

APPENDIX

Q2

INLAND  
RAIL 

# Hydrology and Flooding Technical Report—Volume II

Part 3 of 3

INLAND RAIL—BORDER TO GOWRIE ENVIRONMENTAL IMPACT STATEMENT

APPENDIX

# Q2

## Hydrology and Flooding Technical Report—Volume II

### **Appendix K** Bybera Road Flood Maps

INLAND RAIL—BORDER TO GOWRIE ENVIRONMENTAL IMPACT STATEMENT



# Appendix K

## Bybera Road Flood Maps

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Map by SV / DTH 2:10USGS\_310\_B20Task310-HY-202005121245\_SurfaceWater310-HY-202005121245\_FF\_N\_FigK1-A\_Locality.mxd Date: 22/07/2020 19:20



#### Legend

- |                             |                   |
|-----------------------------|-------------------|
| 5 Chainage (km)             | Watercourses      |
| Existing rail (operational) | Major roads       |
| Border to Gowrie alignment  | Road design       |
|                             | Project footprint |



A3 scale: 1:35,000  
 0 0.35 0.7 1.05 1.4 1.75 km



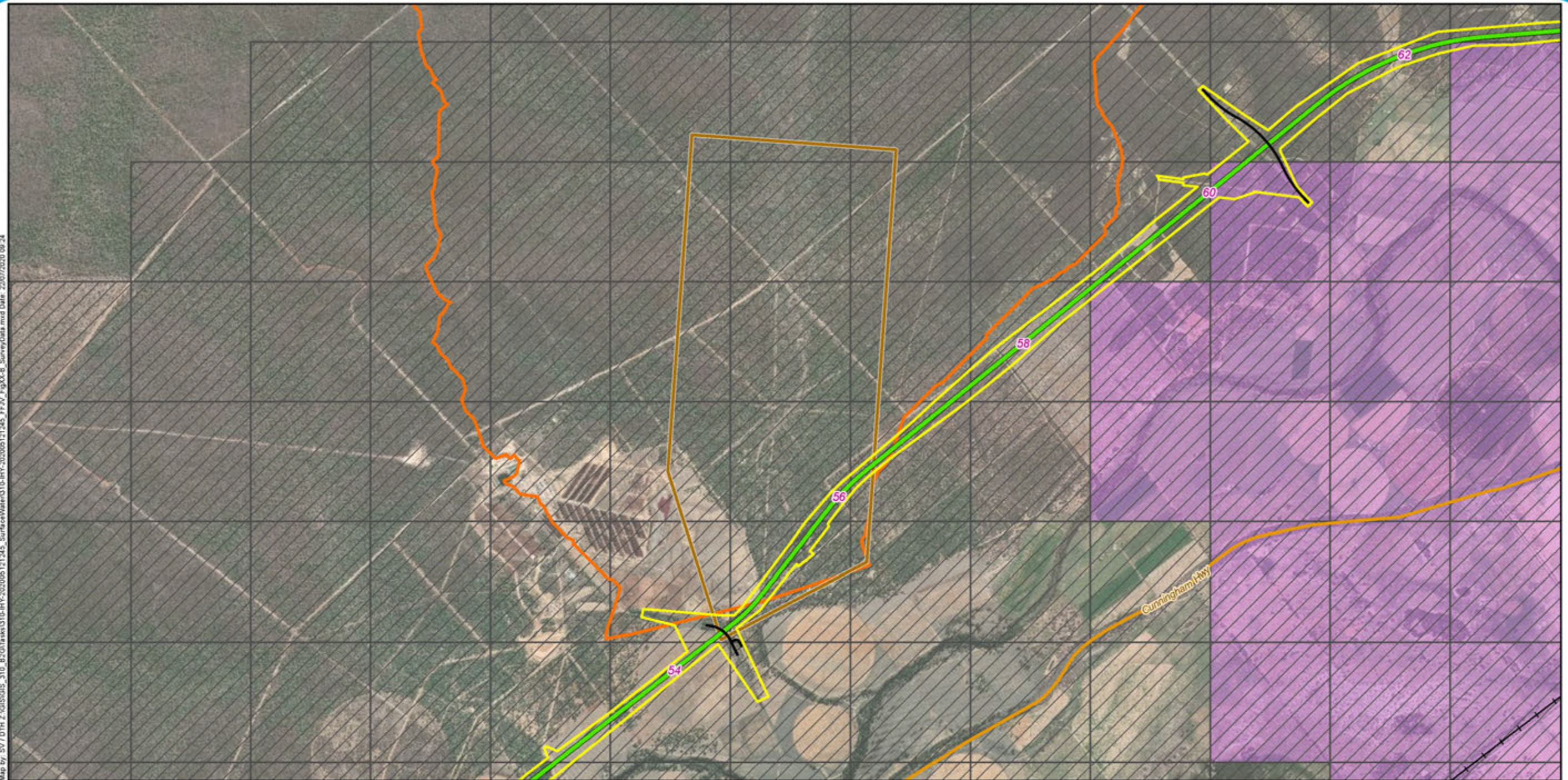
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**Border to Gowrie**  
**Figure K1-A:**  
**Locality plan - Bybera Road**



Map by: SV / DTH 2:10:50GIS\_310\_B20Task310-IRY-202006121245\_SurfaceWater310-IRY-202006121245\_FF3V\_FigK1-B\_SurveyData.mxd Date: 22/07/2020 09:24



#### Legend

- 5 Chainage (km)
- Existing rail (operational)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Hydrologic model extent

#### LiDAR datasets (1m grid)

- Inland Towns Stage 2 2011
- 2015 ARTC LiDAR 1m



A3 scale: 1:35,000  
 0 0.35 0.7 1.05 1.4 1.75 km



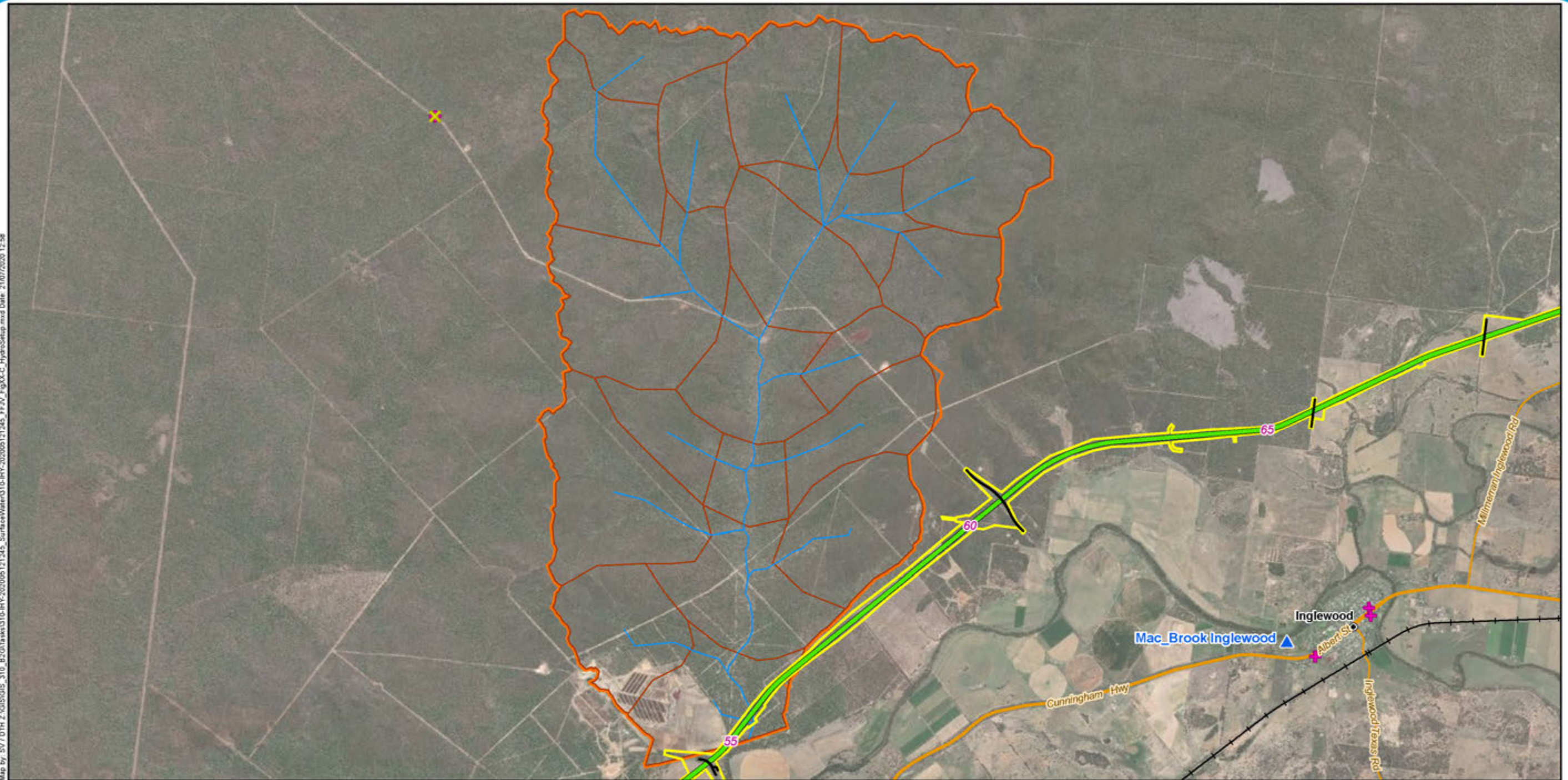
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**Border to Gowrie**  
**Figure K1-B:**  
**Survey data - Bybera Road**



Map by SV / DTH 2:10150GIS\_310\_B201Task1310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF3V\_FigK1-C\_HydroSetup.mxd Date: 21/07/2020 12:58



#### Legend

- |                             |                   |                         |                         |
|-----------------------------|-------------------|-------------------------|-------------------------|
| 5 Chainage (km)             | Major roads       | Catchment links         | Pluviograph stations    |
| Localities                  | Minor roads       | Sub-catchments          | Daily rainfall stations |
| Existing rail (operational) | Road design       | Hydrologic model extent | Stream gauge locations  |
| Border to Gowrie alignment  | Project footprint |                         |                         |



A3 scale: 1:65,000  
 0 0.65 1.3 1.95 2.6 3.25 km



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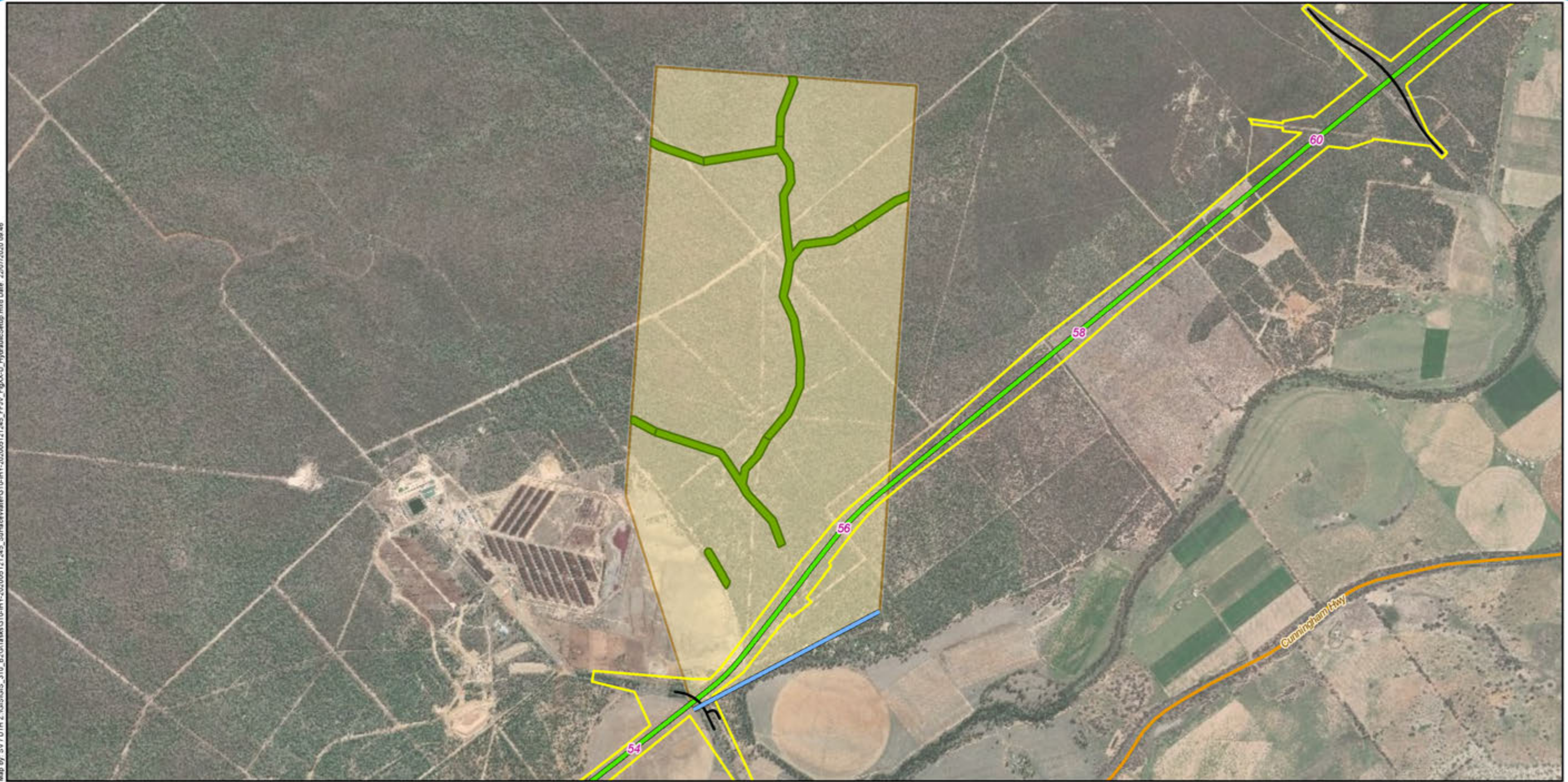
**Border to Gowrie**

**Figure K1-C:**

**Hydrologic model setup - Bybera Road**



Map by SV / DTH 2:10USQGIS\_310\_B20Task310-HY-202005121245\_SurfaceWater310-HY-202005121245\_FF3V\_FigK1-D\_HydraulicSetup.mxd Date: 22/07/2020 09:48



#### Legend

- |                            |                   |                        |
|----------------------------|-------------------|------------------------|
| 5 Chainage (km)            | Major roads       | Hydraulic model extent |
| Border to Gowrie alignment | Road design       | Outflow boundaries     |
|                            | Project footprint | Inflow boundaries      |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25 km



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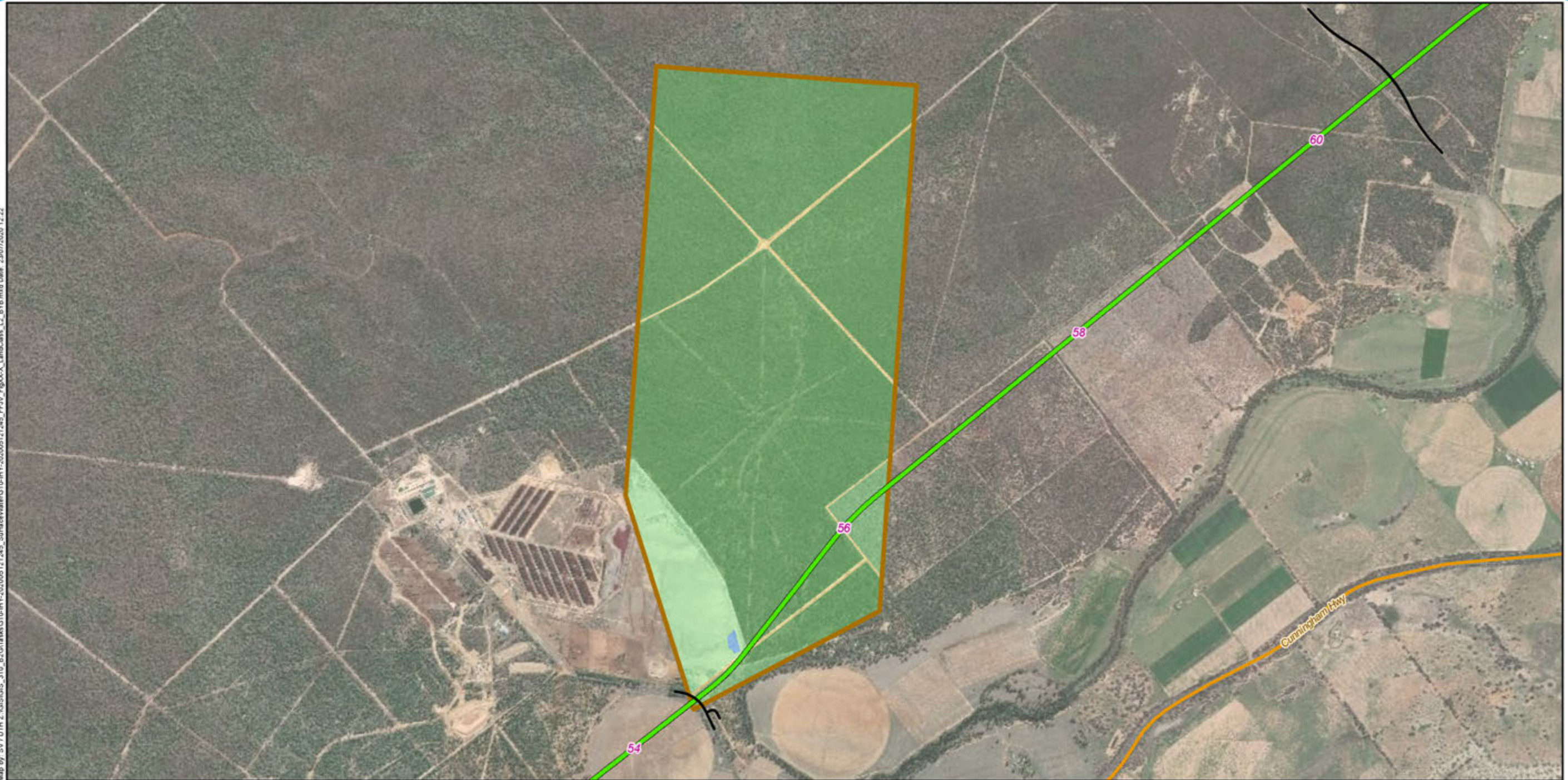
**Border to Gowrie**

**Figure K1-D:**

**Hydraulic model setup - Bybera Road**



Map by SV / DTH 2:10USQGIS\_310\_B20Task310-HY-202005121245\_SurfaceWater310-HY-202005121245\_FFJV\_FigK1-E\_LandClass\_12\_BYB.mxd Date: 23/07/2020 12:22



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design

  Hydraulic model extent

#### Landuse classification

- River (n=0.035)
- Unsealed road corridor (n=0.025)
- Open space - min veg (n=0.045)
- Open space - mod veg (n=0.055)
- Openspace - heavy veg (n=0.065)



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



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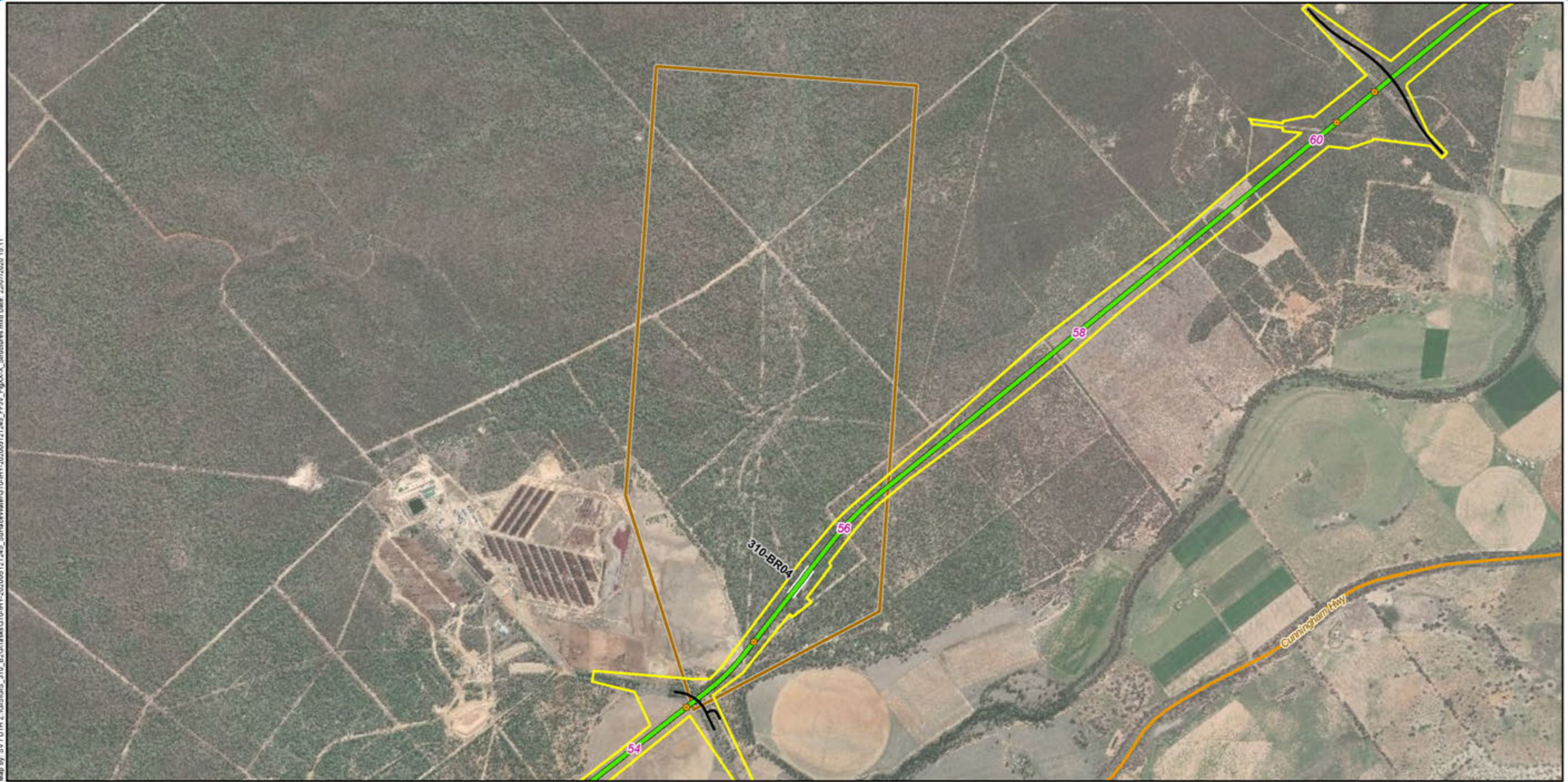
**Border to Gowrie**

**Figure K1-E:**

**Landuse classifications - Bybera Road**



Map by SV / DTH 2:10:50GIS\_310\_B201Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF3V\_FigK1-F\_Structures.mxd Date: 22/07/2020 15:11



#### Legend

- 5 Chainage (km)
- Floodplain culvert
- Local drainage culvert
- Bridges
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent



A3 scale: 1:27,500  
0 0.25 0.5 0.75 1 1.25km



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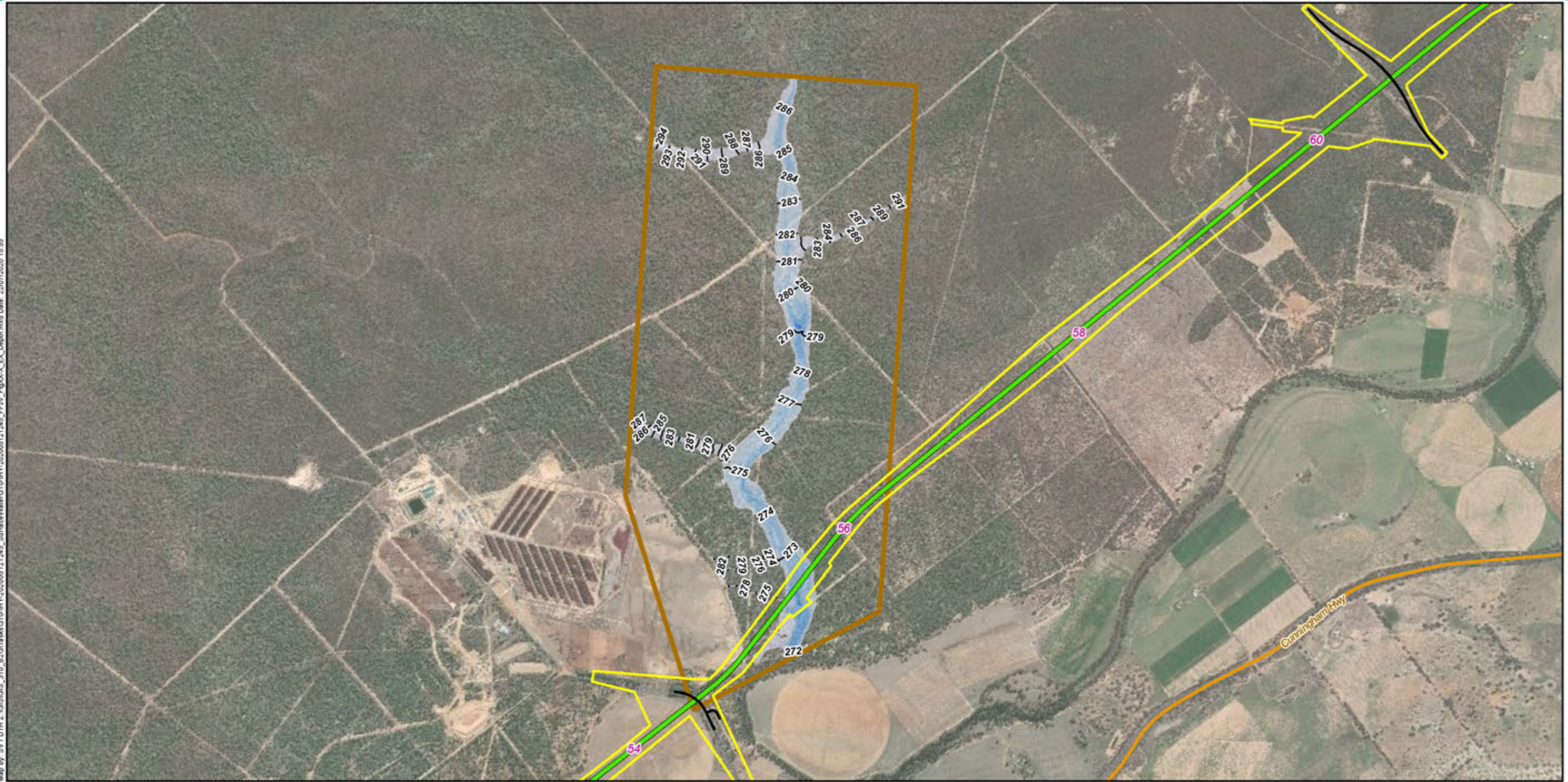
**Border to Gowrie**

**Figure K1-F:**

**Proposed design structures - Bybera Road**



Map by SV / DTH 2:10USQGIS\_310\_B201Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF3V\_FigK2-A\_EX\_Depth.mxd Date: 22/07/2020 15:55



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent

#### Depth (m)

- |                                                                                                                                       |                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <span style="background-color: #f0f0f0; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 0 - 0.5   | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 3.0 - 3.5 |
| <span style="background-color: #add8e6; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 0.5 - 1.0 | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 3.5 - 4.0 |
| <span style="background-color: #87ceeb; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 1.0 - 1.5 | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 4.0 - 4.5 |
| <span style="background-color: #6495ed; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 1.5 - 2.0 | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 4.5 - 5.0 |
| <span style="background-color: #4682b4; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 2.0 - 2.5 | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> > 5.0     |
| <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 2.5 - 3.0 | <span style="color: black;">—</span> 1m contour (mAHD)                                                                                |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



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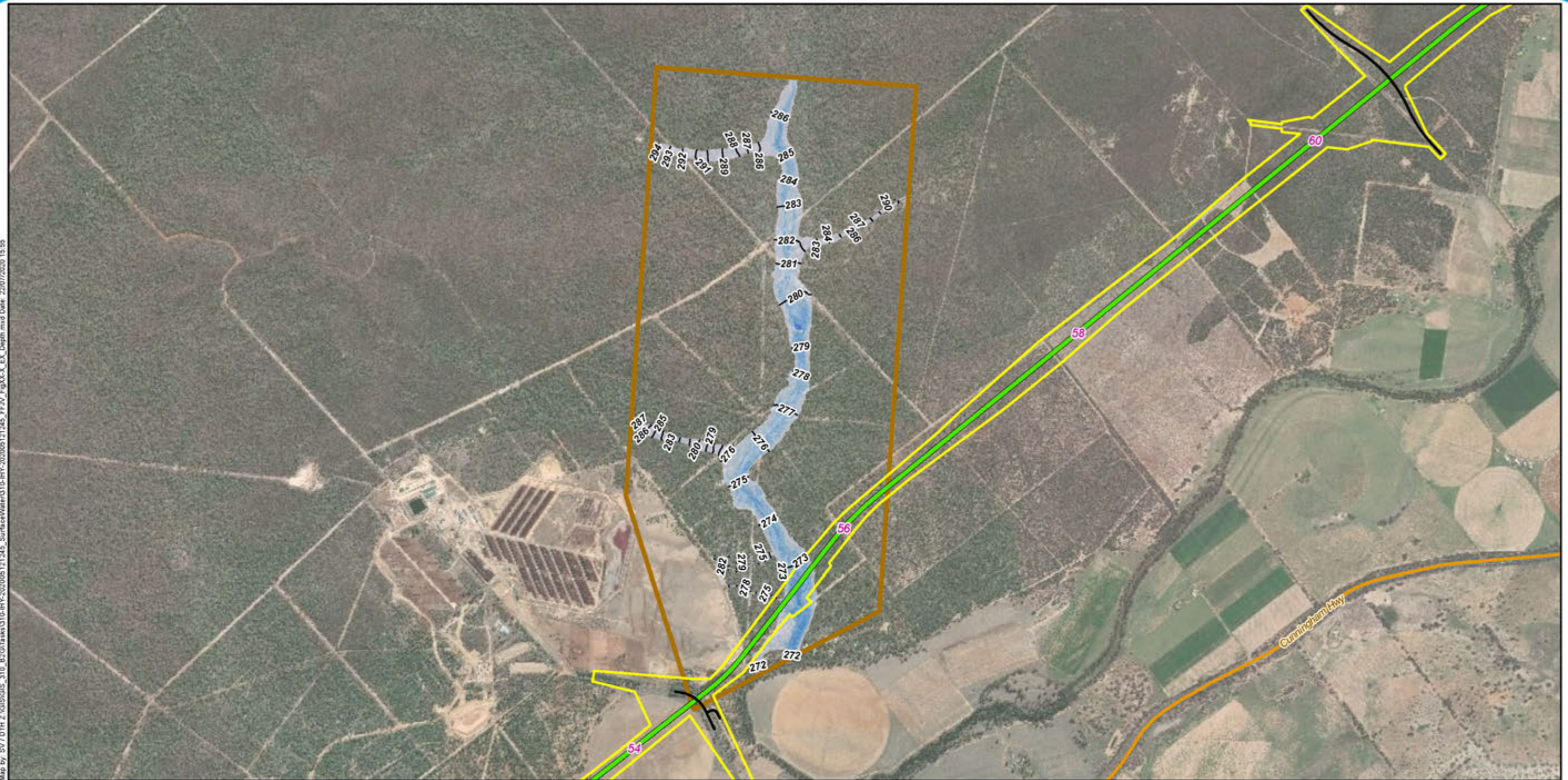
**Border to Gowrie**

**Figure K2-A:**

**20% AEP peak water levels - Existing Case - Bybera Road**



Map by SV / DTH 2:10USQGIS\_310\_B201Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF3V\_FigK2-B\_EX\_Depth.mxd Date: 22/07/2020 15:55



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent

#### Depth (m)

- |                                                                                                                                       |                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <span style="background-color: #f0f0f0; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 0 - 0.5   | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 3.0 - 3.5 |
| <span style="background-color: #add8e6; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 0.5 - 1.0 | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 3.5 - 4.0 |
| <span style="background-color: #87ceeb; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 1.0 - 1.5 | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 4.0 - 4.5 |
| <span style="background-color: #add8e6; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 1.5 - 2.0 | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 4.5 - 5.0 |
| <span style="background-color: #87ceeb; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 2.0 - 2.5 | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> > 5.0     |
| <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 2.5 - 3.0 | <span style="color: black;">—</span> 1m contour (mAHD)                                                                                |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



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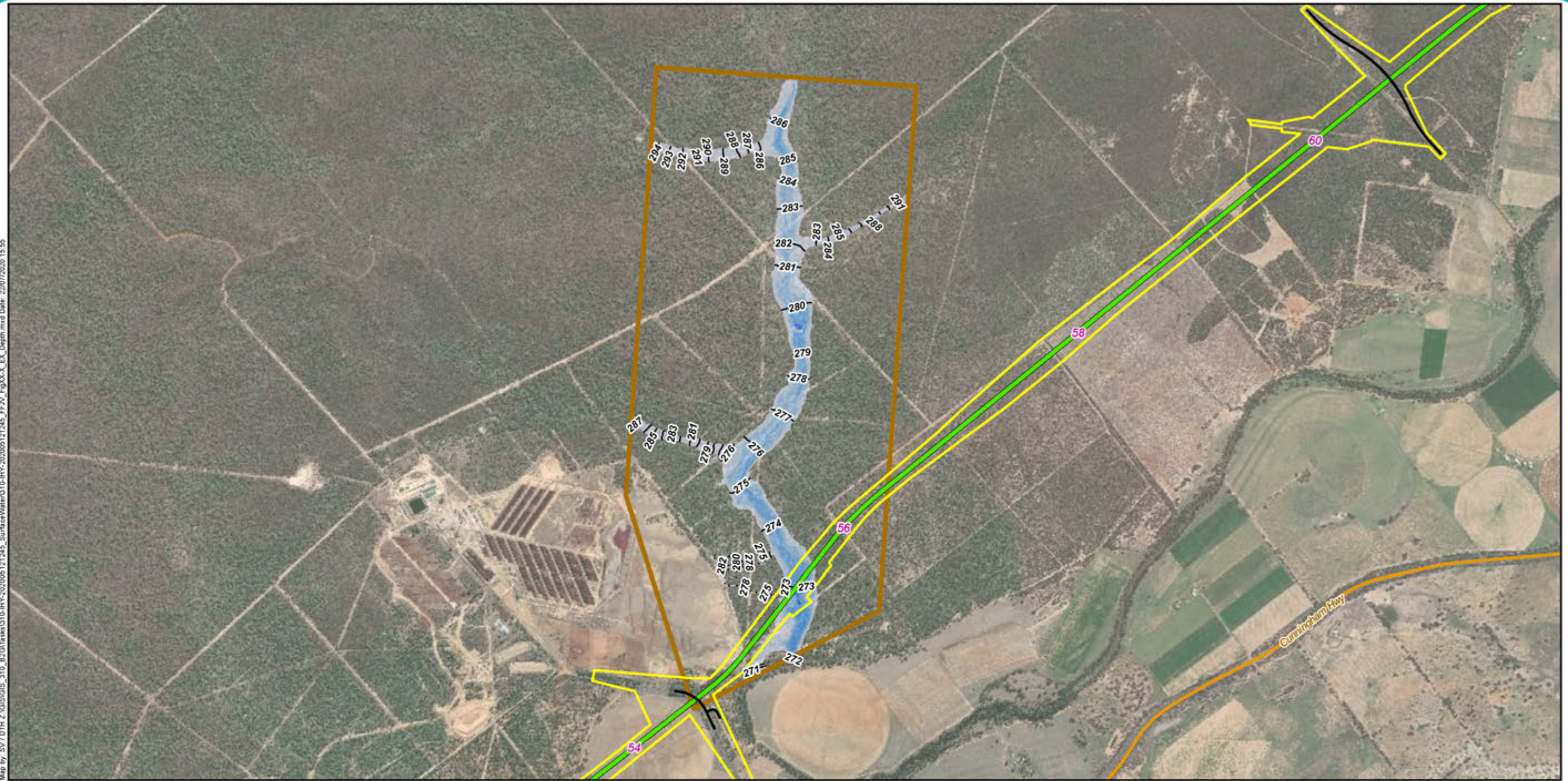
**Border to Gowrie**

**Figure K2-B:**

**10% AEP peak water levels - Existing Case - Bybera Road**



Map by SV / DTH 2:10USQGIS\_310\_B201Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF3V\_FigK2-C\_EX\_Depth.mxd Date: 22/07/2020 15:55



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent

#### Depth (m)

- |                                                    |                                                        |
|----------------------------------------------------|--------------------------------------------------------|
| <span style="color: lightblue;">□</span> 0 - 0.5   | <span style="color: blue;">□</span> 3.0 - 3.5          |
| <span style="color: lightblue;">□</span> 0.5 - 1.0 | <span style="color: blue;">□</span> 3.5 - 4.0          |
| <span style="color: lightblue;">□</span> 1.0 - 1.5 | <span style="color: blue;">□</span> 4.0 - 4.5          |
| <span style="color: lightblue;">□</span> 1.5 - 2.0 | <span style="color: blue;">□</span> 4.5 - 5.0          |
| <span style="color: lightblue;">□</span> 2.0 - 2.5 | <span style="color: blue;">□</span> > 5.0              |
| <span style="color: lightblue;">□</span> 2.5 - 3.0 | <span style="color: black;">—</span> 1m contour (mAHD) |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25 km



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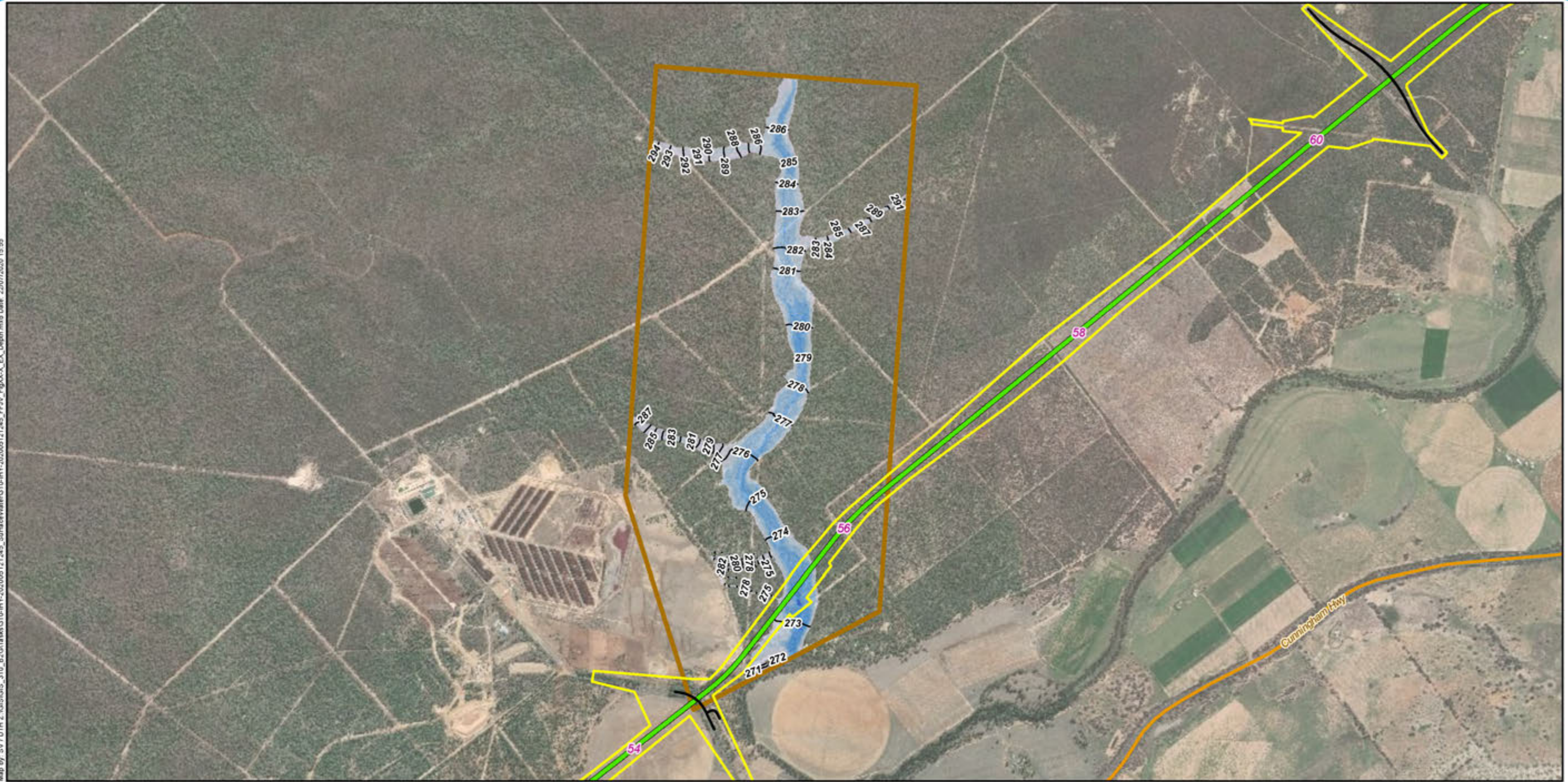
**Border to Gowrie**

**Figure K2-C:**

**5% AEP peak water levels - Existing Case - Bybera Road**



Map by SV / DTH 2:10USQGIS\_310\_B207Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF3V\_FigK2-D\_EX\_Depth.mxd Date: 22/07/2020 15:55



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent

#### Depth (m)

- |                                                    |                                                        |
|----------------------------------------------------|--------------------------------------------------------|
| <span style="color: lightblue;">□</span> 0 - 0.5   | <span style="color: blue;">□</span> 3.0 - 3.5          |
| <span style="color: lightblue;">□</span> 0.5 - 1.0 | <span style="color: blue;">□</span> 3.5 - 4.0          |
| <span style="color: lightblue;">□</span> 1.0 - 1.5 | <span style="color: blue;">□</span> 4.0 - 4.5          |
| <span style="color: lightblue;">□</span> 1.5 - 2.0 | <span style="color: blue;">□</span> 4.5 - 5.0          |
| <span style="color: lightblue;">□</span> 2.0 - 2.5 | <span style="color: blue;">□</span> > 5.0              |
| <span style="color: lightblue;">□</span> 2.5 - 3.0 | <span style="color: black;">—</span> 1m contour (mAHD) |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



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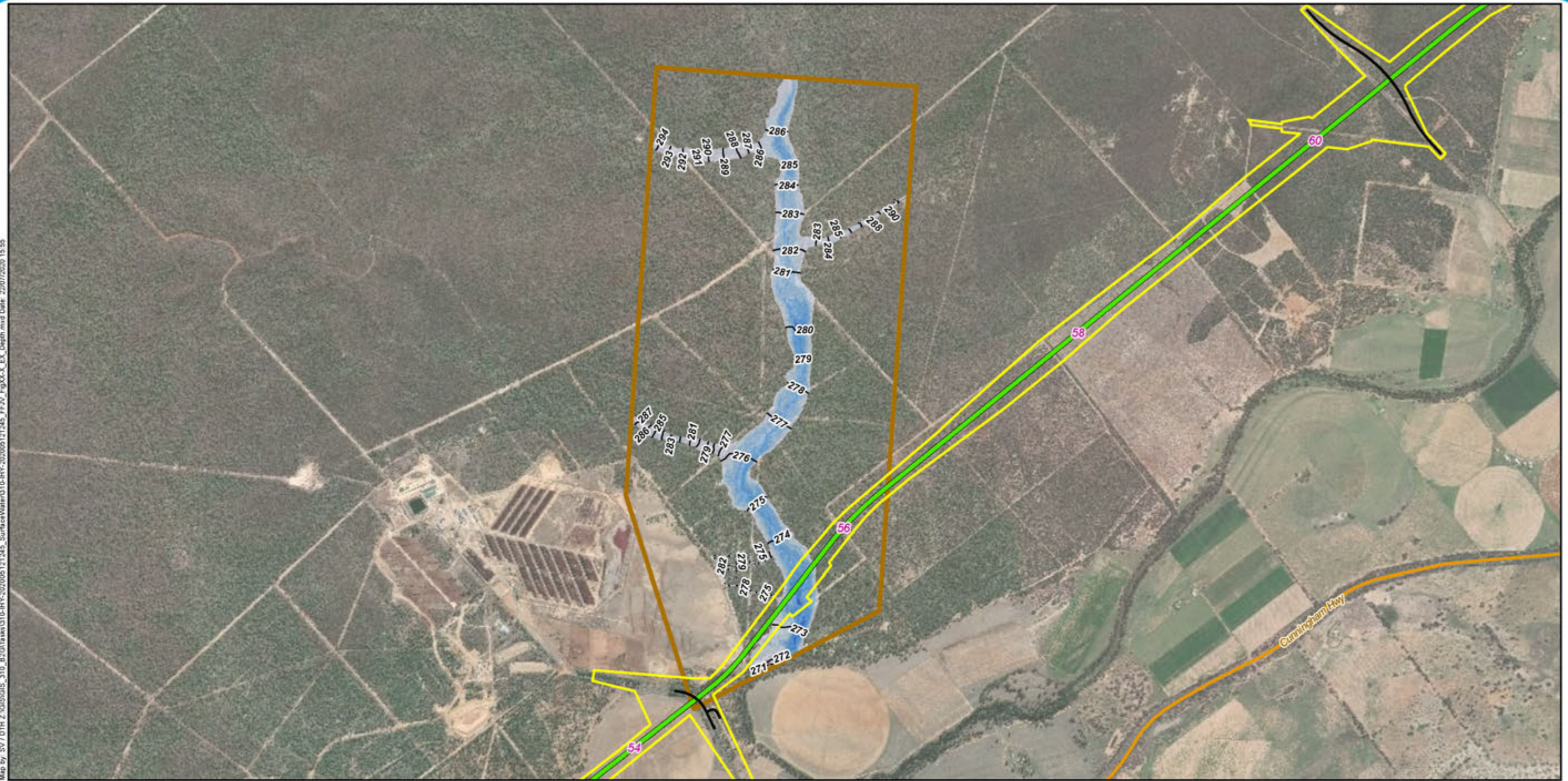
**Border to Gowrie**

**Figure K2-D:**

**2% AEP peak water levels - Existing Case - Bybera Road**



Map by SV / DTH 2:10USQGIS\_310\_B201Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF3V\_FigK2-E\_EX\_Depth.mxd Date: 22/07/2020 15:55



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent

#### Depth (m)

- |                                                                                                                                       |                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <span style="background-color: #f0f0f0; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 0 - 0.5   | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 3.0 - 3.5 |
| <span style="background-color: #add8e6; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 0.5 - 1.0 | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 3.5 - 4.0 |
| <span style="background-color: #87ceeb; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 1.0 - 1.5 | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 4.0 - 4.5 |
| <span style="background-color: #add8e6; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 1.5 - 2.0 | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 4.5 - 5.0 |
| <span style="background-color: #87ceeb; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 2.0 - 2.5 | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> > 5.0     |
| <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 2.5 - 3.0 | <span style="color: black;">—</span> 1m contour (mAHD)                                                                                |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



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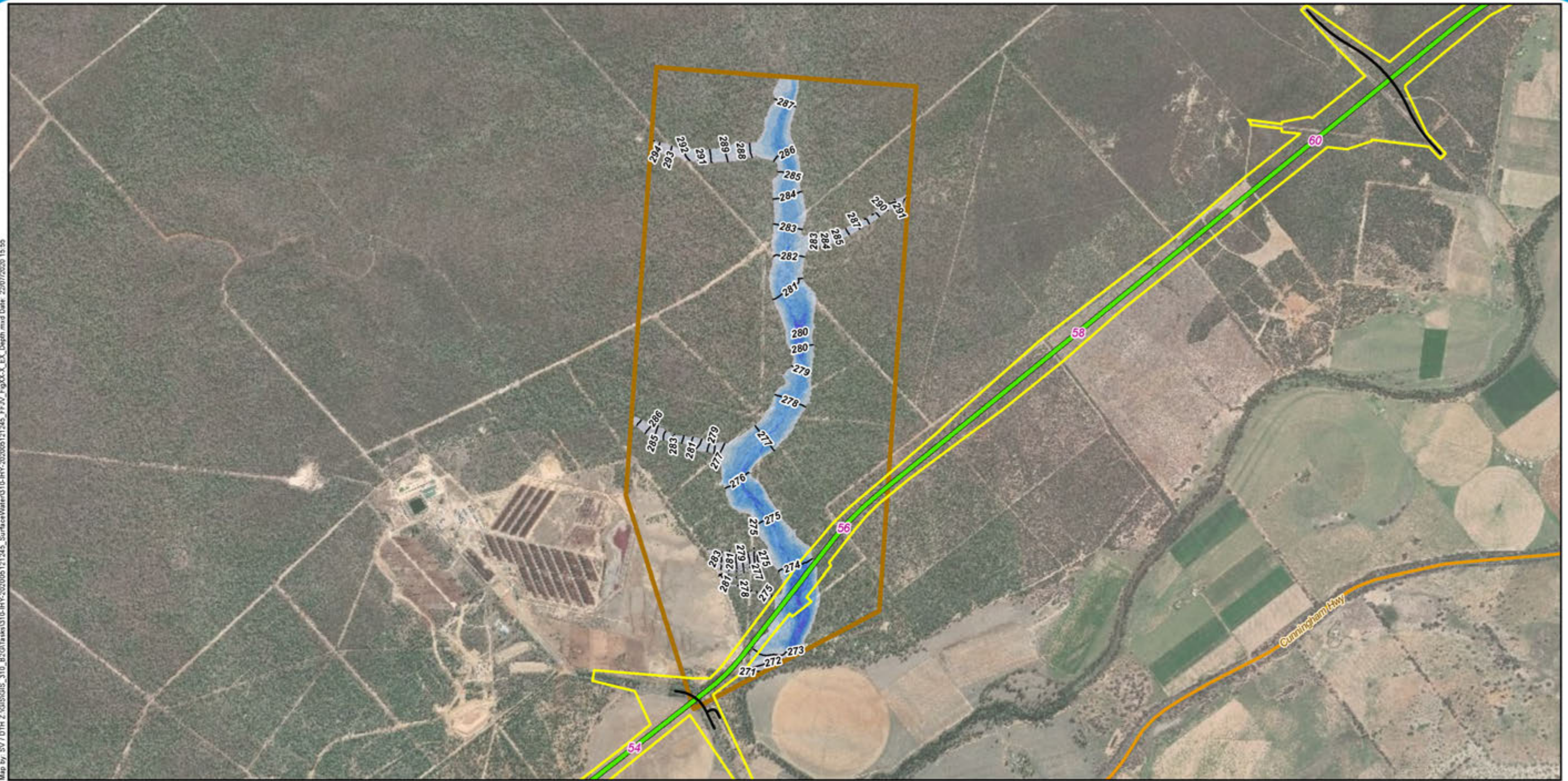
**Border to Gowrie**

**Figure K2-E:**

**1% AEP peak water levels - Existing Case - Bybera Road**



Map by SV / DTH 2:10USQGIS\_310\_B201Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF3V\_FigK2-F\_EX\_Depth.mxd Date: 22/07/2020 15:55



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent

#### Depth (m)

- |                                                    |                                                        |
|----------------------------------------------------|--------------------------------------------------------|
| <span style="color: lightblue;">□</span> 0 - 0.5   | <span style="color: blue;">□</span> 3.0 - 3.5          |
| <span style="color: lightblue;">□</span> 0.5 - 1.0 | <span style="color: blue;">□</span> 3.5 - 4.0          |
| <span style="color: lightblue;">□</span> 1.0 - 1.5 | <span style="color: blue;">□</span> 4.0 - 4.5          |
| <span style="color: lightblue;">□</span> 1.5 - 2.0 | <span style="color: blue;">□</span> 4.5 - 5.0          |
| <span style="color: lightblue;">□</span> 2.0 - 2.5 | <span style="color: blue;">□</span> > 5.0              |
| <span style="color: lightblue;">□</span> 2.5 - 3.0 | <span style="color: black;">—</span> 1m contour (mAHD) |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



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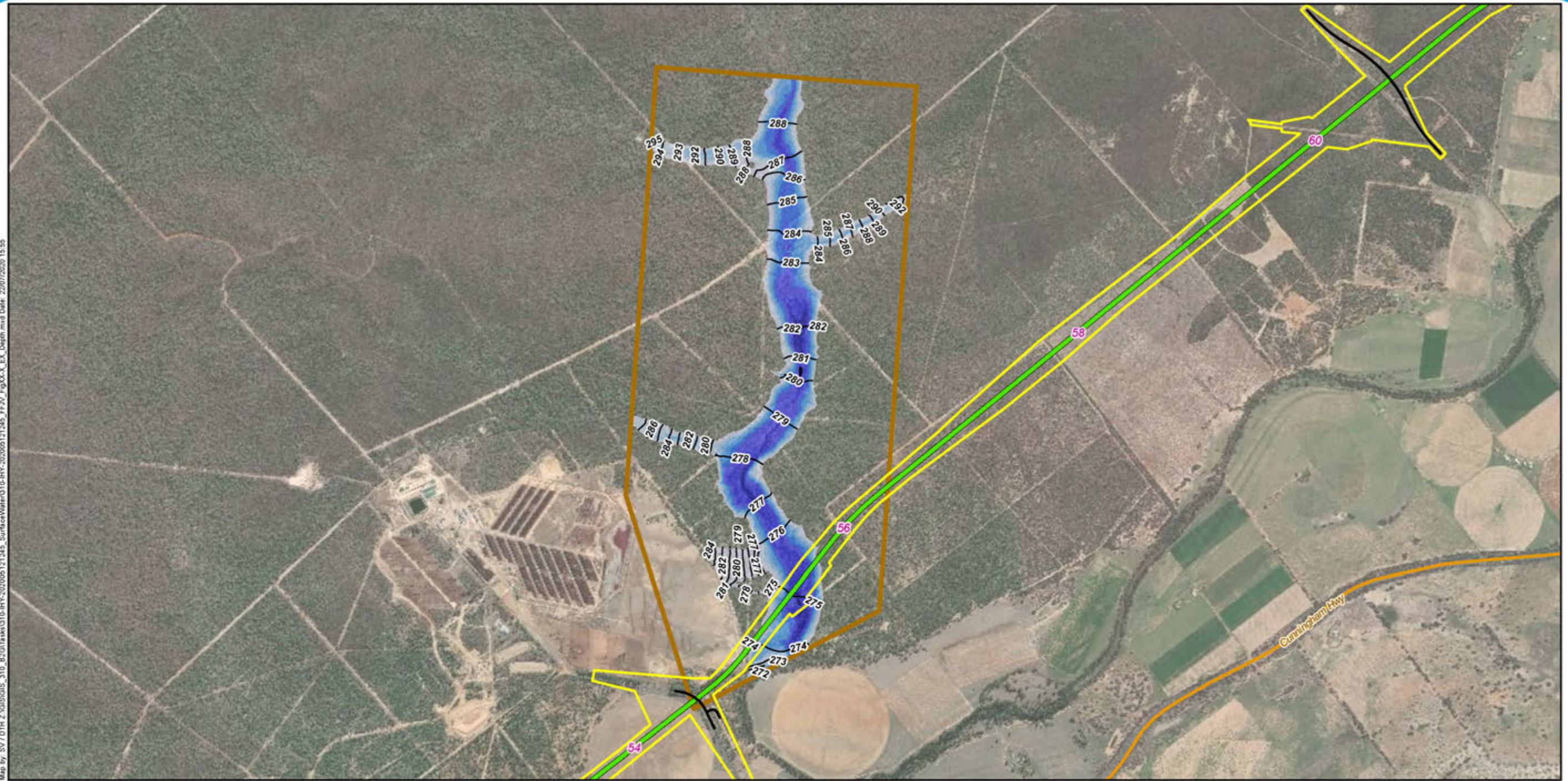
**Border to Gowrie**

**Figure K2-F:**

**1 in 2,000 AEP peak water levels - Existing Case - Bybera Road**



Map by SV / DTH 2:10USQGIS\_310\_B207Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF3V\_FigK2-G\_EX\_Depth.mxd Date: 22/07/2020 15:55



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent

#### Depth (m)

- |                                                    |                                                        |
|----------------------------------------------------|--------------------------------------------------------|
| <span style="color: lightblue;">—</span> 0 - 0.5   | <span style="color: blue;">—</span> 3.0 - 3.5          |
| <span style="color: lightblue;">—</span> 0.5 - 1.0 | <span style="color: blue;">—</span> 3.5 - 4.0          |
| <span style="color: lightblue;">—</span> 1.0 - 1.5 | <span style="color: blue;">—</span> 4.0 - 4.5          |
| <span style="color: lightblue;">—</span> 1.5 - 2.0 | <span style="color: blue;">—</span> 4.5 - 5.0          |
| <span style="color: lightblue;">—</span> 2.0 - 2.5 | <span style="color: blue;">—</span> > 5.0              |
| <span style="color: lightblue;">—</span> 2.5 - 3.0 | <span style="color: black;">—</span> 1m contour (mAHD) |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



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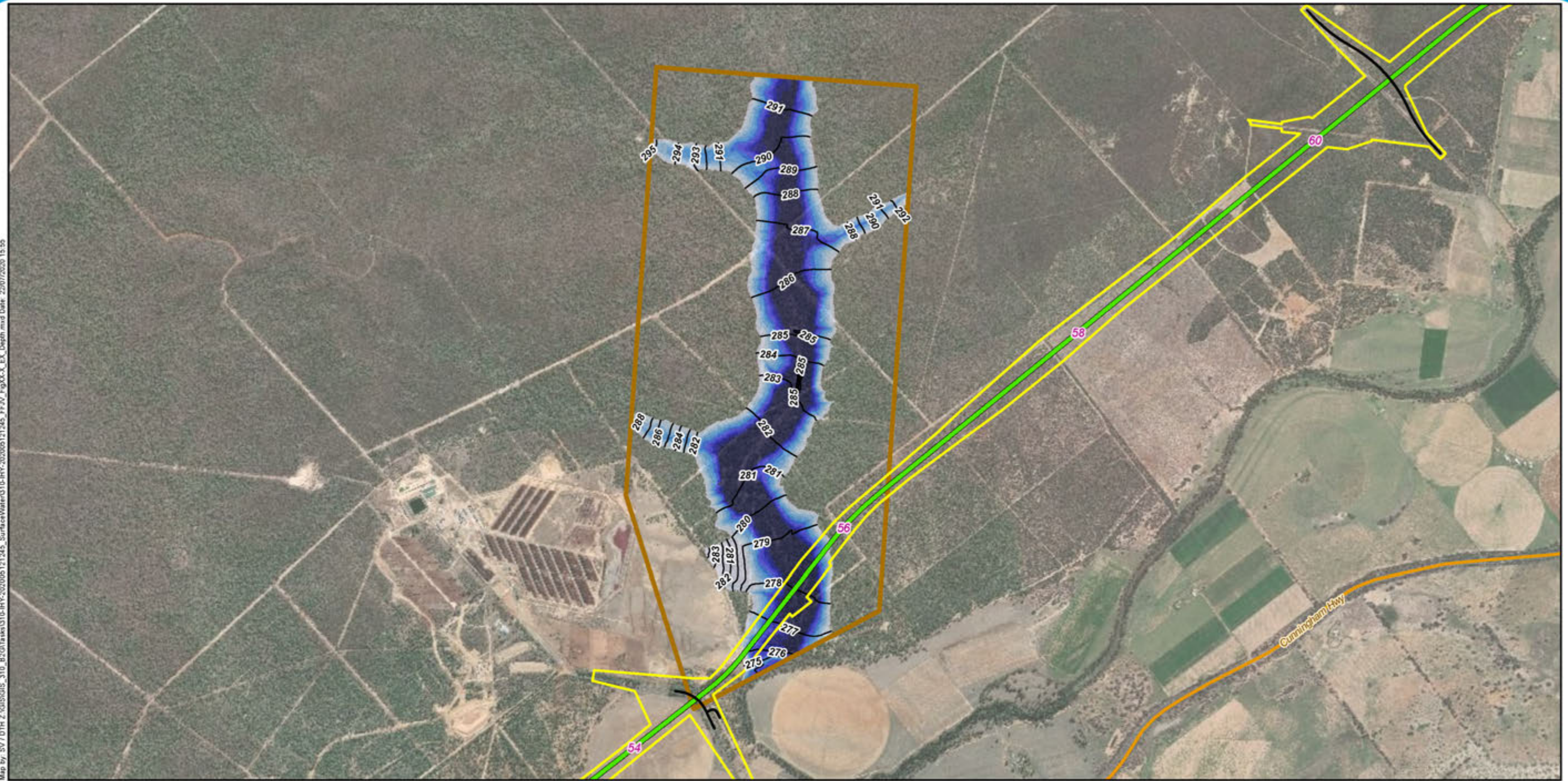
**Border to Gowrie**

**Figure K2-G:**

**1 in 10,000 AEP peak water levels - Existing Case - Bybera Road**



Map by SV / DTH 2:10USQGIS\_310\_B20Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF3V\_FigK2-H\_EX\_Depth.mxd Date: 22/07/2020 15:55



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent

#### Depth (m)

- |                                                    |                                                        |
|----------------------------------------------------|--------------------------------------------------------|
| <span style="color: lightblue;">■</span> 0 - 0.5   | <span style="color: blue;">■</span> 3.0 - 3.5          |
| <span style="color: lightblue;">■</span> 0.5 - 1.0 | <span style="color: blue;">■</span> 3.5 - 4.0          |
| <span style="color: lightblue;">■</span> 1.0 - 1.5 | <span style="color: blue;">■</span> 4.0 - 4.5          |
| <span style="color: lightblue;">■</span> 1.5 - 2.0 | <span style="color: blue;">■</span> 4.5 - 5.0          |
| <span style="color: lightblue;">■</span> 2.0 - 2.5 | <span style="color: blue;">■</span> > 5.0              |
| <span style="color: lightblue;">■</span> 2.5 - 3.0 | <span style="color: black;">—</span> 1m contour (mAHD) |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



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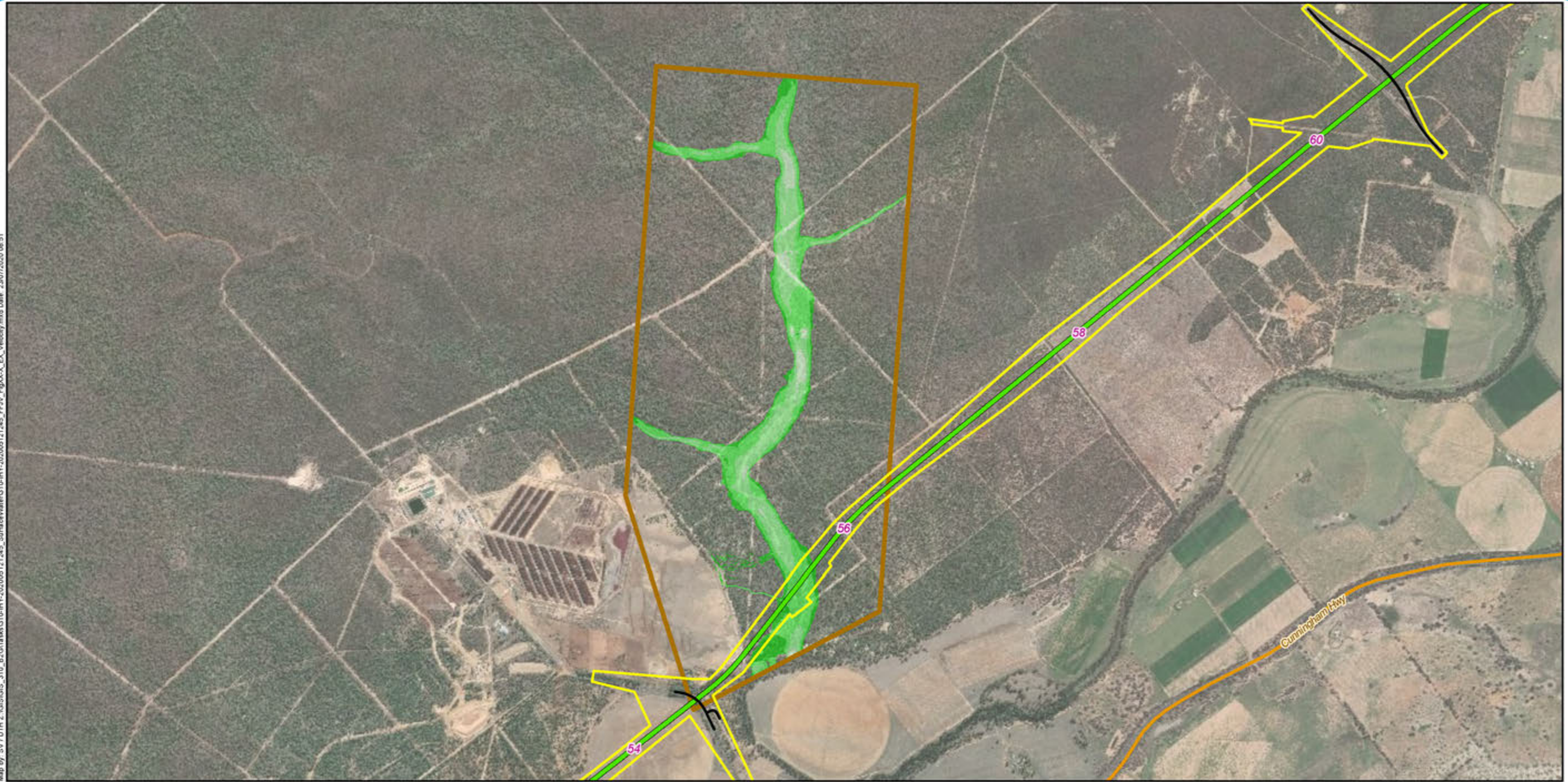
**Border to Gowrie**

**Figure K2-H:**

**PMF peak water levels - Existing Case - Bybera Road**



Map by SV / DTH 2:10USQGIS\_310\_B20Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF3V\_FigK3-A\_EX\_Velocity.mxd Date: 23/07/2020 08:51



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent

#### Peak velocity (m/s)

|                                                |                                               |
|------------------------------------------------|-----------------------------------------------|
| <span style="color: darkgreen;">■</span> 0.0   | <span style="color: lightblue;">■</span> 3.0  |
| <span style="color: green;">■</span> 0.5       | <span style="color: lightcoral;">■</span> 3.5 |
| <span style="color: lightgreen;">■</span> 1.0  | <span style="color: orange;">■</span> 4.0     |
| <span style="color: yellowgreen;">■</span> 1.5 | <span style="color: red;">■</span> 4.5        |
| <span style="color: yellow;">■</span> 2.0      | <span style="color: brown;">■</span> 5.0      |
| <span style="color: lightyellow;">■</span> 2.5 |                                               |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



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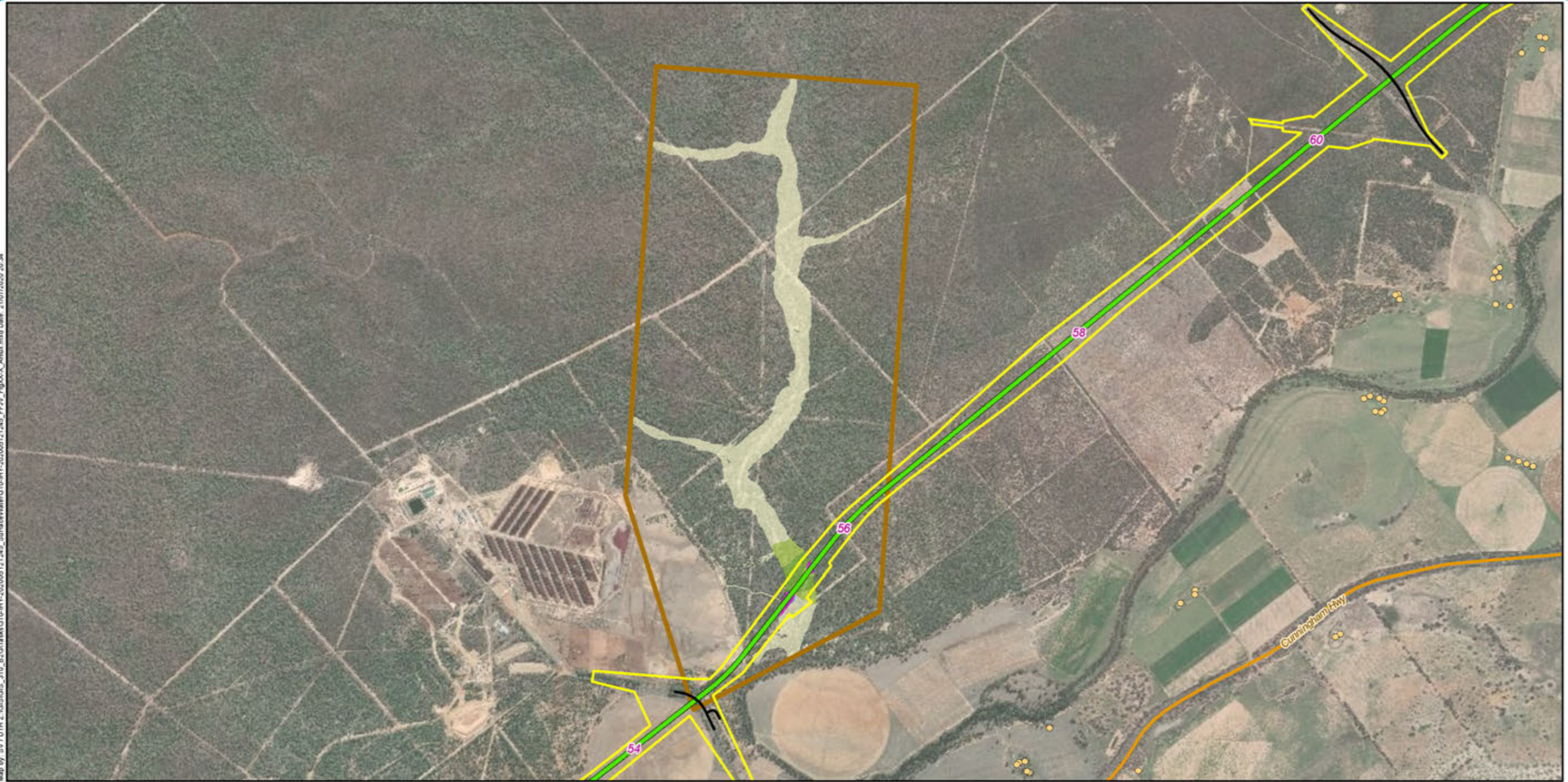
**Border to Gowrie**

**Figure K3-A:**

**1% AEP peak velocity - Existing Case - Bybera Road**



Map by SV / DTH 2:10USQIS\_310\_B201Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF.VN\_FigDocX\_Afflux.mxd Date: 21/07/2020 20:34



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in peak water levels (m)

- |                                                         |                                                         |
|---------------------------------------------------------|---------------------------------------------------------|
| <span style="color: darkblue;">■</span> < -0.5          | <span style="color: lightgreen;">■</span> 0.01 to 0.05  |
| <span style="color: teal;">■</span> -0.50 to -0.20      | <span style="color: green;">■</span> 0.05 to 0.10       |
| <span style="color: lightblue;">■</span> -0.20 to -0.10 | <span style="color: darkgreen;">■</span> 0.10 to 0.20   |
| <span style="color: cyan;">■</span> -0.10 to -0.05      | <span style="color: forestgreen;">■</span> 0.20 to 0.50 |
| <span style="color: skyblue;">■</span> -0.05 to -0.01   | <span style="color: darkslategrey;">■</span> > 0.5      |
| <span style="color: yellow;">■</span> -0.01 to 0.01     |                                                         |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



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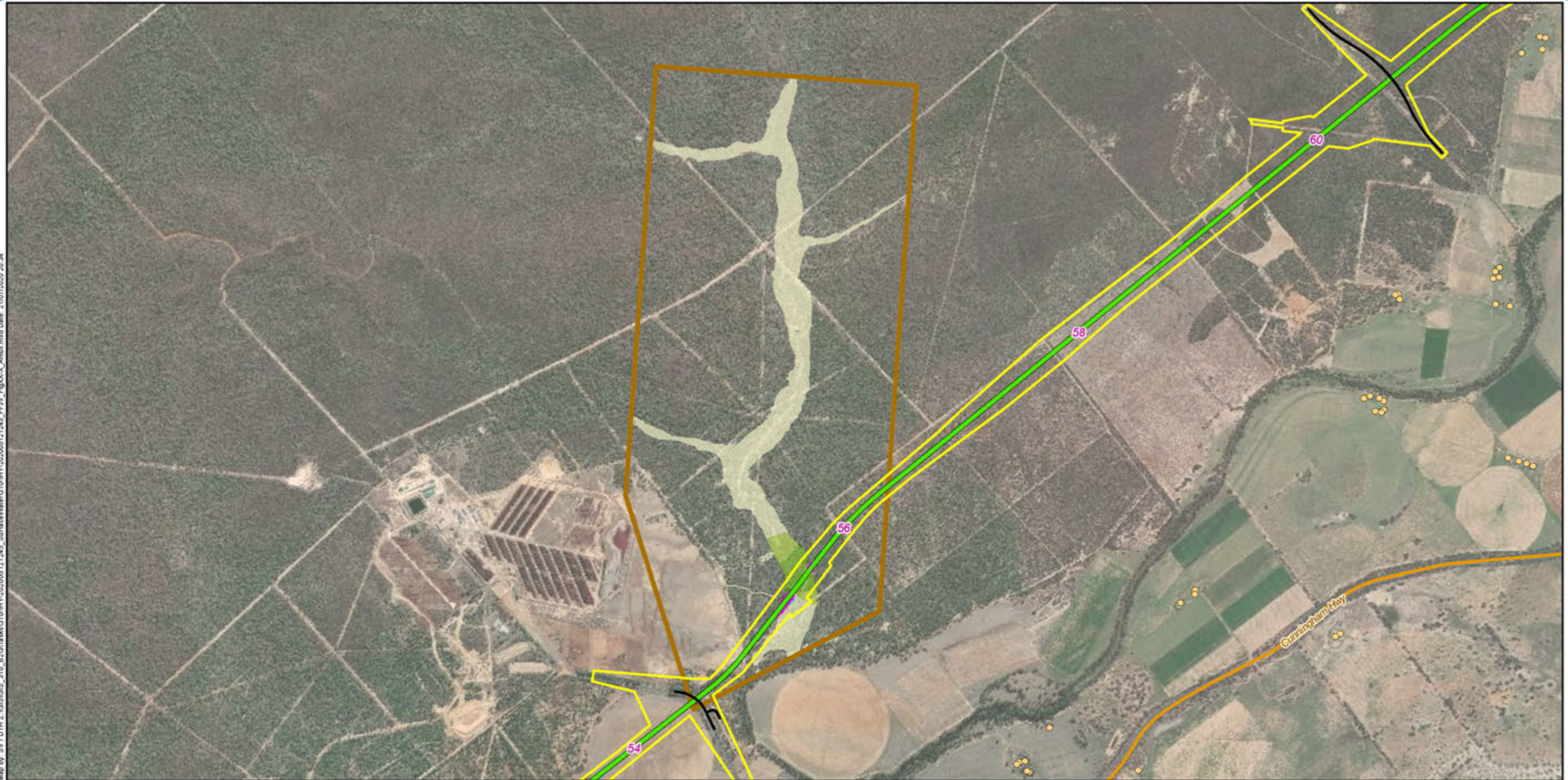
**Border to Gowrie**

**Figure K4-A:**

**20% AEP - design afflux - Bybera Road**



Map by SV / DTH 2:10USQIS\_310\_B201Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF.VN\_FigDoc-X\_Afflux.mxd Date: 21/07/2020 20:34



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in peak water levels (m)

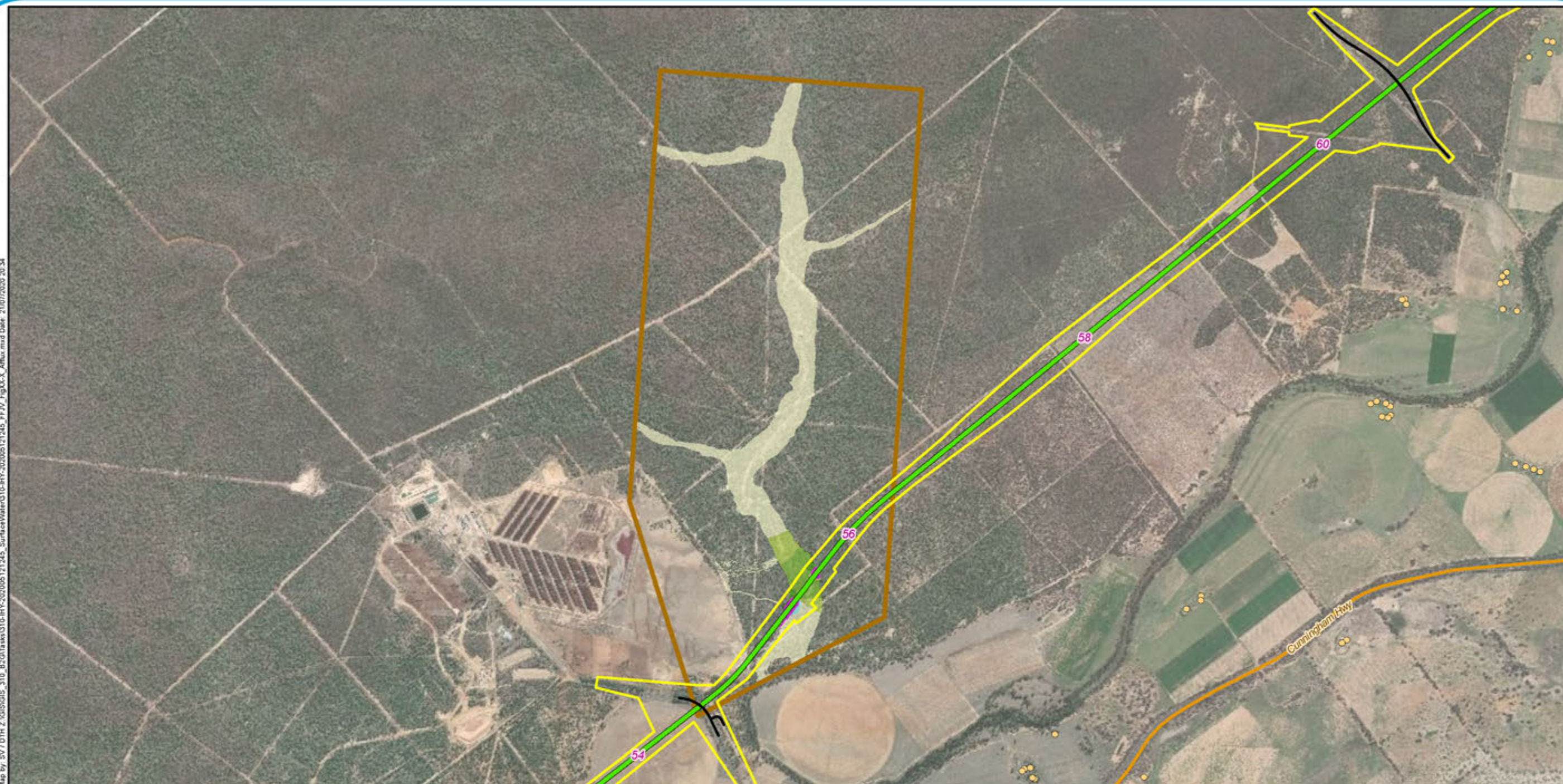
- |                                                         |                                                         |
|---------------------------------------------------------|---------------------------------------------------------|
| <span style="color: darkblue;">■</span> < -0.5          | <span style="color: lightgreen;">■</span> 0.01 to 0.05  |
| <span style="color: teal;">■</span> -0.50 to -0.20      | <span style="color: green;">■</span> 0.05 to 0.10       |
| <span style="color: lightteal;">■</span> -0.20 to -0.10 | <span style="color: darkgreen;">■</span> 0.10 to 0.20   |
| <span style="color: cyan;">■</span> -0.10 to -0.05      | <span style="color: forestgreen;">■</span> 0.20 to 0.50 |
| <span style="color: lightcyan;">■</span> -0.05 to -0.01 | <span style="color: darkgreen;">■</span> > 0.5          |
| <span style="color: yellow;">■</span> -0.01 to 0.01     |                                                         |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



Map by SV / DTH 2:10:50GIS\_310\_B201Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF.VN\_FigDocX\_Afflux.mxd Date: 21/07/2020 20:34



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in peak water levels (m)

- |                                                         |                                                         |
|---------------------------------------------------------|---------------------------------------------------------|
| <span style="color: darkblue;">■</span> < -0.5          | <span style="color: lightgreen;">■</span> 0.01 to 0.05  |
| <span style="color: teal;">■</span> -0.50 to -0.20      | <span style="color: green;">■</span> 0.05 to 0.10       |
| <span style="color: cyan;">■</span> -0.20 to -0.10      | <span style="color: darkgreen;">■</span> 0.10 to 0.20   |
| <span style="color: lightblue;">■</span> -0.10 to -0.05 | <span style="color: forestgreen;">■</span> 0.20 to 0.50 |
| <span style="color: skyblue;">■</span> -0.05 to -0.01   | <span style="color: darkslategrey;">■</span> > 0.5      |
| <span style="color: yellow;">■</span> -0.01 to 0.01     |                                                         |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



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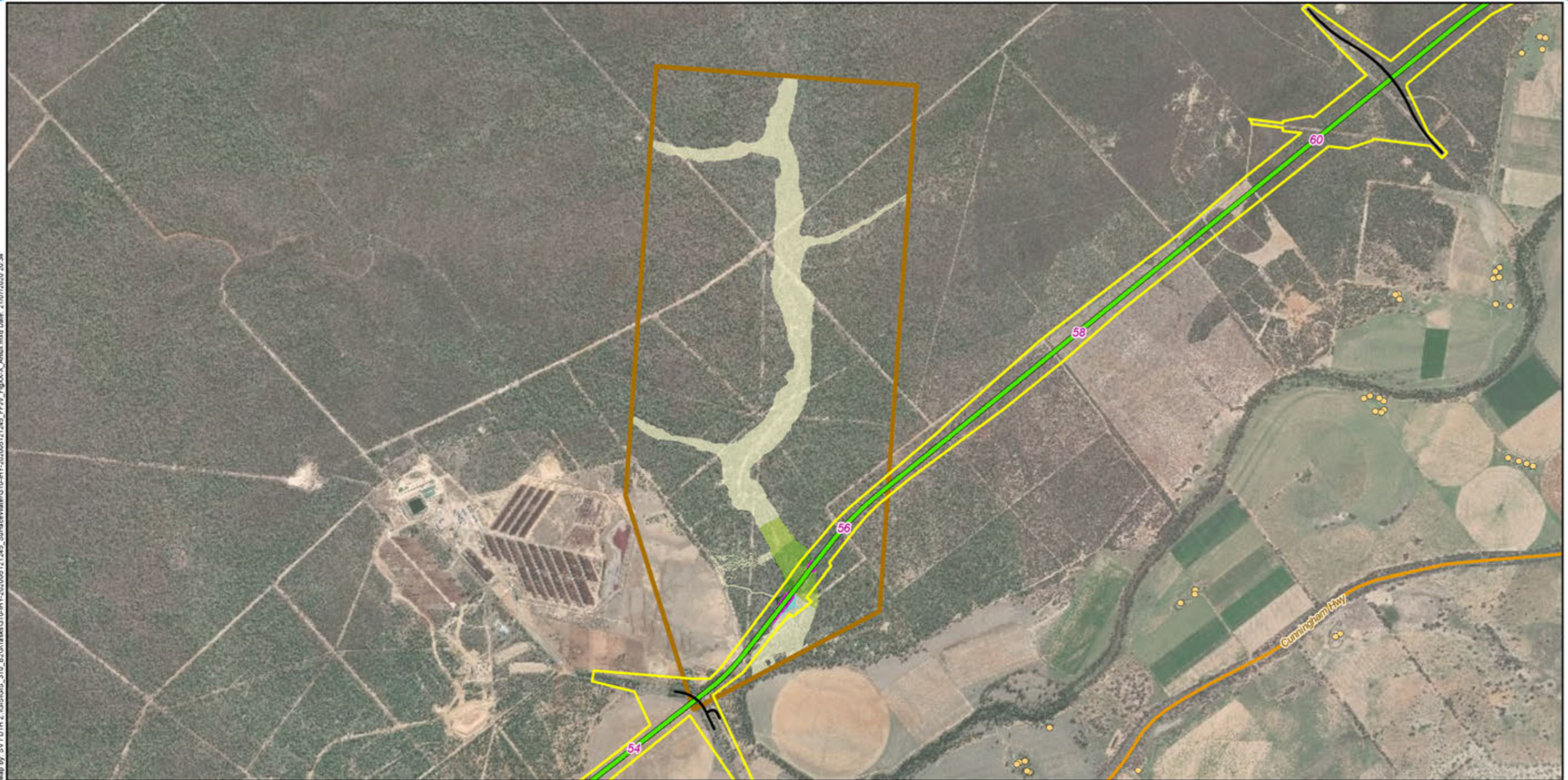
**Border to Gowrie**

**Figure K4-C:**

**5% AEP - design afflux - Bybera Road**



Map by SV / DTH 2:10:50GIS\_310\_B201Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF.VN\_Fig00c-X\_Afflux.mxd Date: 21/07/2020 20:34



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

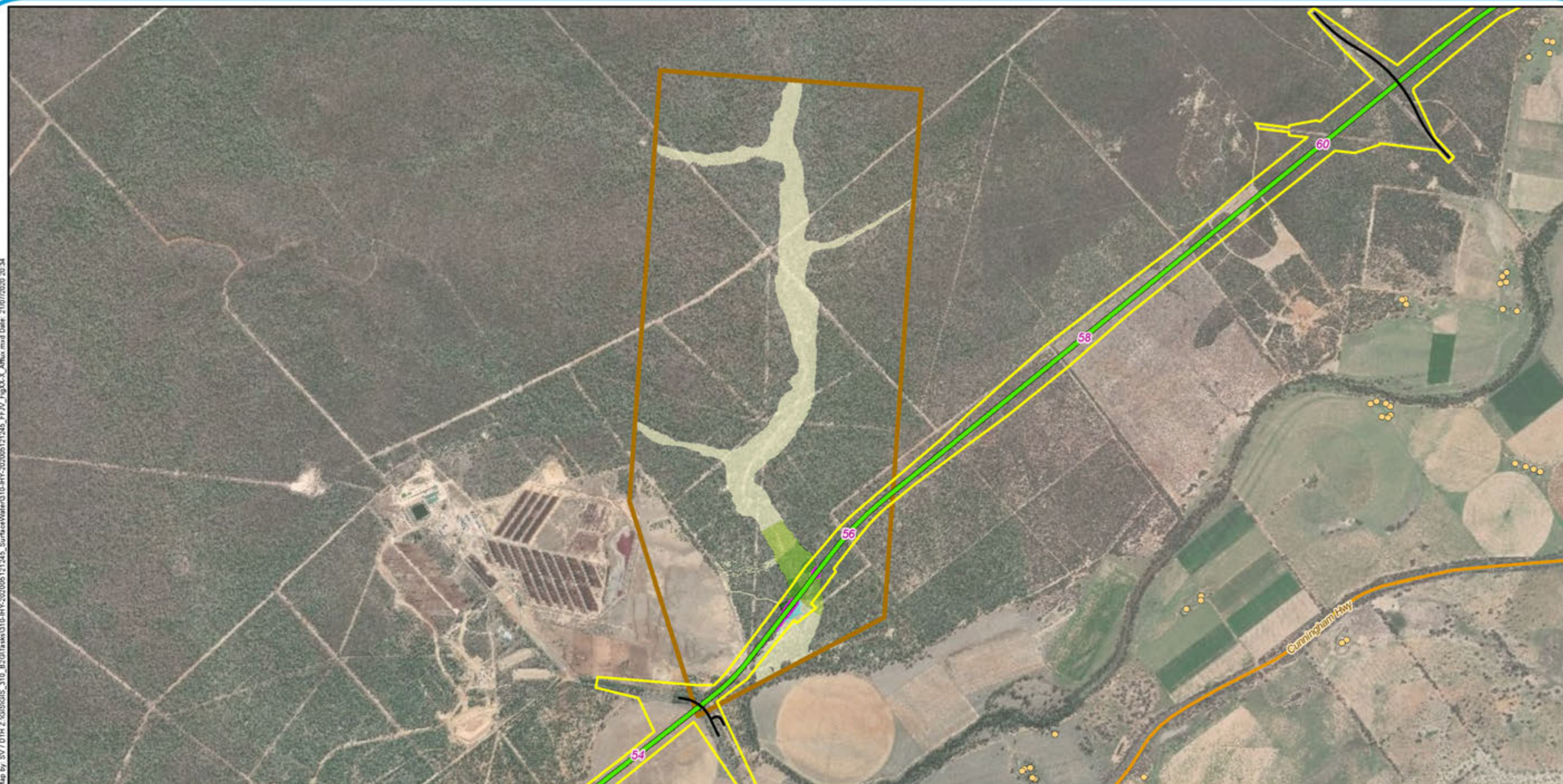
#### Change in peak water levels (m)

- |                                                         |                                                         |
|---------------------------------------------------------|---------------------------------------------------------|
| <span style="color: darkblue;">■</span> < -0.5          | <span style="color: lightgreen;">■</span> 0.01 to 0.05  |
| <span style="color: teal;">■</span> -0.50 to -0.20      | <span style="color: green;">■</span> 0.05 to 0.10       |
| <span style="color: lightteal;">■</span> -0.20 to -0.10 | <span style="color: darkgreen;">■</span> 0.10 to 0.20   |
| <span style="color: cyan;">■</span> -0.10 to -0.05      | <span style="color: forestgreen;">■</span> 0.20 to 0.50 |
| <span style="color: lightcyan;">■</span> -0.05 to -0.01 | <span style="color: darkgreen;">■</span> > 0.5          |
| <span style="color: yellow;">■</span> -0.01 to 0.01     |                                                         |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km





-  Flood sensitive receptor
-  Chainage (km)
-  Border to Gowrie alignment
-  Major roads
-  Road design
-  Project footprint
-  Hydraulic model extent
-  Was Wet Now Dry
-  Was Dry Now Wet

|                |              |
|----------------|--------------|
| < -0.5         | 0.01 to 0.05 |
| -0.50 to -0.20 | 0.05 to 0.10 |
| -0.20 to -0.10 | 0.10 to 0.20 |
| -0.10 to -0.05 | 0.20 to 0.50 |
| -0.05 to -0.01 | > 0.5        |
| -0.01 to 0.01  |              |

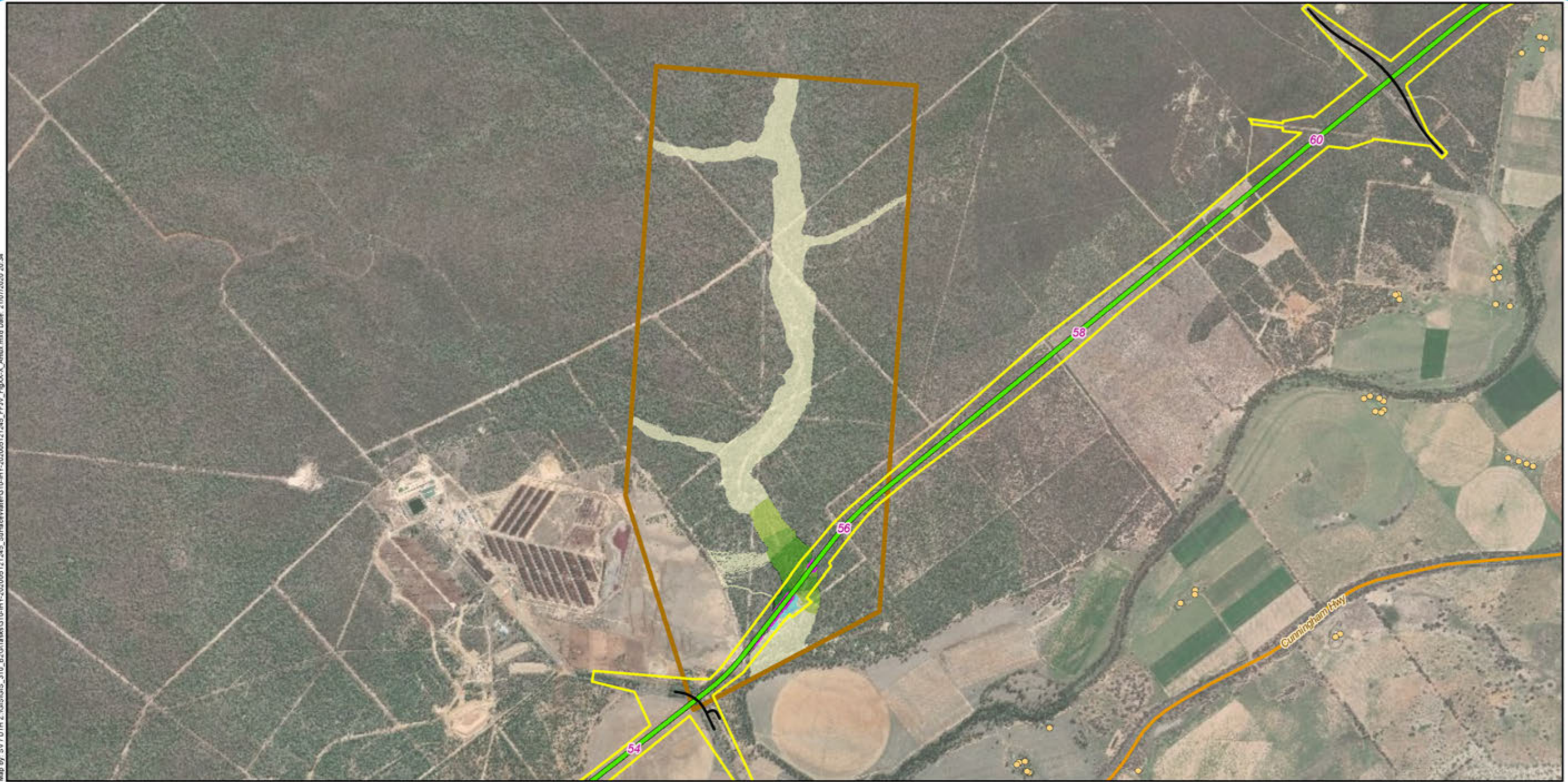


**Figure K4-E:**

1% AEP - design afflux - Bybera Road



Map by SV / DTH 2:10:50GIS\_310\_B201Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF.FIN\_FigDocX\_Afflux.mxd Date: 21/07/2020 20:34



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in peak water levels (m)

- |                                                         |                                                         |
|---------------------------------------------------------|---------------------------------------------------------|
| <span style="color: darkblue;">—</span> < -0.5          | <span style="color: lightgreen;">—</span> 0.01 to 0.05  |
| <span style="color: teal;">—</span> -0.50 to -0.20      | <span style="color: green;">—</span> 0.05 to 0.10       |
| <span style="color: lightblue;">—</span> -0.20 to -0.10 | <span style="color: darkgreen;">—</span> 0.10 to 0.20   |
| <span style="color: cyan;">—</span> -0.10 to -0.05      | <span style="color: forestgreen;">—</span> 0.20 to 0.50 |
| <span style="color: skyblue;">—</span> -0.05 to -0.01   | <span style="color: darkslategrey;">—</span> > 0.5      |
| <span style="color: yellow;">—</span> -0.01 to 0.01     |                                                         |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



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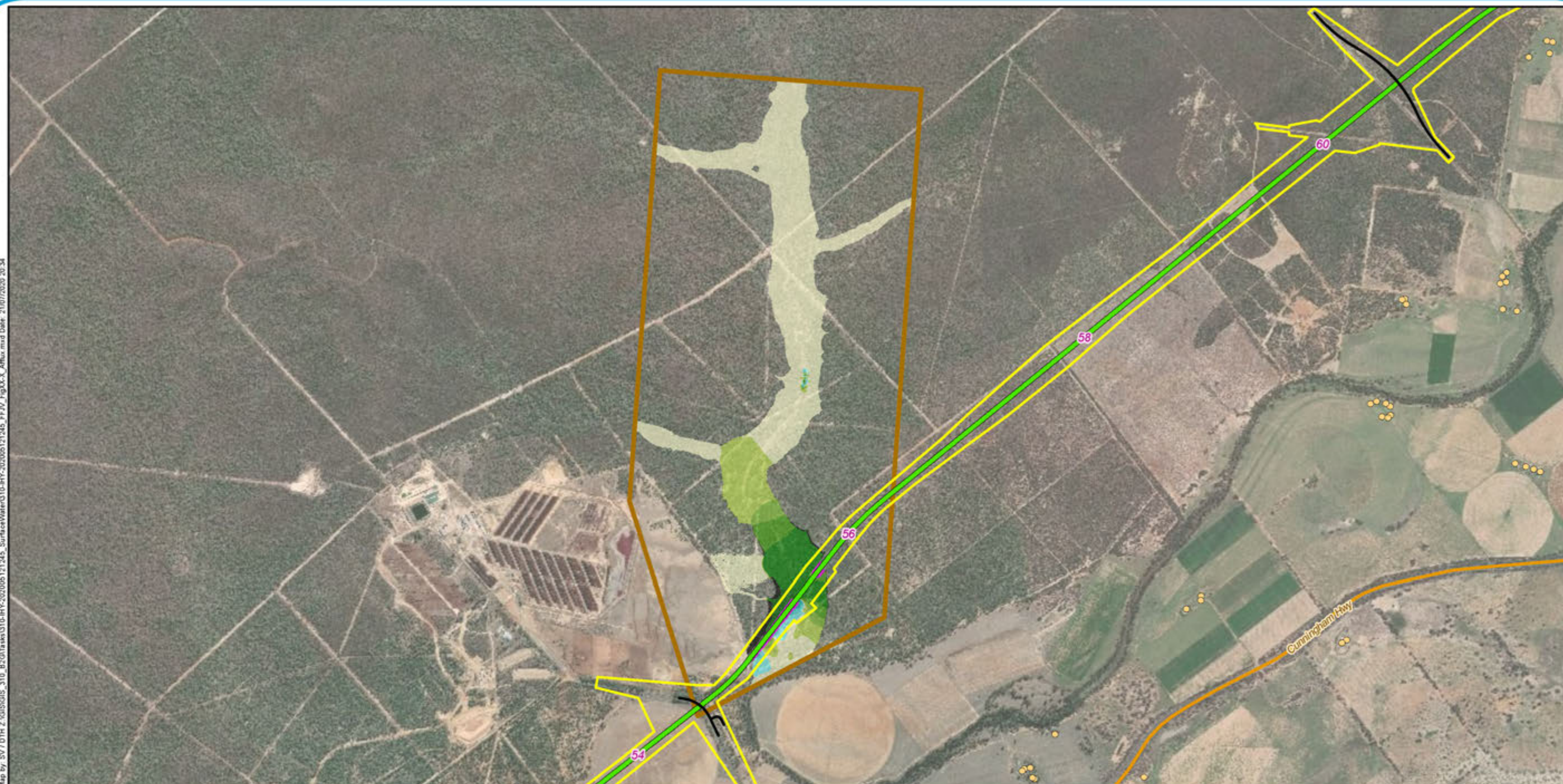
**Border to Gowrie**

**Figure K4-F:**

**1 in 2,000 AEP - design afflux - Bybera Road**



Map by SV / DTH 2:10USQIS\_310\_B201Task310-HY-202005121245\_SurfaceWater310-HY-202005121245\_FF.FIN\_FigDoc-X\_Afflux.mxd Date: 21/07/2020 20:34



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in peak water levels (m)

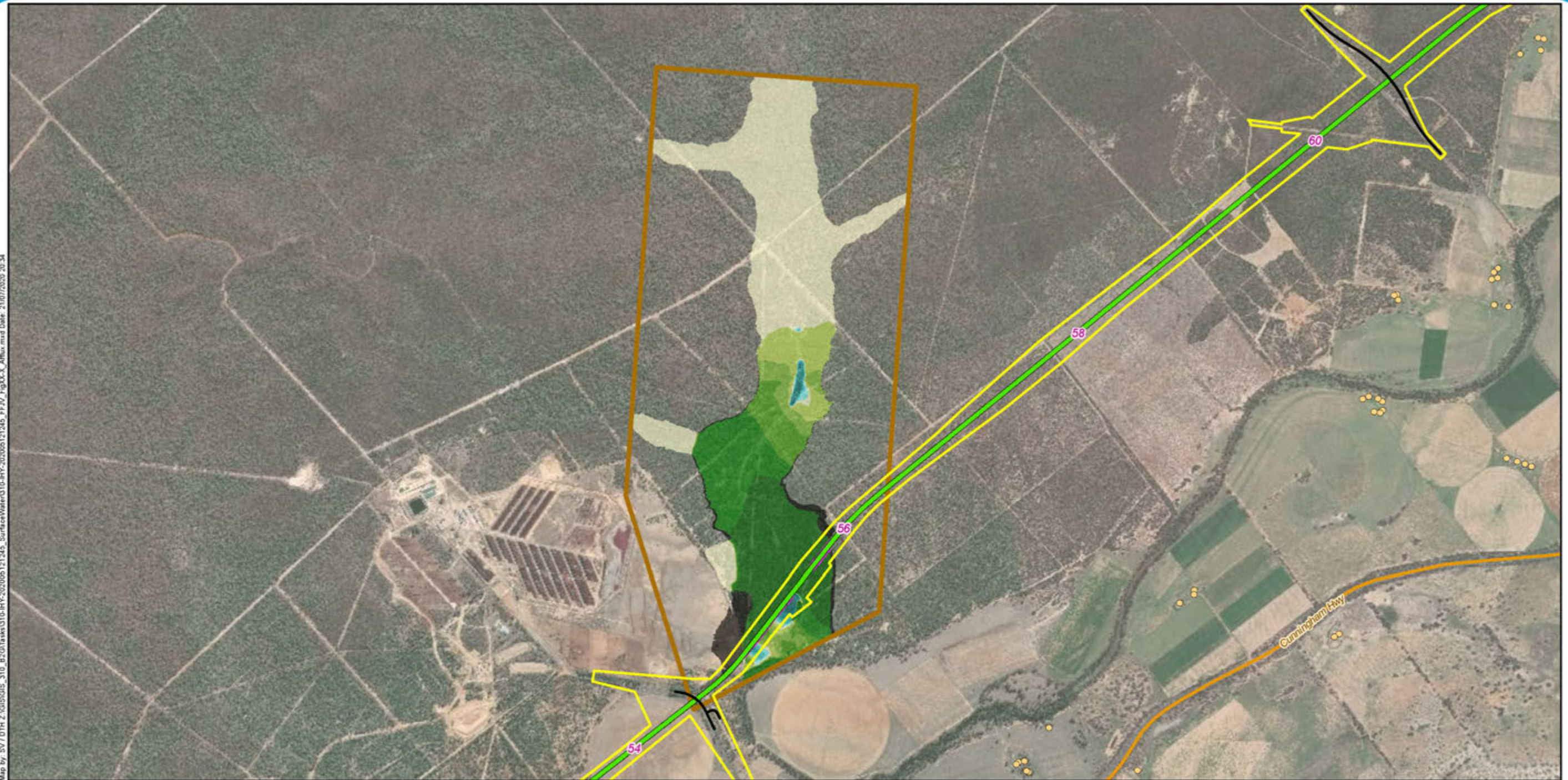
- |                                                         |                                                         |
|---------------------------------------------------------|---------------------------------------------------------|
| <span style="color: darkblue;">■</span> < -0.5          | <span style="color: lightgreen;">■</span> 0.01 to 0.05  |
| <span style="color: teal;">■</span> -0.50 to -0.20      | <span style="color: green;">■</span> 0.05 to 0.10       |
| <span style="color: lightteal;">■</span> -0.20 to -0.10 | <span style="color: darkgreen;">■</span> 0.10 to 0.20   |
| <span style="color: cyan;">■</span> -0.10 to -0.05      | <span style="color: forestgreen;">■</span> 0.20 to 0.50 |
| <span style="color: lightcyan;">■</span> -0.05 to -0.01 | <span style="color: darkgreen;">■</span> > 0.5          |
| <span style="color: yellow;">■</span> -0.01 to 0.01     |                                                         |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



Map by SV / DTH 2:10USQIS\_310\_B201Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF.VN\_FigDocX\_Afflux.mxd Date: 21/07/2020 20:34



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in peak water levels (m)

- |                                                         |                                                         |
|---------------------------------------------------------|---------------------------------------------------------|
| <span style="color: darkblue;">■</span> < -0.5          | <span style="color: lightgreen;">■</span> 0.01 to 0.05  |
| <span style="color: teal;">■</span> -0.50 to -0.20      | <span style="color: green;">■</span> 0.05 to 0.10       |
| <span style="color: lightblue;">■</span> -0.20 to -0.10 | <span style="color: darkgreen;">■</span> 0.10 to 0.20   |
| <span style="color: cyan;">■</span> -0.10 to -0.05      | <span style="color: forestgreen;">■</span> 0.20 to 0.50 |
| <span style="color: skyblue;">■</span> -0.05 to -0.01   | <span style="color: darkslategrey;">■</span> > 0.5      |
| <span style="color: yellow;">■</span> -0.01 to 0.01     |                                                         |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



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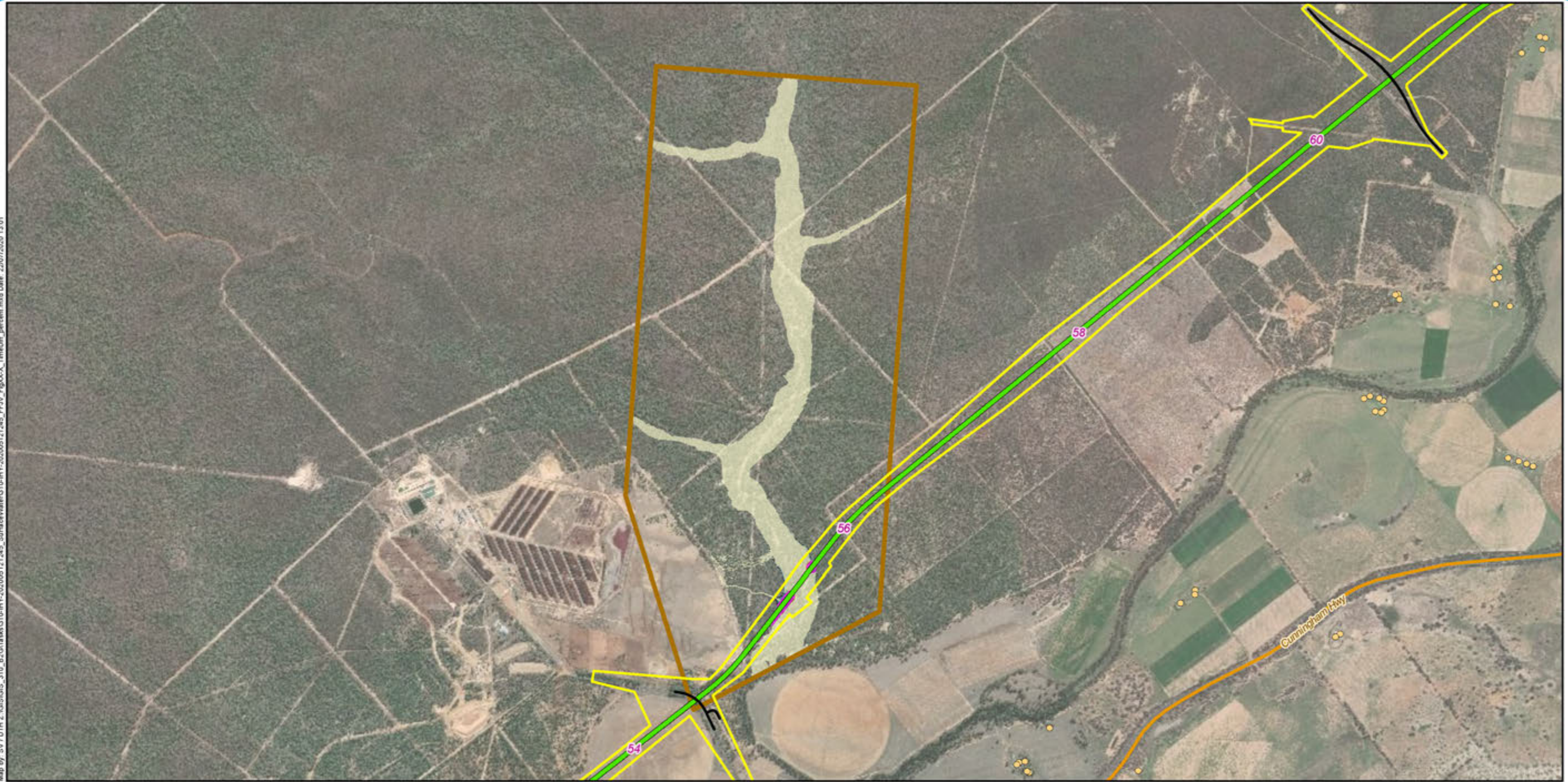
**Border to Gowrie**

**Figure K4-H:**

**PMF - design afflux - Bybera Road**



Map by SV / DTH 2:10USQGIS\_310\_B201Task310-HY-202005121245\_SurfaceWater310-HY-202005121245\_FF JV\_FigK4-I\_TimeDiff\_percent.mxd Date: 22/07/2020 13:01



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in Time of Inundation (percentage)

- |                                                         |                                                       |
|---------------------------------------------------------|-------------------------------------------------------|
| <span style="color: red;">■</span> < -50%               | <span style="color: lightgreen;">■</span> 10% to 20 % |
| <span style="color: orange;">■</span> -50% to -40%      | <span style="color: green;">■</span> 20% to 30 %      |
| <span style="color: yellow;">■</span> -40% to -30%      | <span style="color: lightblue;">■</span> 30% to 40 %  |
| <span style="color: lightyellow;">■</span> -30% to -20% | <span style="color: blue;">■</span> 40% to 50 %       |
| <span style="color: yellow;">■</span> -20% to -10%      | <span style="color: darkblue;">■</span> > 50%         |
| <span style="color: lightyellow;">■</span> -10% to 10 % |                                                       |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



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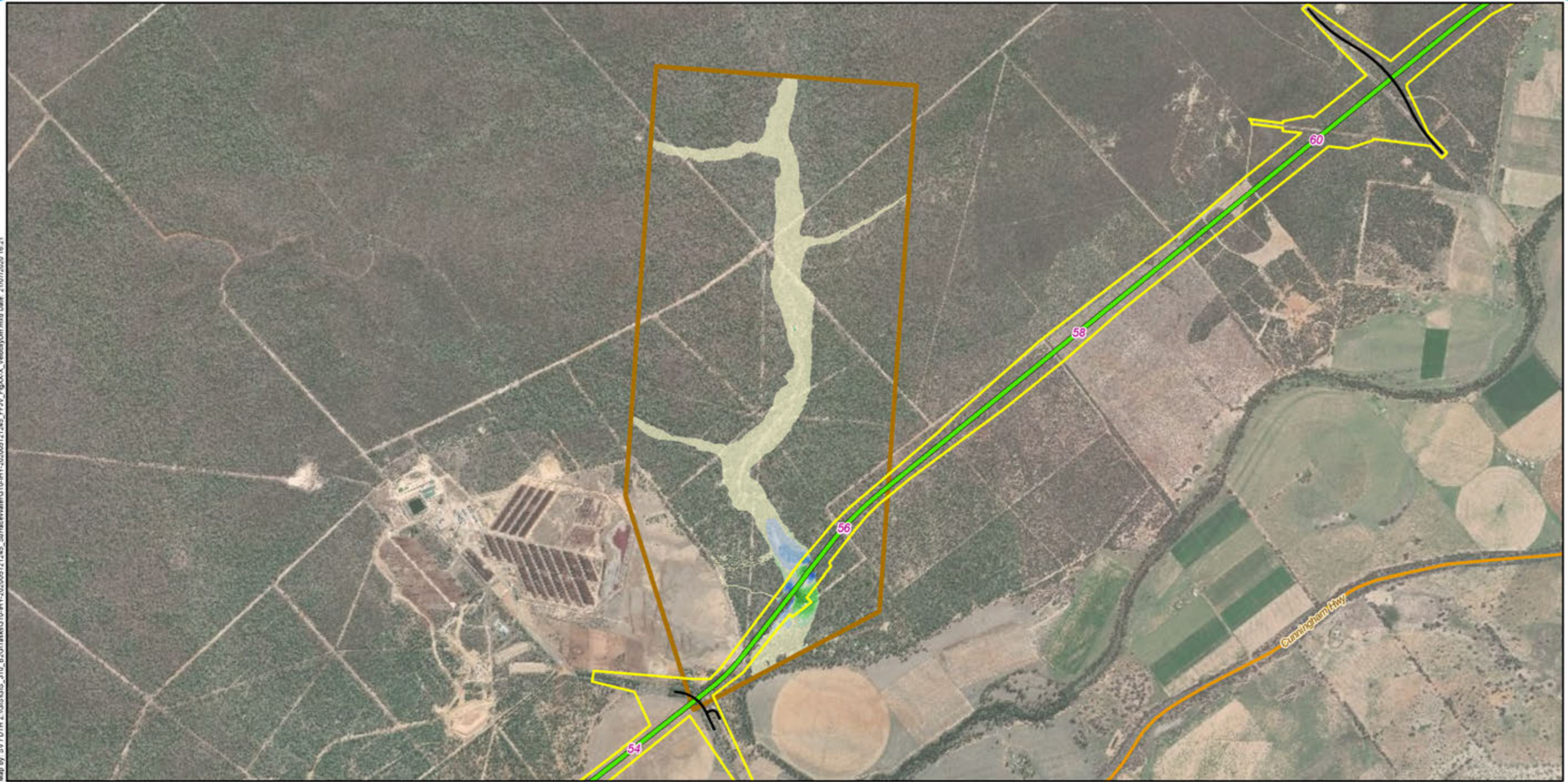
**Border to Gowrie**

**Figure K4-I:**

**1% AEP - change in time of inundation - Bybera Road**



Map by SV / DTH 21/07/2020 16:21  
 B2020Task310-HY-20200512145\_SurfaceWater310-HY-20200512145\_FF\_AV\_FigXX-X\_VelocityOff.mxd Date: 21/07/2020 16:21



**Legend**

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent

**Change in peak velocity (m/s)**

- |                                                    |                                                        |
|----------------------------------------------------|--------------------------------------------------------|
| <span style="color: blue;">■</span> < -0.50        | <span style="color: lightblue;">■</span> 0.01 to 0.05  |
| <span style="color: blue;">■</span> -0.50 to -0.20 | <span style="color: lightgreen;">■</span> 0.05 to 0.10 |
| <span style="color: blue;">■</span> -0.20 to -0.10 | <span style="color: green;">■</span> 0.10 to 0.20      |
| <span style="color: blue;">■</span> -0.10 to -0.05 | <span style="color: green;">■</span> 0.20 to 0.50      |
| <span style="color: blue;">■</span> -0.05 to -0.01 | <span style="color: green;">■</span> > 0.50            |
| <span style="color: blue;">■</span> -0.01 to 0.01  |                                                        |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25 km



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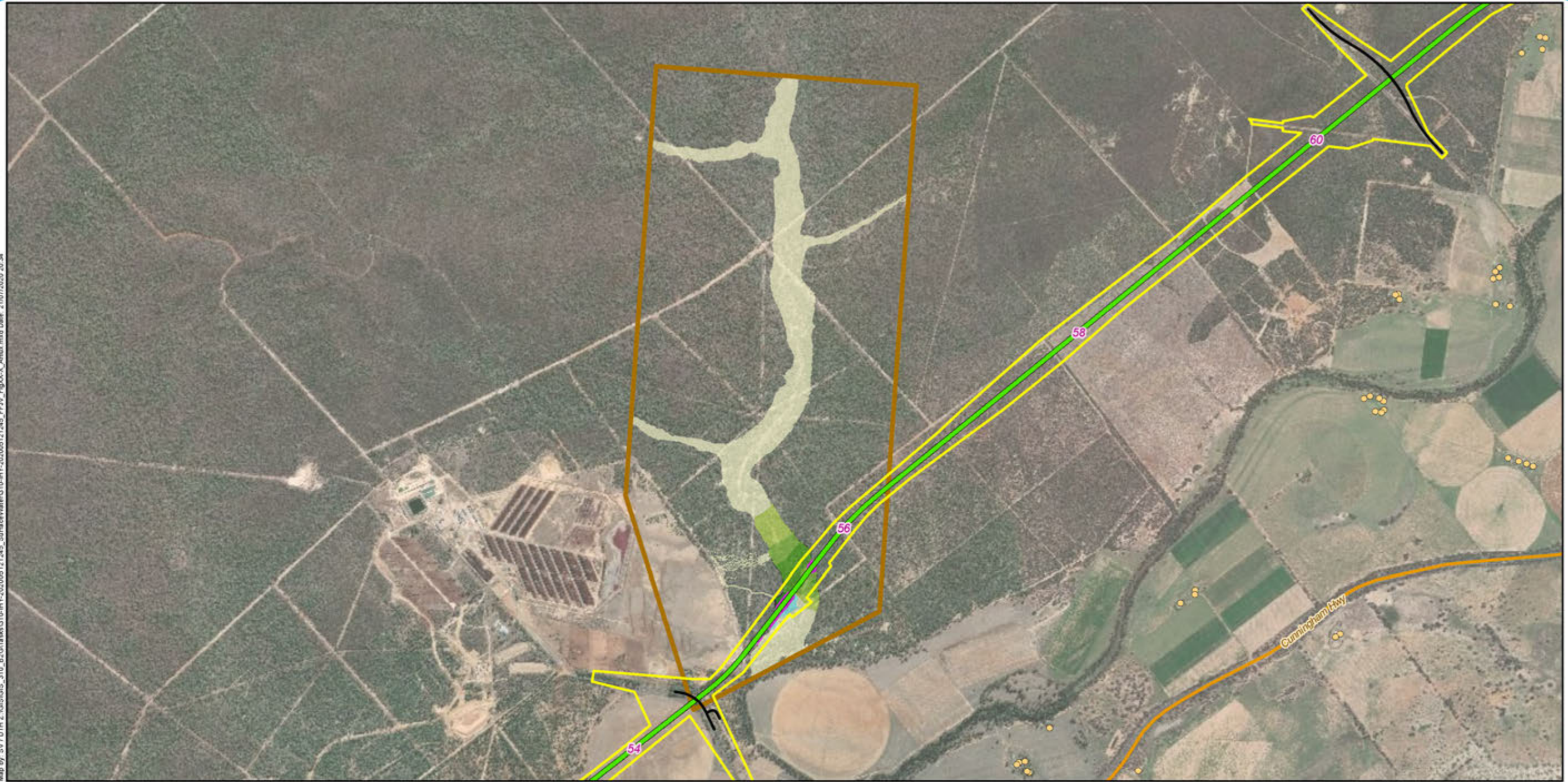
**Border to Gowrie**

**Figure K4-J:**

**1% AEP - change in velocity - Bybera Road**



Map by SV / DTH 2:10:50GIS\_310\_B201Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF.VN\_FigDocX\_Affix.mxd Date: 21/07/2020 20:34



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in peak water levels (m)

- |                                                         |                                                         |
|---------------------------------------------------------|---------------------------------------------------------|
| <span style="color: darkblue;">■</span> < -0.5          | <span style="color: lightgreen;">■</span> 0.01 to 0.05  |
| <span style="color: teal;">■</span> -0.50 to -0.20      | <span style="color: green;">■</span> 0.05 to 0.10       |
| <span style="color: lightteal;">■</span> -0.20 to -0.10 | <span style="color: darkgreen;">■</span> 0.10 to 0.20   |
| <span style="color: cyan;">■</span> -0.10 to -0.05      | <span style="color: forestgreen;">■</span> 0.20 to 0.50 |
| <span style="color: lightcyan;">■</span> -0.05 to -0.01 | <span style="color: darkgreen;">■</span> > 0.5          |
| <span style="color: yellow;">■</span> -0.01 to 0.01     |                                                         |



A3 scale: 1:27,500  
 0 0.25 0.5 0.75 1 1.25km



APPENDIX

# Q2

## Hydrology and Flooding Technical Report—Volume II

### **Appendix L** Cremascos Road Flood Maps

INLAND RAIL—BORDER TO GOWRIE ENVIRONMENTAL IMPACT STATEMENT



# Appendix L

## Cremascos Road Flood Maps

|             |                                                                |
|-------------|----------------------------------------------------------------|
| Figure L1-A | Locality plan                                                  |
| Figure L1-B | Survey data                                                    |
| Figure L1-C | Hydrologic model setup                                         |
| Figure L1-D | Hydraulic model setup                                          |
| Figure L1-E | Landuse classifications                                        |
| Figure L1-F | Proposed design structures                                     |
| Figure L2-A | 20% AEP peak water levels – Existing Case                      |
| Figure L2-B | 10% AEP peak water levels – Existing Case                      |
| Figure L2-C | 5% AEP peak water levels – Existing Case                       |
| Figure L2-D | 2% AEP peak water levels – Existing Case                       |
| Figure L2-E | 1% AEP peak water levels – Existing Case                       |
| Figure L2-F | 1 in 2,000 AEP peak water levels – Existing Case               |
| Figure L2-G | 1 in 10,000 AEP peak water levels – Existing Case              |
| Figure L2-H | PMF peak water levels – Existing Case                          |
| Figure L3-A | 1% AEP peak velocity – Existing Case                           |
| Figure L4-A | 20% AEP – design afflux                                        |
| Figure L4-B | 10% AEP – design afflux                                        |
| Figure L4-C | 5% AEP – design afflux                                         |
| Figure L4-D | 2% AEP – design afflux                                         |
| Figure L4-E | 1% AEP – design afflux                                         |
| Figure L4-F | 1 in 2,000 AEP – design afflux                                 |
| Figure L4-G | 1 in 10,000 AEP – design afflux                                |
| Figure L4-H | PMF – design afflux                                            |
| Figure L4-I | 1% AEP – change in time of inundation                          |
| Figure L4-J | 1% AEP – change in velocity                                    |
| Figure L5-A | 1% AEP sensitivity – climate change RCP8.5 – peak water levels |



Map by: SV / DTH 2:10USGS, 310\_B20Task310-HY-202005121245\_SurfaceWater310-HY-202005121245\_FF3V\_Fig1-A\_Locality.mxd Date: 22/07/2020 19:20



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Watercourses
- Major roads
- Road design
- Project footprint



A3 scale: 1:22,500  
 0 0.2 0.4 0.6 0.8 1 km



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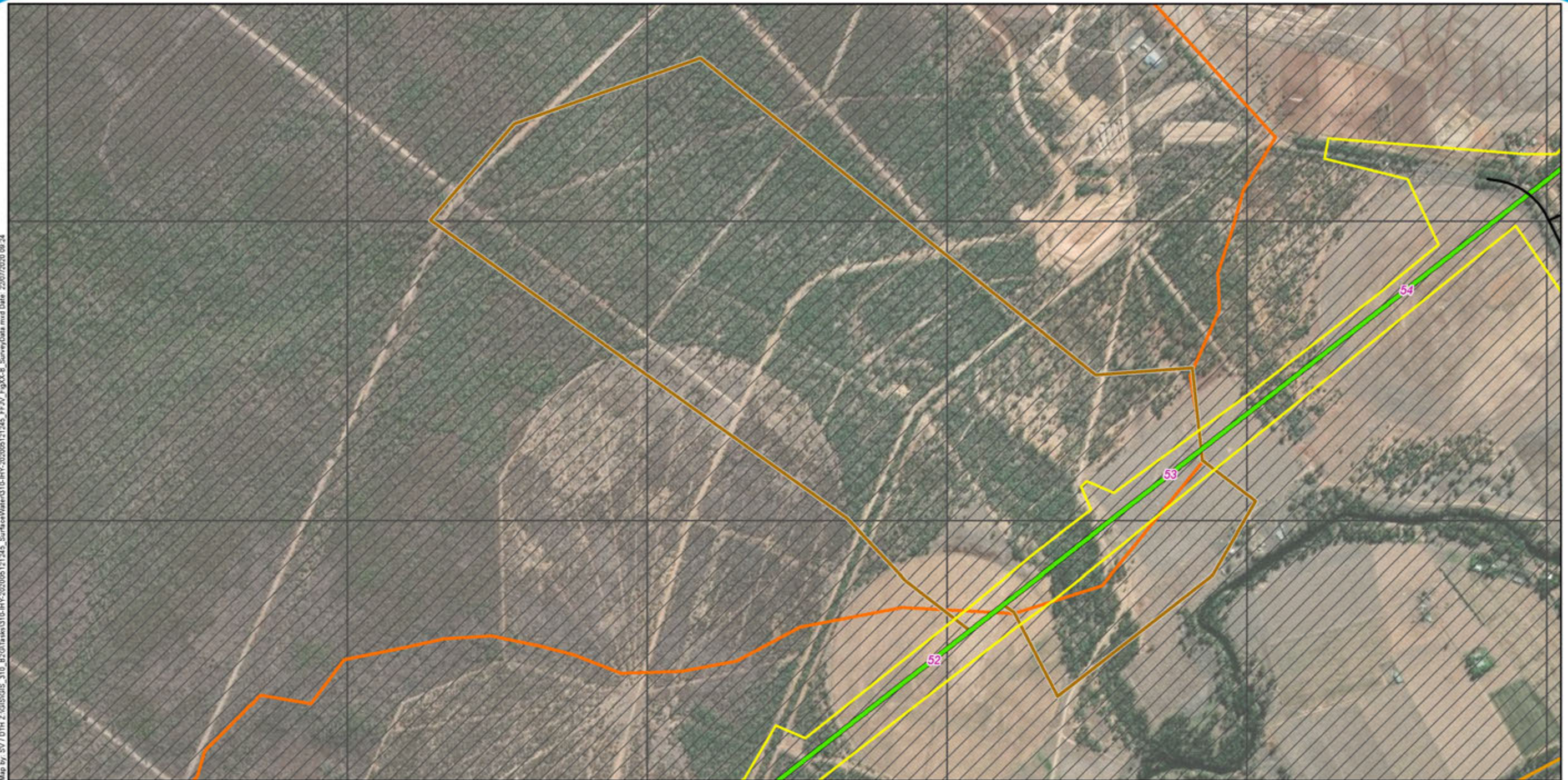
**Border to Gowrie**

**Figure L1-A:**

**Locality plan - Cremascos Road**



Map by: SV / DTH 2:10USGIS\_310\_B20Task310-HY-202005121245\_SurfaceWater310-HY-202005121245\_FF3V\_FigX4-B\_SurveyData.mxd Date: 22/07/2020 09:24



**Legend**

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Hydrologic model extent

**LiDAR datasets (1m grid)**

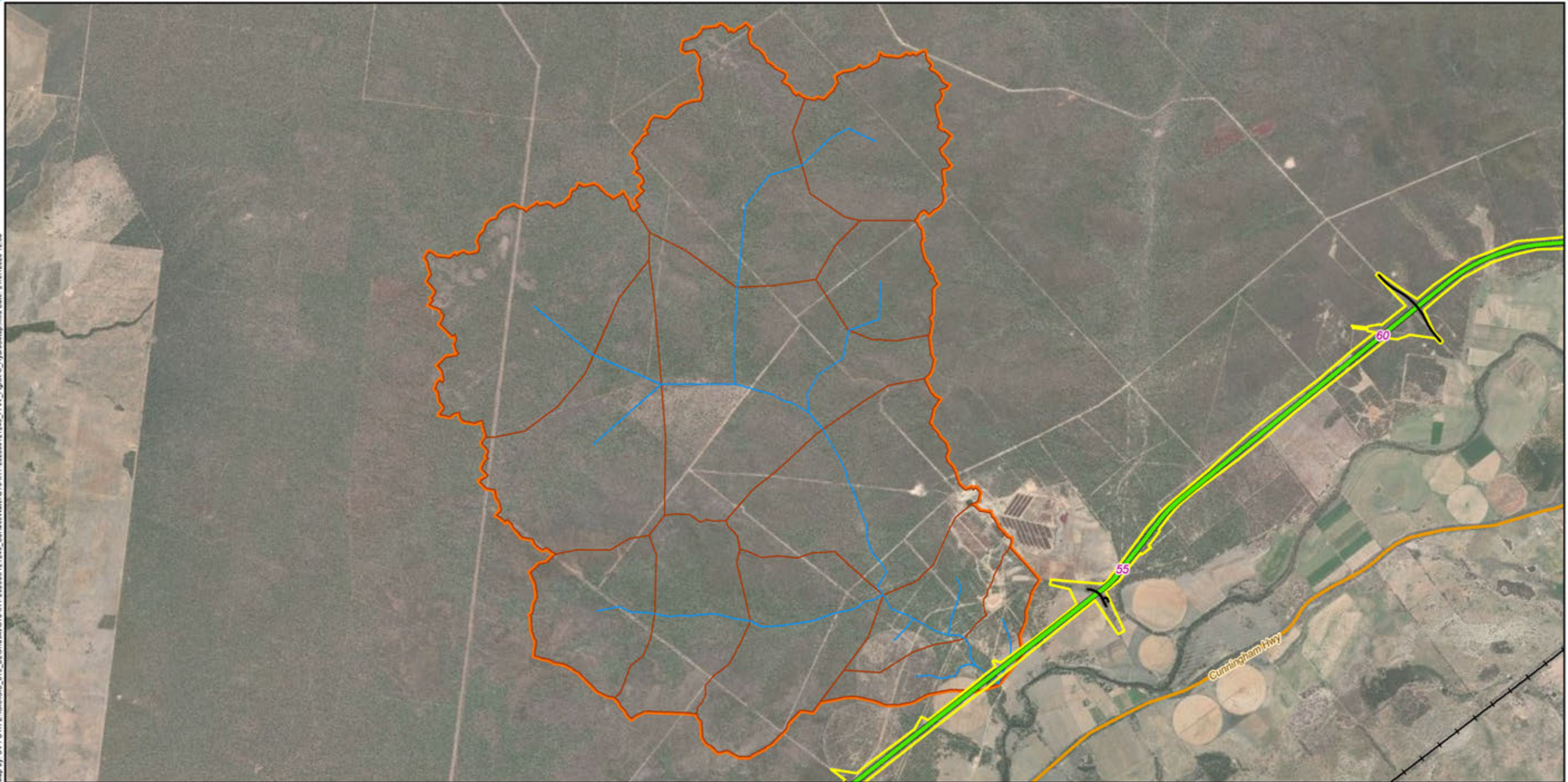
- 2015 ARTC LiDAR 1m



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



Map by: SV / DTH 2:10USGIS\_310\_B20Task310-HY-20200512145\_SurfaceWater310-HY-20200512145\_FF3N\_FigX4-C\_HydroSetup.mxd Date: 21/07/2020 12:58



#### Legend

- |                             |                   |                         |
|-----------------------------|-------------------|-------------------------|
| 5 Chainage (km)             | Major roads       | Catchment links         |
| Existing rail (operational) | Road design       | Sub-catchments          |
| Border to Gowrie alignment  | Project footprint | Hydrologic model extent |



A3 scale: 1:60,000  
 0 0.6 1.2 1.8 2.4 3km



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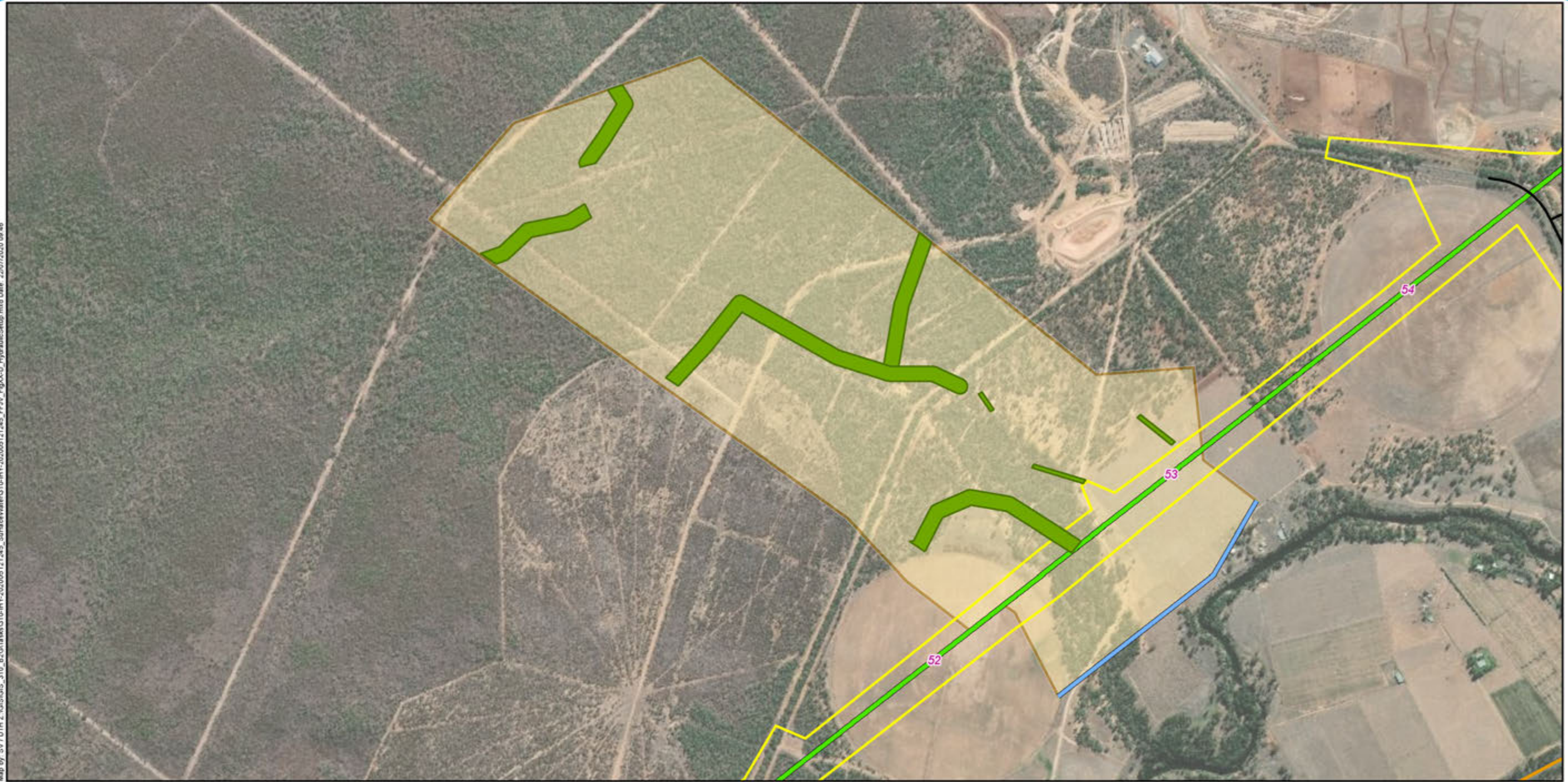
**Border to Gowrie**

**Figure L1-C:**

**Hydrologic model setup - Cremascos Road**



Map by SV / DTH 2:10USGIS\_310\_B20Task310-HY-202005121245\_SurfaceWater310-HY-202005121245\_FF3V\_FigX-D\_HydraulicSetup.mxd Date: 22/07/2020 09:48



#### Legend

- |                            |                   |                        |
|----------------------------|-------------------|------------------------|
| 5 Chainage (km)            | Major roads       | Hydraulic model extent |
| Border to Gowrie alignment | Road design       | Outflow boundaries     |
|                            | Project footprint | Inflow boundaries      |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



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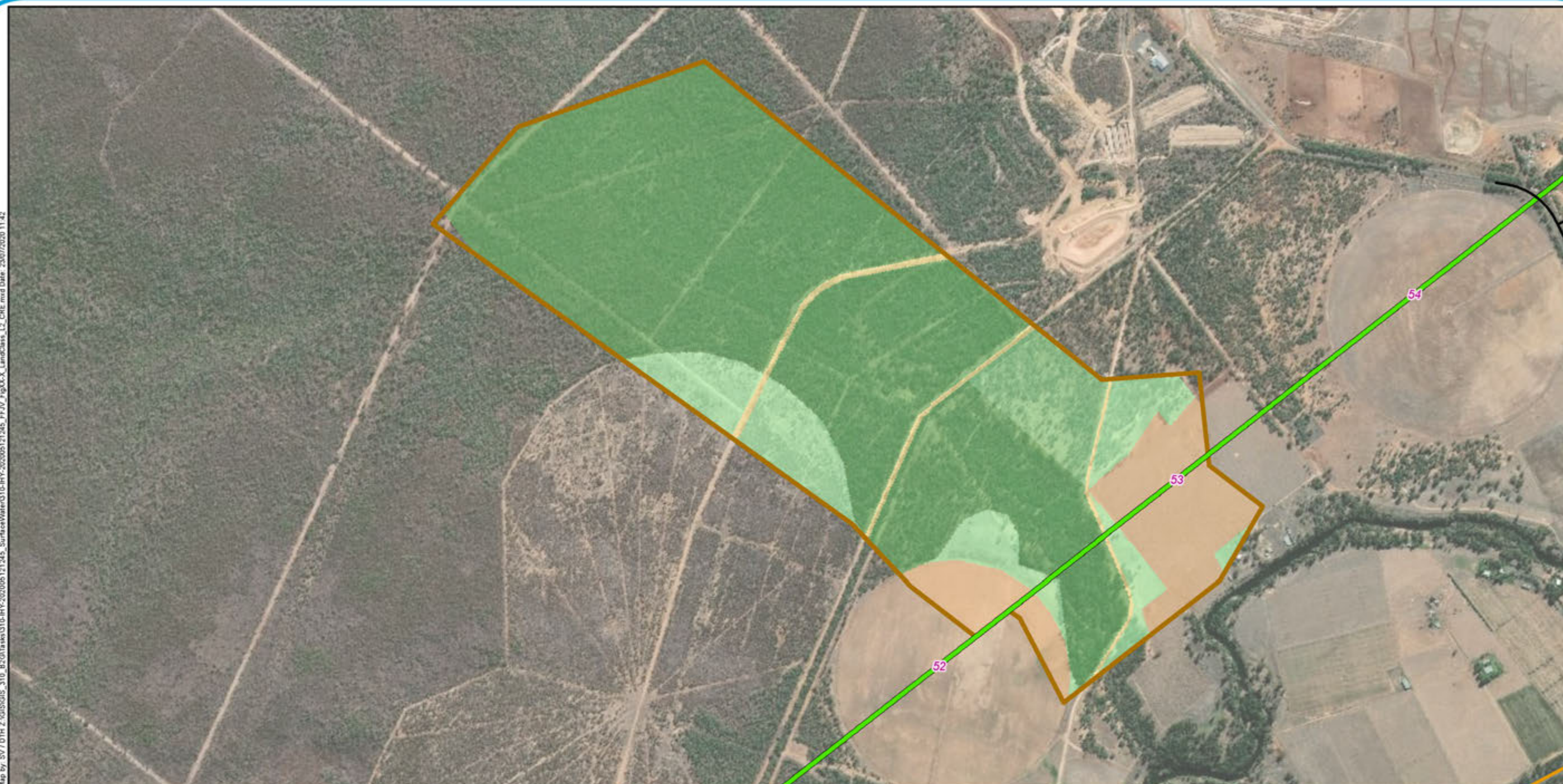
**Border to Gowrie**

**Figure L1-D:**

**Hydraulic model setup - Cremascos Road**



Map by SV / DTH 2:10USGIS\_310\_B20Task310-HY-202005121245\_SurfaceWater310-HY-202005121245\_FFJV\_Fig00-X\_LandClass\_12\_CRE.mxd Date: 23/07/2020 11:42



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design

Hydraulic model extent

#### Landuse classification

- Unsealed road corridor (n=0.025)
- Open space - min veg (n=0.045)
- Open space - mod veg (n=0.055)
- Open space - heavy veg (n=0.065)
- Crop (n=0.109)



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



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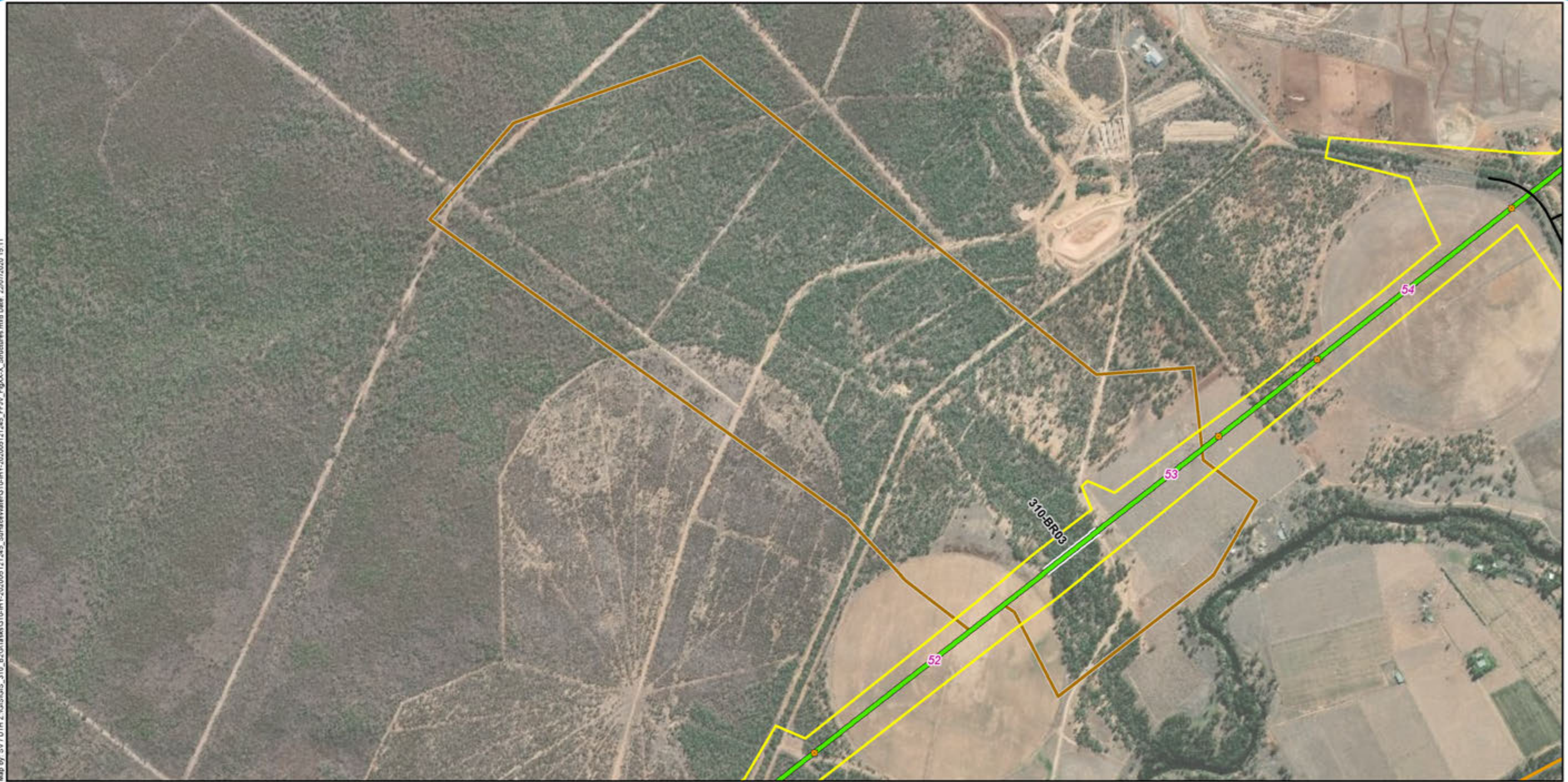
**Border to Gowrie**

**Figure L1-E:**

**Landuse classifications - Cremascos Road**



Map by SV / DTH 2:10USGIS\_310\_B20Task310-HY-202005121245\_SurfaceWater310-HY-202005121245\_FF3V\_FigX-X\_Structures.mxd Date: 22/07/2020 15:11



#### Legend

- 5 Chainage (km)
- Floodplain culvert
- Local drainage culvert
- Bridges
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



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 Coordinate System: GDA 1994 MGA Zone 56

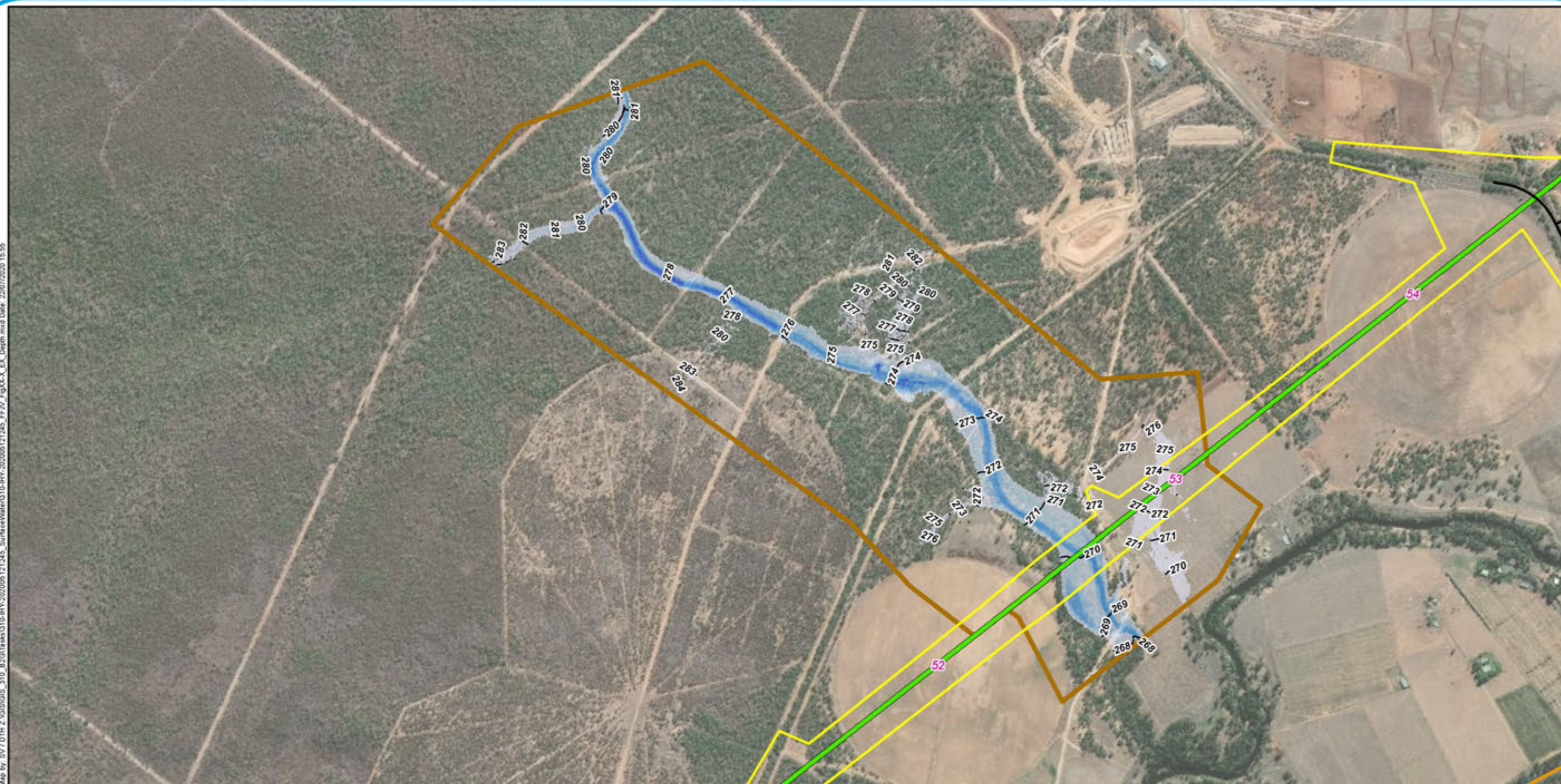
**Border to Gowrie**

**Figure L1-F:**

**Proposed design structures - Cremascos Road**



Map by SV / DTH 2:10USQGIS\_310\_8201Task310-IRY-202006121245\_SurfaceWater310-IRY-Fig000-X\_EX\_Depth.mxd Date: 22/07/2020 15:55



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint

Hydraulic model extent

#### Depth (m)

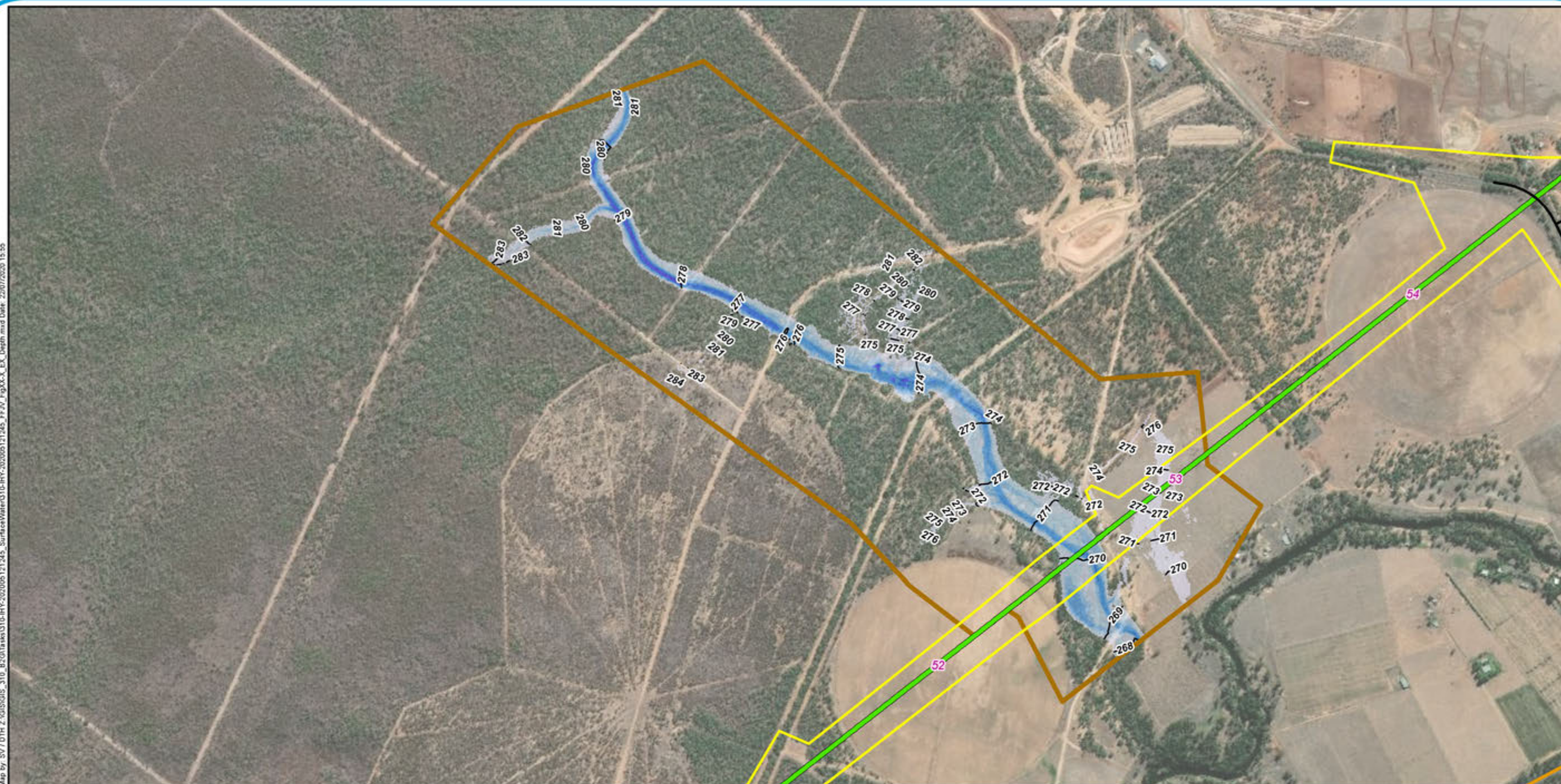
|           |                   |
|-----------|-------------------|
| 0 - 0.5   | 3.0 - 3.5         |
| 0.5 - 1.0 | 3.5 - 4.0         |
| 1.0 - 1.5 | 4.0 - 4.5         |
| 1.5 - 2.0 | 4.5 - 5.0         |
| 2.0 - 2.5 | > 5.0             |
| 2.5 - 3.0 | 1m contour (mAHD) |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



Map by SV / DTH 2:10USGIS\_310\_B20Task310-IRY-202006121245\_SurfaceWater310-IRY-202006121245\_FF3V\_FigX-X\_EX\_Depth.mxd Date: 22/07/2020 15:55



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint

  Hydraulic model extent

#### Depth (m)

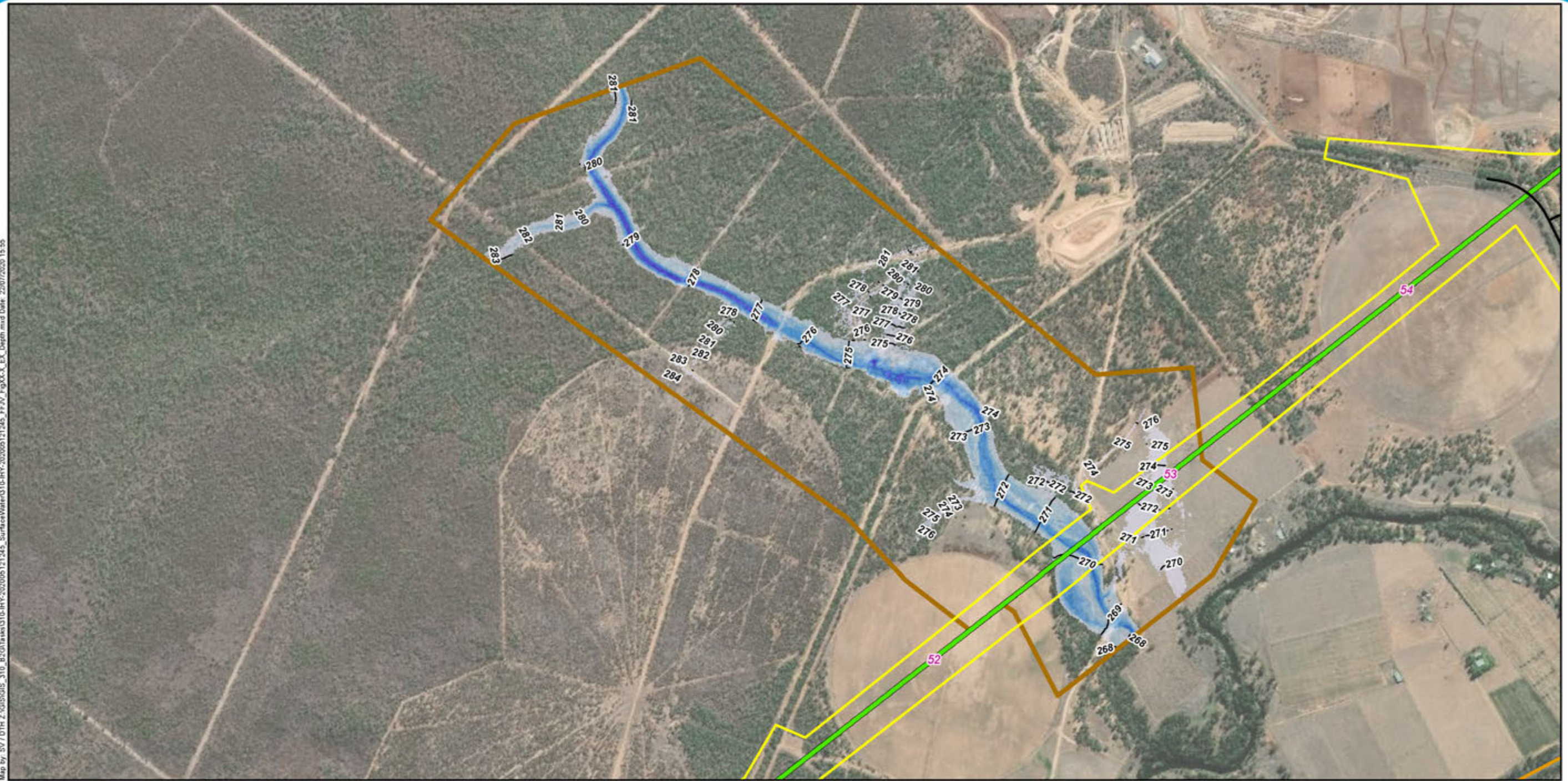
|                                                                                                    |                                                                                                    |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| <span style="background-color: #f0f0f0; border: 1px solid black; padding: 2px;"> </span> 0 - 0.5   | <span style="background-color: #4169e1; border: 1px solid black; padding: 2px;"> </span> 3.0 - 3.5 |
| <span style="background-color: #add8e6; border: 1px solid black; padding: 2px;"> </span> 0.5 - 1.0 | <span style="background-color: #4169e1; border: 1px solid black; padding: 2px;"> </span> 3.5 - 4.0 |
| <span style="background-color: #87ceeb; border: 1px solid black; padding: 2px;"> </span> 1.0 - 1.5 | <span style="background-color: #4169e1; border: 1px solid black; padding: 2px;"> </span> 4.0 - 4.5 |
| <span style="background-color: #66b3ff; border: 1px solid black; padding: 2px;"> </span> 1.5 - 2.0 | <span style="background-color: #4169e1; border: 1px solid black; padding: 2px;"> </span> 4.5 - 5.0 |
| <span style="background-color: #4682b4; border: 1px solid black; padding: 2px;"> </span> 2.0 - 2.5 | <span style="background-color: #4169e1; border: 1px solid black; padding: 2px;"> </span> > 5.0     |
| <span style="background-color: #1e90ff; border: 1px solid black; padding: 2px;"> </span> 2.5 - 3.0 | <span style="color: black;">—</span> 1m contour (mAHD)                                             |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



Map by SV / DTH 2:10USQGIS\_310\_B201Task310-IRY-202005121245\_SurfaceWater310-IRY-202005121245\_FF3V\_FigXX-X\_EX\_Depth.mxd Date: 22/07/2020 15:55



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent

#### Depth (m)

- |                                                                                                                                       |                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <span style="background-color: #f0f0f0; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 0 - 0.5   | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 3.0 - 3.5 |
| <span style="background-color: #add8e6; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 0.5 - 1.0 | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 3.5 - 4.0 |
| <span style="background-color: #87ceeb; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 1.0 - 1.5 | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 4.0 - 4.5 |
| <span style="background-color: #add8e6; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 1.5 - 2.0 | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 4.5 - 5.0 |
| <span style="background-color: #87ceeb; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 2.0 - 2.5 | <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> > 5.0     |
| <span style="background-color: #4169e1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> 2.5 - 3.0 | <span style="color: black;">—</span> 1m contour (mAHD)                                                                                |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



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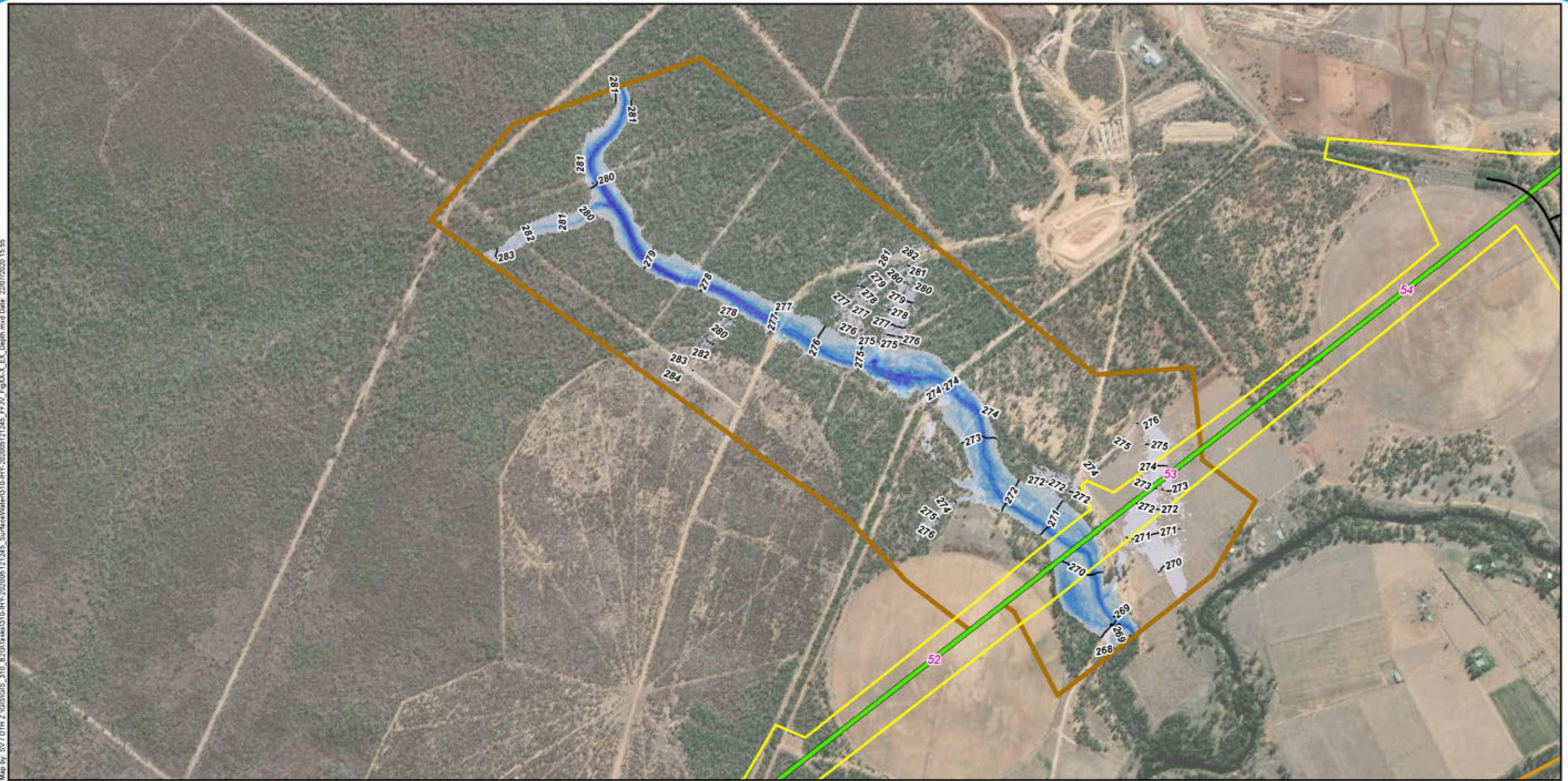
**Border to Gowrie**

**Figure L2-C:**

**5% AEP peak water levels - Existing Case - Cremascos Road**



Map by SV / DTH 2:10USGIS\_310\_B201Task310-IRY-202005121245\_SurfaceWater310-IRY-FigXX-X\_EX\_Depth.mxd Date: 22/07/2020 15:55



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent

#### Depth (m)

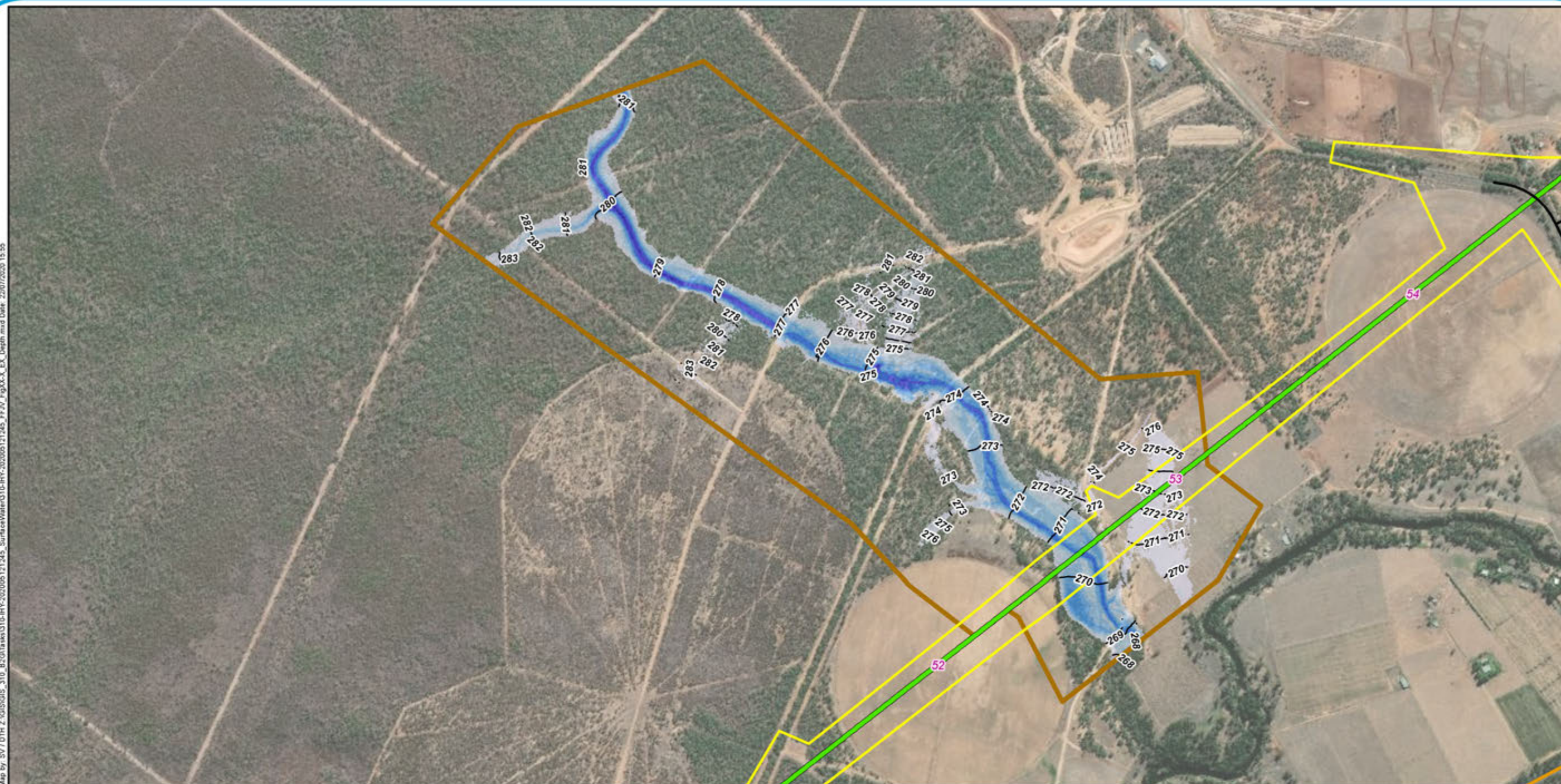
- |                                                                                                                                       |                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <span style="background-color: #f0f0f0; border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> 0 - 0.5   | <span style="background-color: #e0e0ff; border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> 3.0 - 3.5 |
| <span style="background-color: #d0d0ff; border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> 0.5 - 1.0 | <span style="background-color: #c0c0ff; border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> 3.5 - 4.0 |
| <span style="background-color: #b0b0ff; border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> 1.0 - 1.5 | <span style="background-color: #a0a0ff; border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> 4.0 - 4.5 |
| <span style="background-color: #9090ff; border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> 1.5 - 2.0 | <span style="background-color: #8080ff; border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> 4.5 - 5.0 |
| <span style="background-color: #7070ff; border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> 2.0 - 2.5 | <span style="background-color: #6060ff; border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> > 5.0     |
| <span style="background-color: #5050ff; border: 1px solid black; display: inline-block; width: 15px; height: 15px;"></span> 2.5 - 3.0 | <span style="color: black;">—</span> 1m contour (mAHD)                                                                                |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



Map by SV / DTH 2:10USQGIS\_310\_B20TTask310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF3V\_Fig00-X\_EX\_Depth.mxd Date: 22/07/2020 15:55



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint

Hydraulic model extent

#### Depth (m)

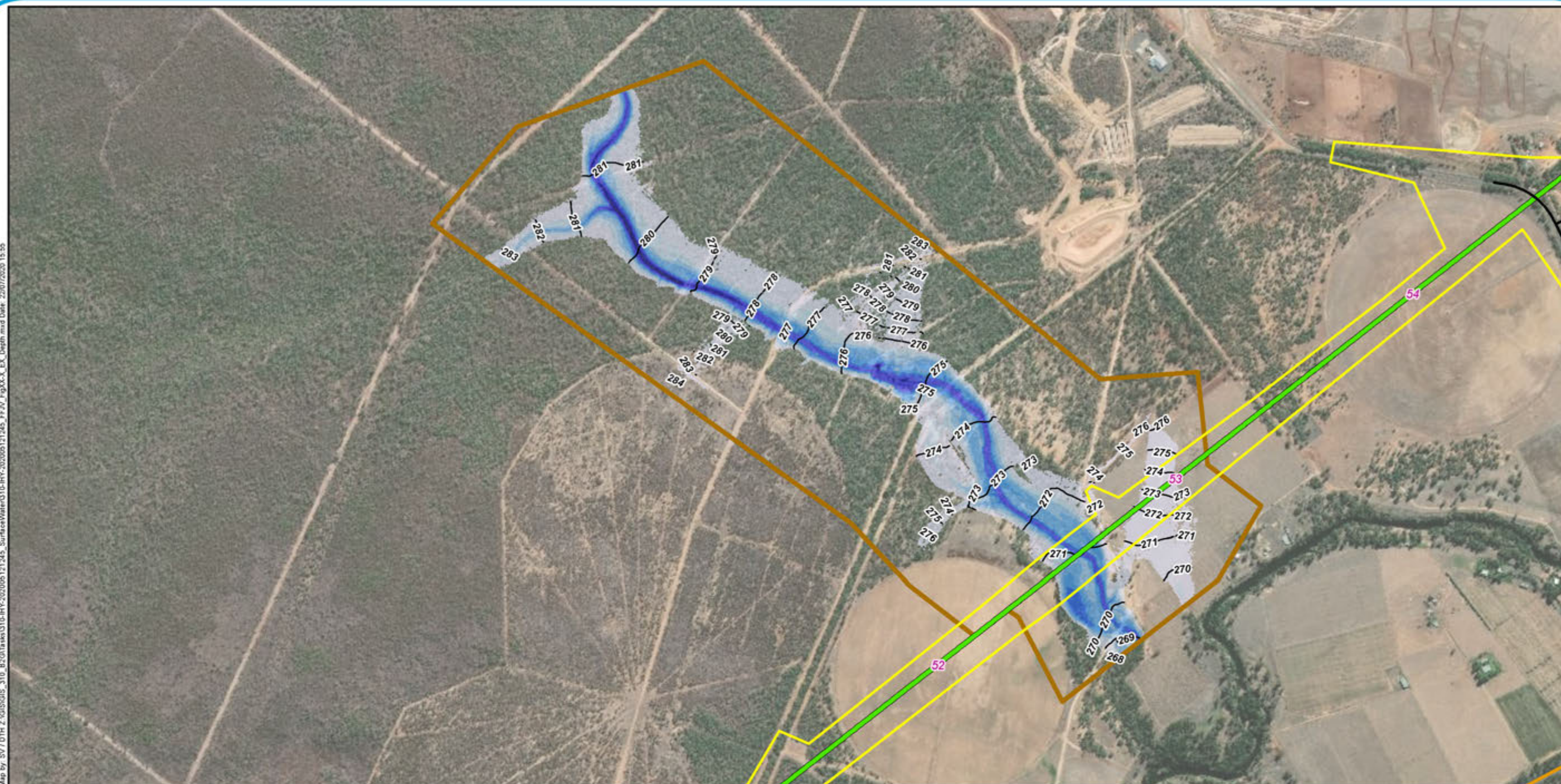
- |           |                   |
|-----------|-------------------|
| 0 - 0.5   | 3.0 - 3.5         |
| 0.5 - 1.0 | 3.5 - 4.0         |
| 1.0 - 1.5 | 4.0 - 4.5         |
| 1.5 - 2.0 | 4.5 - 5.0         |
| 2.0 - 2.5 | > 5.0             |
| 2.5 - 3.0 | 1m contour (mAHD) |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



Map by SV / DTH 2:10USGIS\_310\_B20TTask310-IRY-202006121245\_SurfaceWater310-IRY-202006121245\_FF3V\_Fig00-X\_EX\_Depth.mxd Date: 22/07/2020 15:55



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint

Hydraulic model extent

#### Depth (m)

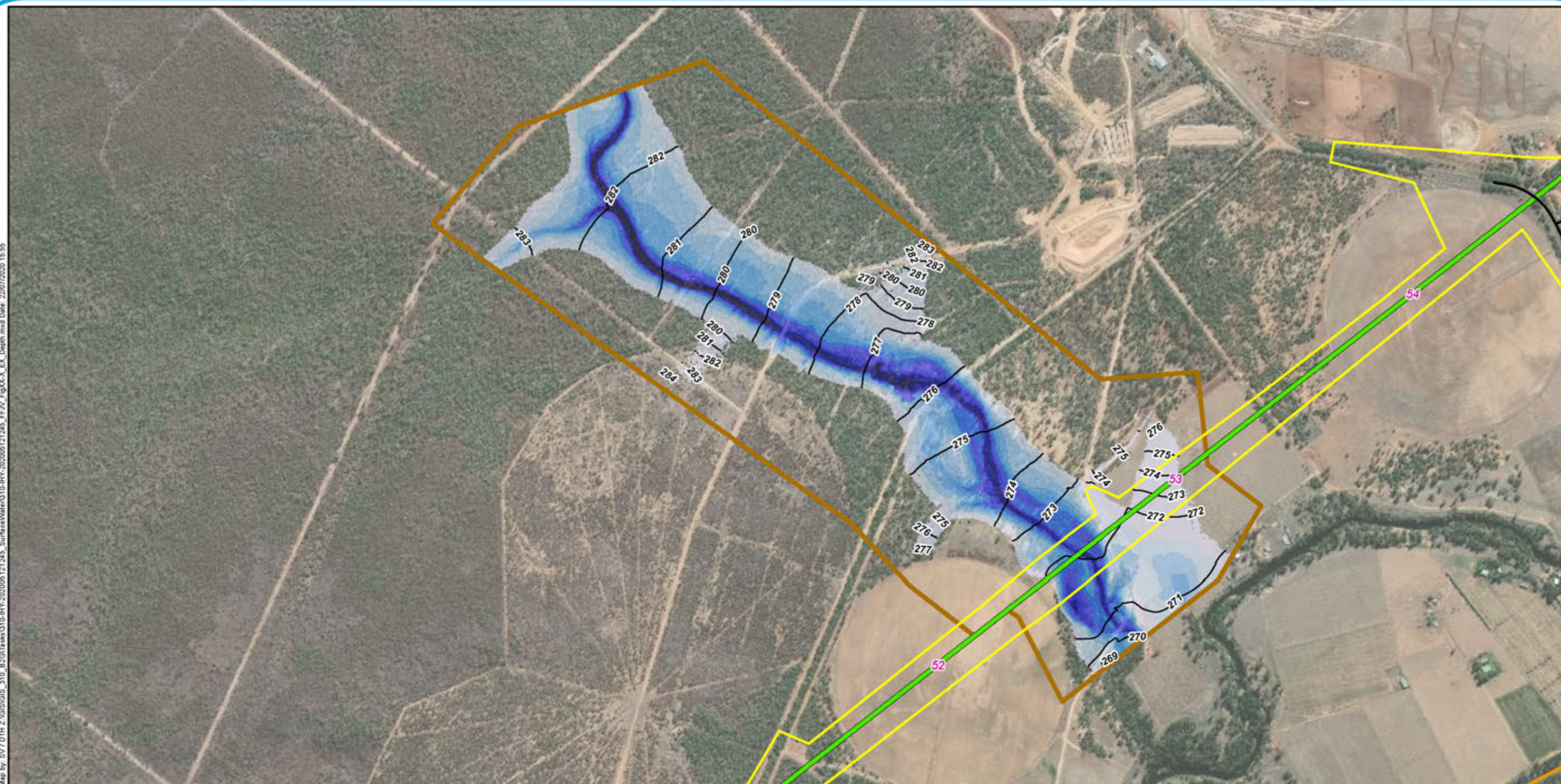
- |           |                   |
|-----------|-------------------|
| 0 - 0.5   | 3.0 - 3.5         |
| 0.5 - 1.0 | 3.5 - 4.0         |
| 1.0 - 1.5 | 4.0 - 4.5         |
| 1.5 - 2.0 | 4.5 - 5.0         |
| 2.0 - 2.5 | > 5.0             |
| 2.5 - 3.0 | 1m contour (mAHD) |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



Map by SV / DTH 2:10USGIS\_310\_B201Task310-HY-202005121245\_SurfaceWater310-HY-202005121245\_FF3V\_FigX-X\_EX\_Depth.mxd Date: 22/07/2020 15:55



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint

  Hydraulic model extent

#### Depth (m)

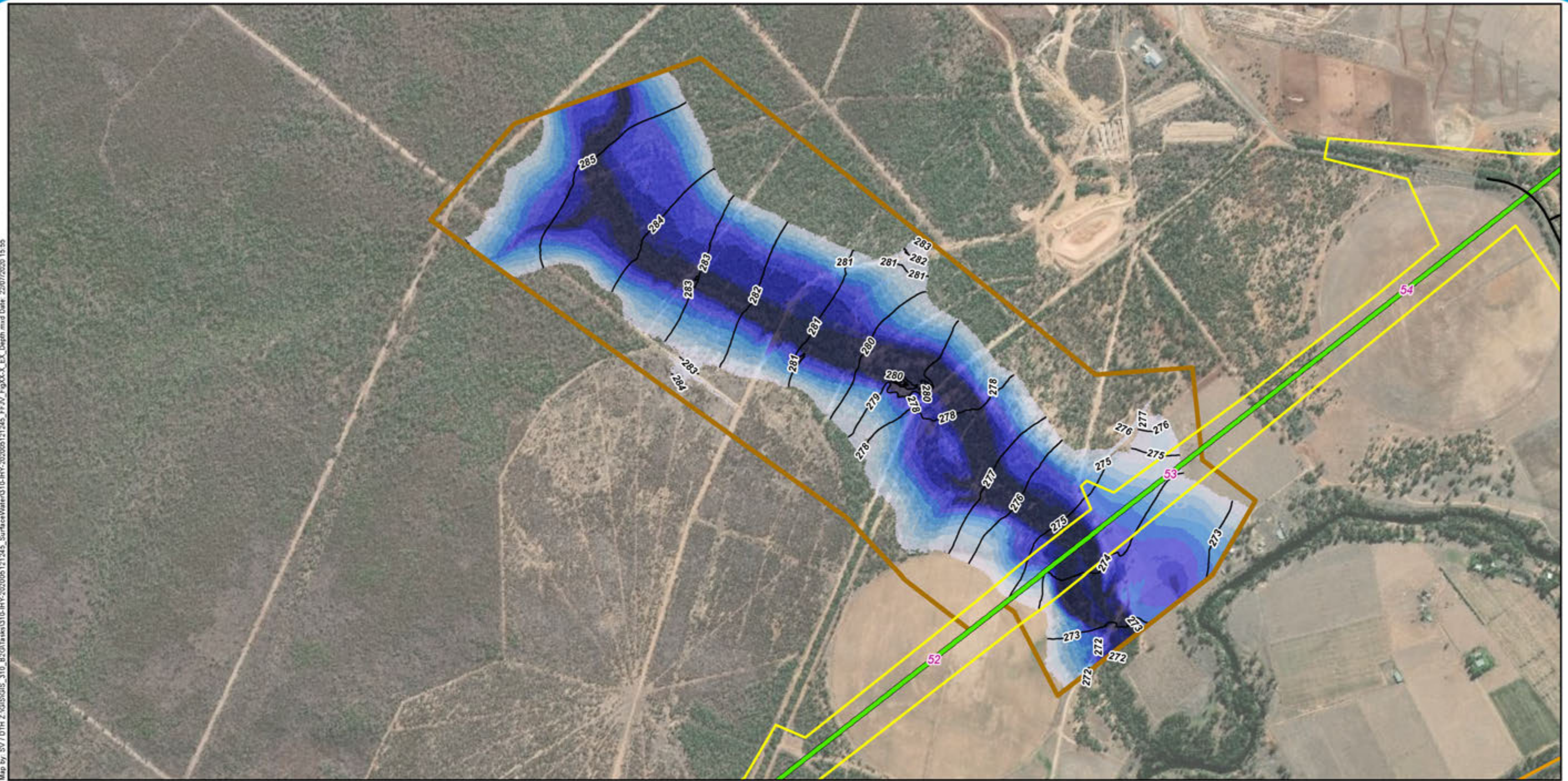
|                                                                                                    |                                                                                                    |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| <span style="background-color: #e0e0ff; border: 1px solid black; padding: 2px;"> </span> 0 - 0.5   | <span style="background-color: #4b4b9b; border: 1px solid black; padding: 2px;"> </span> 3.0 - 3.5 |
| <span style="background-color: #c0c0ff; border: 1px solid black; padding: 2px;"> </span> 0.5 - 1.0 | <span style="background-color: #3b3b8b; border: 1px solid black; padding: 2px;"> </span> 3.5 - 4.0 |
| <span style="background-color: #a0a0ff; border: 1px solid black; padding: 2px;"> </span> 1.0 - 1.5 | <span style="background-color: #2b2b7b; border: 1px solid black; padding: 2px;"> </span> 4.0 - 4.5 |
| <span style="background-color: #8080ff; border: 1px solid black; padding: 2px;"> </span> 1.5 - 2.0 | <span style="background-color: #1b1b6b; border: 1px solid black; padding: 2px;"> </span> 4.5 - 5.0 |
| <span style="background-color: #6060ff; border: 1px solid black; padding: 2px;"> </span> 2.0 - 2.5 | <span style="background-color: #0b0b5b; border: 1px solid black; padding: 2px;"> </span> > 5.0     |
| <span style="background-color: #4040ff; border: 1px solid black; padding: 2px;"> </span> 2.5 - 3.0 | <span style="color: black;">—</span> 1m contour (mAHD)                                             |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



Map by: SV / DTH 2:10USGIS\_310\_B201Task310-HY-202005121245\_SurfaceWater310-HY-202005121245\_FF3V\_FigXX-X\_EX\_Depth.mxd Date: 22/07/2020 15:55



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent

#### Depth (m)

- |                                                    |                                                        |
|----------------------------------------------------|--------------------------------------------------------|
| <span style="color: lightblue;">□</span> 0 - 0.5   | <span style="color: blue;">□</span> 3.0 - 3.5          |
| <span style="color: lightblue;">□</span> 0.5 - 1.0 | <span style="color: blue;">□</span> 3.5 - 4.0          |
| <span style="color: lightblue;">□</span> 1.0 - 1.5 | <span style="color: blue;">□</span> 4.0 - 4.5          |
| <span style="color: lightblue;">□</span> 1.5 - 2.0 | <span style="color: blue;">□</span> 4.5 - 5.0          |
| <span style="color: lightblue;">□</span> 2.0 - 2.5 | <span style="color: blue;">□</span> > 5.0              |
| <span style="color: lightblue;">□</span> 2.5 - 3.0 | <span style="color: black;">—</span> 1m contour (mAHD) |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



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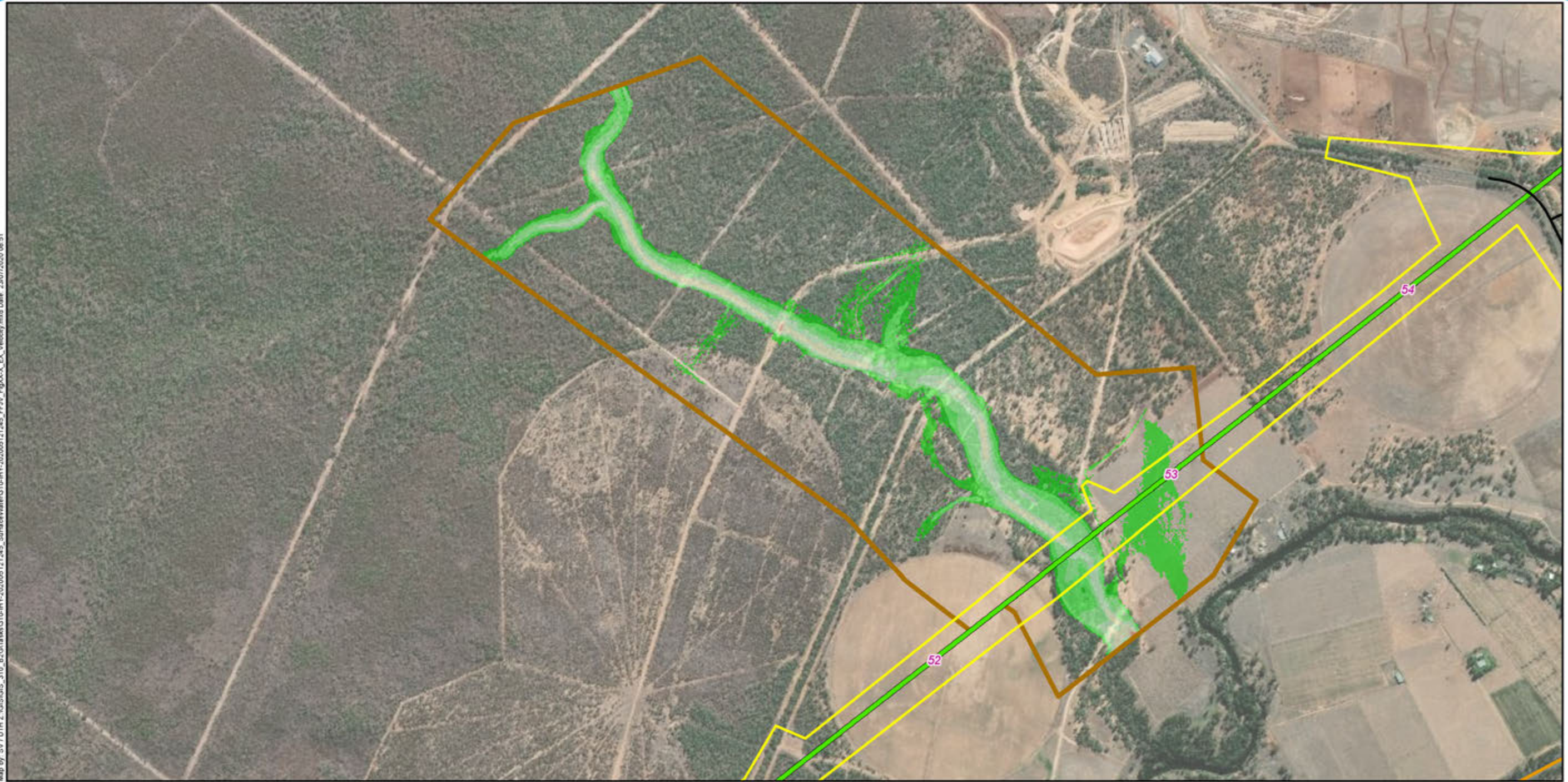
**Border to Gowrie**

**Figure L2-H:**

**PMF peak water levels - Existing Case - Cremascos Road**



Map by SV / DTH 2:10USQGIS\_310\_B20Task310-HY-202005121245\_SurfaceWater310-HY-202005121245\_FF3V\_Fig00-X\_EX\_Velocity.mxd Date: 23/07/2020 08:51



#### Legend

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent

#### Peak velocity (m/s)

|                                                                                                        |                                                                                                        |
|--------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| <span style="background-color: #006400; width: 15px; height: 10px; display: inline-block;"></span> 0.0 | <span style="background-color: #FFDAB9; width: 15px; height: 10px; display: inline-block;"></span> 3.0 |
| <span style="background-color: #90EE90; width: 15px; height: 10px; display: inline-block;"></span> 0.5 | <span style="background-color: #FFB6C1; width: 15px; height: 10px; display: inline-block;"></span> 3.5 |
| <span style="background-color: #3CB371; width: 15px; height: 10px; display: inline-block;"></span> 1.0 | <span style="background-color: #FFA07A; width: 15px; height: 10px; display: inline-block;"></span> 4.0 |
| <span style="background-color: #7FFFD4; width: 15px; height: 10px; display: inline-block;"></span> 1.5 | <span style="background-color: #FF6347; width: 15px; height: 10px; display: inline-block;"></span> 4.5 |
| <span style="background-color: #AFEEEE; width: 15px; height: 10px; display: inline-block;"></span> 2.0 | <span style="background-color: #8B4513; width: 15px; height: 10px; display: inline-block;"></span> 5.0 |
| <span style="background-color: #ADD8E6; width: 15px; height: 10px; display: inline-block;"></span> 2.5 |                                                                                                        |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



**Future Freight**  
 Integrating Community, Environment and Engineering

Issue date: 20/07/2020 Version: 1  
 Coordinate System: GDA 1994 MGA Zone 56

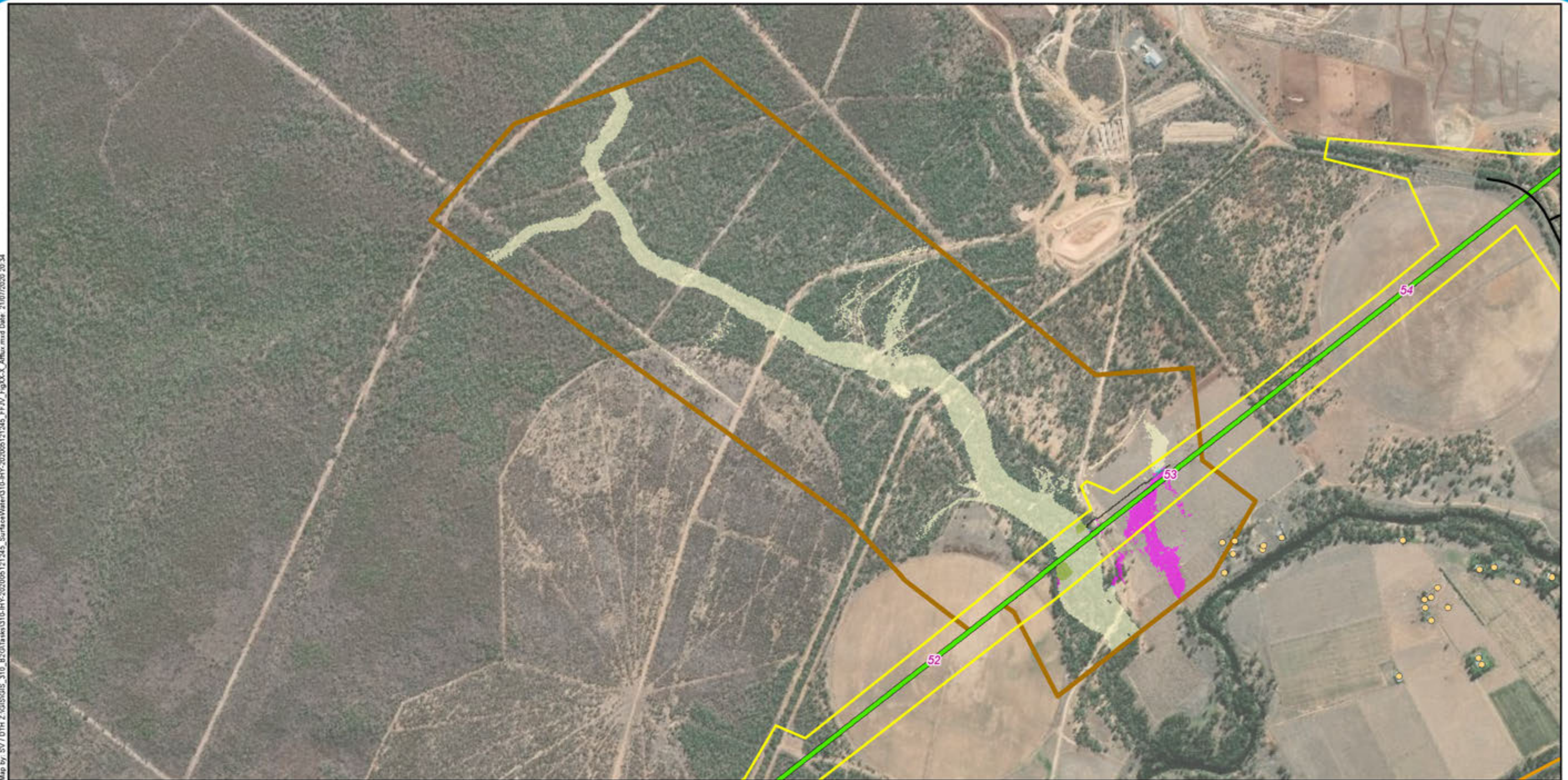
**Border to Gowrie**

**Figure L3-A:**

**1% AEP peak velocity - Existing Case - Cremascos Road**



Map by SV / DTH 2:10USGIS\_310\_B20Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF\_V1\_FigDocX\_Afflux.mxd Date: 21/07/2020 20:34



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in peak water levels (m)

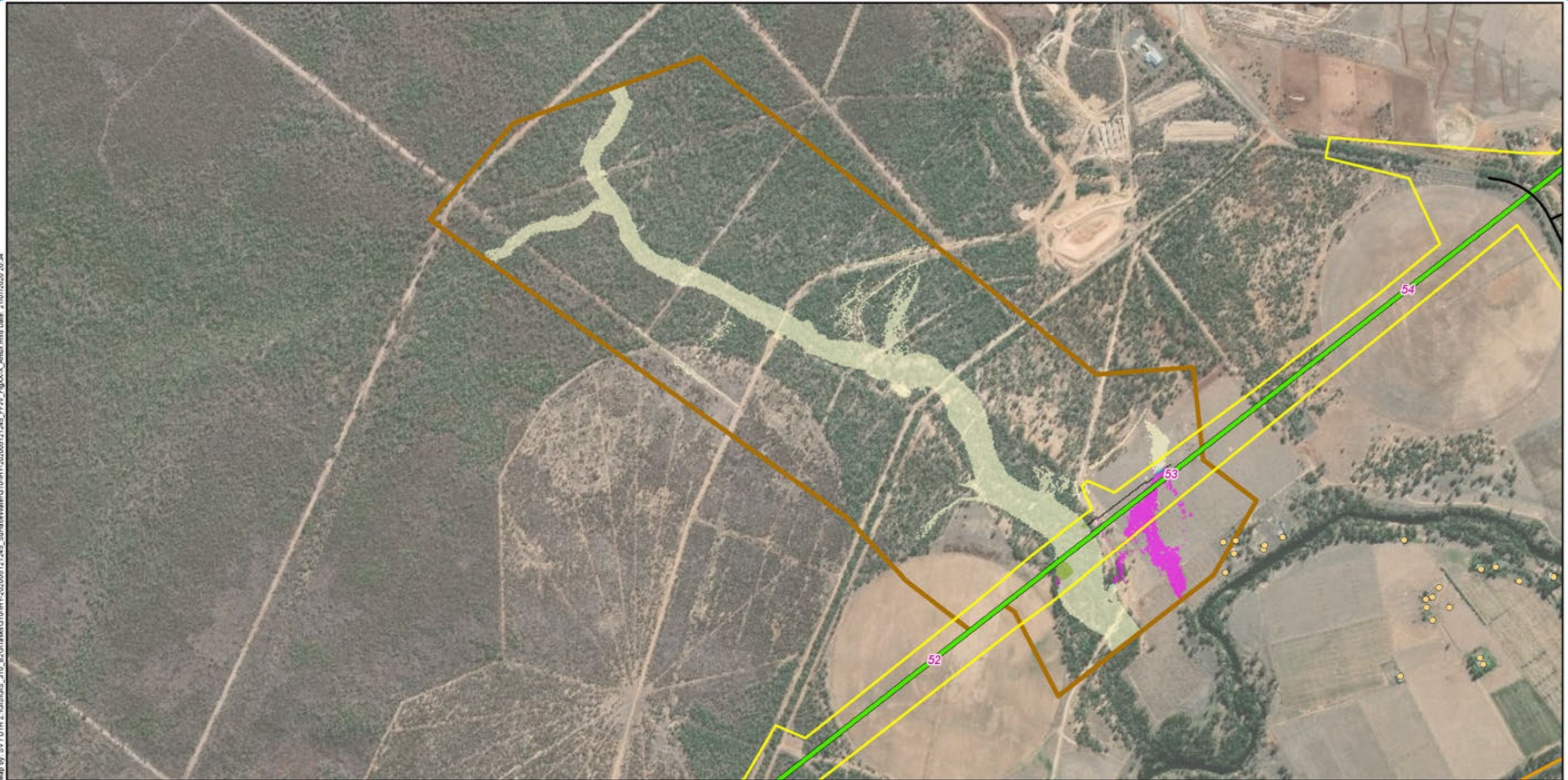
- |                                                         |                                                        |
|---------------------------------------------------------|--------------------------------------------------------|
| <span style="color: darkblue;">■</span> < -0.5          | <span style="color: lightgreen;">■</span> 0.01 to 0.05 |
| <span style="color: teal;">■</span> -0.50 to -0.20      | <span style="color: green;">■</span> 0.05 to 0.10      |
| <span style="color: lightteal;">■</span> -0.20 to -0.10 | <span style="color: darkgreen;">■</span> 0.10 to 0.20  |
| <span style="color: cyan;">■</span> -0.10 to -0.05      | <span style="color: darkgreen;">■</span> 0.20 to 0.50  |
| <span style="color: lightcyan;">■</span> -0.05 to -0.01 | <span style="color: darkgreen;">■</span> > 0.5         |
| <span style="color: yellow;">■</span> -0.01 to 0.01     |                                                        |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



Map by SV / DTH 2:10USGIS\_310\_B20Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF\_V1\_FigDocX\_Afflux.mxd Date: 21/07/2020 20:34



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in peak water levels (m)

- |                                                         |                                                        |
|---------------------------------------------------------|--------------------------------------------------------|
| <span style="color: darkblue;">■</span> < -0.5          | <span style="color: lightgreen;">■</span> 0.01 to 0.05 |
| <span style="color: teal;">■</span> -0.50 to -0.20      | <span style="color: green;">■</span> 0.05 to 0.10      |
| <span style="color: cyan;">■</span> -0.20 to -0.10      | <span style="color: darkgreen;">■</span> 0.10 to 0.20  |
| <span style="color: lightblue;">■</span> -0.10 to -0.05 | <span style="color: darkgreen;">■</span> 0.20 to 0.50  |
| <span style="color: lightcyan;">■</span> -0.05 to -0.01 | <span style="color: darkgreen;">■</span> > 0.5         |
| <span style="color: yellow;">■</span> -0.01 to 0.01     |                                                        |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



**Future Freight**  
 Integrating Community, Environment and Engineering

Issue date: 20/07/2020 Version: 1  
 Coordinate System: GDA 1994 MGA Zone 56

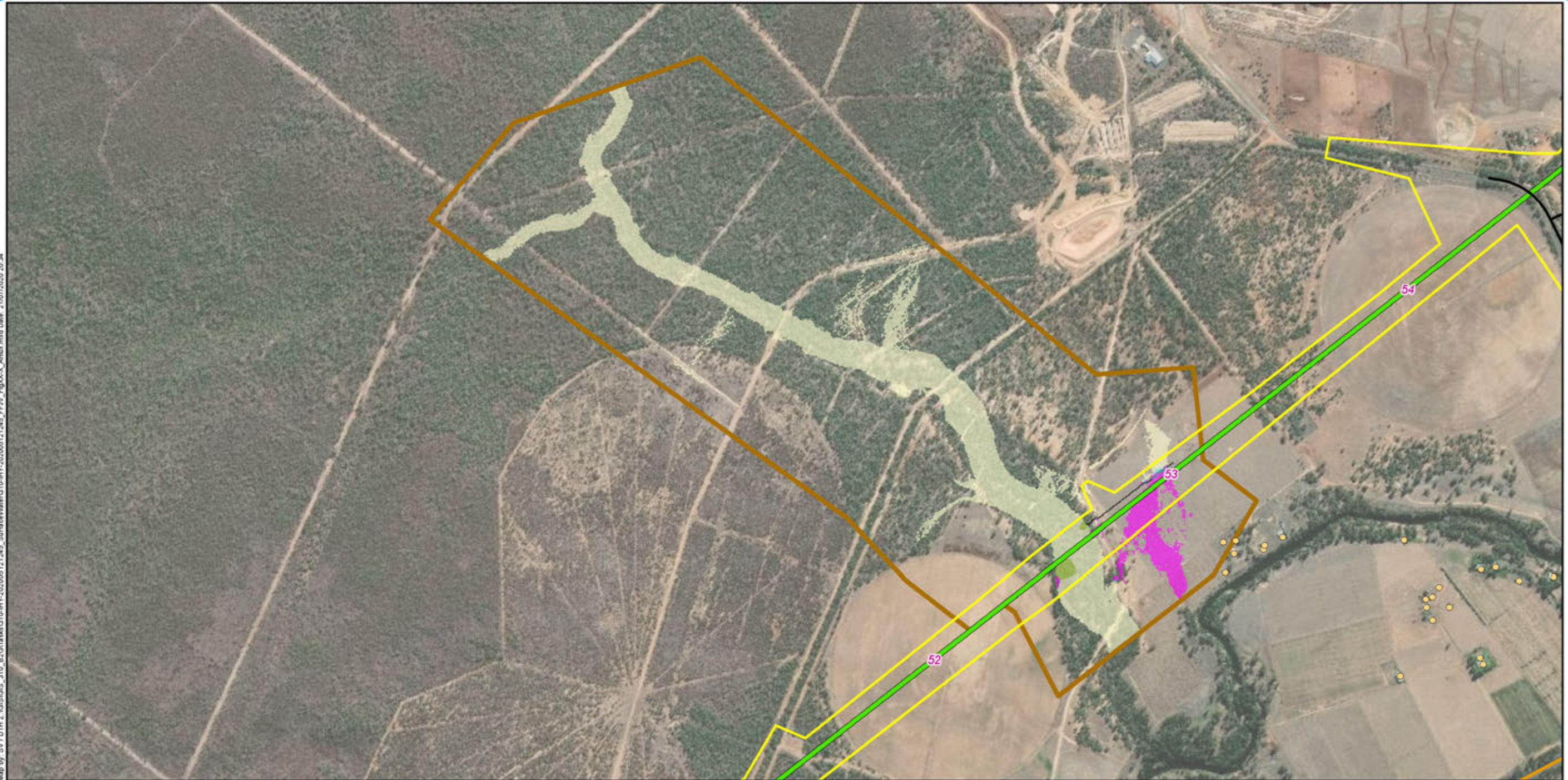
**Border to Gowrie**

**Figure L4-B:**

**10% AEP - design afflux - Cremascos Road**



Map by SV / DTH 2:10USGIS\_310\_B20Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF.FIN\_FigDocX\_Afflux.mxd Date: 21/07/2020 20:34



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in peak water levels (m)

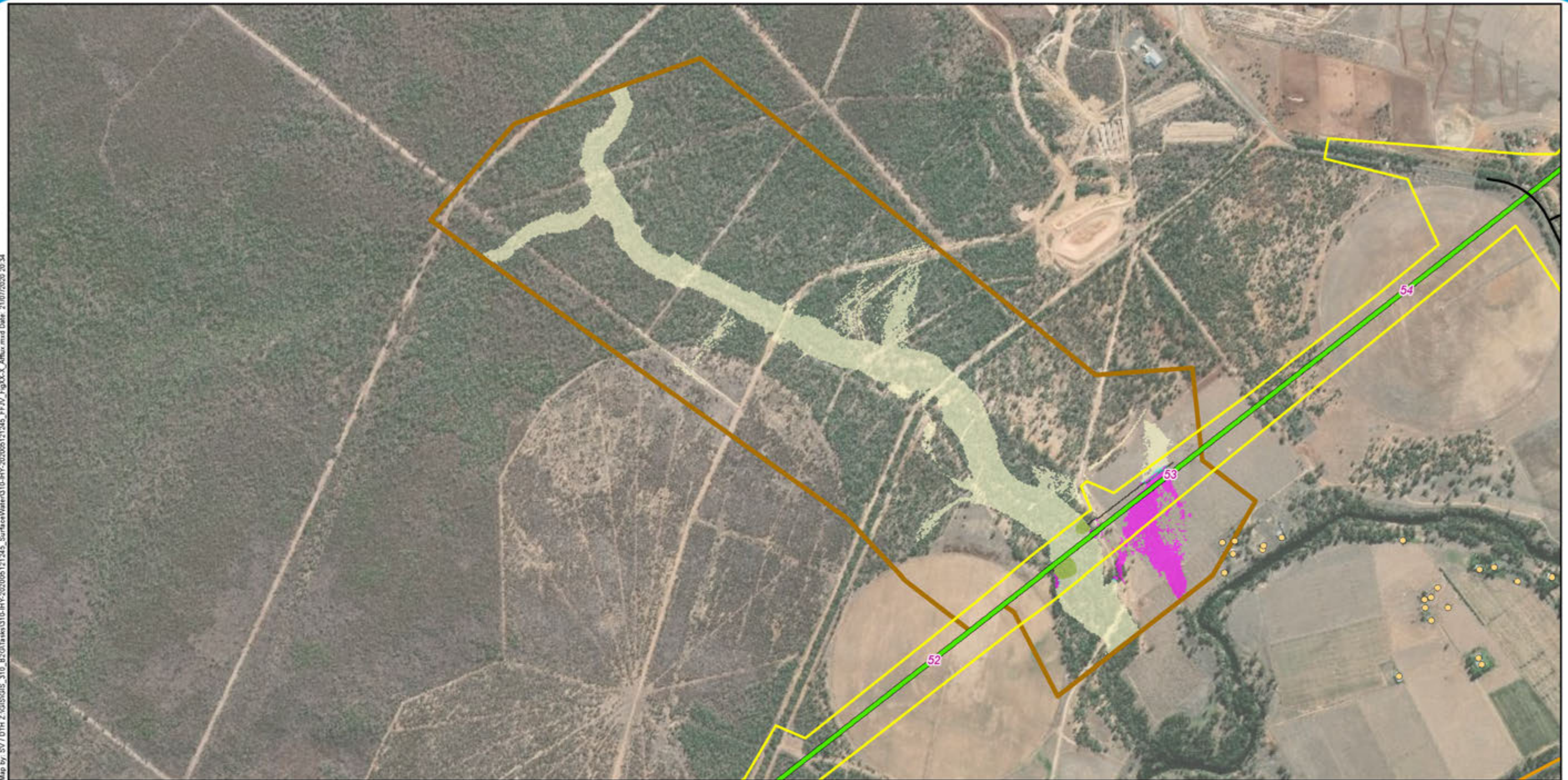
- |                                                         |                                                        |
|---------------------------------------------------------|--------------------------------------------------------|
| <span style="color: darkblue;">■</span> < -0.5          | <span style="color: lightgreen;">■</span> 0.01 to 0.05 |
| <span style="color: teal;">■</span> -0.50 to -0.20      | <span style="color: green;">■</span> 0.05 to 0.10      |
| <span style="color: cyan;">■</span> -0.20 to -0.10      | <span style="color: darkgreen;">■</span> 0.10 to 0.20  |
| <span style="color: lightblue;">■</span> -0.10 to -0.05 | <span style="color: darkgreen;">■</span> 0.20 to 0.50  |
| <span style="color: lightcyan;">■</span> -0.05 to -0.01 | <span style="color: darkgreen;">■</span> > 0.5         |
| <span style="color: yellow;">■</span> -0.01 to 0.01     |                                                        |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



Map by SV / DTH 2:10USGIS\_310\_B20Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF\_V1\_FigDocX\_Afflux.mxd Date: 21/07/2020 20:34



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in peak water levels (m)

- |                                                         |                                                        |
|---------------------------------------------------------|--------------------------------------------------------|
| <span style="color: darkblue;">■</span> < -0.5          | <span style="color: lightgreen;">■</span> 0.01 to 0.05 |
| <span style="color: teal;">■</span> -0.50 to -0.20      | <span style="color: green;">■</span> 0.05 to 0.10      |
| <span style="color: cyan;">■</span> -0.20 to -0.10      | <span style="color: darkgreen;">■</span> 0.10 to 0.20  |
| <span style="color: lightblue;">■</span> -0.10 to -0.05 | <span style="color: darkgreen;">■</span> 0.20 to 0.50  |
| <span style="color: lightcyan;">■</span> -0.05 to -0.01 | <span style="color: darkgreen;">■</span> > 0.5         |
| <span style="color: yellow;">■</span> -0.01 to 0.01     |                                                        |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



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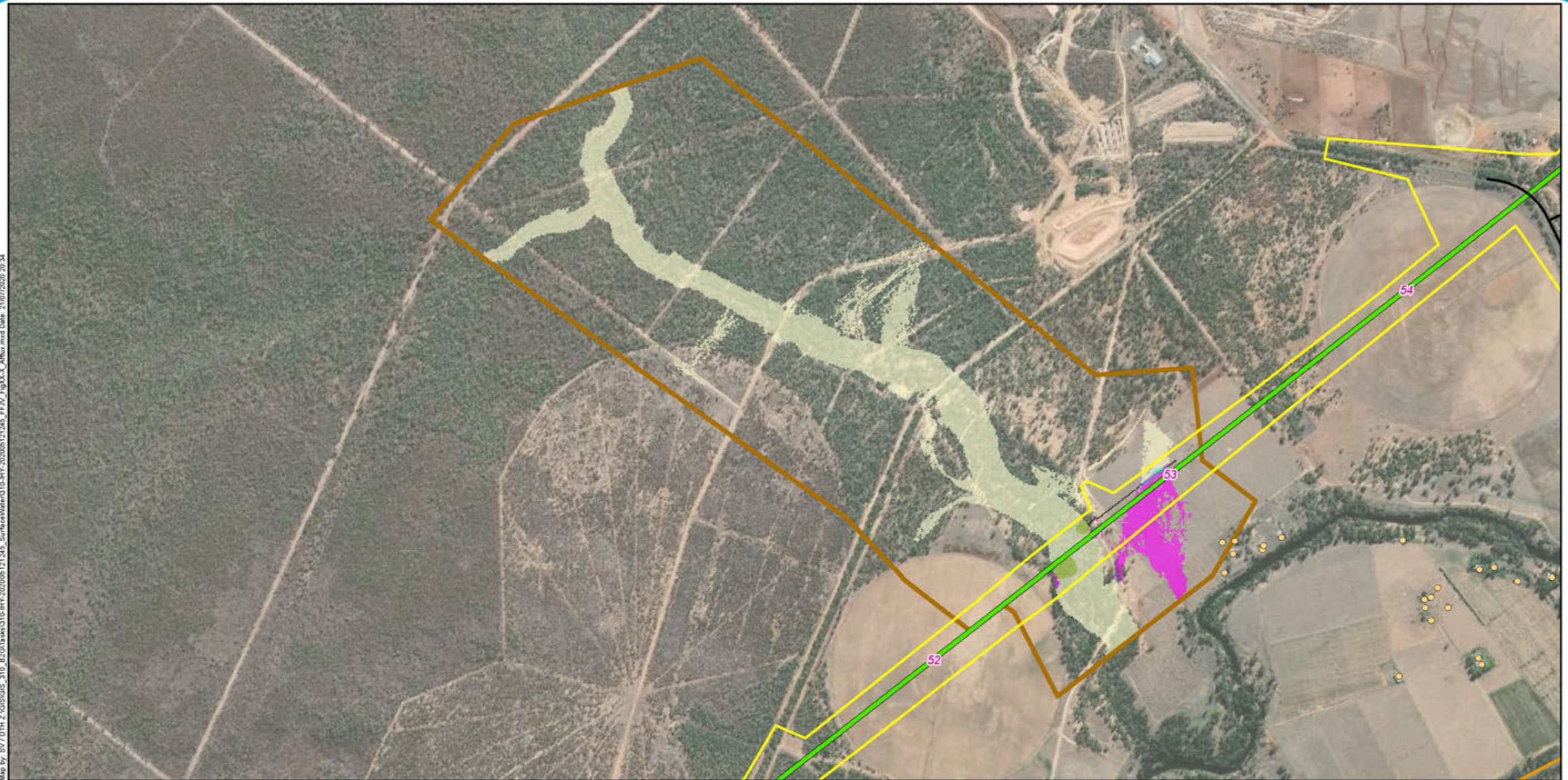
**Border to Gowrie**

**Figure L4-D:**

**2% AEP - design afflux - Cremascos Road**



Map by SV / DTH 2:10USGIS\_310\_B20Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF.FIN\_FigDocX\_Afflux.mxd Date: 21/07/2020 20:34



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in peak water levels (m)

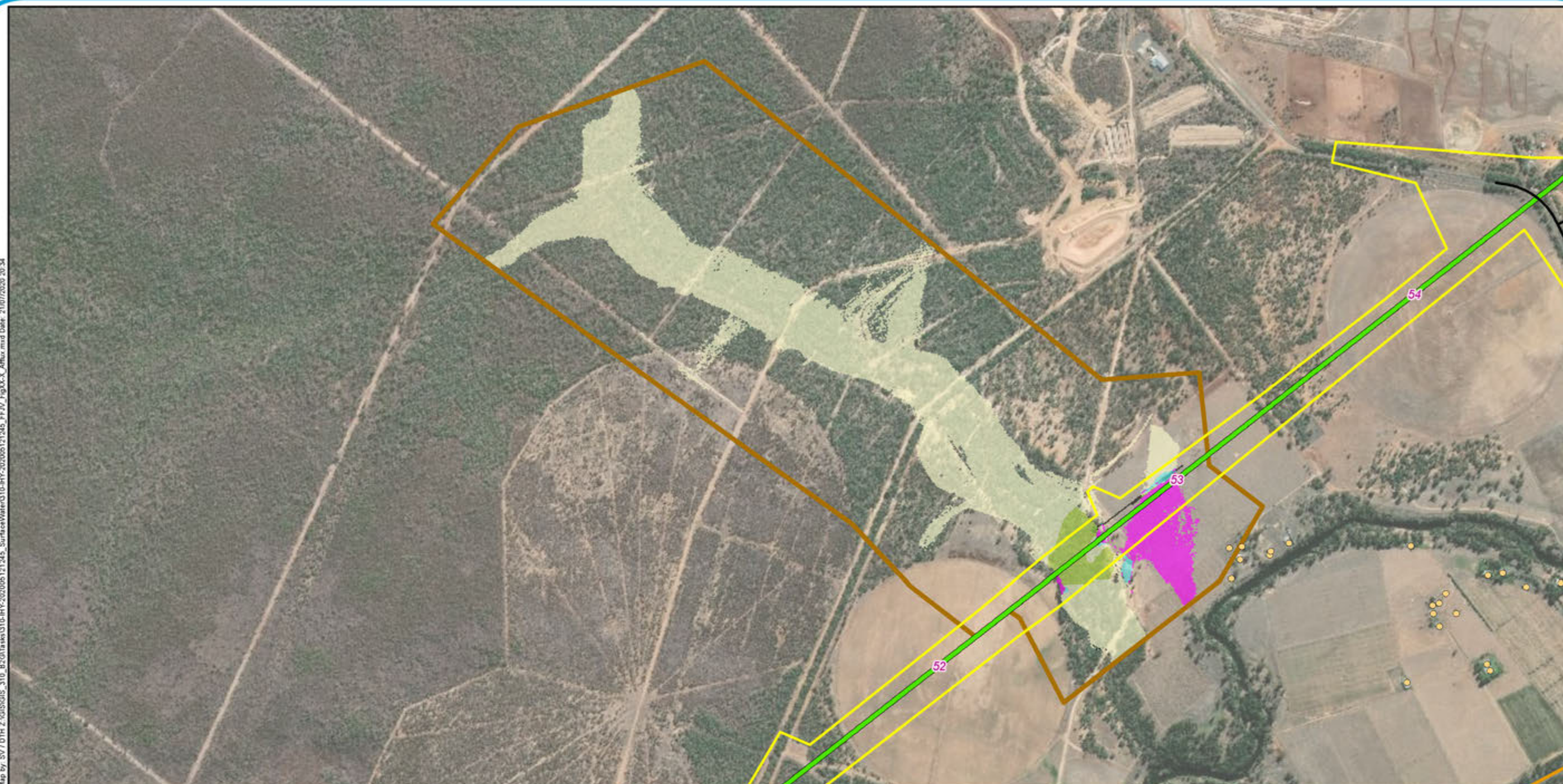
- |                                                         |                                                        |
|---------------------------------------------------------|--------------------------------------------------------|
| <span style="color: darkblue;">■</span> < -0.5          | <span style="color: lightgreen;">■</span> 0.01 to 0.05 |
| <span style="color: teal;">■</span> -0.50 to -0.20      | <span style="color: green;">■</span> 0.05 to 0.10      |
| <span style="color: lightblue;">■</span> -0.20 to -0.10 | <span style="color: darkgreen;">■</span> 0.10 to 0.20  |
| <span style="color: cyan;">■</span> -0.10 to -0.05      | <span style="color: darkgreen;">■</span> 0.20 to 0.50  |
| <span style="color: lightcyan;">■</span> -0.05 to -0.01 | <span style="color: darkgreen;">■</span> > 0.5         |
| <span style="color: yellow;">■</span> -0.01 to 0.01     |                                                        |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



Map by: SV / DTH 2:10USGIS\_310\_B20Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF.FIN\_FigDocX\_Afflux.mxd Date: 21/07/2020 20:34



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

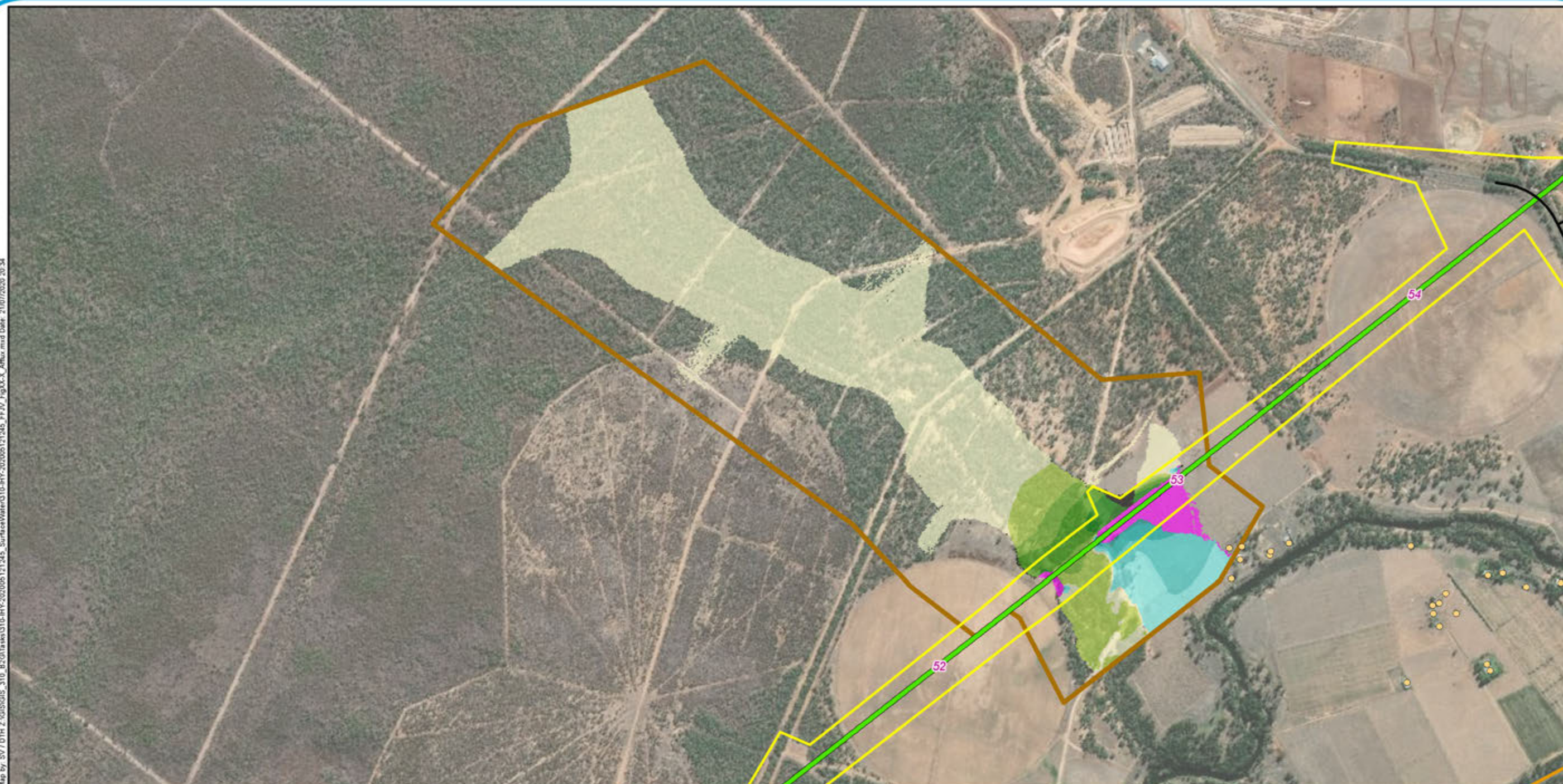
#### Change in peak water levels (m)

- |                                                         |                                                         |
|---------------------------------------------------------|---------------------------------------------------------|
| <span style="color: darkblue;">—</span> < -0.5          | <span style="color: lightgreen;">—</span> 0.01 to 0.05  |
| <span style="color: teal;">—</span> -0.50 to -0.20      | <span style="color: green;">—</span> 0.05 to 0.10       |
| <span style="color: lightblue;">—</span> -0.20 to -0.10 | <span style="color: darkgreen;">—</span> 0.10 to 0.20   |
| <span style="color: cyan;">—</span> -0.10 to -0.05      | <span style="color: forestgreen;">—</span> 0.20 to 0.50 |
| <span style="color: lightcyan;">—</span> -0.05 to -0.01 | <span style="color: darkslategrey;">—</span> > 0.5      |
| <span style="color: yellow;">—</span> -0.01 to 0.01     |                                                         |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km





-  Flood sensitive receptor
-  Chainage (km)
-  Border to Gowrie alignment
-  Major roads
-  Road design
-  Project footprint
-  Hydraulic model extent
-  Was Wet Now Dry
-  Was Dry Now Wet

|                                                                                       |                |                                                                                       |              |
|---------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------|--------------|
|  | < -0.5         |  | 0.01 to 0.05 |
|  | -0.50 to -0.20 |  | 0.05 to 0.10 |
|  | -0.20 to -0.10 |  | 0.10 to 0.20 |
|  | -0.10 to -0.05 |  | 0.20 to 0.50 |
|  | -0.05 to -0.01 |  | > 0.5        |
|  | -0.01 to 0.01  |                                                                                       |              |







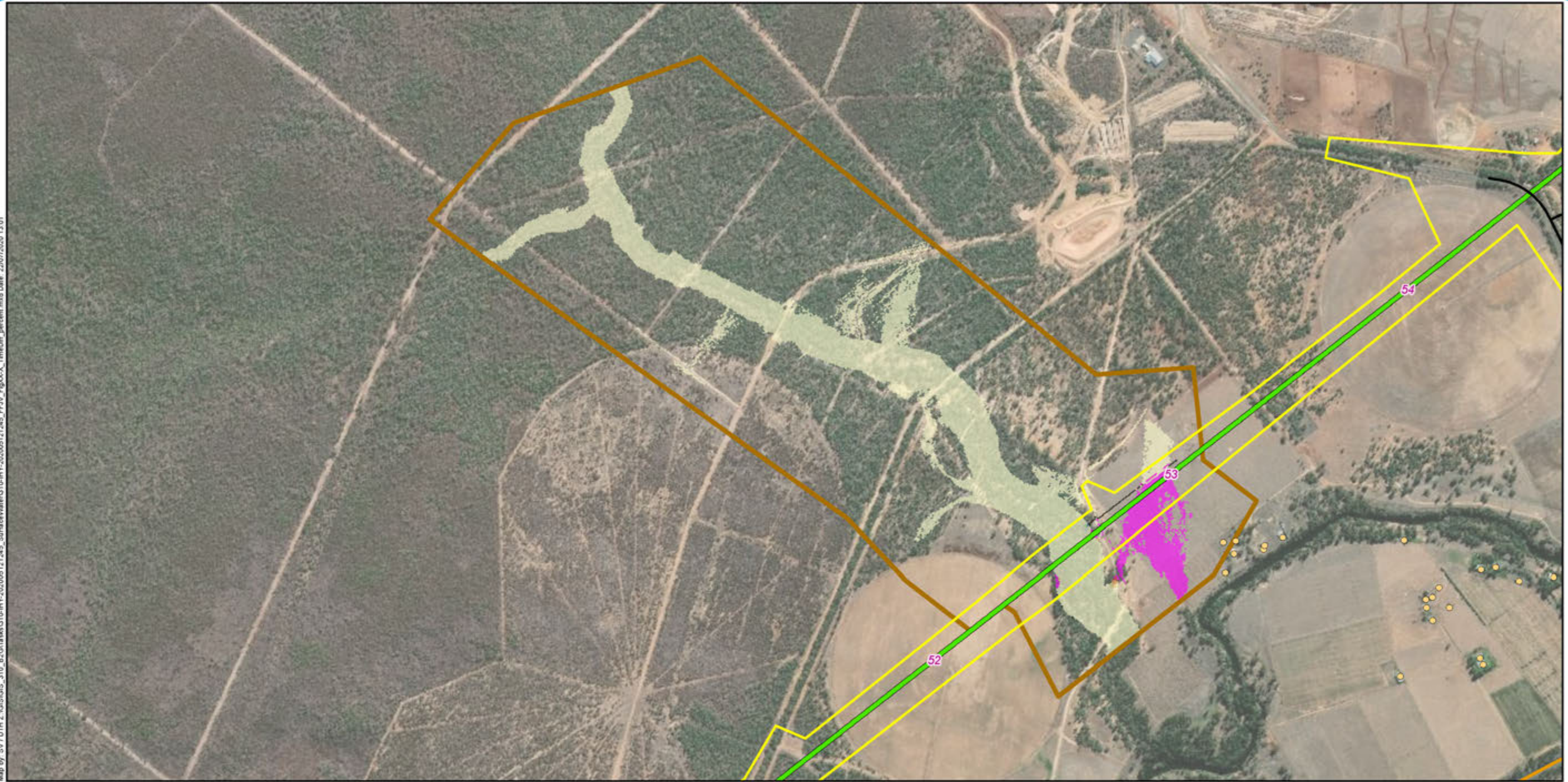
- Change in peak water levels (m)

|                |              |
|----------------|--------------|
| < -0.5         | 0.01 to 0.05 |
| -0.50 to -0.20 | 0.05 to 0.10 |
| -0.20 to -0.10 | 0.10 to 0.20 |
| -0.10 to -0.05 | 0.20 to 0.50 |
| -0.05 to -0.01 | > 0.5        |
| -0.01 to 0.01  |              |





Map by SV / DTH 2:10USGIS\_310\_B20Task310-HY-202005121245\_SurfaceWater310-HY-202005121245\_FF JV\_Fig00-X\_TimeDiff\_percent.mxd Date: 22/07/2020 13:01



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in Time of Inundation (percentage)

- |                                                    |                                                       |
|----------------------------------------------------|-------------------------------------------------------|
| <span style="color: red;">■</span> < -50%          | <span style="color: lightgreen;">■</span> 10% to 20 % |
| <span style="color: orange;">■</span> -50% to -40% | <span style="color: lightgreen;">■</span> 20% to 30 % |
| <span style="color: orange;">■</span> -40% to -30% | <span style="color: lightgreen;">■</span> 30% to 40 % |
| <span style="color: orange;">■</span> -30% to -20% | <span style="color: lightgreen;">■</span> 40% to 50 % |
| <span style="color: orange;">■</span> -20% to -10% | <span style="color: lightblue;">■</span> > 50%        |
| <span style="color: yellow;">■</span> -10% to 10 % |                                                       |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



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**Border to Gowrie**

**Figure L4-I:**

**1% AEP - change in time of inundation - Cremascos Road**



Map by SV / DTH 21/07/2020 16:21  
 B:\2020\Task\310-BY-20200512145\_SurfaceWater\310-BY-20200512145\_FF\_A3\_FigXX-X\_VelocityOff.mxd



**Legend**

- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent

**Change in peak velocity (m/s)**

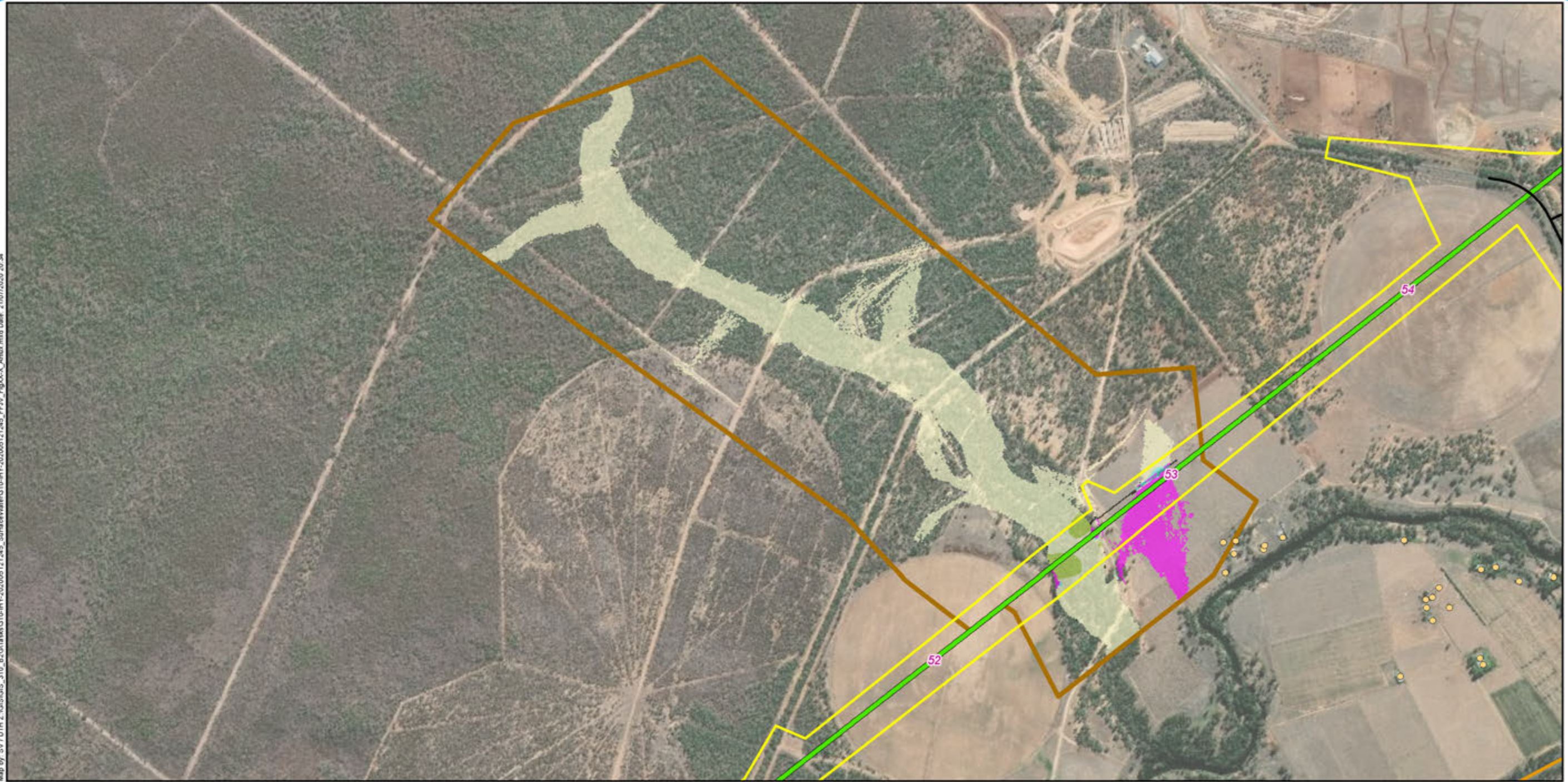
|                                                    |                                                        |
|----------------------------------------------------|--------------------------------------------------------|
| <span style="color: blue;">■</span> < -0.50        | <span style="color: lightgreen;">■</span> 0.01 to 0.05 |
| <span style="color: blue;">■</span> -0.50 to -0.20 | <span style="color: lightgreen;">■</span> 0.05 to 0.10 |
| <span style="color: blue;">■</span> -0.20 to -0.10 | <span style="color: lightgreen;">■</span> 0.10 to 0.20 |
| <span style="color: blue;">■</span> -0.10 to -0.05 | <span style="color: lightgreen;">■</span> 0.20 to 0.50 |
| <span style="color: blue;">■</span> -0.05 to -0.01 | <span style="color: green;">■</span> > 0.50            |
| <span style="color: blue;">■</span> -0.01 to 0.01  |                                                        |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



Map by: SV / DTH 2:10USGIS\_310\_B20Task310-HY-202006121245\_SurfaceWater310-HY-202006121245\_FF\_V1\_FigDocX\_Affix.mxd Date: 21/07/2020 20:34



#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Border to Gowrie alignment
- Major roads
- Road design
- Project footprint
- Hydraulic model extent
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in peak water levels (m)

- |                                                         |                                                        |
|---------------------------------------------------------|--------------------------------------------------------|
| <span style="color: darkblue;">■</span> < -0.5          | <span style="color: lightgreen;">■</span> 0.01 to 0.05 |
| <span style="color: teal;">■</span> -0.50 to -0.20      | <span style="color: green;">■</span> 0.05 to 0.10      |
| <span style="color: cyan;">■</span> -0.20 to -0.10      | <span style="color: darkgreen;">■</span> 0.10 to 0.20  |
| <span style="color: lightblue;">■</span> -0.10 to -0.05 | <span style="color: darkgreen;">■</span> 0.20 to 0.50  |
| <span style="color: lightcyan;">■</span> -0.05 to -0.01 | <span style="color: darkgreen;">■</span> > 0.5         |
| <span style="color: yellow;">■</span> -0.01 to 0.01     |                                                        |



A3 scale: 1:14,000  
 0 0.1 0.2 0.3 0.4 0.5km



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**Border to Gowrie**

**Figure L5-A:**

**1% AEP sensitivity - climate change RCP8.5 - peak water levels - Cremascos Road**



APPENDIX

# Q2

## Hydrology and Flooding Technical Report—Volume II

### **Appendix M** Macintyre River Flood Maps

INLAND RAIL—BORDER TO GOWRIE ENVIRONMENTAL IMPACT STATEMENT

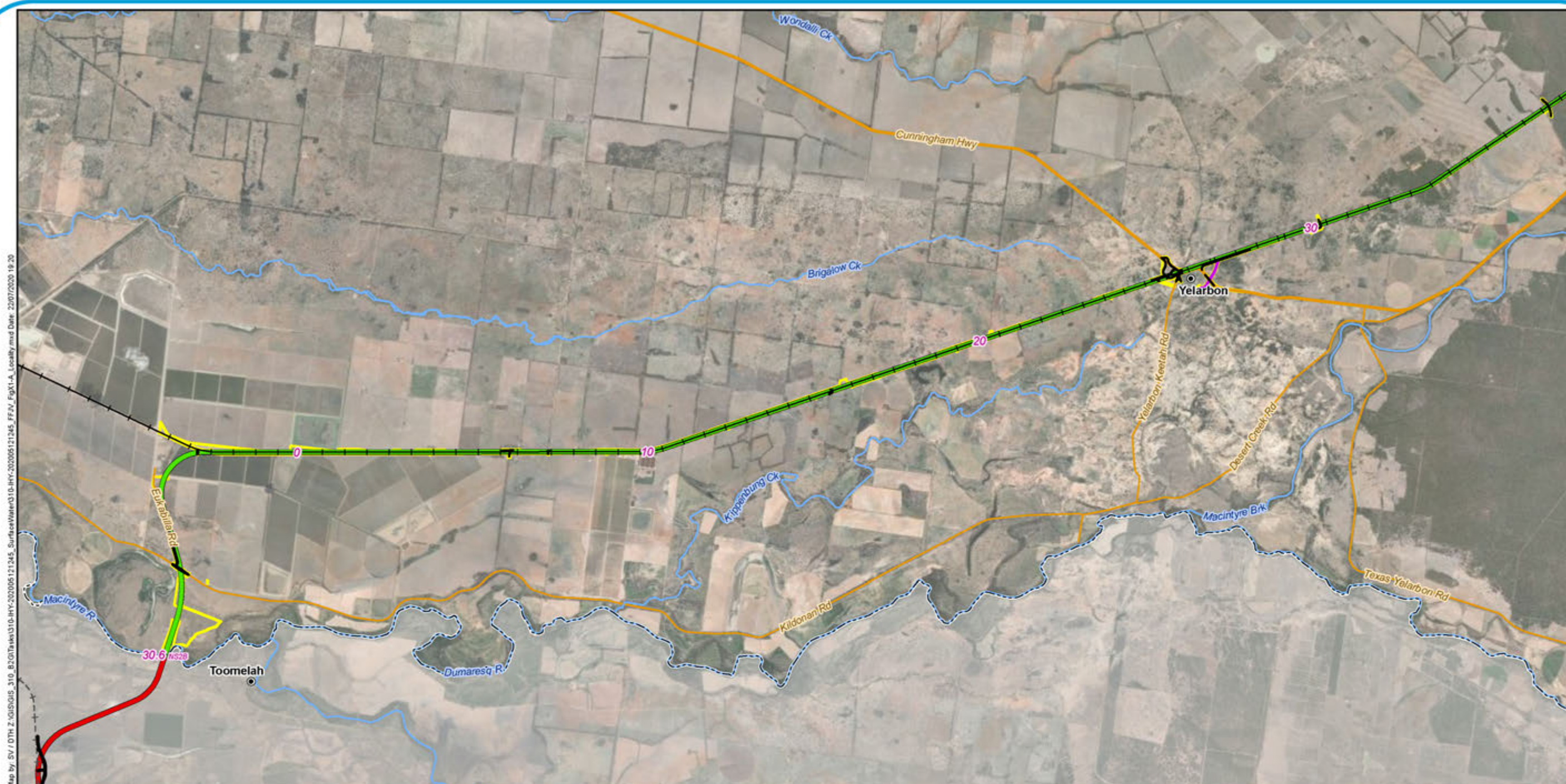


# Appendix M

## Macintyre River Flood Maps

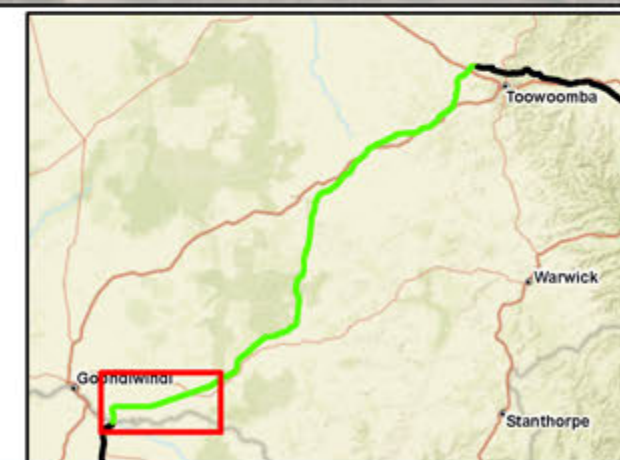
|             |                                                                |
|-------------|----------------------------------------------------------------|
| Figure M1-A | Locality plan                                                  |
| Figure M1-B | Survey data                                                    |
| Figure M1-C | Hydrologic model setup                                         |
| Figure M1-D | Hydraulic model setup                                          |
| Figure M1-E | Landuse classifications                                        |
| Figure M1-F | Proposed design structures                                     |
| Figure M2a  | 1976 calibration event – inundation extent                     |
| Figure M2-B | 1996 calibration event – inundation extent                     |
| Figure M2c  | 2011 calibration event – inundation extent                     |
| Figure M3-A | 20% AEP peak water levels – Existing Case                      |
| Figure M3-B | 10% AEP peak water levels – Existing Case                      |
| Figure M3-C | 5% AEP peak water levels – Existing Case                       |
| Figure M3-D | 2% AEP peak water levels – Existing Case                       |
| Figure M3-E | 1% AEP peak water levels – Existing Case                       |
| Figure M3-F | 1 in 2,000 AEP peak water levels – Existing Case               |
| Figure M3-G | 1 in 10,000 AEP peak water levels – Existing Case              |
| Figure M3-H | PMF peak water levels – Existing Case                          |
| Figure M4-A | 1% AEP peak velocity – Existing Case                           |
| Figure M5-A | 20% AEP – design afflux                                        |
| Figure M5-B | 10% AEP – design afflux                                        |
| Figure M5-C | 5% AEP – design afflux                                         |
| Figure M5-D | 2% AEP – design afflux                                         |
| Figure M5-E | 1% AEP – design afflux                                         |
| Figure M5-F | 1 in 2,000 AEP – design afflux                                 |
| Figure M5-G | 1 in 10,000 AEP – design afflux                                |
| Figure M5-H | PMF – design afflux                                            |
| Figure M5-I | 1% AEP – change in time of inundation                          |
| Figure M5-J | 1% AEP – change in velocity                                    |
| Figure M6-A | 1% AEP sensitivity – 0% blockage                               |
| Figure M6-B | 1% AEP sensitivity – 50% blockage                              |
| Figure M6-C | 1% AEP sensitivity – climate change RCP8.5 – peak water levels |





#### Legend

- |                                        |                   |
|----------------------------------------|-------------------|
| 5 Chainage (km)                        | Watercourses      |
| Localities                             | Major roads       |
| Existing rail (operational)            | Minor roads       |
| Border to Gowrie alignment             | Road design       |
| North Star to NSW/QLD border alignment | NSW/QLD border    |
|                                        | Yelarbon levee    |
|                                        | Project footprint |



A3 scale: 1:120,000  
 0 1 2 3 4 5km

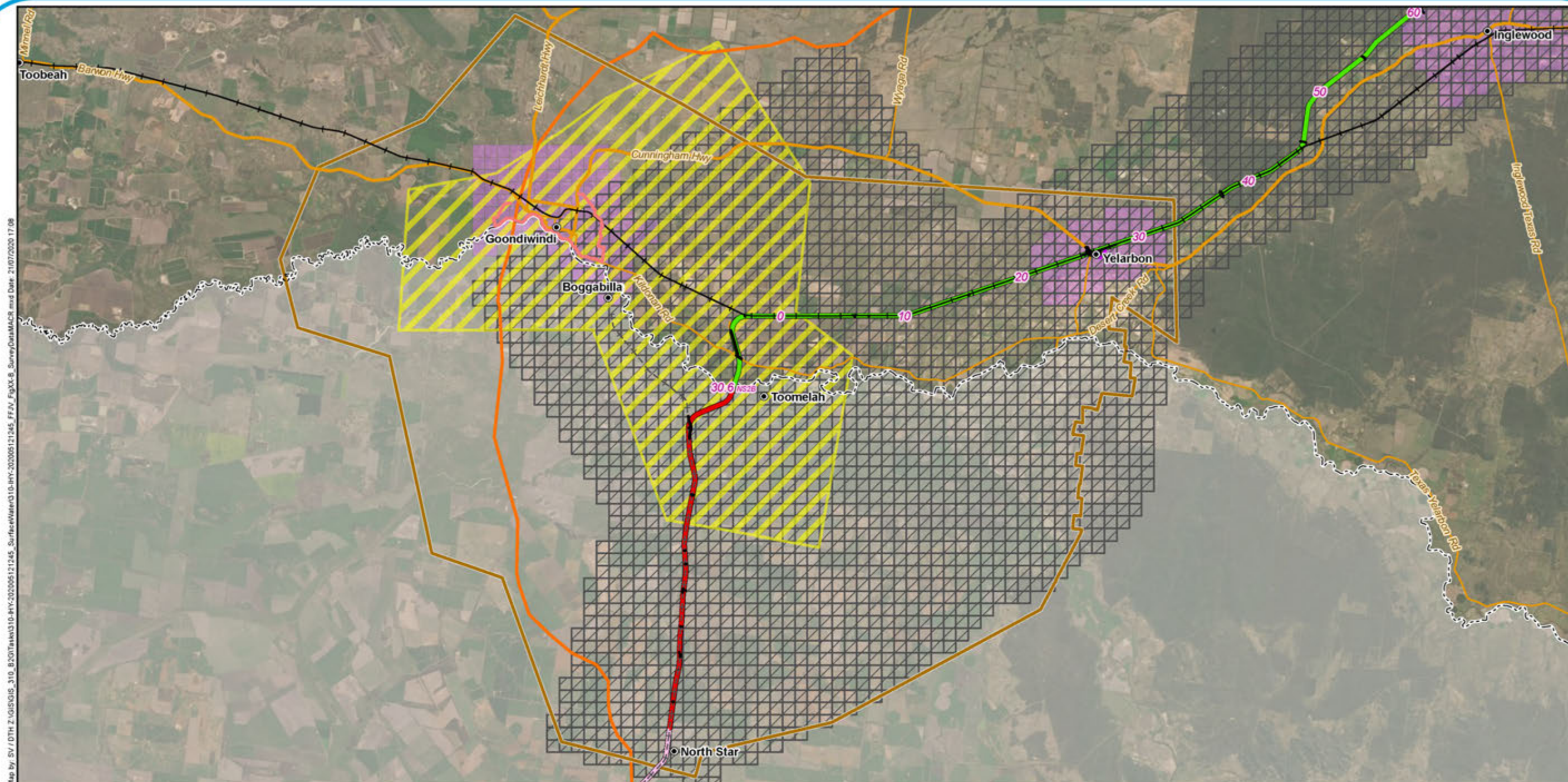


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**Border to Gowrie**  
**Figure M1-A:**  
**Locality plan - Macintyre River**





#### Legend

- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Narrabri to North Star alignment
- Major roads
- Minor roads
- Road design
- NSW/QLD border
- Yelarbon levee
- Goondiwindi levee
- Hydraulic model extent
- Hydrologic model extent

#### LiDAR datasets (1m grid)

- Inland Towns Stage 2 2011
- 2019 ARTC LiDAR
- 2015 ARTC LiDAR



A3 scale: 1:340,000  
0 3 6 9 12 15 km

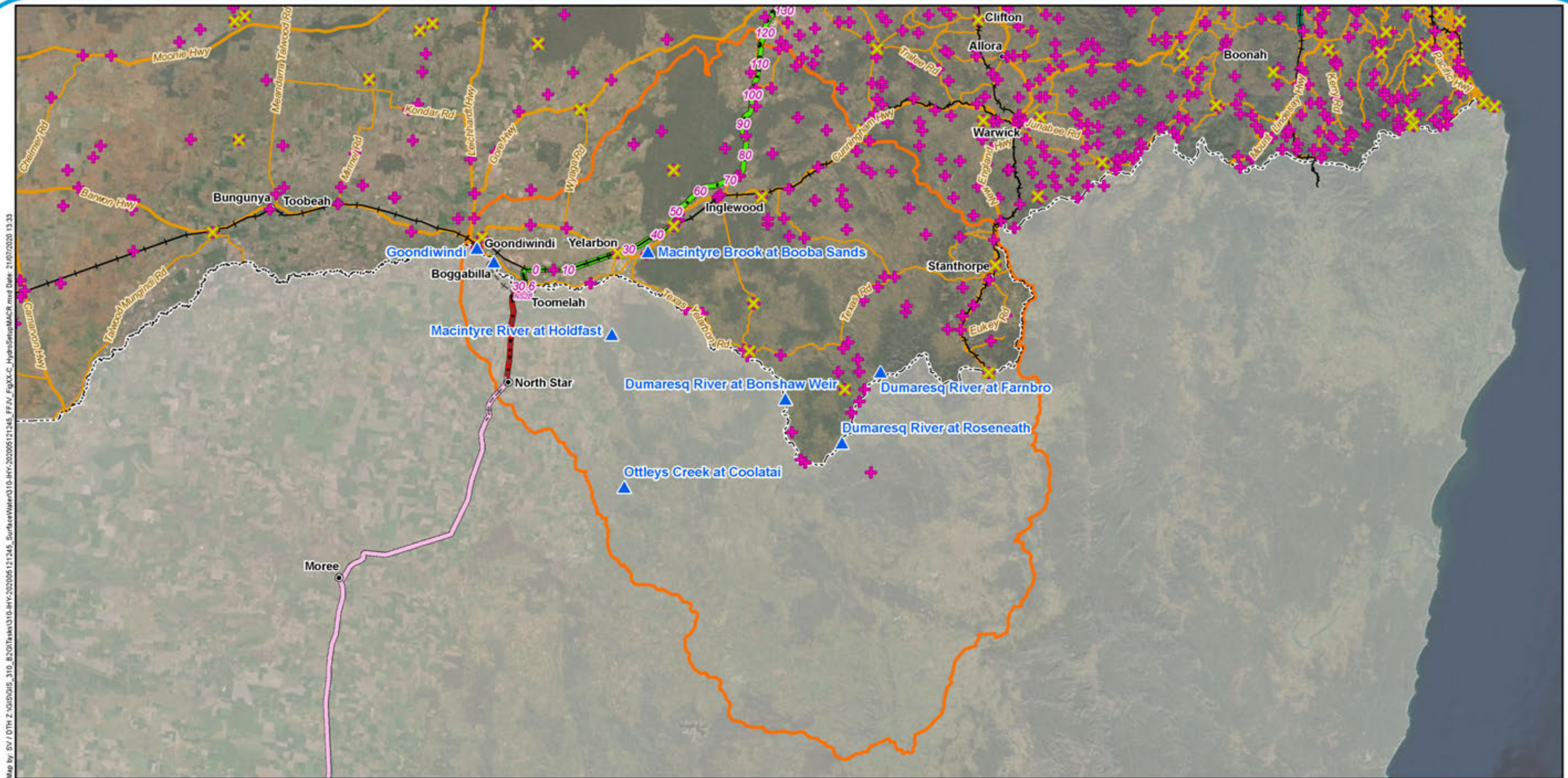


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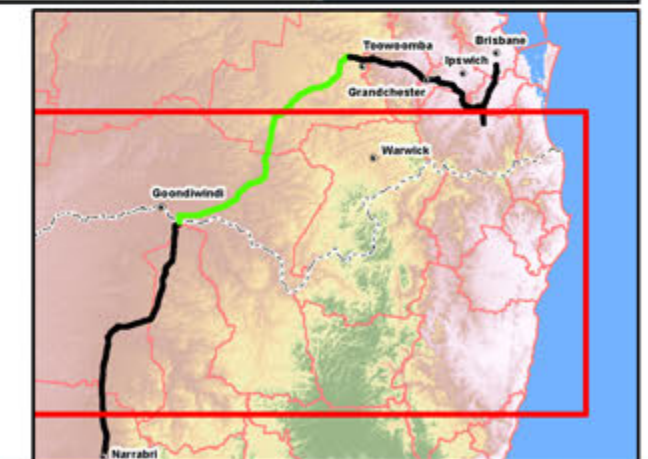
**Border to Gowrie**  
**Figure M1-B:**  
**Survey data - Macintyre River**





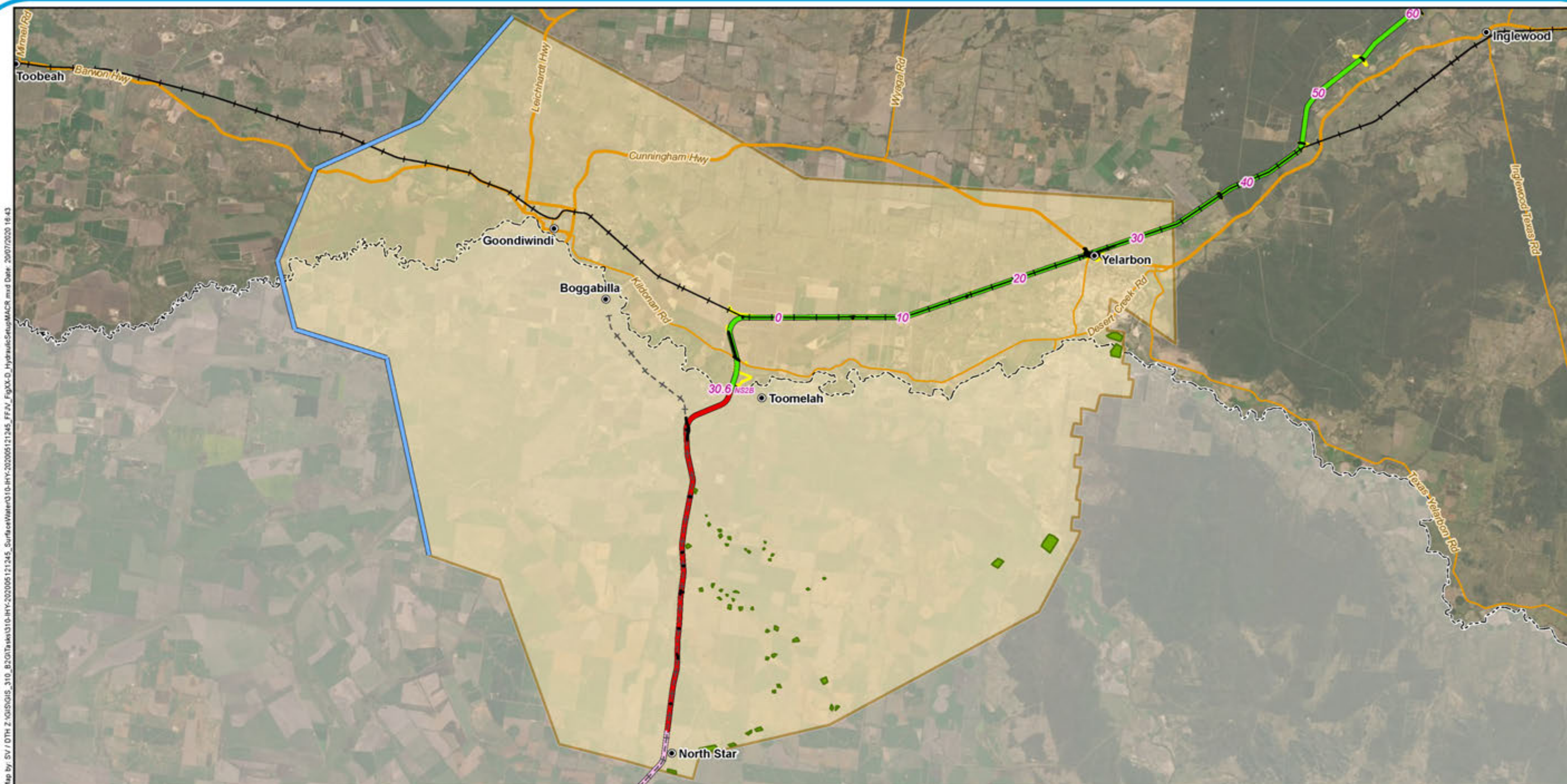
#### Legend

- |                                            |                         |                           |
|--------------------------------------------|-------------------------|---------------------------|
| 5 Chainage (km)                            | Major roads             | X Pluviograph stations    |
| Localities                                 | Minor roads             | + Daily rainfall stations |
| Existing rail (operational)                | Road design             | ▲ Stream gauge locations  |
| Existing rail (non-operational)            | NSW/QLD border          |                           |
| Border to Gowrie alignment                 | Project footprint       |                           |
| North Star to NSW/QLD border alignment     | Hydrologic model extent |                           |
| Narrabri to North Star alignment           |                         |                           |
| Kagaru to Acacia Ridge/Bromelton alignment |                         |                           |



A3 scale: 1:1,300,000  
0 10 20 30 40 50 km





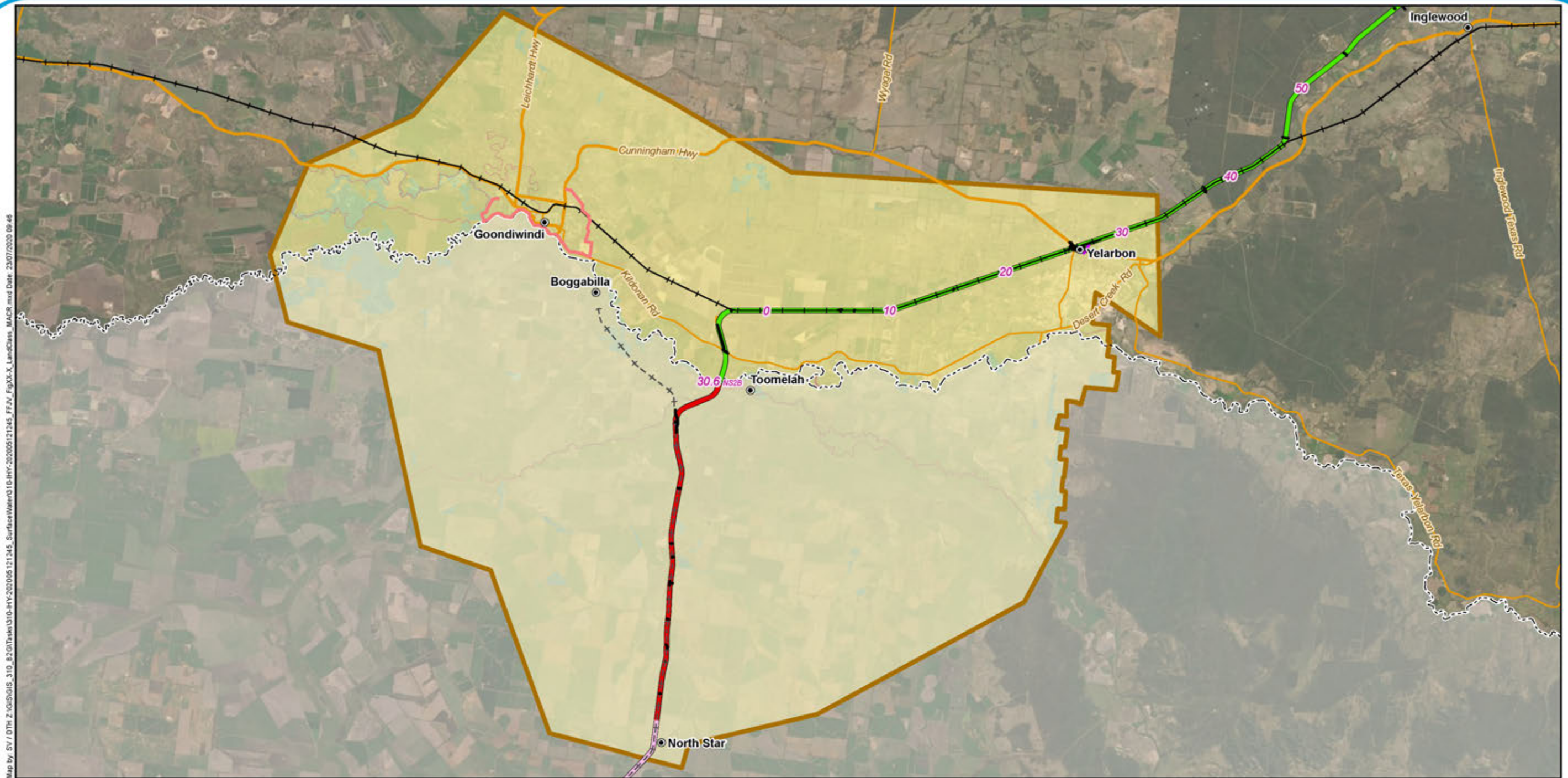
#### Legend

- |                                        |                   |                        |
|----------------------------------------|-------------------|------------------------|
| 5 Chainage (km)                        | Major roads       | Hydraulic model extent |
| Localities                             | Minor roads       | Outflow boundaries     |
| Existing rail (operational)            | Road design       | Inflow boundaries      |
| Border to Gowrie alignment             | NSW/QLD border    |                        |
| North Star to NSW/QLD border alignment | Project footprint |                        |
| Narrabri to North Star alignment       |                   |                        |



A3 scale: 1:340,000  
0 3.5 7 10.5 14 17.5 km





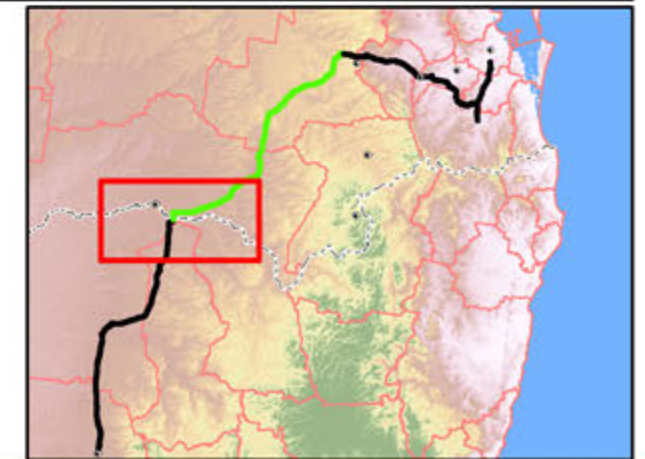
#### Legend

- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Narrabri to North Star alignment
- Major roads
- Minor roads
- Road design
- NSW/QLD border

- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee

#### Landuse classification

- Floodplain
- Vegetated floodplain
- Waterway



A3 scale: 1:340,000  
0 3 6 9 12 15 km



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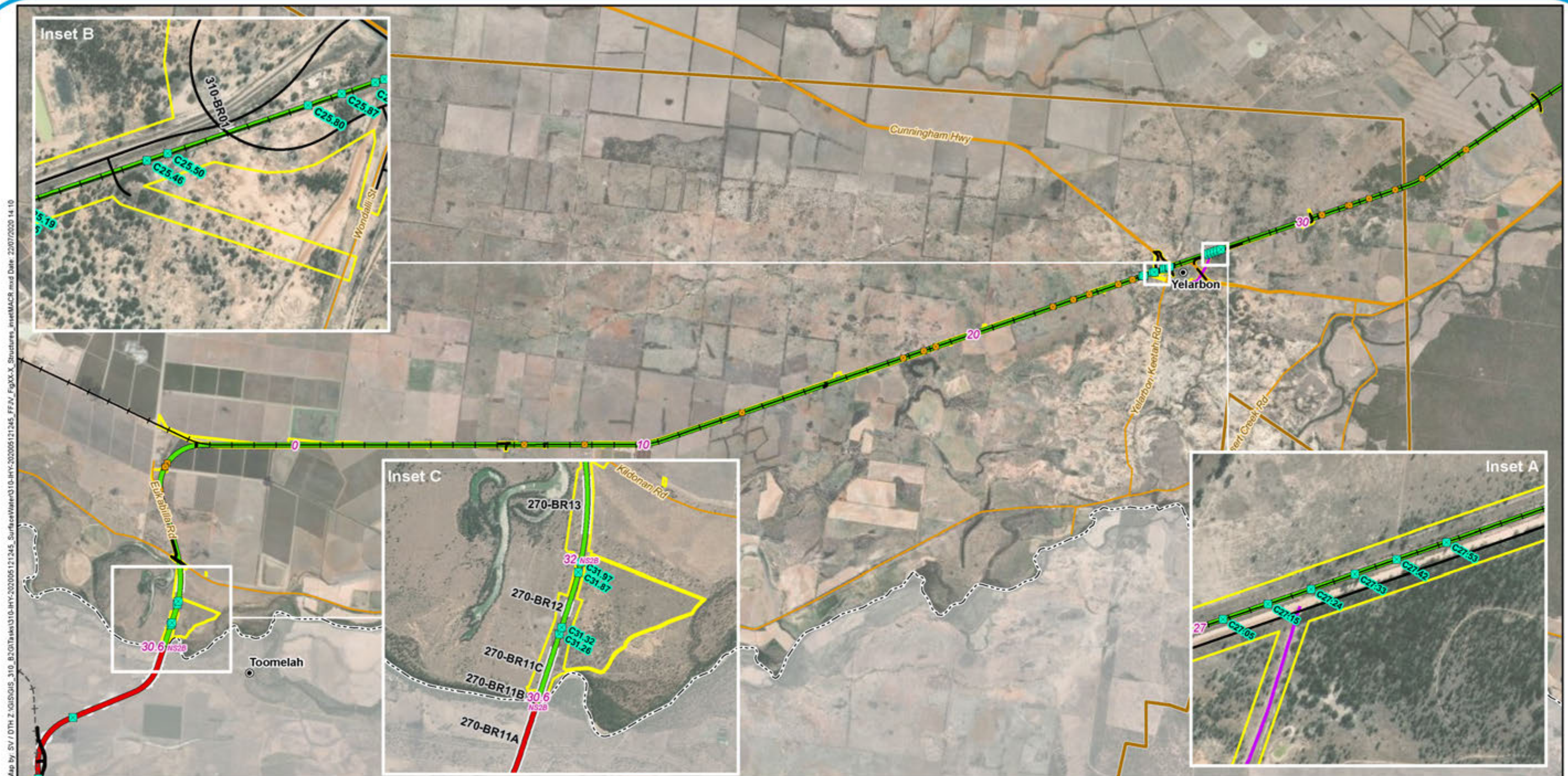
Issue date: 20/07/2020 Version: 1  
Coordinate System: GDA 1994 MGA Zone 56

**Border to Gowrie**

**Figure M1-E:**

**Landuse classifications - Macintyre River**





#### Legend

- |                                        |                        |
|----------------------------------------|------------------------|
| 5 Chainage (km)                        | Major roads            |
| Localities                             | Minor roads            |
| Floodplain culvert                     | Road design            |
| Local drainage culvert                 | NSW/QLD border         |
| Bridges                                | Yelarbon levee         |
| Existing rail (operational)            | Project footprint      |
| Border to Gowrie alignment             | Hydraulic model extent |
| North Star to NSW/QLD border alignment |                        |



A3 scale: 1:120,000  
0 1 2 3 4 5 km



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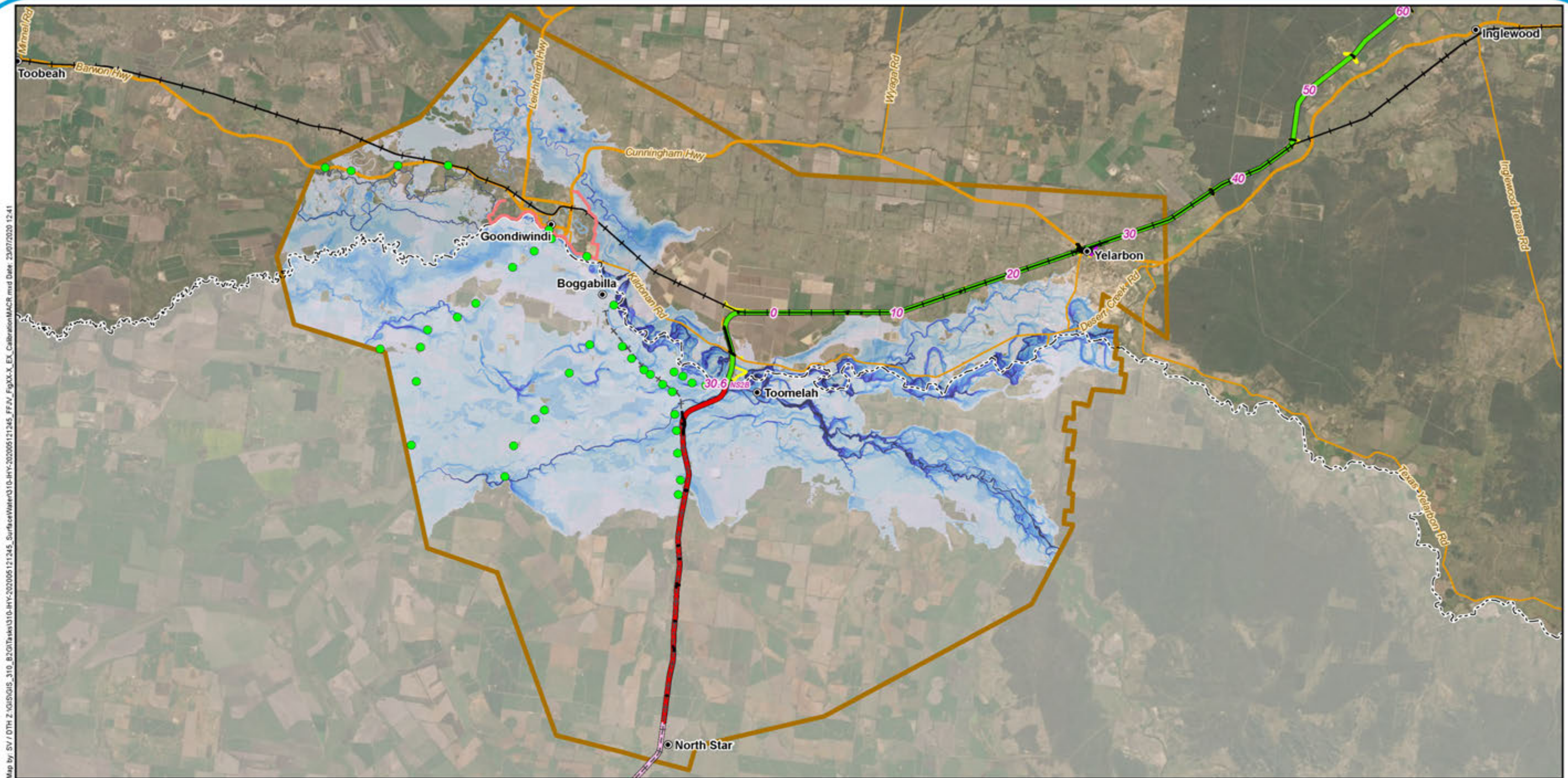
Issue date: 22/07/2020 Version: 1  
Coordinate System: GDA 1994 MGA Zone 56

**Border to Gowrie**

**Figure M1-F:**

**Proposed design structures - Macintyre River**





#### Legend

- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Narrabri to North Star alignment
- Major roads
- Minor roads
- Road design
- NSW/QLD border

- Project footprint
- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee
- Observed floodmarks (1976)

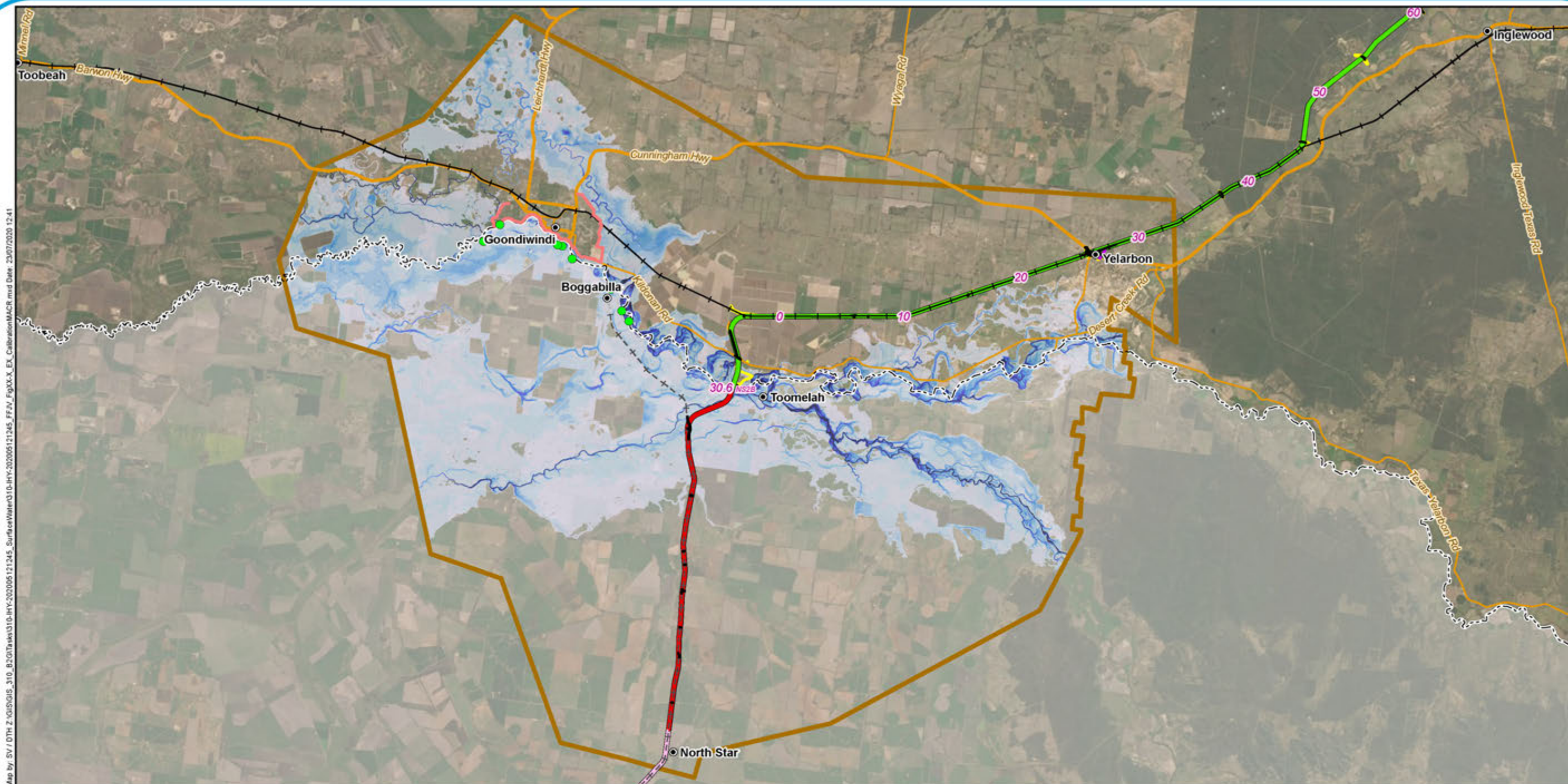
#### Depth (m)

- |             |                     |
|-------------|---------------------|
| □ 0 - 0.5   | □ 3.0 - 3.5         |
| □ 0.5 - 1.0 | □ 3.5 - 4.0         |
| □ 1.0 - 1.5 | □ 4.0 - 4.5         |
| □ 1.5 - 2.0 | □ 4.5 - 5.0         |
| □ 2.0 - 2.5 | □ > 5.0             |
| □ 2.5 - 3.0 | — 1m contour (mAHD) |



A3 scale: 1:340,000  
0 3 6 9 12 15 km





#### Legend

- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Narrabri to North Star alignment
- Major roads
- Minor roads
- Road design
- NSW/QLD border
- Project footprint
- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee
- Observed floodmarks (1996)

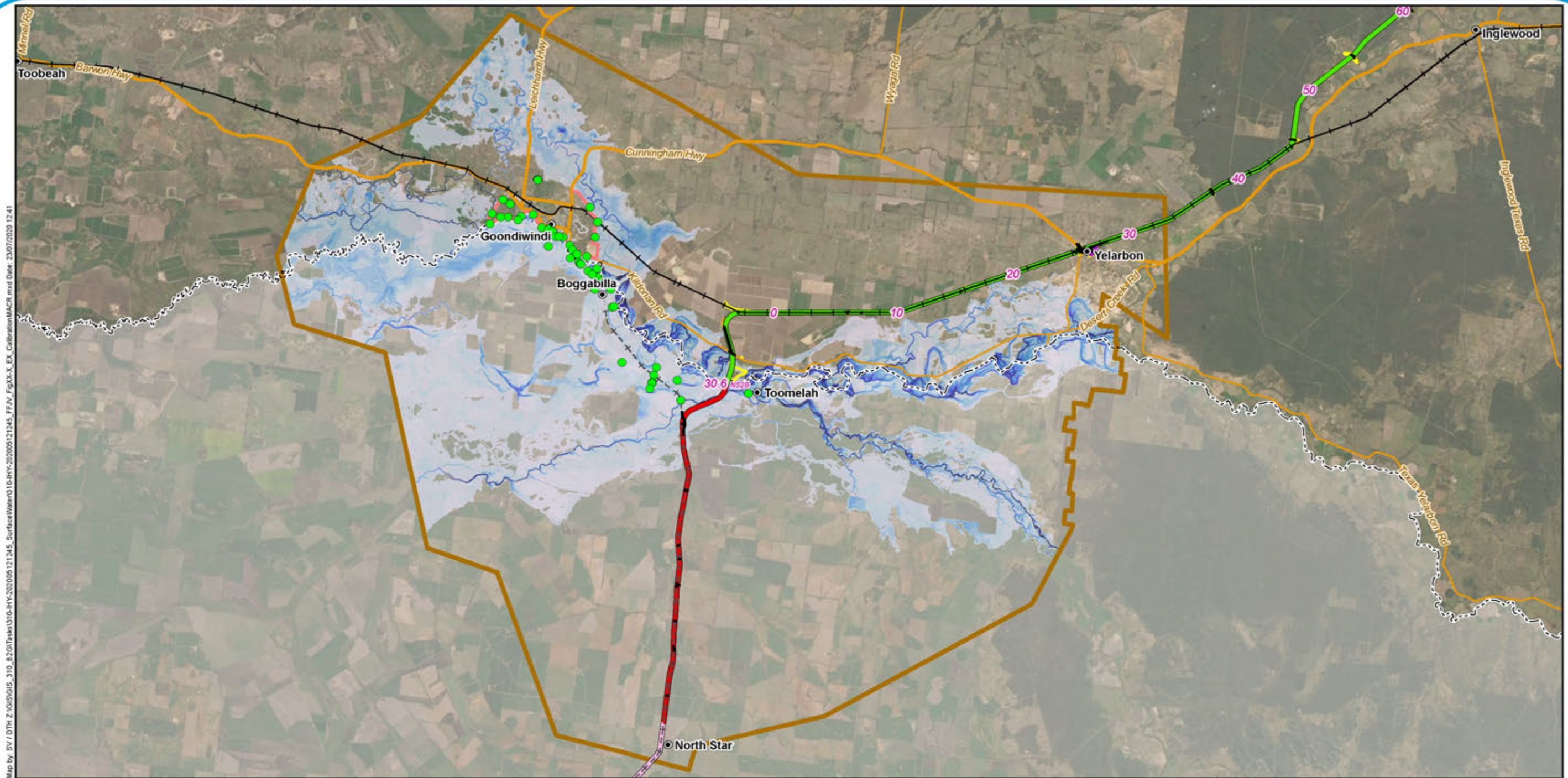
#### Depth (m)

- |           |                     |
|-----------|---------------------|
| 0 - 0.5   | 3.0 - 3.5           |
| 0.5 - 1.0 | 3.5 - 4.0           |
| 1.0 - 1.5 | 4.0 - 4.5           |
| 1.5 - 2.0 | 4.5 - 5.0           |
| 2.0 - 2.5 | > 5.0               |
| 2.5 - 3.0 | — 1m contour (mAHD) |



A3 scale: 1:340,000  
0 3 6 9 12 15 km





#### Legend

- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Narrabri to North Star alignment
- Major roads
- Minor roads
- Road design
- NSW/QLD border

- Project footprint
- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee
- Observed floodmarks (2011)

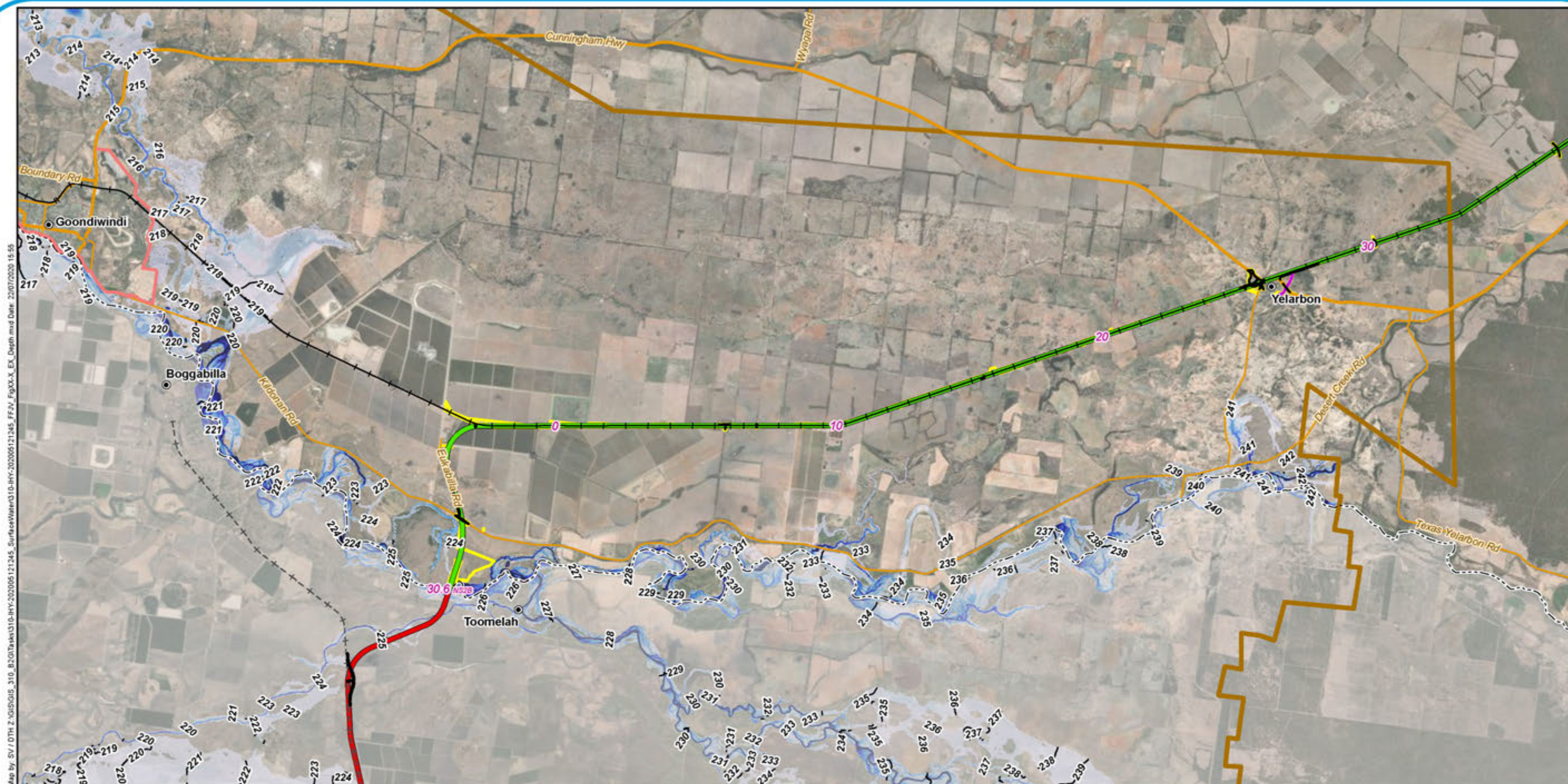
#### Depth (m)

- |           |                     |
|-----------|---------------------|
| 0 - 0.5   | 3.0 - 3.5           |
| 0.5 - 1.0 | 3.5 - 4.0           |
| 1.0 - 1.5 | 4.0 - 4.5           |
| 1.5 - 2.0 | 4.5 - 5.0           |
| 2.0 - 2.5 | > 5.0               |
| 2.5 - 3.0 | — 1m contour (mAHD) |



A3 scale: 1:340,000  
0 3 6 9 12 15 km





#### Legend

- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Major roads
- Minor roads
- Road design
- NSW/QLD border
- Project footprint

- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee

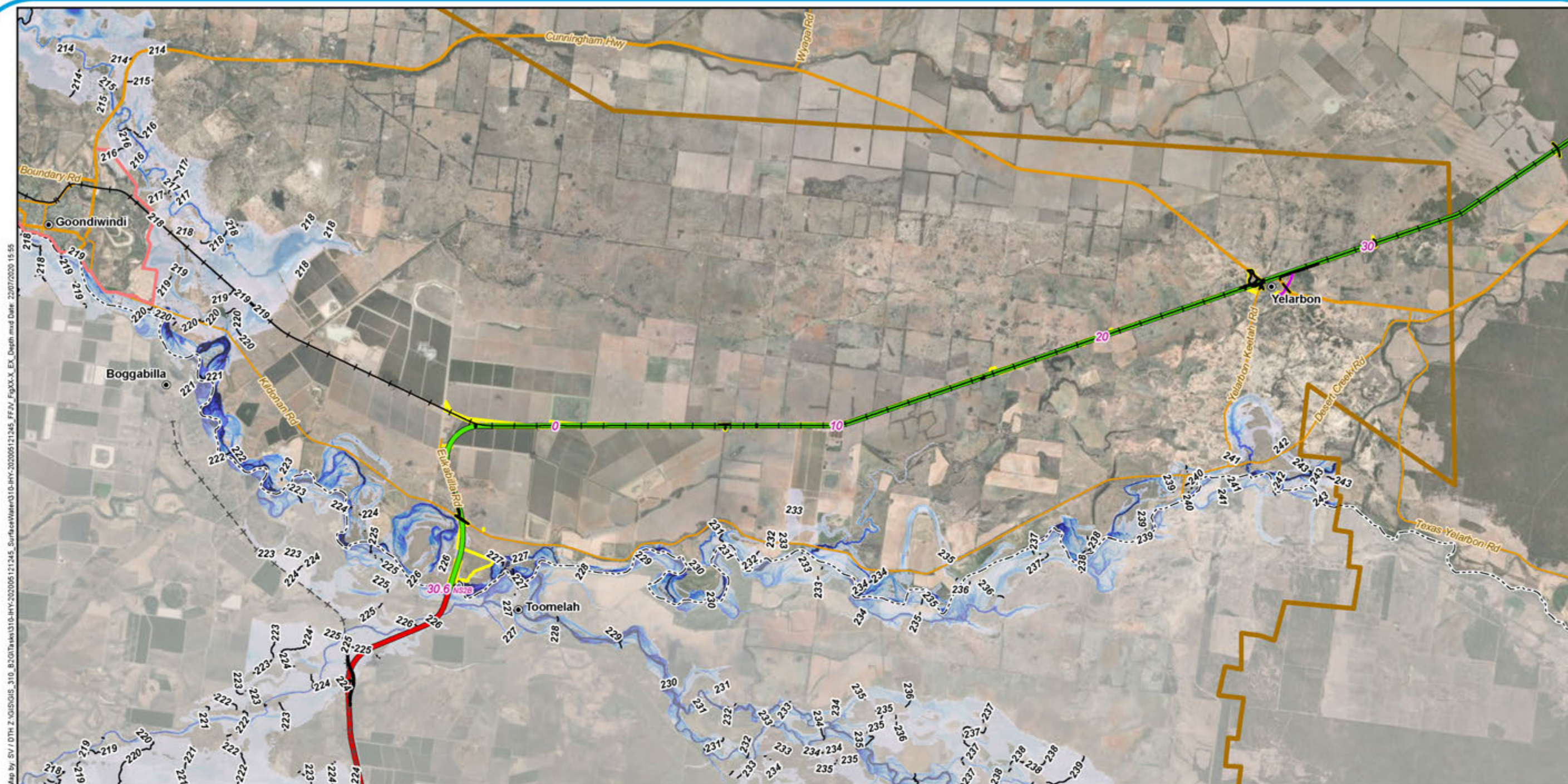
#### Depth (m)

- |             |                     |
|-------------|---------------------|
| □ 0 - 0.5   | □ 3.0 - 3.5         |
| □ 0.5 - 1.0 | □ 3.5 - 4.0         |
| □ 1.0 - 1.5 | □ 4.0 - 4.5         |
| □ 1.5 - 2.0 | □ 4.5 - 5.0         |
| □ 2.0 - 2.5 | □ > 5.0             |
| □ 2.5 - 3.0 | — 1m contour (mAHD) |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km





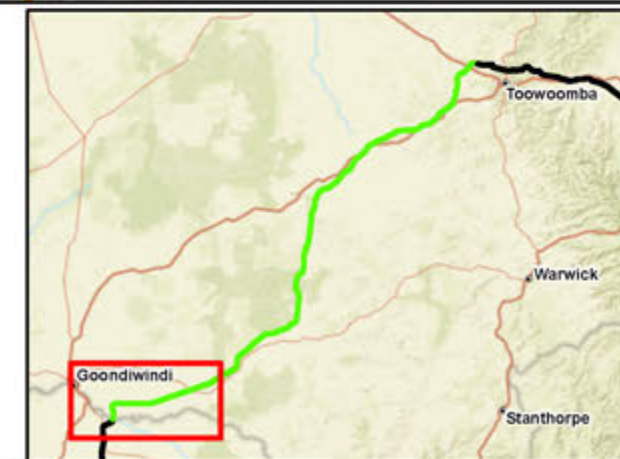
#### Legend

- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Major roads
- Minor roads
- Road design
- NSW/QLD border
- Project footprint

- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee

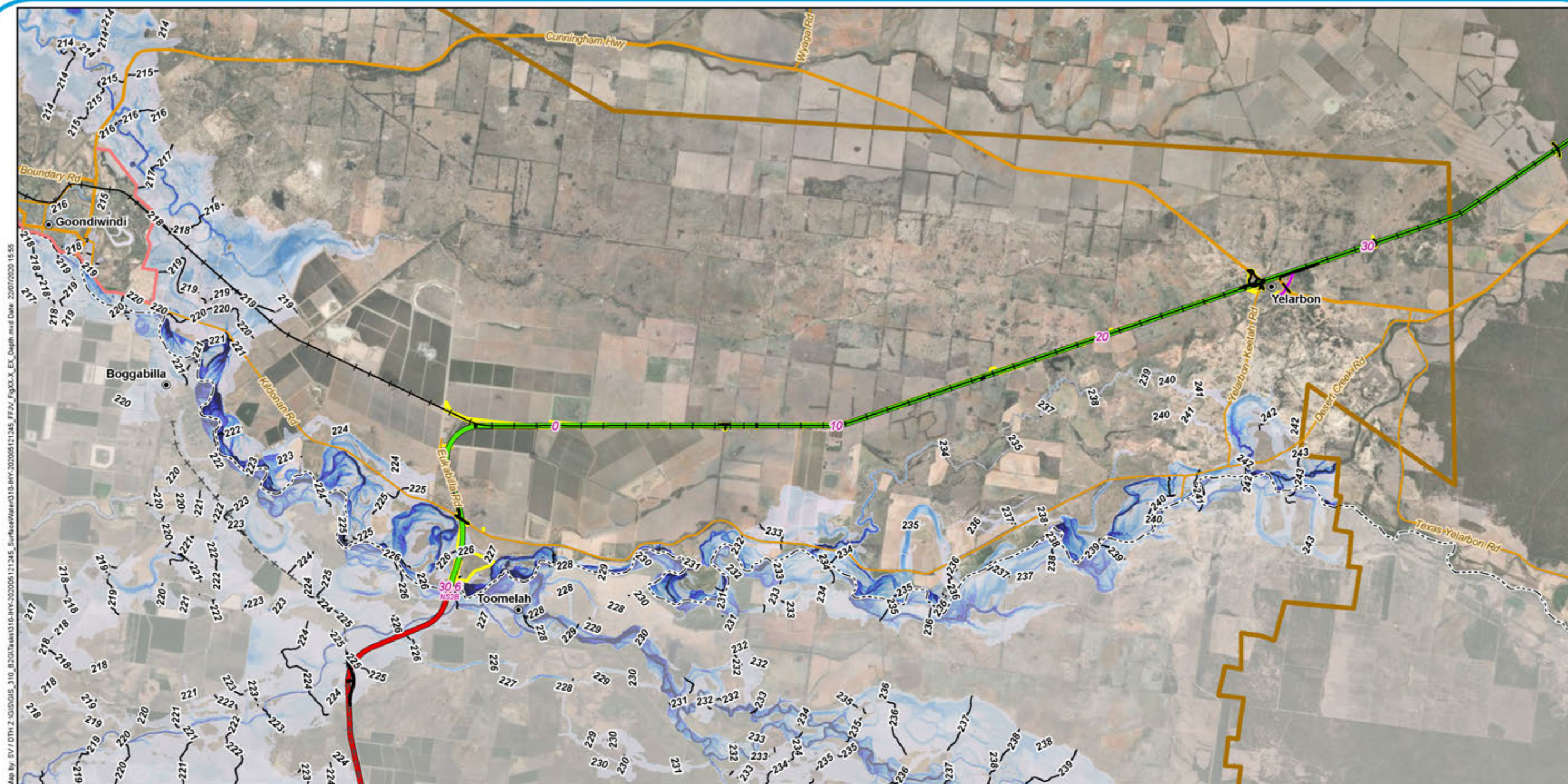
#### Depth (m)

- |             |                     |
|-------------|---------------------|
| □ 0 - 0.5   | □ 3.0 - 3.5         |
| □ 0.5 - 1.0 | □ 3.5 - 4.0         |
| □ 1.0 - 1.5 | □ 4.0 - 4.5         |
| □ 1.5 - 2.0 | □ 4.5 - 5.0         |
| □ 2.0 - 2.5 | □ > 5.0             |
| □ 2.5 - 3.0 | — 1m contour (mAHD) |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km





#### Legend

- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Major roads
- Minor roads
- Road design
- NSW/QLD border
- Project footprint

- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee

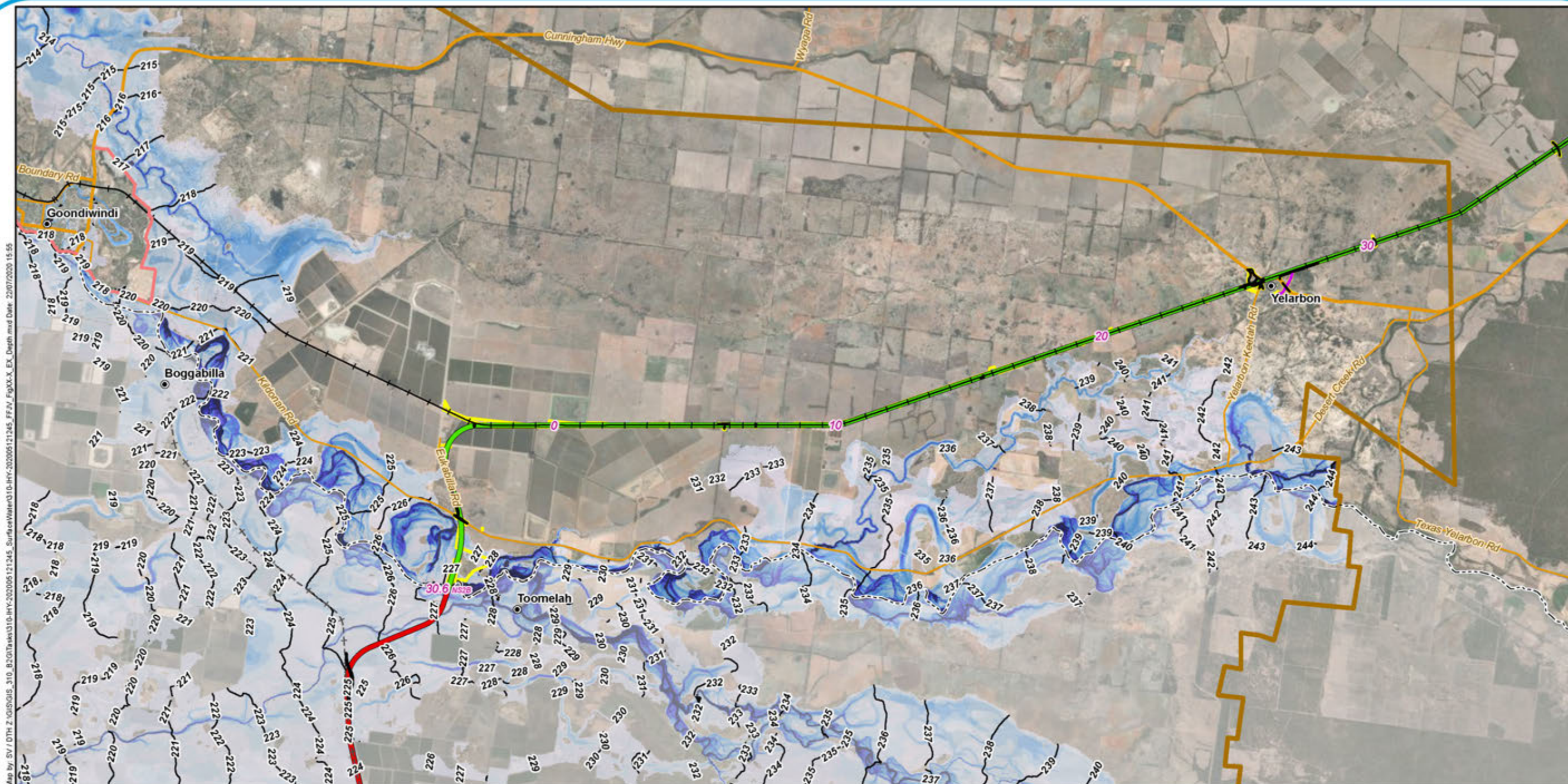
#### Depth (m)

- |             |                     |
|-------------|---------------------|
| □ 0 - 0.5   | □ 3.0 - 3.5         |
| □ 0.5 - 1.0 | □ 3.5 - 4.0         |
| □ 1.0 - 1.5 | □ 4.0 - 4.5         |
| □ 1.5 - 2.0 | □ 4.5 - 5.0         |
| □ 2.0 - 2.5 | □ > 5.0             |
| □ 2.5 - 3.0 | — 1m contour (mAHD) |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km





#### Legend

- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Major roads
- Minor roads
- Road design
- NSW/QLD border
- Project footprint

- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee

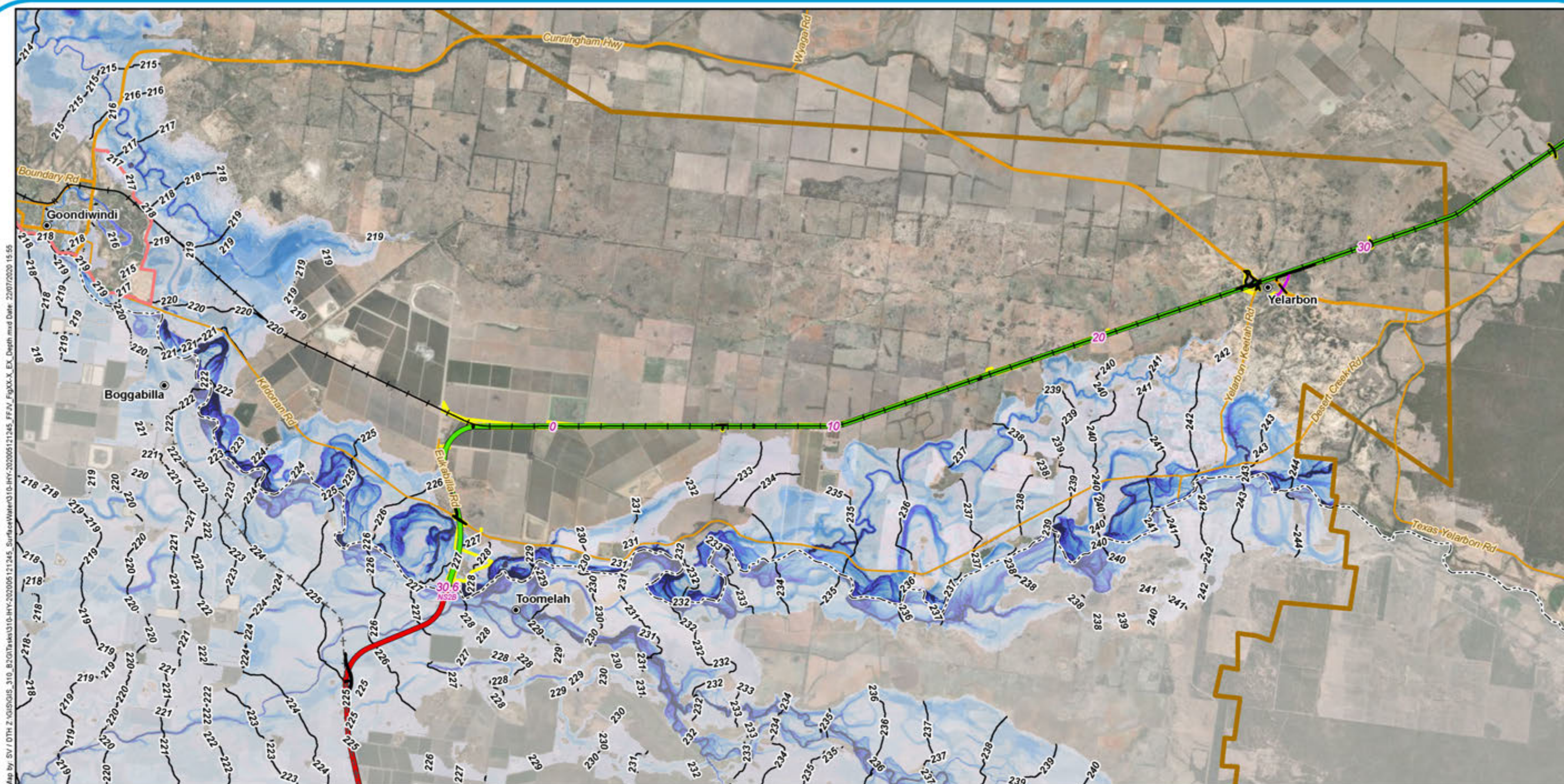
#### Depth (m)

- |             |                     |
|-------------|---------------------|
| □ 0 - 0.5   | □ 3.0 - 3.5         |
| □ 0.5 - 1.0 | □ 3.5 - 4.0         |
| □ 1.0 - 1.5 | □ 4.0 - 4.5         |
| □ 1.5 - 2.0 | □ 4.5 - 5.0         |
| □ 2.0 - 2.5 | □ > 5.0             |
| □ 2.5 - 3.0 | — 1m contour (mAHD) |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km





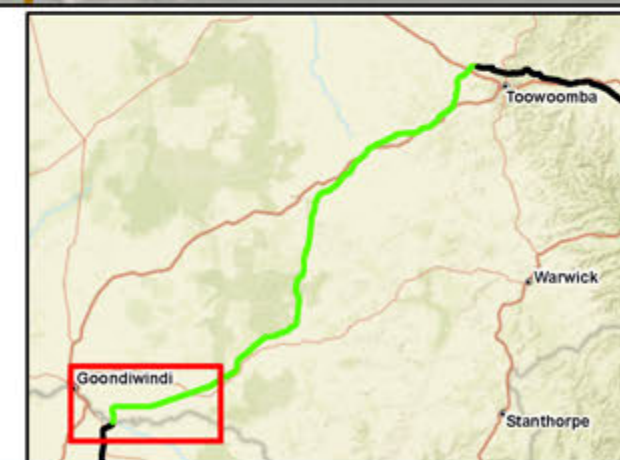
#### Legend

- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Major roads
- Minor roads
- Road design
- NSW/QLD border
- Project footprint

- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee

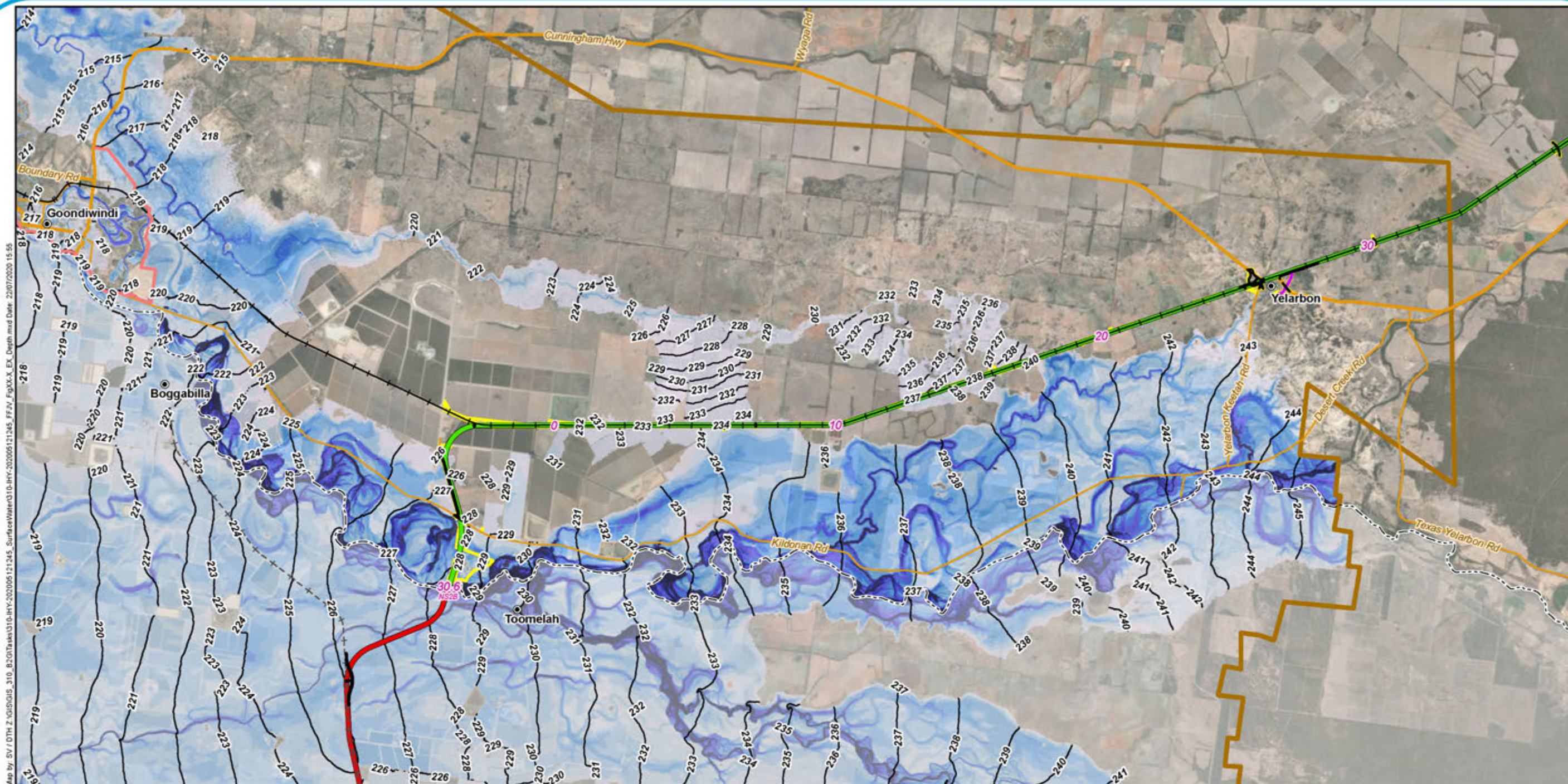
#### Depth (m)

- |             |                     |
|-------------|---------------------|
| □ 0 - 0.5   | □ 3.0 - 3.5         |
| □ 0.5 - 1.0 | □ 3.5 - 4.0         |
| □ 1.0 - 1.5 | □ 4.0 - 4.5         |
| □ 1.5 - 2.0 | □ 4.5 - 5.0         |
| □ 2.0 - 2.5 | □ > 5.0             |
| □ 2.5 - 3.0 | — 1m contour (mAHD) |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km





#### Legend

- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Major roads
- Minor roads
- Road design
- NSW/QLD border
- Project footprint

- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee

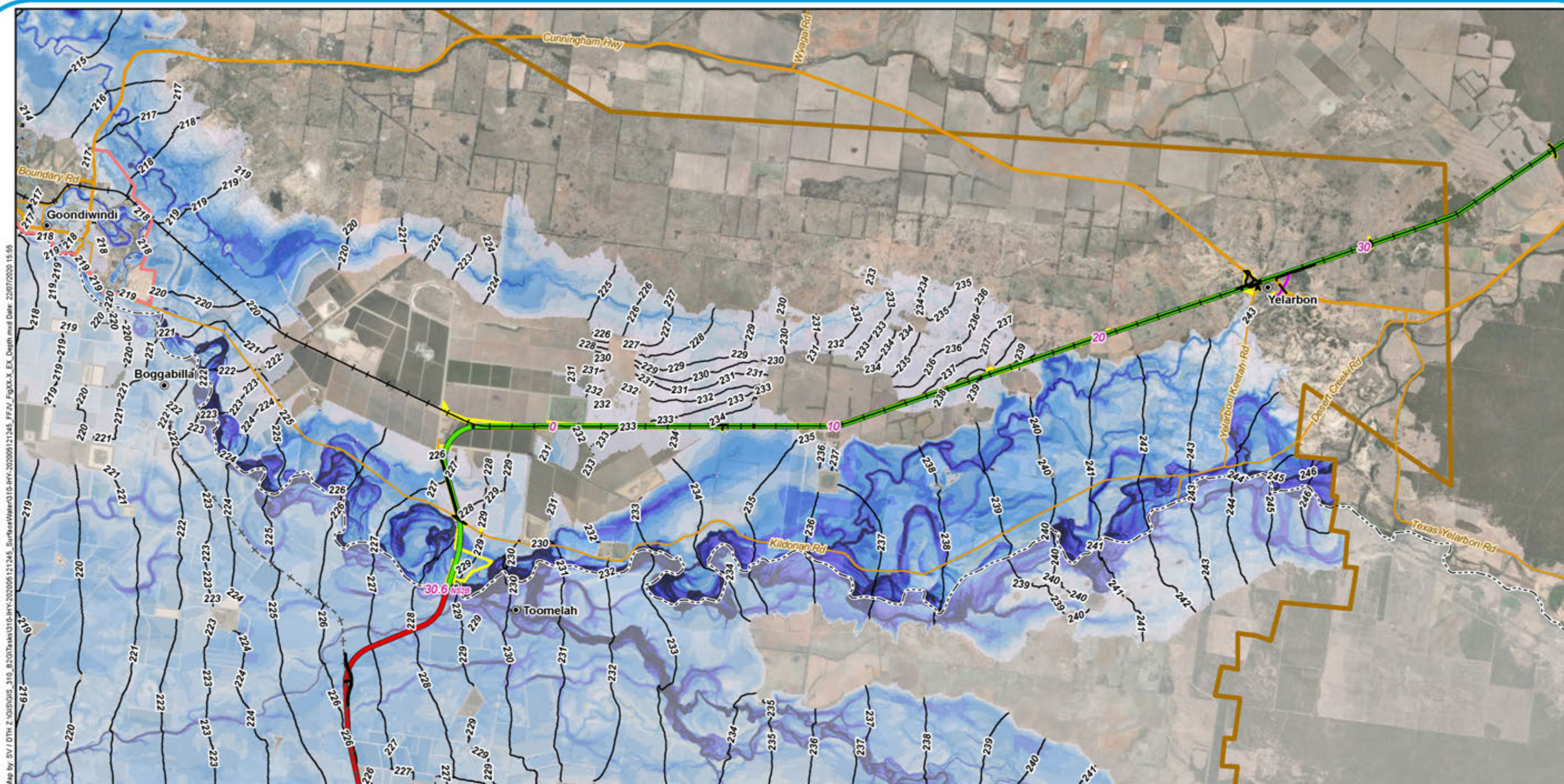
#### Depth (m)

- |             |                     |
|-------------|---------------------|
| □ 0 - 0.5   | □ 3.0 - 3.5         |
| □ 0.5 - 1.0 | □ 3.5 - 4.0         |
| □ 1.0 - 1.5 | □ 4.0 - 4.5         |
| □ 1.5 - 2.0 | □ 4.5 - 5.0         |
| □ 2.0 - 2.5 | □ > 5.0             |
| □ 2.5 - 3.0 | — 1m contour (mAHD) |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km





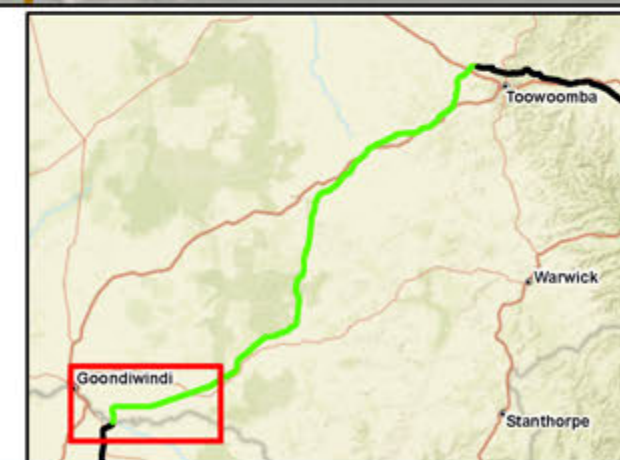
#### Legend

- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Major roads
- Minor roads
- Road design
- NSW/QLD border
- Project footprint

- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee

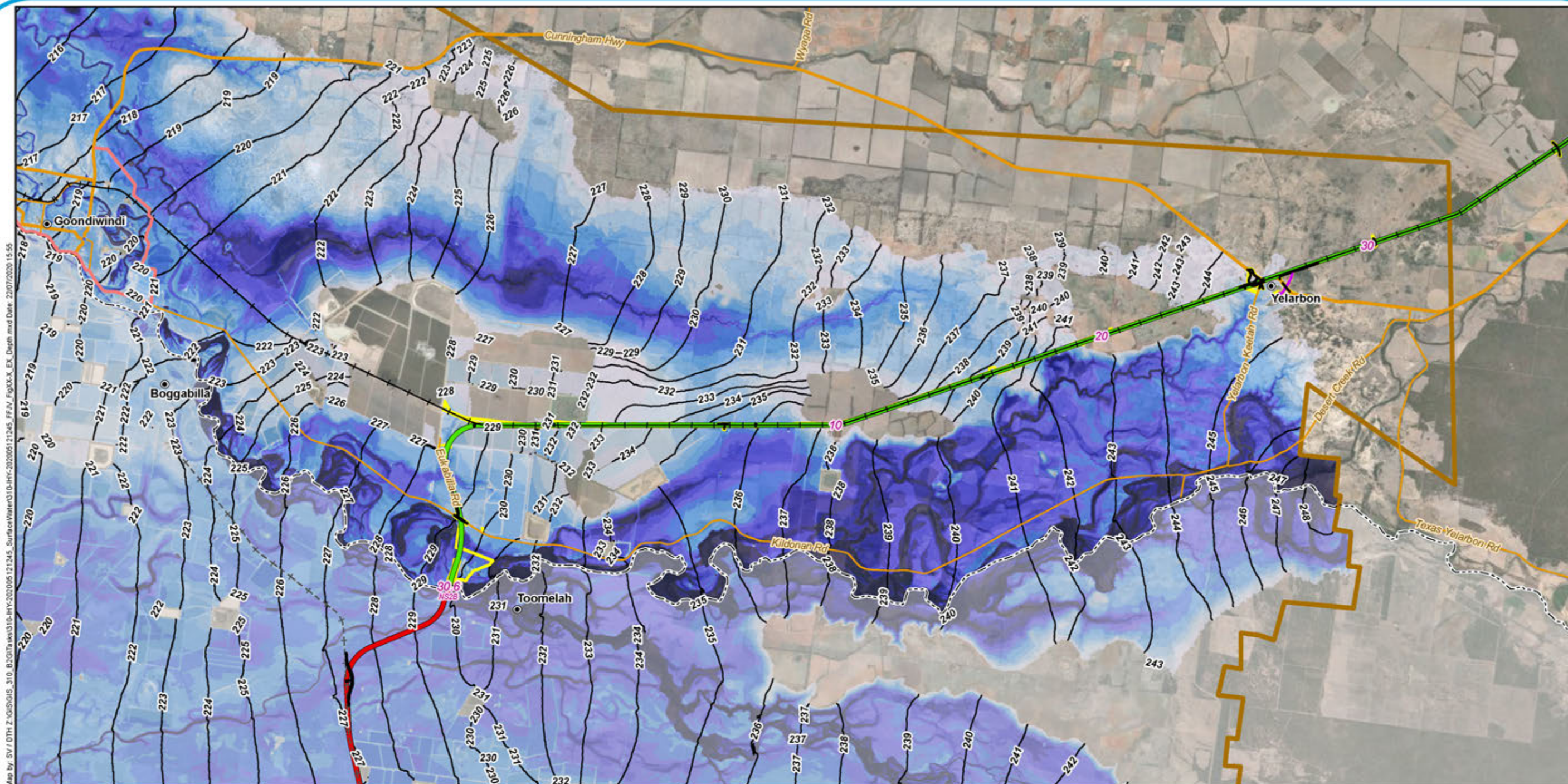
#### Depth (m)

- |           |                     |
|-----------|---------------------|
| 0 - 0.5   | 3.0 - 3.5           |
| 0.5 - 1.0 | 3.5 - 4.0           |
| 1.0 - 1.5 | 4.0 - 4.5           |
| 1.5 - 2.0 | 4.5 - 5.0           |
| 2.0 - 2.5 | > 5.0               |
| 2.5 - 3.0 | — 1m contour (mAHD) |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km





#### Legend

- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Major roads
- Minor roads
- Road design
- NSW/QLD border
- Project footprint

- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee

#### Depth (m)

- |           |                   |
|-----------|-------------------|
| 0 - 0.5   | 3.0 - 3.5         |
| 0.5 - 1.0 | 3.5 - 4.0         |
| 1.0 - 1.5 | 4.0 - 4.5         |
| 1.5 - 2.0 | 4.5 - 5.0         |
| 2.0 - 2.5 | > 5.0             |
| 2.5 - 3.0 | 1m contour (mAHD) |



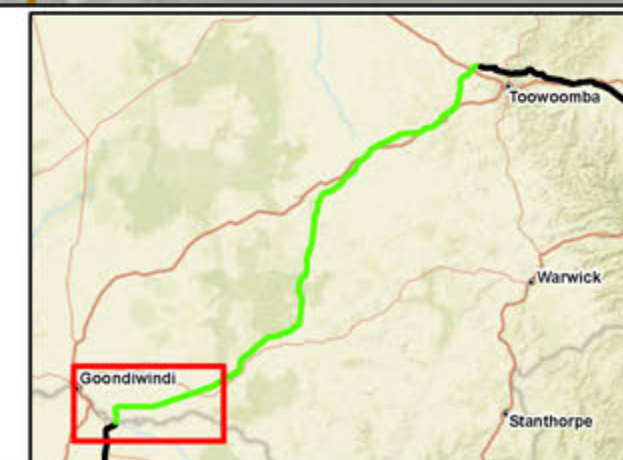
A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km





-  Hydraulic model extent
-  Yelarbon levee
-  Goondiwindi levee

0.0 3.0  
0.5 3.5  
1.0 4.0  
1.5 4.5  
2.0 5.0  
2.5



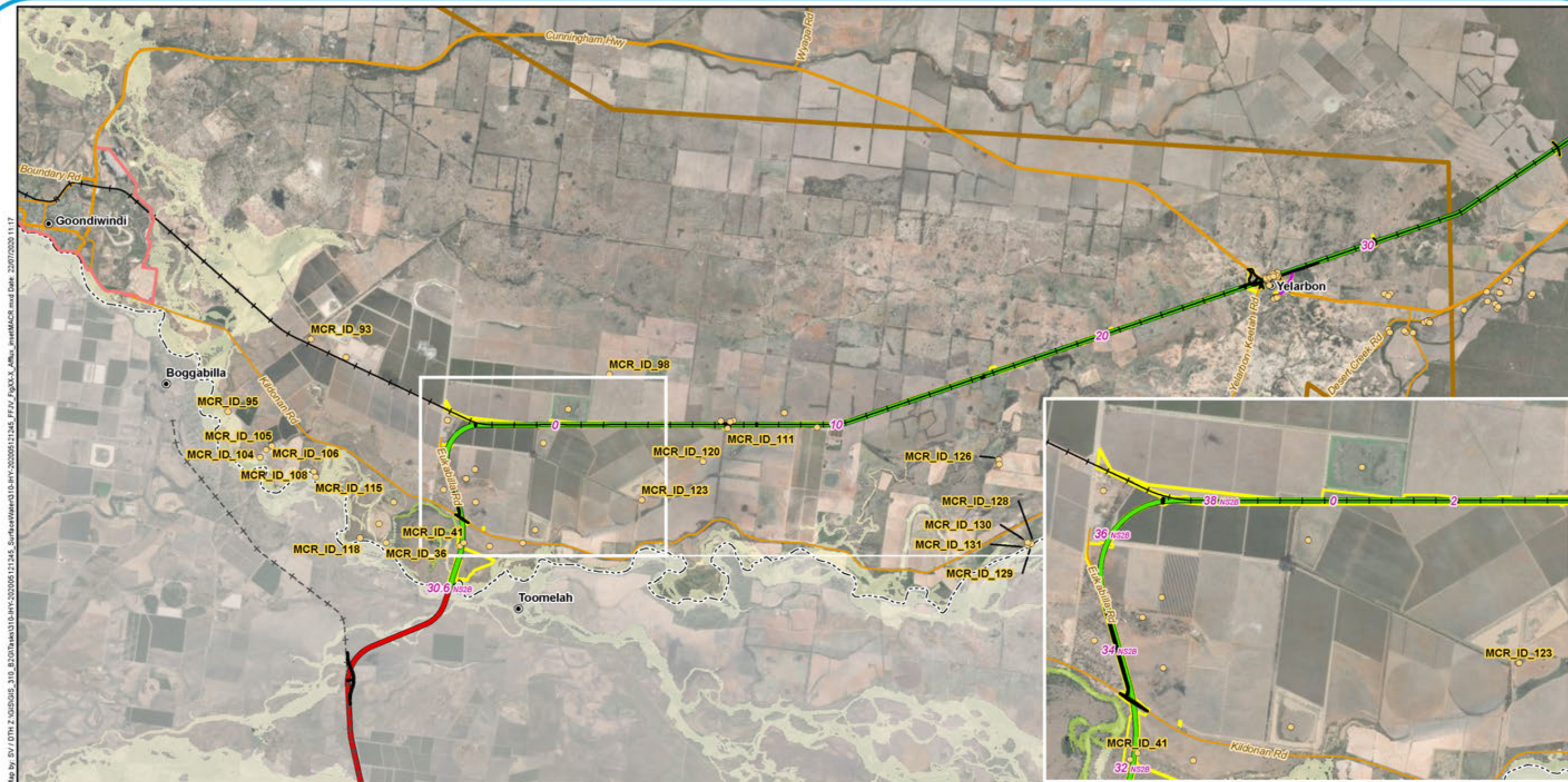
## Future Freight

Issue date: 20/07/2020    Version: 1  
Coordinate System: GDA 1994 MGA Zone 56

**Figure M4-A:**

**1% AEP peak velocity - Existing Case - Macintyre River**





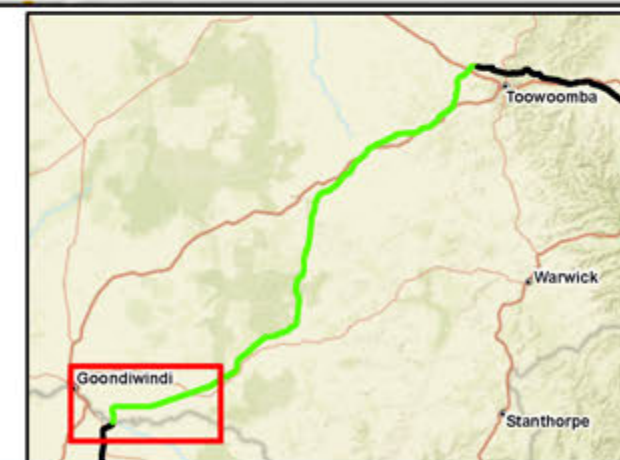
#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Road design
- NSW/QLD border

- Project footprint
- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee
- Was Wet Now Dry
- Was Dry Now Wet

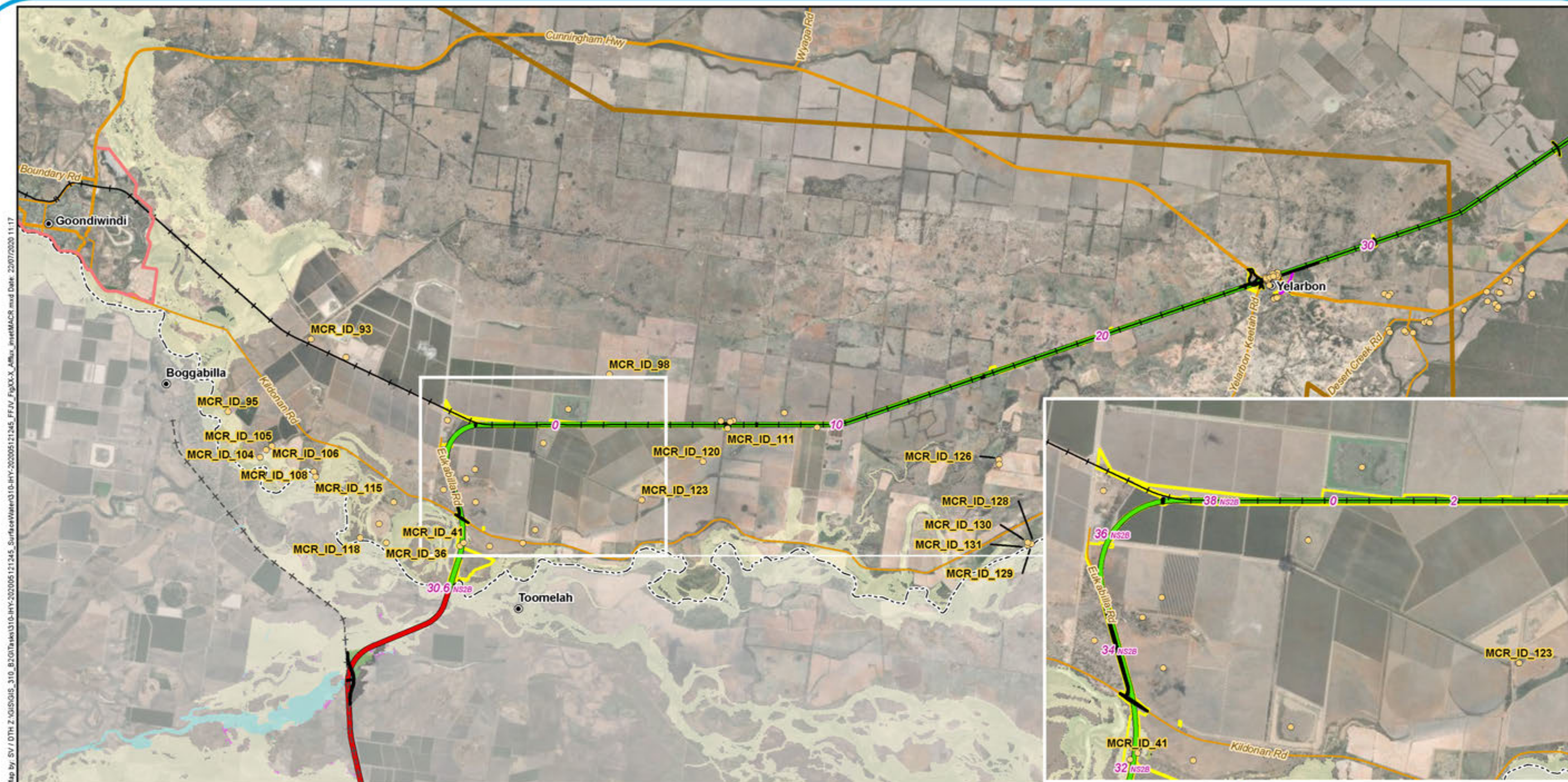
#### Change in peak water levels (m)

- |                  |                |
|------------------|----------------|
| ■ < -0.5         | ■ 0.01 to 0.05 |
| ■ -0.50 to -0.20 | ■ 0.05 to 0.10 |
| ■ -0.20 to -0.10 | ■ 0.10 to 0.20 |
| ■ -0.10 to -0.05 | ■ 0.20 to 0.50 |
| ■ -0.05 to -0.01 | ■ > 0.5        |
| ■ -0.01 to 0.01  |                |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km





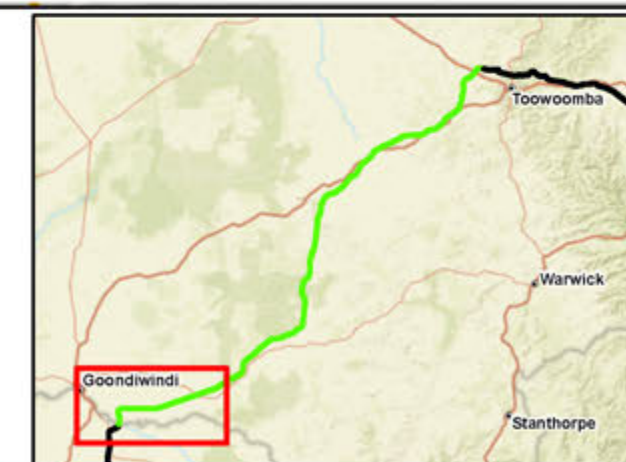
#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Road design
- NSW/QLD border

- Project footprint
- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee
- Was Wet Now Dry
- Was Dry Now Wet

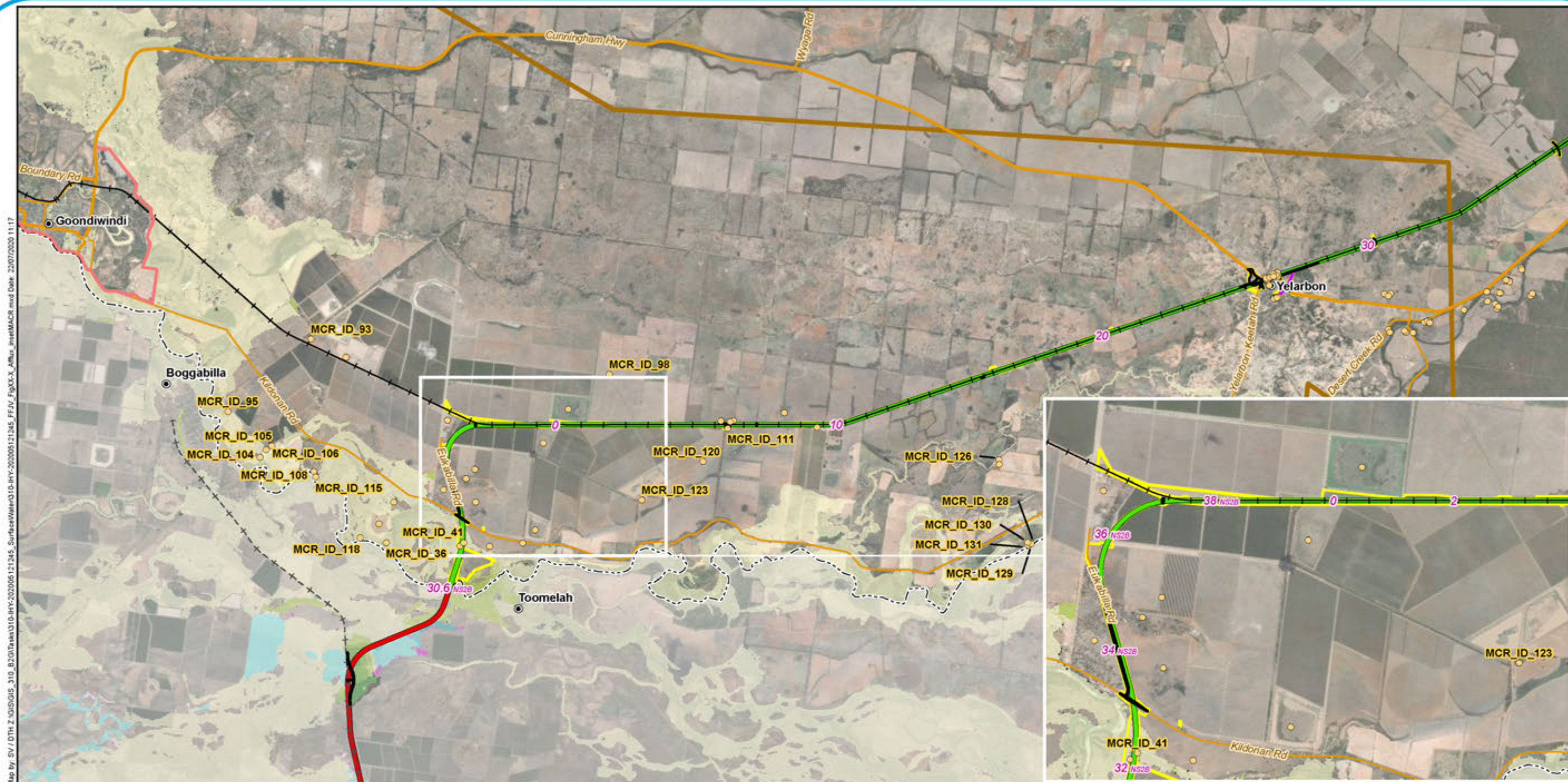
#### Change in peak water levels (m)

- |                  |                |
|------------------|----------------|
| ■ < -0.5         | ■ 0.01 to 0.05 |
| ■ -0.50 to -0.20 | ■ 0.05 to 0.10 |
| ■ -0.20 to -0.10 | ■ 0.10 to 0.20 |
| ■ -0.10 to -0.05 | ■ 0.20 to 0.50 |
| ■ -0.05 to -0.01 | ■ > 0.5        |
| ■ -0.01 to 0.01  |                |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km





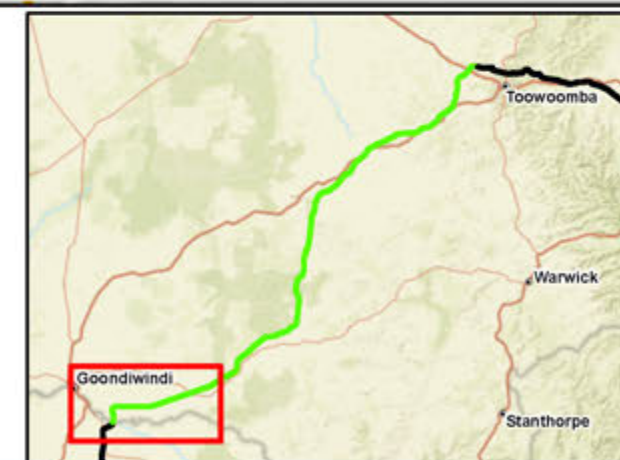
#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Road design
- NSW/QLD border

- Project footprint
- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee
- Was Wet Now Dry
- Was Dry Now Wet

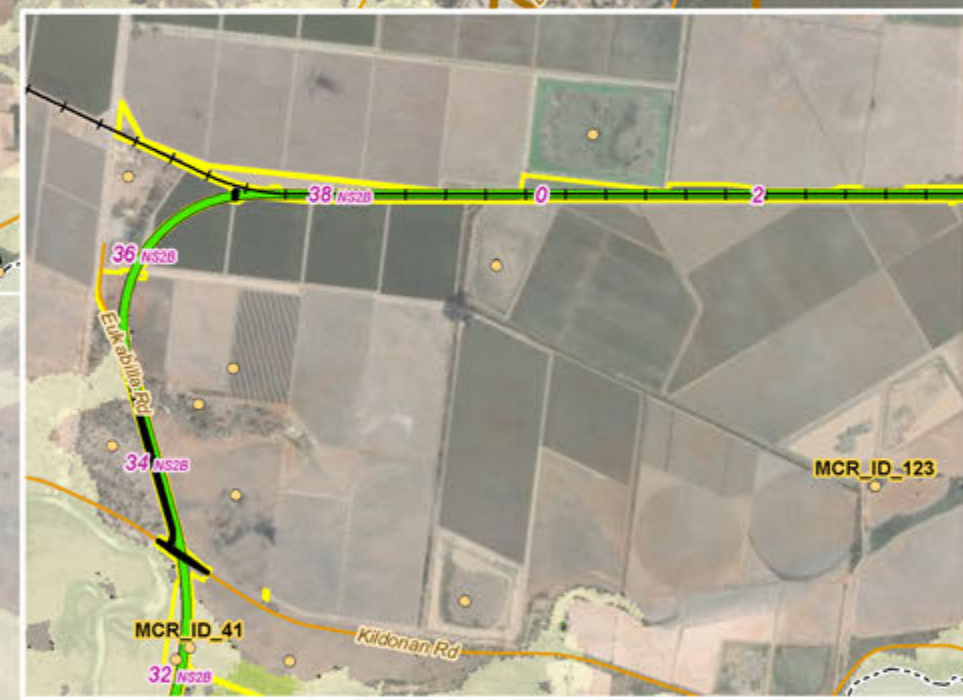
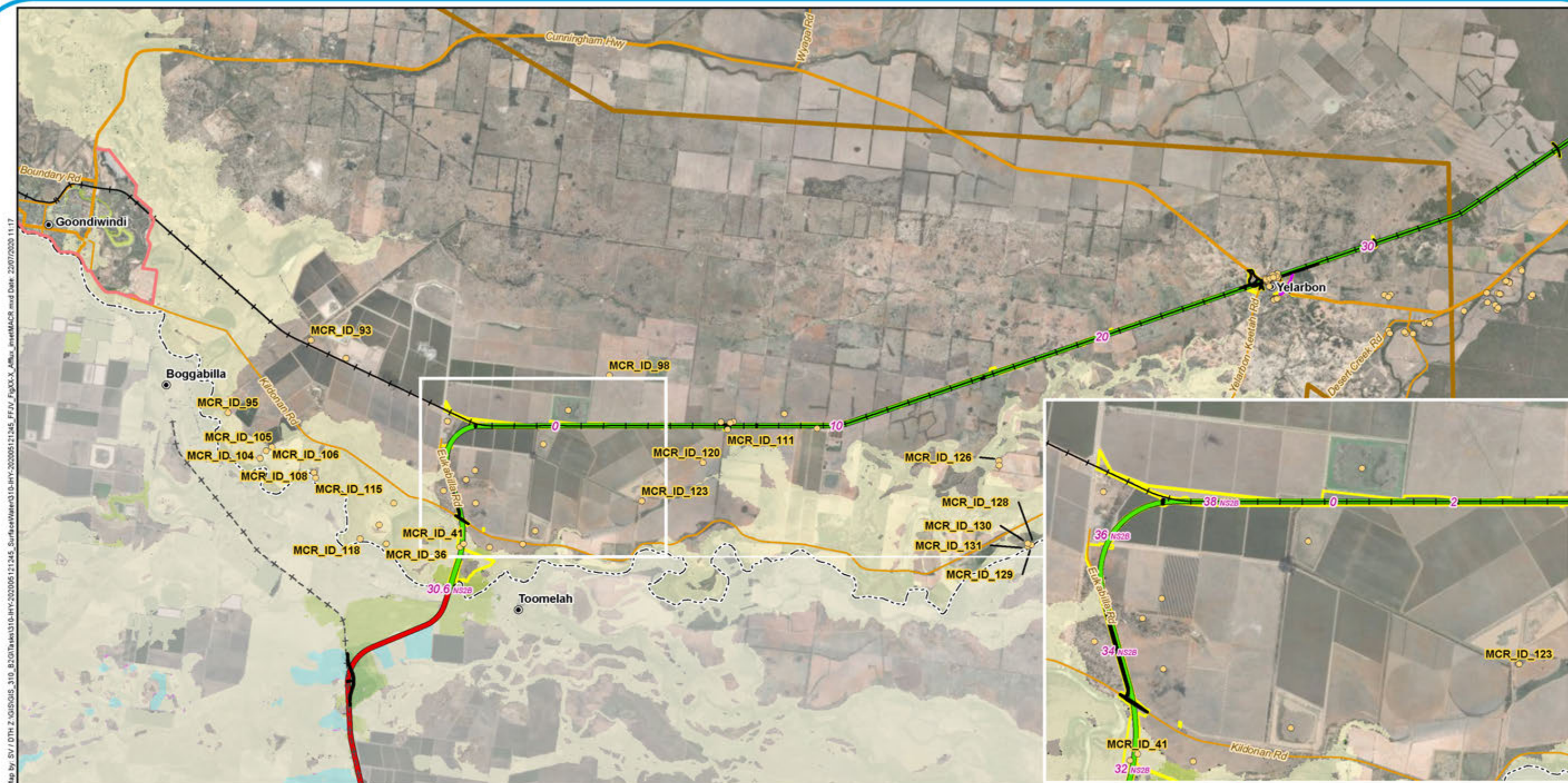
#### Change in peak water levels (m)

- |                  |                |
|------------------|----------------|
| ■ < -0.5         | ■ 0.01 to 0.05 |
| ■ -0.50 to -0.20 | ■ 0.05 to 0.10 |
| ■ -0.20 to -0.10 | ■ 0.10 to 0.20 |
| ■ -0.10 to -0.05 | ■ 0.20 to 0.50 |
| ■ -0.05 to -0.01 | ■ > 0.5        |
| ■ -0.01 to 0.01  |                |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km





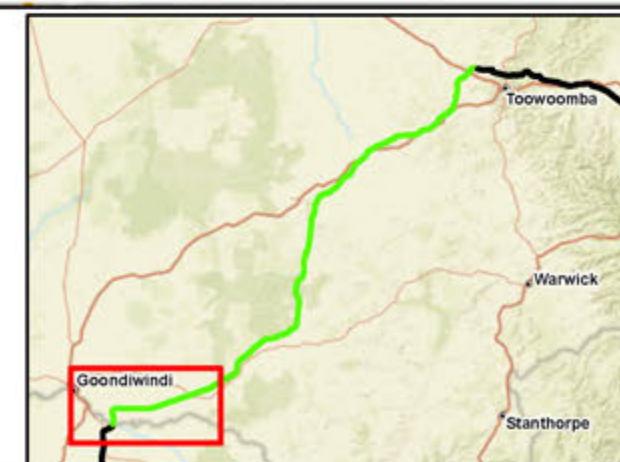
#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Road design
- NSW/QLD border

- Project footprint
- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee
- Was Wet Now Dry
- Was Dry Now Wet

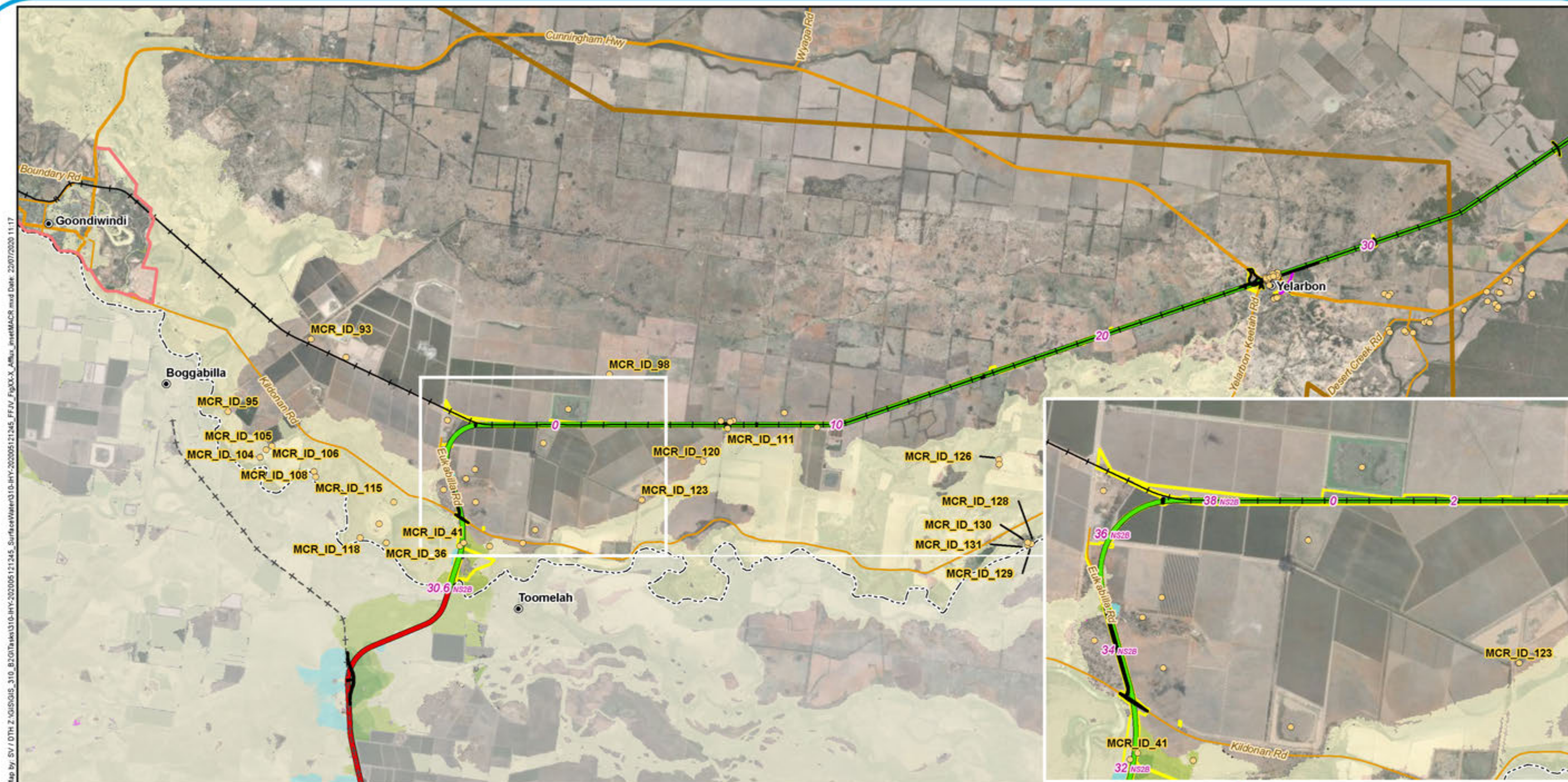
#### Change in peak water levels (m)

- |                  |                |
|------------------|----------------|
| ■ < -0.5         | ■ 0.01 to 0.05 |
| ■ -0.50 to -0.20 | ■ 0.05 to 0.10 |
| ■ -0.20 to -0.10 | ■ 0.10 to 0.20 |
| ■ -0.10 to -0.05 | ■ 0.20 to 0.50 |
| ■ -0.05 to -0.01 | ■ > 0.5        |
| ■ -0.01 to 0.01  |                |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5 km





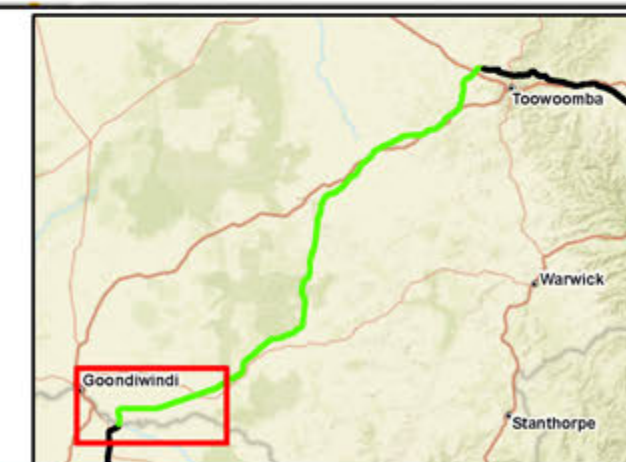
#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Road design
- NSW/QLD border

- Project footprint
- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee
- Was Wet Now Dry
- Was Dry Now Wet

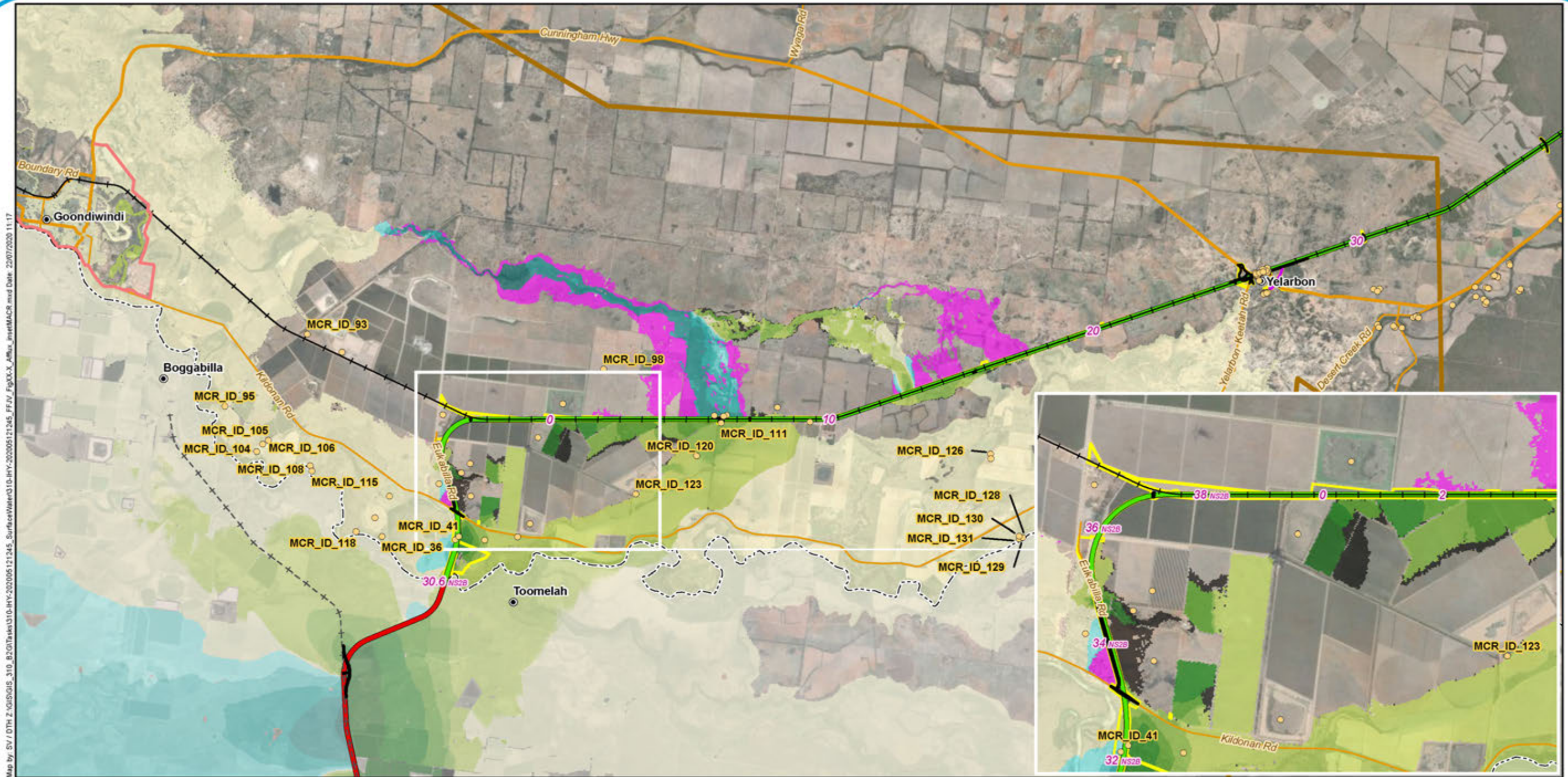
#### Change in peak water levels (m)

- |                |              |
|----------------|--------------|
| < -0.5         | 0.01 to 0.05 |
| -0.50 to -0.20 | 0.05 to 0.10 |
| -0.20 to -0.10 | 0.10 to 0.20 |
| -0.10 to -0.05 | 0.20 to 0.50 |
| -0.05 to -0.01 | > 0.5        |
| -0.01 to 0.01  |              |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km





#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Road design
- NSW/QLD border

- Project footprint
- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee
- Was Wet Now Dry
- Was Dry Now Wet

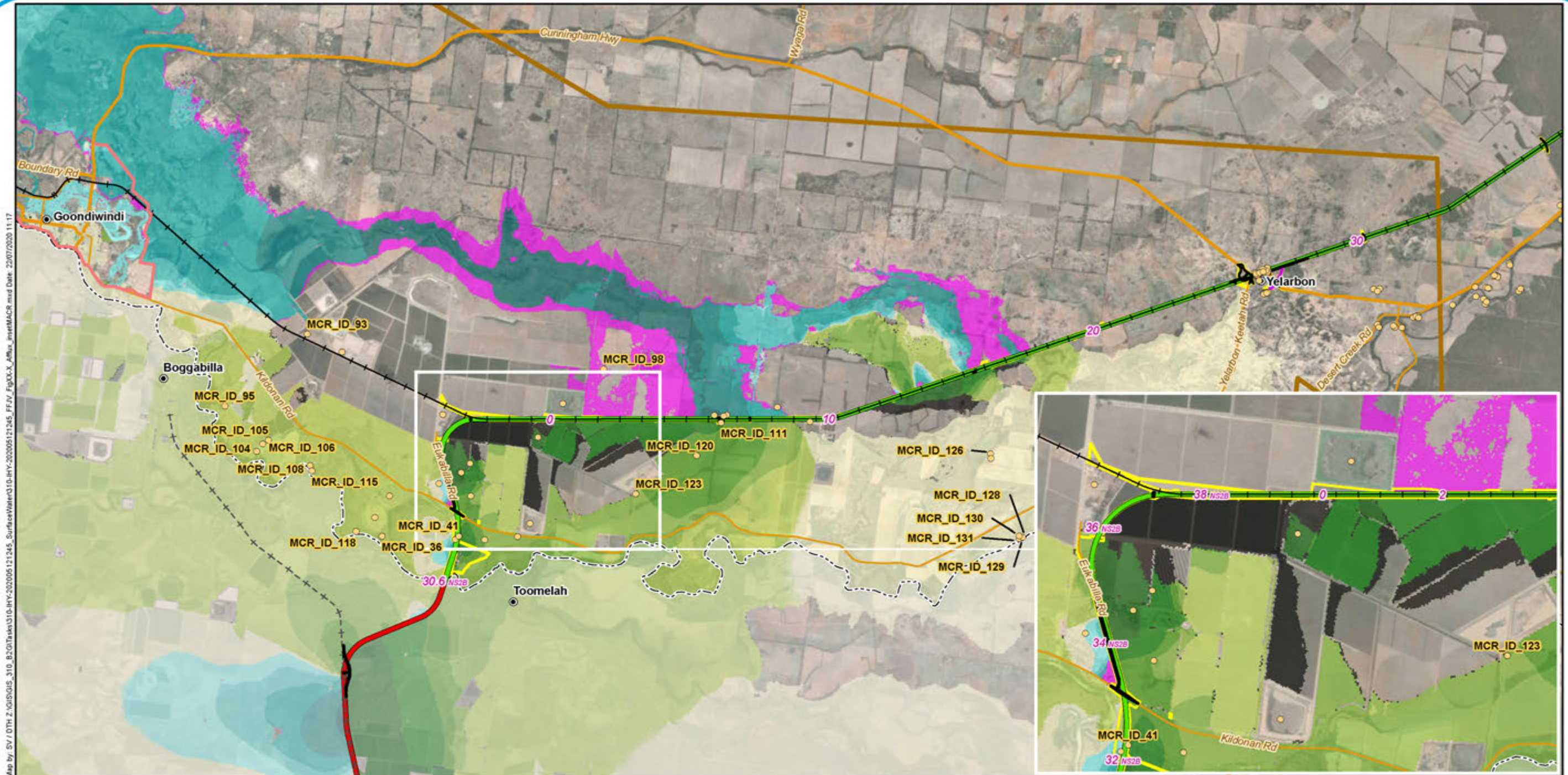
#### Change in peak water levels (m)

- |                  |                |
|------------------|----------------|
| ■ < -0.5         | ■ 0.01 to 0.05 |
| ■ -0.50 to -0.20 | ■ 0.05 to 0.10 |
| ■ -0.20 to -0.10 | ■ 0.10 to 0.20 |
| ■ -0.10 to -0.05 | ■ 0.20 to 0.50 |
| ■ -0.05 to -0.01 | ■ > 0.5        |
| ■ -0.01 to 0.01  |                |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km





#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Road design
- NSW/QLD border

- Project footprint
- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in peak water levels (m)

- |                  |                |
|------------------|----------------|
| ■ < -0.5         | ■ 0.01 to 0.05 |
| ■ -0.50 to -0.20 | ■ 0.05 to 0.10 |
| ■ -0.20 to -0.10 | ■ 0.10 to 0.20 |
| ■ -0.10 to -0.05 | ■ 0.20 to 0.50 |
| ■ -0.05 to -0.01 | ■ > 0.5        |
| ■ -0.01 to 0.01  |                |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km



**Future Freight**  
 Integrating Community, Environment and Engineering

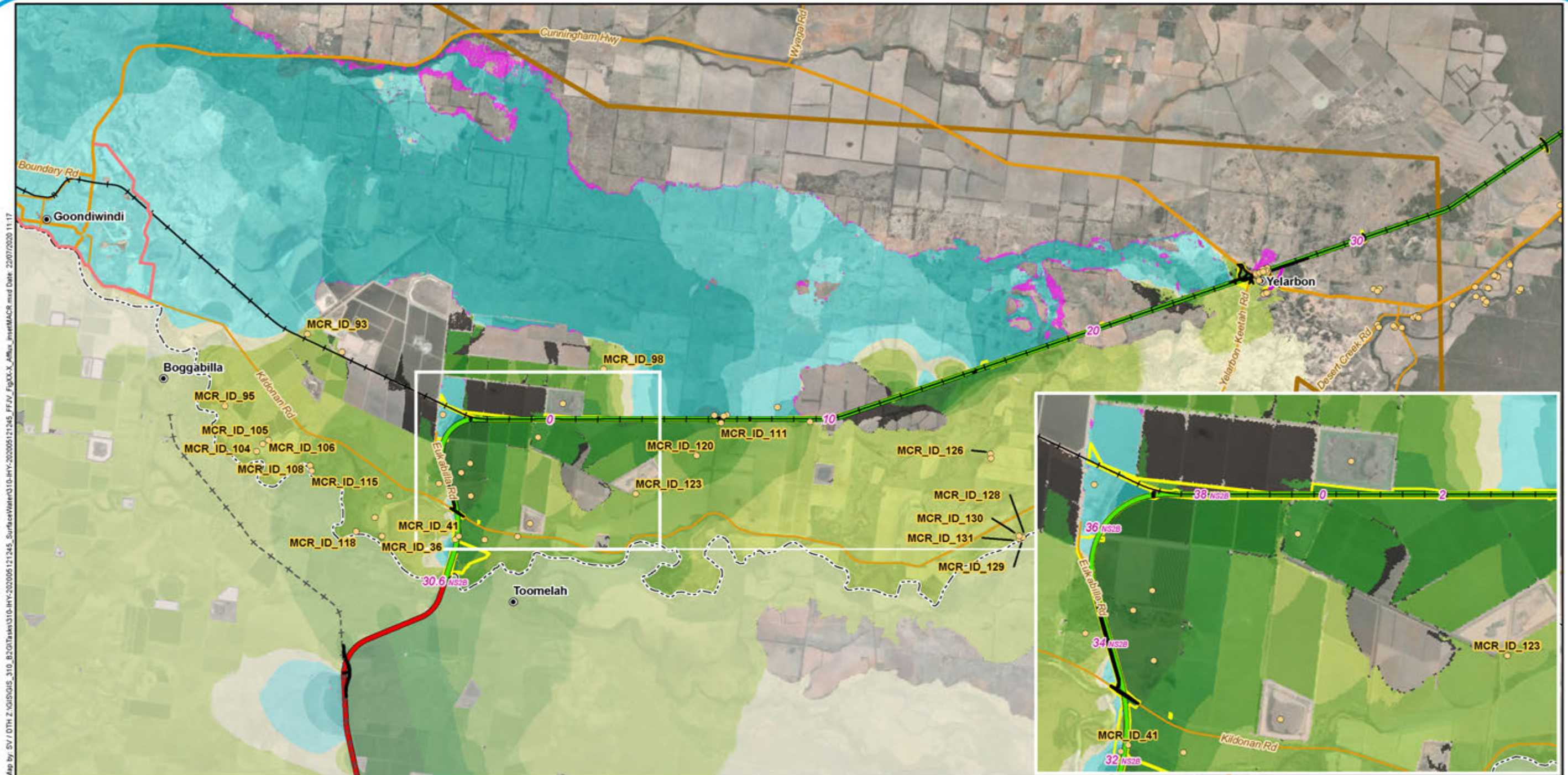
Issue date: 20/07/2020 Version: 1  
 Coordinate System: GDA 1994 MGA Zone 56

**Border to Gowrie**

**Figure M5-G:**

**1 in 10,000 AEP - design afflux - Macintyre River**





#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Road design
- NSW/QLD border

- Project footprint
- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in peak water levels (m)

- |                  |                |
|------------------|----------------|
| ■ < -0.5         | ■ 0.01 to 0.05 |
| ■ -0.50 to -0.20 | ■ 0.05 to 0.10 |
| ■ -0.20 to -0.10 | ■ 0.10 to 0.20 |
| ■ -0.10 to -0.05 | ■ 0.20 to 0.50 |
| ■ -0.05 to -0.01 | ■ > 0.5        |
| ■ -0.01 to 0.01  |                |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km



**Future Freight**  
 Integrating Community, Environment and Engineering

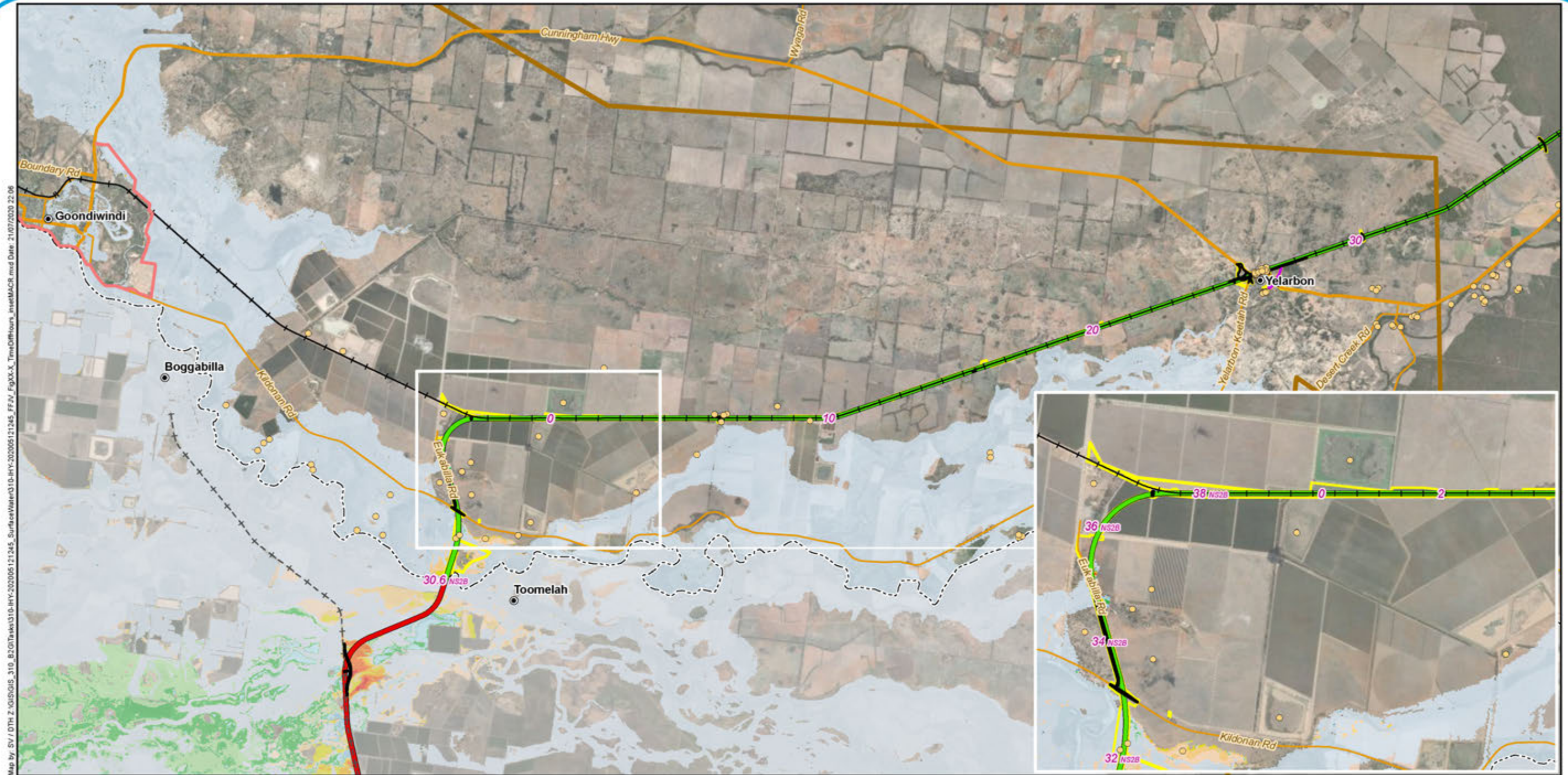
Issue date: 20/07/2020 Version: 1  
 Coordinate System: GDA 1994 MGA Zone 56

**Border to Gowrie**

**Figure M5-H:**

**PMF - design afflux - Macintyre River**





#### Legend

- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Major roads
- Minor roads
- Road design
- NSW/QLD border
- Project footprint

- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee

#### Change in Inundation Time (hours)

- |                         |                         |
|-------------------------|-------------------------|
| Over 10 hour decrease   | Up to 0.5 hour increase |
| Up to 10 hour decrease  | Up to 1 hour increase   |
| Up to 5 hour decrease   | Up to 2 hour increase   |
| Up to 2 hour decrease   | Up to 5 hour increase   |
| Up to 1 hour decrease   | Up to 10 hour increase  |
| Up to 0.5 hour decrease | Over 10 hour increase   |
| Within 15 minutes       |                         |



A3 scale: 1:150,000  
0 1.5 3 4.5 6 7.5km



**Future Freight**  
Integrating Community, Environment and Engineering

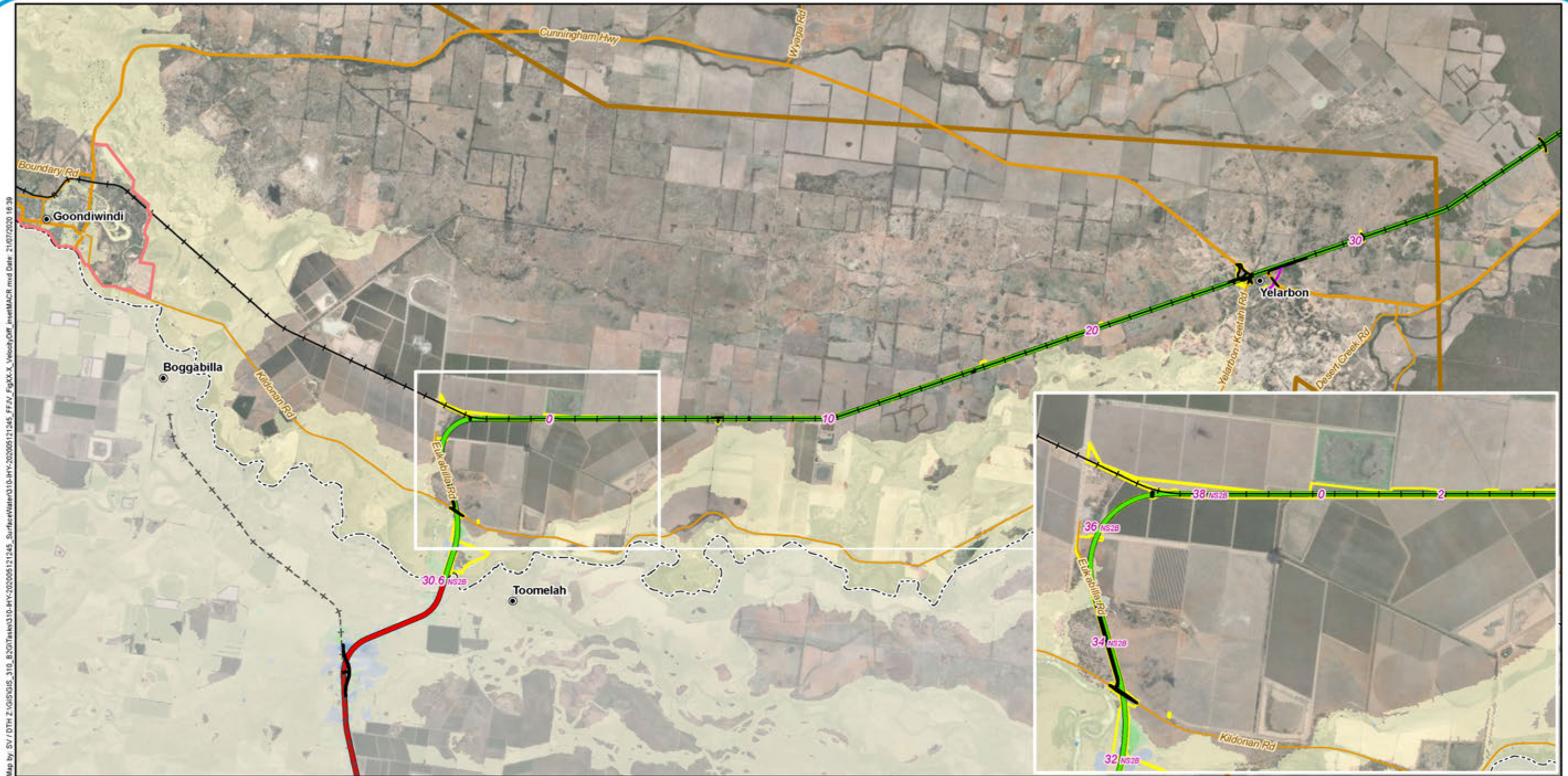
Issue date: 20/07/2020 Version: 1  
Coordinate System: GDA 1994 MGA Zone 56

**Border to Gowrie**

**Figure M5-I:**

**1% AEP - change in time of inundation - Macintyre River**





#### Legend

- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Major roads
- Minor roads
- Road design
- NSW/QLD border
- Project footprint

- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee

#### Change in peak velocity (m/s)

- |                  |                |
|------------------|----------------|
| ■ < -0.50        | ■ 0.01 to 0.05 |
| ■ -0.50 to -0.20 | ■ 0.05 to 0.10 |
| ■ -0.20 to -0.10 | ■ 0.10 to 0.20 |
| ■ -0.10 to -0.05 | ■ 0.20 to 0.50 |
| ■ -0.05 to -0.01 | ■ > 0.50       |
| ■ -0.01 to 0.01  |                |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km



**Future Freight**  
 Integrating Community, Environment and Engineering

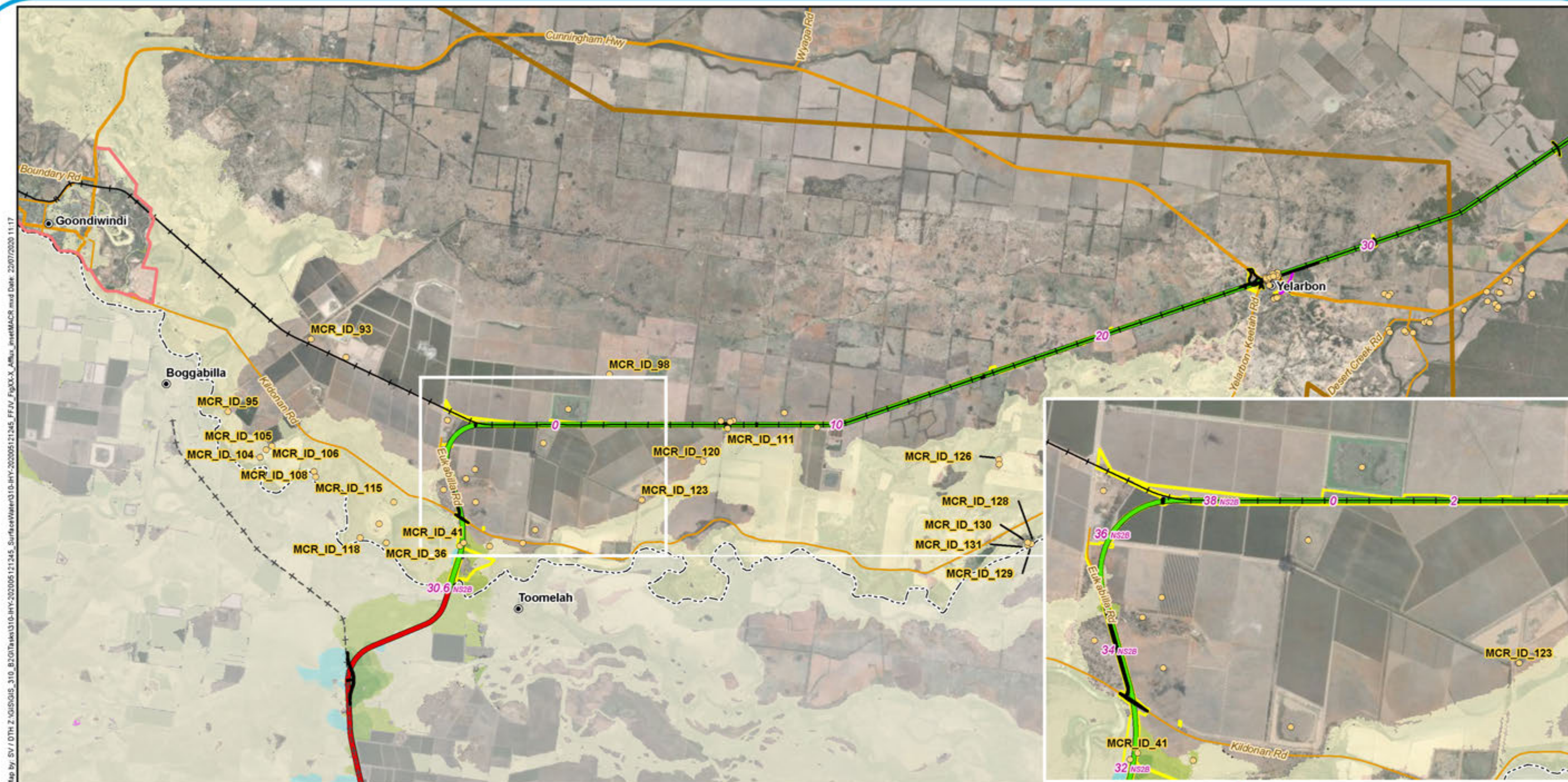
Issue date: 21/07/2020 Version: 1  
 Coordinate System: GDA 1994 MGA Zone 56

**Border to Gowrie**

**Figure M5-J:**

**1% AEP - change in velocity - Macintyre River**





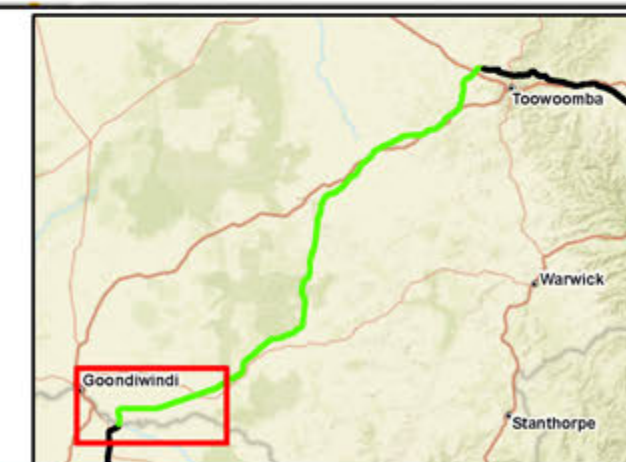
#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Road design
- NSW/QLD border

- Project footprint
- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee
- Was Wet Now Dry
- Was Dry Now Wet

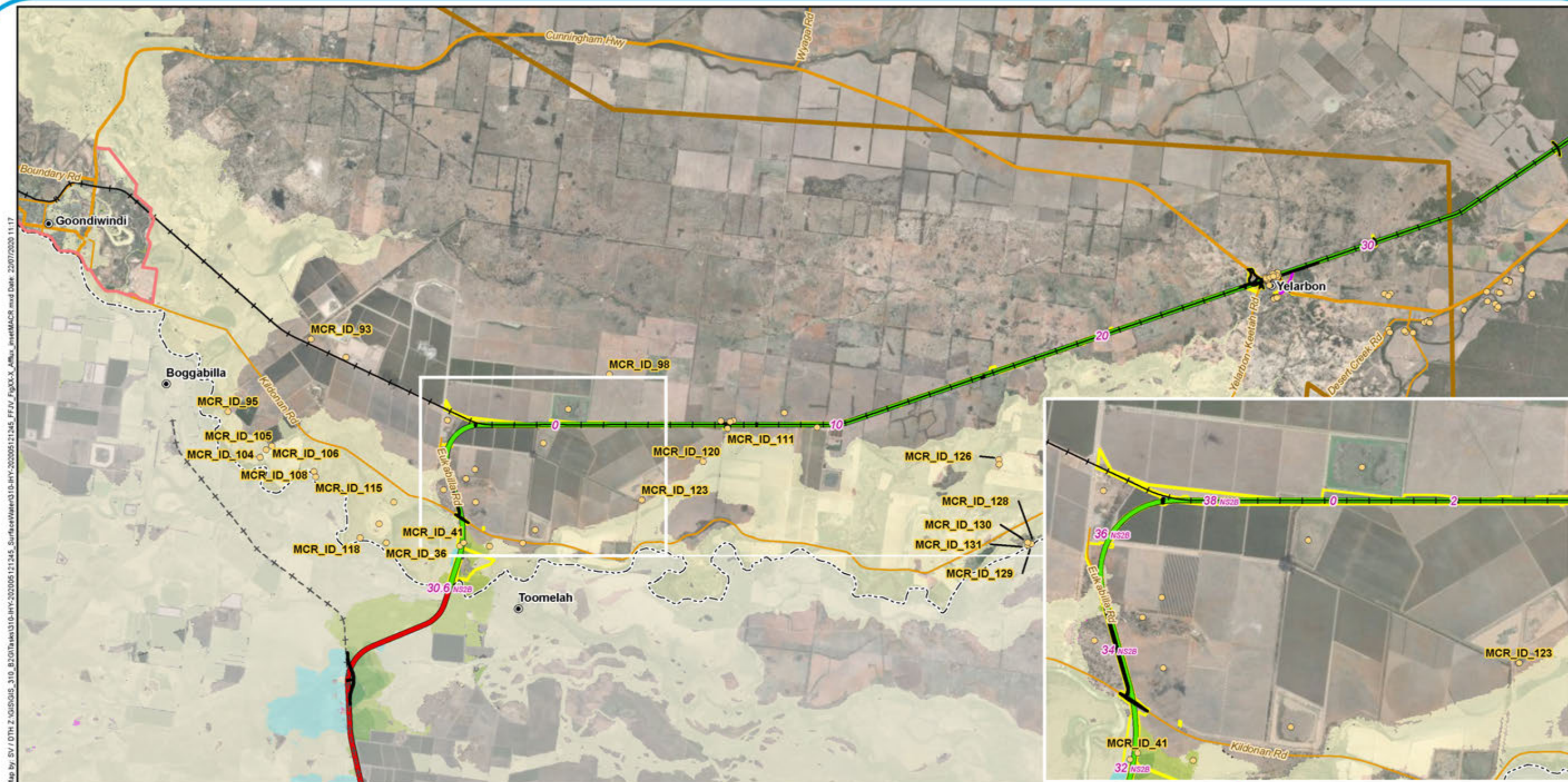
#### Change in peak water levels (m)

- |                |              |
|----------------|--------------|
| < -0.5         | 0.01 to 0.05 |
| -0.50 to -0.20 | 0.05 to 0.10 |
| -0.20 to -0.10 | 0.10 to 0.20 |
| -0.10 to -0.05 | 0.20 to 0.50 |
| -0.05 to -0.01 | > 0.5        |
| -0.01 to 0.01  |              |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km





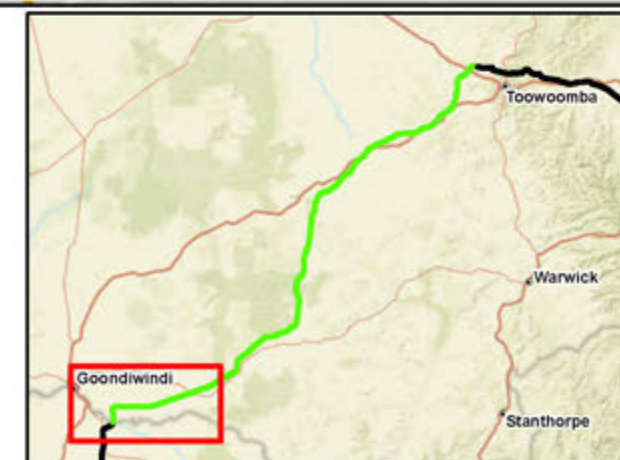
#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Road design
- NSW/QLD border

- Project footprint
- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee
- Was Wet Now Dry
- Was Dry Now Wet

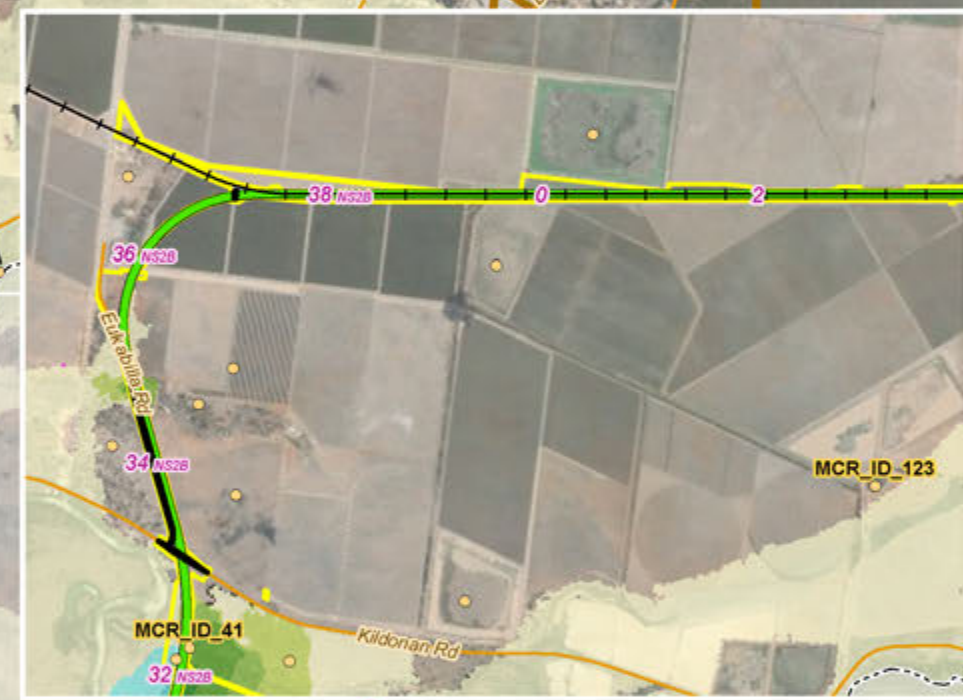
#### Change in peak water levels (m)

- |                  |                |
|------------------|----------------|
| ■ < -0.5         | ■ 0.01 to 0.05 |
| ■ -0.50 to -0.20 | ■ 0.05 to 0.10 |
| ■ -0.20 to -0.10 | ■ 0.10 to 0.20 |
| ■ -0.10 to -0.05 | ■ 0.20 to 0.50 |
| ■ -0.05 to -0.01 | ■ > 0.5        |
| ■ -0.01 to 0.01  |                |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km





#### Legend

- Flood sensitive receptor
- 5 Chainage (km)
- Localities
- Existing rail (operational)
- Border to Gowrie alignment
- North Star to NSW/QLD border alignment
- Road design
- NSW/QLD border

- Project footprint
- Hydraulic model extent
- Yelarbon levee
- Goondiwindi levee
- Was Wet Now Dry
- Was Dry Now Wet

#### Change in peak water levels (m)

- |                                                                                            |                                                                                          |
|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| <span style="background-color: #008080; width: 10px; height: 10px;"></span> < -0.5         | <span style="background-color: #90EE90; width: 10px; height: 10px;"></span> 0.01 to 0.05 |
| <span style="background-color: #4682B4; width: 10px; height: 10px;"></span> -0.50 to -0.20 | <span style="background-color: #7CFC00; width: 10px; height: 10px;"></span> 0.05 to 0.10 |
| <span style="background-color: #40E0D0; width: 10px; height: 10px;"></span> -0.20 to -0.10 | <span style="background-color: #3CB371; width: 10px; height: 10px;"></span> 0.10 to 0.20 |
| <span style="background-color: #AFEEEE; width: 10px; height: 10px;"></span> -0.10 to -0.05 | <span style="background-color: #228B22; width: 10px; height: 10px;"></span> 0.20 to 0.50 |
| <span style="background-color: #7FFFD4; width: 10px; height: 10px;"></span> -0.05 to -0.01 | <span style="background-color: #006400; width: 10px; height: 10px;"></span> > 0.5        |
| <span style="background-color: #FFFFE0; width: 10px; height: 10px;"></span> -0.01 to 0.01  |                                                                                          |



A3 scale: 1:150,000  
 0 1.5 3 4.5 6 7.5km



APPENDIX

# Q2

## Hydrology and Flooding Technical Report—Volume II

### **Appendix N**    B2G Flood Sensitive Receptors

INLAND RAIL—BORDER TO GOWRIE ENVIRONMENTAL IMPACT STATEMENT



# Appendix N

## B2G Flood Sensitive Receptors





#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- Localities
- North Star to NSW/QLD border alignment
- B2G project alignment
- Existing rail

- Minor roads
- Watercourses
- NSW/QLD border



A3 scale: 1:75,000  
0 0.7 1.4 2.1 2.8 3.5km



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Coordinate System: GDA 1994 MGA Zone 56





#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- Localities
- B2G project alignment
- Existing rail
- Major roads
- Minor roads
- Watercourses
- NSW/QLD border
- 1:10,000 scale map extents
- Yelarbon town outline



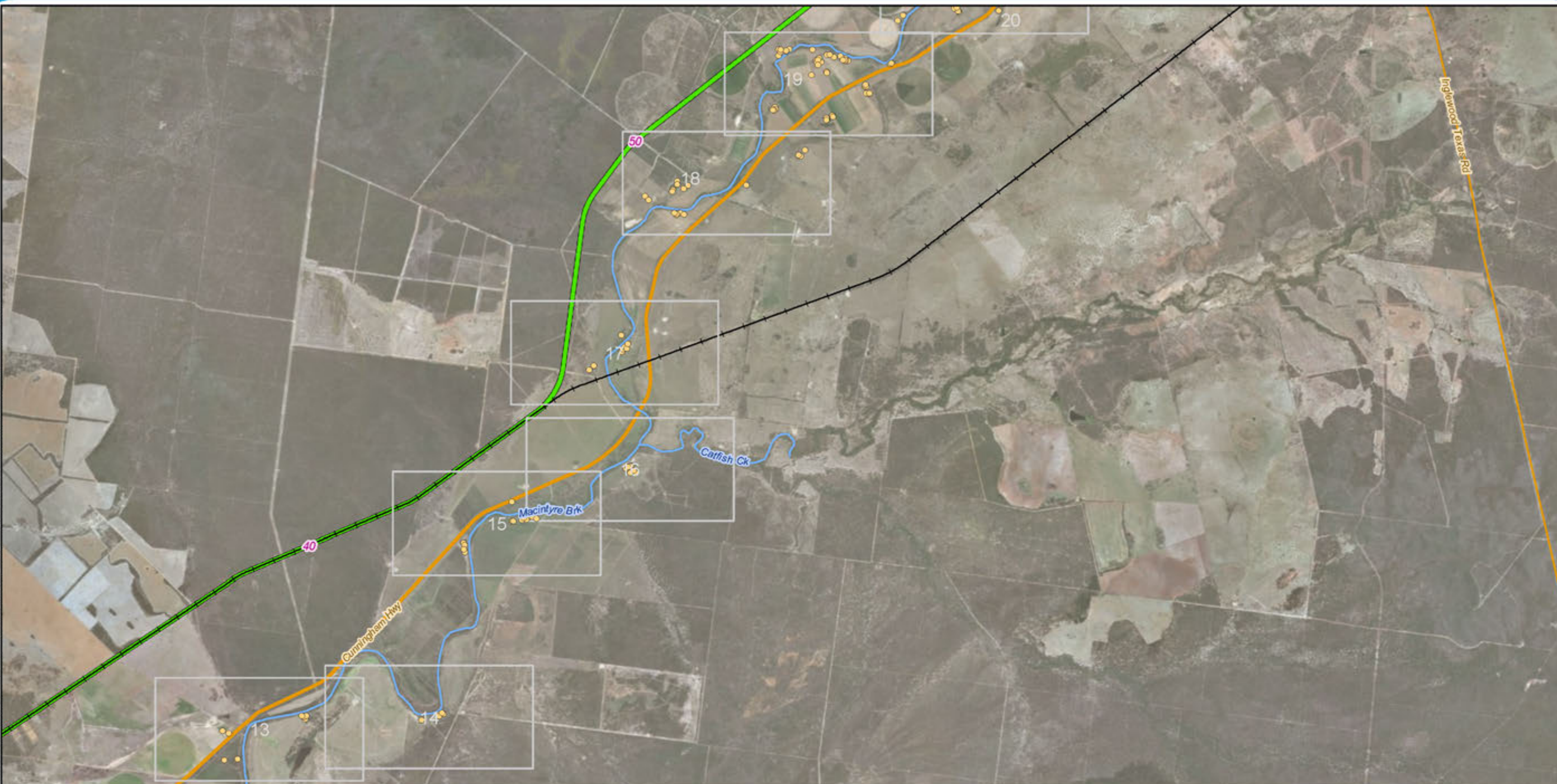
A3 scale: 1:75,000  
 0 0.7 1.4 2.1 2.8 3.5km



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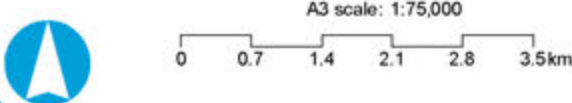
Issue date: 26/11/2019 Version: 0  
 Coordinate System: GDA 1994 MGA Zone 56





**Legend**

- Flood sensitive Receptors
- Chainage (km)
- B2G project alignment
- Existing rail
- Major roads
- Minor roads
- Watercourses
- 1:10,000 scale map extents





Map by: MF 21050505\_310\_8201Task0310-1HY-201811181414\_FF JV Flood\_sensitive\_receptors310-1HY-201811181414.mxd Date: 26/11/2019 13:54



#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- Localities
- B2G project alignment
- Existing rail
- Major roads
- Minor roads
- Watercourses
- 1:10,000 scale map extents



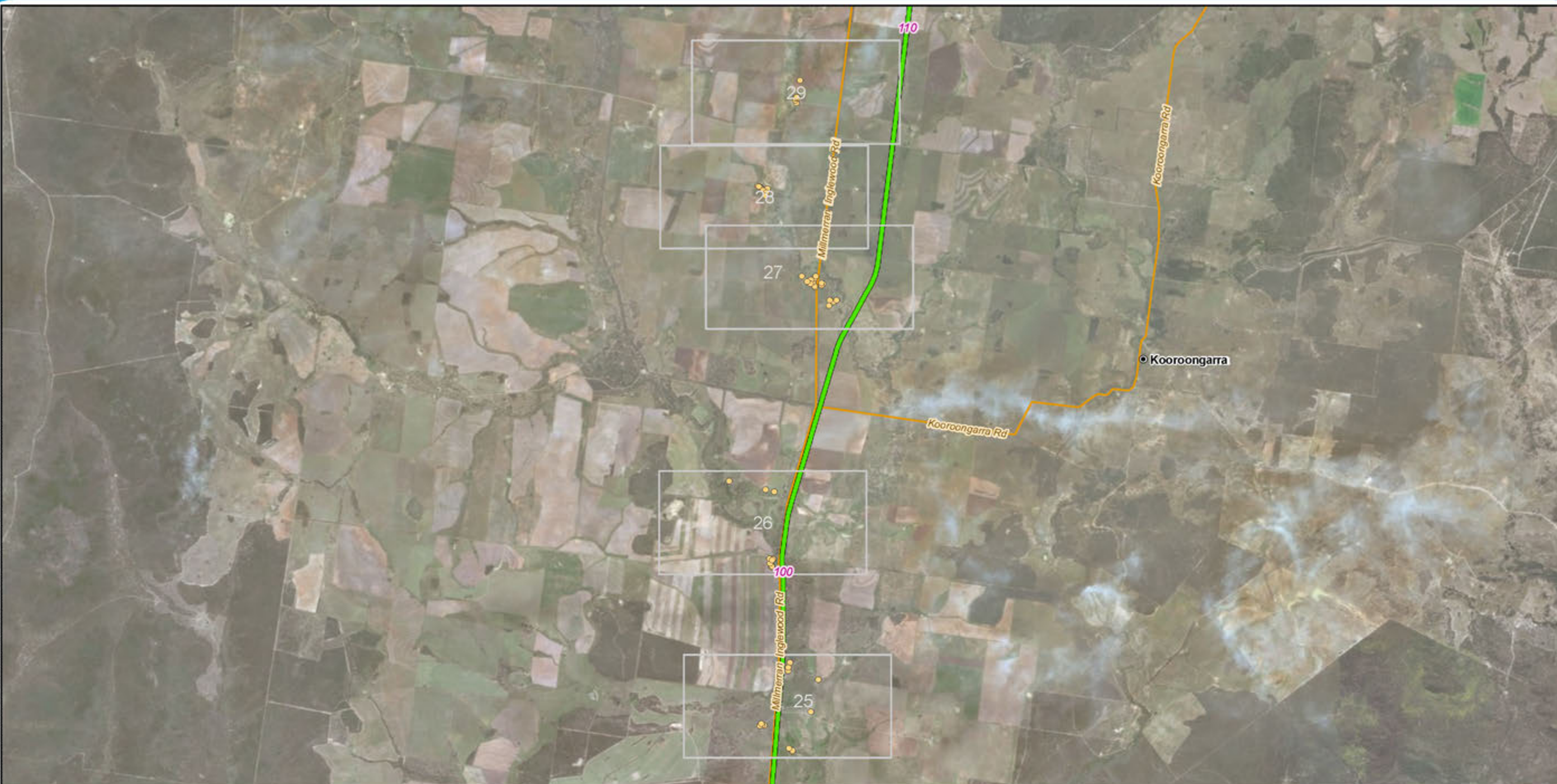
A3 scale: 1:75,000  
 0 0.7 1.4 2.1 2.8 3.5km



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**Legend**

- Flood sensitive Receptors
- 5 Chainage (km)
- Localities
- B2G project alignment
- Minor roads
- 1:10,000 scale map extents



A3 scale: 1:75,000  
 0 0.7 1.4 2.1 2.8 3.5km



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#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- Localities
- B2G project alignment
- Major roads
- Minor roads
- Watercourses
- 1:10,000 scale map extents



A3 scale: 1:75,000  
0 0.7 1.4 2.1 2.8 3.5km



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#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- Localities
- B2G project alignment
- Existing rail
- Major roads
- Minor roads
- Watercourses
- 1:10,000 scale map extents



A3 scale: 1:75,000  
 0 0.7 1.4 2.1 2.8 3.5km

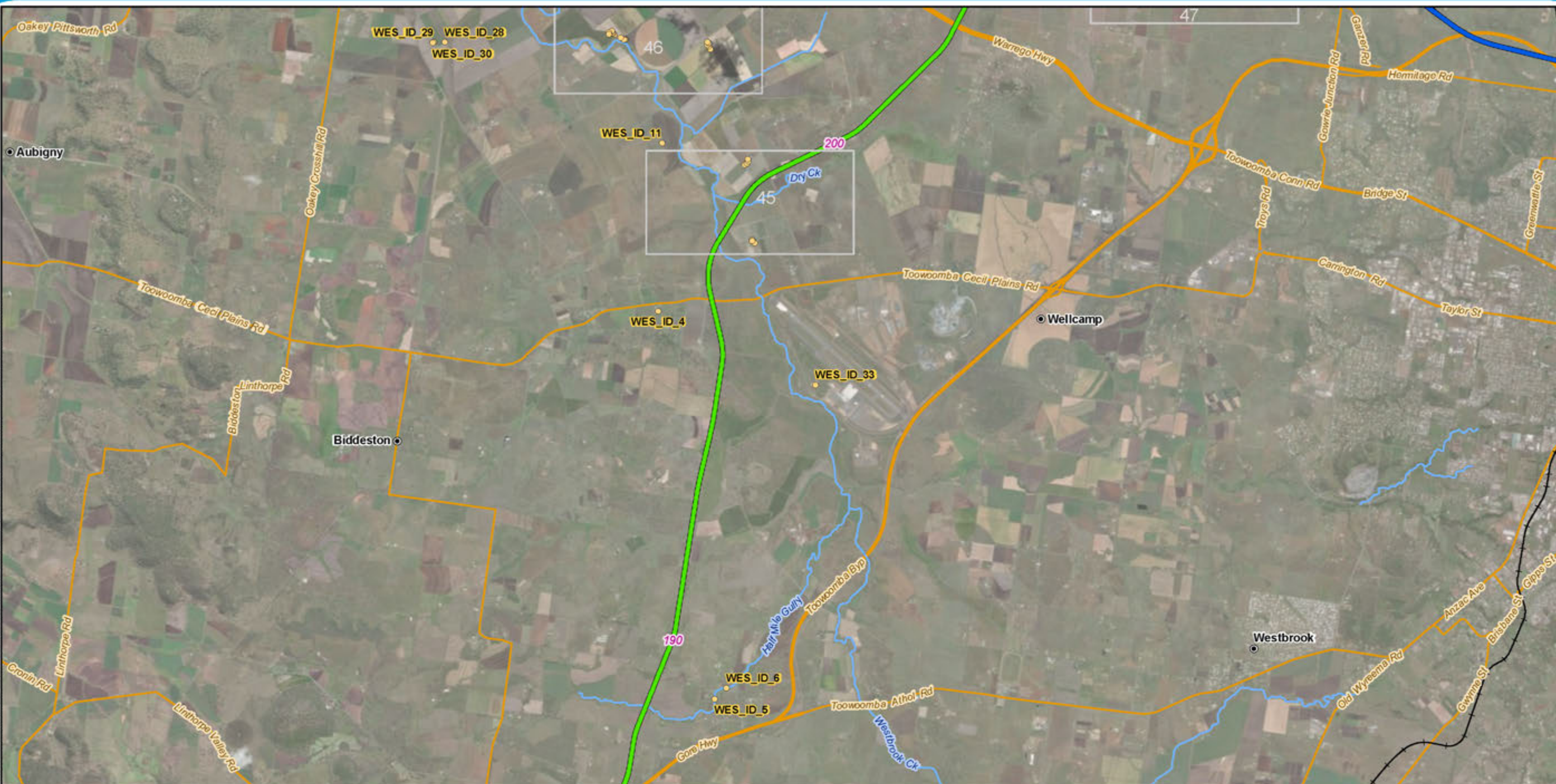


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**Border to Gowrie**  
**Appendix N:**  
**Map 7 of 47**





#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- Localities
- B2G project alignment
- Gowrie to Helidon alignment
- Existing rail
- Major roads
- Minor roads
- Watercourses
- 1:10,000 scale map extents



A3 scale: 1:75,000  
 0 0.7 1.4 2.1 2.8 3.5km

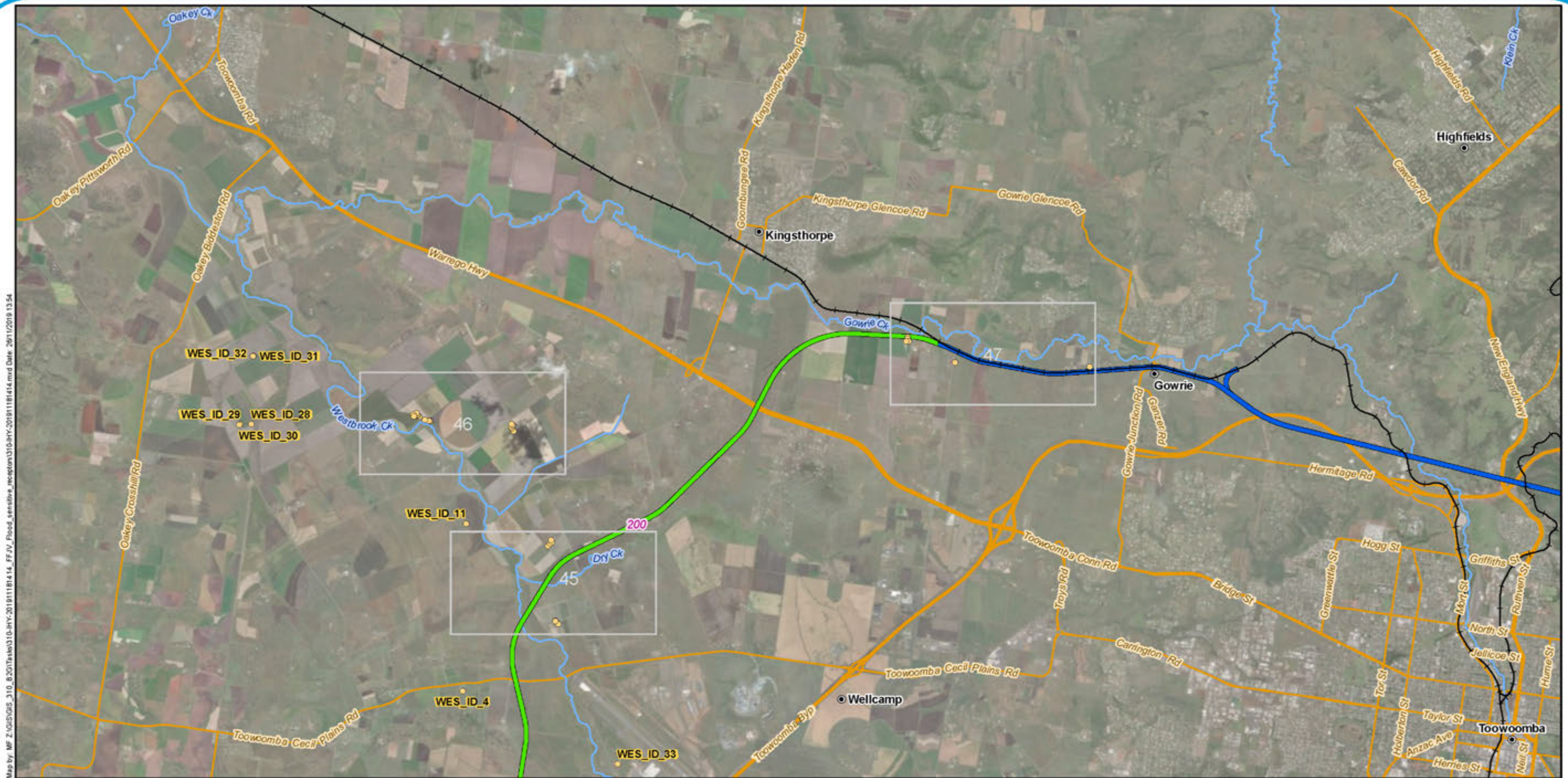


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 Coordinate System: GDA 1994 MGA Zone 56

**Border to Gowrie**  
**Appendix N:**  
**Map 8 of 47**





#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- Localities
- B2G project alignment
- Gowrie to Helidon alignment
- Existing rail
- Major roads
- Minor roads
- Watercourses
- 1:10,000 scale map extents



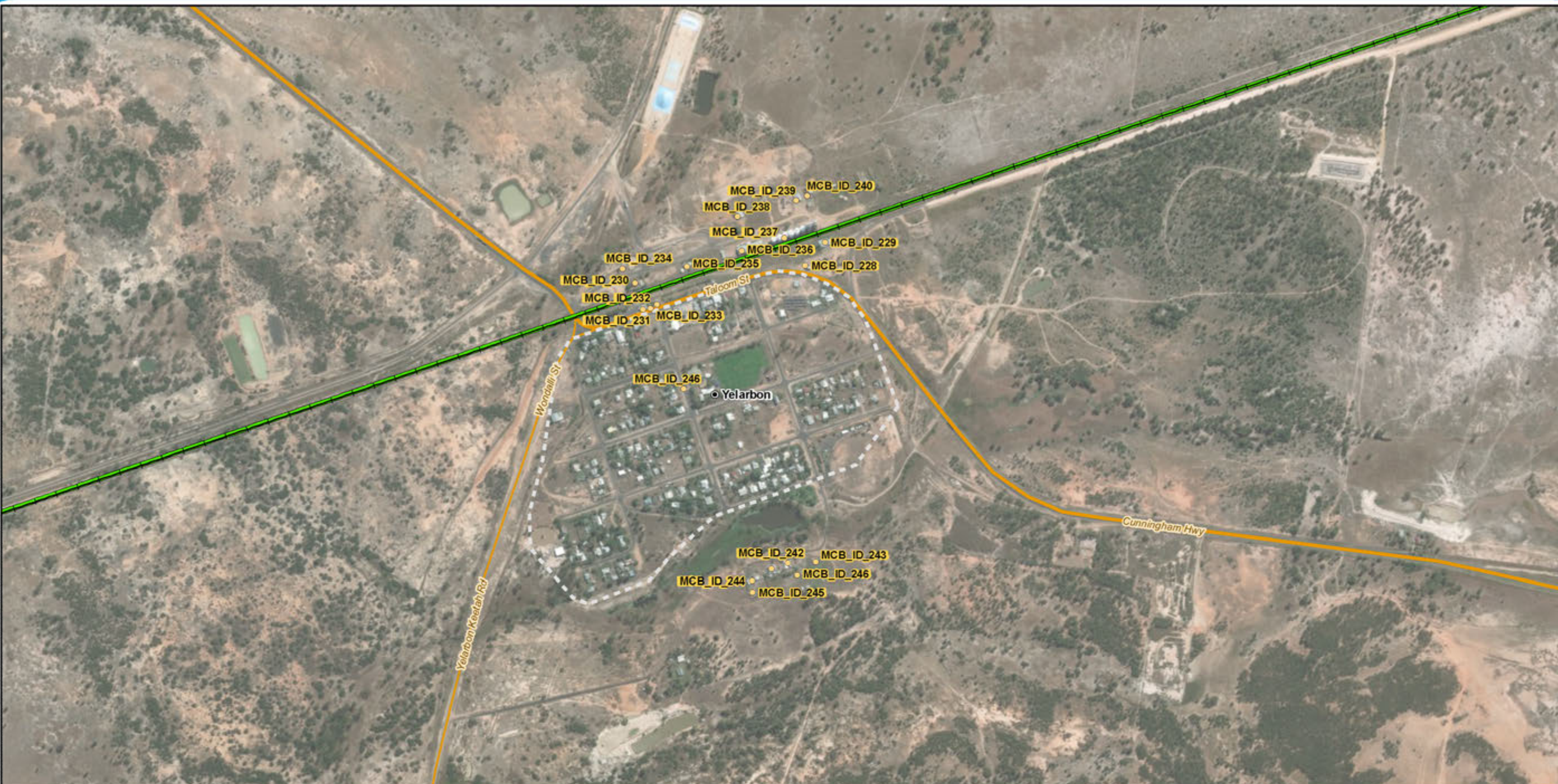
A3 scale: 1:75,000  
 0 0.7 1.4 2.1 2.8 3.5km



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 Coordinate System: GDA 1994 MGA Zone 56





#### Legend

- Flood sensitive Receptors
- Major roads
- Minor roads
- 5 Chainage (km)
- Localities
- Yelarbon town outline
- B2G project alignment
- Existing rail



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



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 Coordinate System: GDA 1994 MGA Zone 56





# Legend

- Flood sensitive Receptors
- Major roads
- Minor roads
- Watercourses
- 5 Chainage (km)



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



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**Border to Gowrie**

**Appendix N:**  
**Map 11 of 47**





**Legend**

- Flood sensitive Receptors
- Major roads
- Watercourses
- 5 Chainage (km)



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km





#### Legend

- Flood sensitive Receptors
- Major roads
- Watercourses
- 5 Chainage (km)



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



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 Coordinate System: GDA 1994 MGA Zone 56

**Border to Gowrie**  
**Appendix N:**  
**Map 13 of 47**





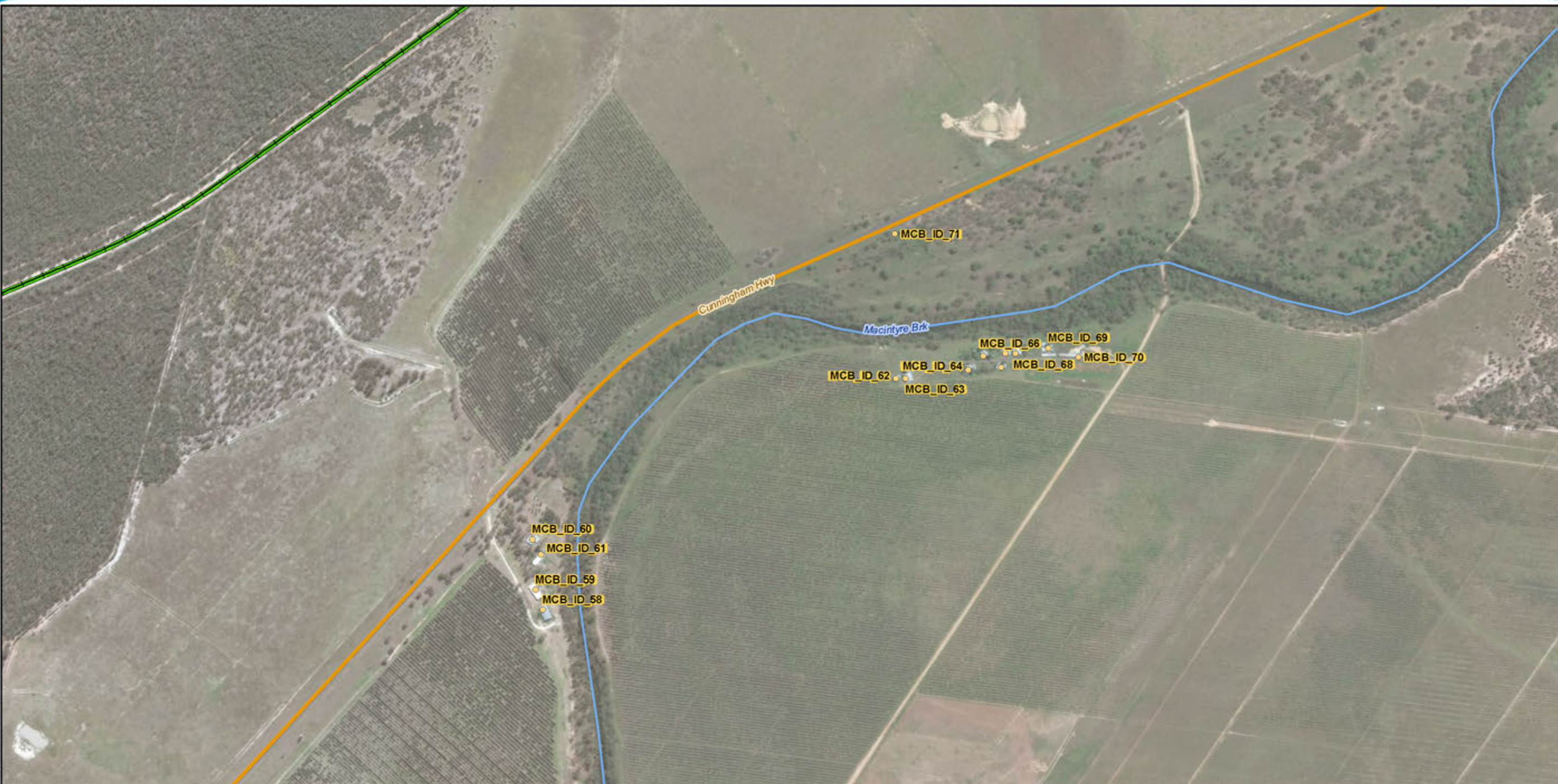
#### Legend

- Flood sensitive Receptors
- Major roads
- Chainage (km)
- Watercourses



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km





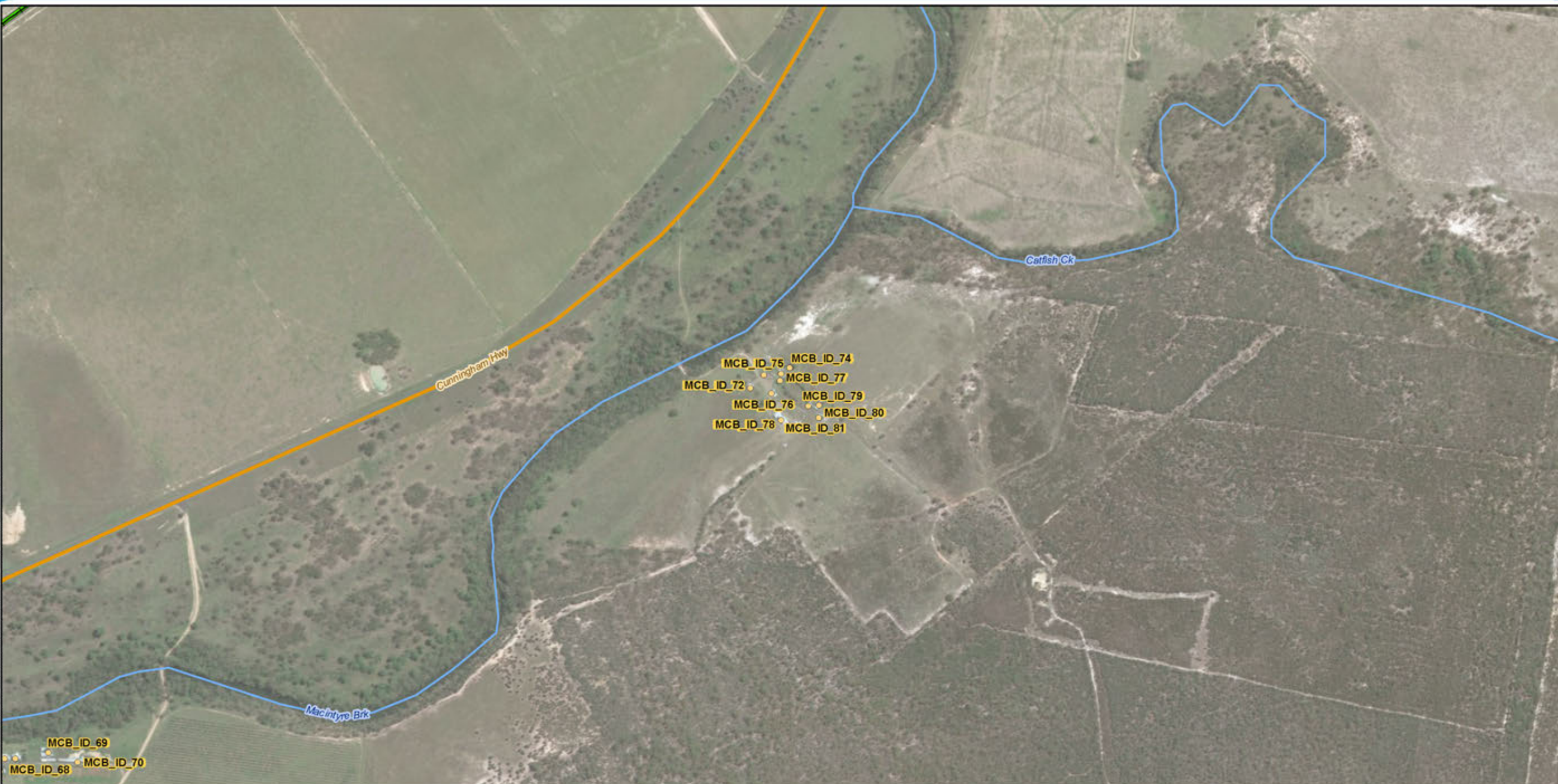
#### Legend

- Flood sensitive Receptors
- Major roads
- Chainage (km)
- Watercourses
- B2G project alignment
- Existing rail



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km





#### Legend

- Flood sensitive Receptors
- Major roads
- Chainage (km)
- Watercourses
- B2G project alignment
- Existing rail



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



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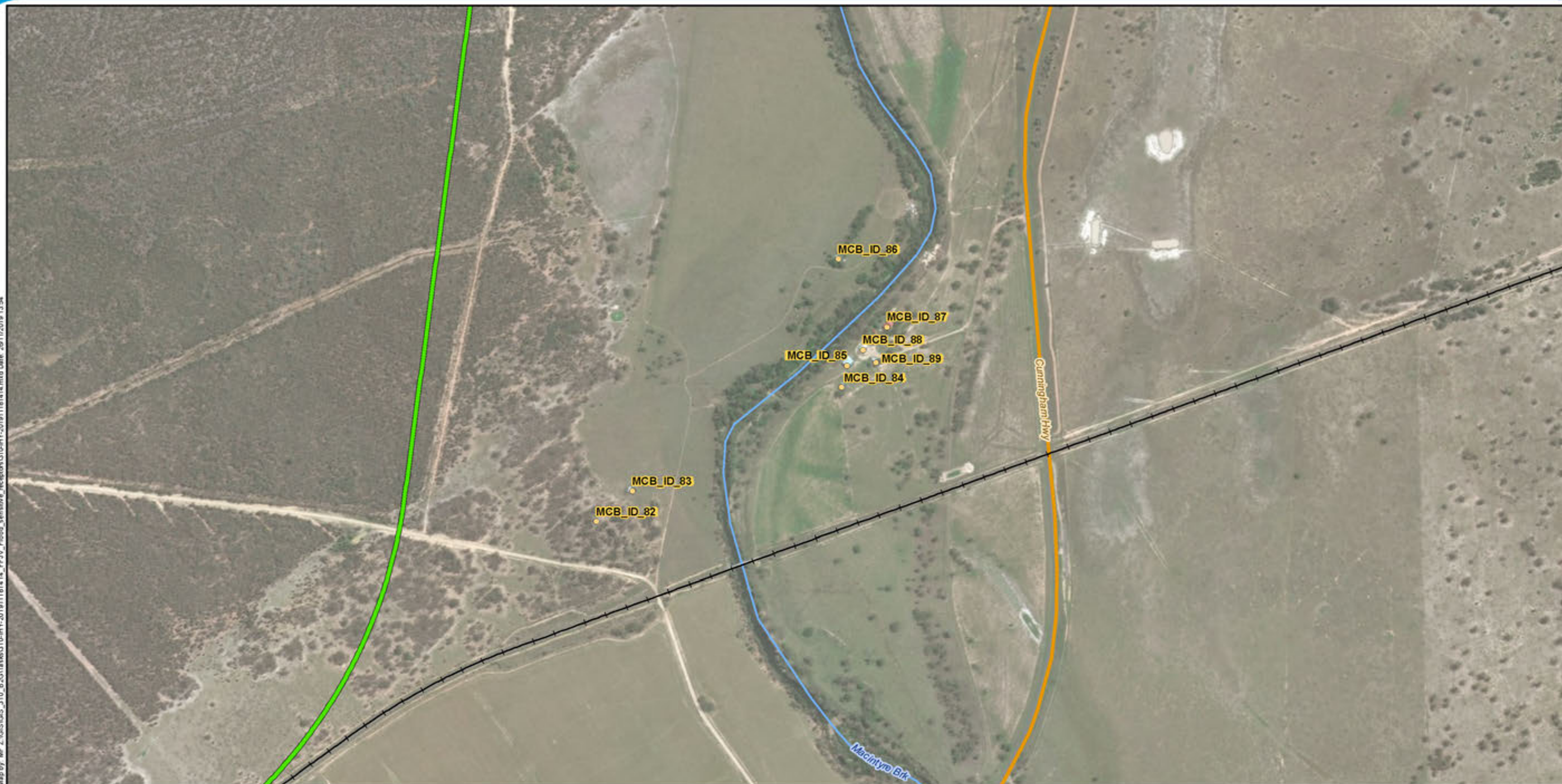
Issue date: 26/11/2019 Version: 0  
 Coordinate System: GDA 1994 MGA Zone 56

**Border to Gowrie**

**Appendix N:**  
**Map 16 of 47**



Map by MF 210450535\_310\_8201Task0310-HY-201811181414\_FF JV\_Flood\_sensitive\_receptors310-HY-201811181414.mxd Date: 26/11/2019 13:54



#### Legend

- Flood sensitive Receptors
- Major roads
- Chainage (km)
- Watercourses
- B2G project alignment
- Existing rail



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



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 Coordinate System: GDA 1994 MGA Zone 56





#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- B2G project alignment
- Major roads
- Watercourses



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



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Map by: MF\_Z:\GIS\SGIS\_310\_8201Task\0310-HY-201811181414\_FF JV\_Flood\_sensitive\_receptors\0310-HY-201811181414.mxd Date: 26/11/2019 13:54



#### Legend

- Flood sensitive Receptors
- Major roads
- Chainage (km)
- Watercourses
- B2G project alignment



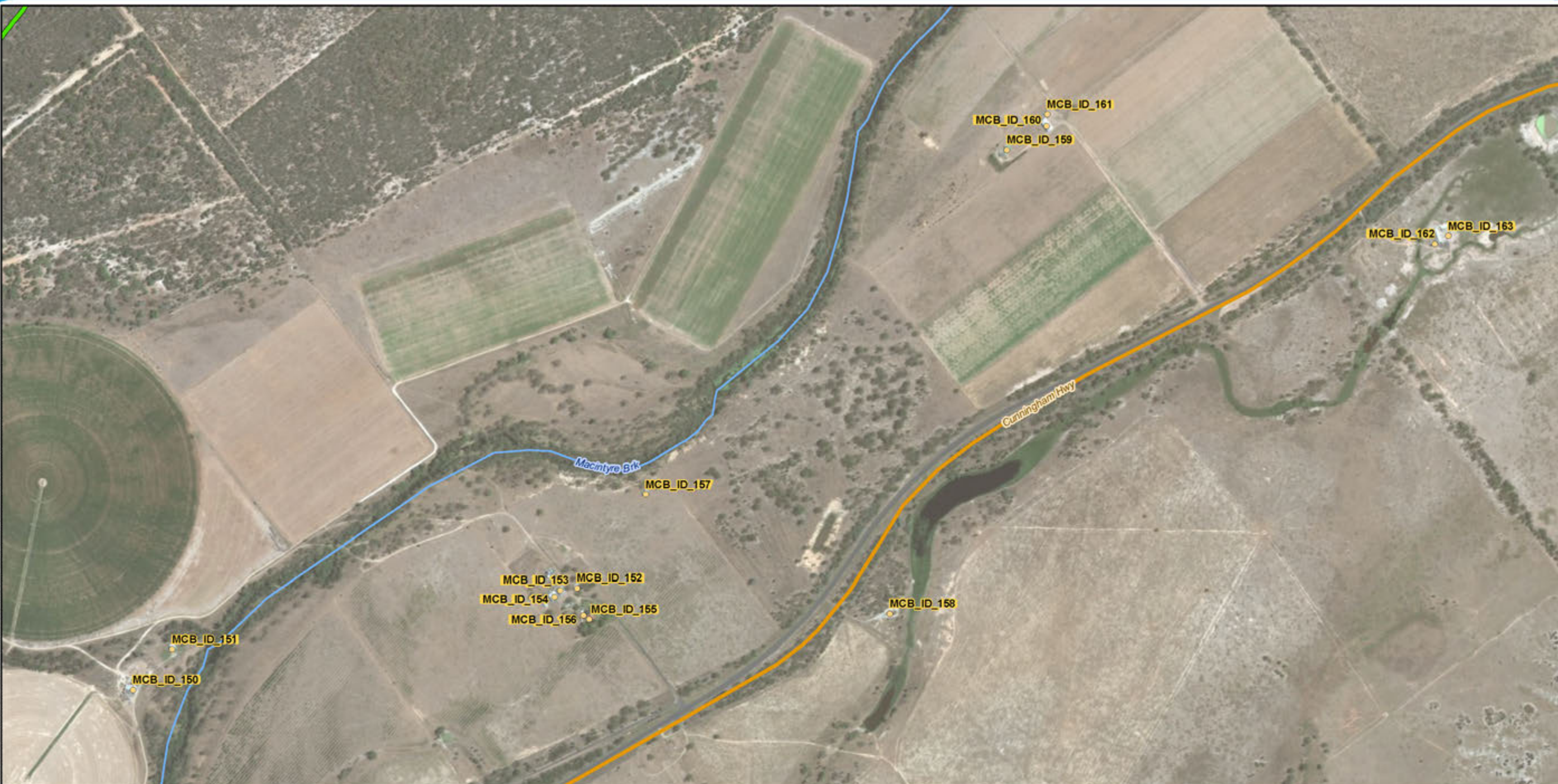
A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



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 Coordinate System: GDA 1994 MGA Zone 56





#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- B2G project alignment
- Major roads
- Watercourses



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



**Future Freight**  
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 Coordinate System: GDA 1994 MGA Zone 56

**Border to Gowrie**

**Appendix N:**  
**Map 20 of 47**





#### Legend

- Flood sensitive Receptors
- Major roads
- Watercourses
- 5 Chainage (km)



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km

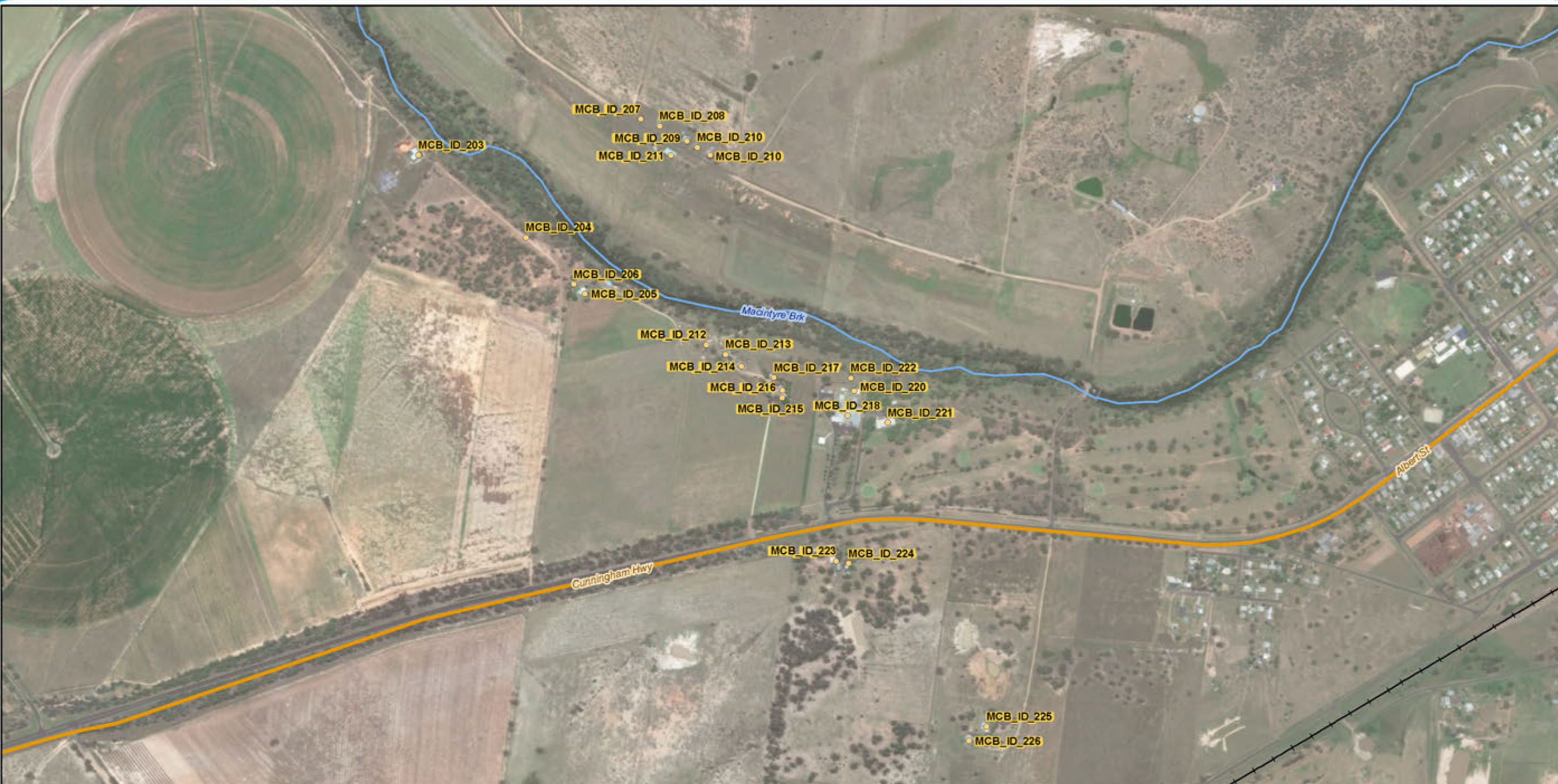


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 Coordinate System: GDA 1994 MGA Zone 56

**Border to Gowrie**  
**Appendix N:**  
**Map 21 of 47**





#### Legend

- Flood sensitive Receptors
- Major roads
- Watercourses
- Existing rail
- 5 Chainage (km)



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



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 Coordinate System: GDA 1994 MGA Zone 56



Map by: MF\_Z:\GIS\GIS\_310\_B201Task\310-IRVY-201811181414\_FF JV\_Flood\_sensitive\_receptors\310-IRVY-201811181414.mxd Date: 26/11/2019 13:54



#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- B2G project alignment
- Watercourses



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



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 Coordinate System: GDA 1994 MGA Zone 56





# Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- Major roads
- Minor roads
- Watercourses



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km





**Legend**

- Flood sensitive Receptors
- Minor roads
- 5 Chainage (km)
- B2G project alignment



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



Map by: MF\_Z:\GIS\GIS\_310\_8201Task\GIS\_310\_8201Task\310-8201Task\310-8201Task\_Flood\_Sensitive\_Receptors\310-8201Task\_Flood\_Sensitive\_Receptors.mxd Date: 26/11/2019 13:54



#### Legend

- Flood sensitive Receptors
- Minor roads
- 5 Chainage (km)
- B2G project alignment



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km

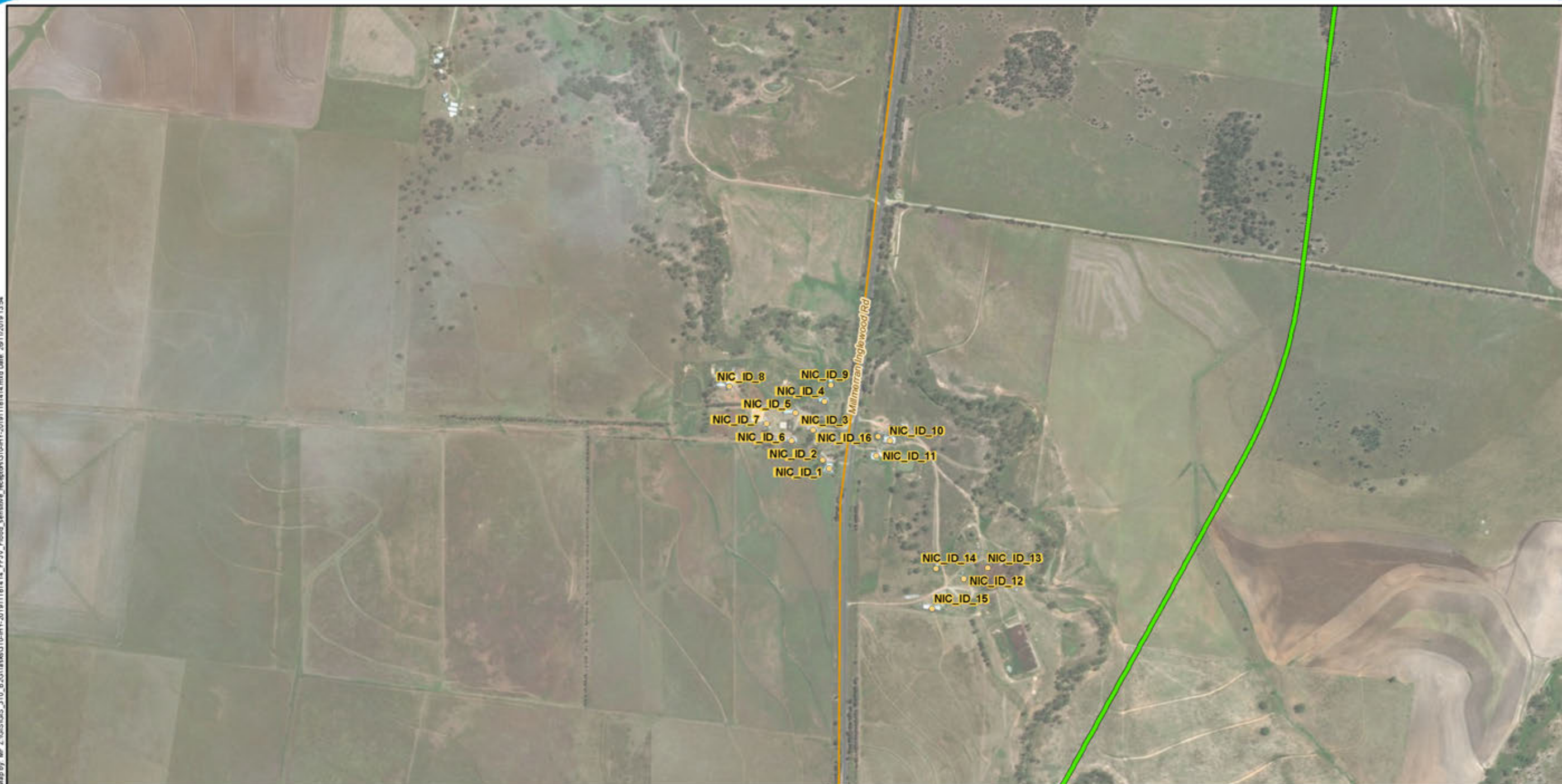


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Map by MF 210450535\_310\_8201Task0310-IRY-201811181414\_FFJV\_Flood\_sensitive\_receptors310-IRY-201811181414.mxd Date: 26/11/2019 13:54



#### Legend

- Flood sensitive Receptors
- Minor roads
- 5 Chainage (km)
- B2G project alignment



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



**Future Freight**  
 Integrating Community, Environment and Engineering

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**Legend**

- Flood sensitive Receptors
- Minor roads
- 5 Chainage (km)



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



**Future Freight**  
 Integrating Community, Environment and Engineering

Issue date: 26/11/2019 Version: 0  
 Coordinate System: GDA 1994 MGA Zone 56





**Legend**

- Flood sensitive Receptors
- 5 Chainage (km)
- B2G project alignment
- Minor roads



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



**Future Freight**  
 Integrating Community, Environment and Engineering

Issue date: 26/11/2019 Version: 0  
 Coordinate System: GDA 1994 MGA Zone 56





#### Legend

- Flood sensitive Receptors
- Minor roads
- Chainage (km)
- B2G project alignment



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



**Future Freight**  
 Integrating Community, Environment and Engineering

Issue date: 26/11/2019 Version: 0  
 Coordinate System: GDA 1994 MGA Zone 56





# Legend

- Flood sensitive Receptors
- Minor roads
- Watercourses
- 5 Chainage (km)



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



**Future Freight**  
 Integrating Community, Environment and Engineering

Issue date: 26/11/2019 Version: 0  
 Coordinate System: GDA 1994 MGA Zone 56

**Border to Gowrie**  
**Appendix N:**  
**Map 31 of 47**





**Legend**

- Flood sensitive Receptors
- 5 Chainage (km)
- Minor roads
- Watercourses



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



Map by: MF 2104505\_310\_8201Task0310-IRY-201811181414\_FF JV\_Flood\_sensitive\_receptors310-IRY-201811181414.mxd Date: 26/11/2019 13:54



#### Legend

- Flood sensitive Receptors
- Minor roads
- 5 Chainage (km)



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



**Future Freight**  
 Integrating Community, Environment and Engineering

Issue date: 26/11/2019 Version: 0  
 Coordinate System: GDA 1994 MGA Zone 56





#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- Major roads
- Watercourses



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km





#### Legend

- Flood sensitive Receptors
- Minor roads
- 5 Chainage (km)
- B2G project alignment



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km





**Legend**

- Flood sensitive Receptors
- Minor roads
- 5 Chainage (km)



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km





#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- Major roads
- Minor roads
- B2G project alignment
- Watercourses



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



**Future Freight**  
 Integrating Community, Environment and Engineering

Issue date: 26/11/2019 Version: 0  
 Coordinate System: GDA 1994 MGA Zone 56





#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- Watercourses



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



**Future Freight**  
 Integrating Community, Environment and Engineering

Issue date: 26/11/2019 Version: 0  
 Coordinate System: GDA 1994 MGA Zone 56





#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



**Future Freight**  
 Integrating Community, Environment and Engineering

Issue date: 26/11/2019 Version: 0  
 Coordinate System: GDA 1994 MGA Zone 56





#### Legend

- Flood sensitive Receptors
- Major roads
- Watercourses
- 5 Chainage (km)



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



**Future Freight**  
 Integrating Community, Environment and Engineering

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**Border to Gowrie**  
**Appendix N:**  
**Map 40 of 47**



Map by: MF 21050505\_310\_8201Task0310-IRY-201811181414\_FF JV\_Flood\_sensitive\_receptors310-IRY-201811181414.mxd Date: 26/11/2019 13:54



#### Legend

- Flood sensitive Receptors
- Major roads
- Minor roads
- Chainage (km)
- B2G project alignment



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



**Future Freight**  
 Integrating Community, Environment and Engineering

Issue date: 26/11/2019 Version: 0  
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#### Legend

- Flood sensitive Receptors
- Minor roads
- Watercourses
- 5 Chainage (km)



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km





**Legend**

- Flood sensitive Receptors
- 5 Chainage (km)
- B2G project alignment
- Major roads
- Watercourses





Map by: MF\_Z:\GIS\GIS\_310\_8201Task\310-8201Task\310-8201Task\310-8201Task.mxd Date: 26/11/2019 13:54



#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- Watercourses



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



**Future Freight**  
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**Legend**

- Flood sensitive Receptors
- 5 Chainage (km)
- B2G project alignment
- Watercourses



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



**Future Freight**  
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#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- Watercourses



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



**Future Freight**  
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Issue date: 26/11/2019 Version: 0  
 Coordinate System: GDA 1994 MGA Zone 56

**Border to Gowrie**  
**Appendix N:**  
**Map 46 of 47**





Map by: MF 210450535\_310\_8201Task0310-IRY-201811181414\_FF JV\_Flood\_sensitive\_receptors310-IRY-201811181414.mxd Date: 26/11/2019 13:54

#### Legend

- Flood sensitive Receptors
- 5 Chainage (km)
- B2G project alignment
- Gowrie to Helidon alignment
- +— Existing rail
- Watercourses



A3 scale: 1:10,000  
 0 0.1 0.2 0.3 0.4 0.5 km



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