APPENDIX D

global environmental solutions

Flooding Addendum

Euroley Poultry Production Complex

Euroley, NSW

Report Number 610.14072-FA1

20 August 2015

ProTen Holdings Pty Ltd

Version: Revision 1

Flooding Addendum

Euroley Poultry Production Complex

Euroley, NSW

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1 INTRODUCTION

1.1 Background

This Flooding Addendum has been prepared in relation to the application submitted by ProTen Holdings Pty Limited (ProTen) seeking development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to develop an intensive poultry broiler production farm known as the Euroley Poultry Production Complex, within a rural property near Euroley in south-western New South Wales (NSW) (the Site).

This report is an addendum to the Flooding Assessment report (SLR, 2015a) prepared by SLR Consulting Australia (SLR) in May 2015 which was included as an appendix to the Environmental Impact Statement (EIS) for SSD 6682 (SLR, 2015b).

The objective of this addendum is to present the additional information in relation to flooding requested by the NSW Office of Water (NOW) and the NSW Office of Environment and Heritage (OEH) as detailed in their responses to the EIS (referenced OUT15/16271 and DOC15/167915 respectively). In summary, the NOW and OEH raised the following issues:

NOW:

> *Appendix H (Flooding Assessment) provides modelled information on the flood extent on the site for the 1 in 100yr ARI flood event and the PMF. An interpretation has been provided of the potential impacts of the projects which indicates a local increase in flood heights of 150mm for the 1 in 100yr ARI and a 300mm increase of the PMF. This however has not been confirmed with a detailed hydraulic assessment. Clarification is requested of the project impacts on-site and to the neighbouring properties in terms of changes to the flood extent, flood velocities, and flood depths due to the project.*

OEH:

> *The assessment of flooding provided in the draft EIS has been extensively revised following consultation with OEH and provides an adequate model of the potential impacts due to mainstream and local overland flooding. The revised modelling does show some flood impacts on the development site during the 100 year Annual Recurrence Interval (ARI) and Probable Maximum Flood events that have not been fully considered.*
>
> *Flood Modelling (Appendix H. Section 4)*
>
> *Figure 8 (page 18) demonstrates that some of the PPUs are impacted by shallow flows. The flooding assessment provides justification of the existing planned location of the PPUs based on the assumption that construction of raised floor levels (0.3m above ground level) will provide flood immunity in the 100 year ARI event. However, Figure 8 shows the current site conditions without the presence of PPUs. There are likely to be hydraulic impacts that have not been considered if PPUs are constructed in the proposed locations. Section 4.4 of the flooding assessment (page 19), states that hydraulic impact modelling was completed and that the afflux due to the PPUs was "less than 150mm" in the 100 year ARI event. The assessment does not address the potential for inundation of PPU floors due to these results. In a situation where the PPU floor level is 0.3 m above ground level and the "pre-development" flood levels are around 0.3 m, any impediment to this flow (such as presence of a PPU) that would cause an associated afflux could potentially result in inundation of the PPU.*

OEH understands that the proposed site layout includes a minimum distance of 1000 metres between PPUs to reduce the risk of disease transmission between units (EIS Section 3.2, page 23). This design constraint appears to be restricting the ability of the proponent to consider the flooding impacts when locating the PPUs and to select more appropriate locations away from natural drainage lines. PPUs 1 and 3 would be less susceptible to potential flooding impacts if located to the east of their proposed location, PPU 4 to the north and PPU 2 to the south. Altering the proposed location of PPU 5 has reduced the threat from flooding to that unit, however the proposed access road . Greater consideration of flooding impacts could also be applied to the location of residences, particularly 4, 7 and 8 (shown on EIS Figure 6.7, page 96), which are proposed in areas prone to flooding.

Emergency and Evacuation Plan

The implications of the flooding assessment should be considered in an Emergency and Evacuation Plan. Access to PPU 5 is likely to be restricted during local overland flooding events.

Based on consideration of the above, we recommend the following conditions of development consent:

- *Develop an Emergency and Evacuation Plan that includes consideration of the implications of the flooding assessment, particularly access to Poultry Production Unit 5 during local flood events.*

1.2 Scope of Work

To address the issues raised by NOW and OEH, SLR undertook the following additional works:

- One dimensional hydraulic modelling of local overland flood flows for the post-development scenario (the pre-development scenario was modelled previously by SLR (2015a));
- Comparison of flooding behaviour between pre-development and post-development scenarios to identify the impact of the proposed development; and
- Preparation of flood maps and reporting.

1.3 Limitations

The assessment was undertaken with consideration to the project constraints and the following limitations:

- No detailed topographical data for land surrounding the Site;
- No topographical data at the eastern and southern fringes of the Site;
- No detailed historical flood flow or level data.

Due to the limitations above, a conservative, but simplified approach was adopted for assessing flooding across the Site as detailed in the Section **2**.

2 FLOOD MODELLING

Flood modelling, including hydrological modelling and one dimensional (1D) hydraulic modelling, was undertaken to assess flood levels across the Site in relation to overland flow via ephemeral flow paths which run through the site as part of the Flooding Assessment (SLR, 2015a).

2.1 Hydrology

The hydrological model detailed in the Flooding Assessment (SLR, 2015a) was adopted for use to assess post-development flooding impacts. This is considered to be appropriate as onsite stormwater detention facilities will be provided to manage the impact of additional runoff generated as a result of the increase in impervious surfaces onsite (i.e. building roofs) and the peak flow rates are associated with the wider local overland catchment runoff rather than runoff generated onsite.

2.1.1 Peak flow rates

The peak flow rates applied within the 1D hydraulic model are detailed in **Table 1** below. These flow rates relate to the peak flow at the downstream end of the Site.

Table 1 Predicted peak flow rates

ARI	Southern Catchment Flow Rate (m^3/s)	Northern Catchment Flow Rate (m^3/s)
100 year	60.6	13.5
PMF	686	172

2.2 Hydraulic Model

2.2.1 Model development

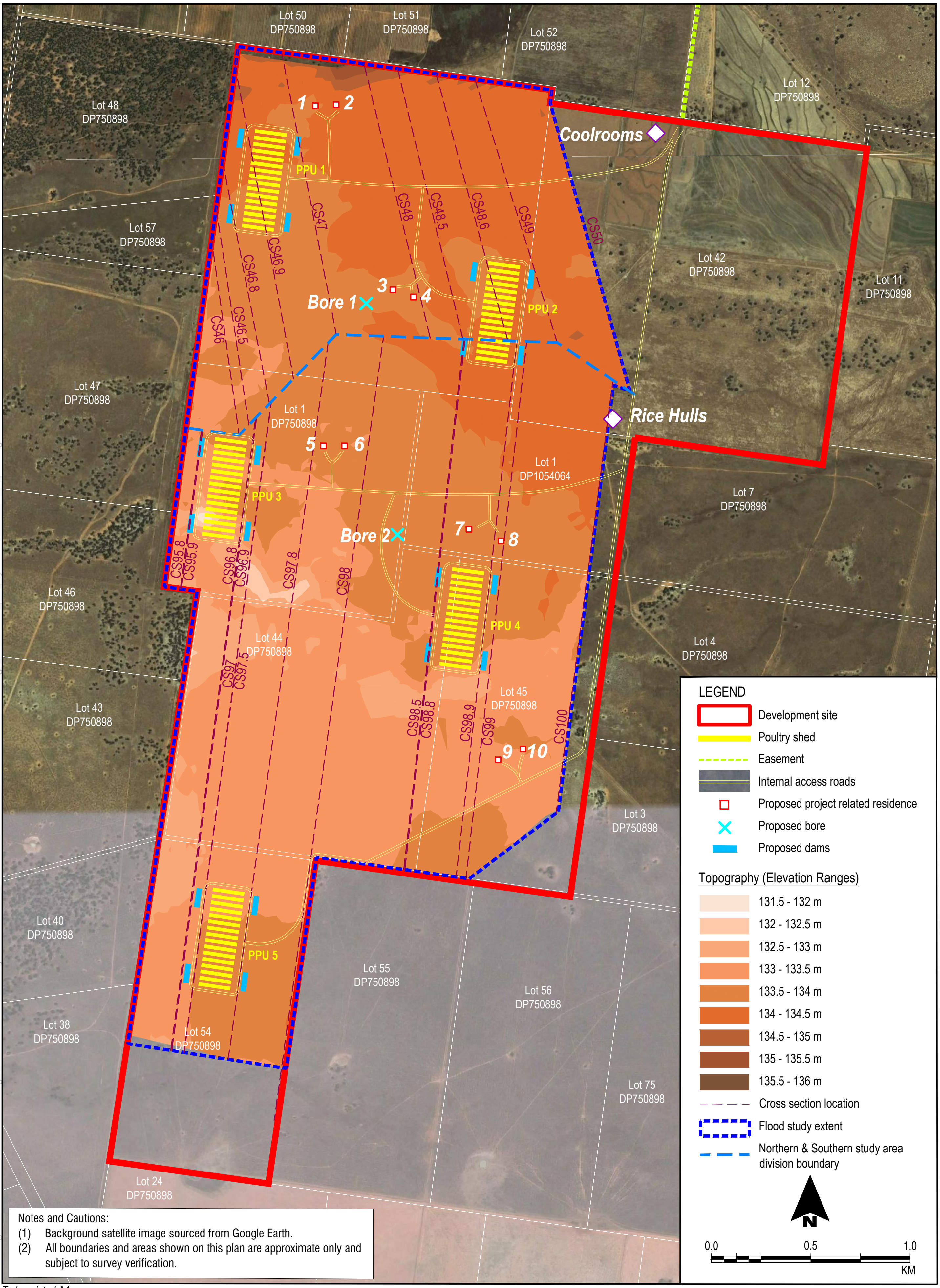
Two hydraulic models were developed for the pre-development Site (SLR, 2015), one to simulate the northern ephemeral flow path and one to simulate both the combined southern and northern ephemeral flow paths (with the worst case flood level for the northern ephemeral flow path selected). To address the issues raised by NOW and OEH, both of these hydraulic models were modified to account for the construction of the five proposed poultry production units (PPUs) (i.e. post-development scenario). Additional cross sections were added to both the pre-development and post-development hydraulic models as required to develop the model and enable the change in hydraulic conditions to be identified and assessed. The cross section elevations were raised to block flow at the proposed PPUs. Each PPU was assumed to be a solid structure with no allowance for flow in between the buildings. This is considered to be a conservative approach to assessing flood afflux.

The modelled peak flow rates as detailed in **Table 1** were applied to all cross sections in each of the hydraulic models.

A roughness value (Manning's coefficient) of 0.04, which is commensurate with floodplains with pasture/farmland or light brush, was adopted for the entire Site. A roughness value of 0.025, which is commensurate with masonry or corrugated metal buildings, was adopted for the building walls.

The post-development hydraulic model was used to assess the post-development flood extent and flood afflux and flood velocity impacts.

A schematic of the hydraulic models is outlined in **Figure 1**.



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Hydraulic Model Details

FIGURE 1

2.2.2 Model Limitations

Computer simulations of flooding within the Site were undertaken using HEC-RAS software. This 1D hydraulic modelling approach was adopted due to project constraints (refer to Section **1.3**). The limitations of this 1D modelling are that it tends to slightly overestimate flood levels within the main ephemeral flow paths (i.e. running east to west) and slightly underestimate flood levels where low risk shallow lateral minor flows and sheet flow (i.e. from north to south) occur between the main ephemeral flow paths. As with any computer modelling, it is a predictive tool only.

The proposed residences were not incorporated into the modelling given their size in the context of the overall 100 year ARI flood extent would pose a negligible impact to flood levels and flood velocities.

The assessment of flood levels along internal roadways is beyond the limitations of the 1D hydraulic modelling. The raising of road levels may slightly alter flood behaviour locally up gradient of the roadway but it is unlikely to pose a significant impact to flooding on or offsite providing the road level is not raised significantly. Recommendations in relation to road levels are provided in Section **3**.

2.3 Flood Impacts

The pre-development and post-development flood levels and associated flood afflux impacts for the 100 year ARI flood event and the PMF are presented for comparison in **Table 2** and **Table 3**, respectively, below.

Flood Afflux impacts for the northern and southern ephemeral flow paths are also shown in **Figure 2**.

The pre-development and post-development average flood velocities and associated average flood velocity impacts for the 100 year ARI and the PMF are presented for comparison in **Table 4** and **Table 5**, respectively, below.

The 100 year ARI flood levels for the PPUs and farm residences and proposed finished floor levels for the farm residences are presented in **Table 6** and **Table 7**. PPU construction details are outlined in **Figure 5**.

Flood mapping showing the flooding extent and flood depths for the pre-development 100 year ARI and PMF events in relation to the ephemeral flow paths is provided in **Figure 3** and **Figure 4**.

Flood mapping showing the flooding extent and flood depths for the post-development 100 year ARI and PMF events in relation to the ephemeral flow paths is provided in **Figure 5** and **Figure 6**.

The modelling indicates that the maximum 100 year ARI flood afflux will be 90 mm upstream of PPU 2 and the maximum PMF flood afflux will be 110 mm upstream of PPU 2. No flood afflux impacts were shown to occur downstream of the buildings near the western boundary. The impact at the eastern boundary was shown to be less than 50 mm during a 100 year ARI event and 80 mm during a PMF event. There are no existing buildings or infrastructure items on the properties to the east of the Site that will to be adversely affected by the construction of the proposed development buildings, residences or associated infilling earthworks in terms of flooding.

The maximum average velocity increase is predicted to be 0.08 m/s during a 100 year ARI event and 0.11 m/s during the PMF event.

There are no existing buildings or infrastructure items on neighbouring properties that are likely to be affected by the construction of the proposed development buildings, residences or associated infilling earthworks in terms of flooding.

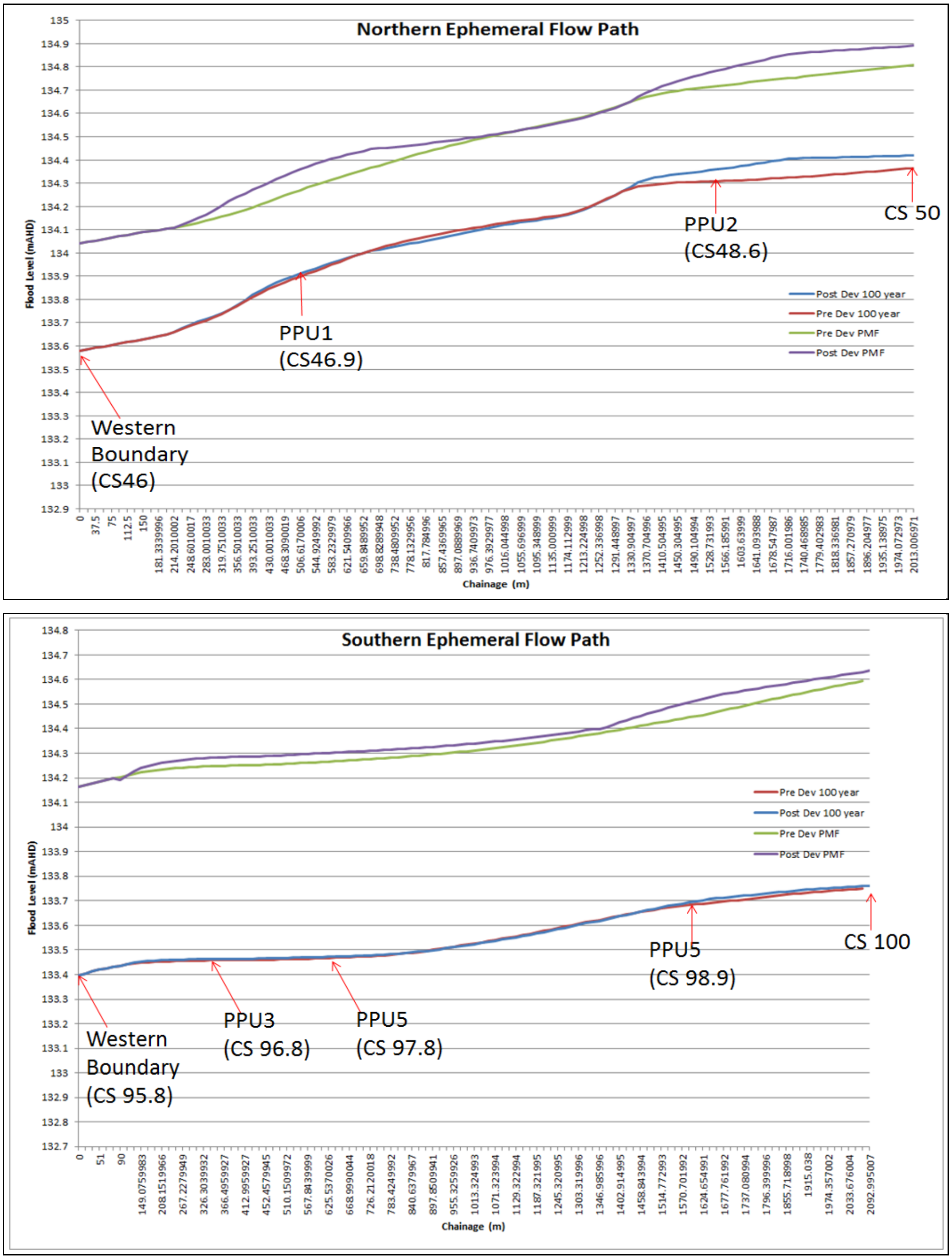
Table 2 100 year ARI Flood Afflux Impacts

Cross Section	Relevant Model	100 year ARI Pre-Development Flood Level (mAHD)	100 year ARI Post-Development Flood Level (mAHD)	Flood Afflux (m)
50	Northern	134.37	134.42	0.05
49.5	Northern	134.33	134.41	0.08
49	Northern	134.32	134.41	0.09
48.6	Northern	134.31	134.35	0.04
48.5	Northern	134.26	134.26	0
48	Northern	134.16	134.15	-0.01
47	Northern	134.01	134.01	0
46.9	Northern	133.84	133.86	0.02
46.8	Northern	133.71	133.71	0
46.5	Northern	133.65	133.65	0
46	Northern	133.63	133.63	0
100	Southern	133.75	133.76	0.01
99	Southern	133.69	133.71	0.02
98.9	Southern	133.68	133.7	0.02
98.8	Southern	133.62	133.62	0
98.5	Southern	133.61	133.61	0
98	Southern	133.5	133.51	0.01
97.8	Southern	133.47	133.47	0
97.5	Southern	133.46	133.46	0
97	Southern	133.46	133.46	0
96.9	Southern	133.46	133.46	0
96.8	Southern	133.46	133.46	0
95.9	Southern	133.44	133.43	-0.01
95.8	Southern	133.43	133.43	0
95.7	Southern	133.40	133.40	0

Table 3 PMF Flood Afflux Impacts

Cross Section	Relevant Model	PMF Pre-Development Flood Level (mAHD)	PMF Post-Development Flood Level (mAHD)	Flood Afflux (m)
50	Northern	134.81	134.89	0.08
49.5	Northern	134.75	134.86	**0.11**
49	Northern	134.75	134.85	0.1
48.6	Northern	134.71	134.77	0.06
48.5	Northern	134.64	134.64	0
48	Northern	134.56	134.55	-0.01
47	Northern	134.37	134.45	0.08
46.9	Northern	134.22	134.3	0.08
46.8	Northern	134.14	134.16	0.02
46.5	Northern	134.1	134.1	0
46	Northern	134.09	134.09	0
100	Southern	134.59	134.64	0.05
99	Southern	134.46	134.54	0.08
98.9	Southern	134.45	134.51	0.06
98.8	Southern	134.38	134.4	0.02
98.5	Southern	134.38	134.4	0.02
98	Southern	134.3	134.33	0.03
97.8	Southern	134.27	134.3	0.03
97.5	Southern	134.25	134.29	0.04
97	Southern	134.25	134.29	0.04
96.9	Southern	134.25	134.28	0.03
96.8	Southern	134.25	134.28	0.03
95.9	Southern	134.2	134.19	-0.01
95.8	Southern	134.2	134.2	0
95.7	Southern	134.16	134.16	0

Figure 2 Flood Afflux Impacts



*Refer to **Figure 1** for Cross Section (CS) locations*

Table 4 100 year ARI Flood Velocity Impacts

Cross Section	Relevant Model	100 year ARI Pre-Development Mean Flood Velocity (mAHD)	100 year ARI Post-Development Mean Flood Velocity (mAHD)	Change in Mean Velocity (m/s)
50	Northern	0.09	0.06	-0.03
49.5	Northern	0.08	0.05	-0.03
49	Northern	0.08	0.12	0.04
48.6	Northern	0.06	0.12	0.06
48.5	Northern	0.16	0.16	0
48	Northern	0.11	0.12	0.01
47	Northern	0.12	0.09	-0.03
46.9	Northern	0.15	0.18	0.03
46.8	Northern	0.14	0.16	0.02
46.5	Northern	0.14	0.14	0
46	Northern	0.11	0.11	0
100	Southern	0.12	0.12	0
99	Southern	0.16	0.16	0
98.9	Southern	0.16	0.19	0.03
98.8	Southern	0.19	0.2	0.01
98.5	Southern	0.19	0.19	0
98	Southern	0.14	0.14	0
97.8	Southern	0.09	0.09	0
97.5	Southern	0.07	0.07	0
97	Southern	0.06	0.06	0
96.9	Southern	0.06	0.06	0
96.8	Southern	0.06	0.06	0
95.9	Southern	0.2	0.28	0.08
95.8	Southern	0.21	0.21	0
95.7	Southern	0.22	0.22	0

Table 5 PMF Flood Velocity Impacts

Cross Section	Relevant Model	PMF Pre-Development Mean Flood Velocity (mAHD)	PMF Post-Development Mean Flood Velocity (mAHD)	Change in Mean Velocity (m/s)
50	Northern	0.22	0.19	-0.03
49.5	Northern	0.24	0.20	-0.04
49	Northern	0.24	0.34	0.10
48.6	Northern	0.23	0.34	0.11
48.5	Northern	0.36	0.36	0
48	Northern	0.27	0.27	0
47	Northern	0.32	0.20	-0.12
46.9	Northern	0.34	0.43	0.09
46.8	Northern	0.32	0.44	0.12
46.5	Northern	0.3	0.30	0
46	Northern	0.29	0.29	0
100	Southern	0.3	0.28	-0.02
99	Southern	0.33	0.29	-0.04
98.9	Southern	0.29	0.36	0.07
98.8	Southern	0.3	0.4	0.1
98.5	Southern	0.3	0.29	-0.01
98	Southern	0.23	0.22	-0.01
97.8	Southern	0.19	0.2	0.01
97.5	Southern	0.17	0.18	0.01
97	Southern	0.17	0.17	0
96.9	Southern	0.17	0.17	0
96.8	Southern	0.17	0.2	0.03
95.9	Southern	0.4	0.65	0.25
95.8	Southern	0.41	0.41	0
95.7	Southern	0.41	0.41	0

Table 6 PPU 100 year ARI Flood Levels

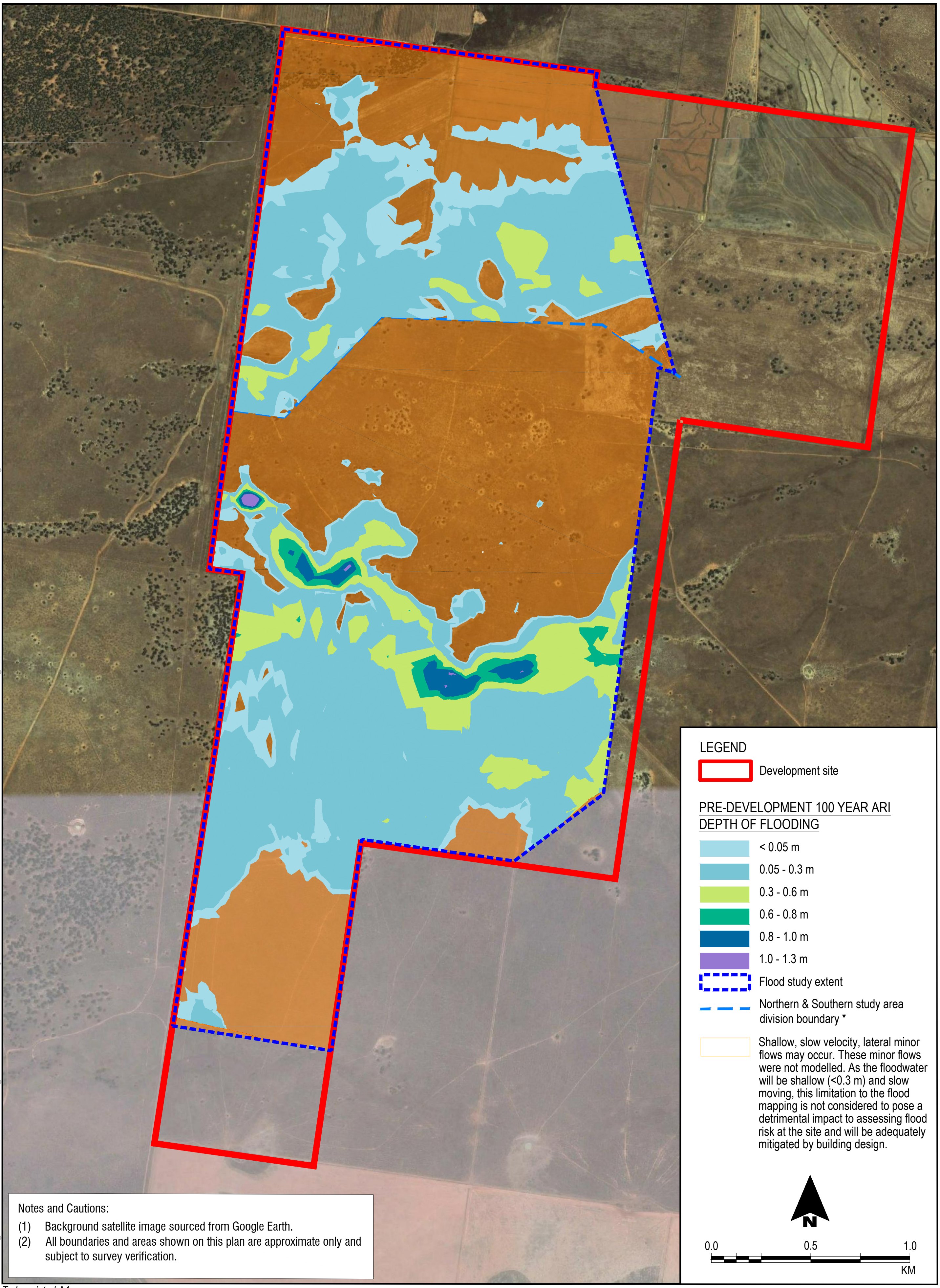
Farm	Relevant Model	100 year ARI Flood Level (mAHD)
PPU1	Northern	133.98
PPU2	Northern	134.39
PPU3	Southern	133.46
PPU4	Southern	133.69
PPU5	Southern	133.47

Comments in relation to PPU construction are provided in **Figure 5**. The raising of the PPU pad level a minimum of 300 mm above adjacent ground level, infilling works at PPU2, PPU3 and PPU4 and the 400 mm high concrete bund around the poultry sheds will adequately protect the poultry sheds from flooding during a 100 year ARI event.

Table 7 Residence 100 year ARI Flood Level and Proposed FFL

Residence	Relevant Model	Modelled 100 year ARI Flood Level (mAHD)	Finished Floor Level (mAHD)
1	Northern	134.05	134.35[1]
2	Northern	134.09	134.39[1]
3	Northern	134.11	134.41[1]
4	Northern	134.14	134.44[1]
5	Southern	133.48	133.89[2]
6	Southern	133.49	133.83[2]
7	Southern	133.66	133.96[2]
8	Southern	133.71	134.12[2]
9	Southern	133.72	134.02[1]
10	Southern	133.74	134.04[1]

[1] Finished floor level set as 300 mm above the modelled ephemeral flow path 100 year ARI flood Level
[2] Residence located outside ephemeral flow path 100 year ARI flood extent. Finished floor level set as 300 mm above adjacent ground level



Notes and Cautions:

(1) Background satellite image sourced from Google Earth.

(2) All boundaries and areas shown on this plan are approximate only and subject to survey verification.

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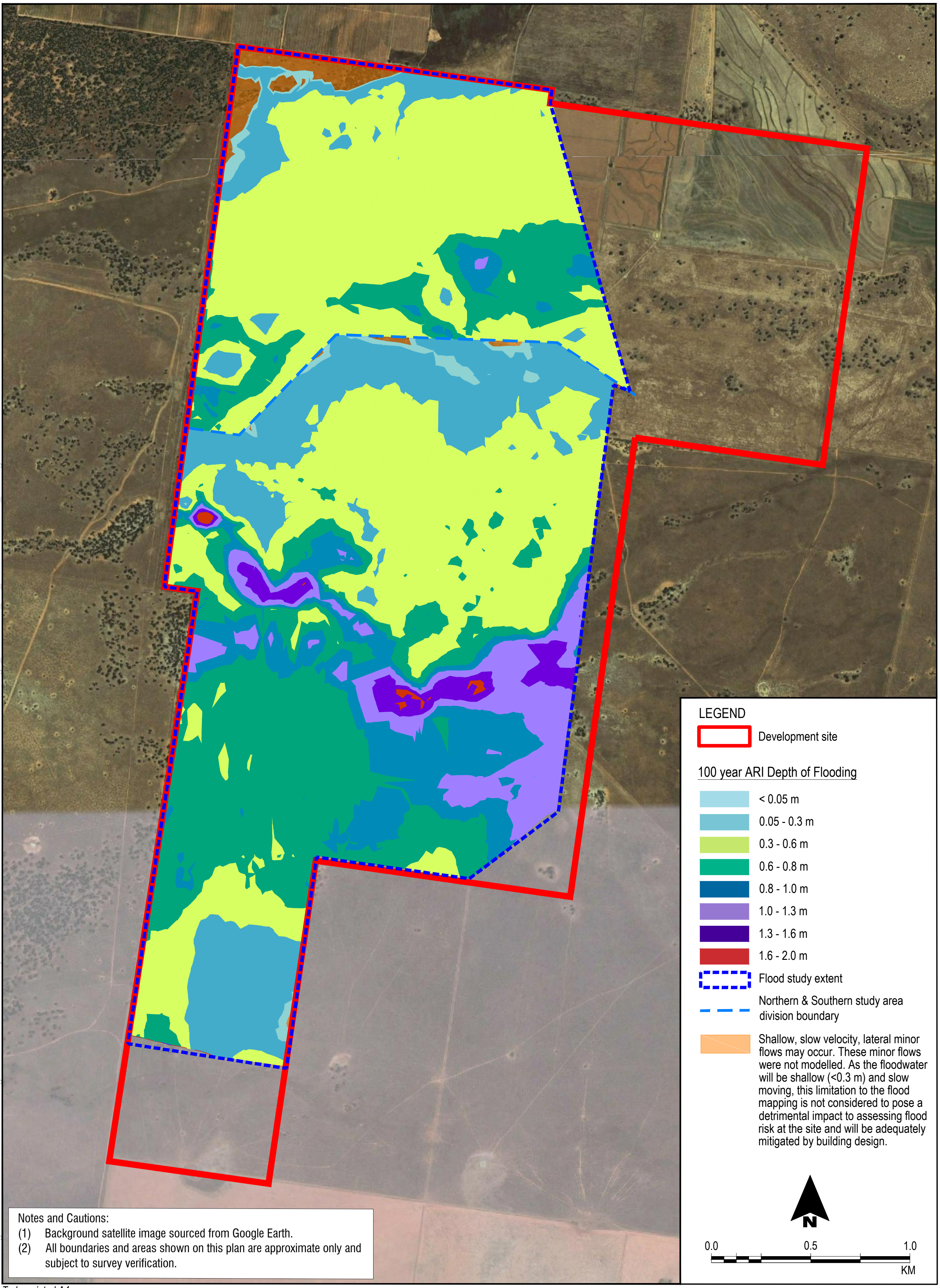
100 Year ARI Pre-Development Flood Extent

FIGURE 3



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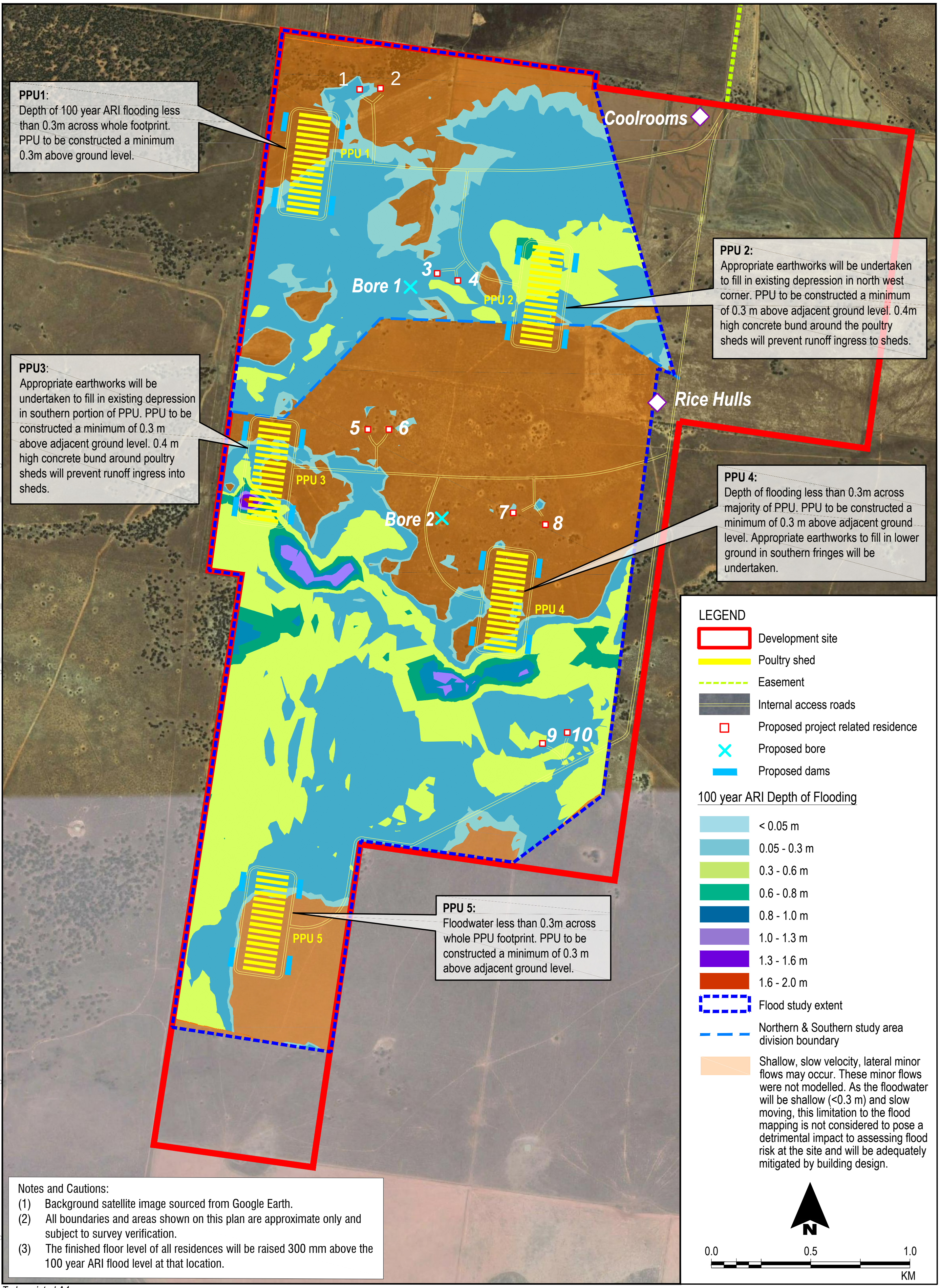
PMF Pre-Development Flood Extent

FIGURE 4



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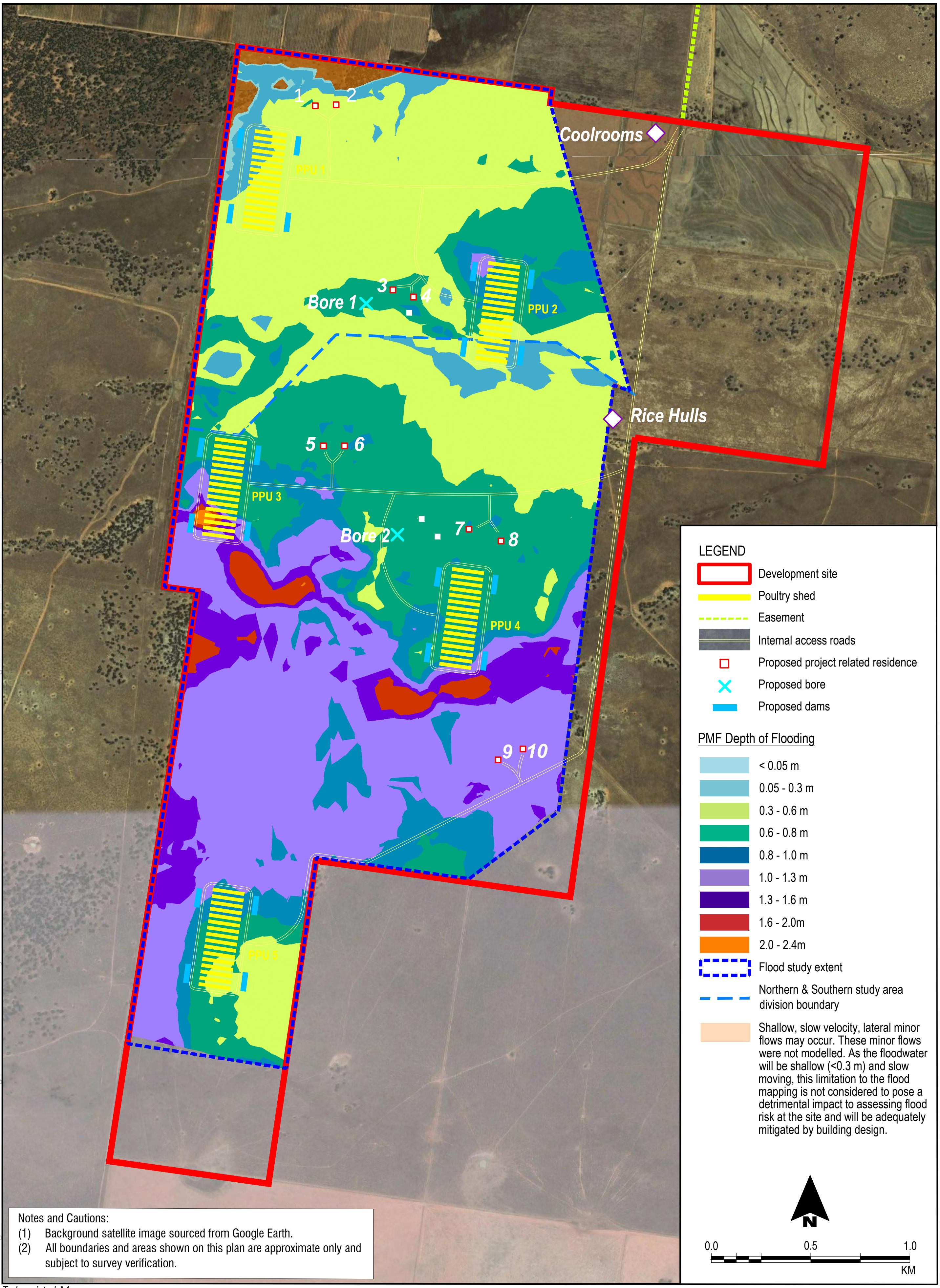
100 Year ARI Post-Development Flood Extent

FIGURE 5



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PMF Post-Development Flood Extent

FIGURE 6

3 CONCLUSIONS AND RECOMMENDATIONS

The pre-development flood model developed by SLR was updated to account for the proposed development.

A hydraulic impact assessment was undertaken to assess flood afflux and flood velocity impacts as a result of the proposed development.

Due to the relatively minor development footprint in the context of the overall property area and flooding extent, the proposed development will pose a minimal impact on flood behaviour within the site and within the neighbouring properties.

The modelling indicates that the maximum flood afflux will be 90 mm during a 100 year ARI event and 100 mm during the PMF event. No flood afflux impacts were shown to occur downstream of the buildings in the western extent of the Site. The impact at the eastern boundary was shown to be less than 50 mm during a 100 year ARI event and 80 mm during a PMF event. The maximum average velocity increase is predicted to be 0.08 m/s during a 100 year ARI event and 0.11 m/s during the PMF event. Flood velocities decreased at the eastern boundary and were not impacted along the western boundary.

In conclusion, the additional flooding assessment indicates that there are no existing buildings or infrastructure items on the neighbouring properties to the Site that are likely to be affected by the construction of the proposed development buildings, residences or associated infilling earthworks in terms of flooding. As the flood afflux is predicted to be relatively minor within the site and at the site boundaries and flood velocities did not increase significantly onsite or at the site boundaries, agricultural practices in neighbouring properties are unlikely to be affected by the flood impacts associated with the proposed development.

The finished floor level of all of the proposed residences within the Site will be raised 300 mm above the ephemeral flow path 100 year ARI flood level at that location. For residences that are located outside of the ephemeral flow path 100 year ARI flood extent (residences 5, 6, 7 and 8), the finished floor level will be raised 300 mm above adjacent ground level.

The PPU locations have remained unchanged as the proposed site layout includes a minimum distance of 1000 metres between PPUs to reduce the risk of disease transmission between units.This design constraint has prevented the location of the PPU2 and PPU3 from being relocated to less flood impacted areas..

Residences 4, 7, 8, 9 and 10 have been relocated and are now located within shallow flood depth zones (<300 mm deep).

It is noted that the Department of Planning and Environment (DP&E) has recommended that internal roads be constructed to the 1 in 100 year flood level for access/egress for farm employees to the Sturt Highway. This is not considered to be appropriate as:

- The site is affected by overland flooding;
- Overland flooding is likely to have also impacted the Sturt Highway;
- The worst case overland flooding relates to short duration storms, therefore it would be safer for farm employees to remain onsite during significant rainfall events until flood waters have resided;
- Floodwaters are unlikely to take more than a few hours to reside with the exception of the topographical depressions and ephemeral flow paths; and
- Significant raising of ground levels along roadways may impede floodwaters and further alter flood behaviour.

It is recommended that roadways be raised by a minimal amount (up to 300 mm) above adjacent ground level to prevent farm traffic disruption during the majority of rainfall events.

As recommended by the OEH, an Emergency and Evacuation Plan will be developed to outline a strategy for responding to local food events. It is envisaged that this will be imposed as a conditions of development consent.

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