Doolin Farming Pty Ltd

# Proposed Intensive Livestock Agriculture Development on the Property “Springfield”

## (Expansion of Beef Cattle Feedlot from 999 Head to 3,000 Head)

# HYDRAULIC ASSESSMENT AND CATCHMENT ANALYSIS

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VERSION CONTROL

| Revision | Date | Comment |
|---|---|---|
| A | 07/02/2025 | Draft for Client Review |
| B | 20/02/2025 | Final |
| C | | |
| D | | |

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# 1. INTRODUCTION

This study investigates overland flow behaviour on the property, *Springfield* and includes an assessment of the effects the proposed expansion of the feedlot development complex has on overland flow conditions. It has been prepared as part of the Development Application for Intensive Livestock Agriculture and forms part of the Environmental Impact Statement.

# 2. PROPERTY DETAILS

## 2.1. Study Area

Springfield is a grazing, dryland and irrigated cropping and intensive livestock property located on Getta Getta Road, 15 km East of North Star, New South Wales (NSW).

The property is located in the catchment area of the ephemeral streams, Scrubby Gully and Back Creek.

The property is located in the Gwydir Shire Council Local Government Area. The property location is shown in **Figure 2.1** and the layout is shown on **Drawing No. 0828_1**.

## 2.2. Available Topographic Data

The topographical information used in this study was based on aerial laser survey collected by NSW Government Spatial Services, a unit of Department of Finance, Services and Innovation in August 2011. The reference system is GDA94/MGA Zone

56. The model ground surface is based on the 5m digital elevation model (DEM). The existing ground surface contours are shown on **Drawing No. 0828_2**.


**Figure 2-1 Springfield Location (source: Google Earth)**

## 2.3. DEVELOPMENT HISTORY

The 999 head beef cattle feedlot on Springfield was established in 2022 after approval for intensive livestock agriculture was granted by the Gwydir shire Council in 2021 (DA 31/2020).

## 2.4. Existing and Proposed Works

The proposed works are shown on **Drawing No. 0828_1**. The proposed works include expansion of the feedlot development complex footprint and a diversion bank to redirect rainfall runoff around the feedlot development complex. The diversion bank is designed to not be overtopped in a 1 in 100 year rainfall event.

# 3. HYDRAULIC ASSESSMENT

## 3.1. Catchment Area

A watershed analysis was undertaken to determine the catchment area upstream of the proposed feedlot development complex. The existing contour banks were removed from the 5m DEM terrain surface and the natural stream flow lines for the catchments are shown on **Drawing No. 0828_2.1**.

The existing catchment upstream of the feedlot development complex varies from the natural catchment area as contour banks have altered the flow paths. There are existing contour banks that divert water into the natural catchment and other contour banks that divert water out of the natural catchment. As shown on **Drawing No. 0828_2.1**, contour banks along the south western and north eastern sides of the existing catchment area intercept overland flow from other catchments and divert it towards the feedlot development complex. Existing contour banks on the adjacent property on the south eastern side of the modelled area intercept overland flow and divert it south away from the feedlot development complex catchment.

The catchment area is 209 Hectares (Ha) as shown on **Drawing No. 0828_2.1**.

## 3.2. Rainfall Event Details

### 3.2.1. Rainfall Events and Duration

Rainfall events with Annual Exceedance Probabilities (AEP) of 10%, 1%, 0.5%, 0.2% and 0.05% were analysed and modelled as required by the Planning Secretary's Environmental Assessment Requirements (SEAR) 1687.

The design rainfall event duration was calculated using the Generalised Short-Duration Method (BoM, 2003, p.7). The design rainfall event duration for the catchment area is 4 hours 34 minutes.

### 3.2.2. Rainfall Event Intensity

The intensities for the rainfall events modelled were calculated using the Bureau of Meteorology Design Rainfall System (BoM, 2016). The rainfall intensity for each of the rainfall events modelled is shown in **Table 3-1**. These rainfall intensities were kept constant for the duration of the rainfall event.

| Rainfall Event Annual Exceedance Probability | Rainfall Intensity (mm/hr) |
|---|---|
| 10% | 14.6 |
| 1% | 22.6 |
| 0.5% | 26.0 |
| 0.2% | 30.5 |
| 0.05% | 38.0 |

**Table 3-1 Rainfall Intensity for Modelled Rainfall Events**

## 3.3. Landscape Characteristics

### 3.3.1. Land Cover

The land cover classifications for the modelled area are shown on **Drawing No. 0828_2.2**. The existing land cover within the catchment area are easily classifiable and readily defined as changes in land cover are typically separated by field boundaries or roads. In the pre-development modelling it has been assumed that the feedlot development complex area is pasture/grassland.

### 3.3.2. Infiltration Classification

The infiltration characteristics of the soils within the catchment area was based on the NSW statewide land and soil mapping hydrologic soil groups (eSPADE, 2025). The soil classifications within the catchment area ranges from moderate infiltration to very slow infiltration as shown on **Drawing No. 0828_2.3**.

## 3.4. Model Details

### 3.4.1. Model Setup

The works were assessed using the HEC-RAS Two Dimensional River Analysis Model. Rainfall runoff in the HEC-Ras Two Dimensional Model is calculated using the US Department of Agriculture Soil Conservation Service (SCS) Curve Number Runoff Method.

Break lines were used to define the terrain surface, existing contour banks and the proposed feedlot development complex. The model layout and the location of the break lines are shown on **Drawing No. 0828_3.**

The two layouts modelled were;

1) Pre-development (no feedlot development complex) on Springfield
2) Proposed development (existing and proposed expanded feedlot development complex) on Springfield

The model input parameters used are;

Hec Ras Version: 6.3.1

Maximum cell size: 2 m

Model time step: 1 second

Model equation set: Full momentum equations

Model soil parameters: As shown in **Table 3-2**

The modelled rainfall intensities were held constant for the duration of the design rainfall events to simulate peak flows from the catchment area.

All public roads have been defined in the model surface. The model cell size in the vicinity of all roads and primary flow paths was 2m.

The LiDAR surface has been modified for the pre-development modelling. All works associated with the existing feedlot development complex area on Springfield have been removed. The existing contour banks in the catchment area were included in all models.

### 3.4.2. Model Calibration

There were no known overland flow water surface levels available in the catchment area for any rainfall events. Without any known levels or measured flow rates an accurate model calibration could not be undertaken. The soil infiltration parameters and Mannings n values are considered representative of the soil types and typical vegetation cover within the catchment area. A large range in the magnitudes of the rainfall events modelled also affords a sensitivity analysis for any potential effects the development has on the overland flows.

| Land Cover | Soil Infiltration Group | SCS Curve Number | Abstraction Ratio | Minimum Infiltration Rate (mm/hr) | Mannings n | Percent Impervious |
|---|---|---|---|---|---|---|
| **Feedlot** | Very Slow | 90 | 0.1 | 1.5 | 0.04 | 5 |
| **Feedlot** | Slow | 90 | 0.1 | 2 | 0.04 | 0 |
| **Feedlot** | Moderate | 90 | 0.1 | 2 | 0.04 | 0 |
| **Cultivation** | Very Slow | 84 | 0.1 | 1.5 | 0.04 | 0 |
| **Cultivation** | Slow | 81 | 0.1 | 2 | 0.04 | 0 |
| **Cultivation** | Moderate | 73 | 0.1 | 3 | 0.04 | 0 |
| **Trees** | Very Slow | 83 | 0.1 | 1.5 | 0.05 | 0 |
| **Trees** | Slow | 77 | 0.1 | 2 | 0.05 | 0 |
| **Trees** | Moderate | 66 | 0.1 | 3 | 0.05 | 0 |
| **Road** | Very Slow | 92 | 0.05 | 1.5 | 0.03 | 5 |
| **Road** | Slow | 90 | 0.05 | 2 | 0.03 | 0 |
| **Road** | Moderate | 90 | 0.05 | 2 | 0.03 | 0 |
| **Pasture** | Very Slow | 84 | 0.1 | 1.5 | 0.04 | 0 |
| **Pasture** | Slow | 79 | 0.1 | 2 | 0.04 | 0 |
| **Pasture** | Moderate | 69 | 0.1 | 3 | 0.04 | 0 |
| **Water** | Very Slow | 100 | 0.1 | 1.5 | 0.04 | 100 |
| **Water** | Slow | 100 | 0.1 | 2 | 0.04 | 100 |
| **Water** | Moderate | 100 | 0.1 | 3 | 0.04 | 100 |

**Table 3-2 Model Soil Parameters**

## 3.5. Modelling Results

### 3.5.1. Modelled Flow Distribution

As shown in **Table 3-3**, the proposed feedlot development complex has no effect on flow distribution. Regardless of the rainfall event magnitude all rainfall runoff follows the natural flow paths and flows into Back Creek downstream of the proposed feedlot development complex. The proposed development does not divert any water out of the catchment area or change the flow distribution.

| Development Condition | Rainfall Event | | | | |
|---|---|---|---|---|---|
| | 10% AEP ($m^3/s$) | 1% AEP ($m^3/s$) | 0.5% AEP ($m^3/s$) | 0.2% AEP ($m^3/s$) | 0.05% AEP ($m^3/s$) |
| **Pre-Development** | 5 | 10 | 12 | 15 | 19 |
| **Proposed Development** | 5 | 10 | 12 | 15 | 19 |
| **Change from Pre-Development** | 0 | 0 | 0 | 0 | 0 |

**Table 3-3 Modelled Catchment Discharge**

There are no changes in flow distribution and this complies with the Water Management Act 2000.

### 3.5.2. Modelled Flow Depth

The effect of the proposed feedlot development complex on flow depth in the design rainfall events are shown in **Figures 3-1 to 3-30**. When compared to pre-development flow depths there is no off property depth increases with the proposed feedlot development in any of the modelled rainfall events. This complies with the Water Management Act 2000.

The proposed diversion bank does not get overtopped in the 0.05% AEP Rainfall Event.

The proposed sedimentation basin has enough capacity to capture all the runoff from the proposed feedlot area in a 0.1% AEP rainfall event. The proposed sedimentation basin bywashes excess runoff in the 1% AEP and larger rainfall events.

### 3.5.3. Modelled Flow Velocity

The modelled flow velocities are shown in **Figures 3-1 to 3-30**. The results show that in the design rainfall events, with pre-development conditions, the flow velocities over the majority of the catchment area are in the range 0.1 to 0.3 m/s in the field areas and 0.3 m/s to 1.5 m/s in the contour bank drains and the unnamed gully that flows adjacent to the southern side of the proposed feedlot development complex.

When compared to pre-development flow velocities there is no off property velocity increases with the proposed feedlot development complex in any of the modelled rainfall events. There are some small localised velocity increases in the immediate vicinity of the proposed diversion bank. Flow depths adjacent to diversion bank on the north, east and western sides of the proposed feedlot development complex are typically less than 0.1m. The velocities adjacent to the north, east and western sides of the proposed levee in a 1% AEP or smaller rainfall event are less than 0.4 m/s and are non erosive. There is a small increase in velocity in the unnamed gully adjacent to the sedimentation basin. The maximum velocity increase in the area to the south of the sedimentation basin in a 1% AEP or smaller rainfall event is 15% (a velocity increase from approximately 0.7 m/s to 0.8 m/s).

Having no off property changes in flow velocity in all modelled rainfall events complies with the Water Management Act 2000.

### 3.5.4. Community Infrastructure

There are no houses or other farm buildings within the modelled area that are impacted by overland flows in the rainfall events. The modelling results show that the flow conditions in the vicinity of all public roads and community infrastructure are unchanged by the proposed feedlot development complex.

### 3.5.5. Flood Hazard Assessment

The flood Hazard has been mapped and is shown in **Figures 3.31 and 3.32** for the 1% AEP Rainfall Event. The flood hazard maps have been prepared in accordance with Australian Disaster Resilience Guideline 7-3: Technical flood risk management guideline: Flood hazard, 2014. The definitions of the flood hazard vulnerability classifications are shown in **Table 3-4**.

The results show there is virtually no change in flood hazard with the proposed feedlot development. All of the catchment except a small area in the unnamed gully to the south of the proposed feedlot development complex is classified H1 (Generally safe for vehicles, people and buildings). The small area in the unnamed gully is classified H2 (unsafe for small vehicles). The flood hazard with pre-development and the proposed development is essentially the same.

| Hazard Vulnerability Classification | Description |
|---|---|
| **H1** | Generally safe for vehicles, people and buildings. |
| **H2** | Unsafe for small vehicles |
| **H3** | Unsafe for vehicles, children and the elderly. |
| **H4** | Unsafe for vehicles and people. |
| **H5** | Unsafe for vehicles and people. All building types vulnerable to structural damage. Some less robust building types vulnerable to failure. |
| **H6** | Unsafe for vehicles and people. All building types considered vulnerable to failure. |

**Table 3-4 - Flood Hazard Vulnerability Classifications.**

## 4. ENVIRONMENT

The existing 999 head beef cattle feedlot was established in 2022. The additional area protected by the proposed diversion bank is currently used as holding pens for stock. No further clearing or changes to land cover are required. There will be no further impact on existing native flora and fauna.

The proposed feedlot development complex is aligned with the natural flow paths through the property. This ensures that local drainage is not inhibited

# 5. CONCLUSION

The proposed feedlot development complex on Springfield has minimal impact on overland flow events in the catchment. In all the modelled rainfall events the flow distribution with the proposed feedlot development complex is essentially the same as that of pre-development and complies with the Water Management Act 2000.

The proposed feedlot development complex does not change any off property flow depths or velocities. Any velocity changes within the property are localised adjacent to the proposed levee and velocities with the proposed feedlot development complex are non erosive.

The proposed diversion bank does not get overtopped in any of the modelled rainfall events. The proposed sedimentation basin has enough capacity to capture all the runoff from the proposed feedlot area in a 0.1% AEP rainfall event. The proposed sedimentation basin bywashes excess runoff in the 1% AEP and larger rainfall events.

All changes in flow depths and velocities are within the Water Management Act 2000 guidelines.

The proposed feedlot development complex does not change the flow conditions in the vicinity of any community infrastructure.

The proposed feedlot development complex does not change the flood hazard classification for the overland flows in the catchment area. Virtually all of the catchment area is classified H1 in a 1% AEP rainfall event.

The proposed feedlot development complex is aligned with the flow paths through the property. This minimises any effects that it has on overland flows and ensures that local drainage is not inhibited.

Based on the assessment outlined above the proposed works are considered to be acceptable development.

# 6. REFERENCES

Australian Disaster Resilience Guideline 7-3: Technical Flood Risk Management Guideline: Flood Hazard, 2014, Australian Institute for Disaster Resilience CC BY-NC

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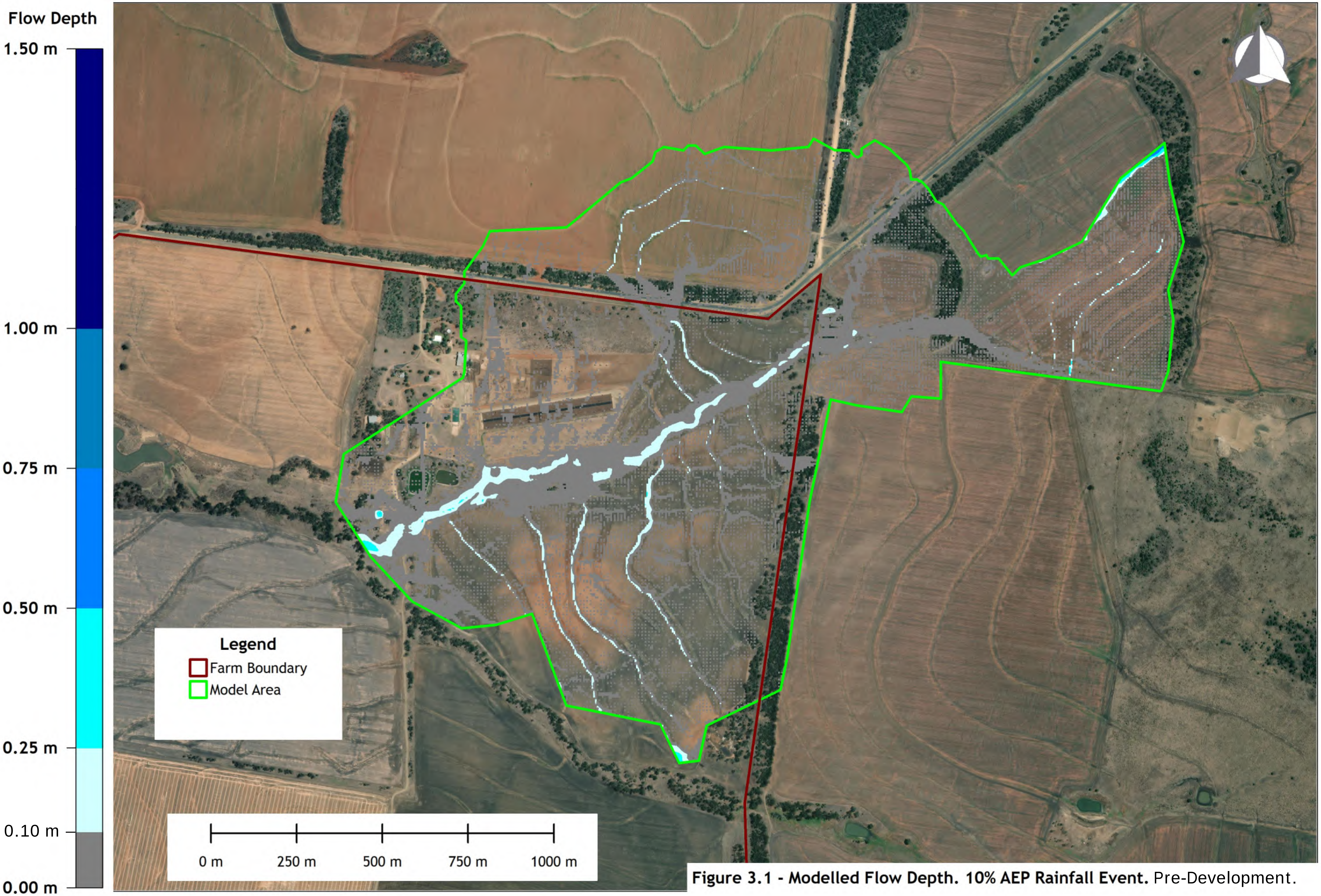



**Figure 3.1 - Modelled Flow Depth. 10% AEP Rainfall Event.** Pre-Development.

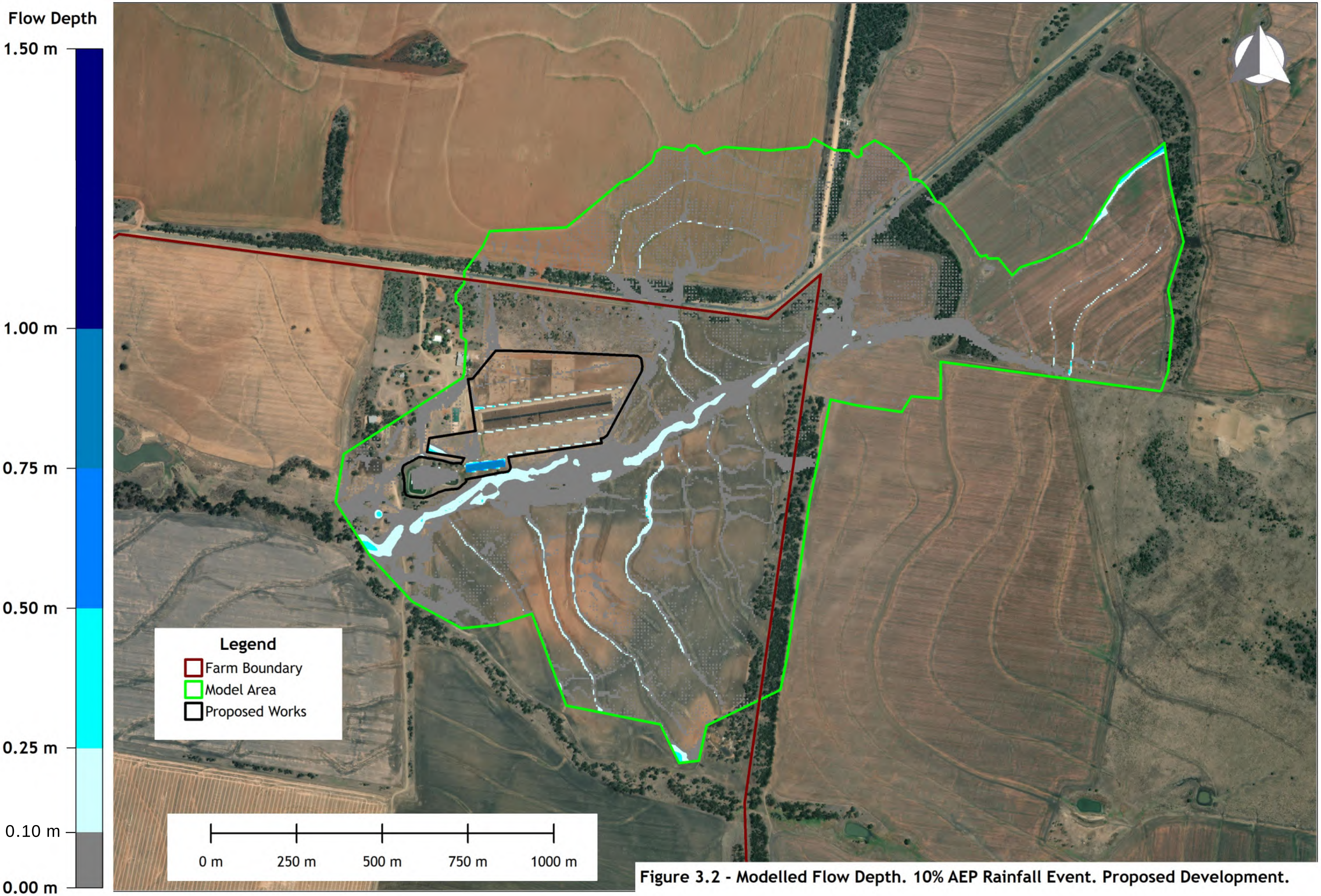



Figure 3.2 - Modelled Flow Depth. 10% AEP Rainfall Event. Proposed Development.

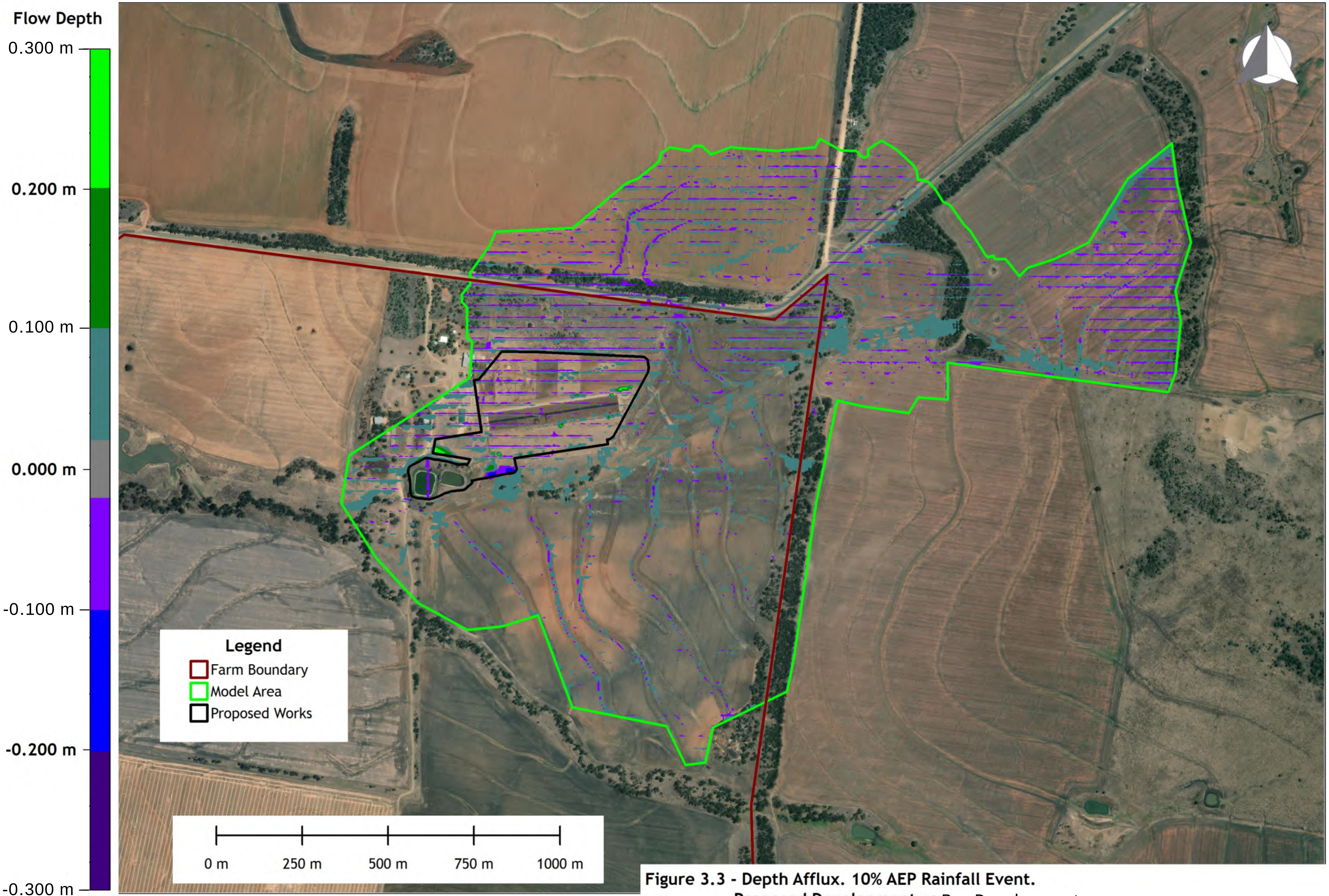



**Figure 3.3 - Depth Afflux. 10% AEP Rainfall Event. Proposed Development vs Pre-Development.**

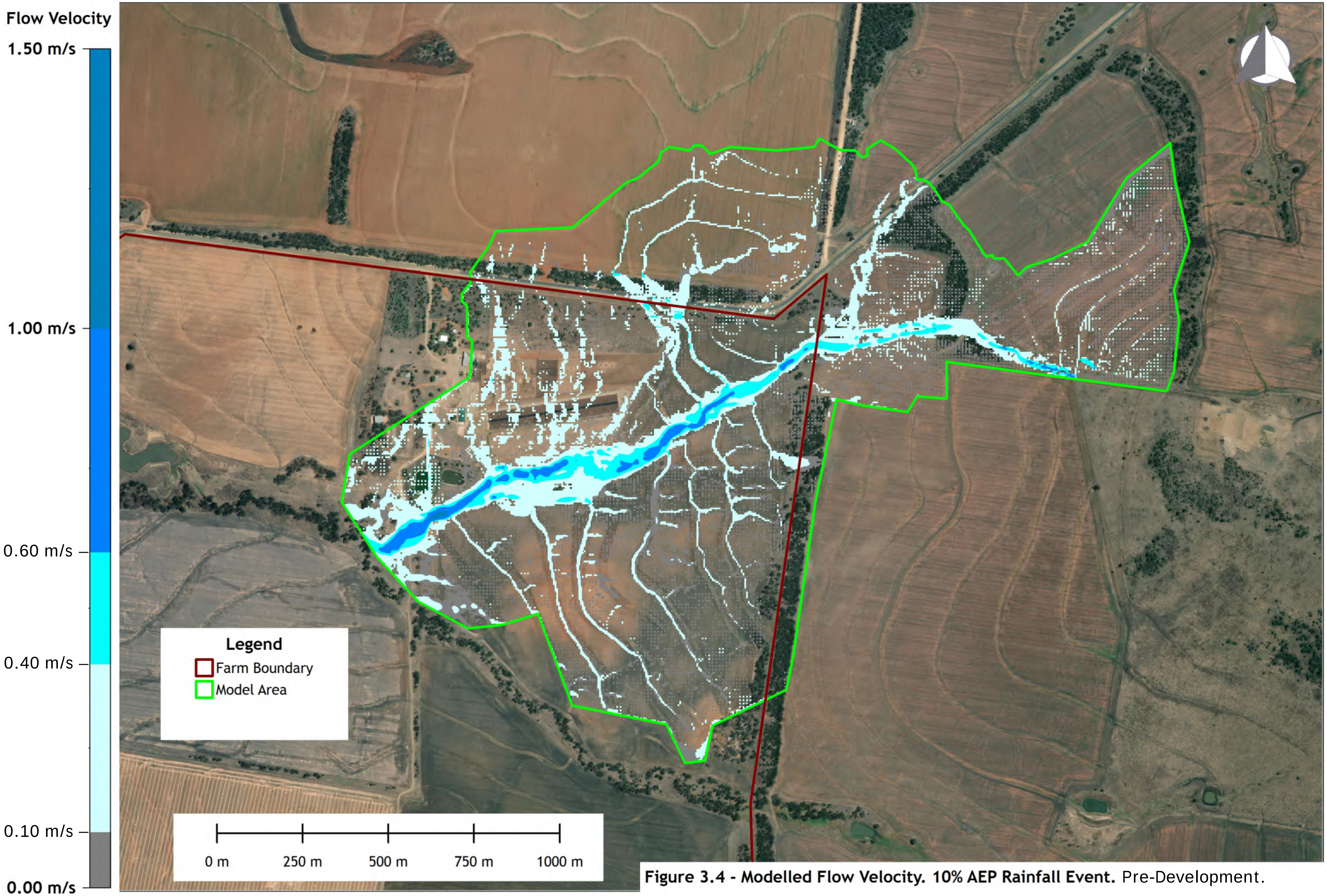



**Figure 3.4 - Modelled Flow Velocity. 10% AEP Rainfall Event.** Pre-Development.

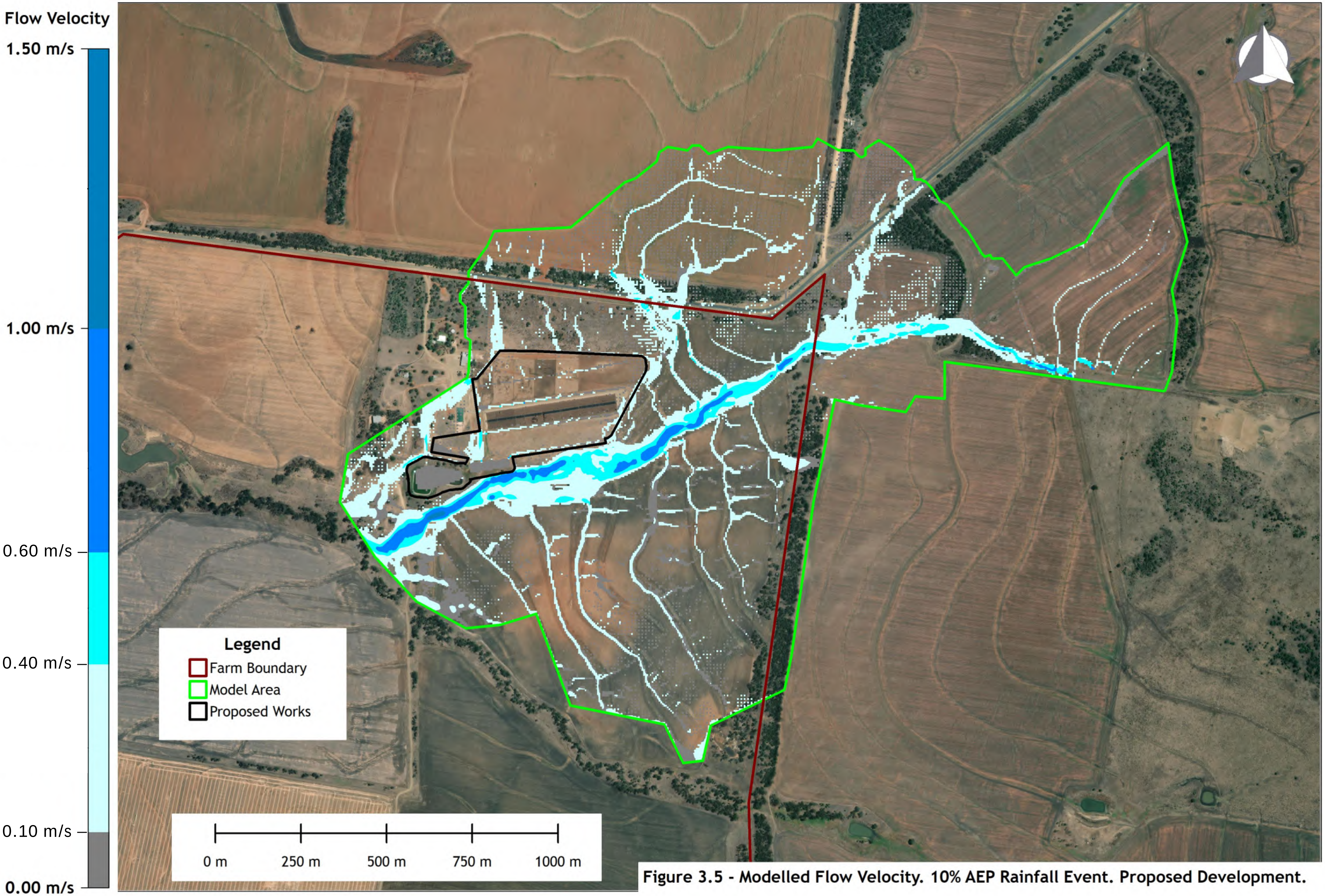



**Figure 3.5 - Modelled Flow Velocity. 10% AEP Rainfall Event. Proposed Development.**

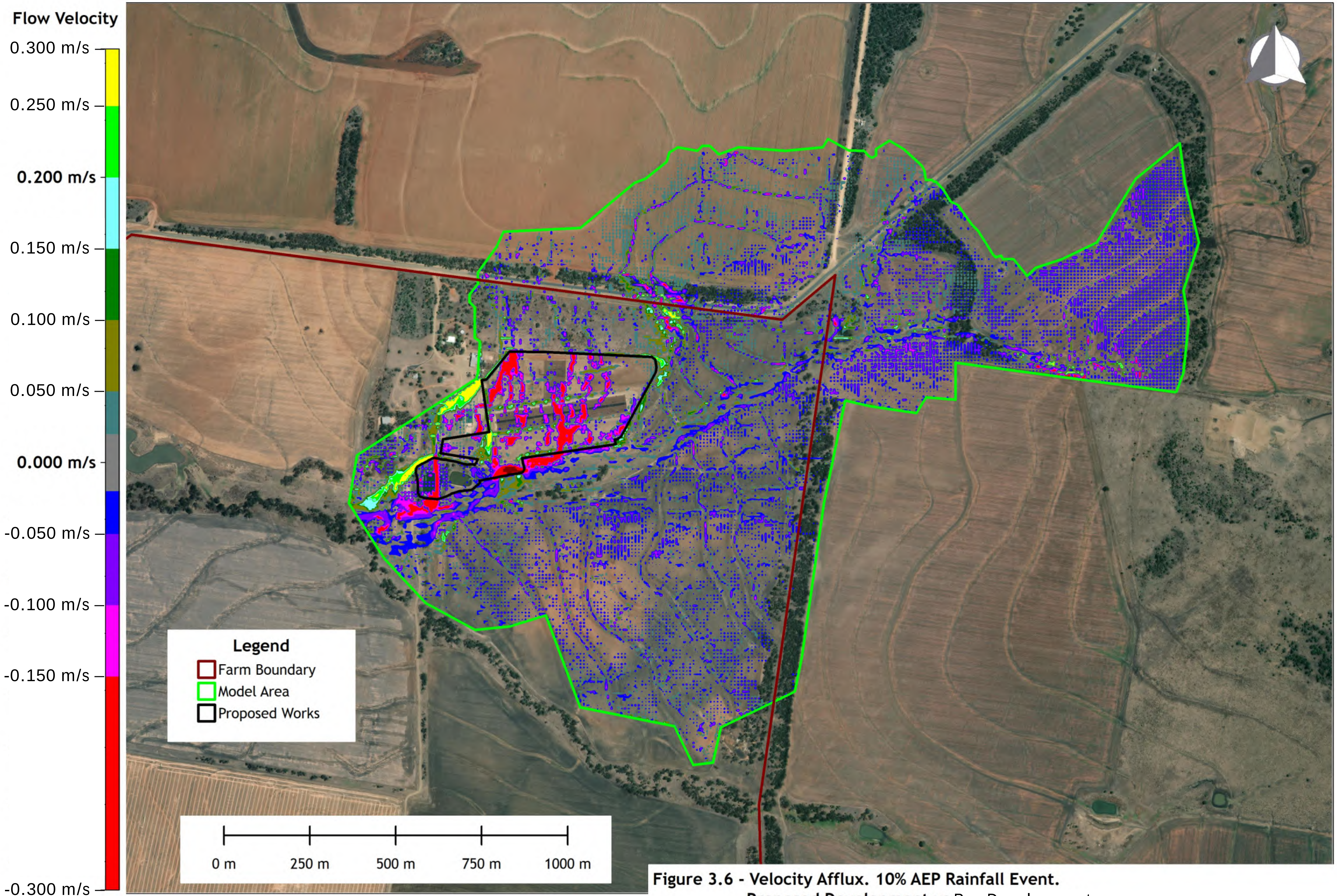



**Figure 3.6 - Velocity Afflux. 10% AEP Rainfall Event.**
**Proposed Development vs** Pre-Development.

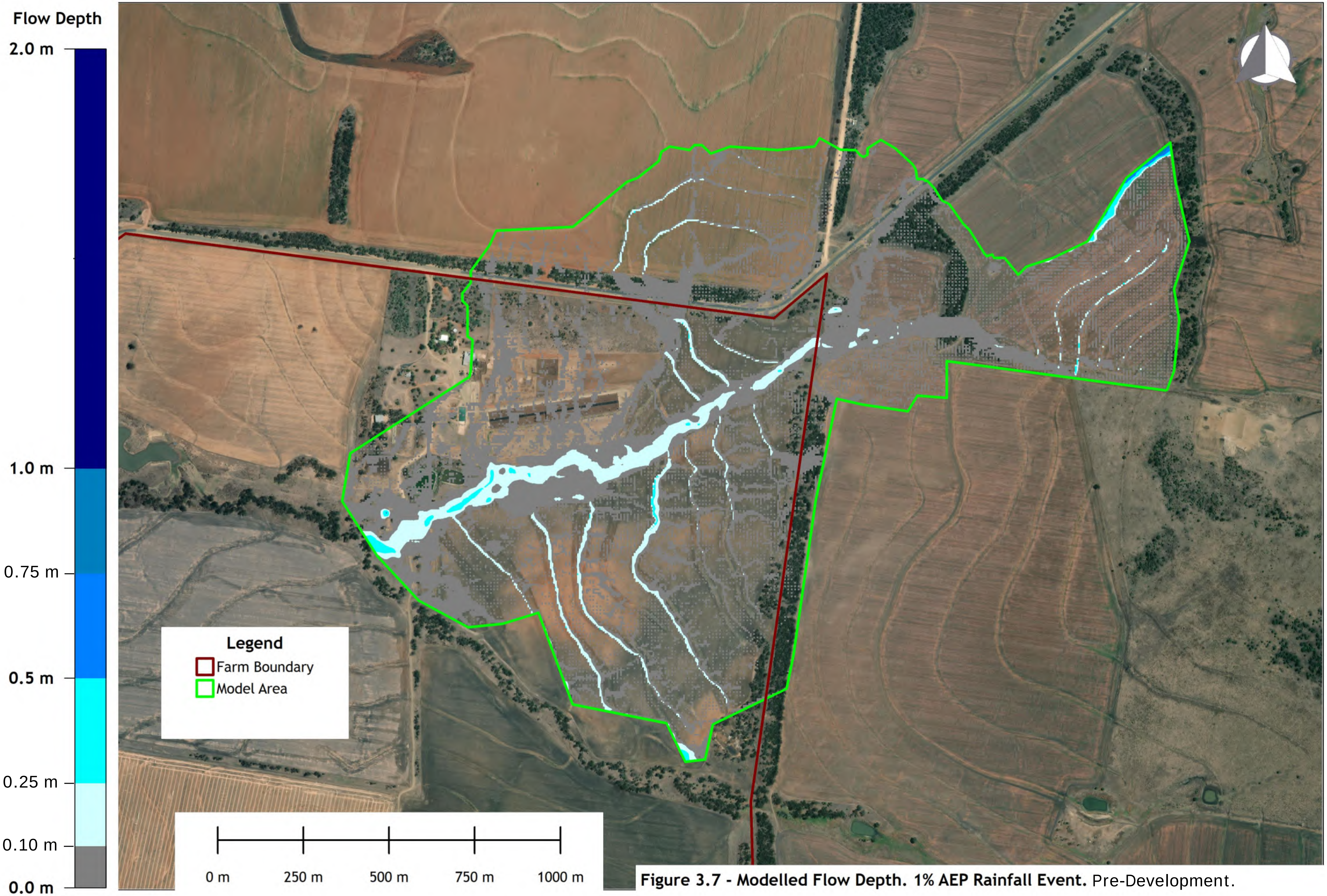



**Figure 3.7 - Modelled Flow Depth. 1% AEP Rainfall Event.** Pre-Development.

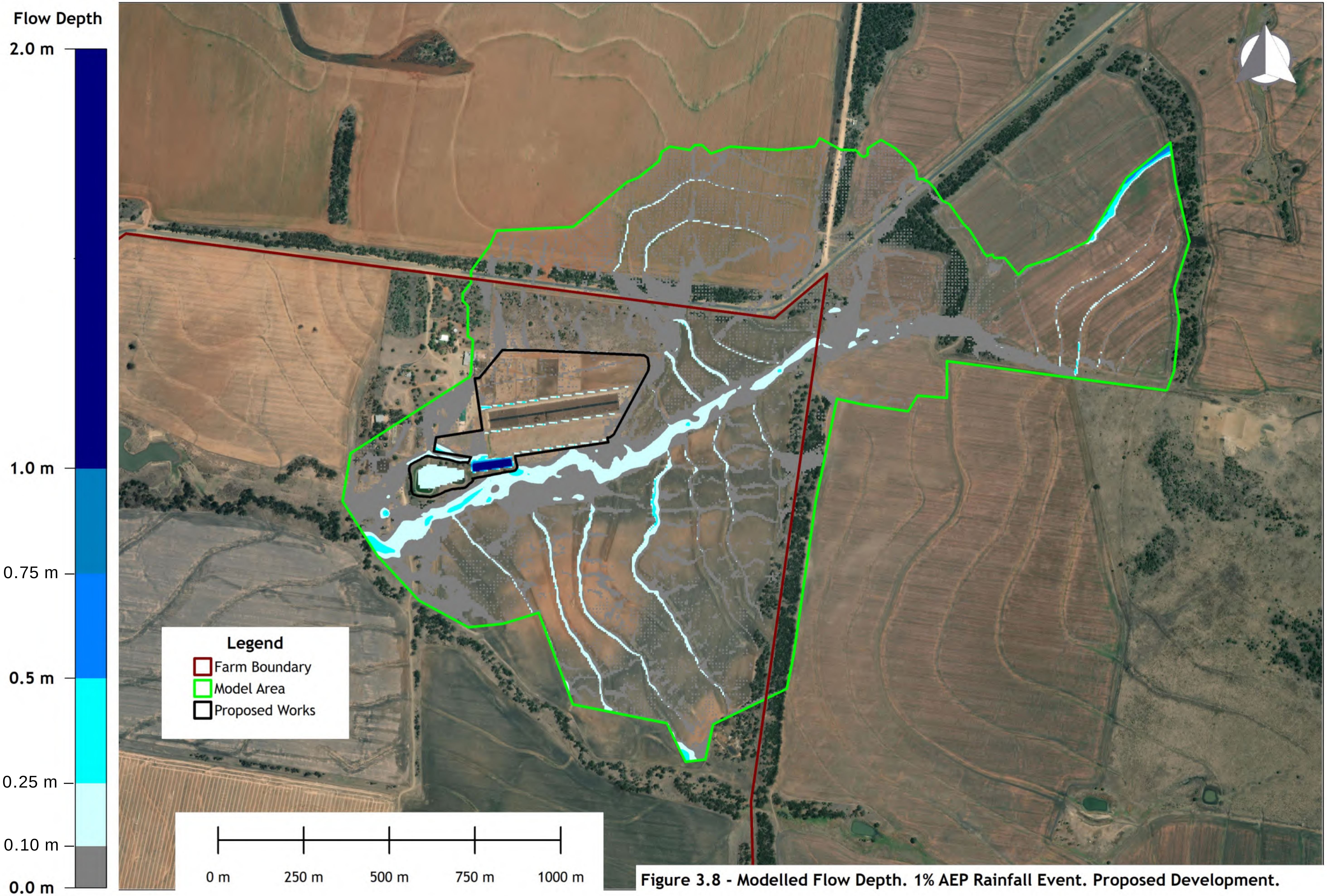



**Figure 3.8 - Modelled Flow Depth. 1% AEP Rainfall Event. Proposed Development.**

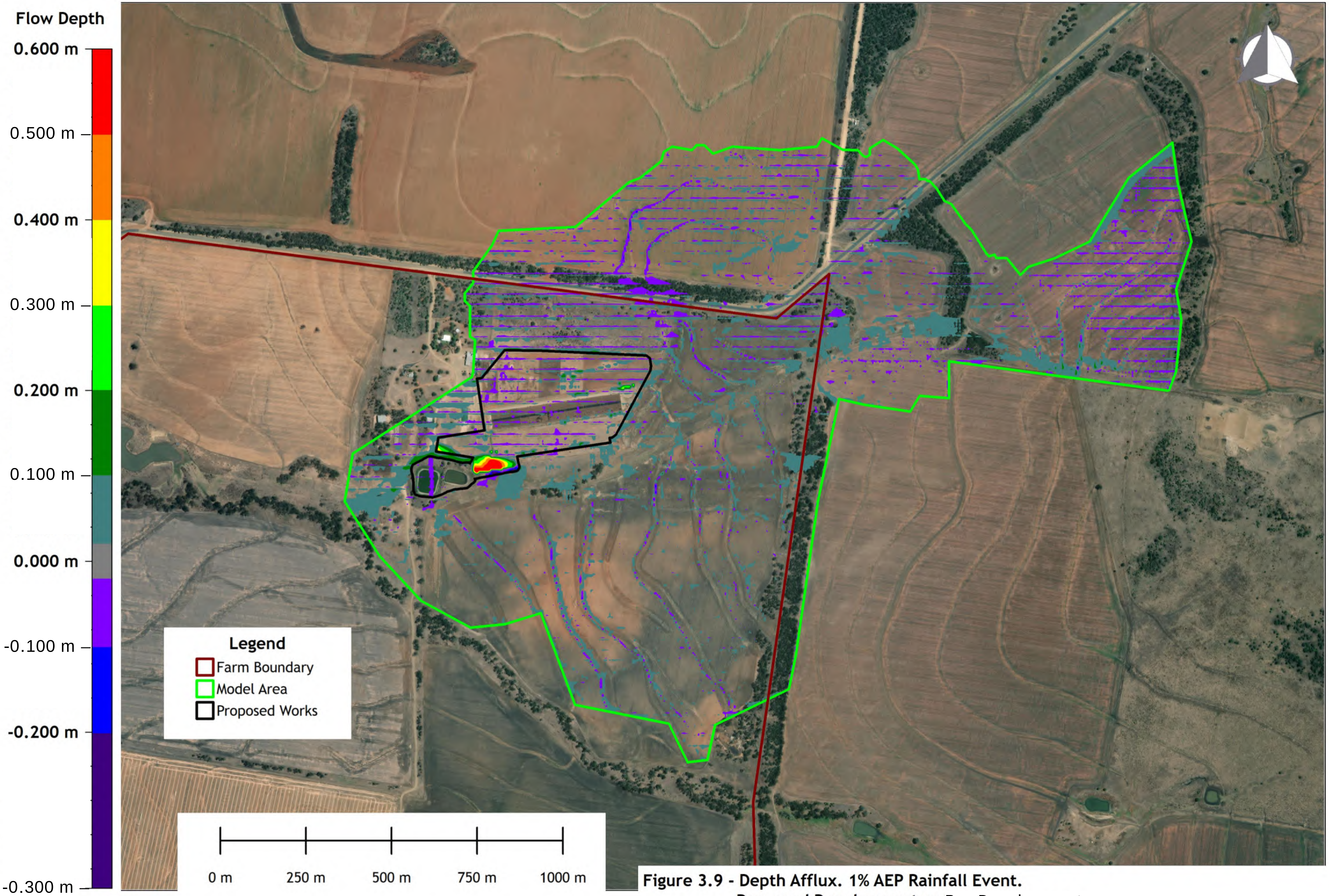



**Figure 3.9 - Depth Afflux. 1% AEP Rainfall Event.**
**Proposed Development vs** Pre-Development.

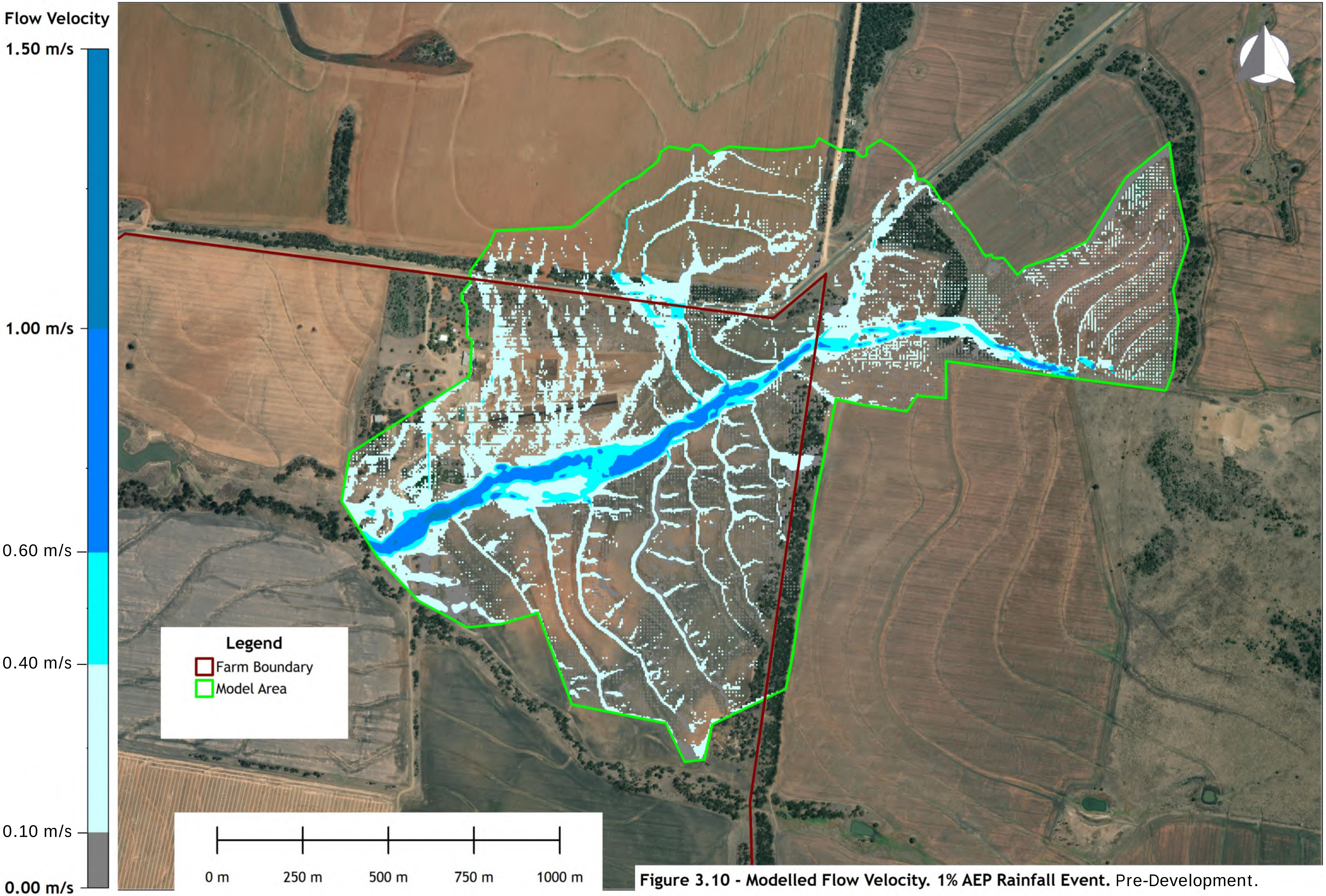



**Figure 3.10 - Modelled Flow Velocity. 1% AEP Rainfall Event.** Pre-Development.

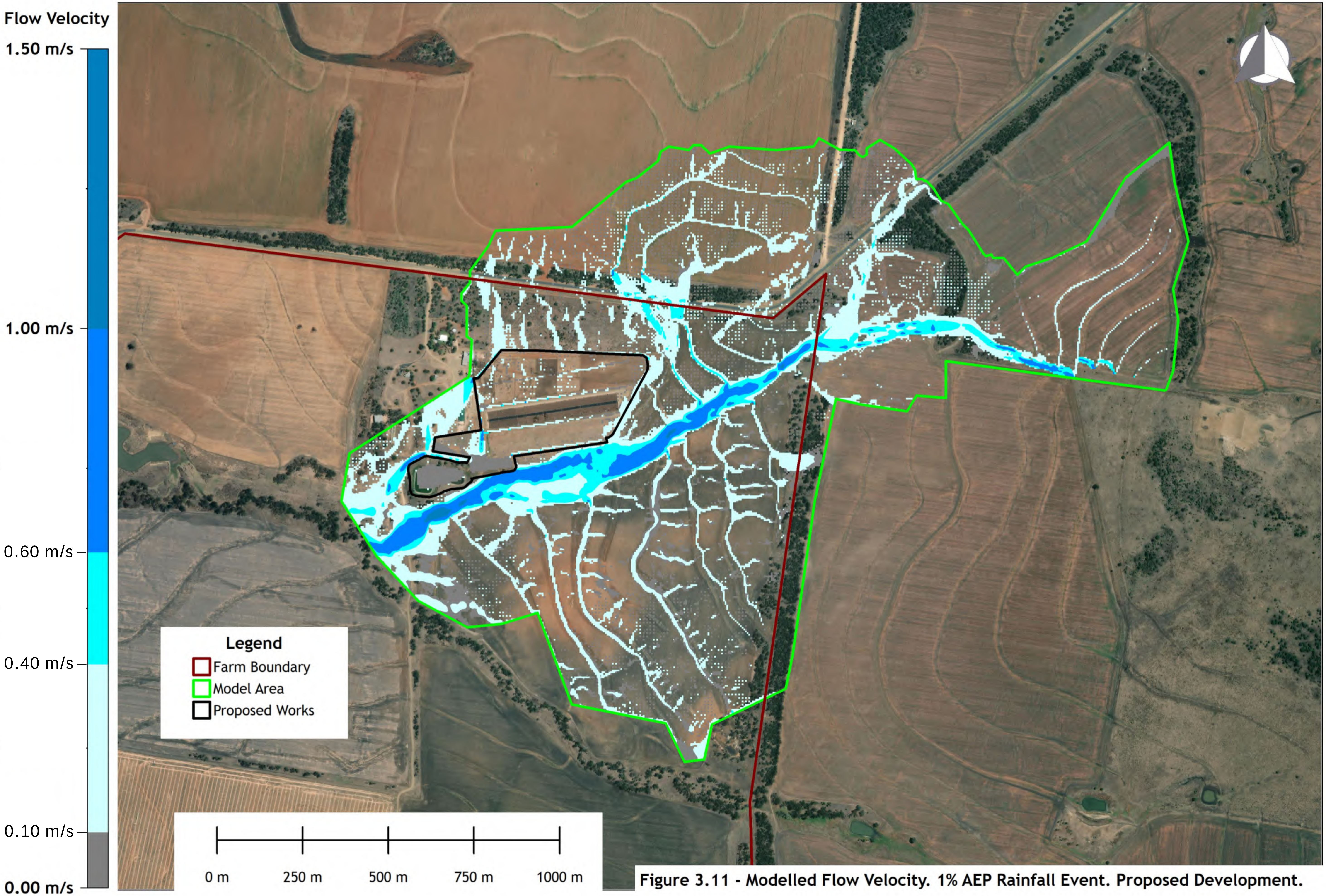



Figure 3.11 - Modelled Flow Velocity. 1% AEP Rainfall Event. Proposed Development.

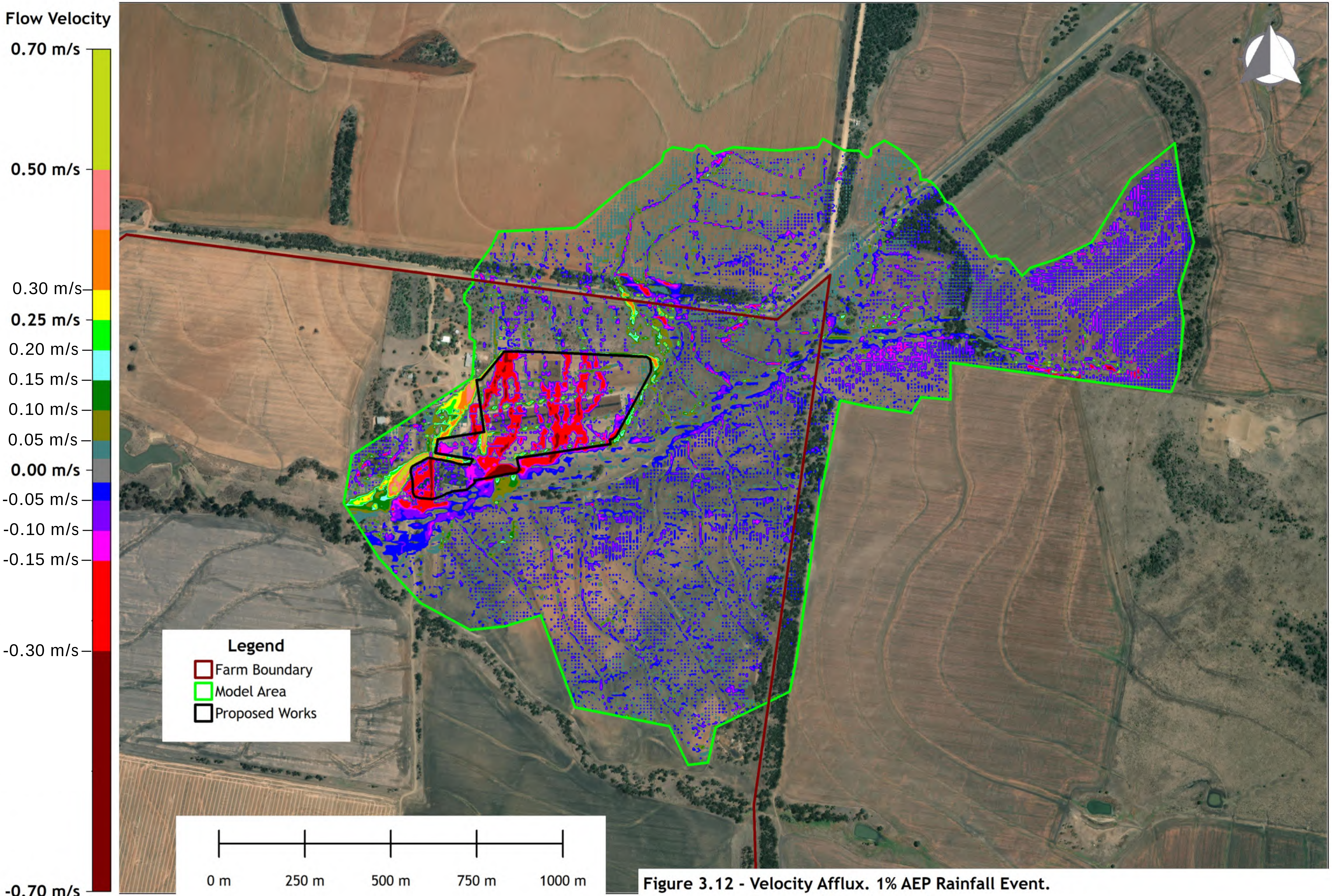



**Figure 3.12 - Velocity Afflux. 1% AEP Rainfall Event. Proposed Development vs** Pre-Development.

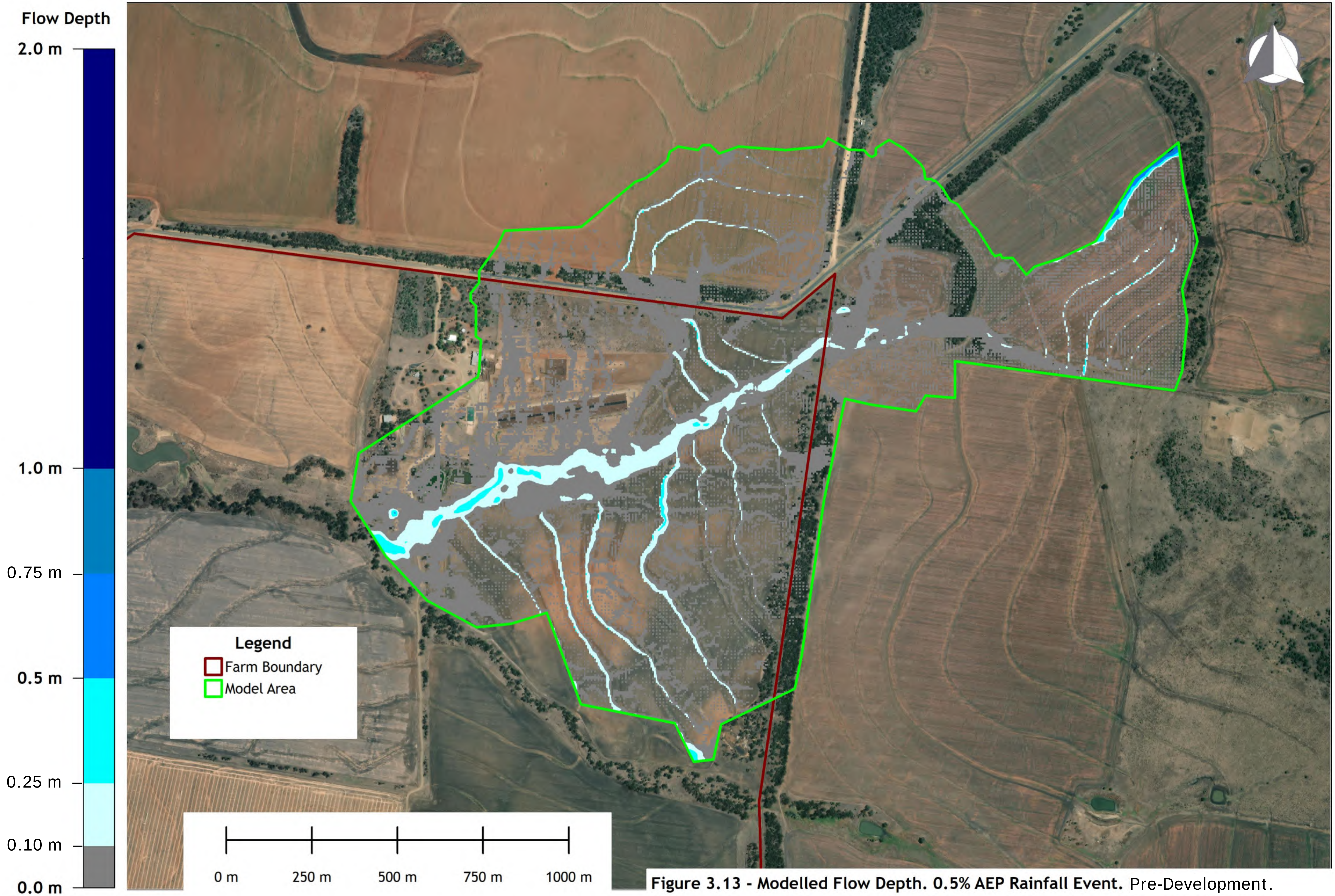



**Figure 3.13 - Modelled Flow Depth. 0.5% AEP Rainfall Event.** Pre-Development.

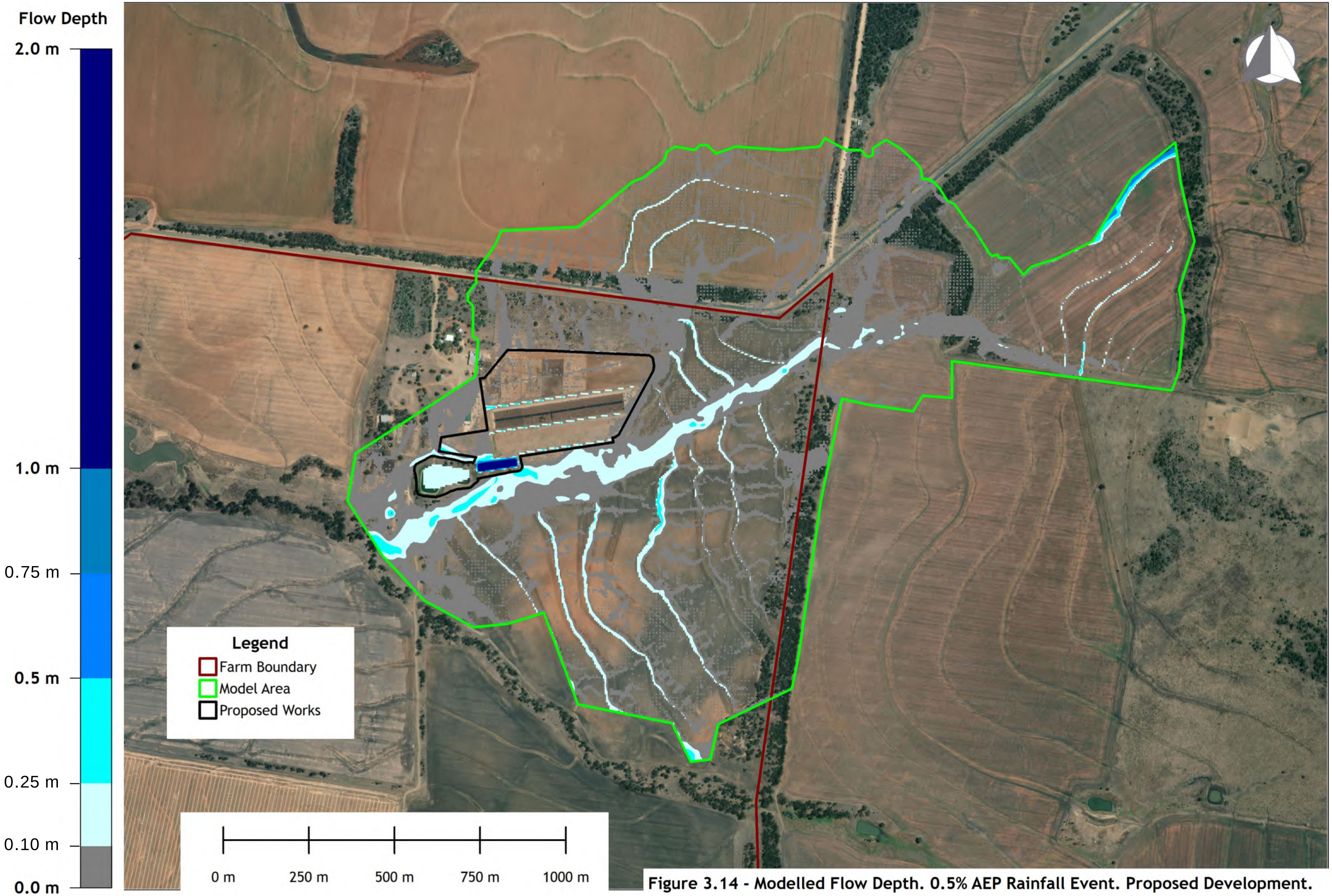



Figure 3.14 - Modelled Flow Depth. 0.5% AEP Rainfall Event. Proposed Development.

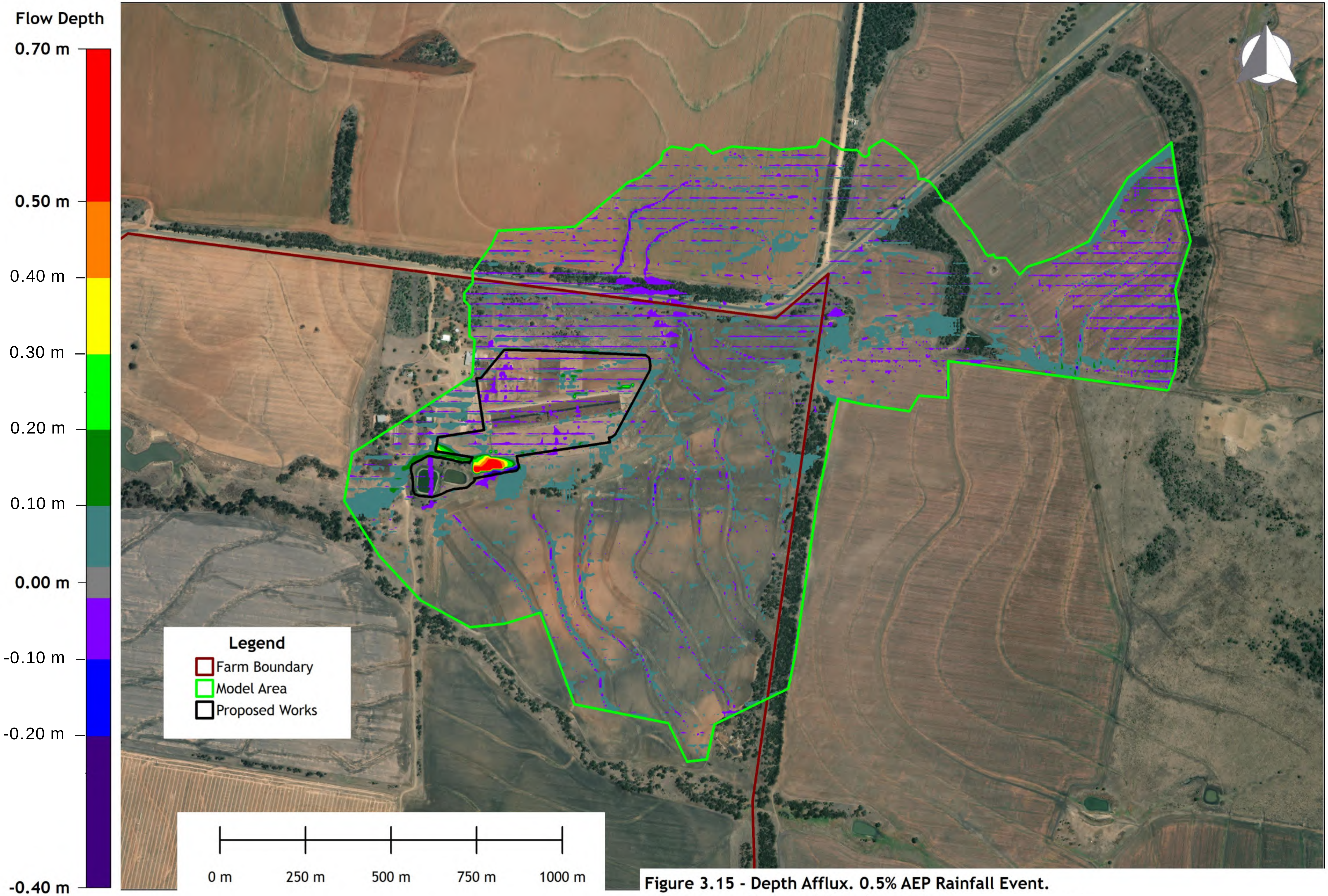



**Figure 3.15 - Depth Afflux. 0.5% AEP Rainfall Event. Proposed Development vs Pre-Development.**

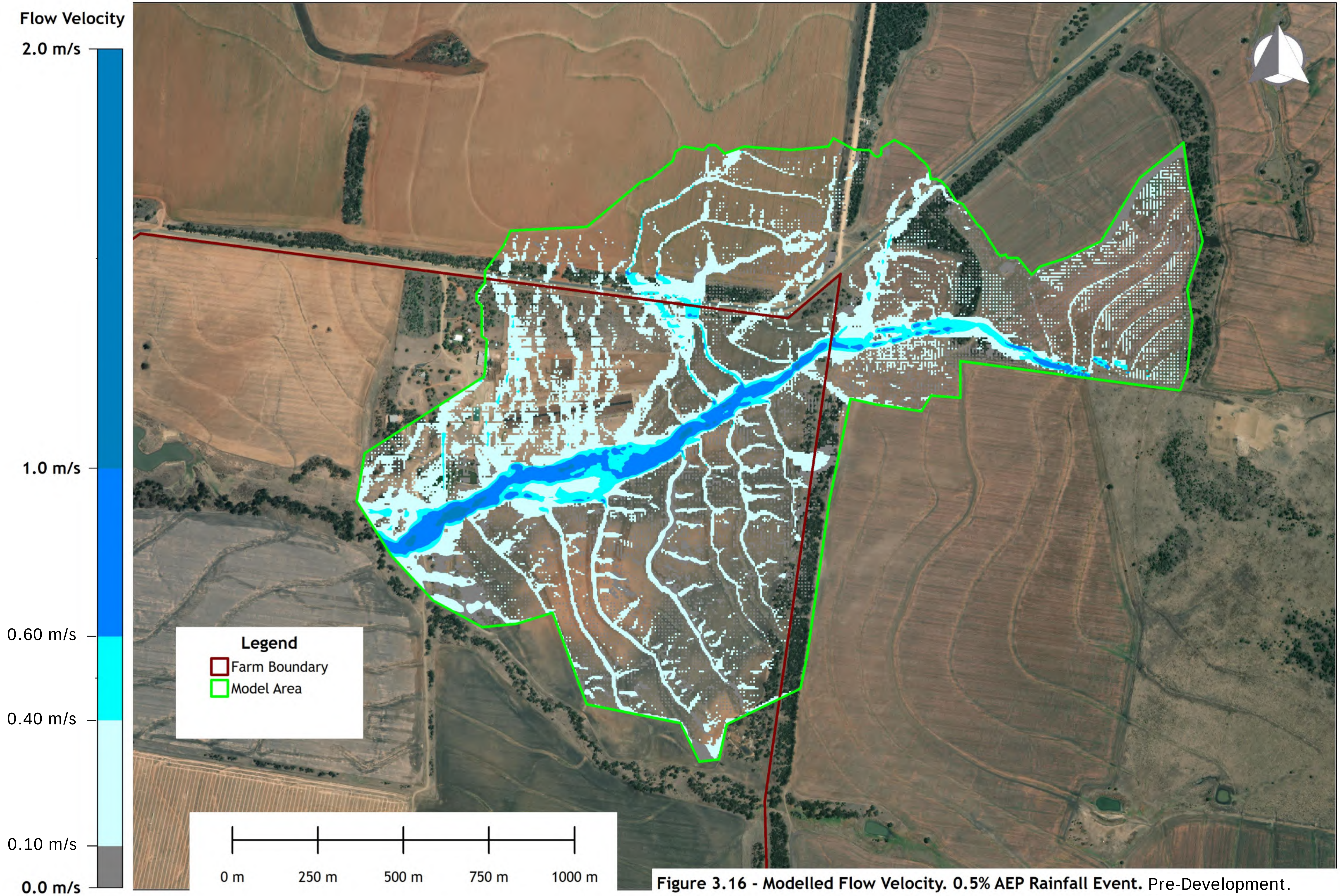



**Figure 3.16 - Modelled Flow Velocity. 0.5% AEP Rainfall Event.** Pre-Development.

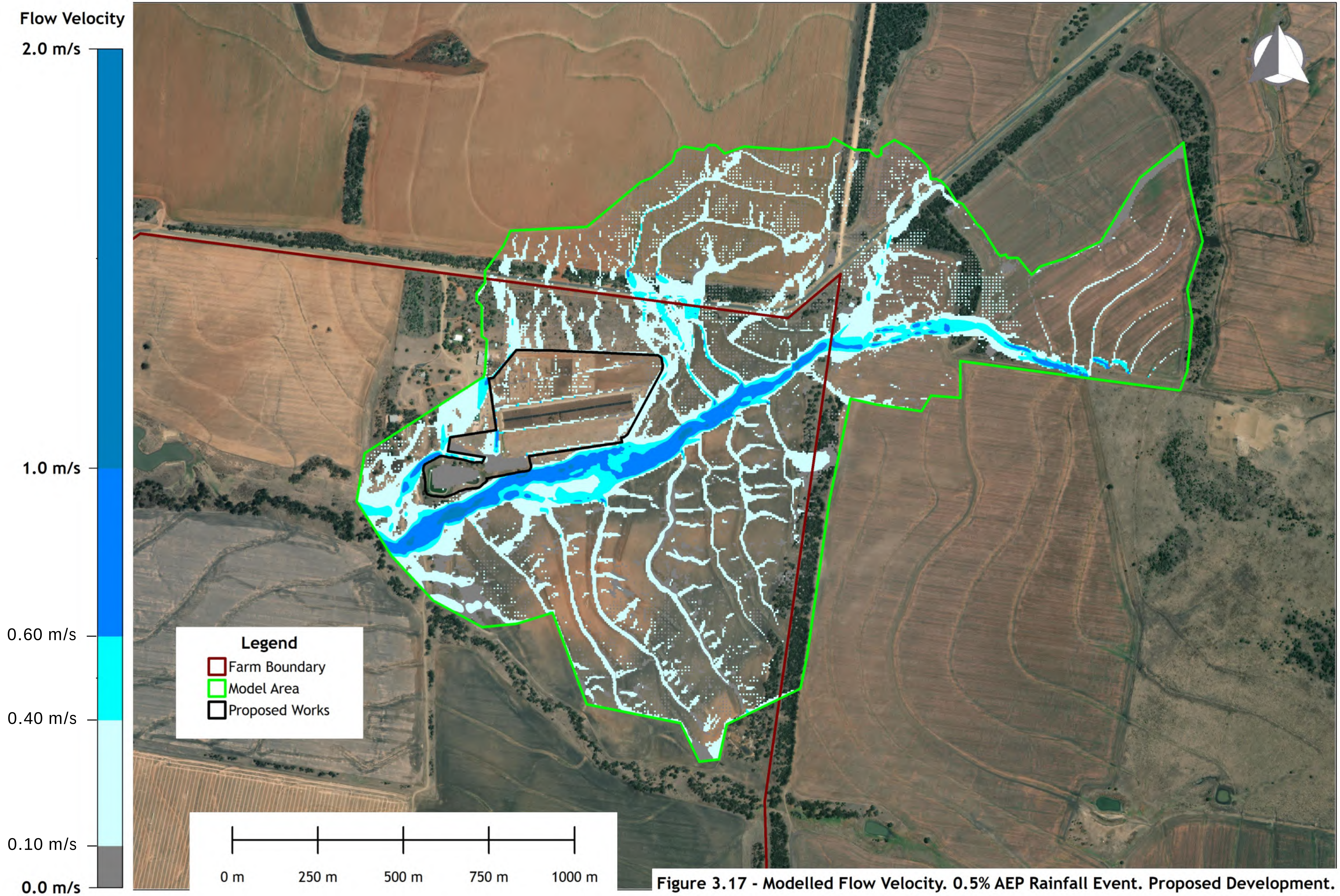



Figure 3.17 - Modelled Flow Velocity. 0.5% AEP Rainfall Event. Proposed Development.

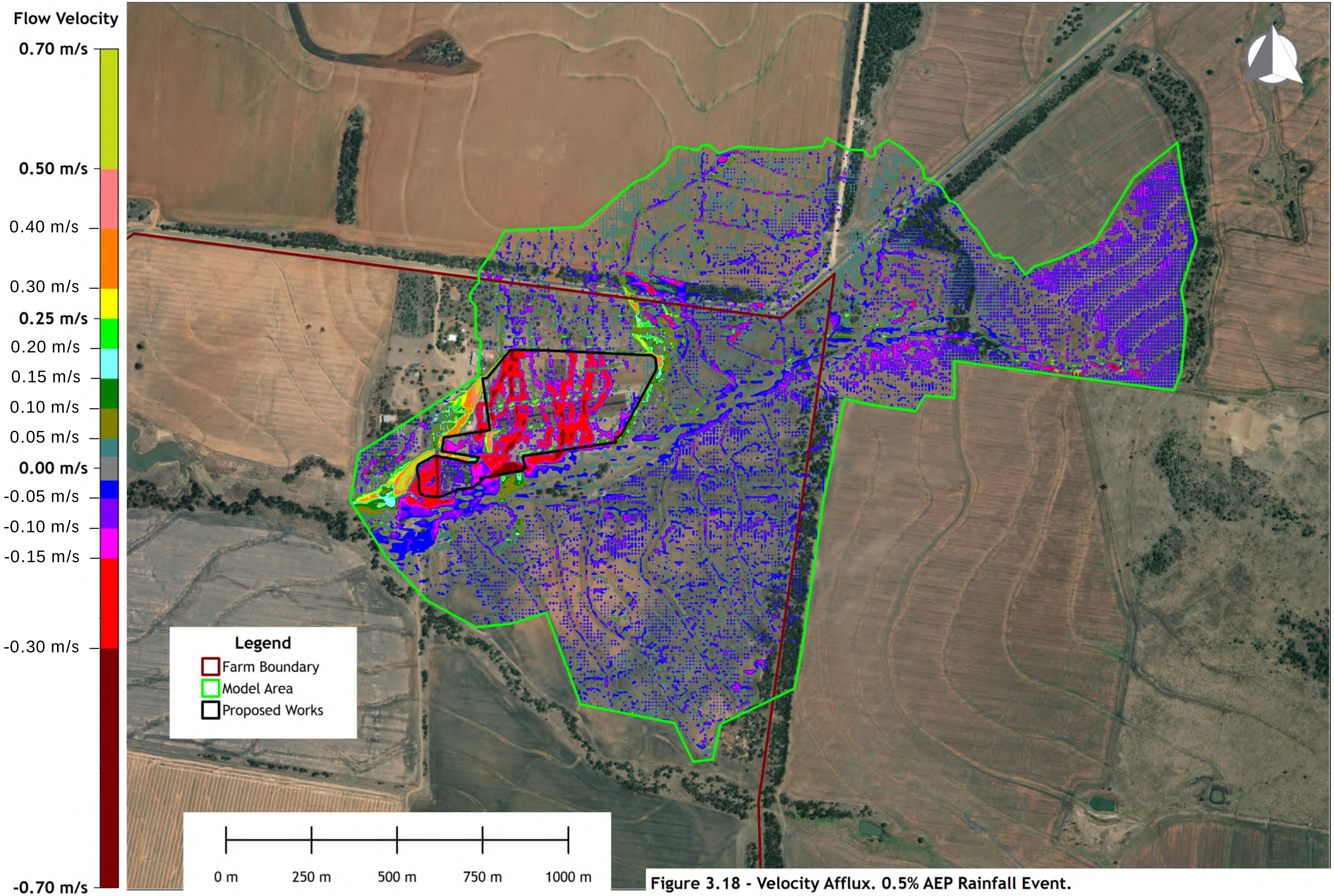



**Figure 3.18 - Velocity Afflux. 0.5% AEP Rainfall Event. Proposed Development vs** Pre-Development.

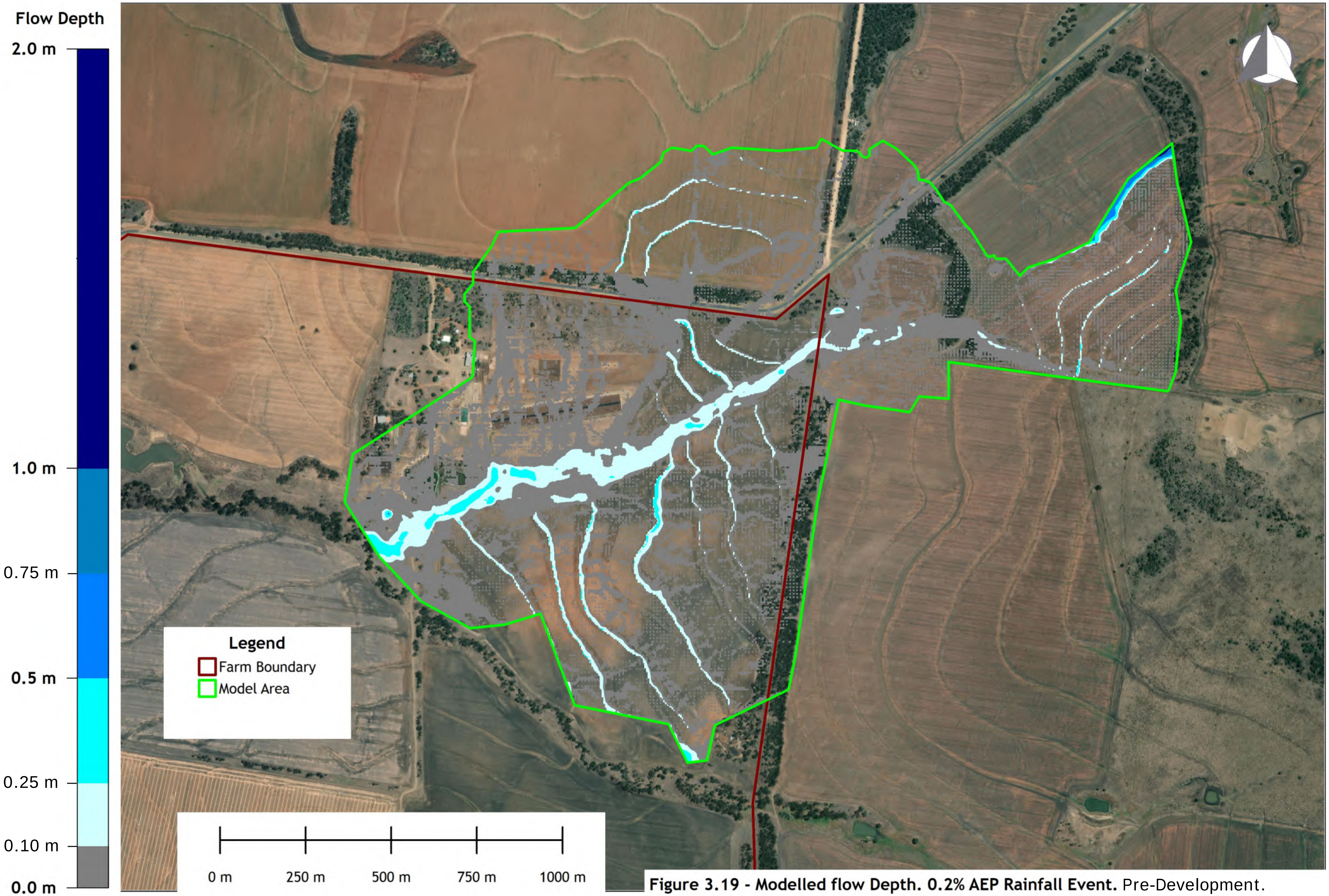



**Figure 3.19 - Modelled flow Depth. 0.2% AEP Rainfall Event.** Pre-Development.

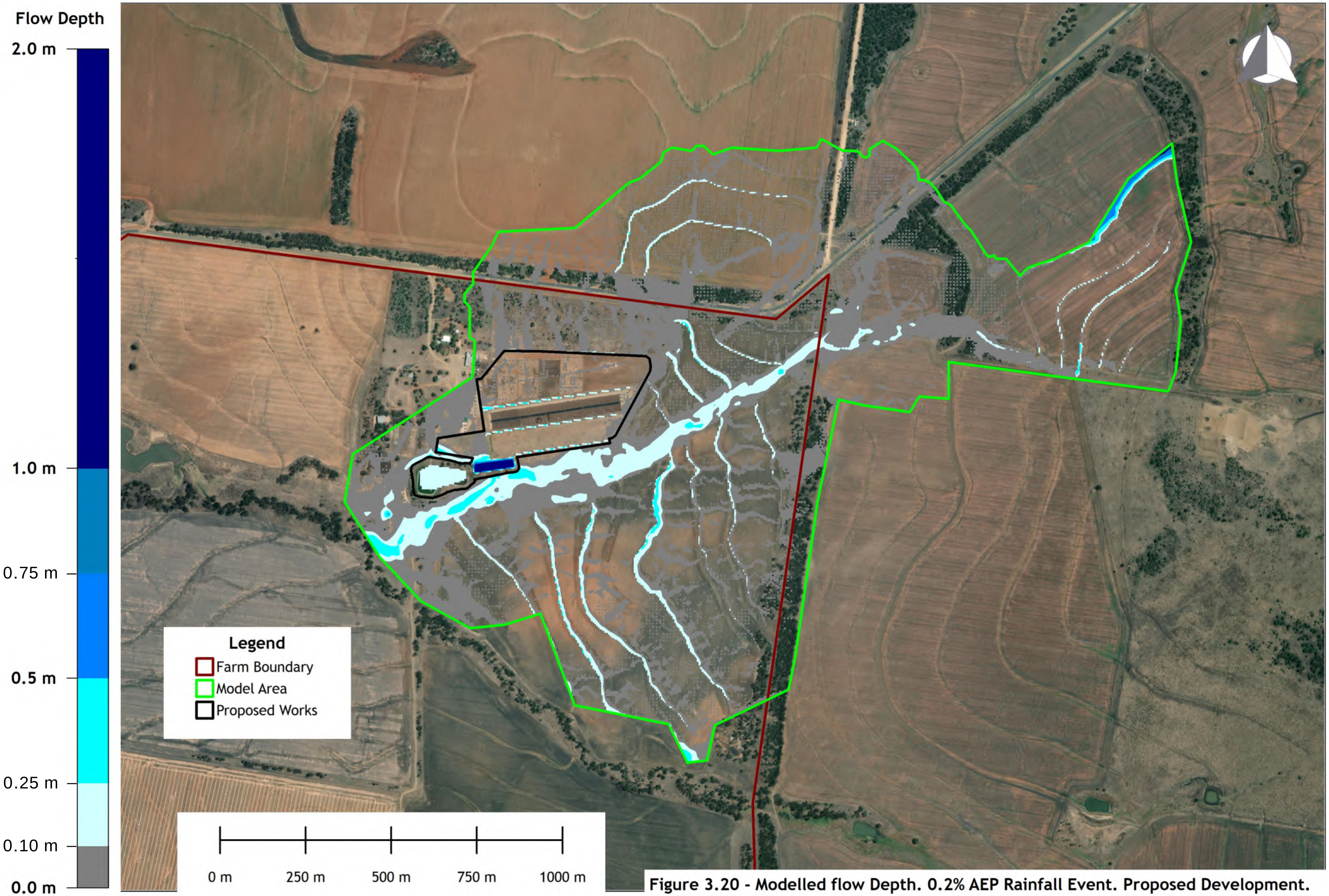



Figure 3.20 - Modelled flow Depth. 0.2% AEP Rainfall Event. Proposed Development.

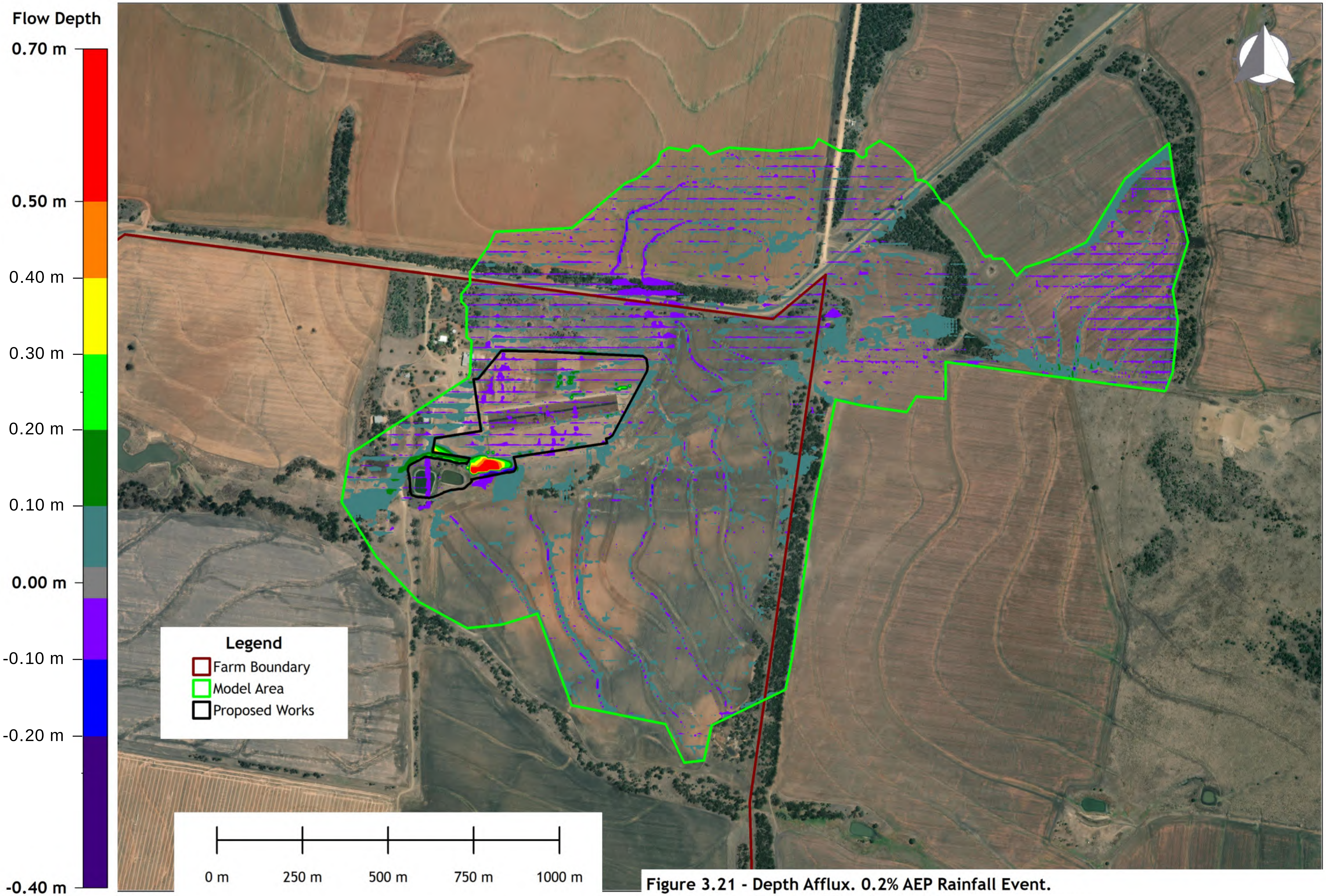



**Figure 3.21 - Depth Afflux. 0.2% AEP Rainfall Event.**
**Proposed Development vs** Pre-Development.

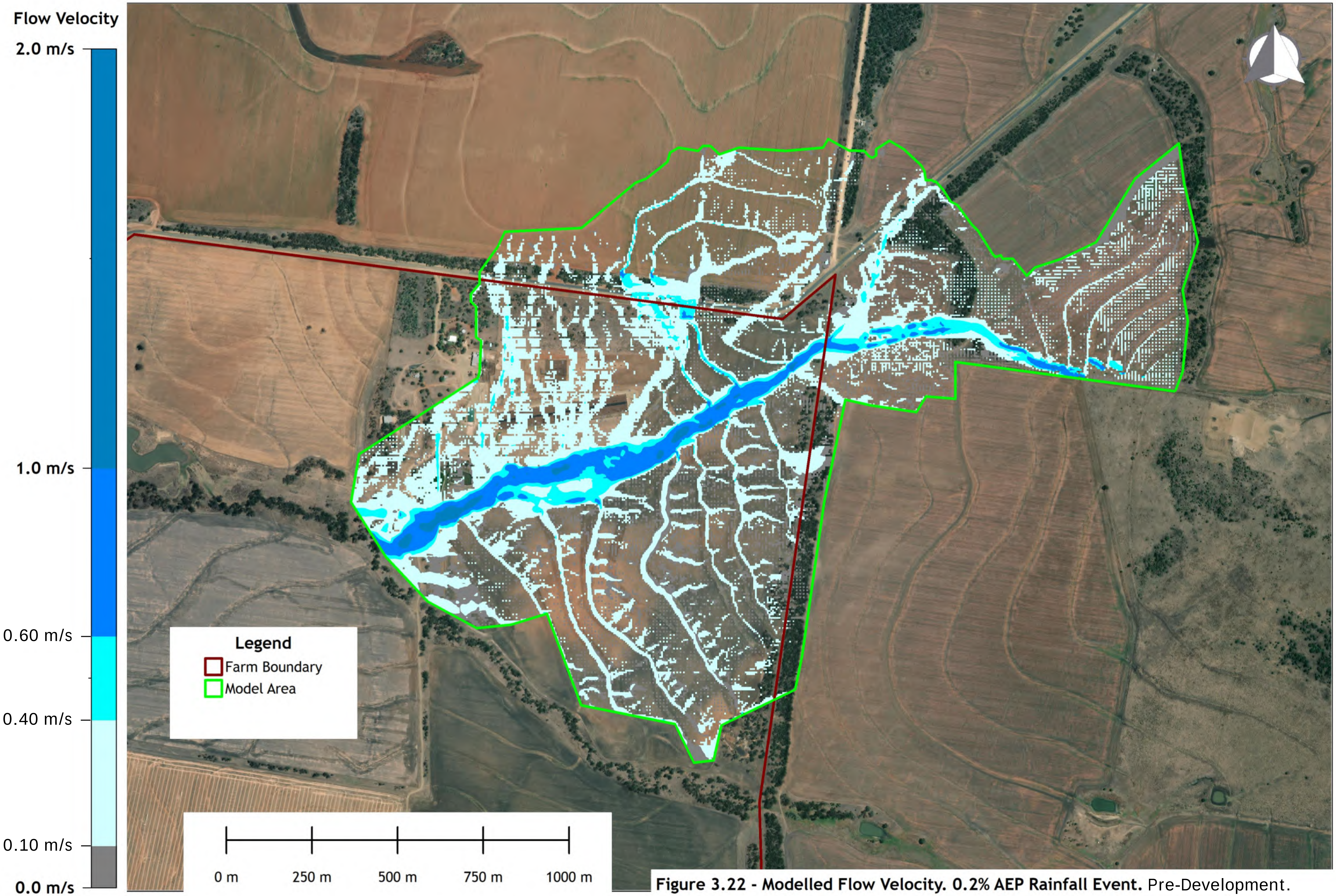



**Figure 3.22 - Modelled Flow Velocity. 0.2% AEP Rainfall Event.** Pre-Development.

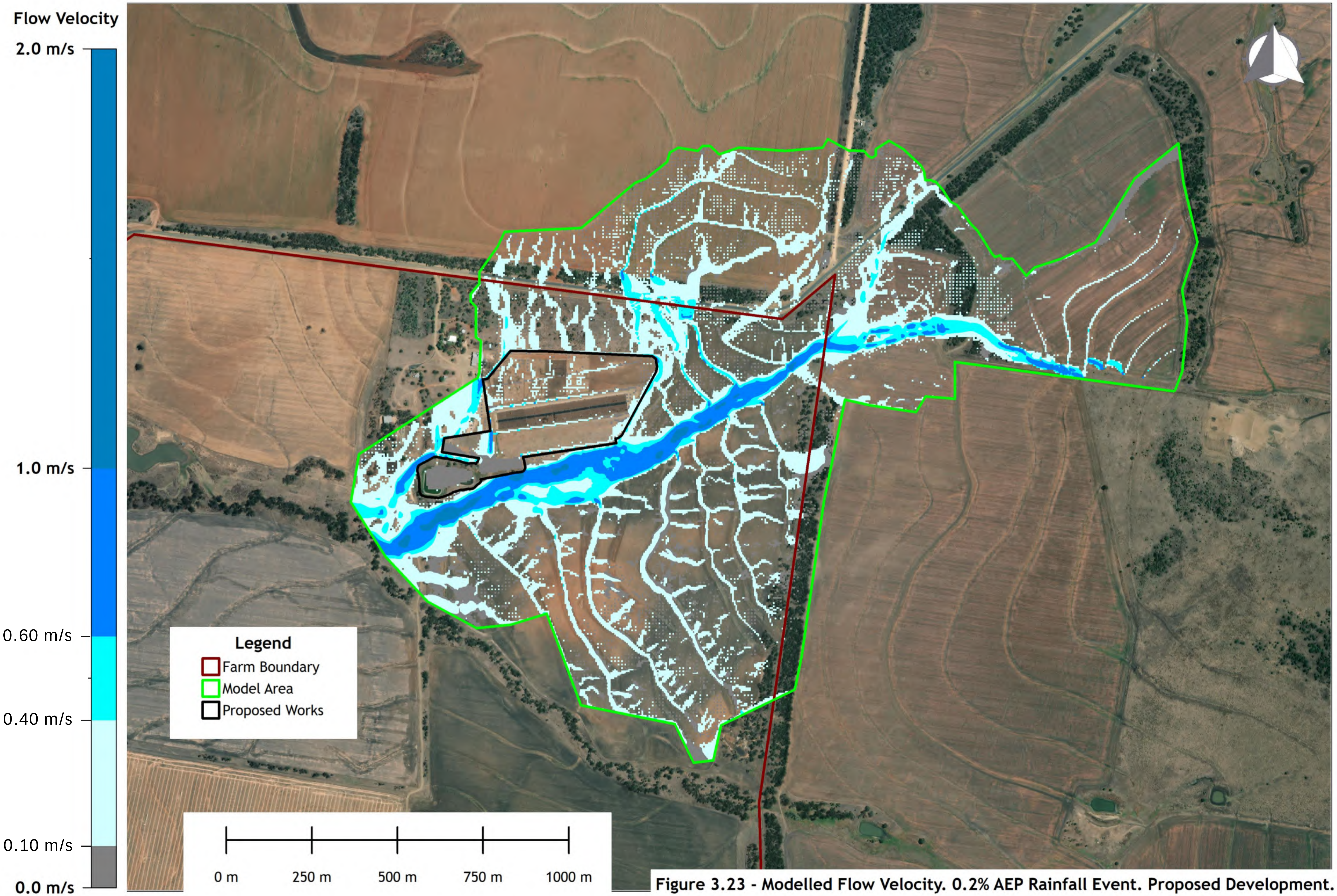



Figure 3.23 - Modelled Flow Velocity. 0.2% AEP Rainfall Event. Proposed Development.

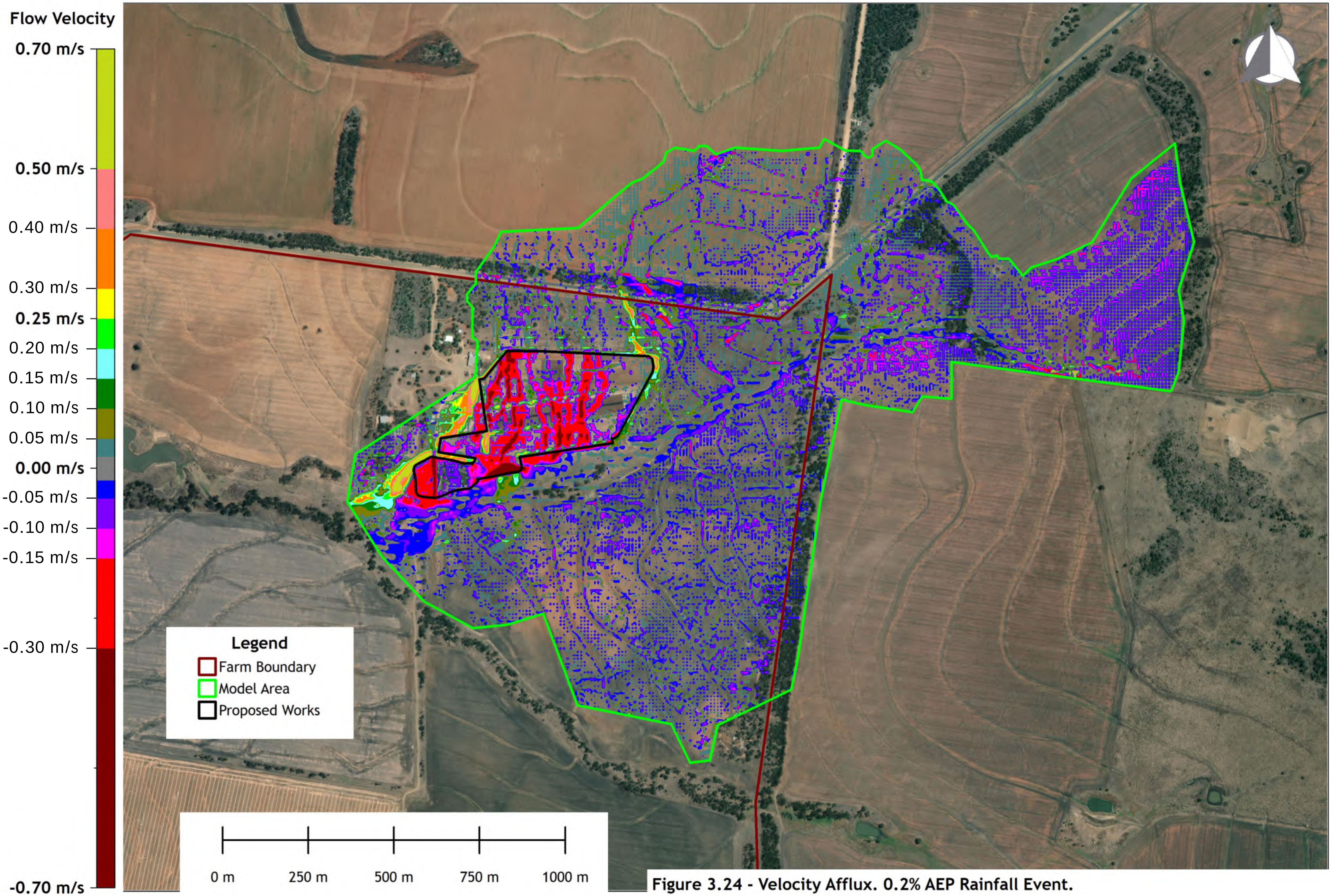



**Figure 3.24 - Velocity Afflux. 0.2% AEP Rainfall Event.
Proposed Development vs** Pre-Development.

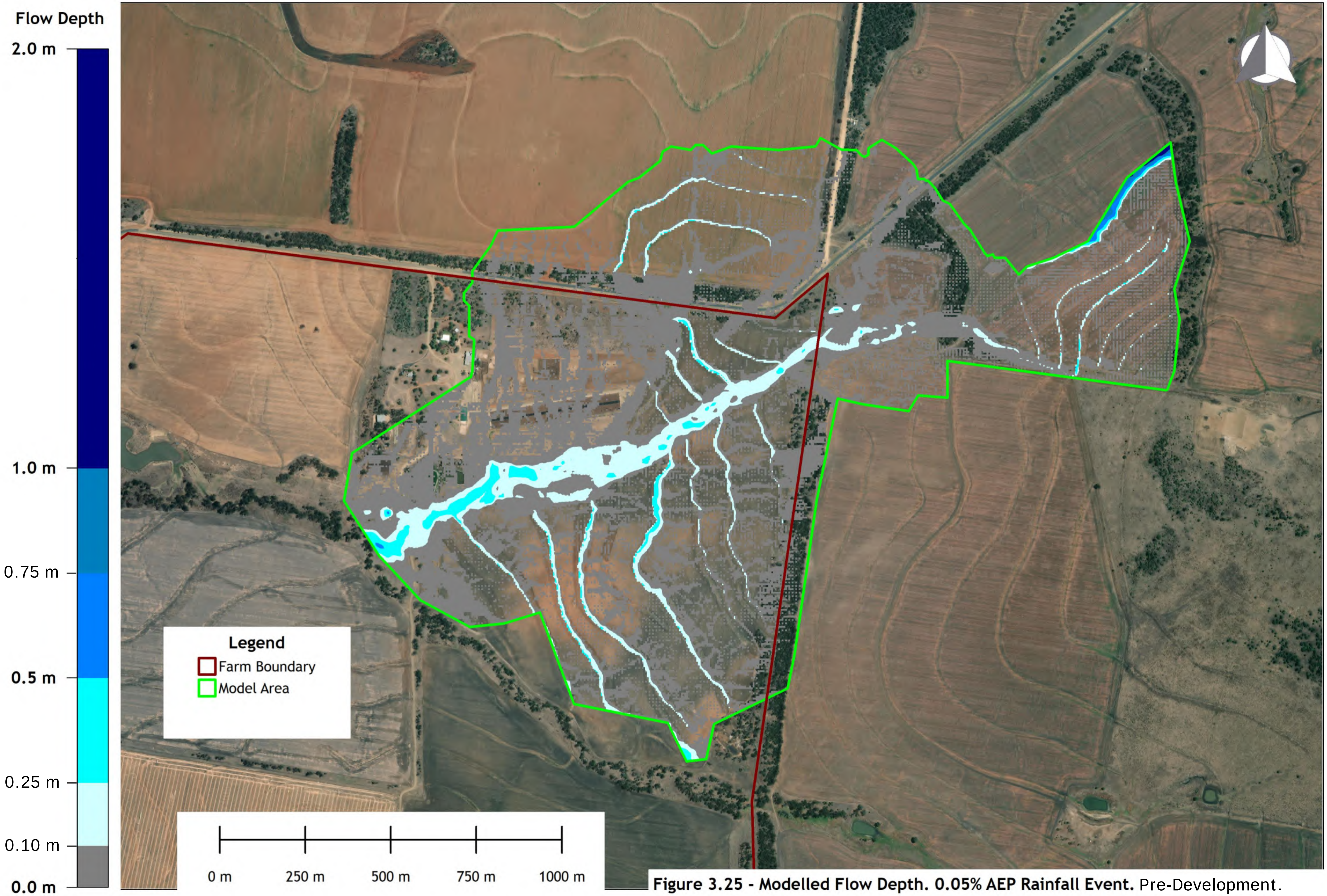



**Figure 3.25 - Modelled Flow Depth. 0.05% AEP Rainfall Event.** Pre-Development.

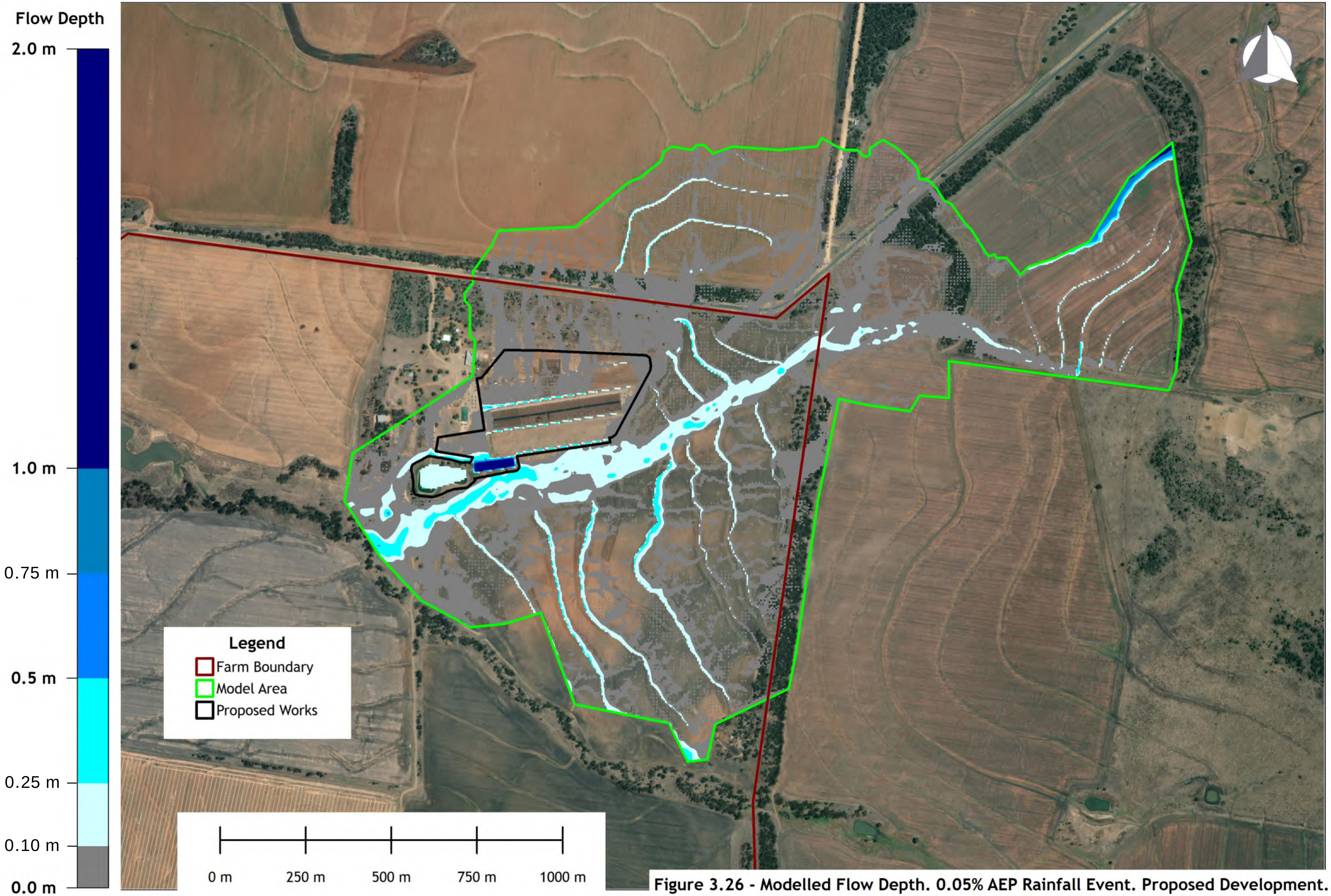



Figure 3.26 - Modelled Flow Depth. 0.05% AEP Rainfall Event. Proposed Development.

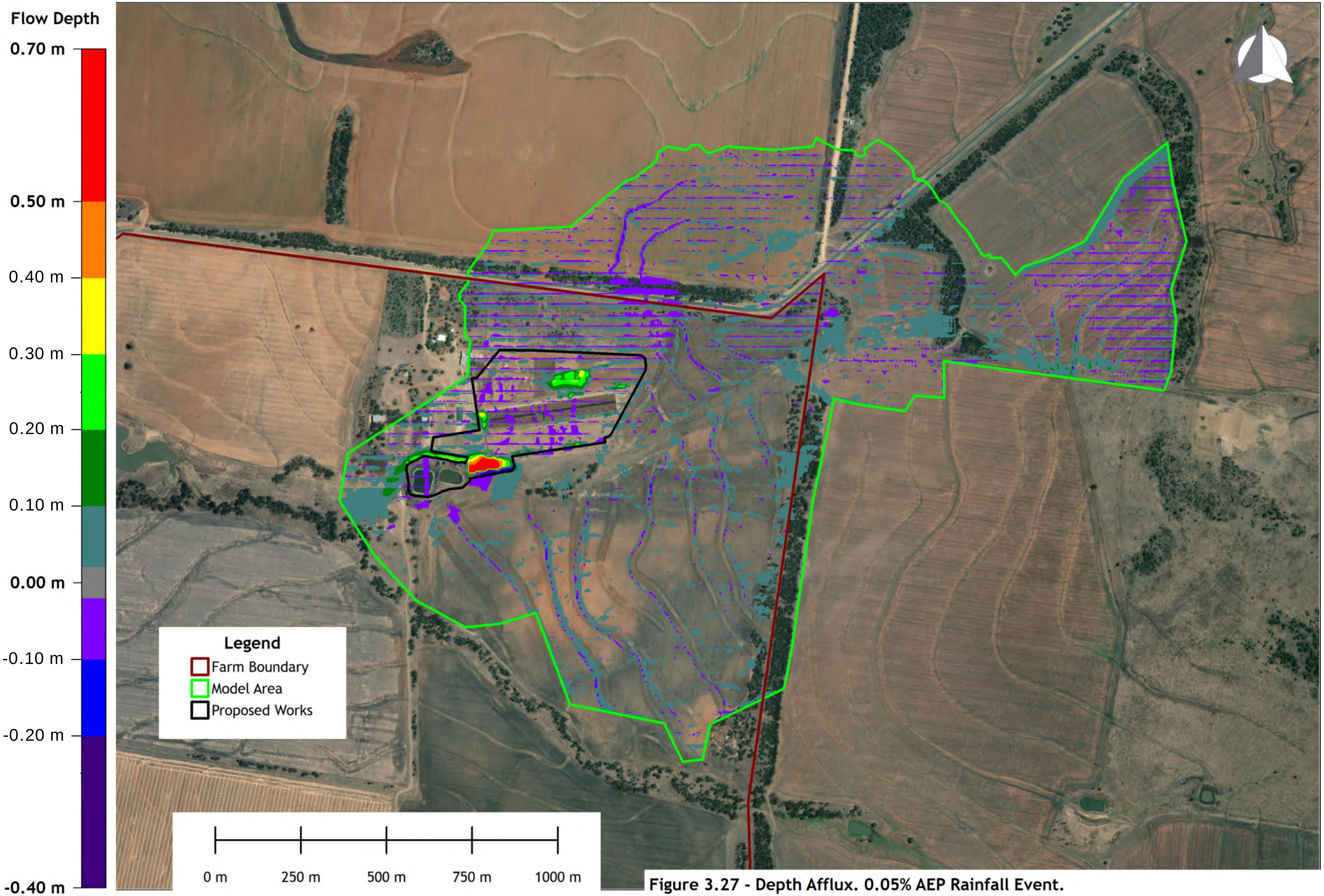



**Figure 3.27 - Depth Afflux. 0.05% AEP Rainfall Event. Proposed Development vs** Pre-Development.

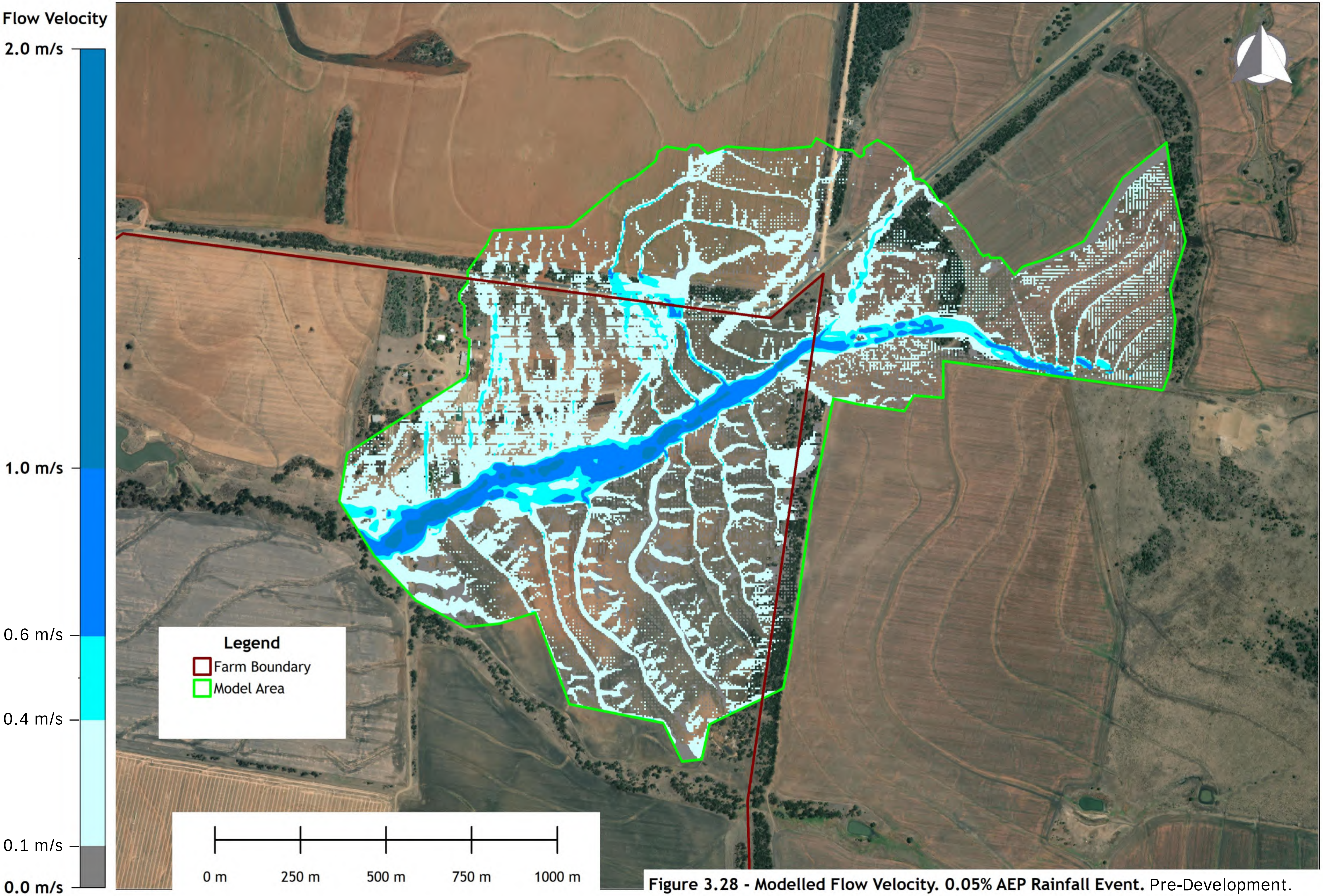



**Figure 3.28 - Modelled Flow Velocity. 0.05% AEP Rainfall Event.** Pre-Development.

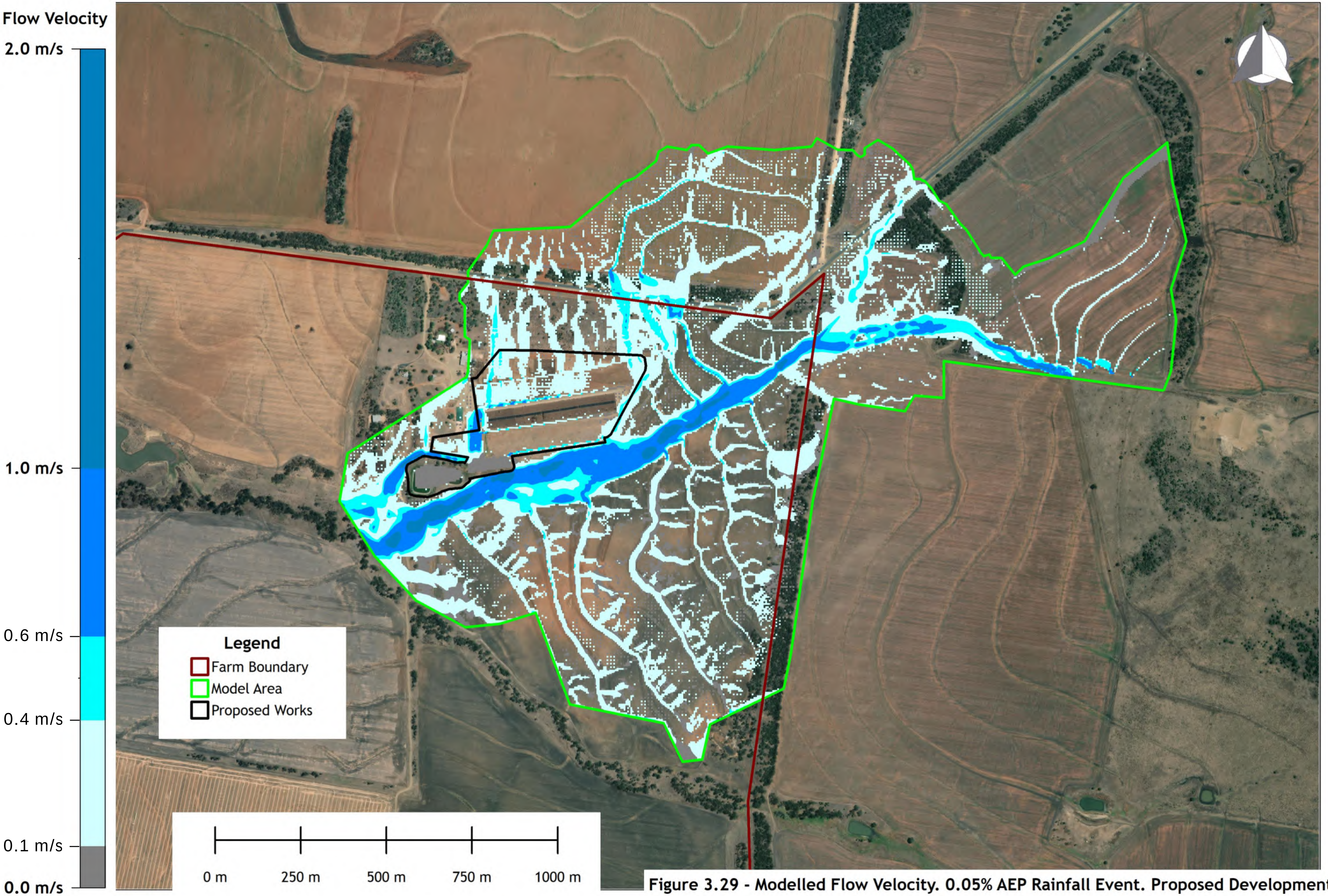



Figure 3.29 - Modelled Flow Velocity. 0.05% AEP Rainfall Event. Proposed Development.

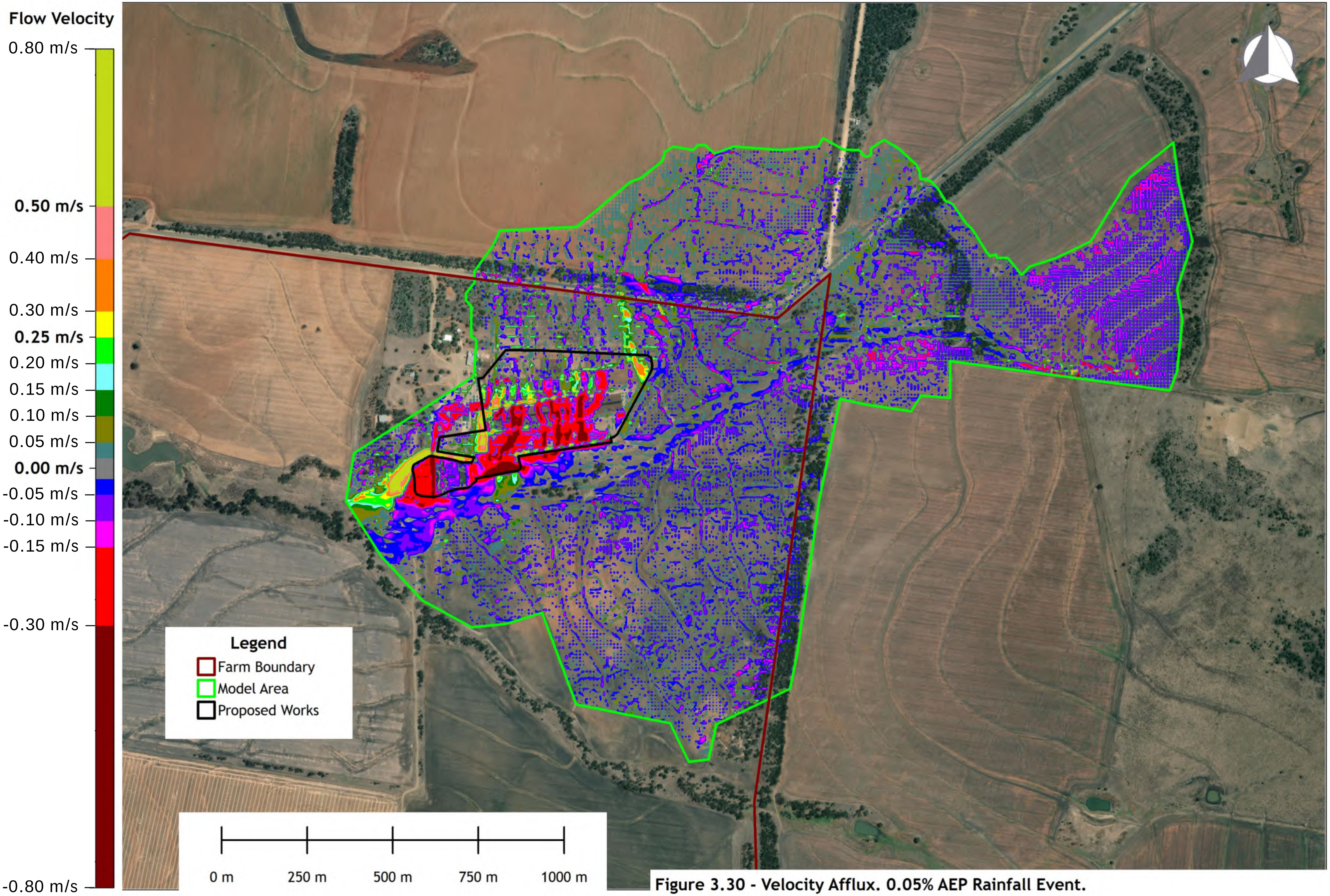



**Figure 3.30 - Velocity Afflux. 0.05% AEP Rainfall Event.**
**Proposed Development vs** Pre-Development.

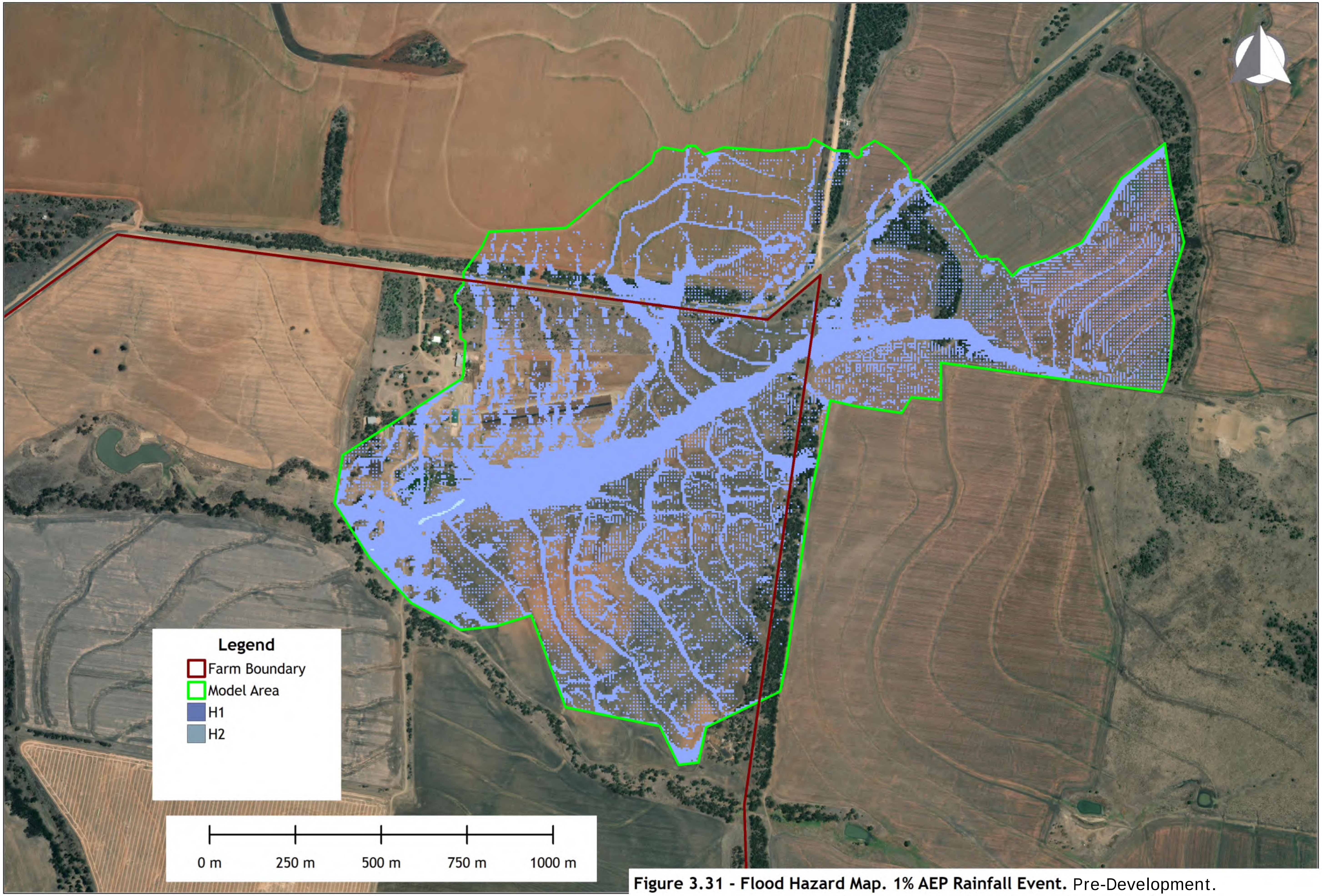



**Figure 3.31 - Flood Hazard Map. 1% AEP Rainfall Event.** Pre-Development.

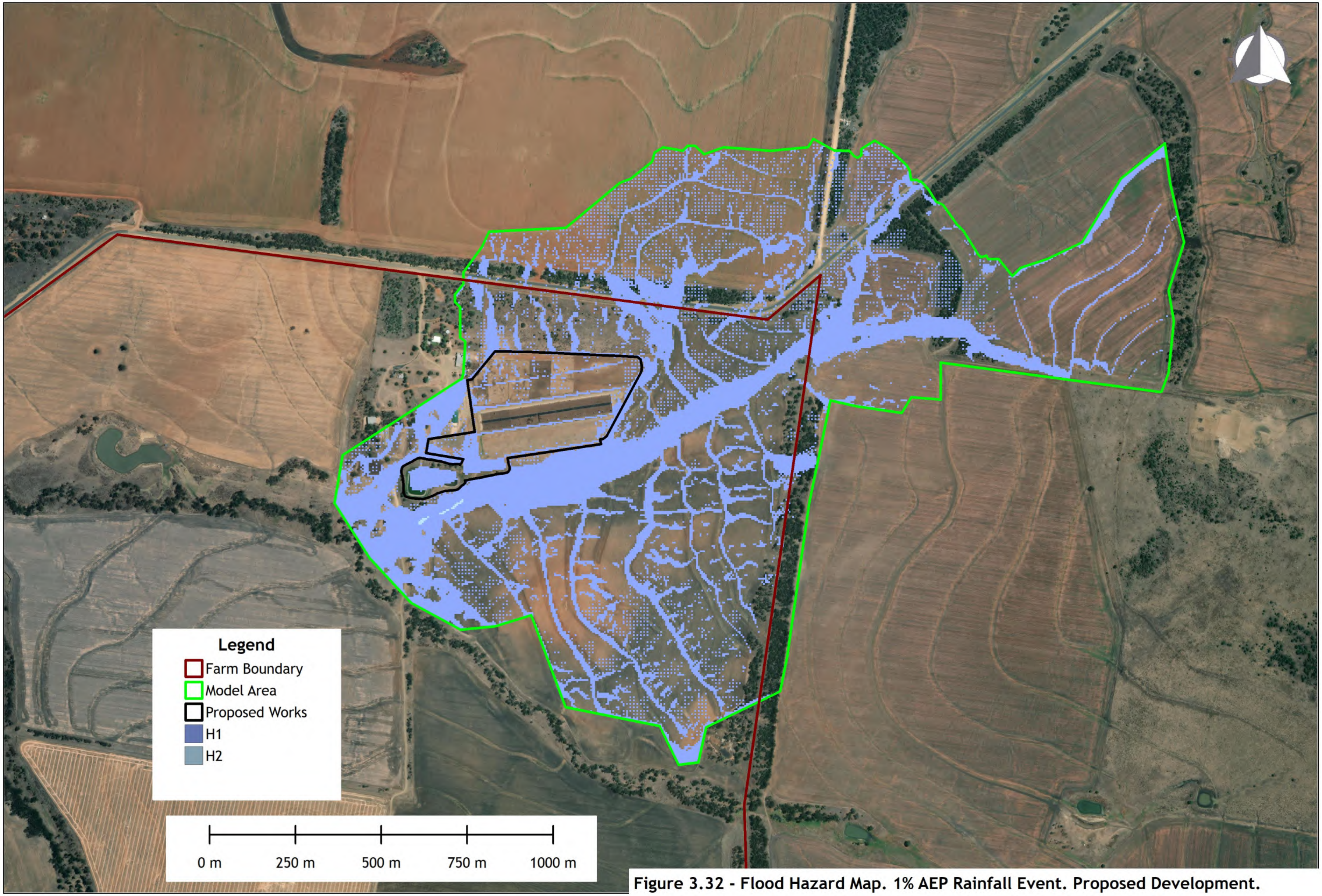
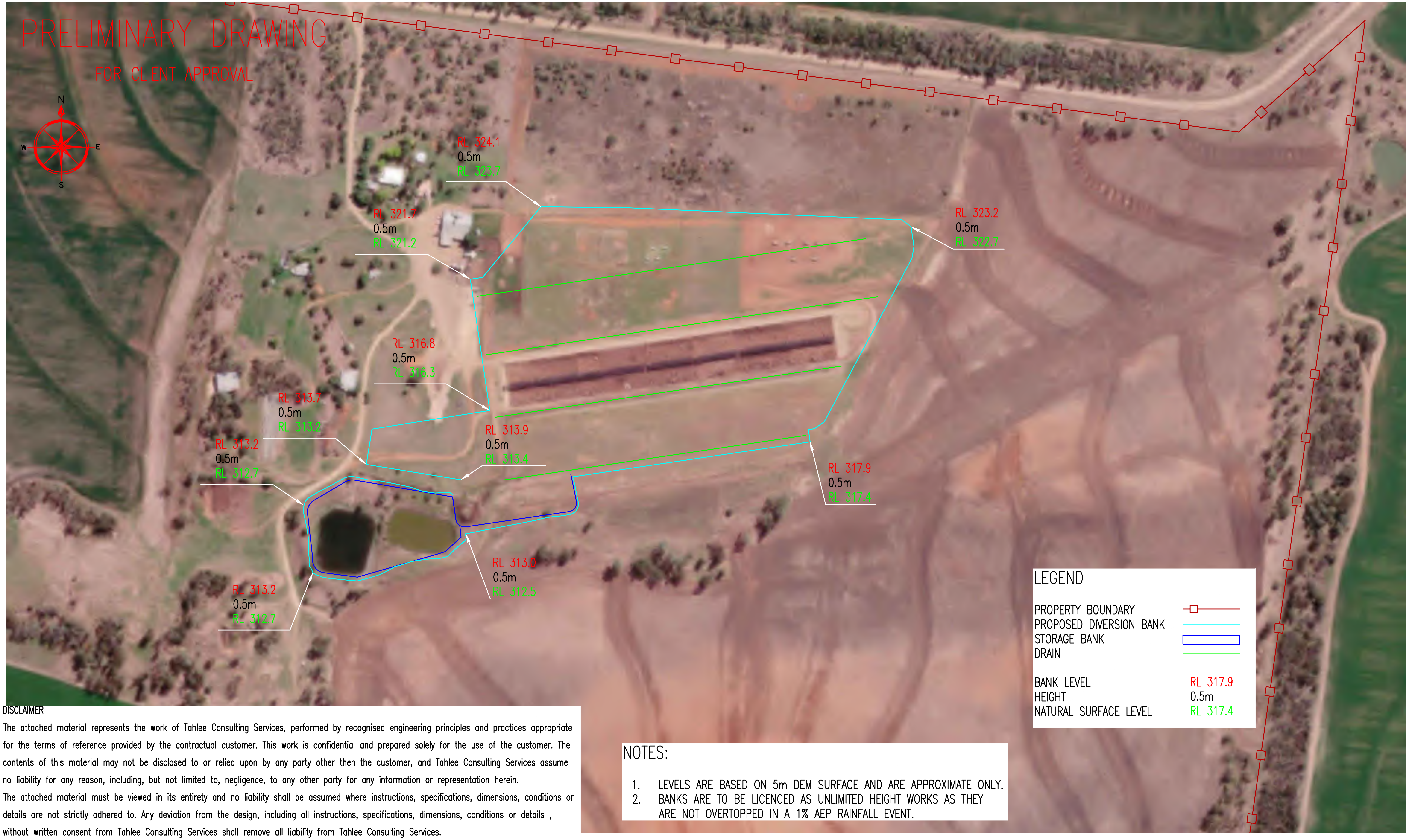



Figure 3.32 - Flood Hazard Map. 1% AEP Rainfall Event. Proposed Development.

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NOTES:

1. LEVELS ARE BASED ON 5m DEM SURFACE AND ARE APPROXIMATE ONLY.
2. BANKS ARE TO BE LICENCED AS UNLIMITED HEIGHT WORKS AS THEY ARE NOT OVERTOPPED IN A 1% AEP RAINFALL EVENT.

| No. | REVISION | DATE | BY |
|---|---|---|---|
| B | NOTES CHANGED | 17/02/25 | ARF |
| A | ORIGINAL ISSUE | 17/01/24 | HNF |

SURVEYED BY: ALS – 5m DEM

DATUM: GDA94. ZONE 56. AHD APPROX.



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PROJECT
DOOLIN FARMING PTY LTD
SPRINGFIELD

SCALE 1:4,000 (A3 SHEET)

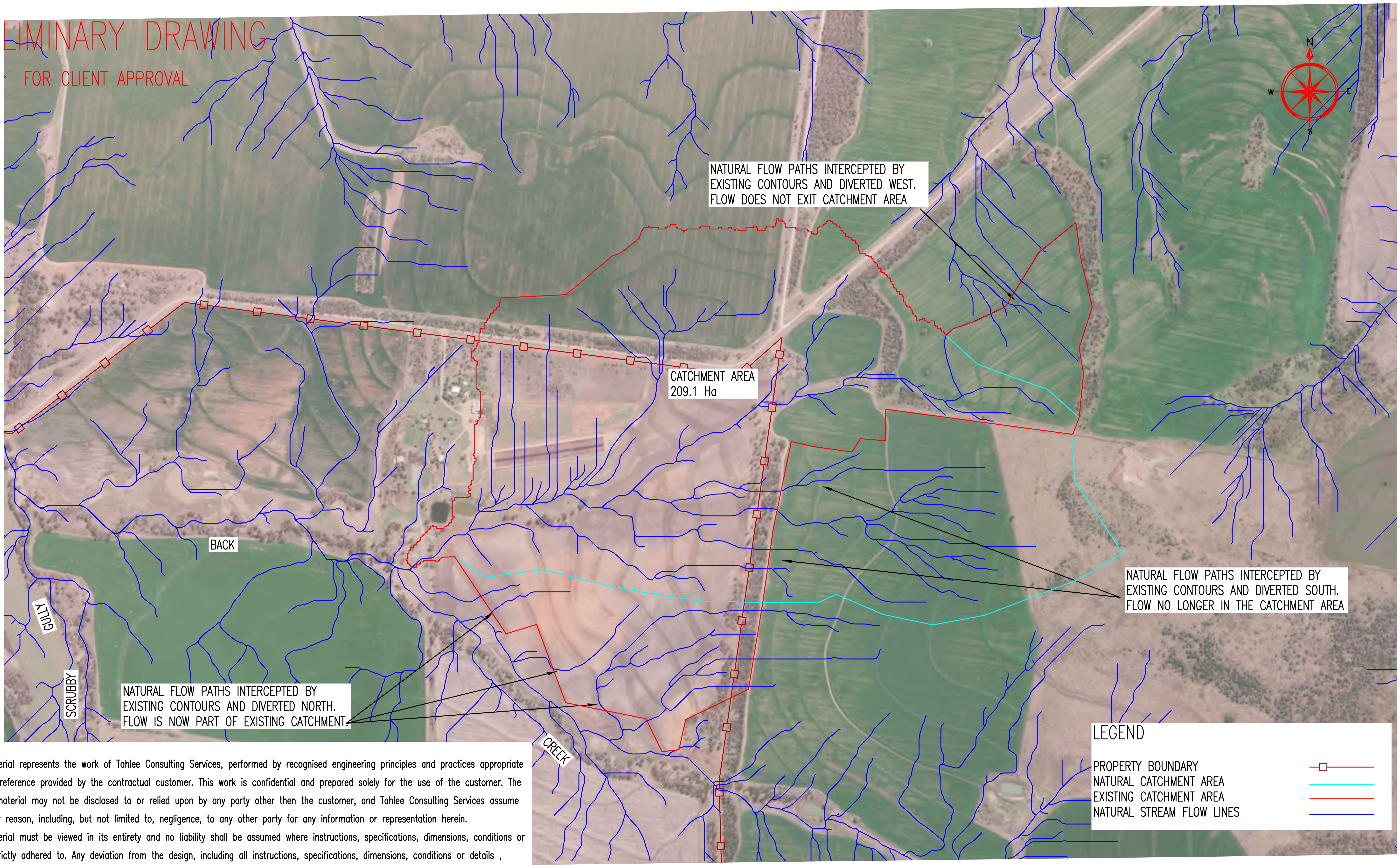
TITLE
PROPOSED FEEDLOT DEVELOPMENT COMPLEX EIS
WORKS LOCATIONS
LAYOUT
SHEET 1 OF 1

DRAWING NO. 0828_1.1

AMDT. B

PRELIMINARY DRAWING

FOR CLIENT APPROVAL

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| D | NOTES ADDED | 17/2/25 | ARF |
| C | STREAM LINES ADDED | 31/1/25 | ARF |
| B | CATCHMENT AREA ADJUSTED TO INCLUDE ADDITIONAL CONTOUR | 9/9/23 | ARF |
| A | ORIGINAL ISSUE | 15/08/23 | ARF |

SURVEYED BY: ALS – 5m DEM

DATUM: GDA94. ZONE 56. AHD.



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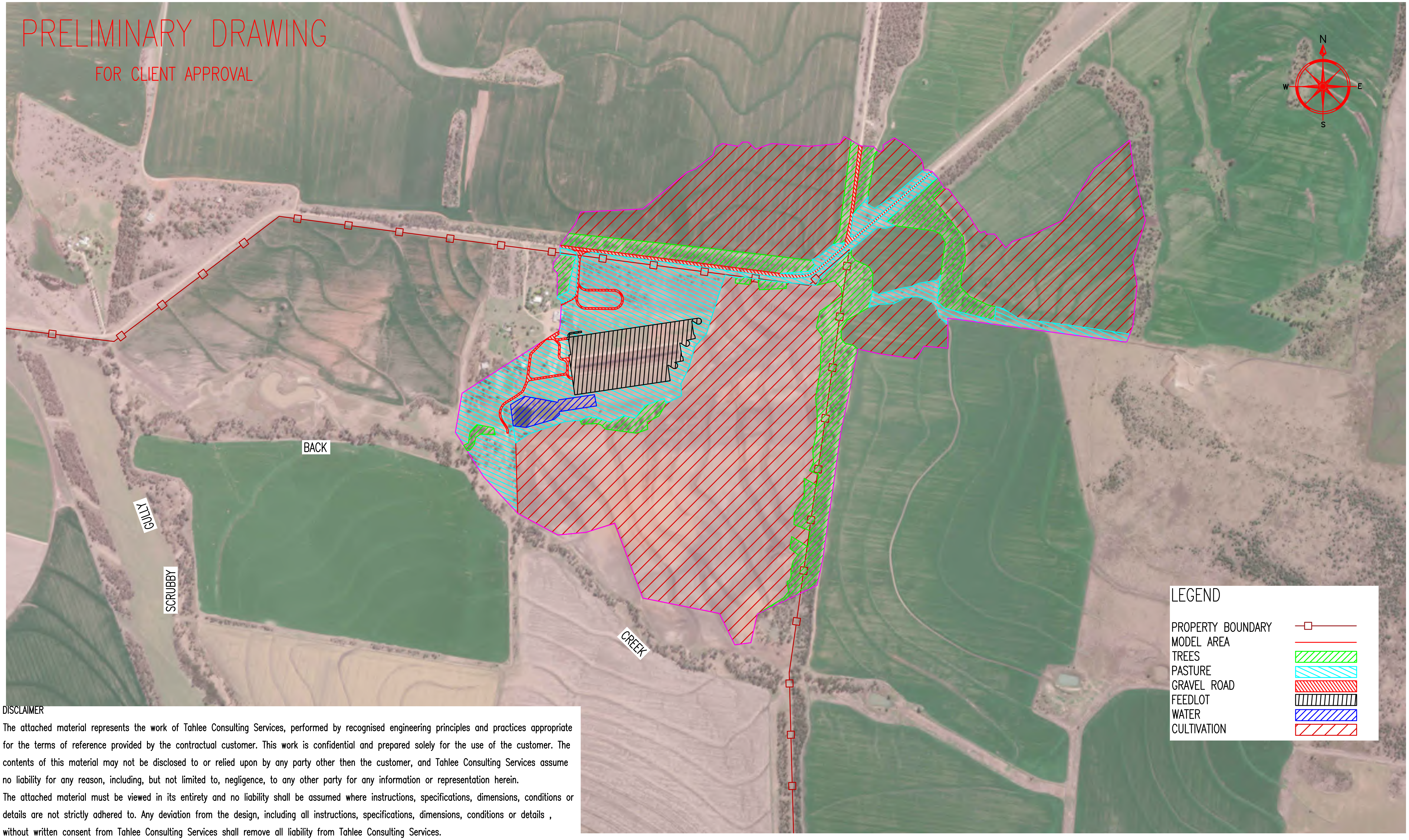
PROJECT: DOOLIN FARMING PTY LTD SPRINGFIELD

SCALE: 1:12,500 (A3 SHEET)

TITLE: PROPOSED FEEDLOT DEVELOPMENT COMPLEX EIS CATCHMENT AREA LAYOUT SHEET 1 OF 3

DRAWING NO. 0828_2.1

AMDT. D

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| A | ORIGINAL ISSUE | 15/08/23 | ARF |

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GUNNEDAH

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PROJECT
DOOLIN FARMING PTY LTD
SPRINGFIELD

TITLE
PROPOSED FEEDLOT DEVELOPMENT COMPLEX EIS
MODEL AREA
GROUND COVER
SHEET 2 OF 3

SCALE 1:12,500 (A3 SHEET)

DRAWING NO. 0828_2.2

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NOTE:

HYDROLOGIC SOIL GROUP CLASSIFICATION TAKEN FROM STATEWIDE LAND AND SOIL MAPPING NSW GOVERNMENT DEPARTMENT of CLIMATE CHANGE, ENERGY, the ENVIRONMENT and WATER eSPADE SOIL MAPPING DATABASE

| No. | REVISION | DATE | BY |
|---|---|---|---|
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| B | CATCHMENT AREA ADJUSTED TO INCLUDE ADDITIONAL CONTOUR | 9/9/23 | ARF |
| A | ORIGINAL ISSUE | 15/08/23 | ARF |

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GUNNEDAH

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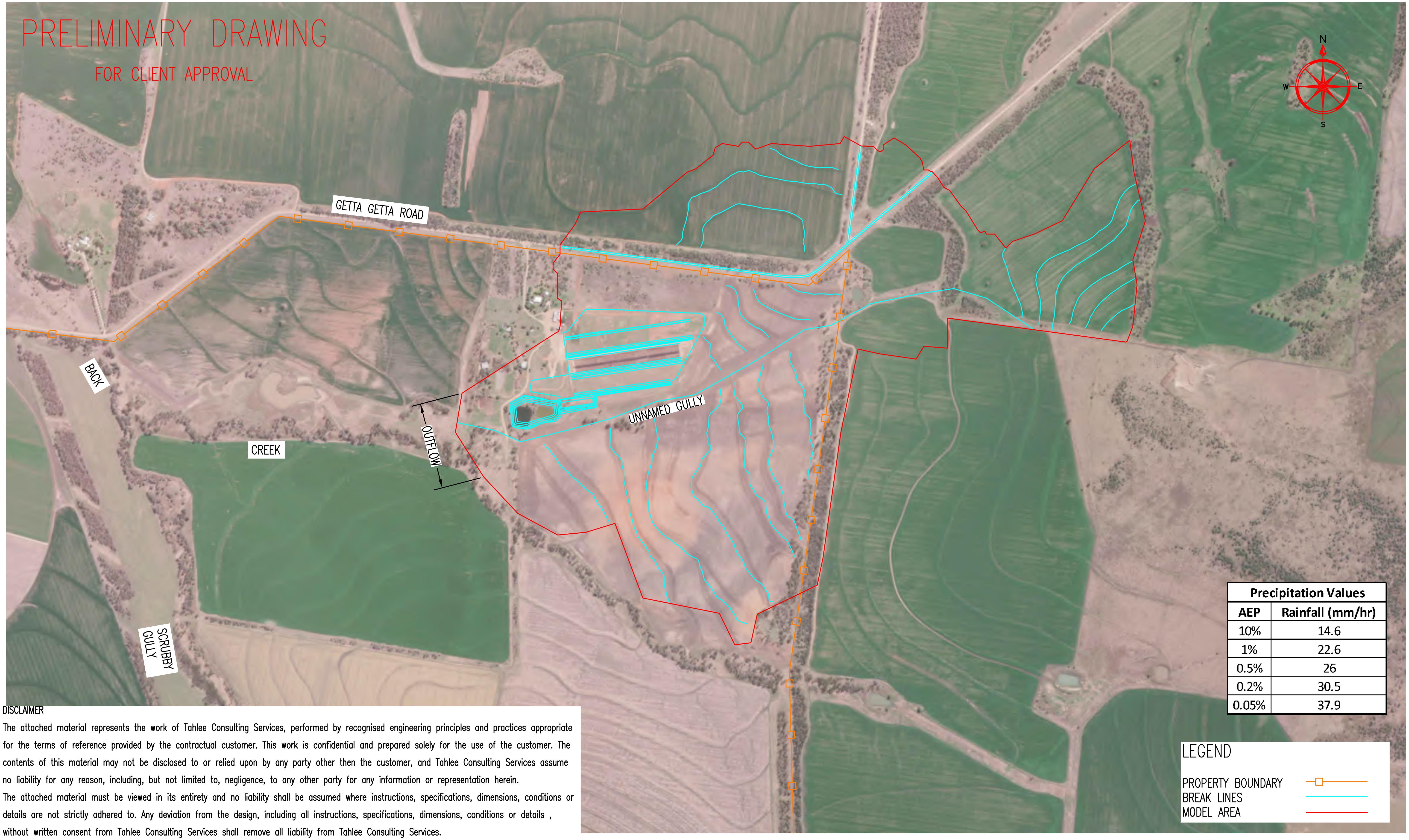
PROJECT
DOOLIN FARMING PTY LTD
SPRINGFIELD

SCALE
1:12,500 (A3 SHEET)

TITLE
PROPOSED FEEDLOT DEVELOPMENT COMPLEX EIS
MODEL AREA
HYDROLOGIC SOIL GROUP CLASSIFICATION
SHEET 3 OF 3

DRAWING NO. 0828_2.3

AMDT. D




| Precipitation Values | |
|---|---|
| AEP | Rainfall (mm/hr) |
| 10% | 14.6 |
| 1% | 22.6 |
| 0.5% | 26 |
| 0.2% | 30.5 |
| 0.05% | 37.9 |

LEGEND

PROPERTY BOUNDARY
BREAK LINES
MODEL AREA



| No. | REVISION | DATE | BY |
|---|---|---|---|
| C | NOTES ADDED | 19/02/25 | ARF |
| B | NOTES ADDED | 9/02/25 | ARF |
| A | ORIGINAL ISSUE | 17/01/25 | HNF |

SURVEYED BY:
ALS – 5m DEM
0.5m CONTOUR INTERVAL
DATUM:
GDA94. ZONE 56.
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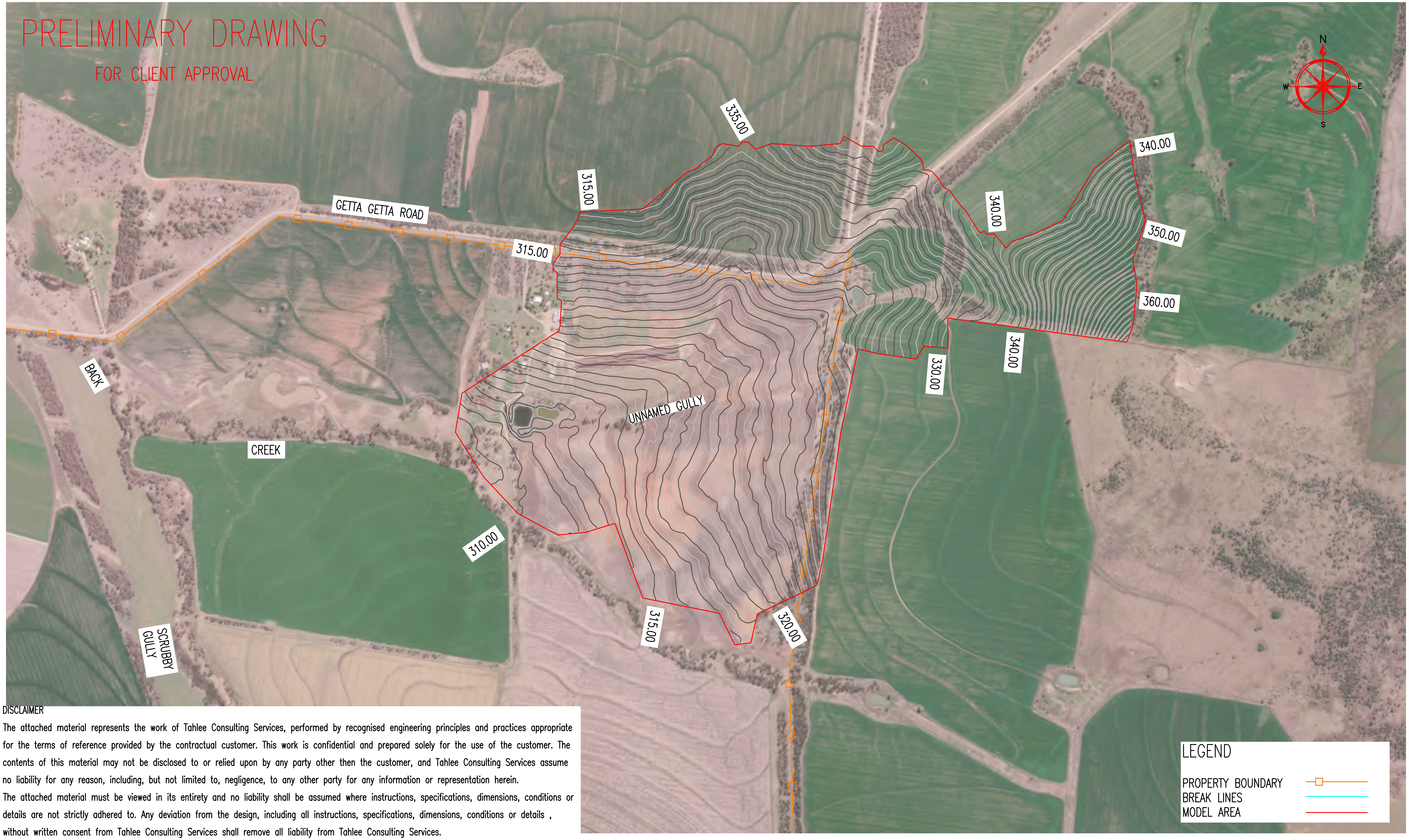
PROJECT
DOOLIN FARMING PTY LTD
SPRINGFIELD

SCALE
1:12,500 (A3 SHEET)

TITLE
PROPOSED FEEDLOT DEVELOPMENT COMPLEX EIS
MODEL SETUP
LAYOUT
SHEET 1 OF 2

DRAWING NO.
0828_3.1

AMDT.
C

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| B | NOTES ADDED | 9/02/25 | ARF |
| A | ORIGINAL ISSUE | 17/01/25 | HNF |

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DATUM:
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PROJECT
DOOLIN FARMING PTY LTD
SPRINGFIELD

TITLE
PROPOSED FEEDLOT DEVELOPMENT COMPLEX EIS
TERRAIN CONTOURS
LAYOUT
SHEET 2 OF 2

SCALE
1:12,500 (A3 SHEET)

DRAWING NO.
0828_3.2

AMDT.
C