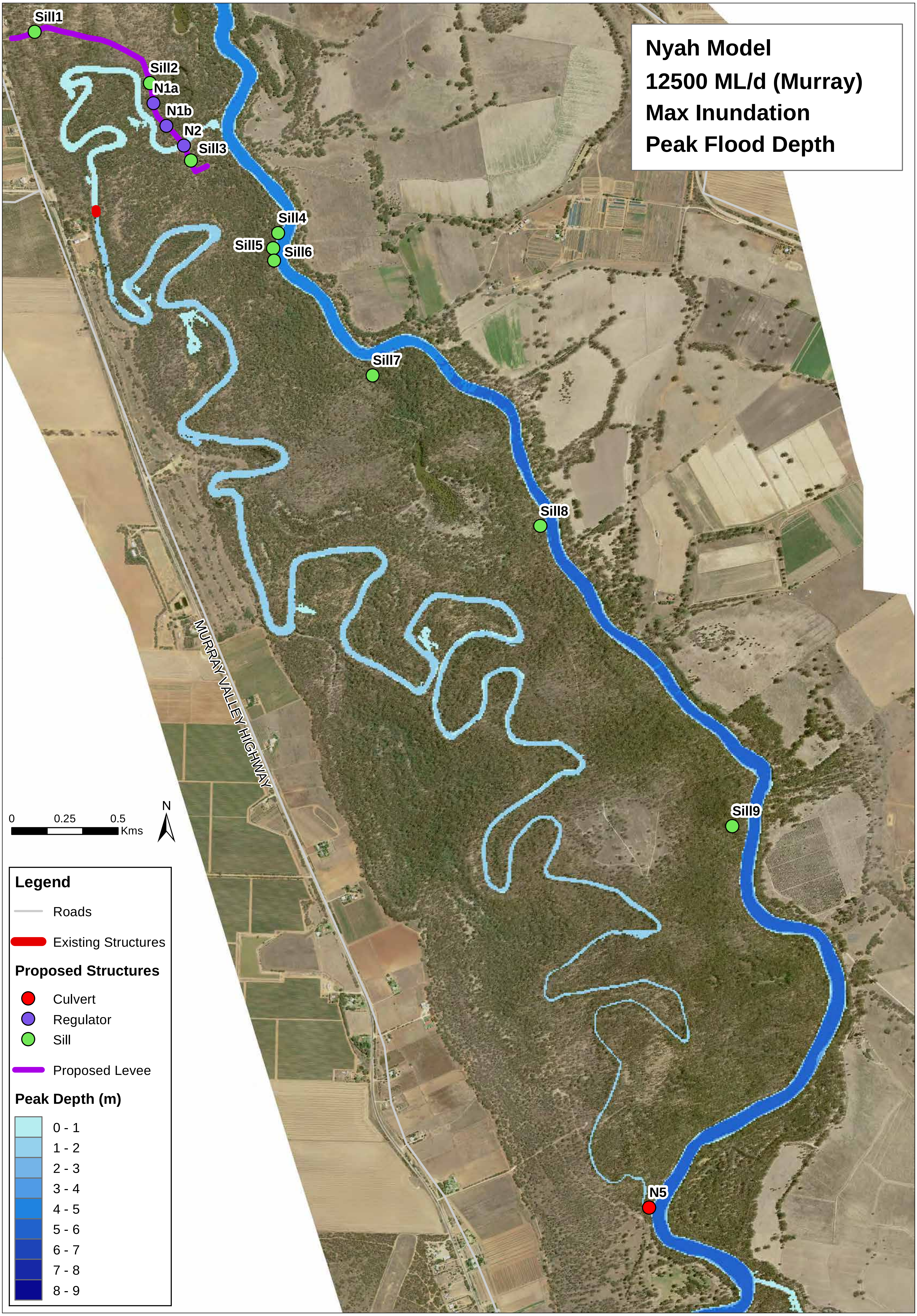
Nyah Model
5000 ML/d (Murray)
Max Inundation
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

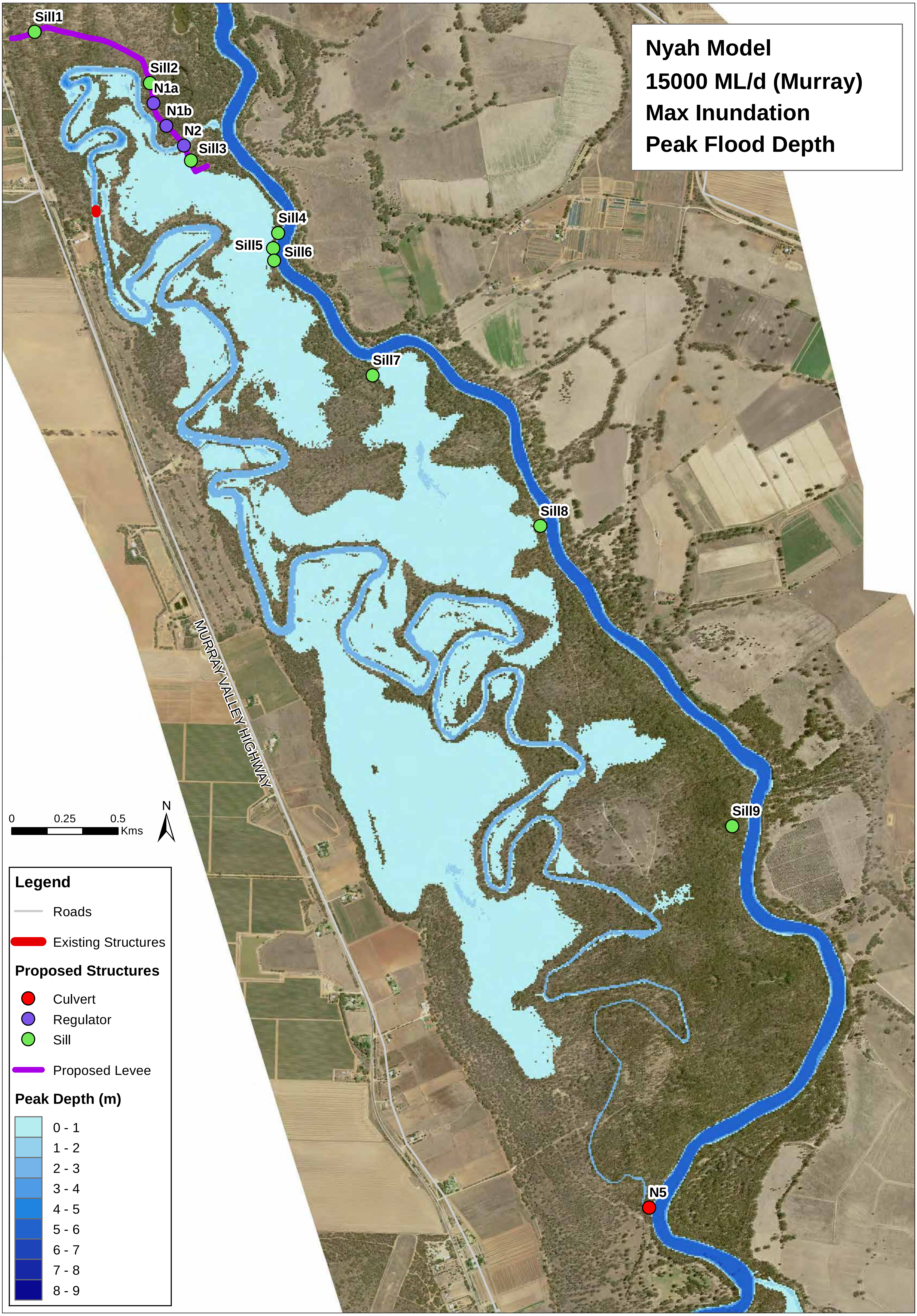


Nyah Model
7500 ML/d (Murray)
Max Inundation
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

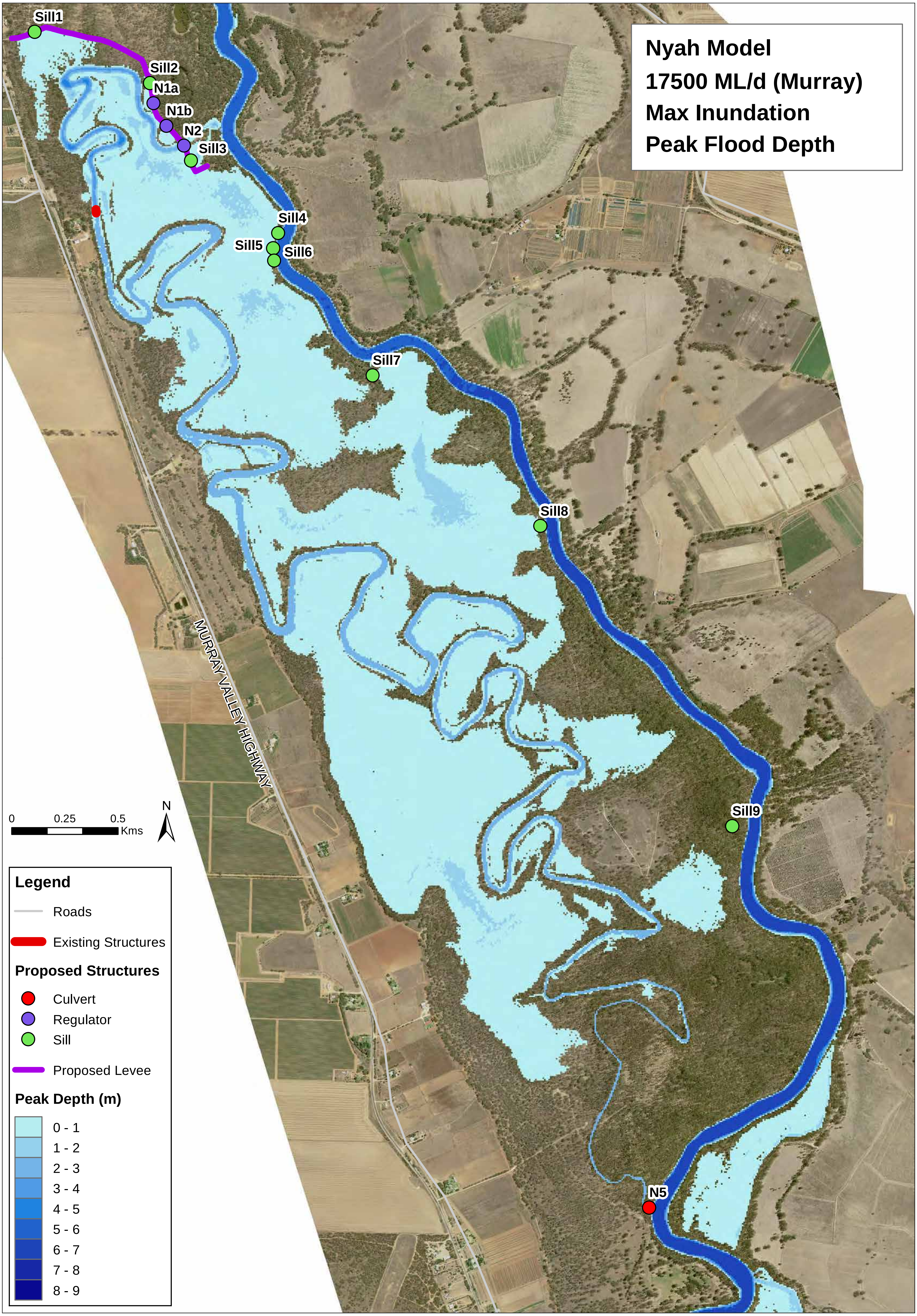


Nyah Model
10000 ML/d (Murray)
Max Inundation
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

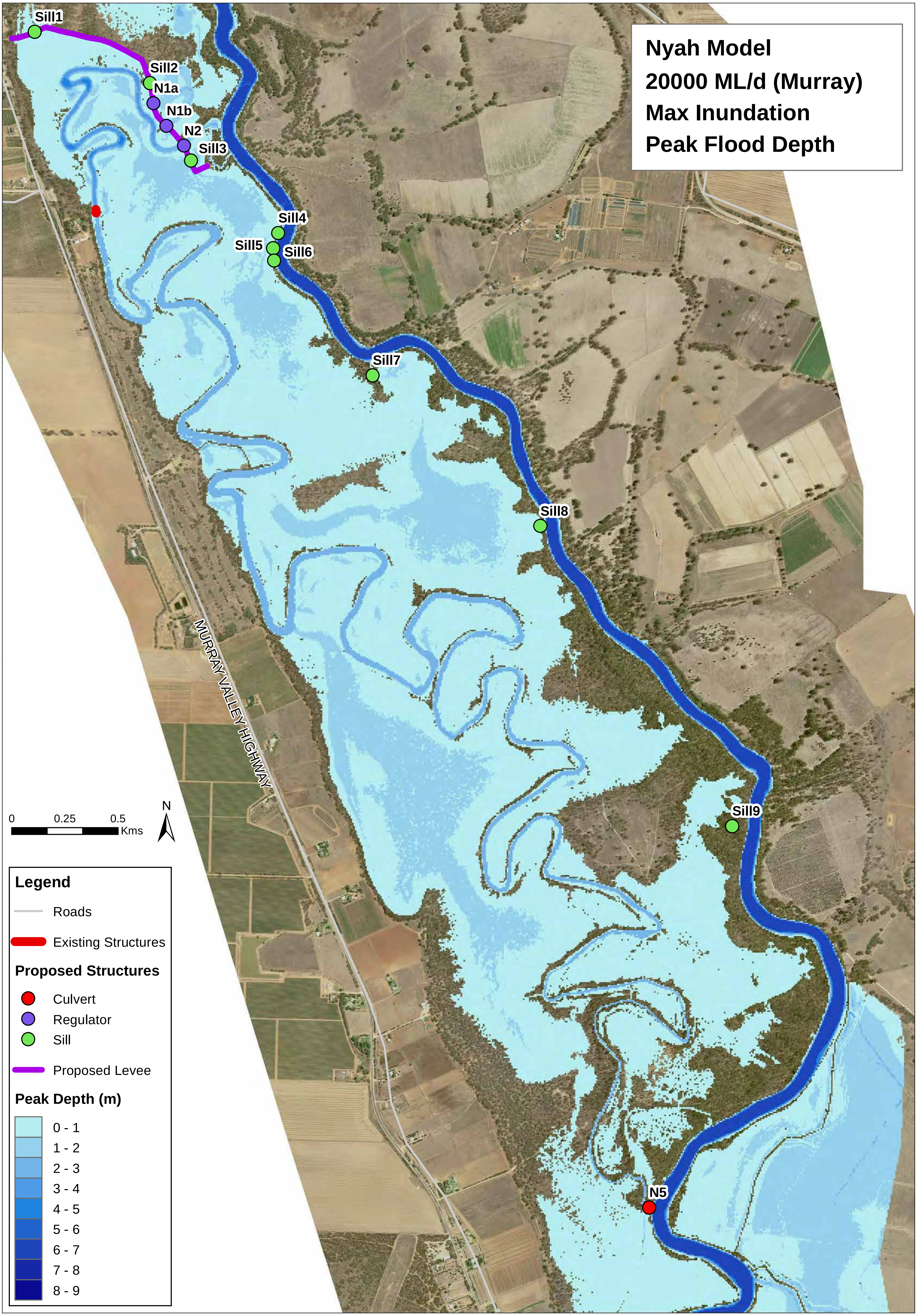

Nyah Model
12500 ML/d (Murray)
Max Inundation
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

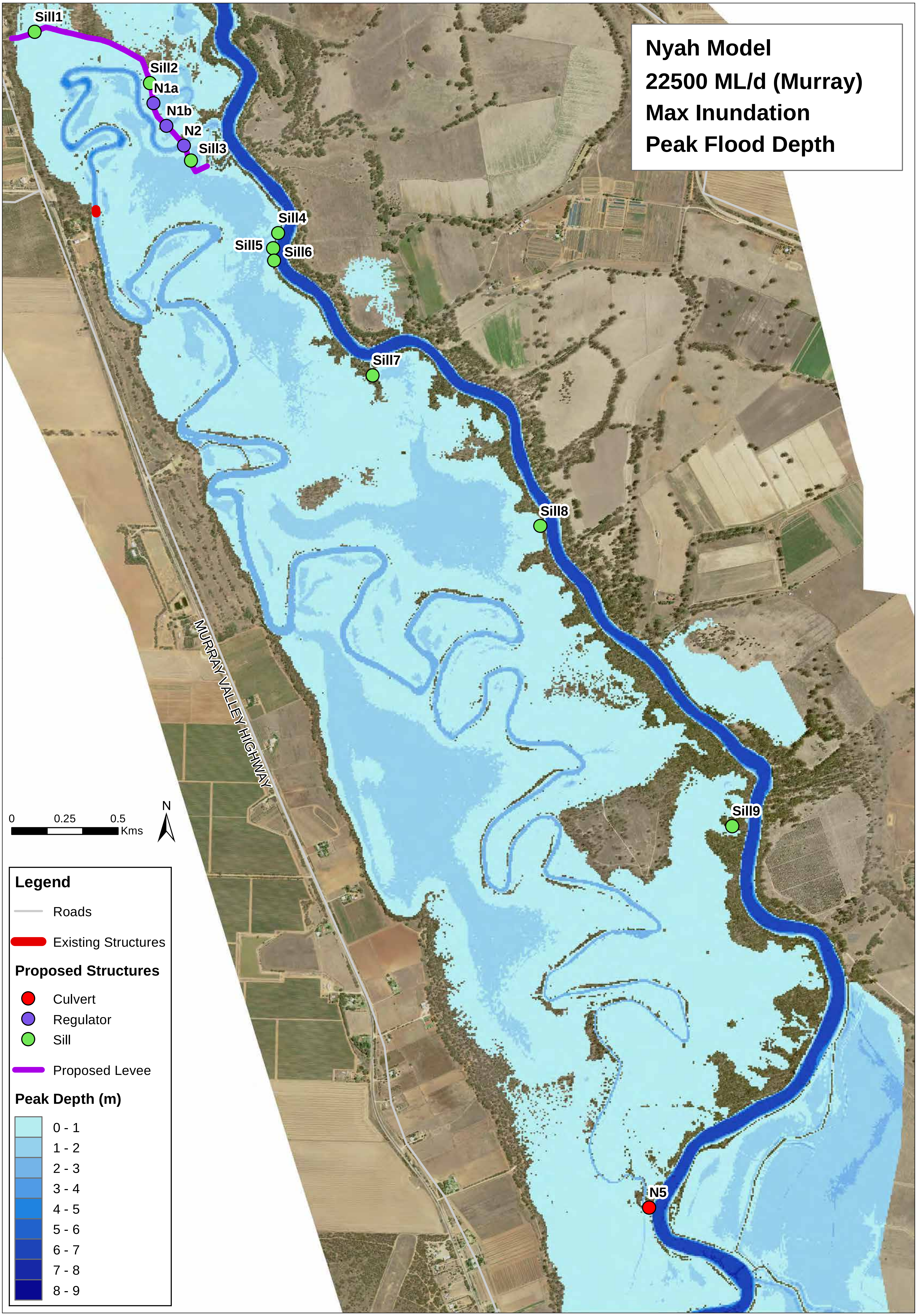


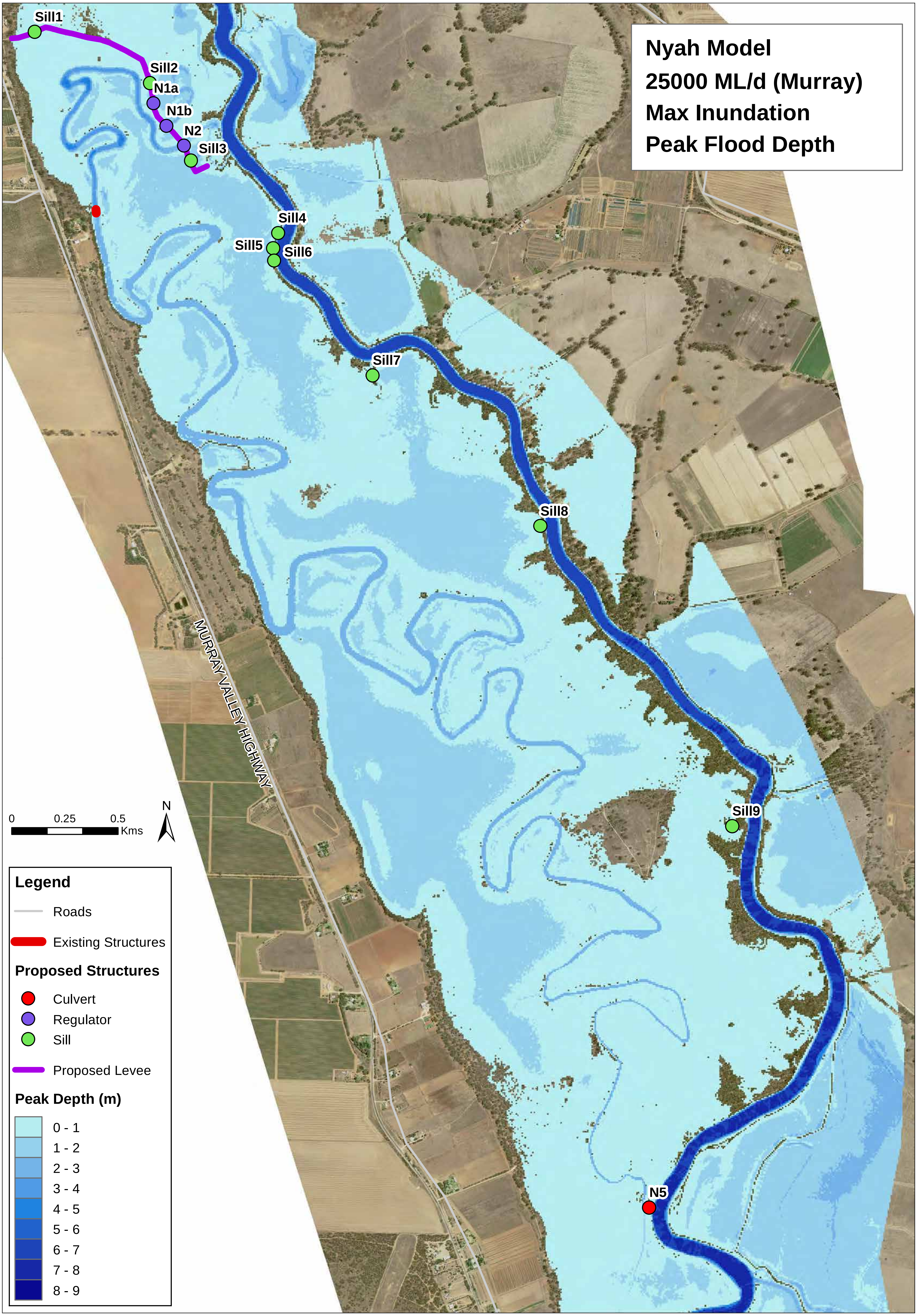
Nyah Model
15000 ML/d (Murray)
Max Inundation
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

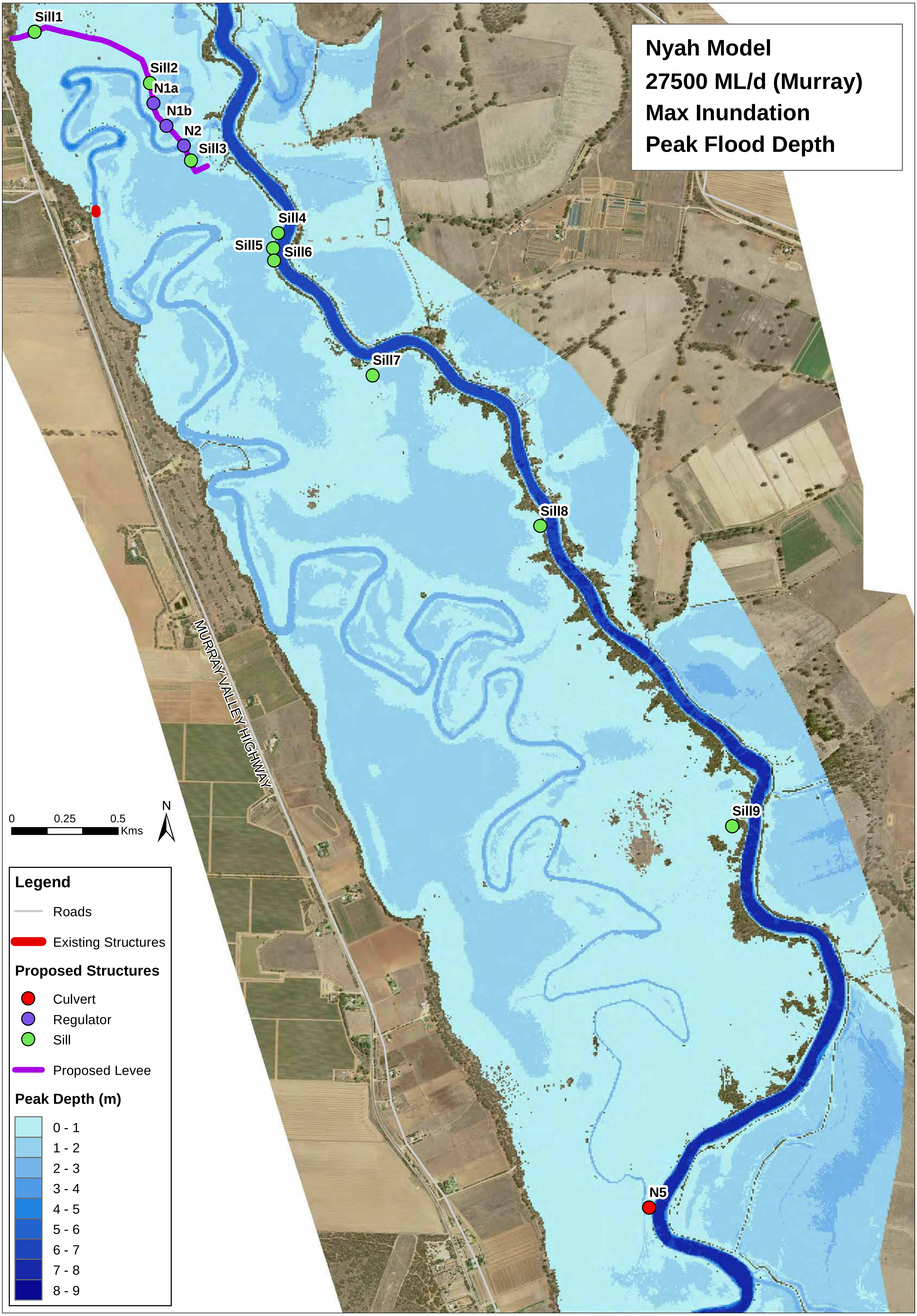


Nyah Model
17500 ML/d (Murray)
Max Inundation
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

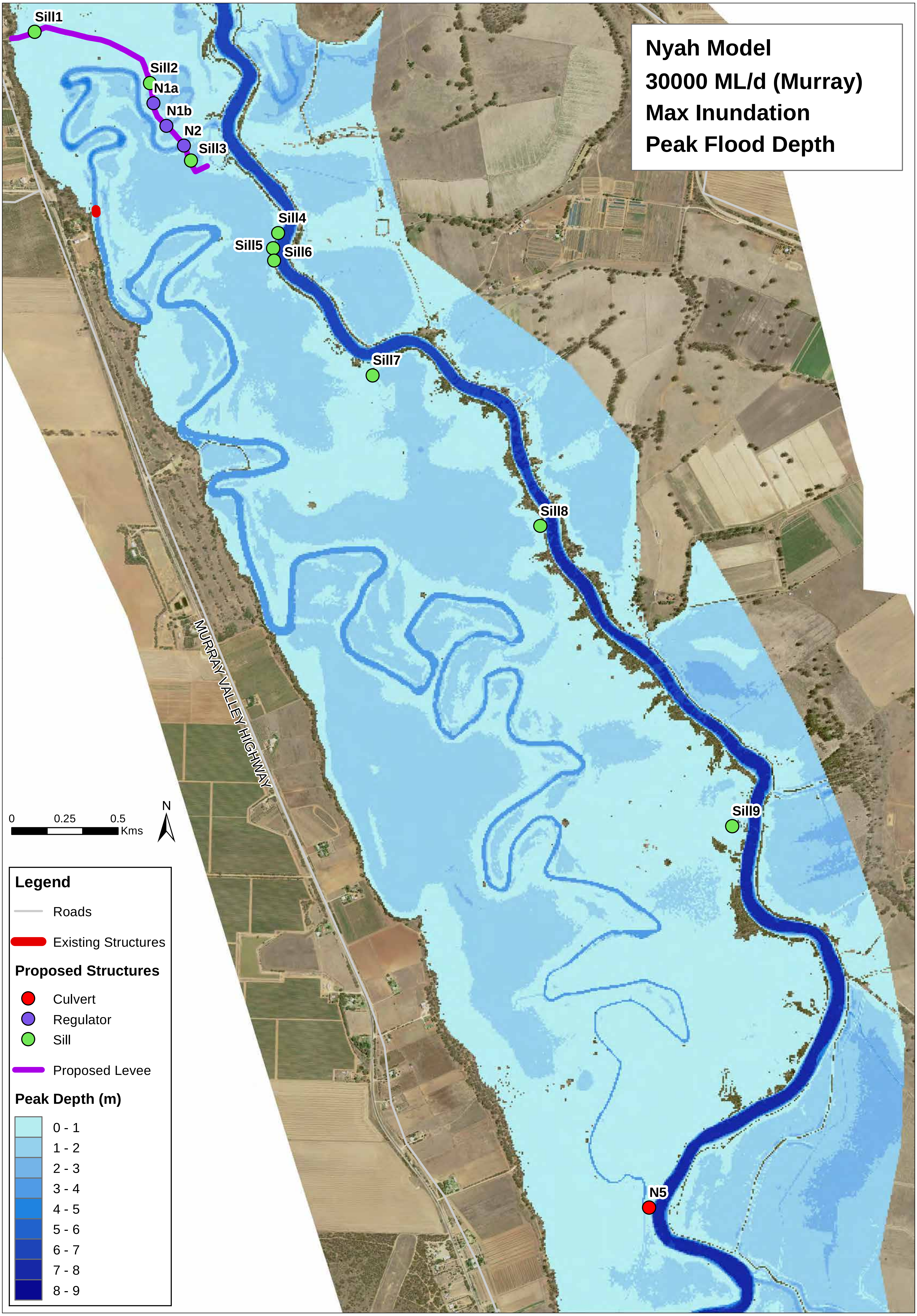

Nyah Model
20000 ML/d (Murray)
Max Inundation
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

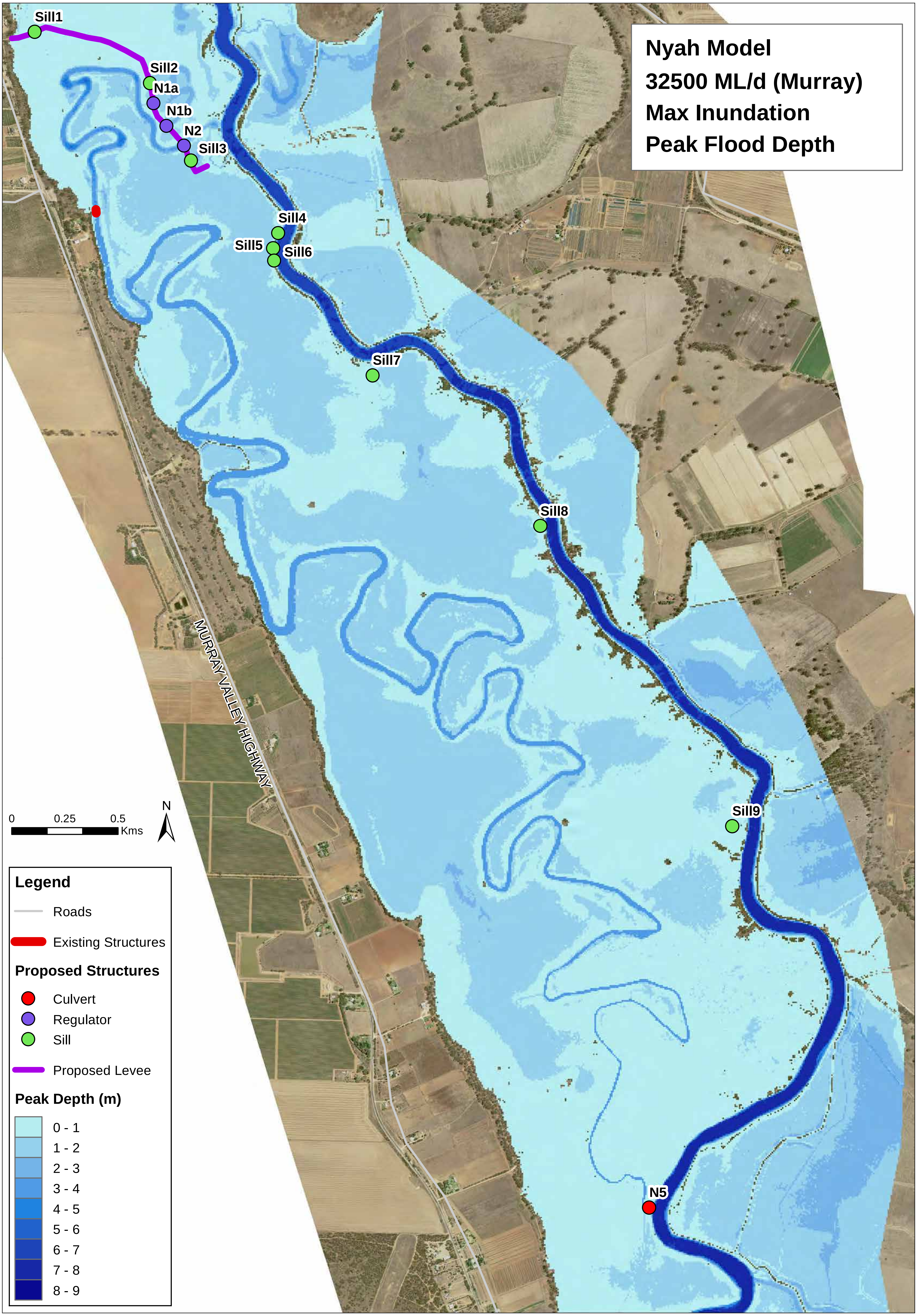

Nyah Model
22500 ML/d (Murray)
Max Inundation
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9


Nyah Model
25000 ML/d (Murray)
Max Inundation
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9

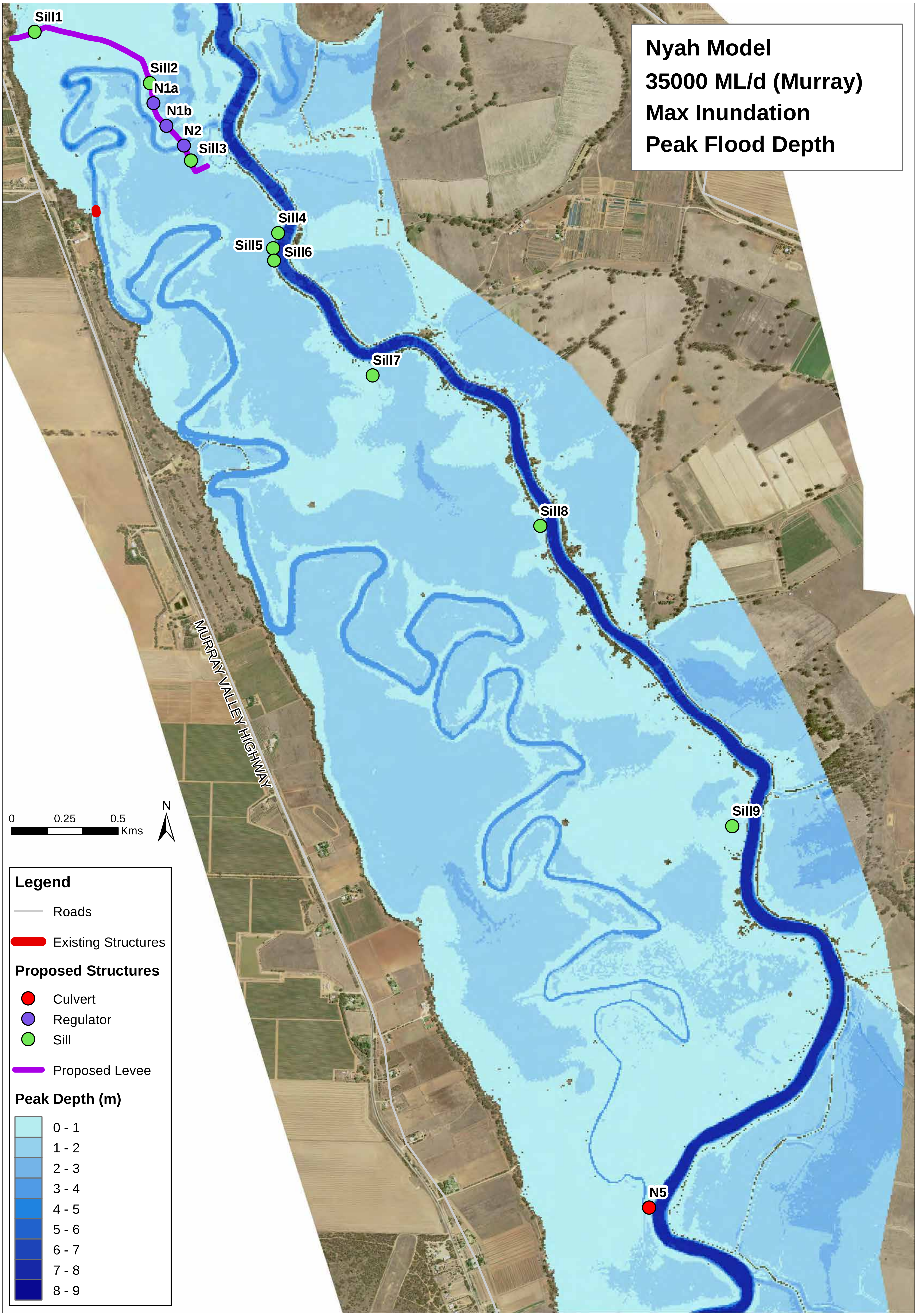


Nyah Model
27500 ML/d (Murray)
Max Inundation
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9


Nyah Model
30000 ML/d (Murray)
Max Inundation
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9



Nyah Model
32500 ML/d (Murray)
Max Inundation
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9



Nyah Model
35000 ML/d (Murray)
Max Inundation
Peak Flood Depth
Sill1
Sill2
N1a
N1b
N2
Sill3
Sill4
Sill5
Sill6
Sill7
Sill8
Sill9
N5
MURRAY VALLEY HIGHWAY
0
0.25
0.5
Kms
N
Legend
Roads
Existing Structures
Proposed Structures
Culvert
Regulator
Sill
Proposed Levee
Peak Depth (m)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9