

APPENDIX A. GLOSSARY

Taken from the Floodplain Development Manual (April 2005 edition), which was developed for NSW but generally applied within Australian water industry.

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| acid sulfate soils | Are sediments which contain sulfidic mineral pyrite which may become extremely acid following disturbance or drainage as sulfur compounds react when exposed to oxygen to form sulfuric acid. More detailed explanation and definition can be found in the NSW Government Acid Sulfate Soil Manual published by Acid Sulfate Soil Management Advisory Committee. |
| Annual Exceedance Probability (AEP) | The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. For example, if a peak flood discharge of 500 m ³ /s has an AEP of 5%, it means that there is a 5% chance (that is one-in-20 chance) of a 500 m ³ /s or larger event occurring in any one year (see ARI). |
| Australian Height Datum (AHD) | A common national surface level datum approximately corresponding to mean sea level. |
| Average Annual Damage (AAD) | Depending on its size (or severity), each flood will cause a different amount of flood damage to a flood prone area. AAD is the average damage per year that would occur in a nominated development situation from flooding over a very long period of time. |
| Average Recurrence Interval (ARI) | The long-term average number of years between the occurrence of a flood as big as, or larger than, the selected event. For example, floods with a discharge as great as, or greater than, the 20-year ARI flood event will occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event. |
| caravan and moveable home parks | Caravans and moveable dwellings are being increasingly used for long-term and permanent accommodation purposes. Standards relating to their siting, design, construction and management can be found in the Regulations under the LG Act. |
| catchment | The land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location. |
| consent authority | The Council, government agency or person having the function to determine a development application for land use under the EP&A Act. The consent authority is most often the Council, however legislation or an EPI may specify a Minister or public authority (other than a Council), or the Director General of DIPNR, as having the function to determine an application. |
| development | Is defined in Part 4 of the Environmental Planning and Assessment Act (EP&A Act). infill development: refers to the development of vacant blocks of land that are generally surrounded by developed properties and is permissible under the current zoning of the land. Conditions such as minimum floor levels may be imposed on infill development. new development: refers to development of a completely different nature to that associated with the former land use. For example, the urban subdivision of an area previously used for rural purposes. New developments involve rezoning and typically require major extensions of existing urban services, such as roads, water supply, sewerage and electric power. |

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| | redevelopment: refers to rebuilding in an area. For example, as urban areas age, it may become necessary to demolish and reconstruct buildings on a relatively large scale. Redevelopment generally does not require either rezoning or major extensions to urban services. |
| disaster plan (DISPLAN) | A step-by-step sequence of previously agreed roles, responsibilities, functions, actions and management arrangements for the conduct of a single or series of connected emergency operations, with the object of ensuring the coordinated response by all agencies having responsibilities and functions in emergencies. |
| discharge | The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second (m ³ /s). Discharge is different from the speed or velocity of flow, which is a measure of how fast the water is moving for example, metres per second (m/s). |
| ecologically sustainable development (ESD) | Using, conserving and enhancing natural resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be maintained or increased. A more detailed definition is included in the Local Government Act 1993. The use of sustainability and sustainable in this manual relate to ESD. |
| effective warning time | The time available after receiving advice of an impending flood and before the floodwaters prevent appropriate flood response actions being undertaken. The effective warning time is typically used to move farm equipment, move stock, raise furniture, evacuate people and transport their possessions. |
| emergency management | A range of measures to manage risks to communities and the environment. In the flood context it may include measures to prevent, prepare for, respond to and recover from flooding. |
| flash flooding | Flooding which is sudden and unexpected. It is often caused by sudden local or nearby heavy rainfall. Often defined as flooding which peaks within six hours of the causative rain. |
| flood | Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami. |
| flood awareness | Flood awareness is an appreciation of the likely effects of flooding and a knowledge of the relevant flood warning, response and evacuation procedures. |
| flood education | Flood education seeks to provide information to raise awareness of the flood problem to enable individuals to understand how to manage themselves and their property in response to flood warnings and in a flood event. It invokes a state of flood readiness. |
| flood fringe areas | The remaining area of flood prone land after floodway and flood storage areas have been defined. |
| flood liable land | Is synonymous with flood prone land (i.e., land susceptible to flooding by the probable maximum flood (PMF) event). Note that the term flood liable land covers the whole of the floodplain, not just that part below the flood planning level (see flood planning area). |
| flood mitigation standard | The average recurrence interval of the flood, selected as part of the floodplain risk management process that forms the basis for physical works to modify the impacts of flooding. |

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| floodplain | Area of land which is subject to inundation by floods up to and including the probable maximum flood event, that is, flood prone land. |
| floodplain risk management options | The measures that might be feasible for the management of a particular area of the floodplain. Preparation of a floodplain risk management plan requires a detailed evaluation of floodplain risk management options. |
| floodplain risk management plan | A management plan developed in accordance with the principles and guidelines in this manual. Usually includes both written and diagrammatic information describing how particular areas of flood prone land are to be used and managed to achieve defined objectives. |
| flood plan (local) | A sub-plan of a disaster plan that deals specifically with flooding. They can exist at State, Division and local levels. Local flood plans are prepared under the leadership of the State Emergency Service. |
| flood planning area | The area of land below the flood planning level and thus subject to flood related development controls. The concept of flood planning area generally supersedes the flood liable land concept in the 1986 Manual. |
| Flood Planning Levels (FPLs) | FPLs are the combinations of flood levels (derived from significant historical flood events or floods of specific AEPs) and freeboards selected for floodplain risk management purposes, as determined in management studies, and incorporated in management plans. FPLs supersede the standard flood events in the 1986 manual. |
| flood proofing | A combination of measures incorporated in the design, construction and alteration of individual buildings or structures subject to flooding, to reduce or eliminate flood damages. |
| flood prone land | Is land susceptible to flooding by the Probable Maximum Flood (PMF) event. Flood prone land is synonymous with flood liable land. |
| flood readiness | Flood readiness is an ability to react within the effective warning time. |
| flood risk | <p>Potential danger to personal safety and potential damage to property resulting from flooding. The degree of risk varies with circumstances across the full range of floods. Flood risk in this manual is divided into 3 types, existing, future and continuing risks. They are described below.</p> <p>existing flood risk: the risk a community is exposed to as a result of its location on the floodplain.</p> <p>future flood risk: the risk a community may be exposed to as a result of new development on the floodplain.</p> <p>continuing flood risk: the risk a community is exposed to after floodplain risk management measures have been implemented. For a town protected by levees, the continuing flood risk is the consequences of the levees being overtopped. For an area without any floodplain risk management measures, the continuing flood risk is simply the existence of its flood exposure.</p> |
| flood storage areas | Those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood. The extent and behaviour of flood storage areas may change with flood severity, and loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation. Hence, it is necessary to investigate a range of flood sizes before defining flood storage areas. |

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| floodway areas | Those areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flows, or a significant increase in flood levels. |
| freeboard | Freeboard provides reasonable certainty that the risk exposure selected in deciding on a particular flood chosen as the basis for the FPL is actually provided. It is a factor of safety typically used in relation to the setting of floor levels, levee crest levels, etc. Freeboard is included in the flood planning level. |
| habitable room | <p>in a residential situation: a living or working area, such as a lounge room, dining room, rumpus room, kitchen, bedroom or workroom.</p> <p>in an industrial or commercial situation: an area used for offices or to store valuable possessions susceptible to flood damage in the event of a flood.</p> |
| hazard | A source of potential harm or a situation with a potential to cause loss. In relation to this manual the hazard is flooding which has the potential to cause damage to the community. Definitions of high and low hazard categories are provided in the Manual. |
| hydraulics | Term given to the study of water flow in waterways; in particular, the evaluation of flow parameters such as water level and velocity. |
| hydrograph | A graph which shows how the discharge or stage/flood level at any particular location varies with time during a flood. |
| hydrology | Term given to the study of the rainfall and runoff process; in particular, the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of floods. |
| local overland flooding | Inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam. |
| local drainage | Are smaller scale problems in urban areas. They are outside the definition of major drainage in this glossary. |
| mainstream flooding | Inundation of normally dry land occurring when water overflows the natural or artificial banks of a stream, river, estuary, lake or dam. |
| major drainage | <p>Councils have discretion in determining whether urban drainage problems are associated with major or local drainage. For the purpose of this manual major drainage involves:</p> <ul style="list-style-type: none"> - the floodplains of original watercourses (which may now be piped, channelised or diverted), or sloping areas where overland flows develop along alternative paths once system capacity is exceeded; and/or - water depths generally in excess of 0.3 m (in the major system design storm as defined in the current version of Australian Rainfall and Runoff). These conditions may result in danger to personal safety and property damage to both premises and vehicles; and/or - major overland flow paths through developed areas outside of defined drainage reserves; and/or - the potential to affect a number of buildings along the major flow path. |
| mathematical/computer models | The mathematical representation of the physical processes involved in runoff generation and stream flow. These models are often run-on computers due to the |

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| | complexity of the mathematical relationships between runoff, stream flow and the distribution of flows across the floodplain. |
| merit approach | <p>The merit approach weighs social, economic, ecological and cultural impacts of land use options for different flood prone areas together with flood damage, hazard and behaviour implications, and environmental protection and wellbeing of the States rivers and floodplains.</p> <p>The merit approach operates at two levels. At the strategic level it allows for the consideration of social, economic, ecological, cultural and flooding issues to determine strategies for the management of future flood risk which are formulated into Council plans, policy and EPIs. At a site-specific level, it involves consideration of the best way of conditioning development allowable under the floodplain risk management plan, local floodplain risk management policy and EPIs.</p> |
| minor, moderate and major flooding | <p>Both the State Emergency Service and the Bureau of Meteorology use the following definitions in flood warnings to give a general indication of the types of problems expected with a flood:</p> <p>minor flooding: causes inconvenience such as closing of minor roads and the submergence of low-level bridges. The lower limit of this class of flooding on the reference gauge is the initial flood level at which landholders and townspeople begin to be flooded.</p> <p>moderate flooding: low-lying areas are inundated requiring removal of stock and/or evacuation of some houses. Main traffic routes may be covered.</p> <p>major flooding: appreciable urban areas are flooded and/or extensive rural areas are flooded. Properties, villages and towns can be isolated.</p> |
| modification measures | Measures that modify either the flood, the property or the response to flooding. Examples are indicated in Table 2.1 with further discussion in the Manual. |
| peak discharge | The maximum discharge occurring during a flood event. |
| Probable Maximum Flood (PMF) | The PMF is the largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation, and where applicable, snow melt, coupled with the worst flood producing catchment conditions. Generally, it is not physically or economically possible to provide complete protection against this event. The PMF defines the extent of flood prone land, that is, the floodplain. The extent, nature and potential consequences of flooding associated with a range of events rarer than the flood used for designing mitigation works and controlling development, up to and including the PMF event should be addressed in a floodplain risk management study. |
| Probable Maximum Precipitation (PMP) | The PMP is the greatest depth of precipitation for a given duration meteorologically possible over a given size storm area at a particular location at a particular time of the year, with no allowance made for long-term climatic trends (World Meteorological Organisation, 1986). It is the primary input to PMF estimation. |
| probability | A statistical measure of the expected chance of flooding (see AEP). |
| risk | Chance of something happening that will have an impact. It is measured in terms of consequences and likelihood. In the context of the manual it is the likelihood of consequences arising from the interaction of floods, communities and the environment. |

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| runoff | The amount of rainfall which actually ends up as streamflow, also known as rainfall excess. |
| stage | Equivalent to water levels. Both are measured with reference to a specified datum. |
| stage hydrograph | A graph that shows how the water level at a particular location changes with time during a flood. It must be referenced to a particular datum. |
| survey plan | A plan prepared by a registered surveyor. |
| water surface profile | A graph showing the flood stage at any given location along a watercourse at a particular time. |
| wind fetch | The horizontal distance in the direction of wind over which wind waves are generated. |

APPENDIX B. DESIGN FLOOD MAPPING



Appendix B

FIGURE B1
PEAK FLOOD EXTENT
EXISTING CONDITIONS
COFFEE CREEK
DEPTH > 0.05M



FIGURE B2
PEAK FLOOD EXTENT AND LEVELS
EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT



FIGURE B3
PEAK FLOOD EXTENT AND LEVELS
EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT



FIGURE B4
PEAK FLOOD EXTENT AND LEVELS
EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT



FIGURE B5
PEAK FLOOD VELOCITIES
EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT

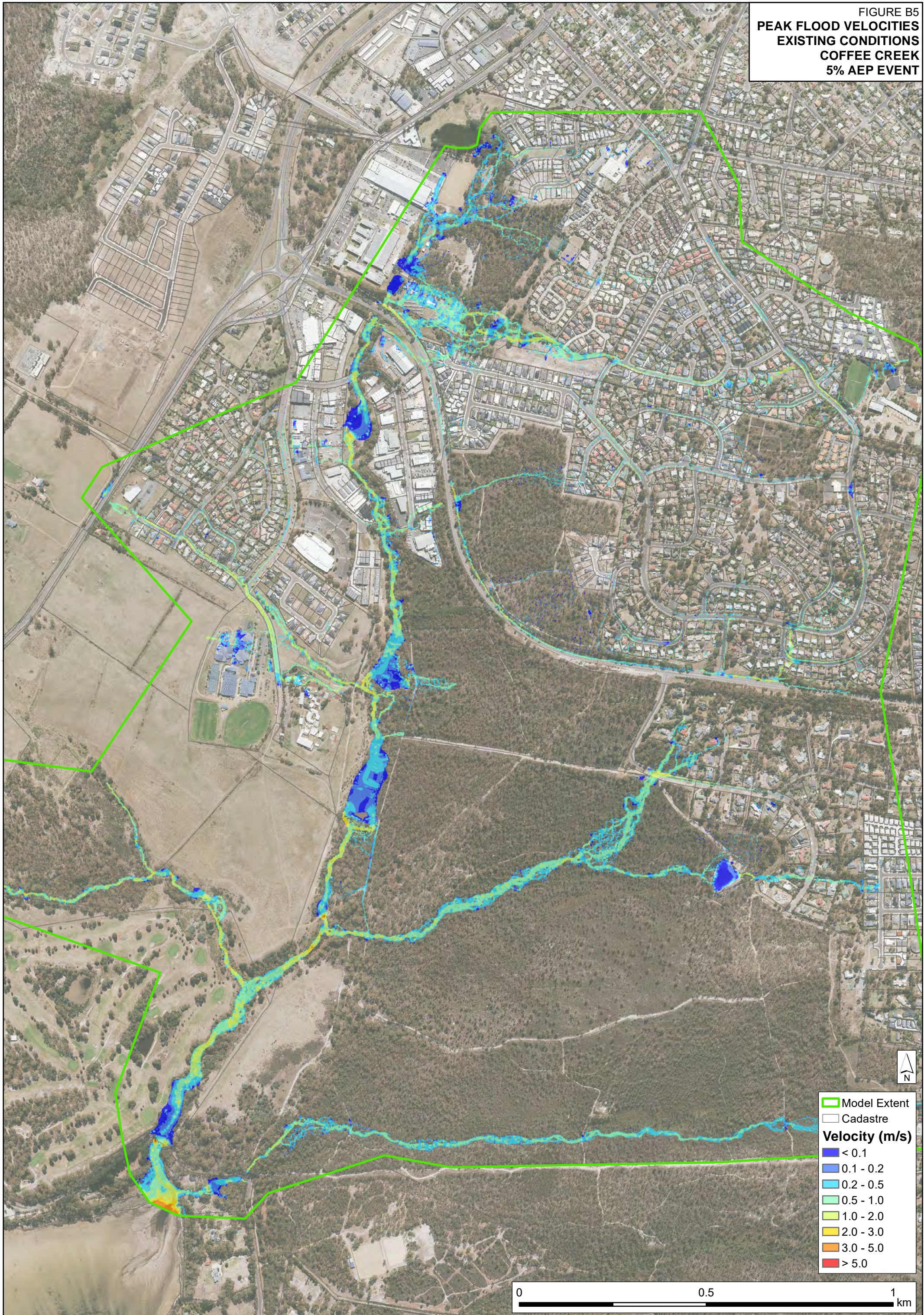


FIGURE B6
PEAK FLOOD VELOCITIES
EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

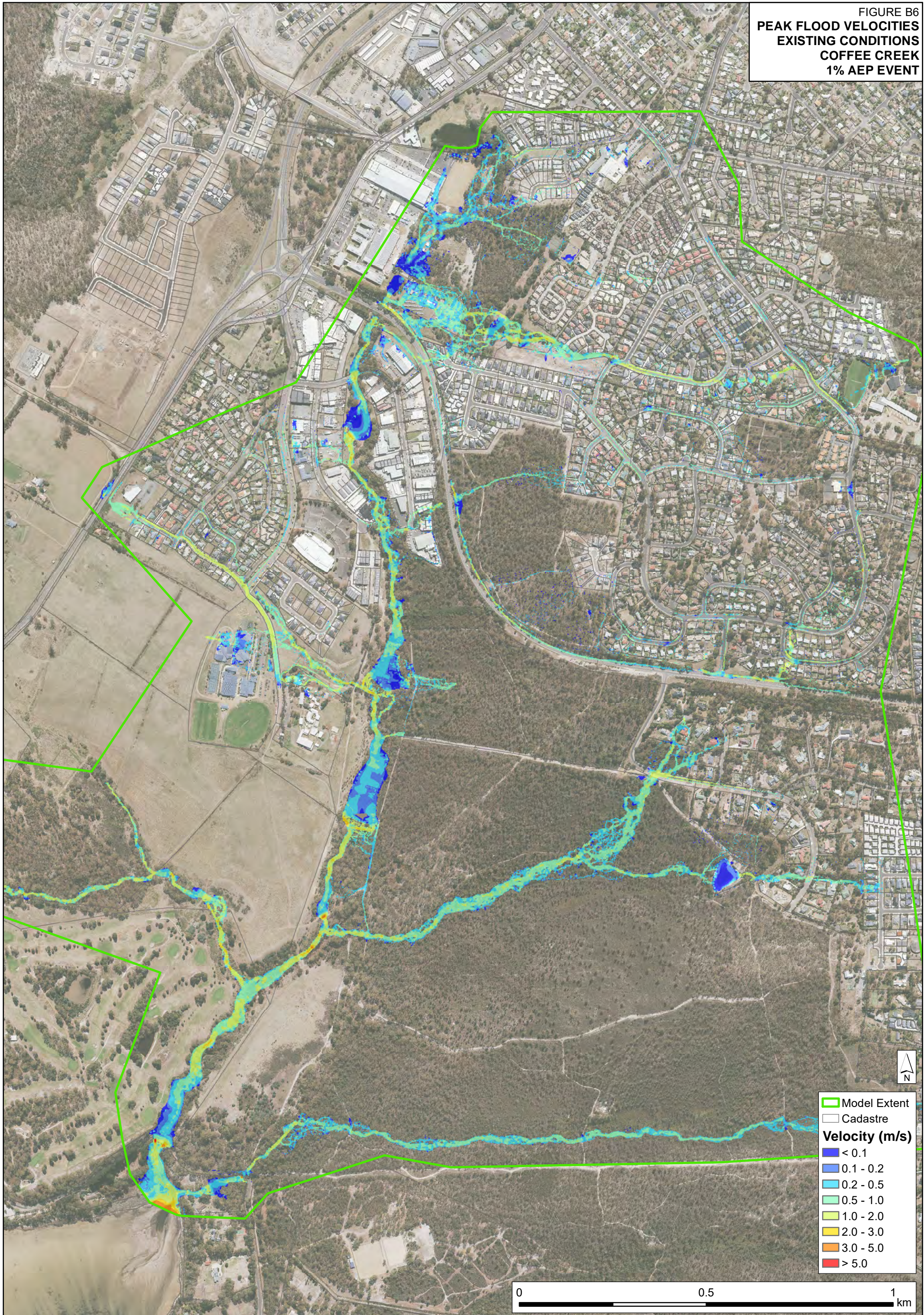


FIGURE B7
PEAK FLOOD VELOCITIES
EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT

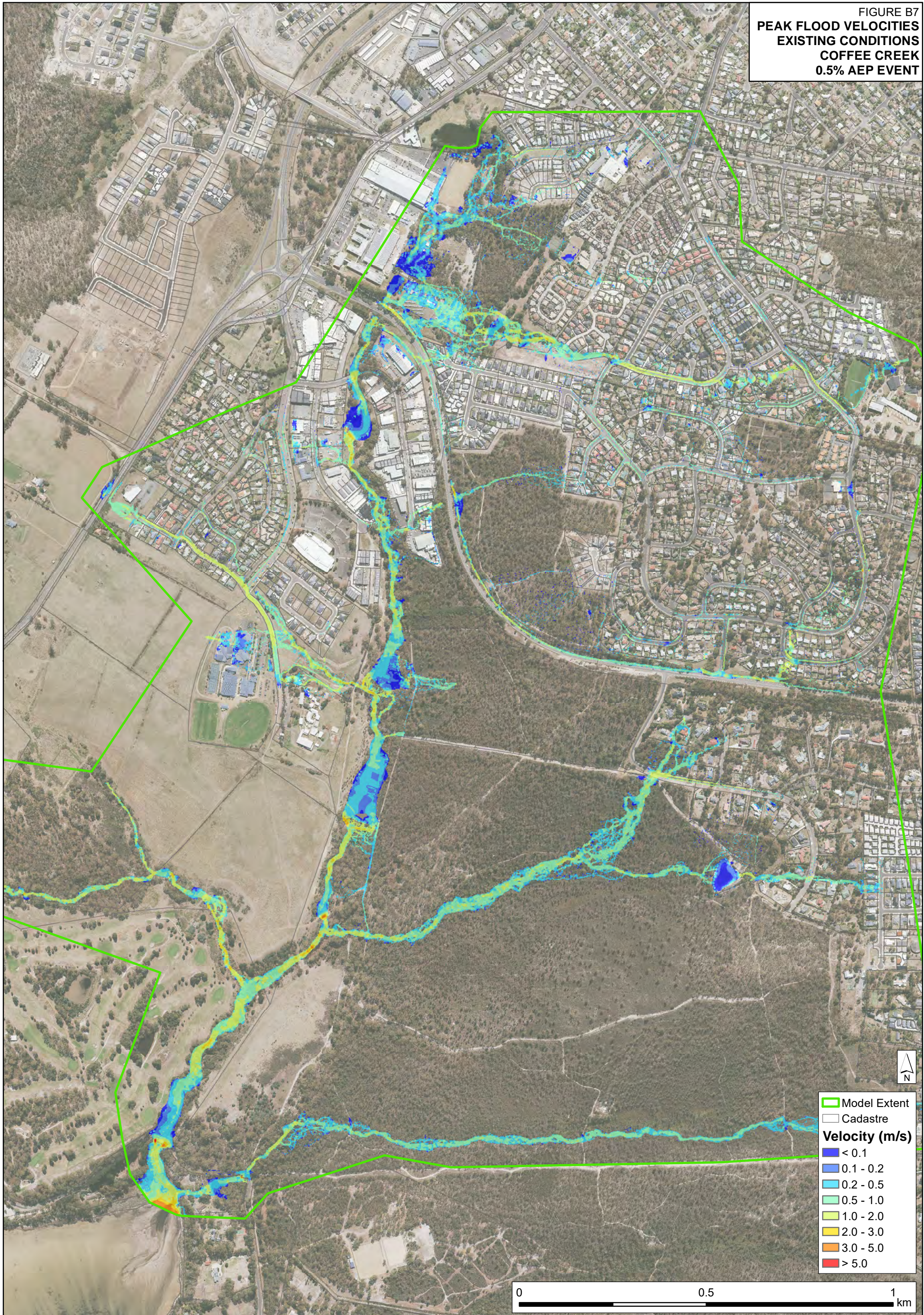


FIGURE B8
PEAK FLOOD DEPTHS
EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT

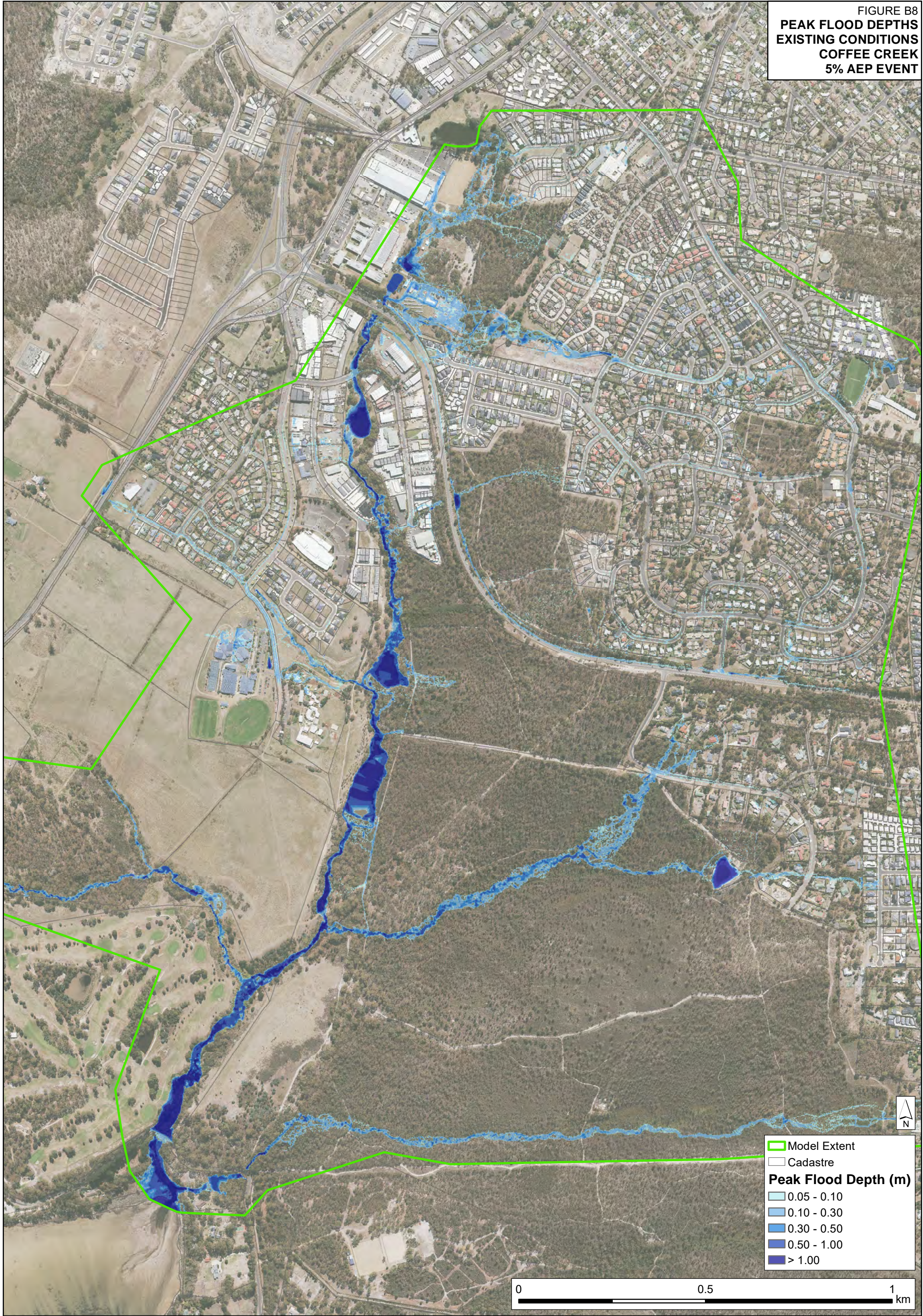


FIGURE B9
PEAK FLOOD DEPTHS
EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

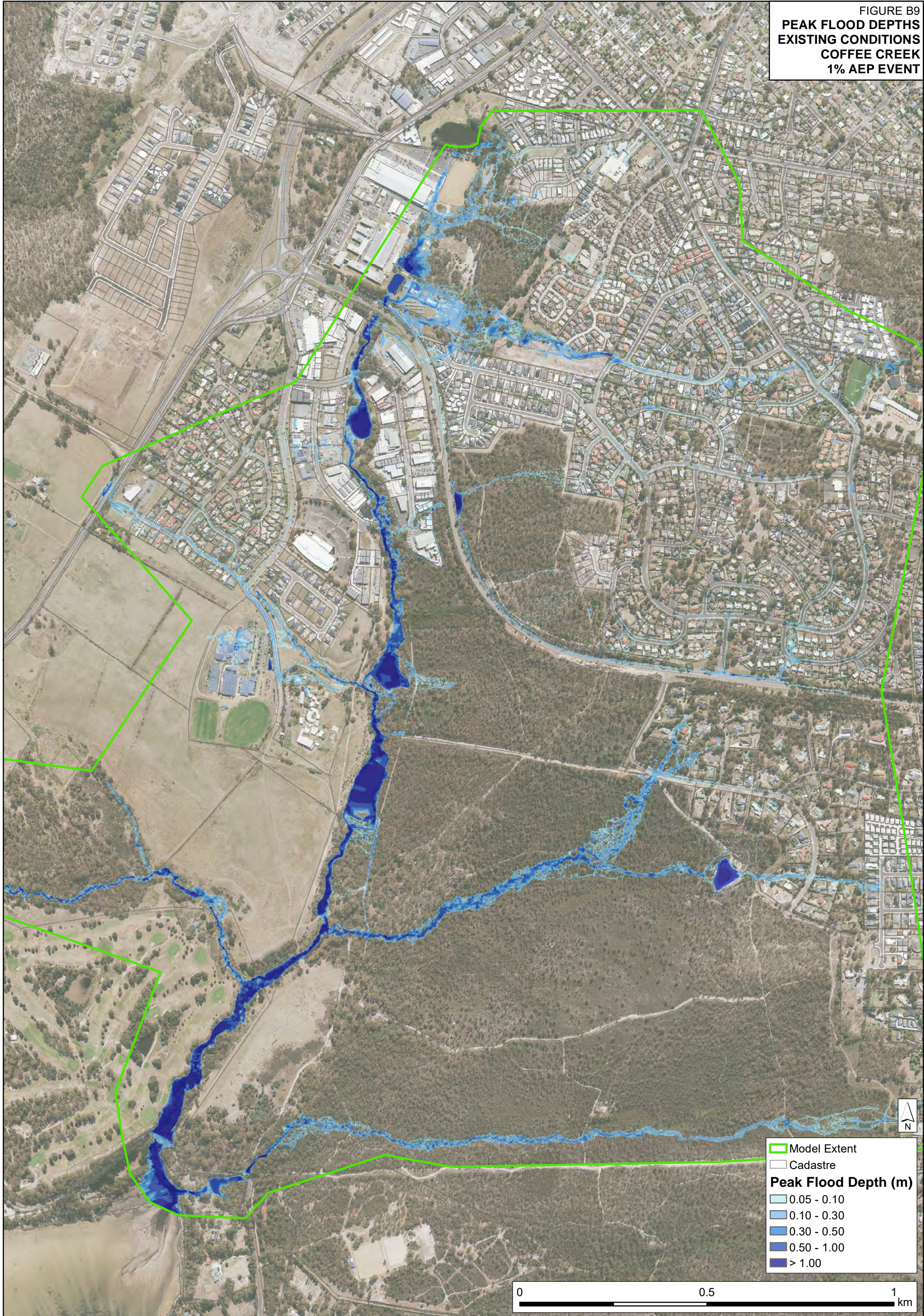


FIGURE B10
PEAK FLOOD DEPTHS
EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT

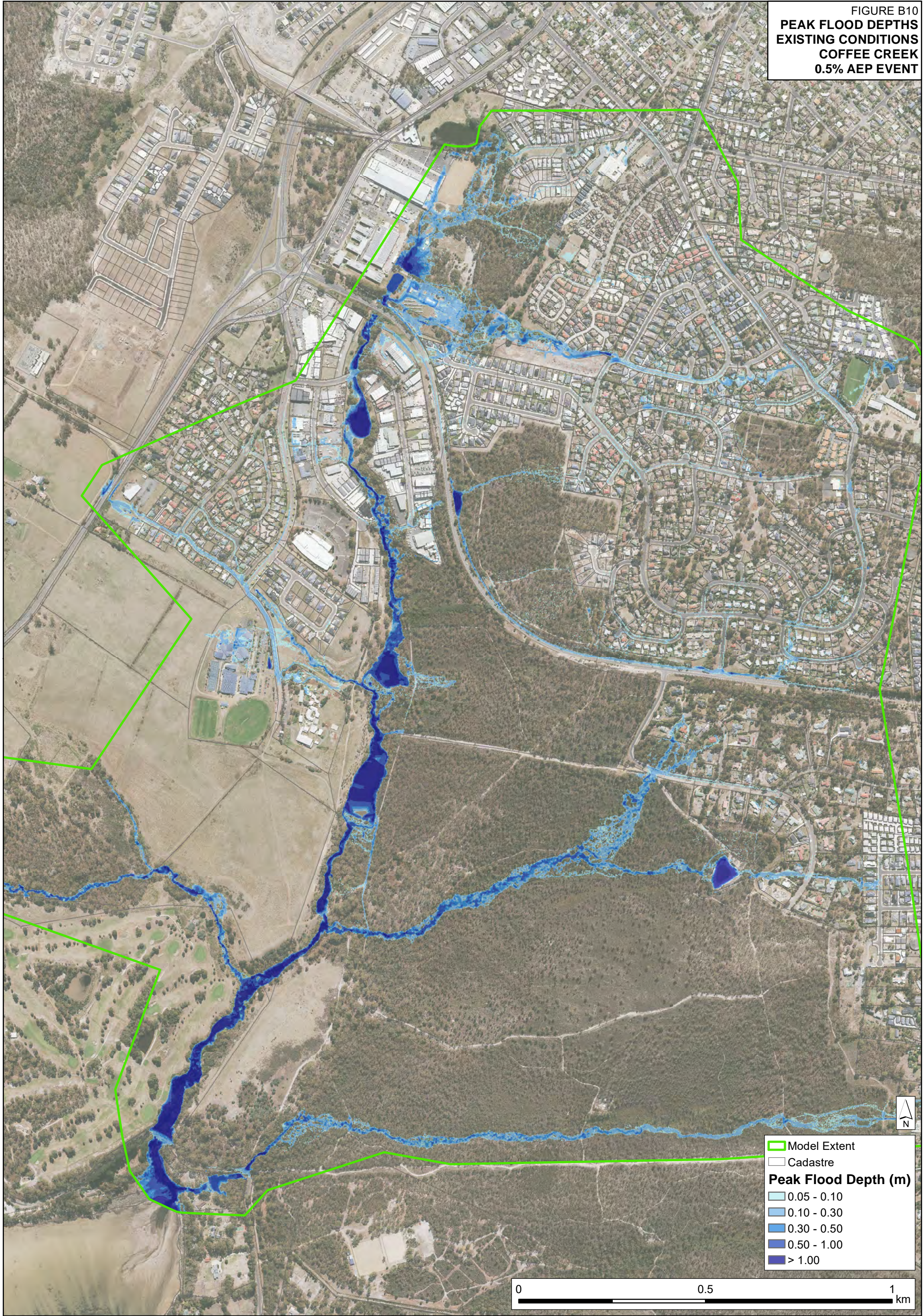


FIGURE B11
HYDRAULIC HAZARD
EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT

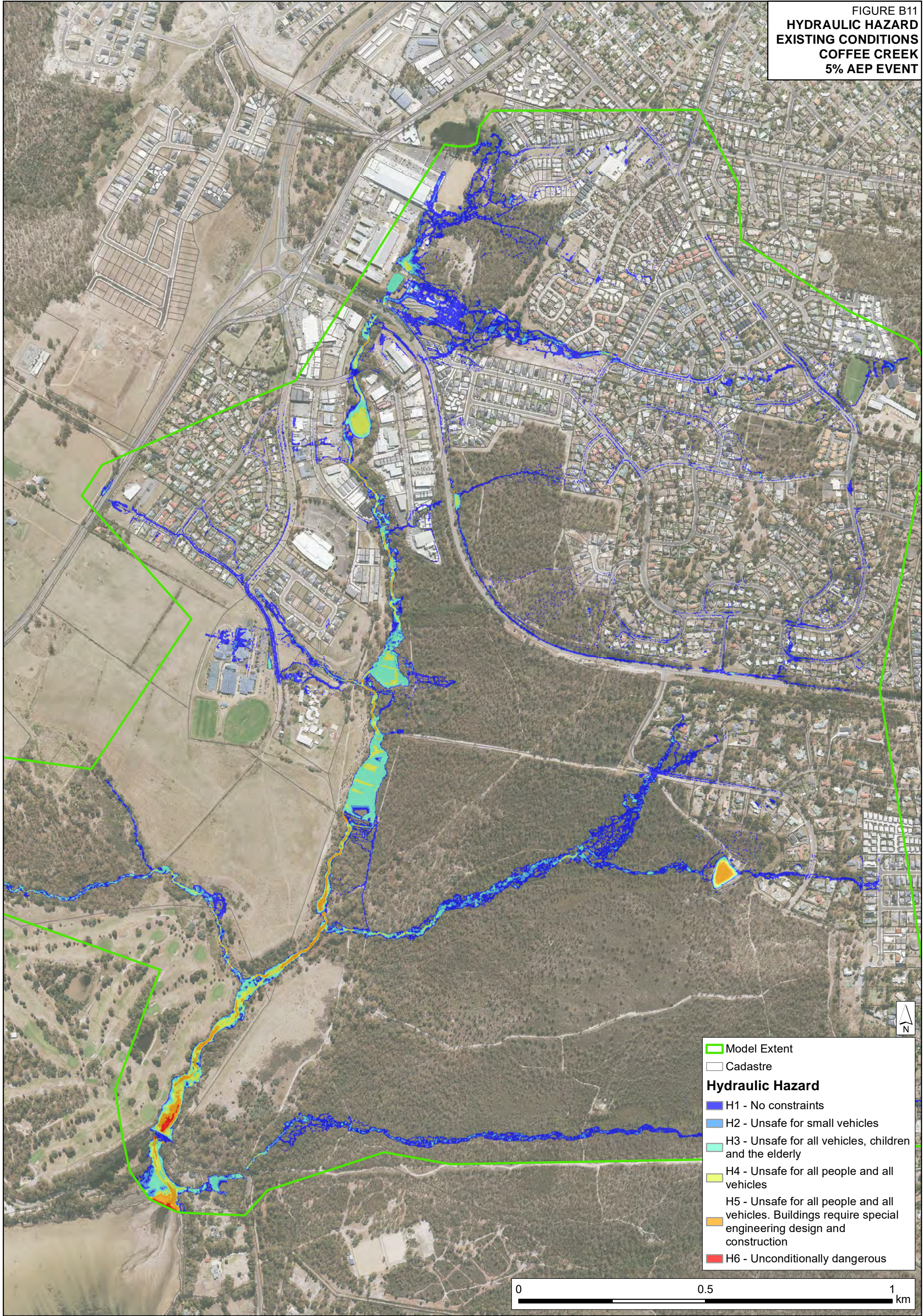


FIGURE B12
HYDRAULIC HAZARD
EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

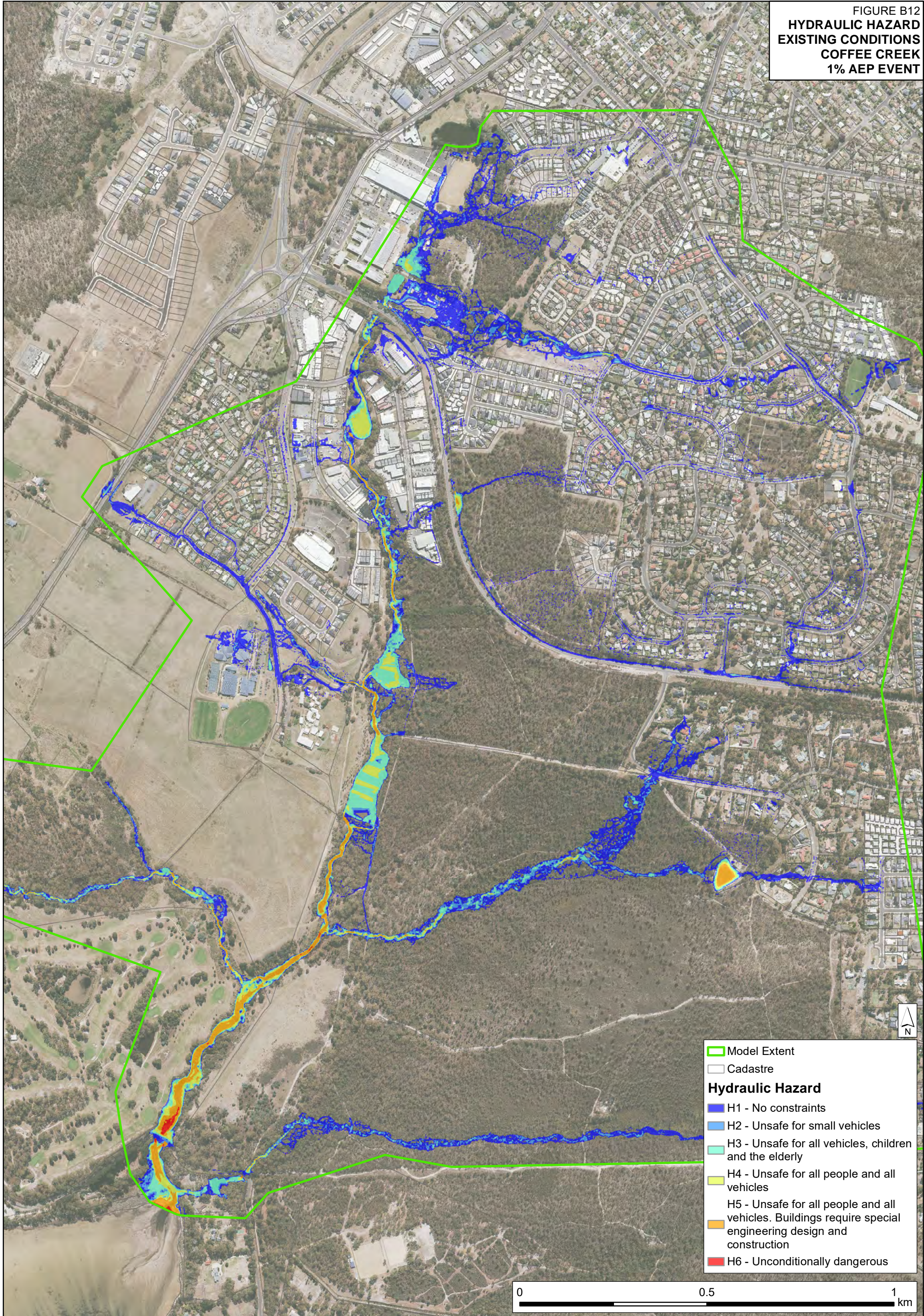


FIGURE B13
HYDRAULIC HAZARD
EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT

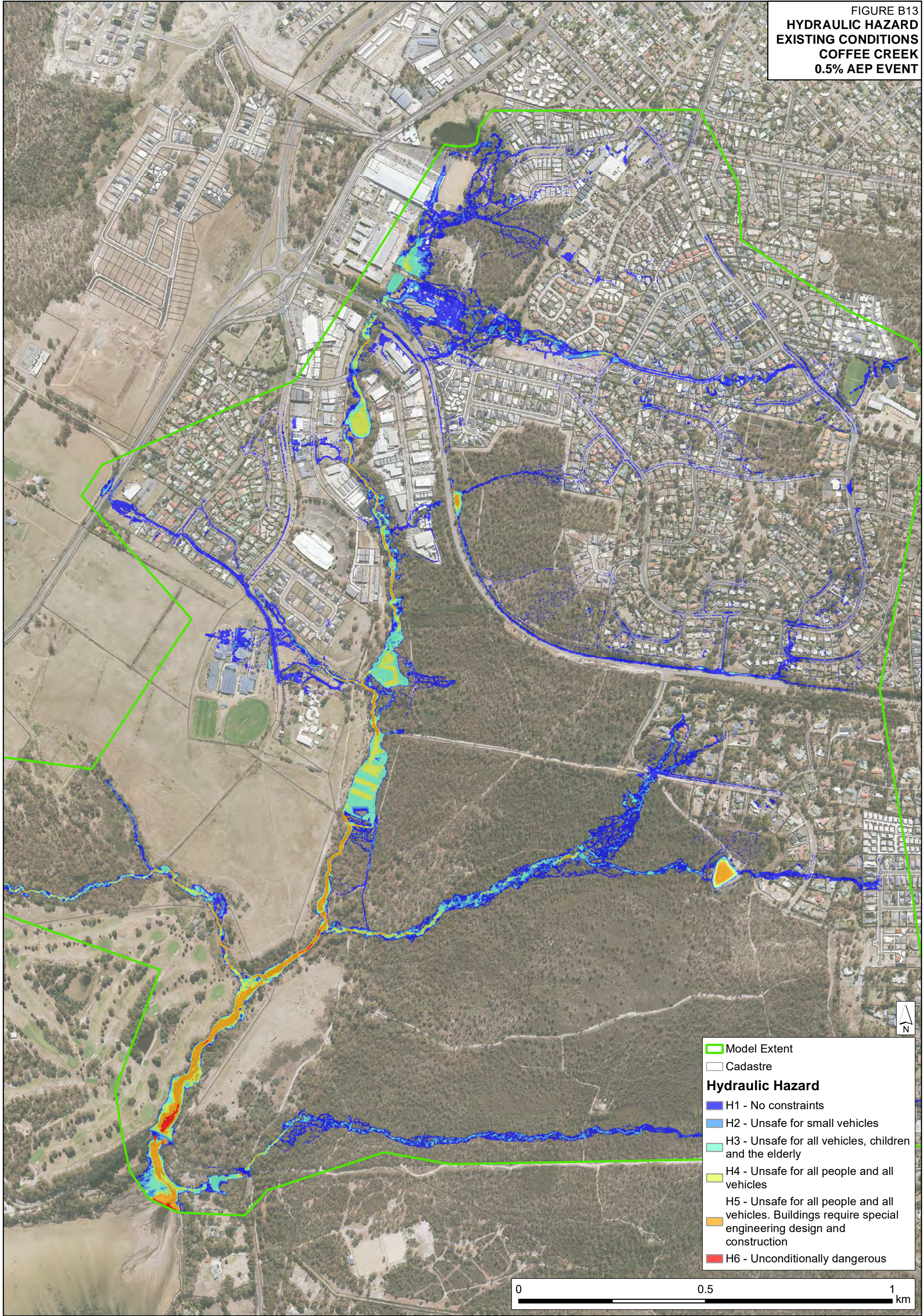
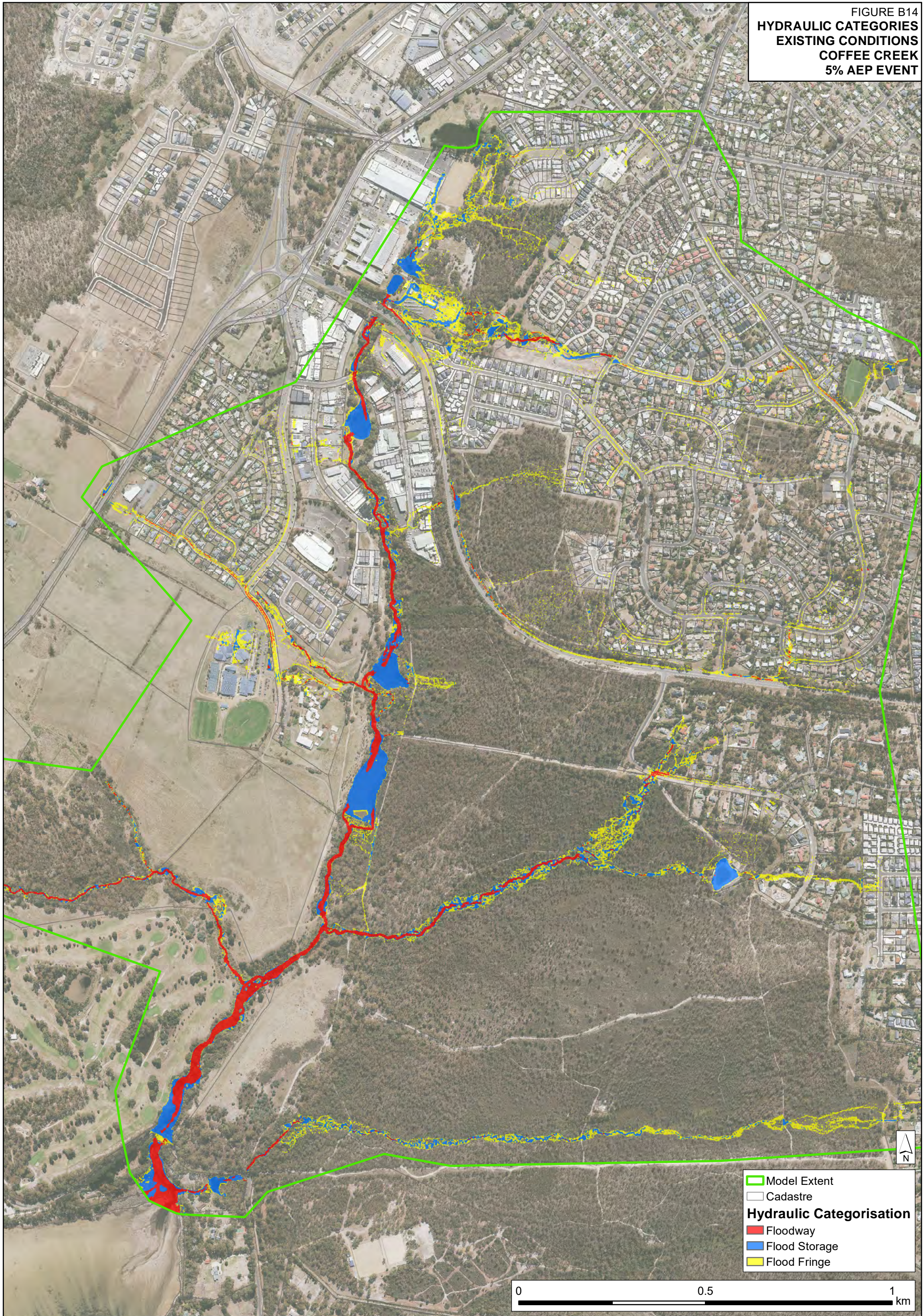


FIGURE B14
HYDRAULIC CATEGORIES
EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT



- Model Extent
- Cadastre
- Hydraulic Categorisation**
- Floodway
- Flood Storage
- Flood Fringe

0 0.5 1 km

FIGURE B15
HYDRAULIC CATEGORIES
EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

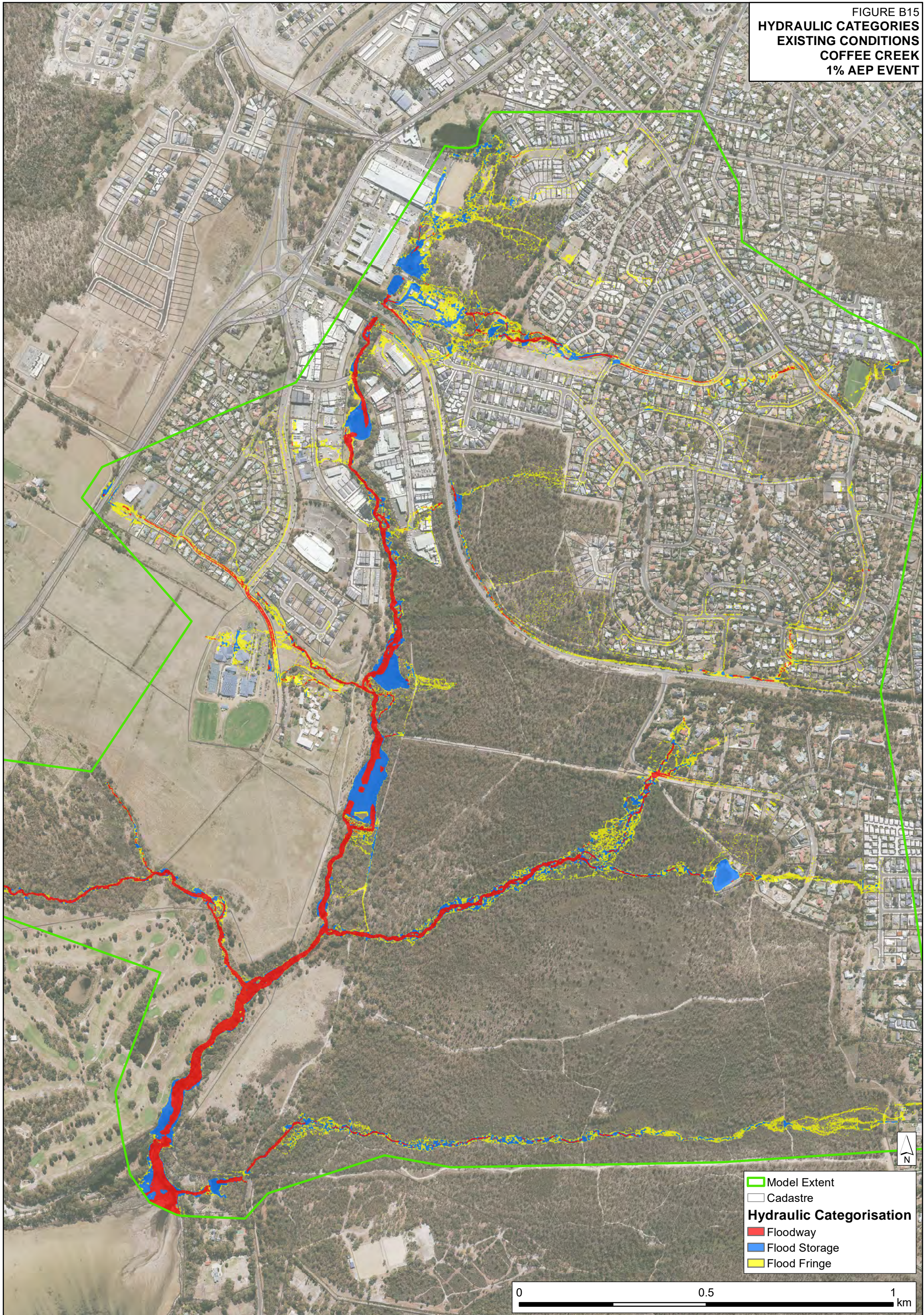
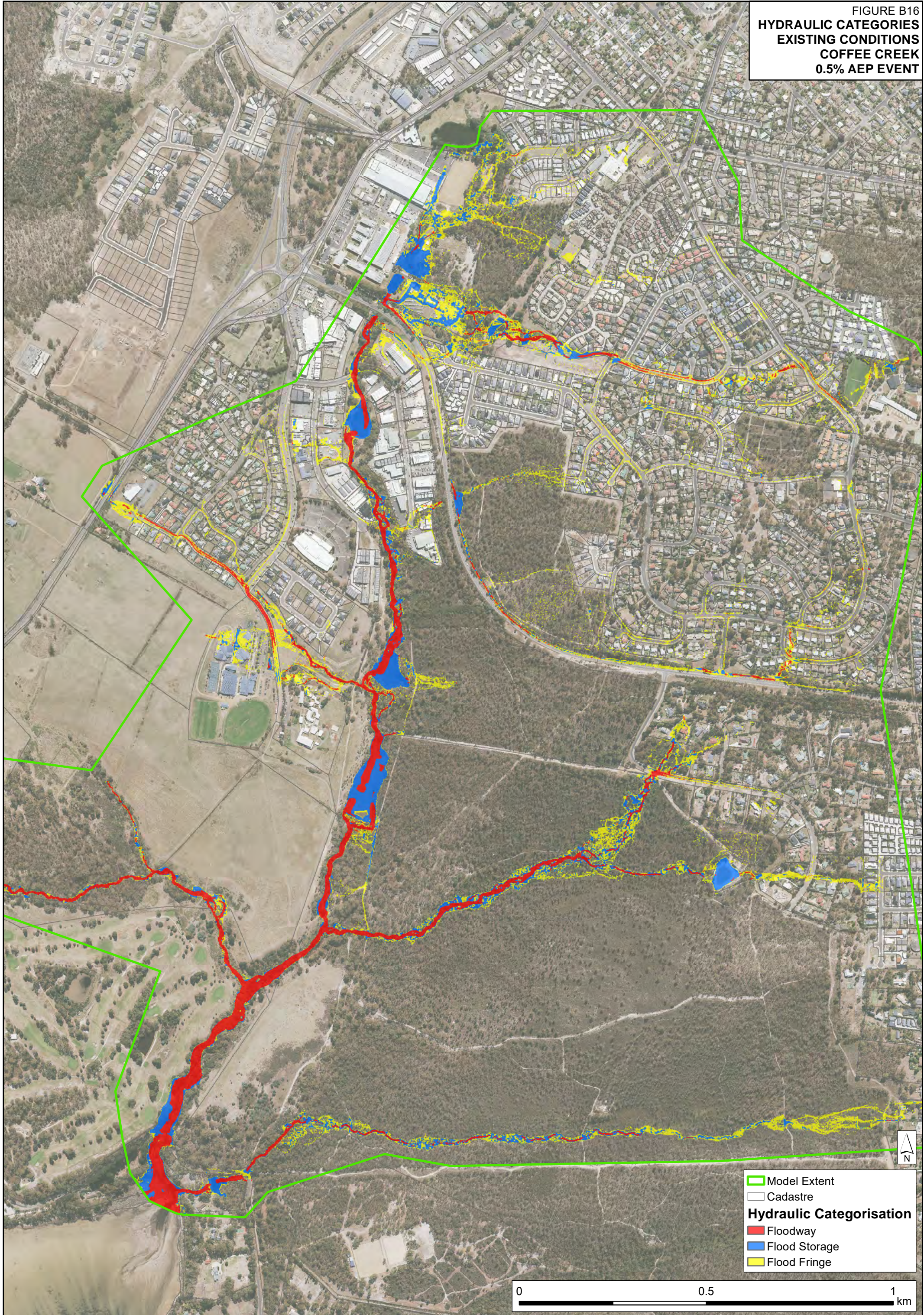


FIGURE B16
HYDRAULIC CATEGORIES
EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT



APPENDIX C. SENSITIVITY FLOOD MAPPING



Appendix C

FIGURE C1
PEAK FLOOD DEPTHS
YEAR 2050
COFFEE CREEK
1% AEP EVENT

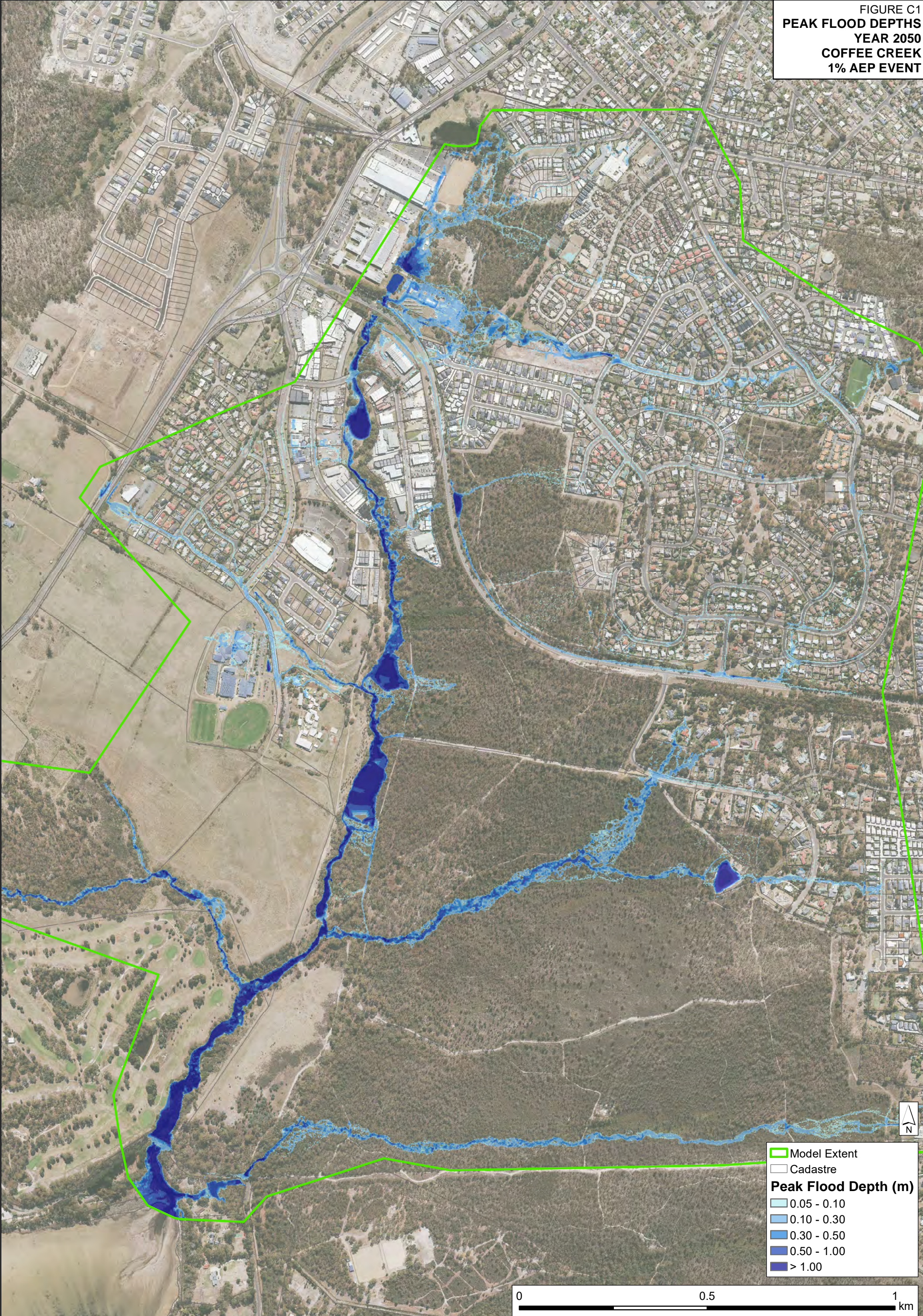


FIGURE C2
PEAK FLOOD VELOCITIES
YEAR 2050
COFFEE CREEK
1% AEP EVENT

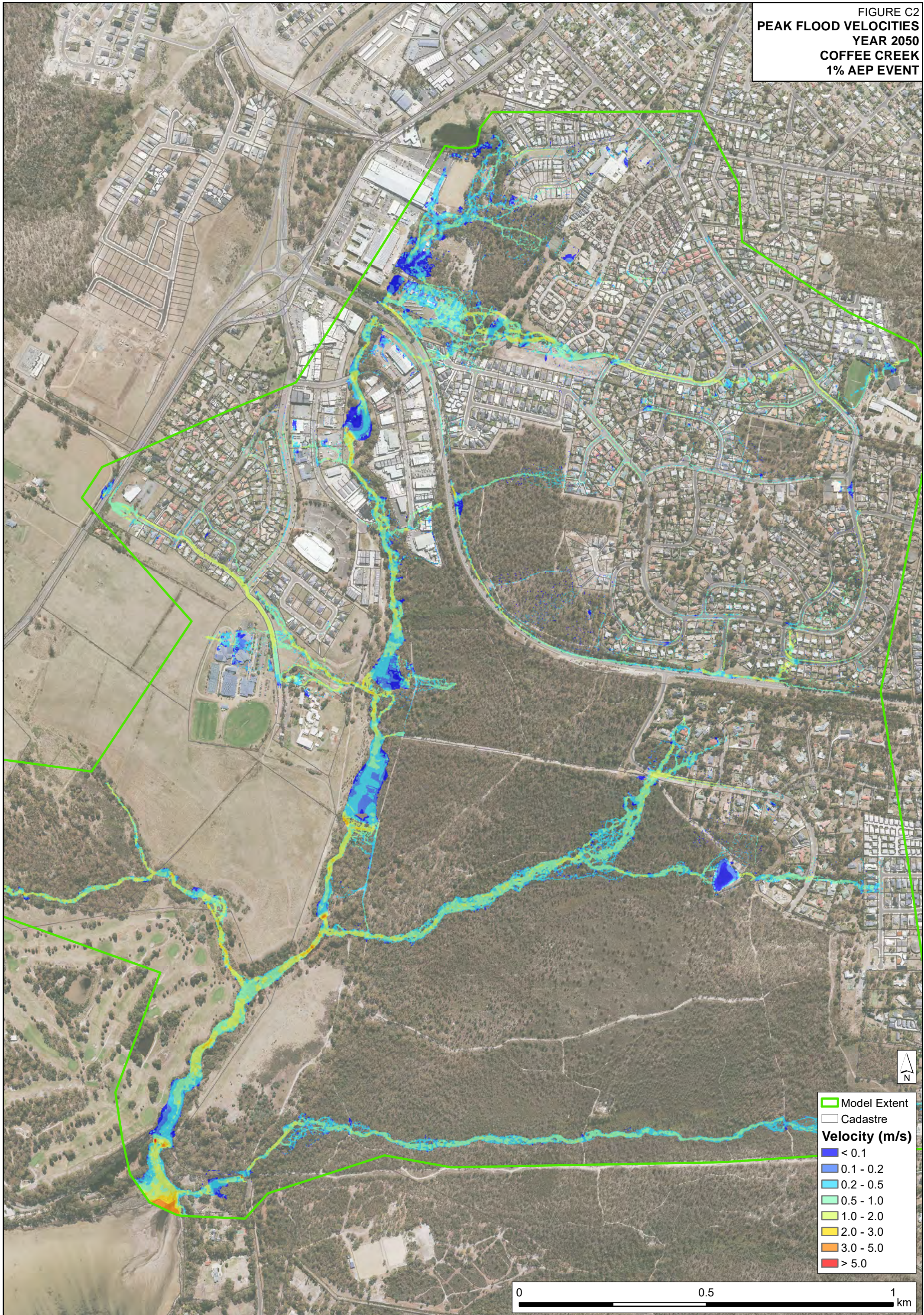


FIGURE C3
PEAK FLOOD DEPTHS
YEAR 2100
COFFEE CREEK
1% AEP EVENT



Model Extent
Cadastral

Peak Flood Depth (m)

- 0.05 - 0.10
- 0.10 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- > 1.00

0 0.5 1 km

FIGURE C4
PEAK FLOOD VELOCITIES
YEAR 2100
COFFEE CREEK
1% AEP EVENT

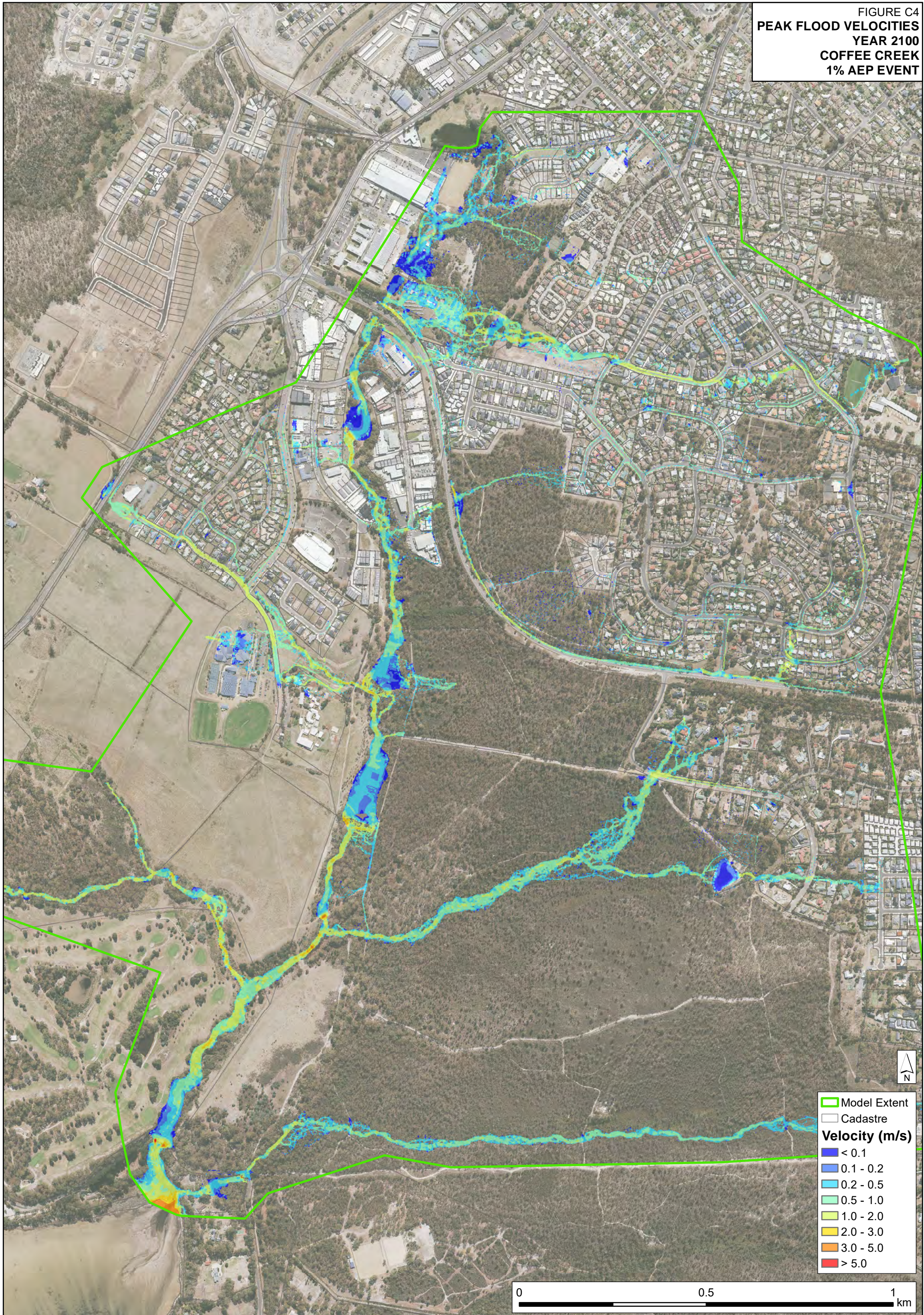


FIGURE C5
PEAK FLOOD DEPTHS
20% ROUGHNESS DECREASE
COFFEE CREEK
1% AEP EVENT

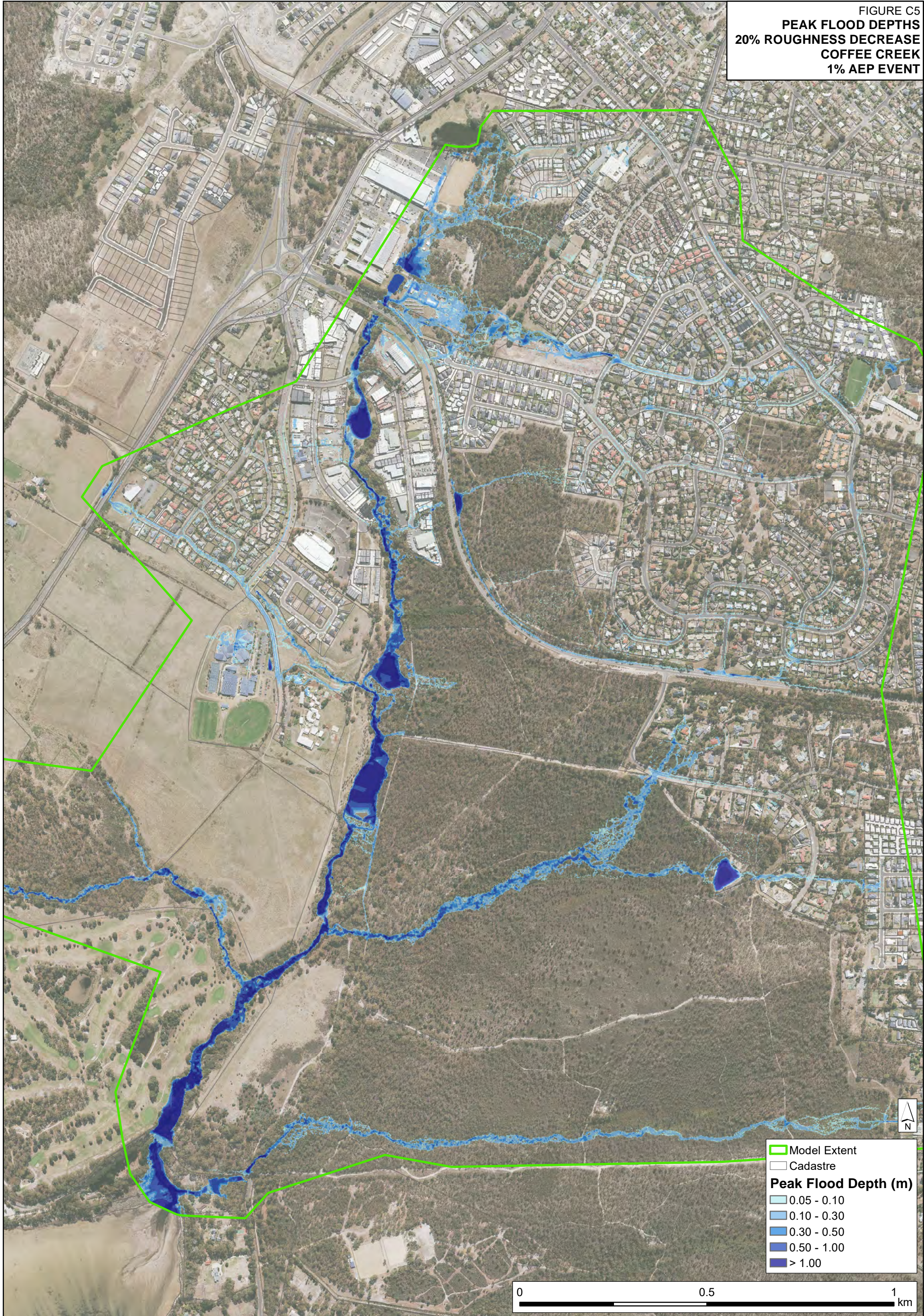


FIGURE C6
PEAK FLOOD VELOCITIES
20% ROUGHNESS DECREASE
COFFEE CREEK
1% AEP EVENT

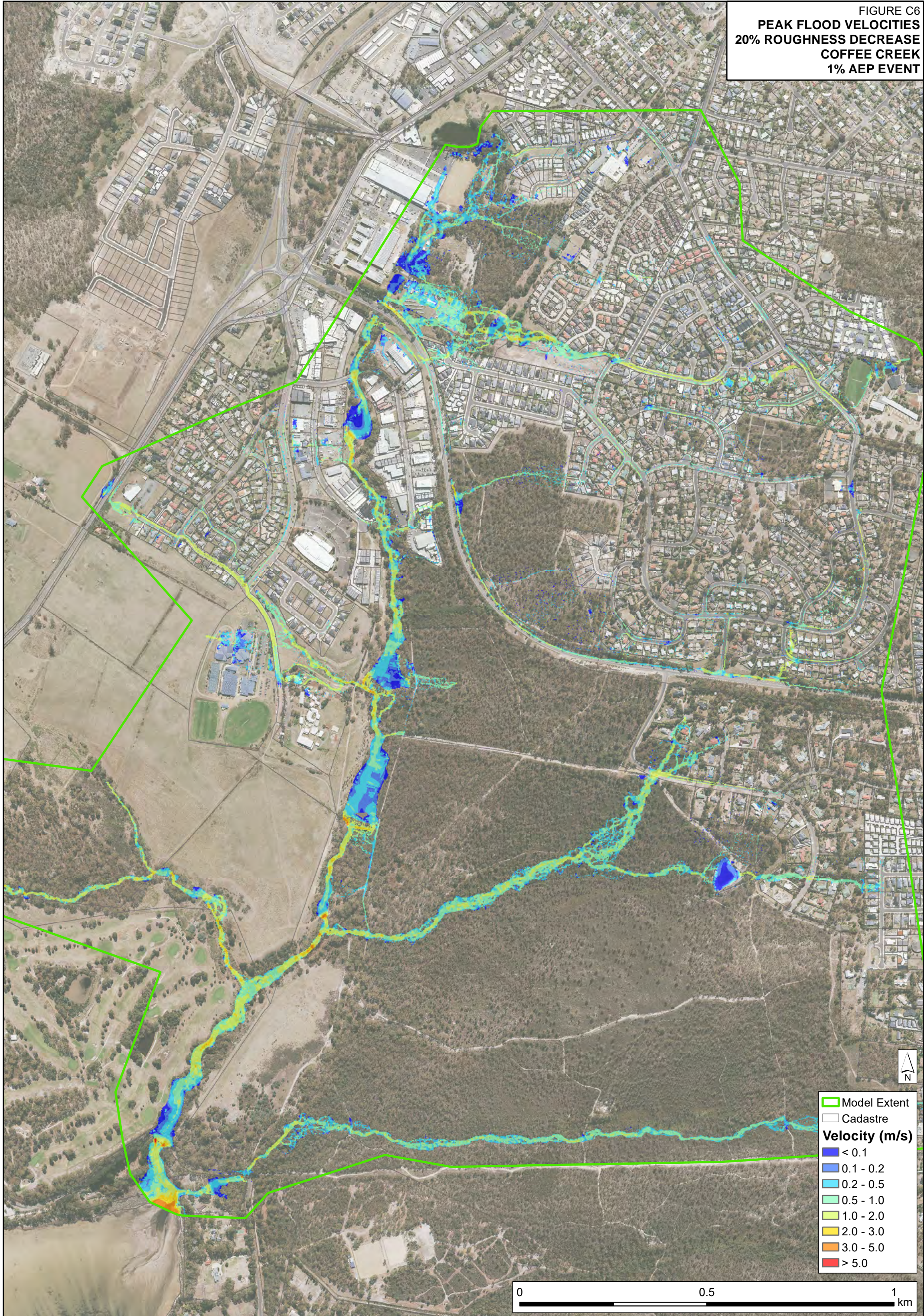


FIGURE C7
PEAK FLOOD DEPTHS
20% ROUGHNESS INCREASE
COFFEE CREEK
1% AEP EVENT



FIGURE C8
PEAK FLOOD VELOCITIES
20% ROUGHNESS INCREASE
COFFEE CREEK
1% AEP EVENT

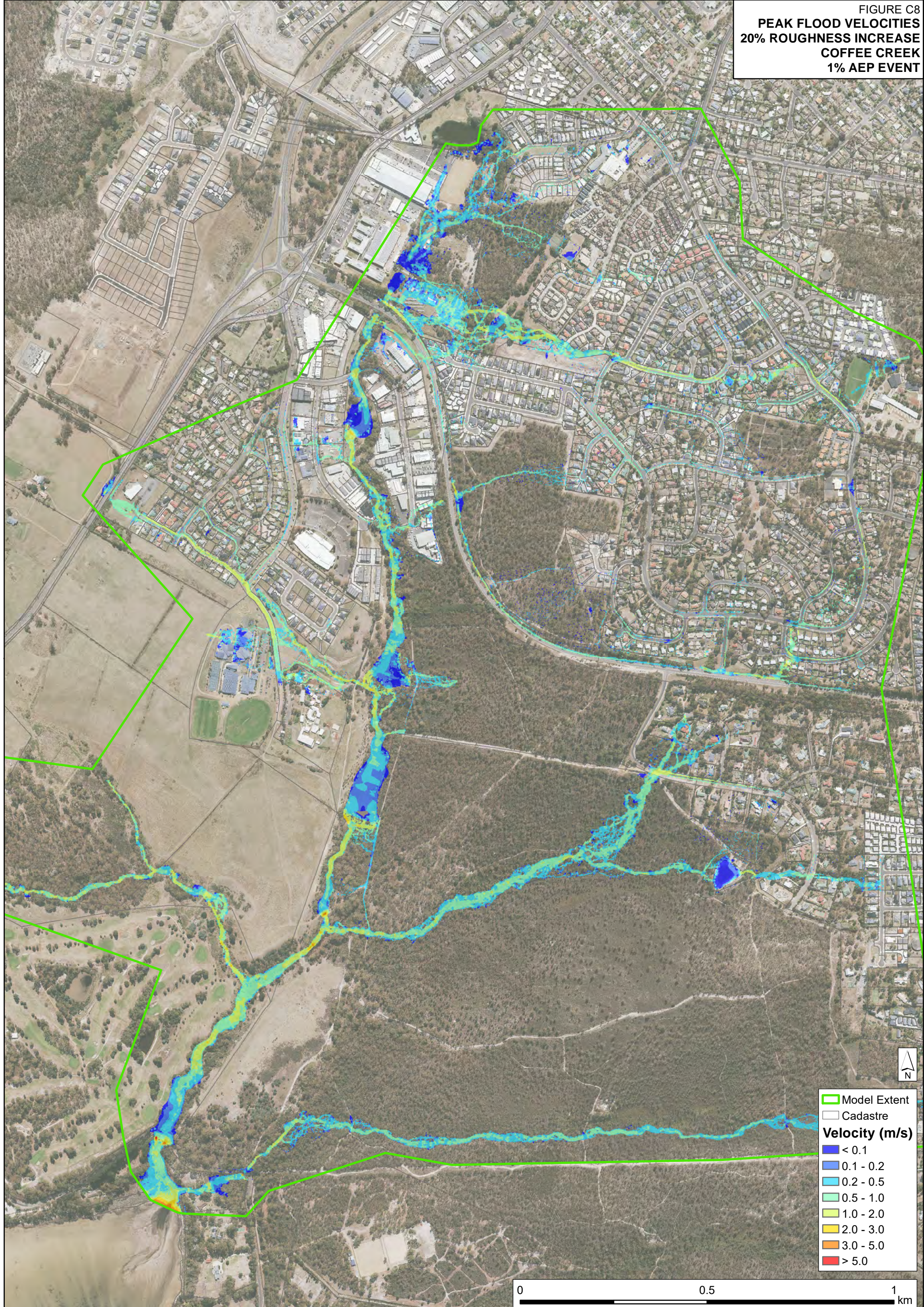


FIGURE C9
PEAK FLOOD DEPTHS
50% BRIDGE AND CULVERTS BLOCKAGE
COFFEE CREEK
1% AEP EVENT

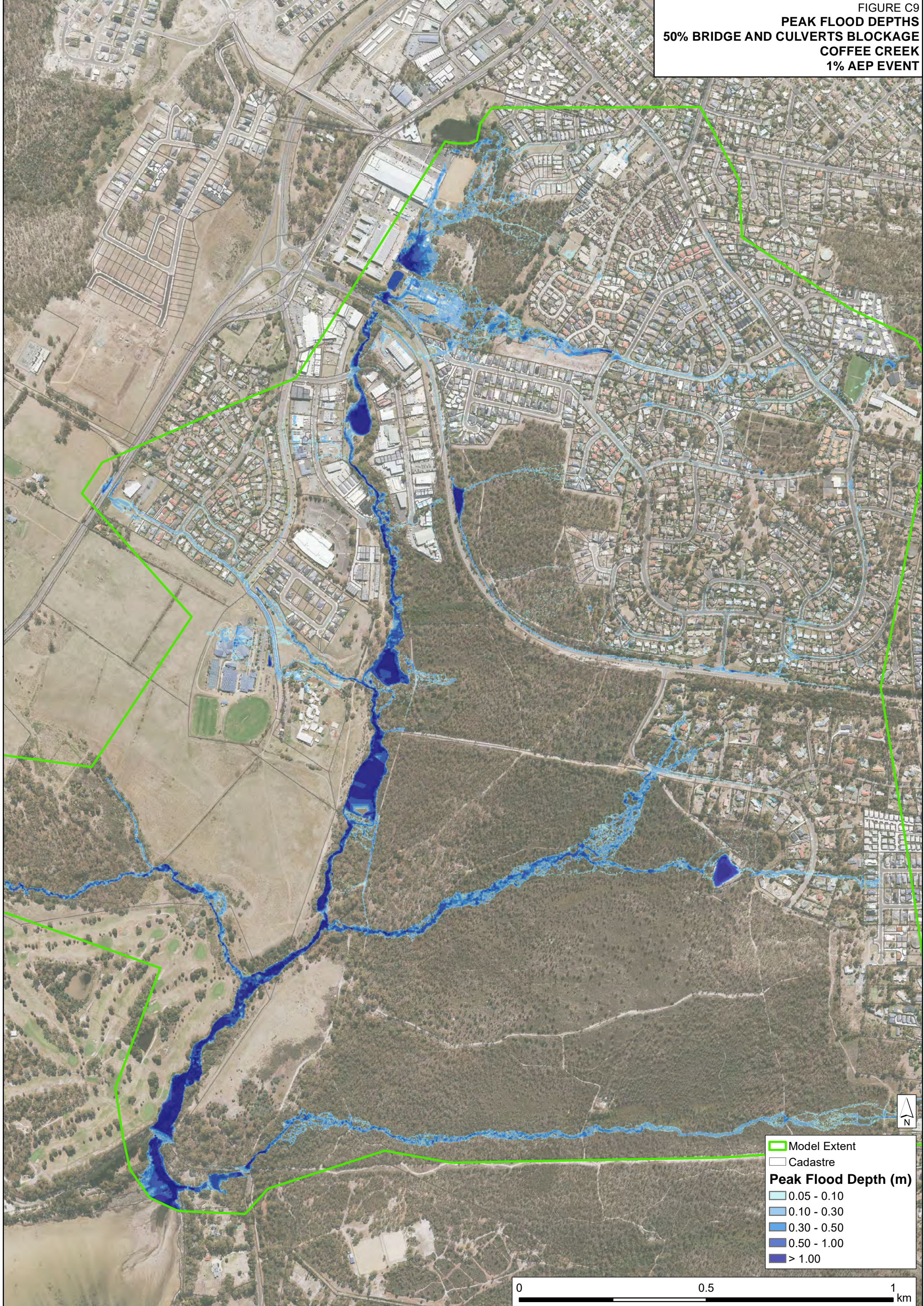


FIGURE C10
PEAK FLOOD VELOCITIES
50% BRIDGE AND CULVERTS BLOCKAGE
COFFEE CREEK
1% AEP EVENT

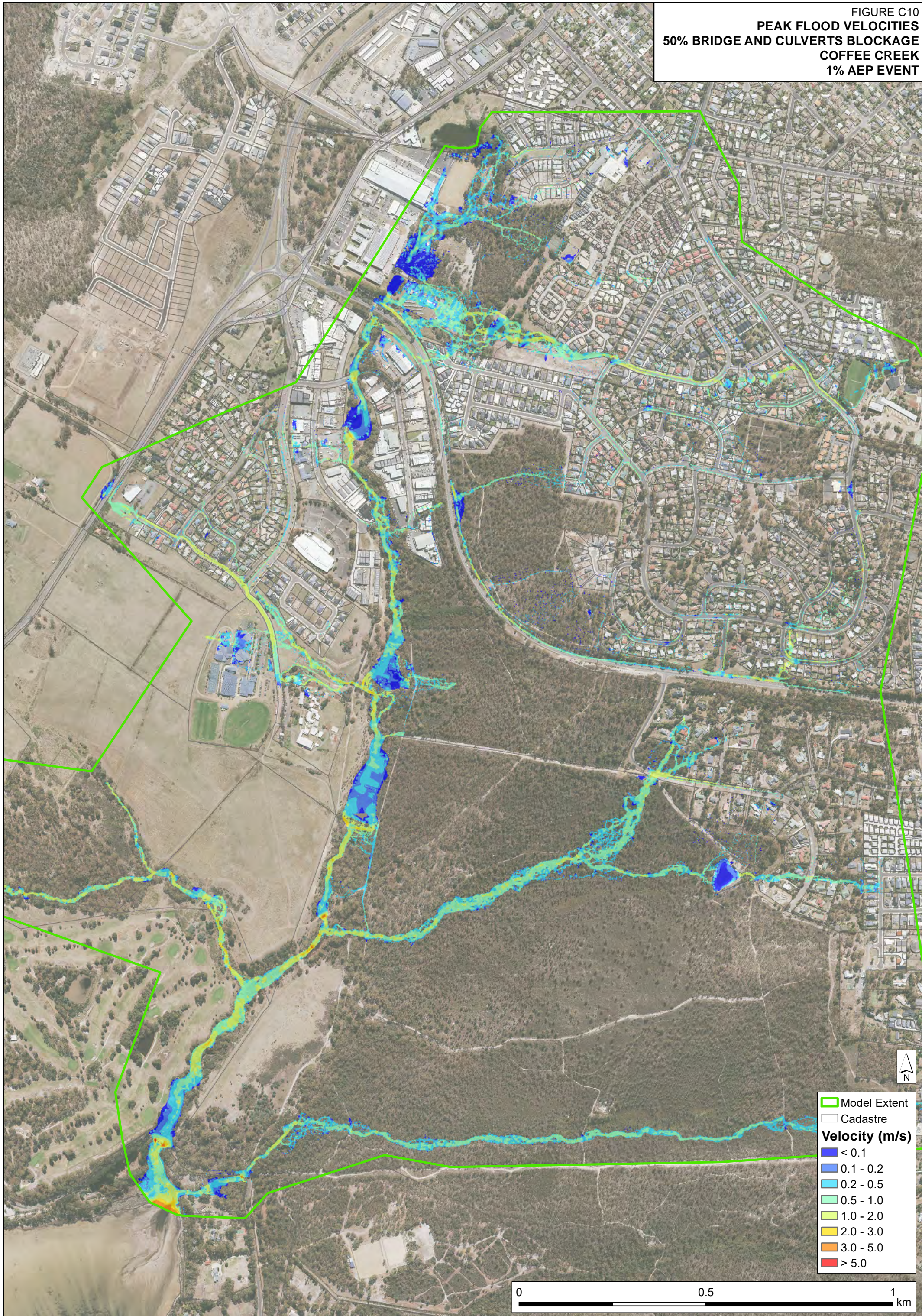


FIGURE C11
PEAK FLOOD DEPTHS
50% INLET PITS BLOCKAGE
COFFEE CREEK
1% AEP EVENT



Model Extent
Cadastrate

Peak Flood Depth (m)

| |
|-------------|
| 0.05 - 0.10 |
| 0.10 - 0.30 |
| 0.30 - 0.50 |
| 0.50 - 1.00 |
| > 1.00 |

0 0.5 1 km

FIGURE C12
PEAK FLOOD VELOCITIES
50% INLET PITS BLOCKAGE
COFFEE CREEK
1% AEP EVENT

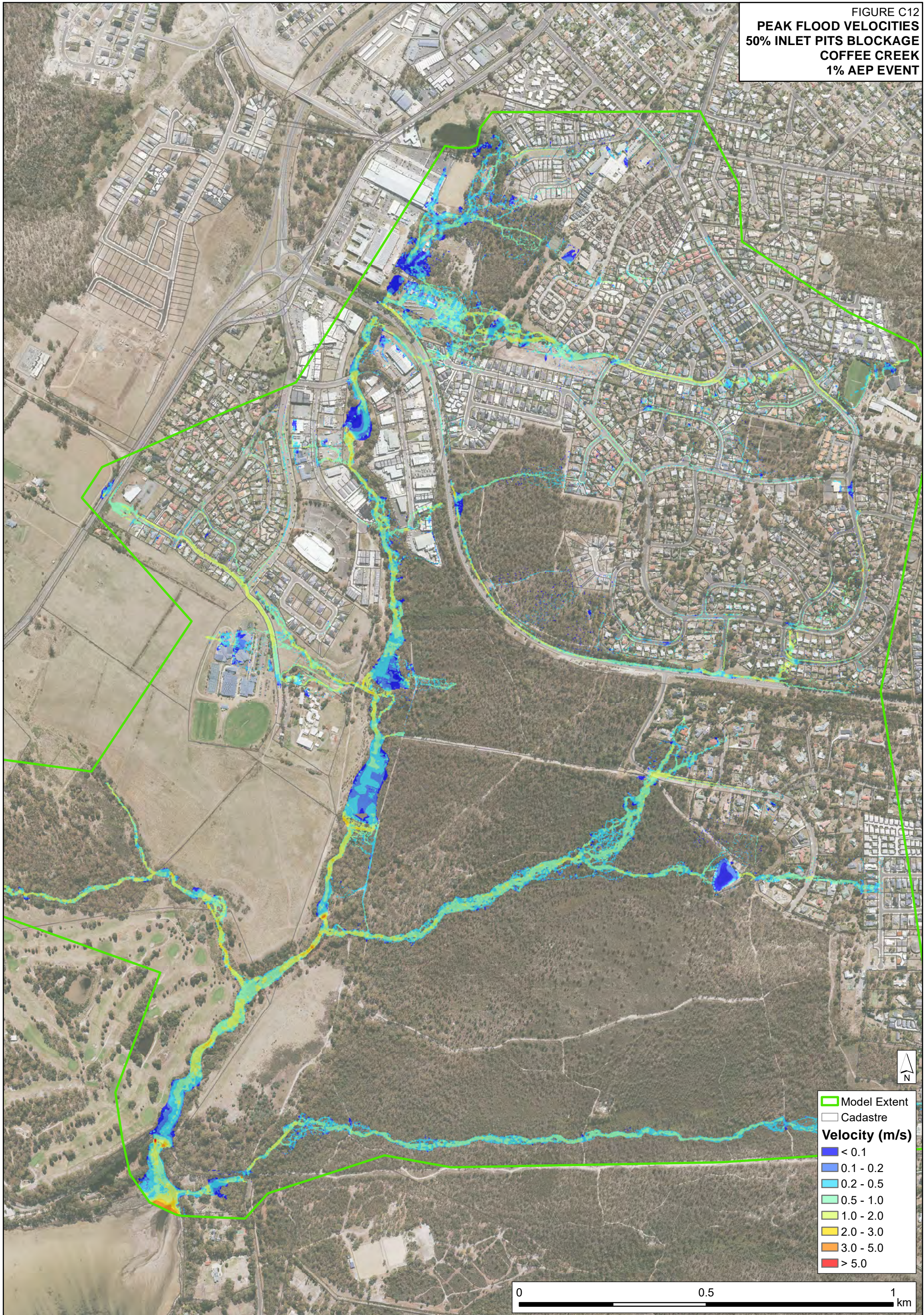


FIGURE C13
PEAK FLOOD DEPTHS
50% BRIDGE, CULVERTS AND INLET PITS BLOCKAGE
COFFEE CREEK
1% AEP EVENT

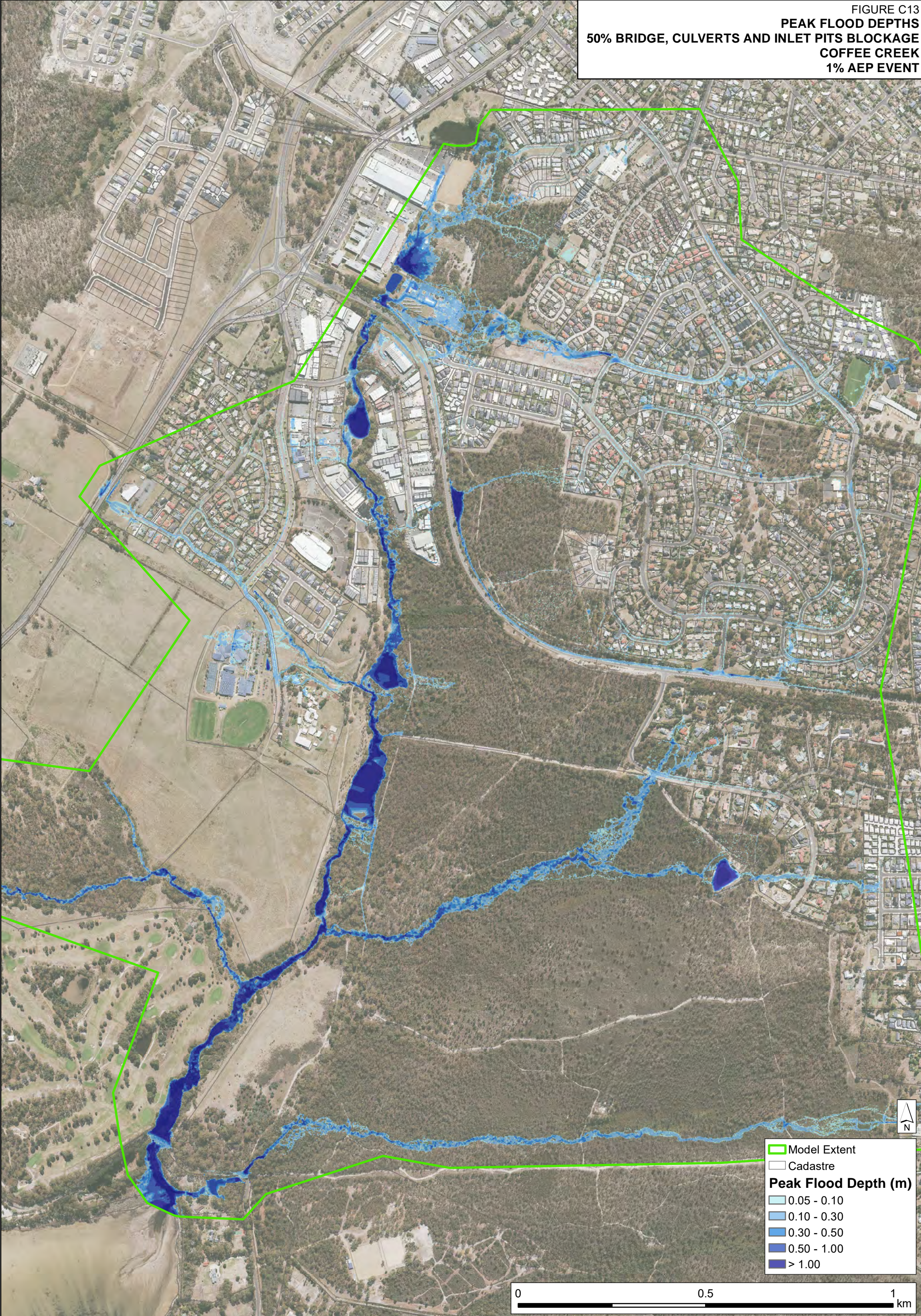


FIGURE C14
PEAK FLOOD VELOCITIES
50% BRIDGE, CULVERTS AND INLET PITS BLOCKAGE
COFFEE CREEK
1% AEP EVENT

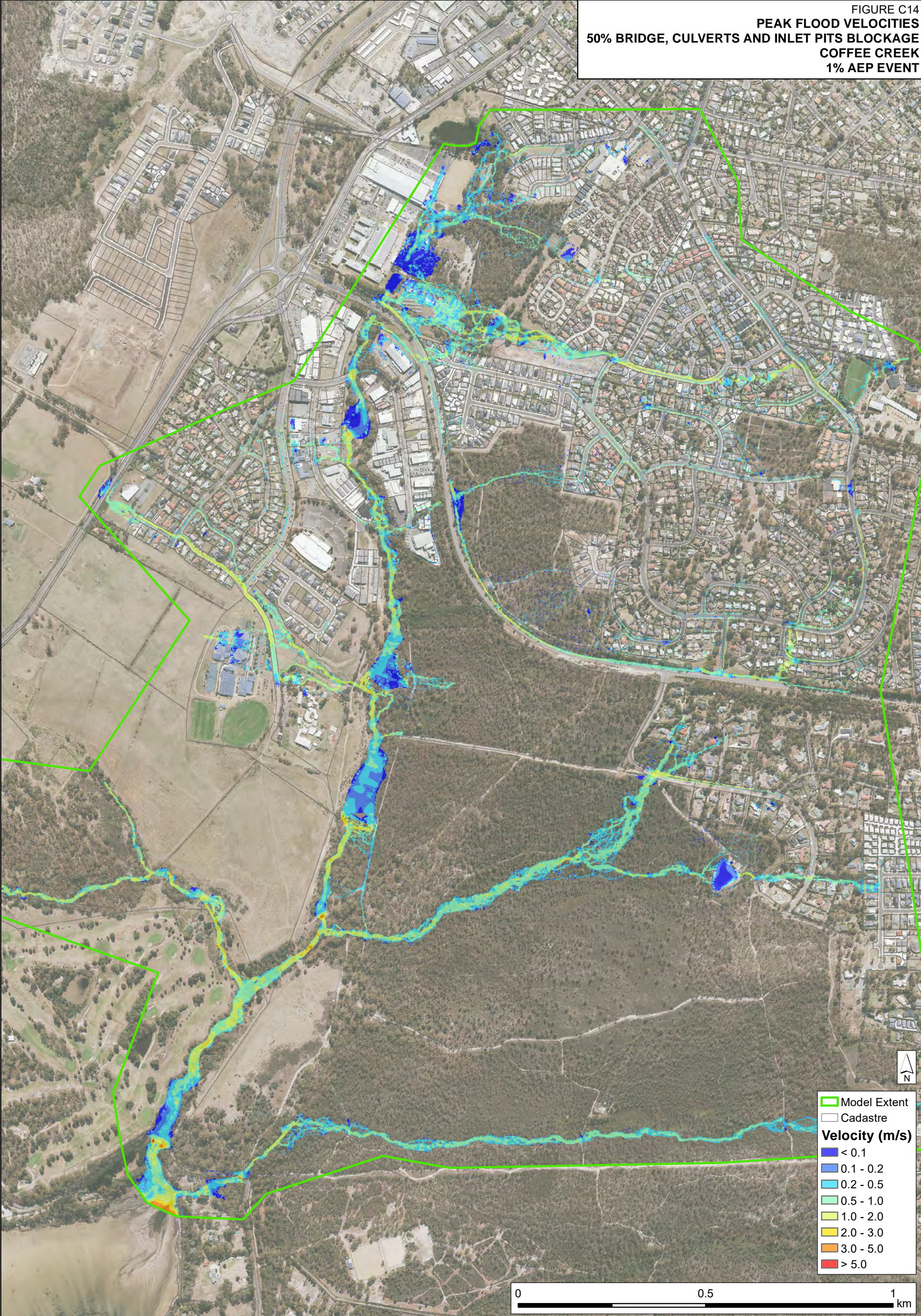


FIGURE C15
PEAK FLOOD DEPTHS
ULTIMATE DEVELOPED CONDITIONS
COFFEE CREEK
1% AEP EVENT

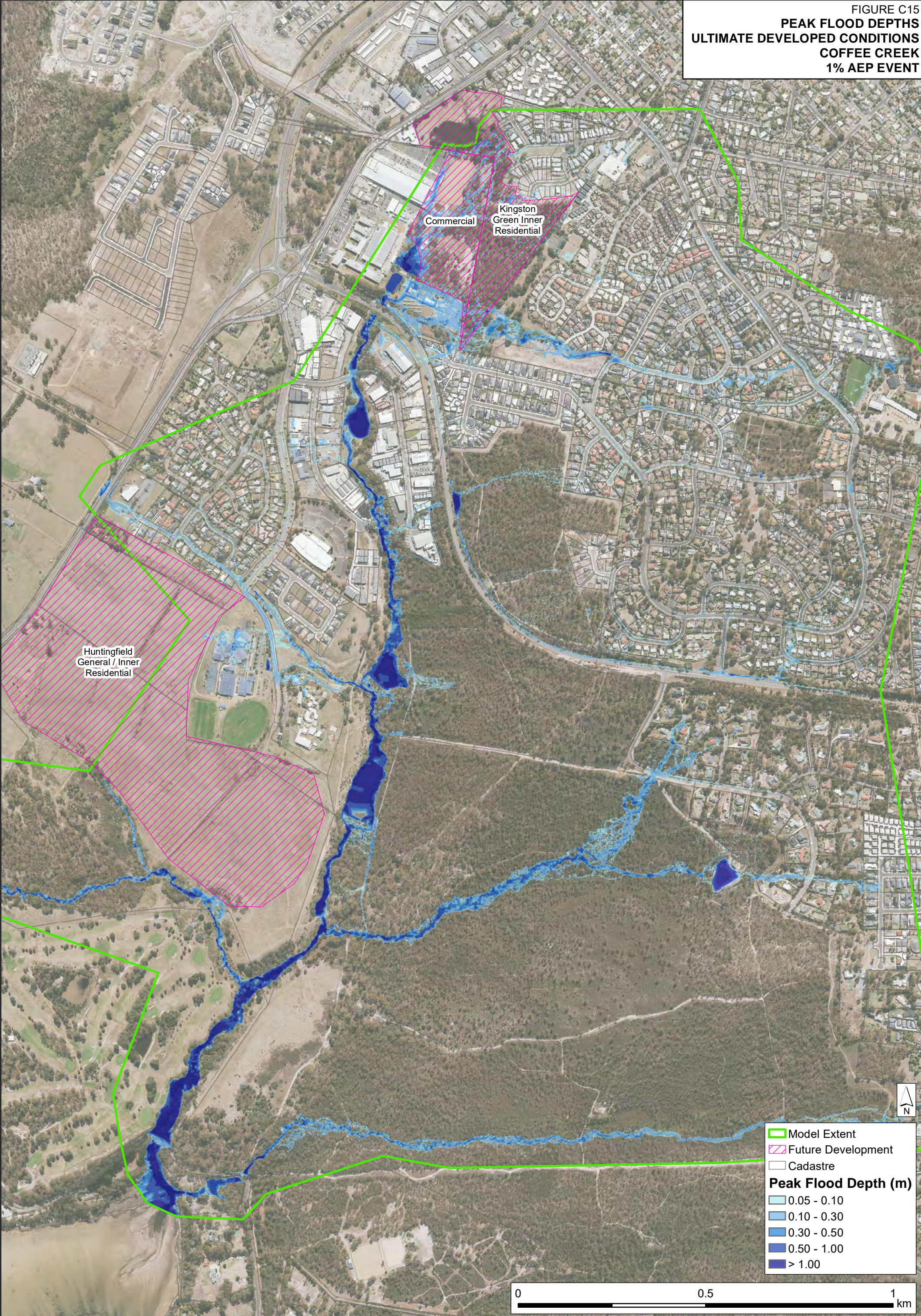
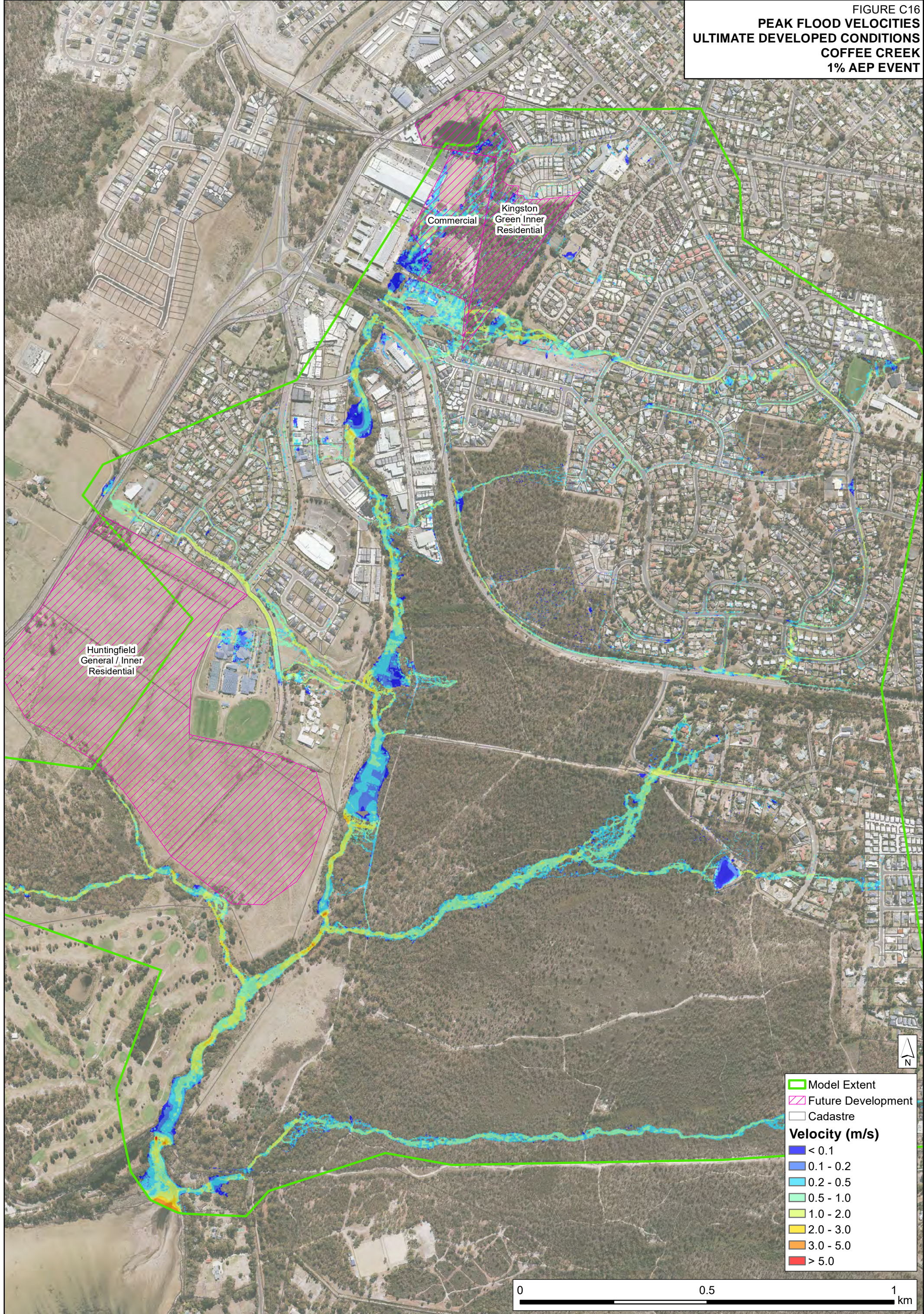


FIGURE C16
PEAK FLOOD VELOCITIES
ULTIMATE DEVELOPED CONDITIONS
COFFEE CREEK
1% AEP EVENT



APPENDIX D. FLOOD IMPACT MAPPING



Appendix D

FIGURE D1
CHANGE IN FLOOD HEIGHT
POND 1 VS EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT

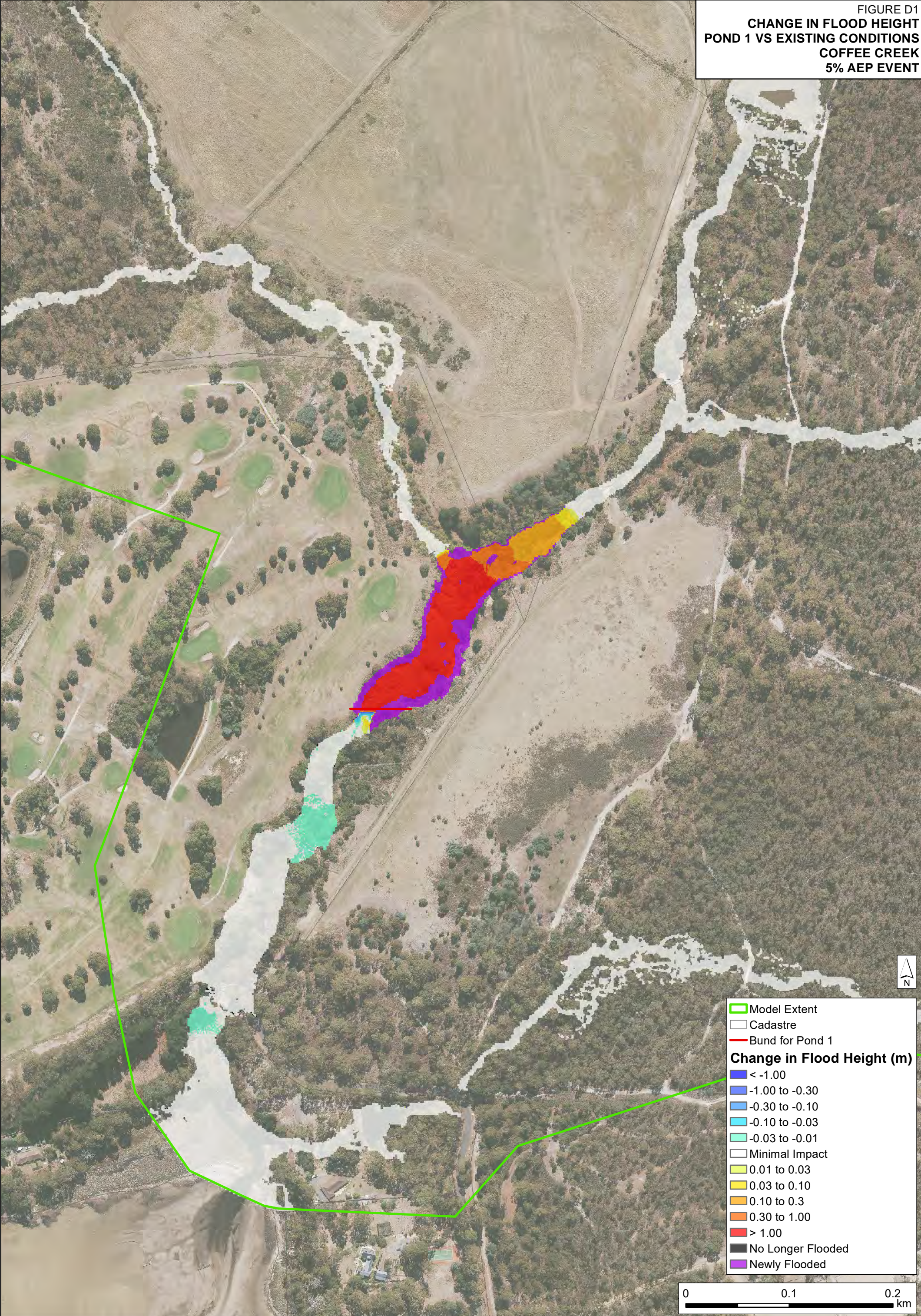


FIGURE D2
CHANGE IN FLOOD HEIGHT
POND 1 VS EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

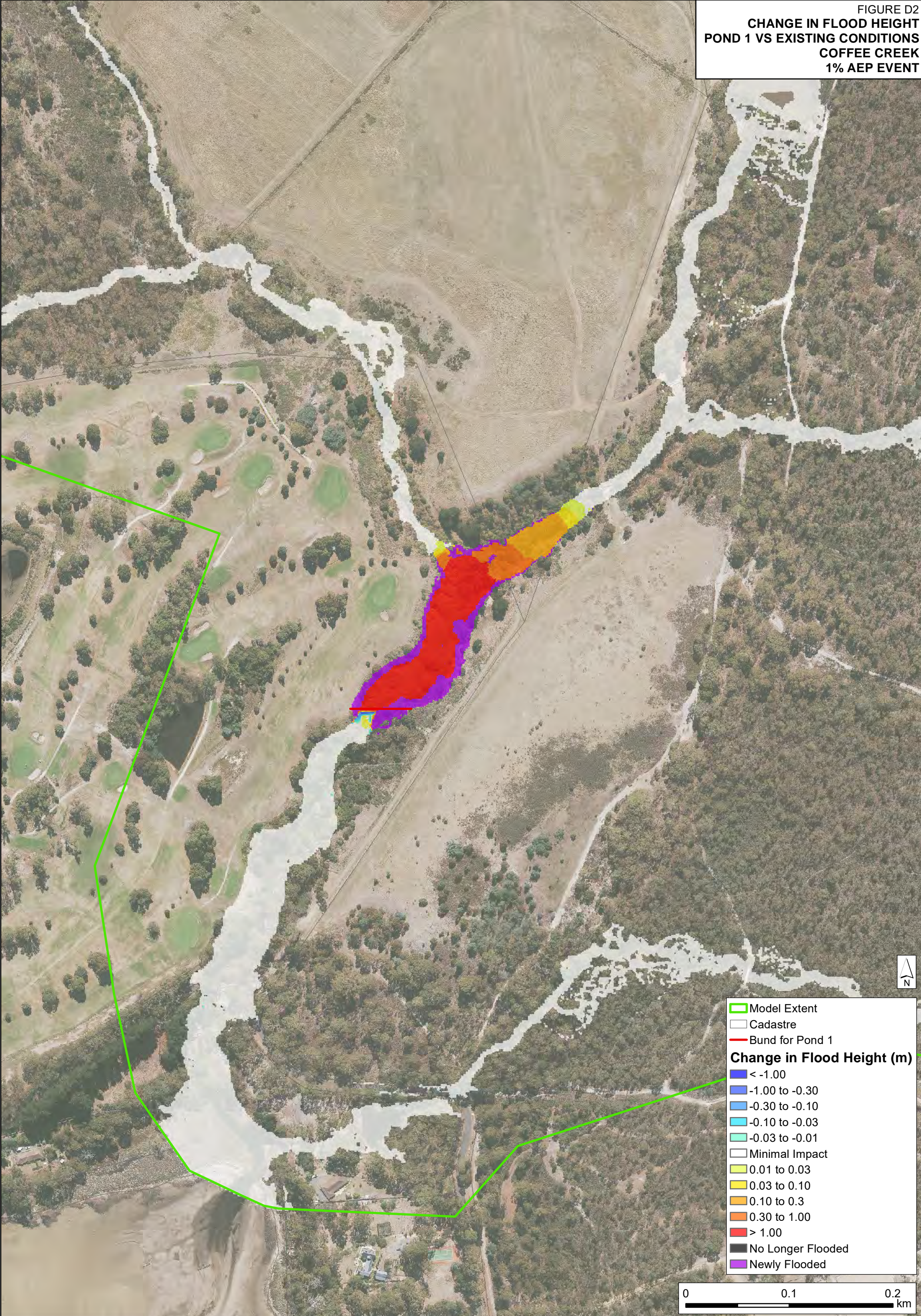


FIGURE D3
CHANGE IN FLOOD HEIGHT
POND 1 VS EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT

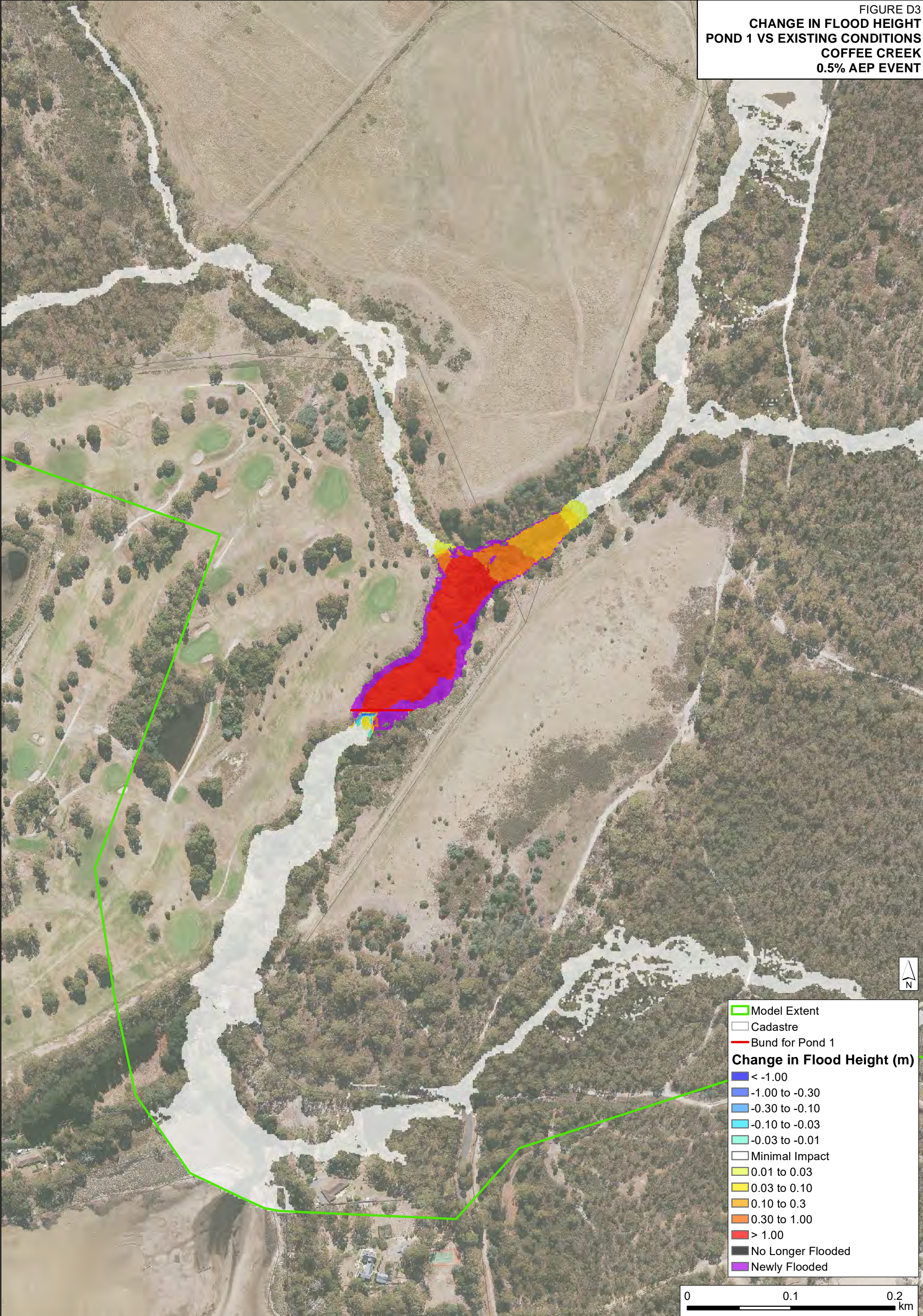


FIGURE D4
CHANGE IN FLOOD VELOCITY
POND 1 VS EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT

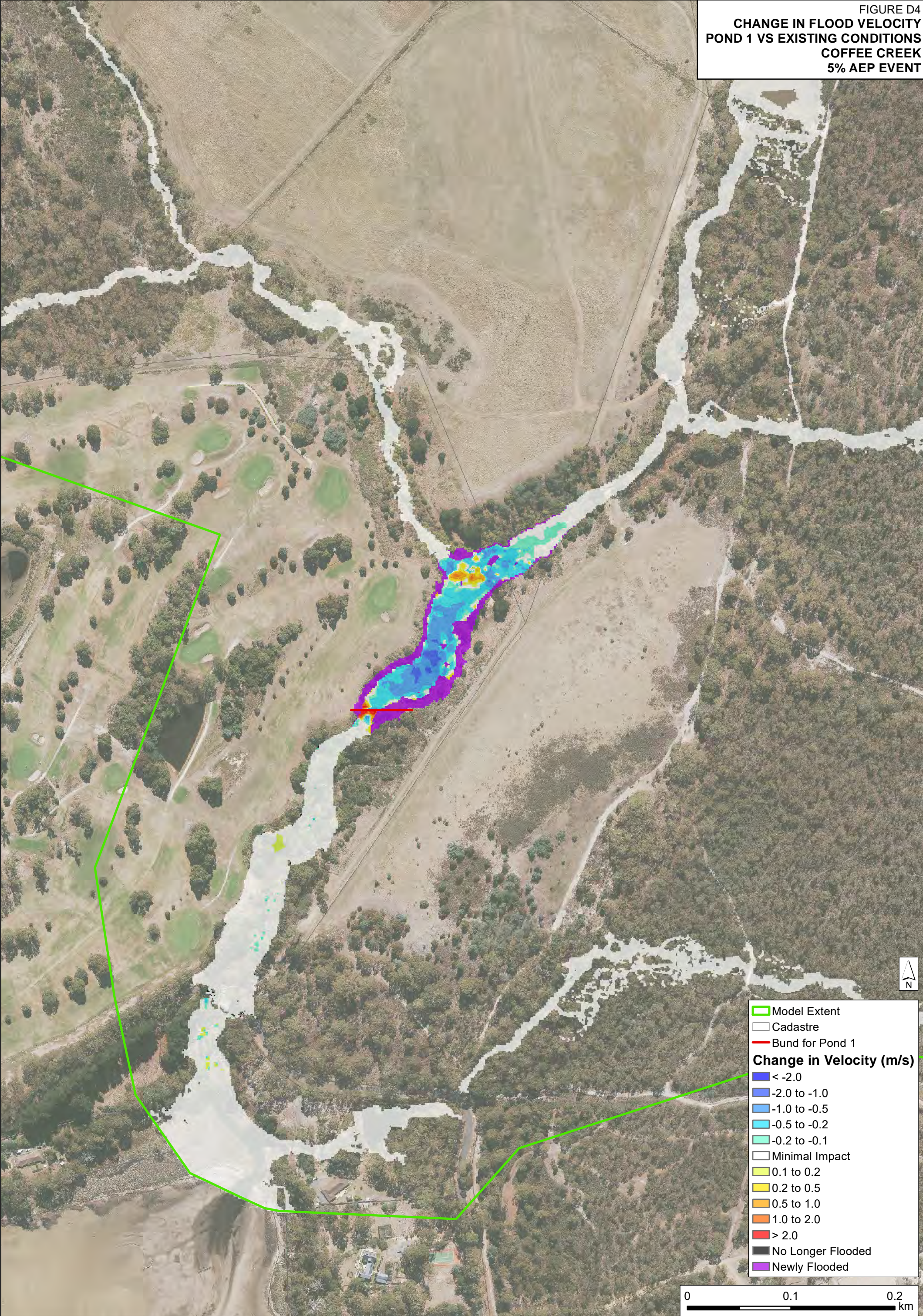


FIGURE D5
CHANGE IN FLOOD VELOCITY
POND 1 VS EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

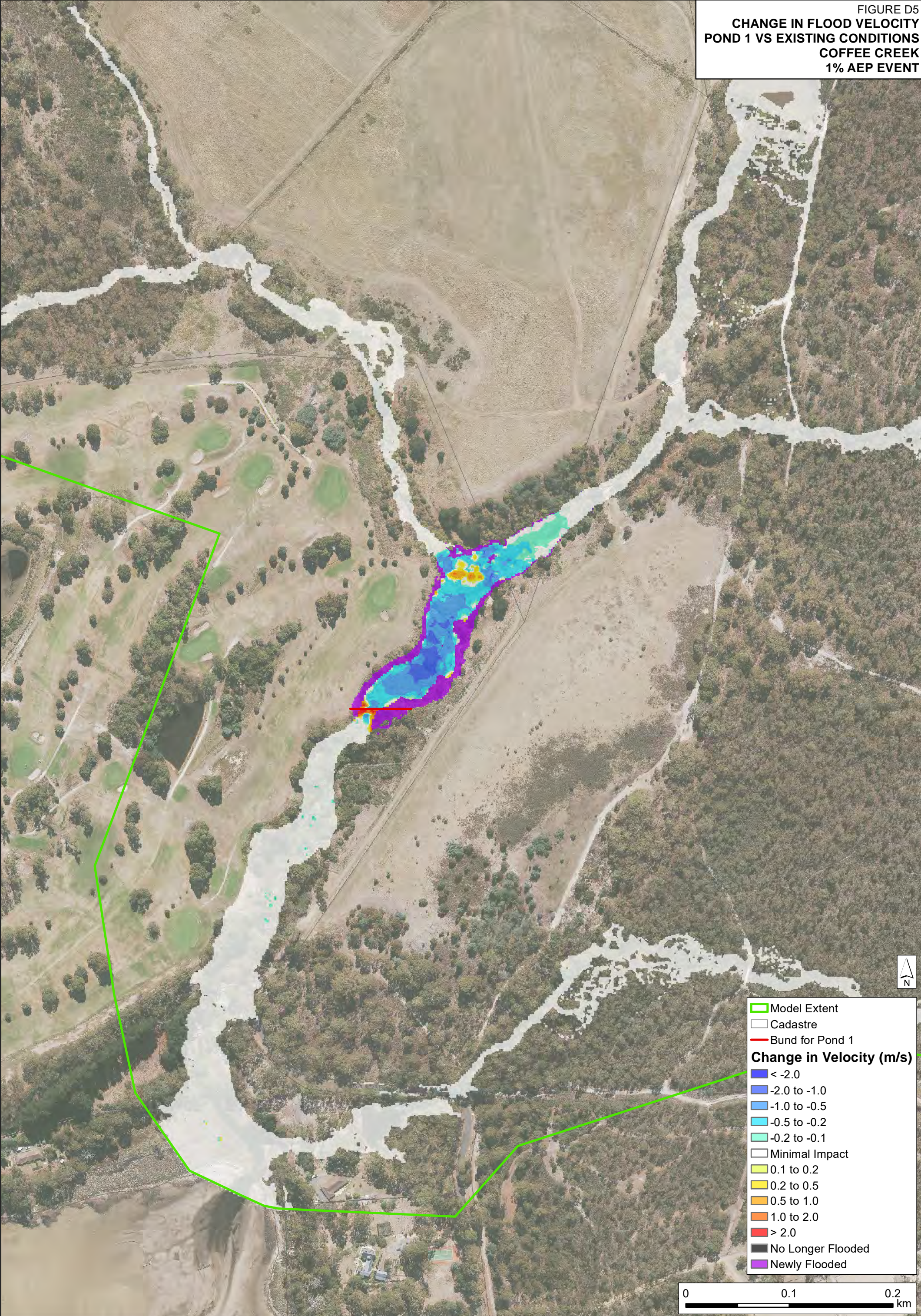


FIGURE D6
CHANGE IN FLOOD VELOCITY
POND 1 VS EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT

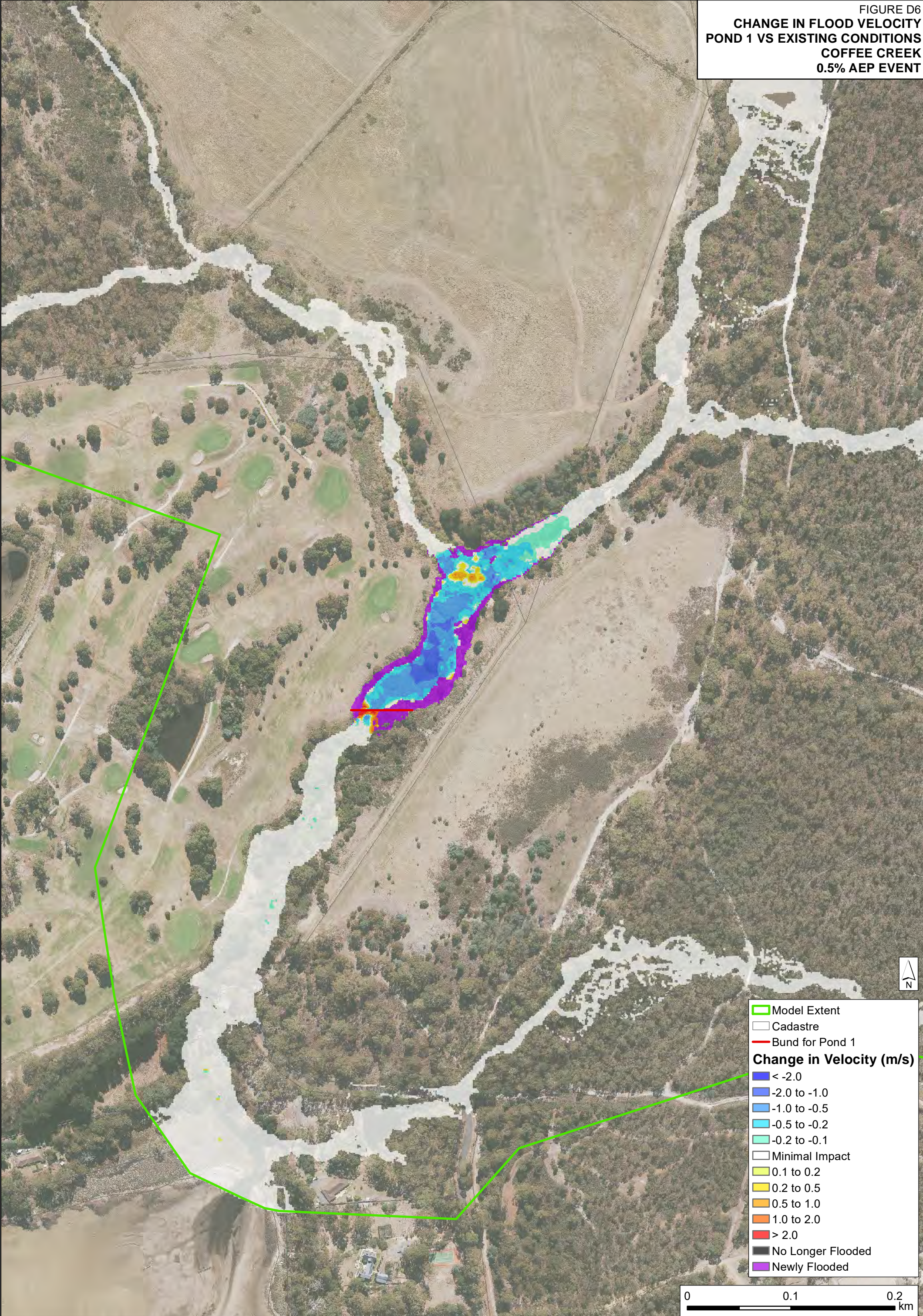


FIGURE D7
CHANGE IN FLOOD HEIGHT
POND 2 VS EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT

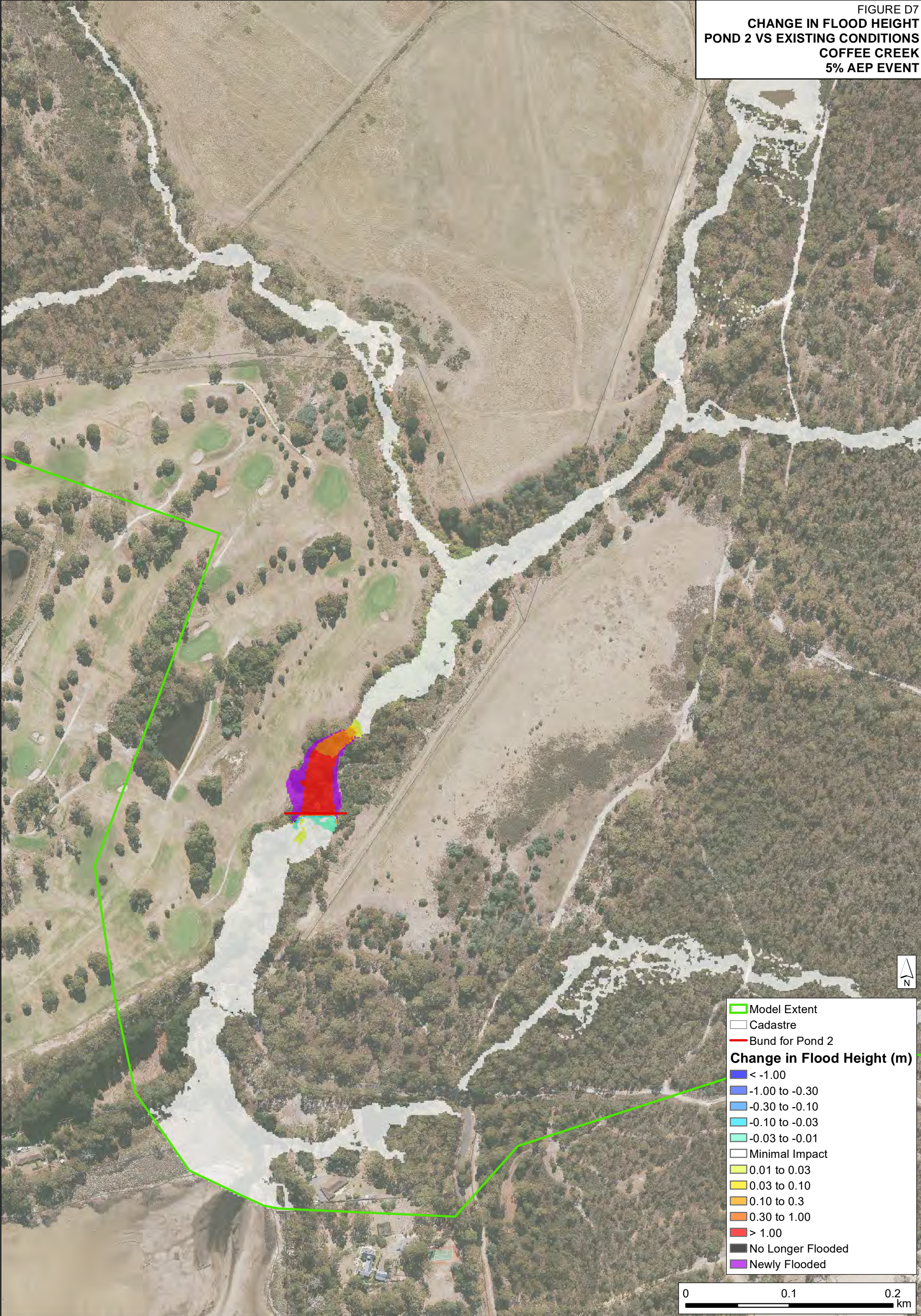


FIGURE D8
CHANGE IN FLOOD HEIGHT
POND 2 VS EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

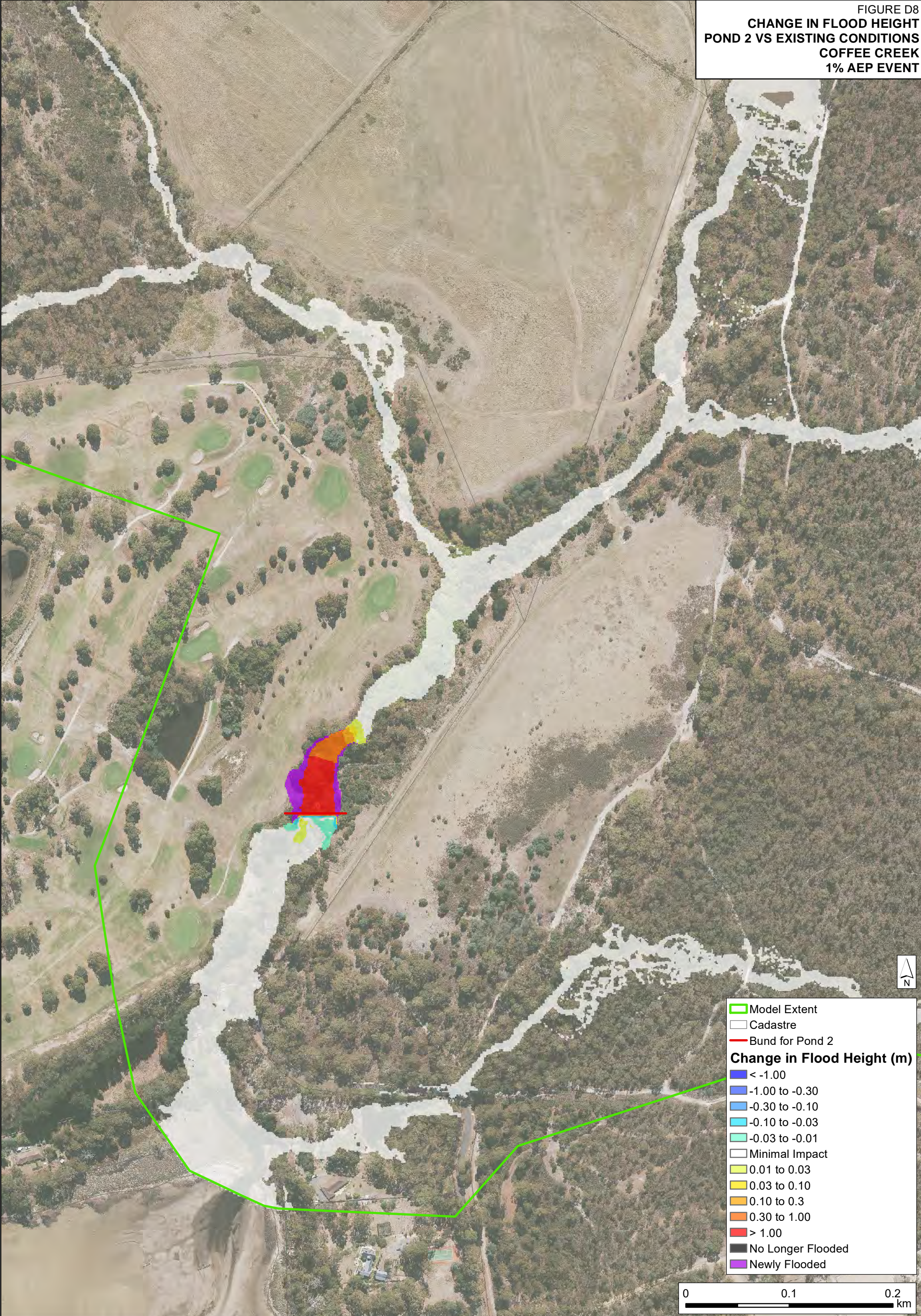


FIGURE D9
CHANGE IN FLOOD HEIGHT
POND 2 VS EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT

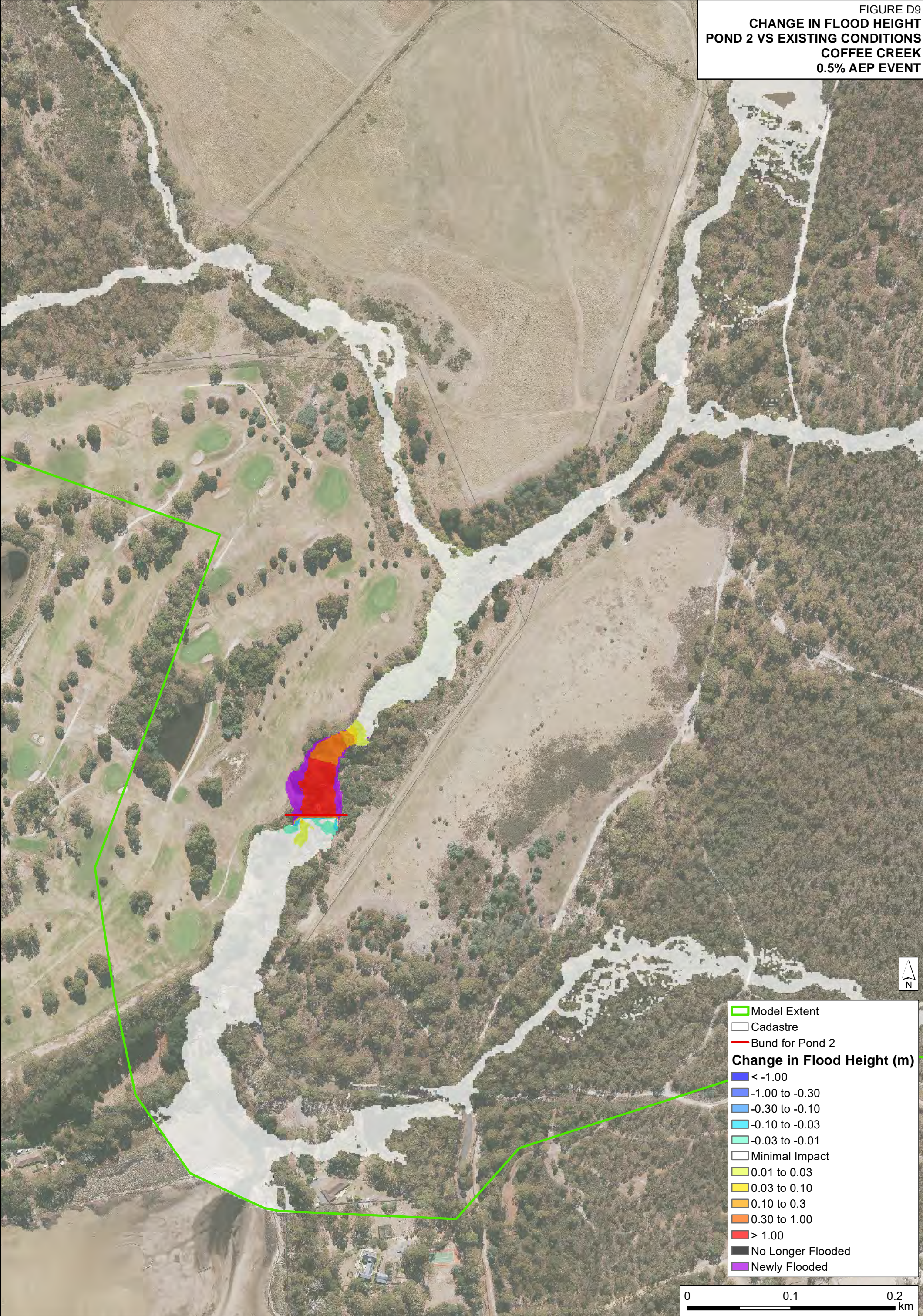


FIGURE D10
CHANGE IN FLOOD VELOCITY
POND 2 VS EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT

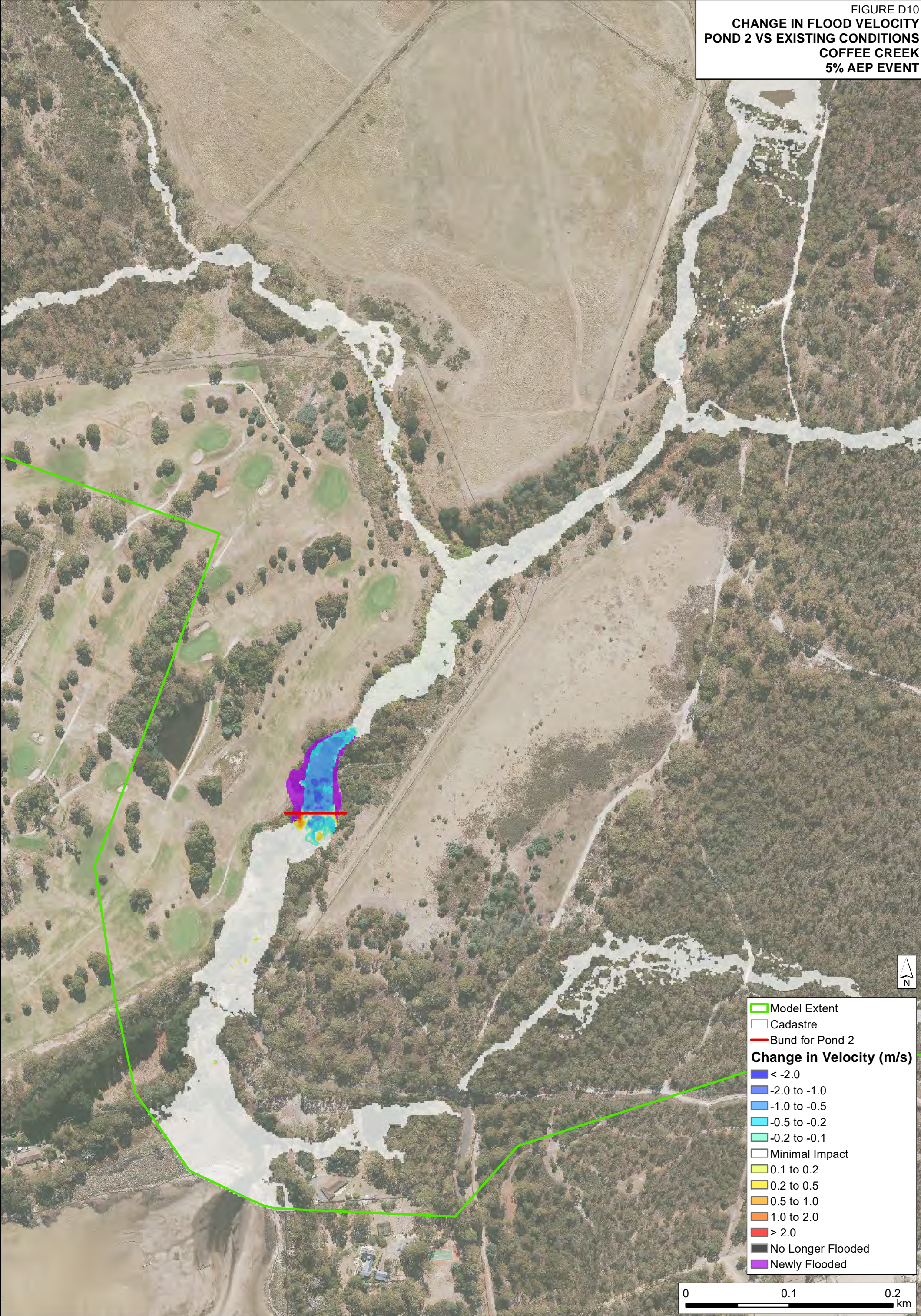


FIGURE D11
CHANGE IN FLOOD VELOCITY
POND 2 VS EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

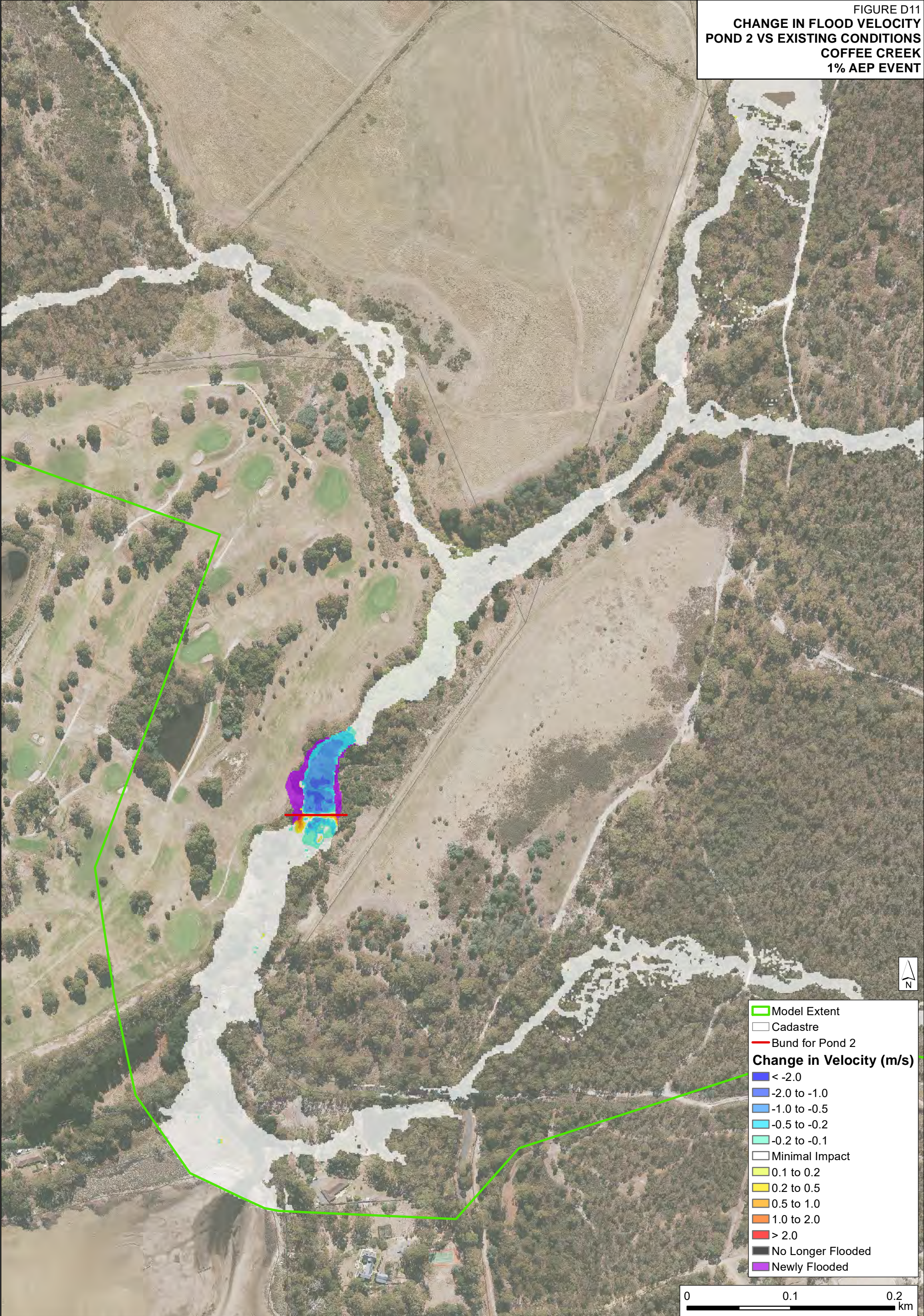


FIGURE D12
CHANGE IN FLOOD VELOCITY
POND 2 VS EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT

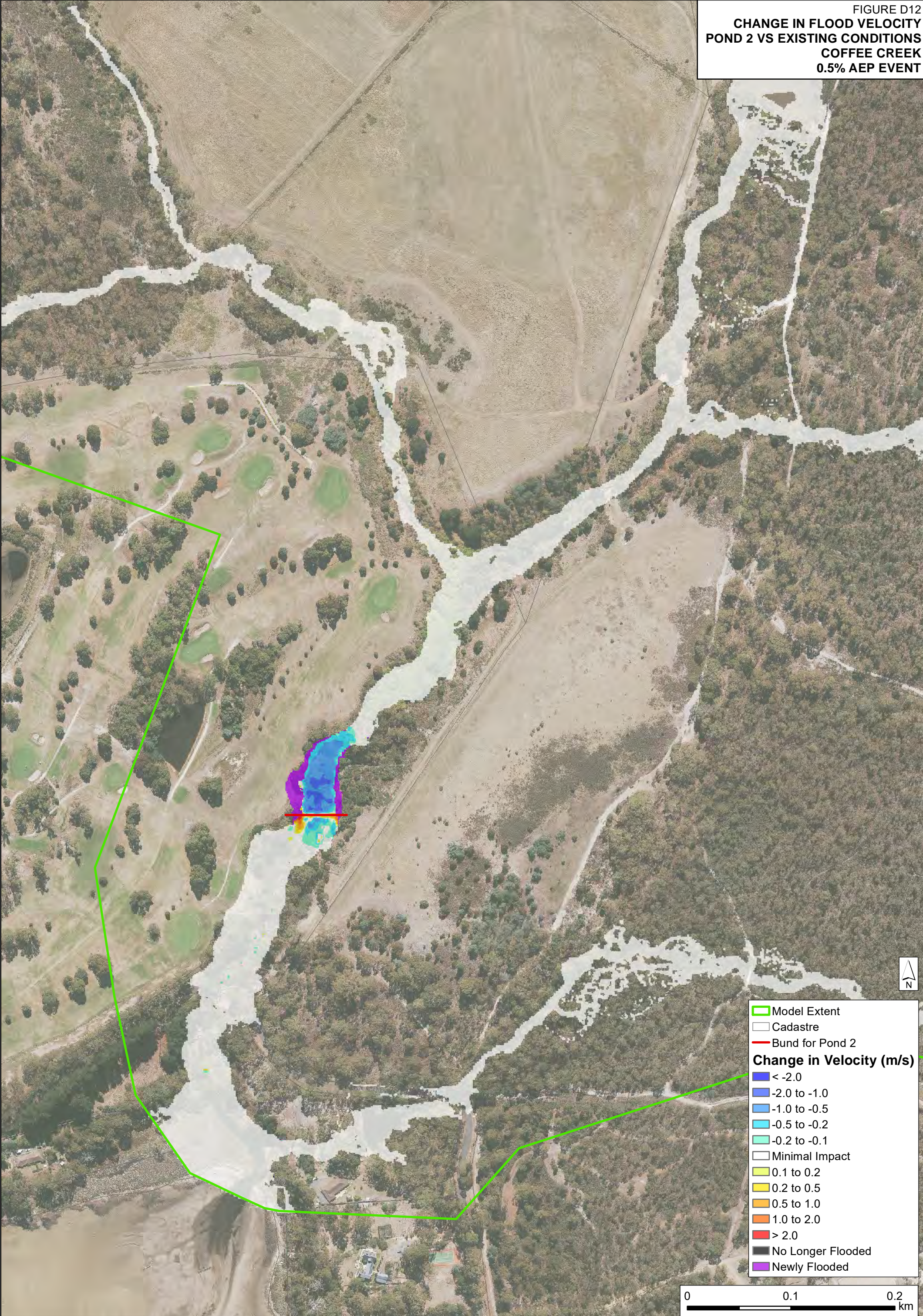
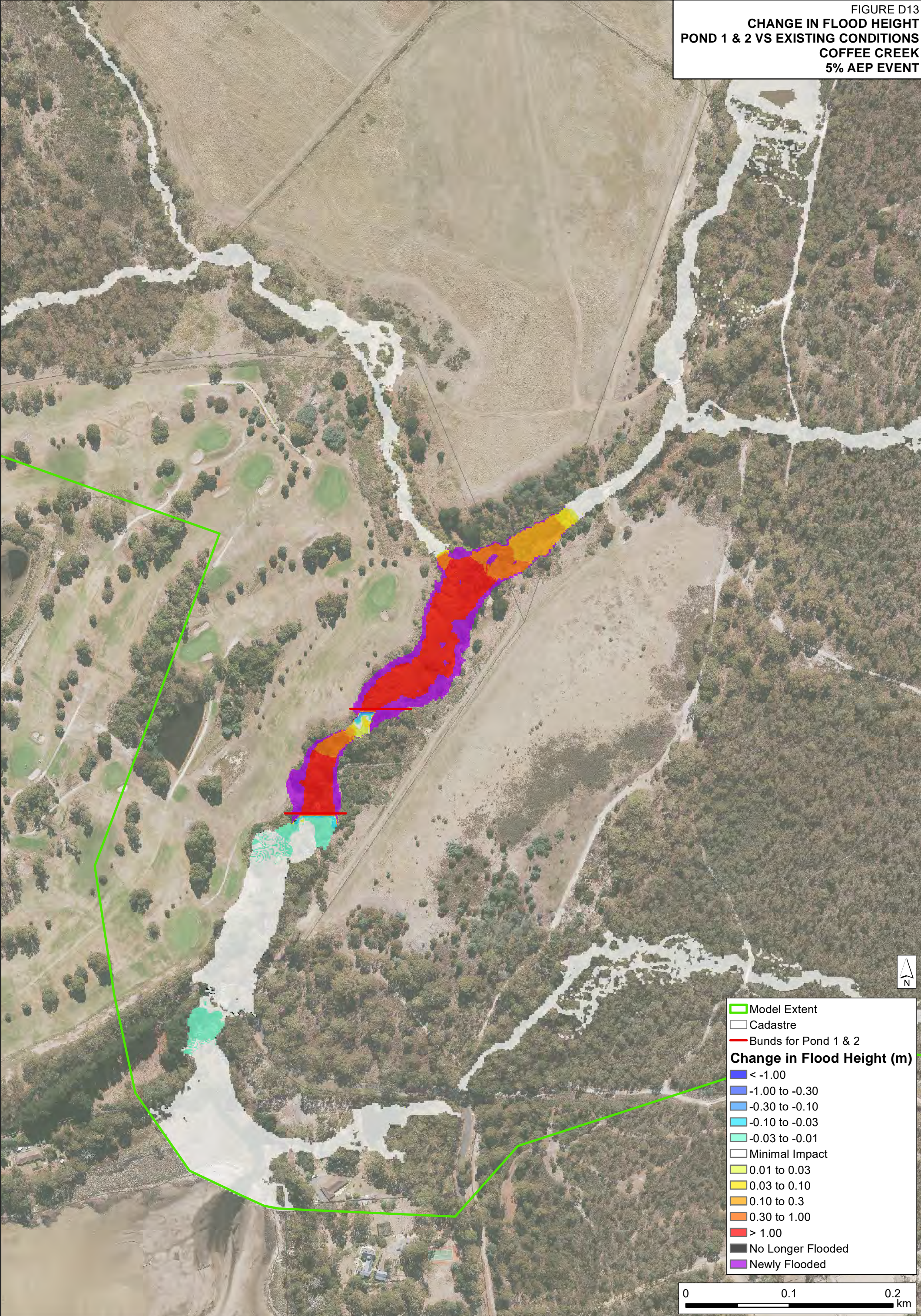


FIGURE D13
CHANGE IN FLOOD HEIGHT
POND 1 & 2 VS EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT



Model Extent
Cadastre
Bunds for Pond 1 & 2

Change in Flood Height (m)

- < -1.00
- 1.00 to -0.30
- 0.30 to -0.10
- 0.10 to -0.03
- 0.03 to -0.01
- Minimal Impact
- 0.01 to 0.03
- 0.03 to 0.10
- 0.10 to 0.3
- 0.30 to 1.00
- > 1.00
- No Longer Flooded
- Newly Flooded

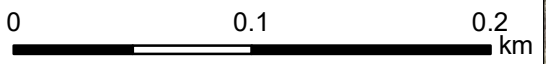


FIGURE D14
CHANGE IN FLOOD HEIGHT
POND 1 & 2 VS EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

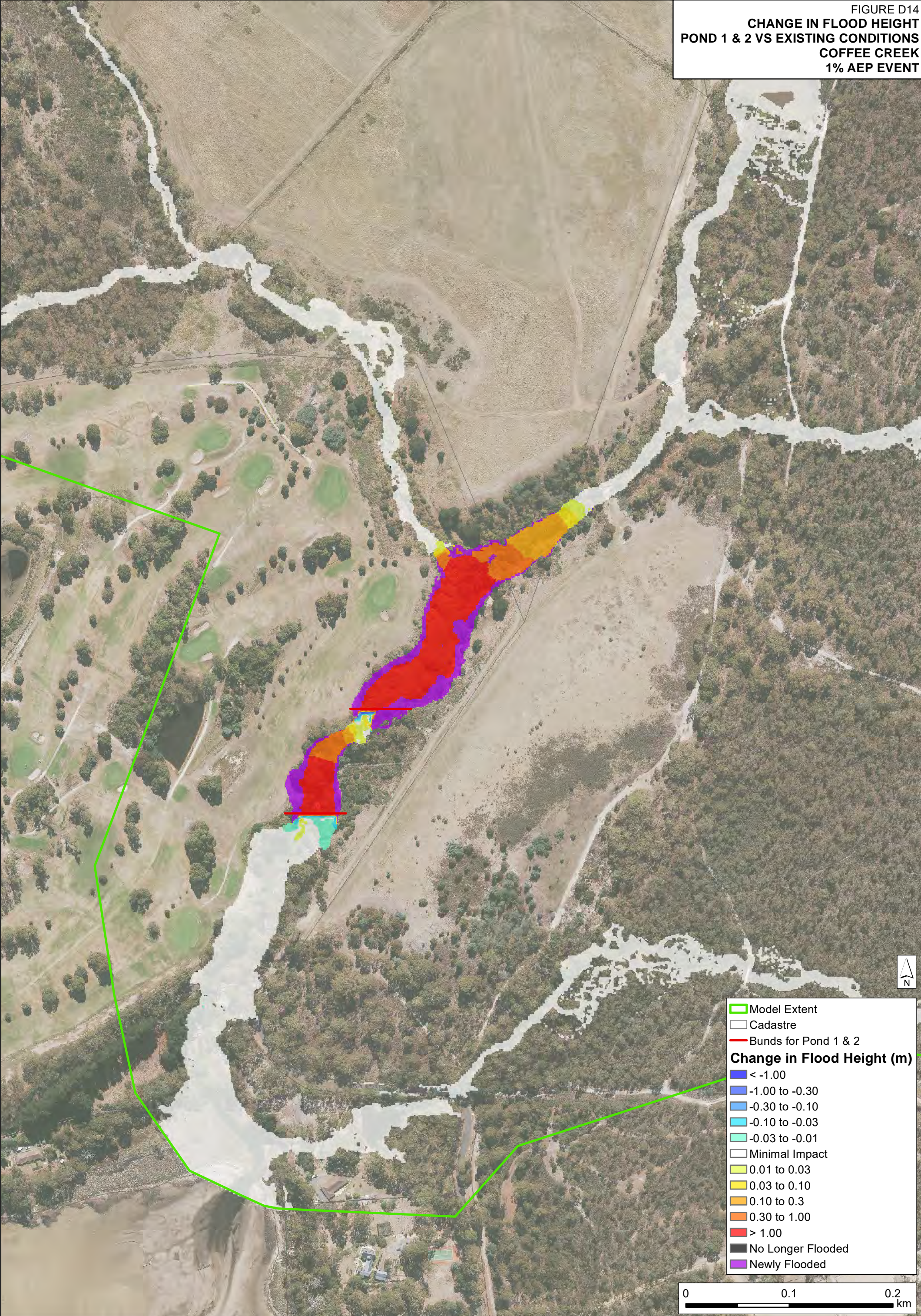


FIGURE D15
CHANGE IN FLOOD HEIGHT
POND 1 & 2 VS EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT

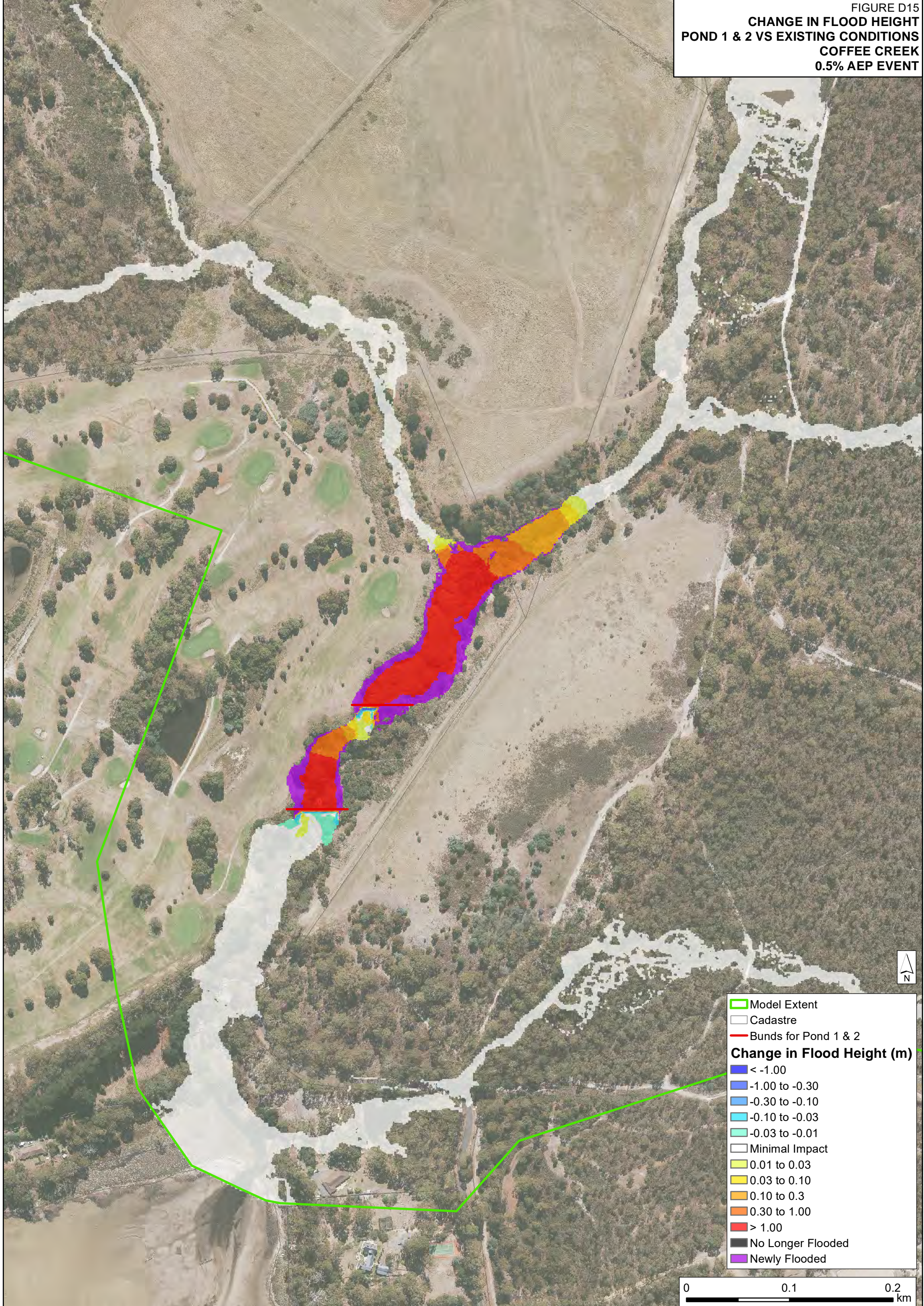


FIGURE D16
CHANGE IN FLOOD VELOCITY
POND 1 & 2 VS EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT

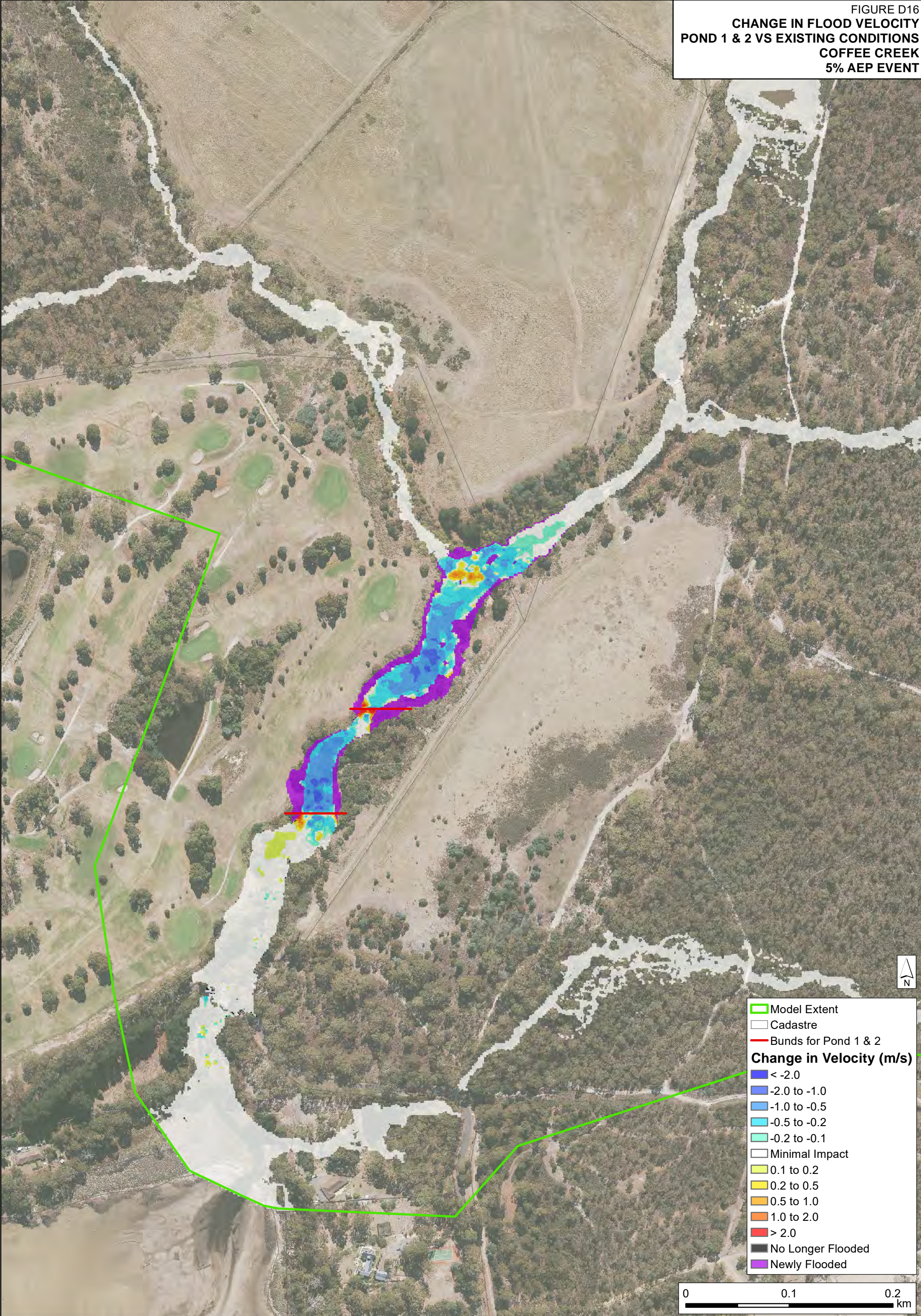


FIGURE D17
CHANGE IN FLOOD VELOCITY
POND 1 & 2 VS EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

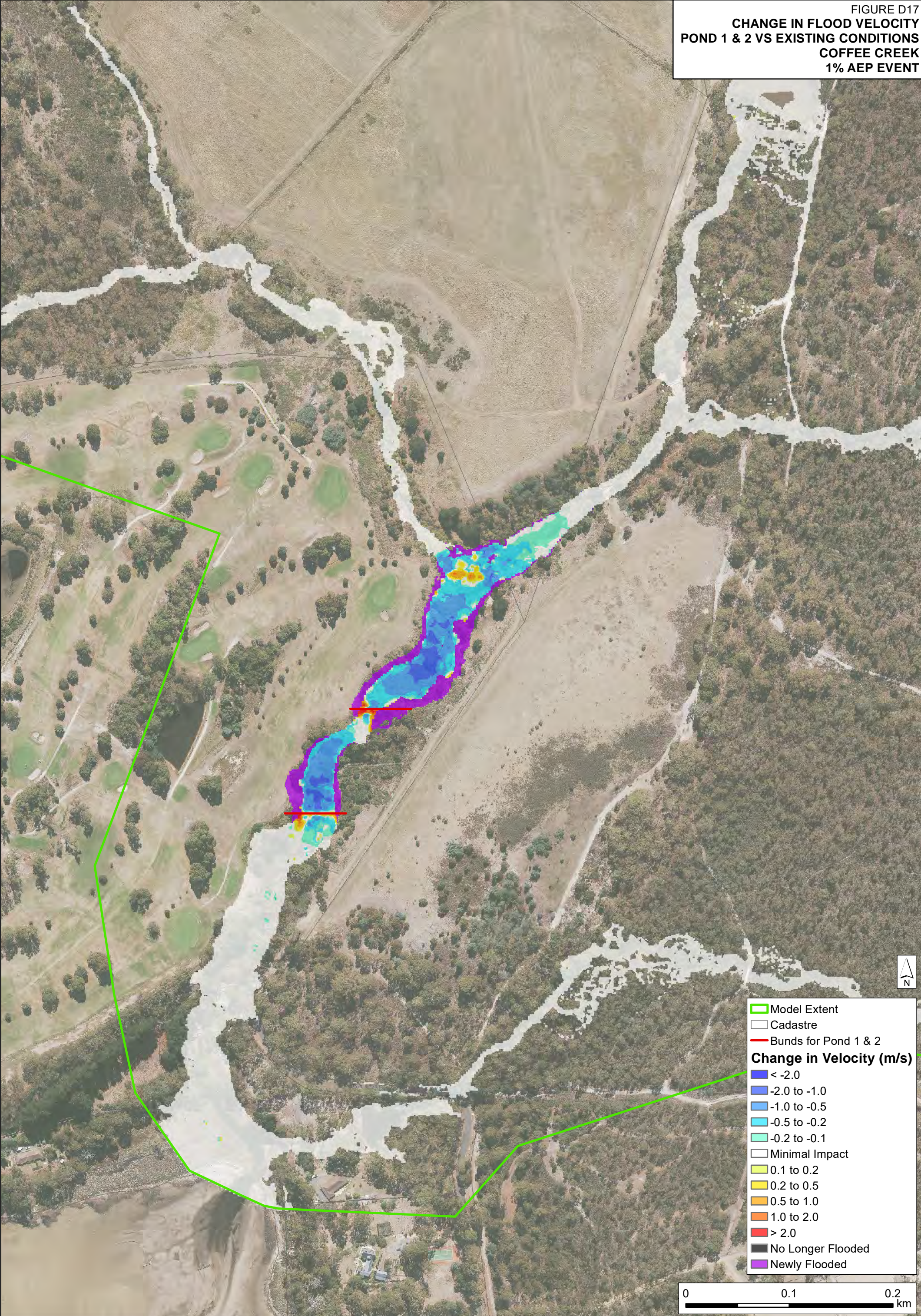


FIGURE D18
CHANGE IN FLOOD VELOCITY
POND 1 & 2 VS EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT

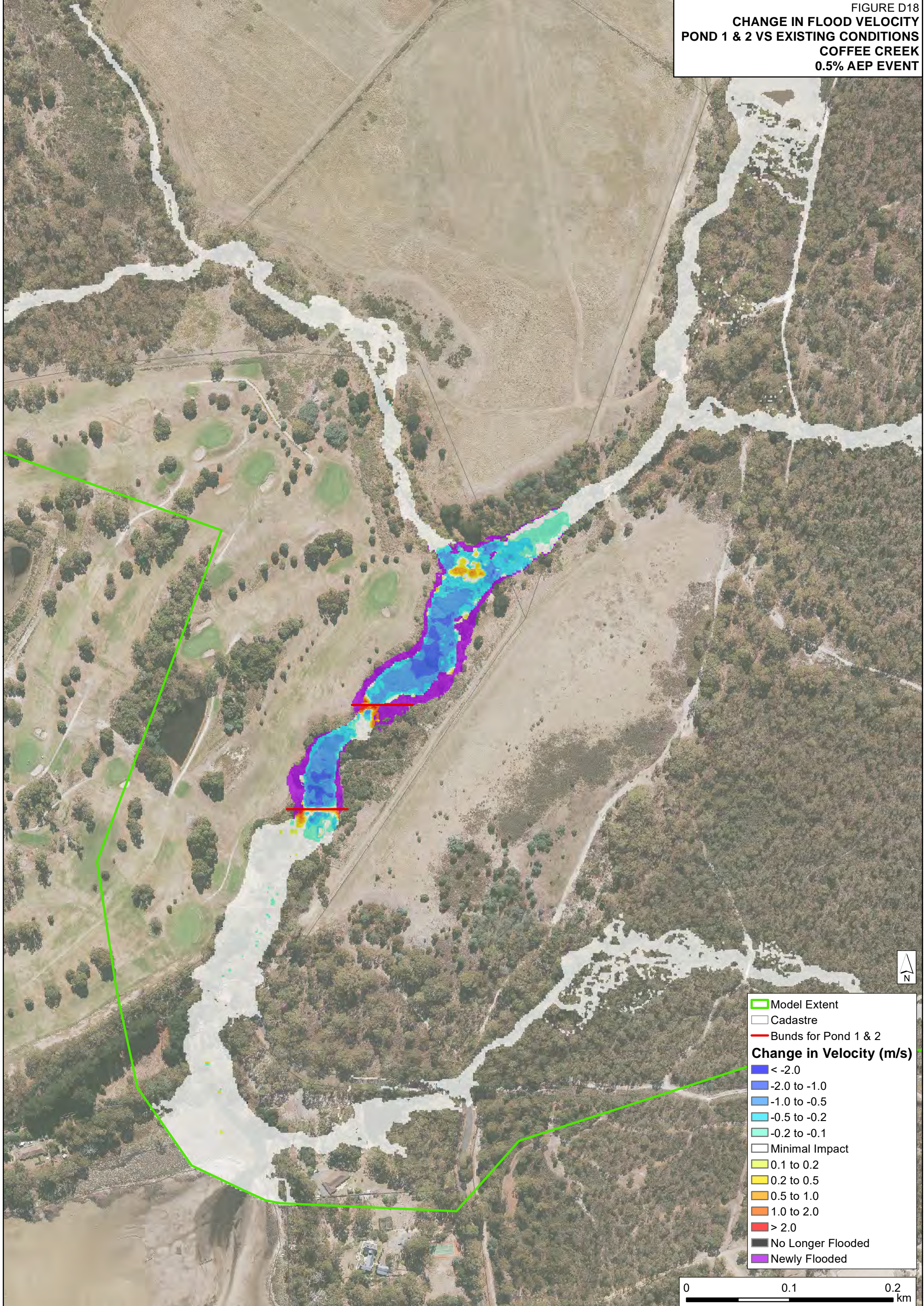


FIGURE D19
CHANGE IN FLOOD HEIGHT
DETENTION BASIN 1 VS EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT

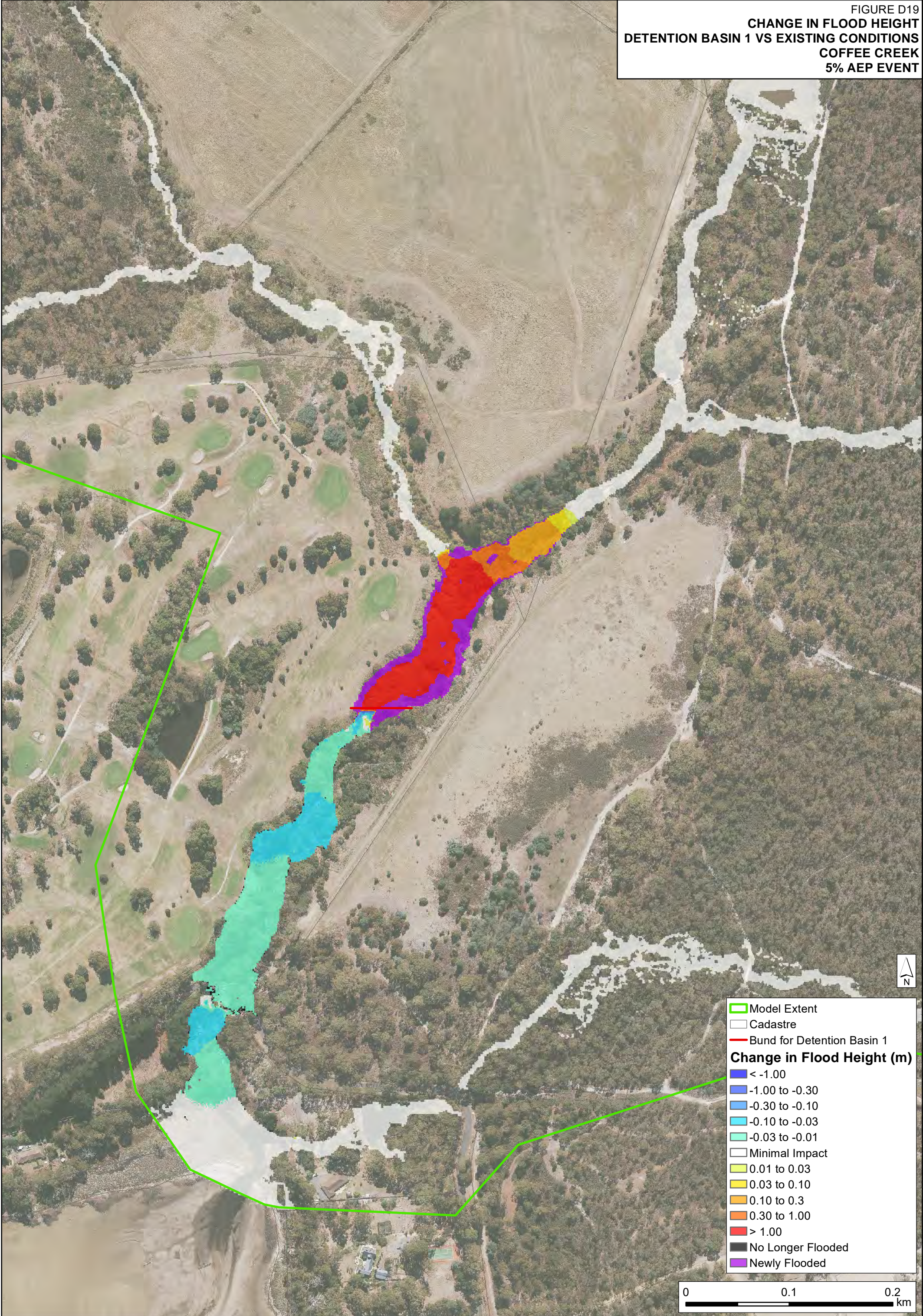


FIGURE D20
CHANGE IN FLOOD HEIGHT
DETENTION BASIN 1 VS EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

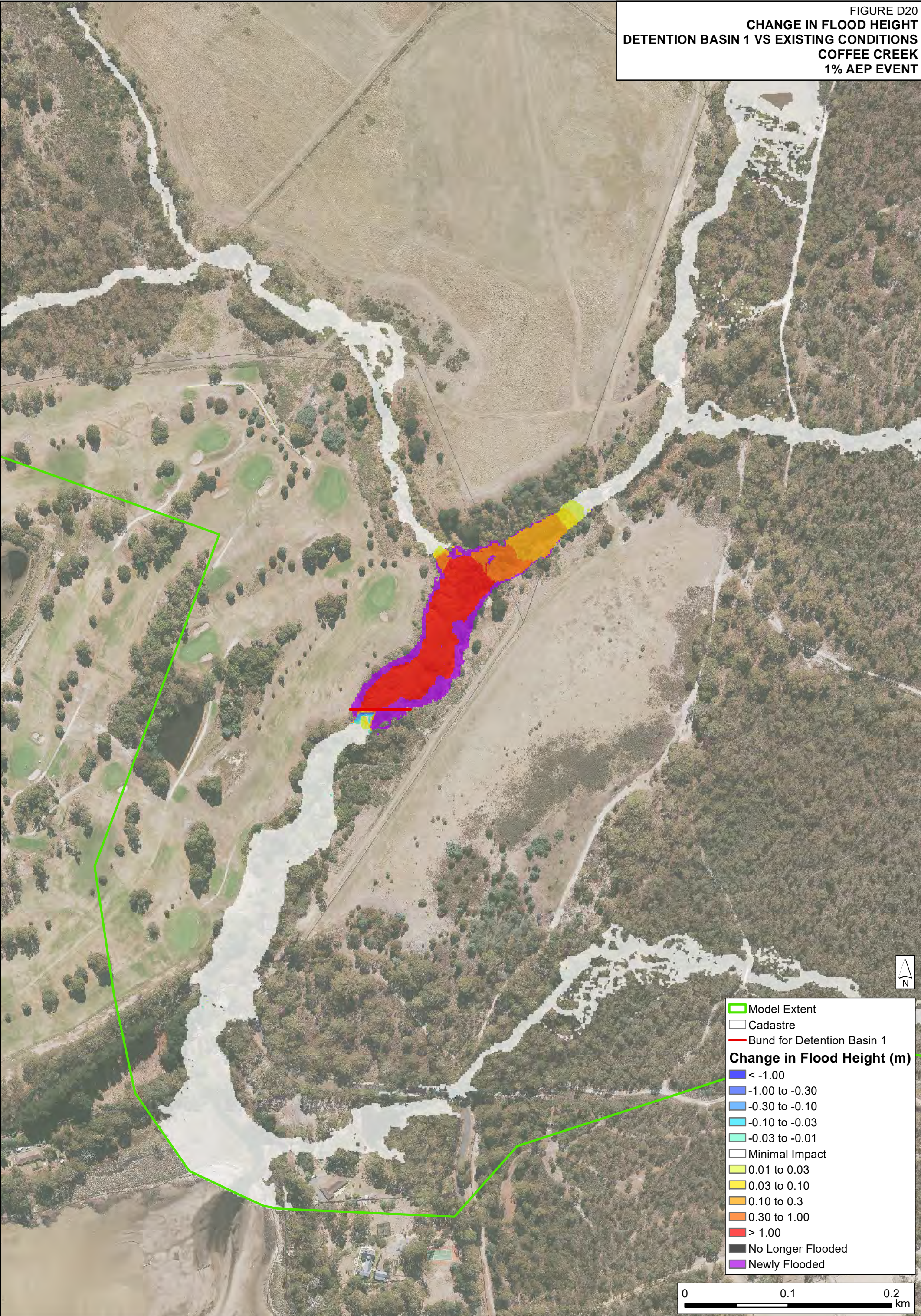


FIGURE D21
CHANGE IN FLOOD HEIGHT
DETENTION BASIN 1 VS EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT

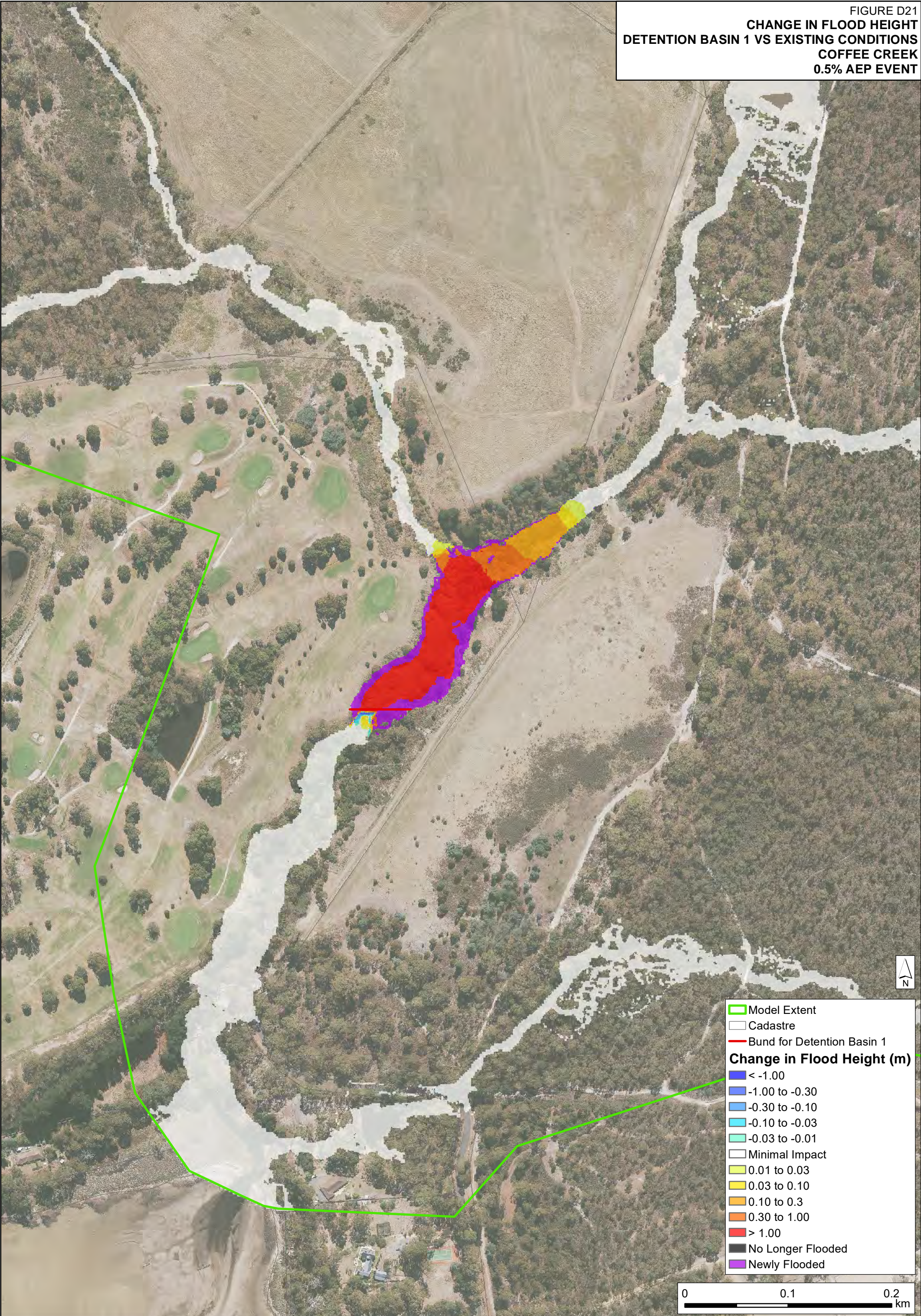


FIGURE D22
CHANGE IN FLOOD VELOCITY
DETENTION BASIN 1 VS EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT

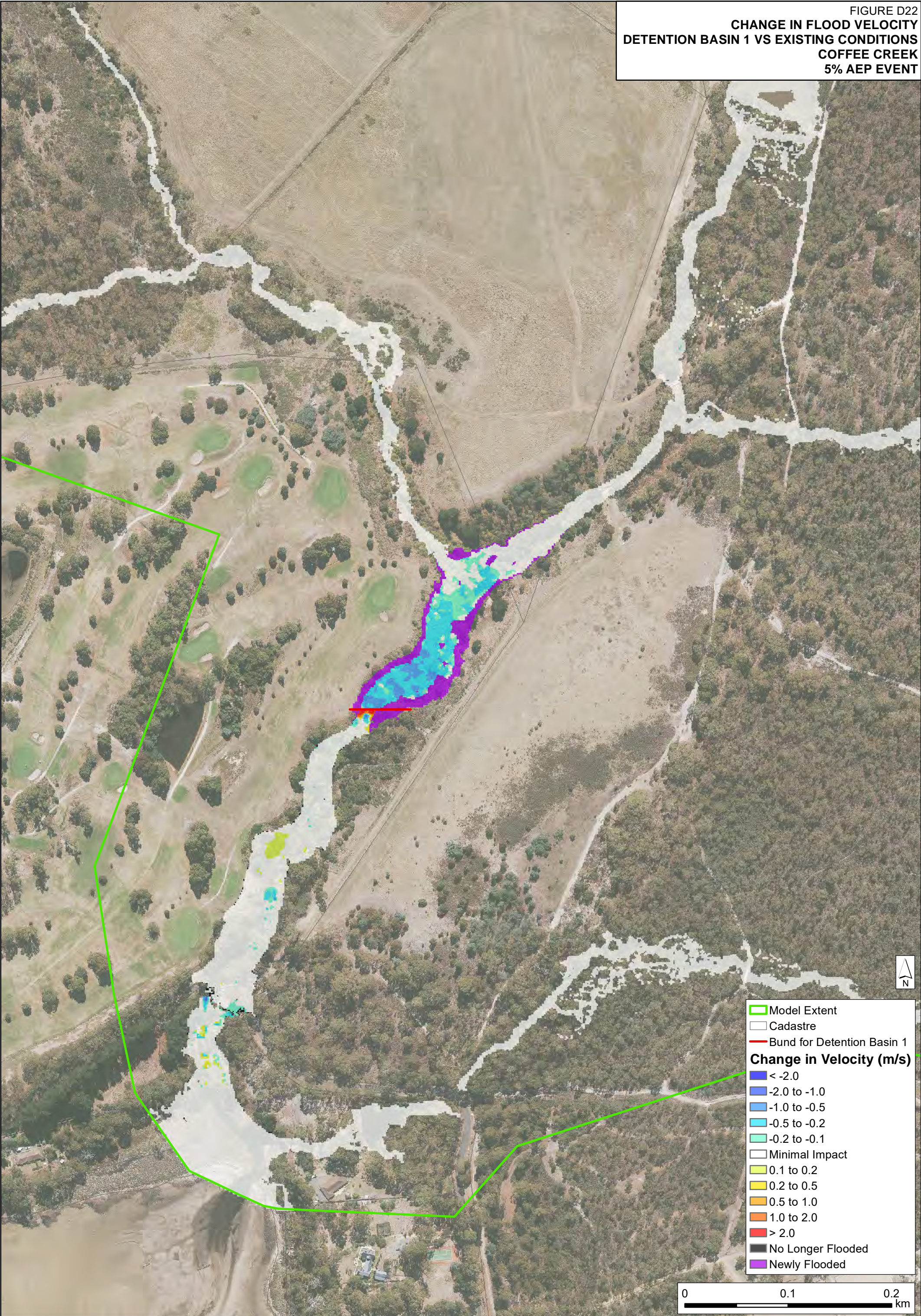


FIGURE D23
CHANGE IN FLOOD VELOCITY
DETENTION BASIN 1 VS EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

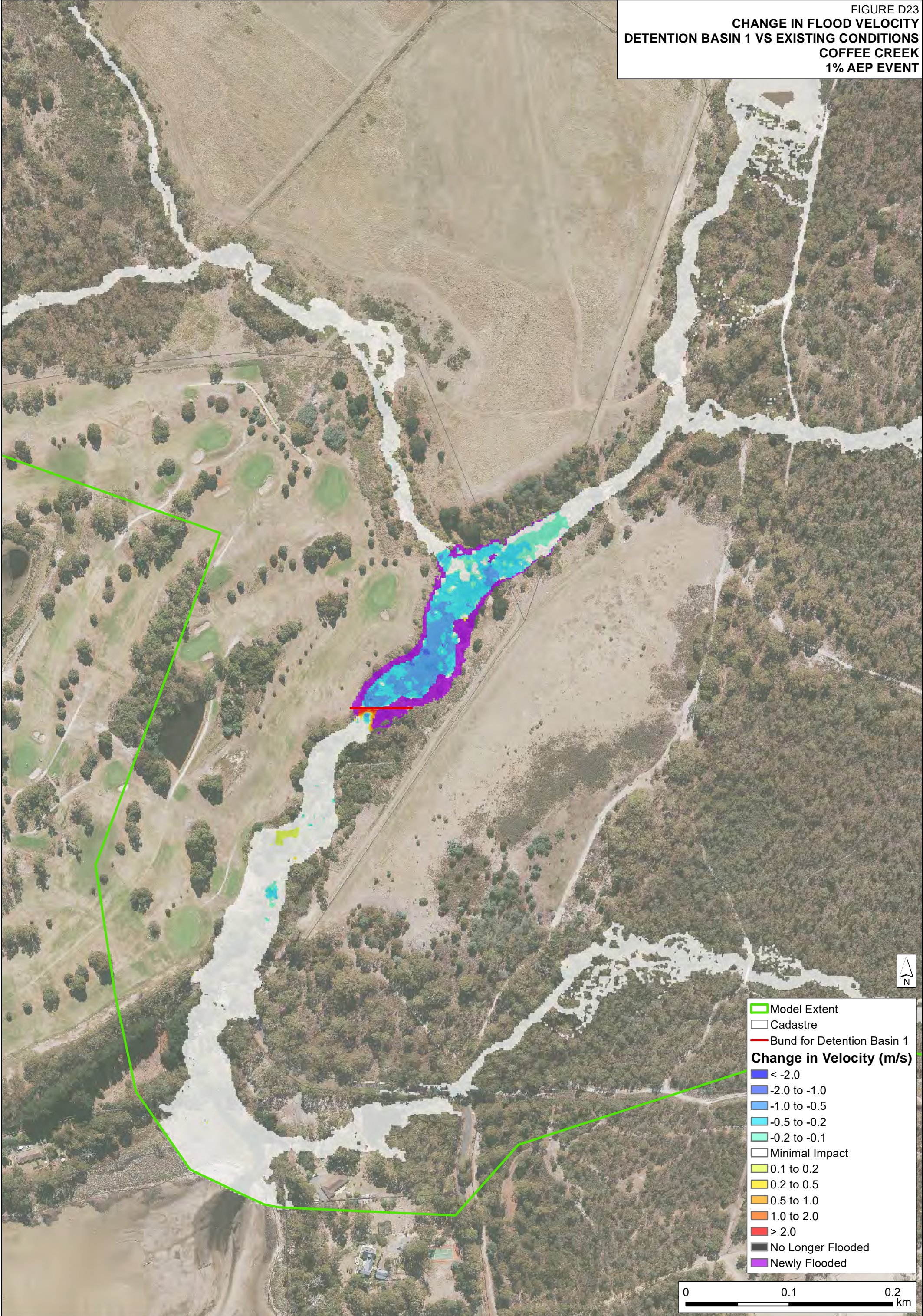


FIGURE D24
CHANGE IN FLOOD VELOCITY
DETENTION BASIN 1 VS EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT

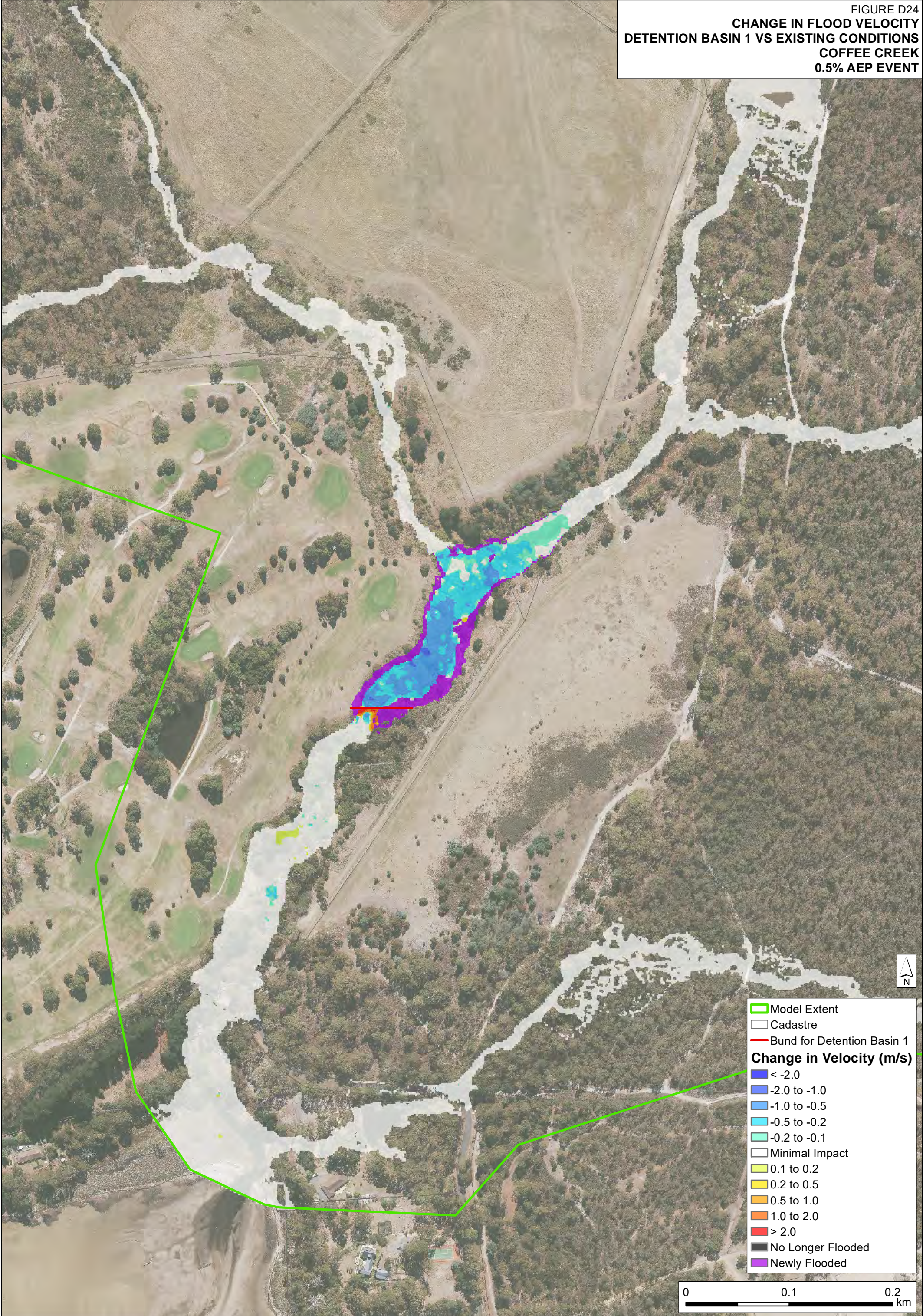


FIGURE D25
CHANGE IN FLOOD HEIGHT
DETENTION BASIN 2 VS EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT

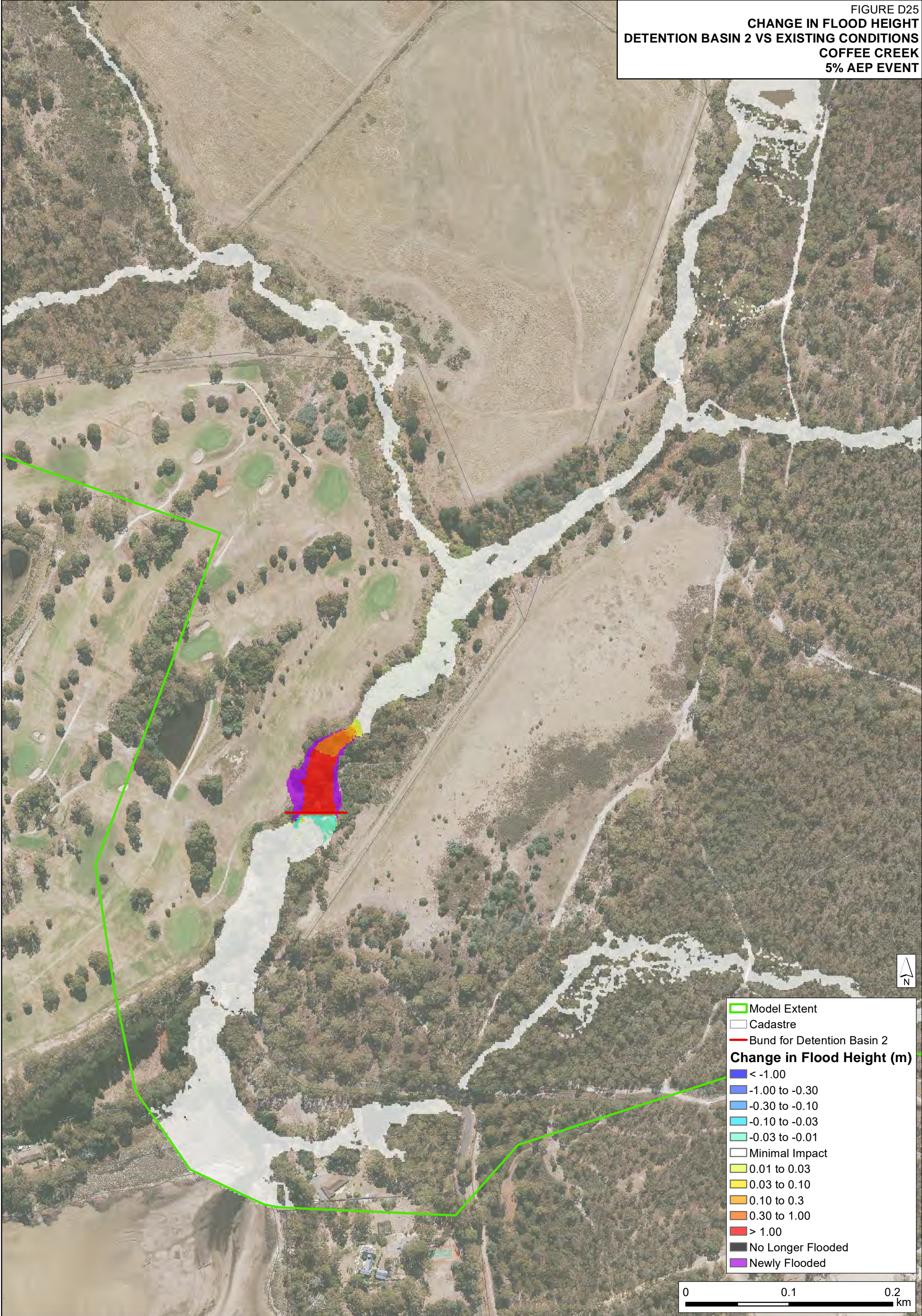


FIGURE D26
CHANGE IN FLOOD HEIGHT
DETENTION BASIN 2 VS EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

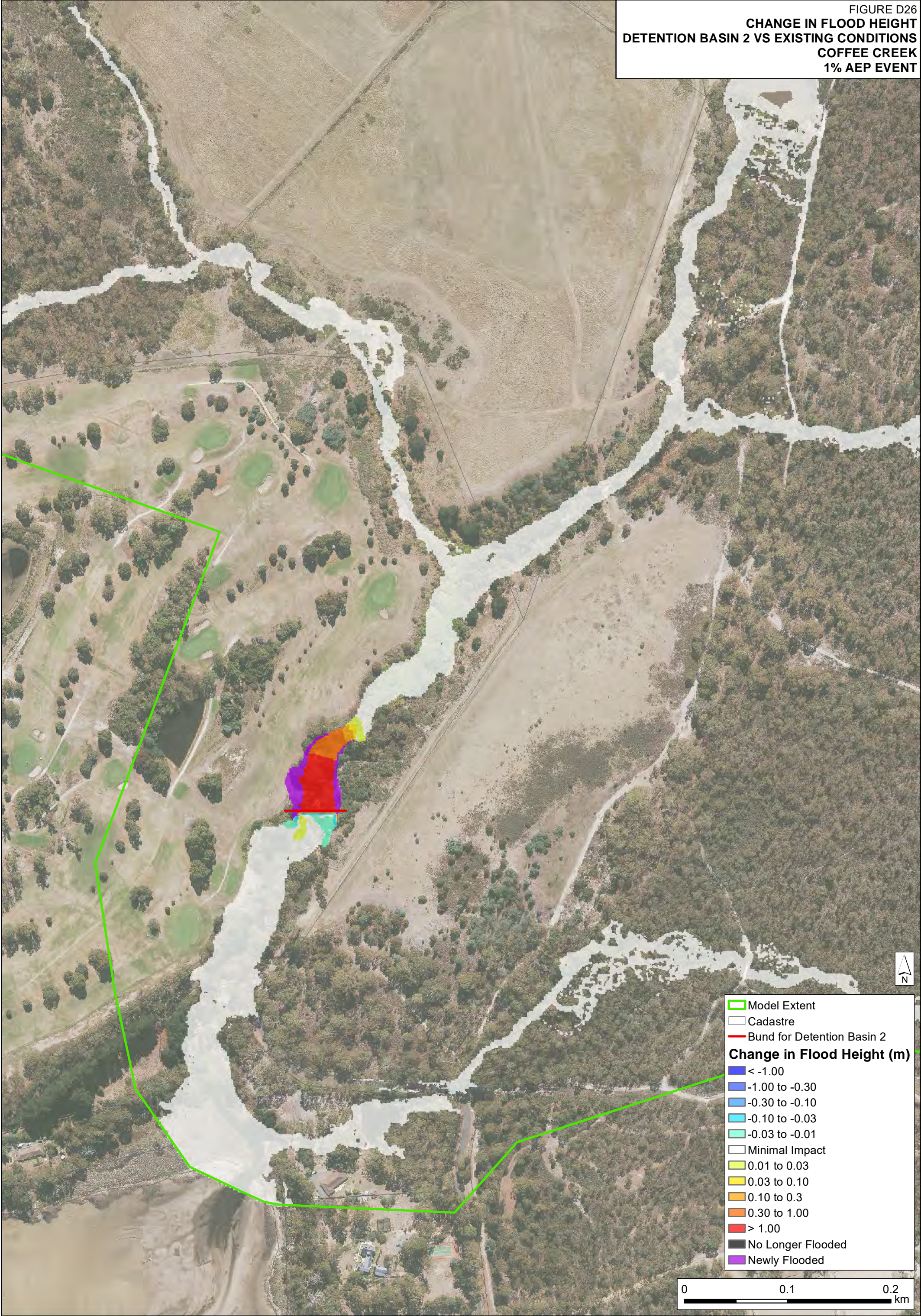


FIGURE D27
CHANGE IN FLOOD HEIGHT
DETENTION BASIN 2 VS EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT

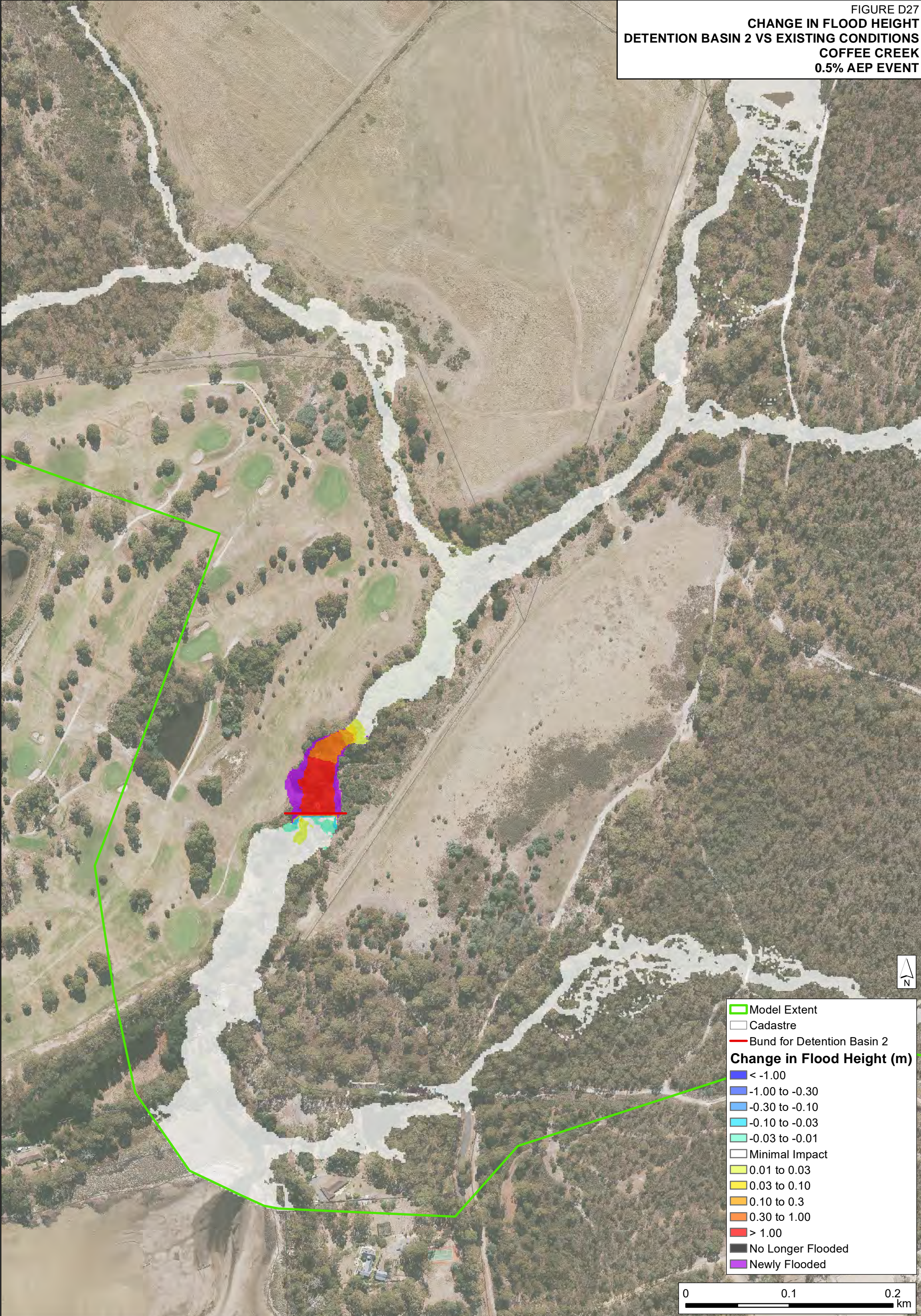


FIGURE D28
CHANGE IN FLOOD VELOCITY
DETENTION BASIN 2 VS EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT

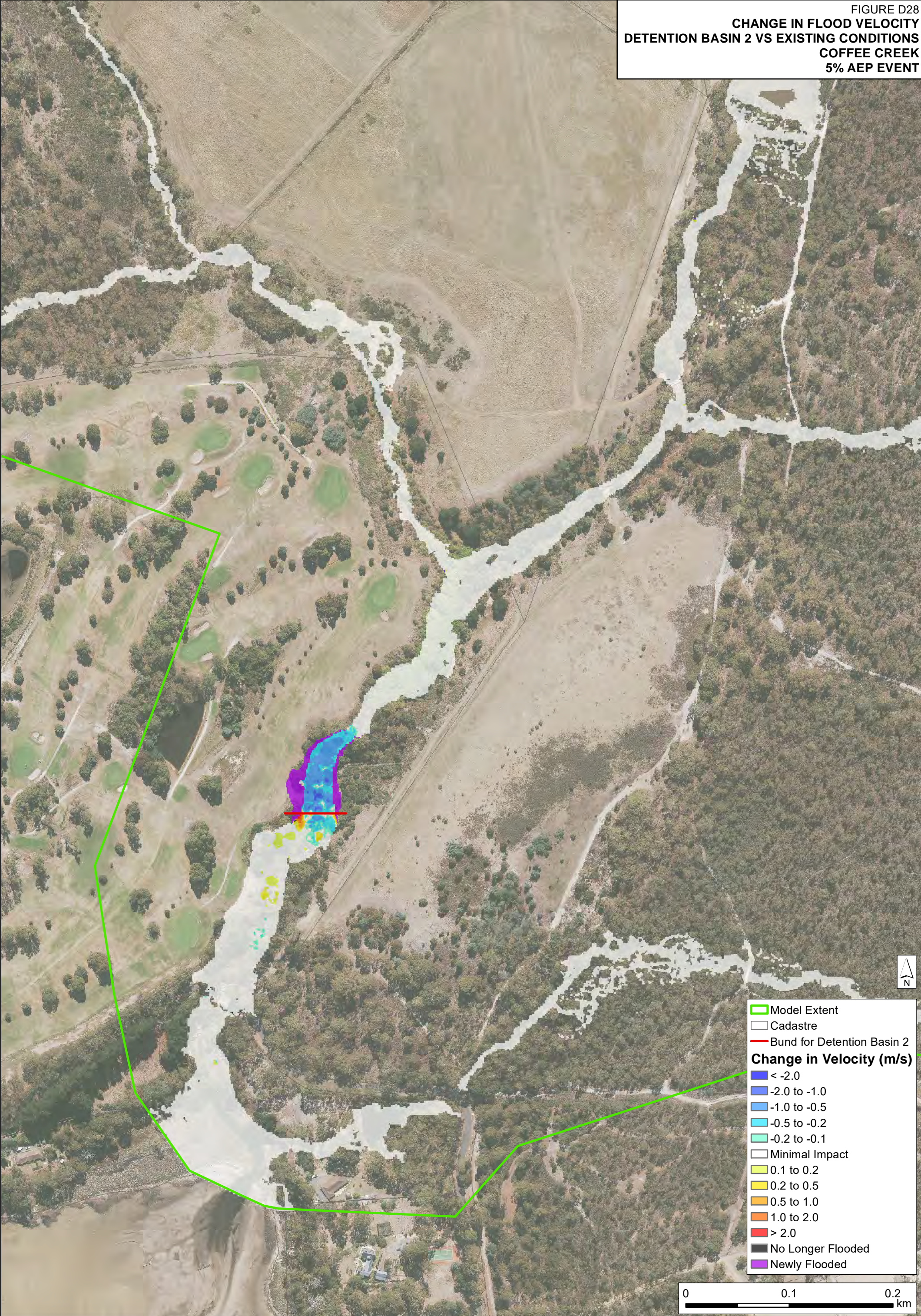


FIGURE D29
CHANGE IN FLOOD VELOCITY
DETENTION BASIN 2 VS EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

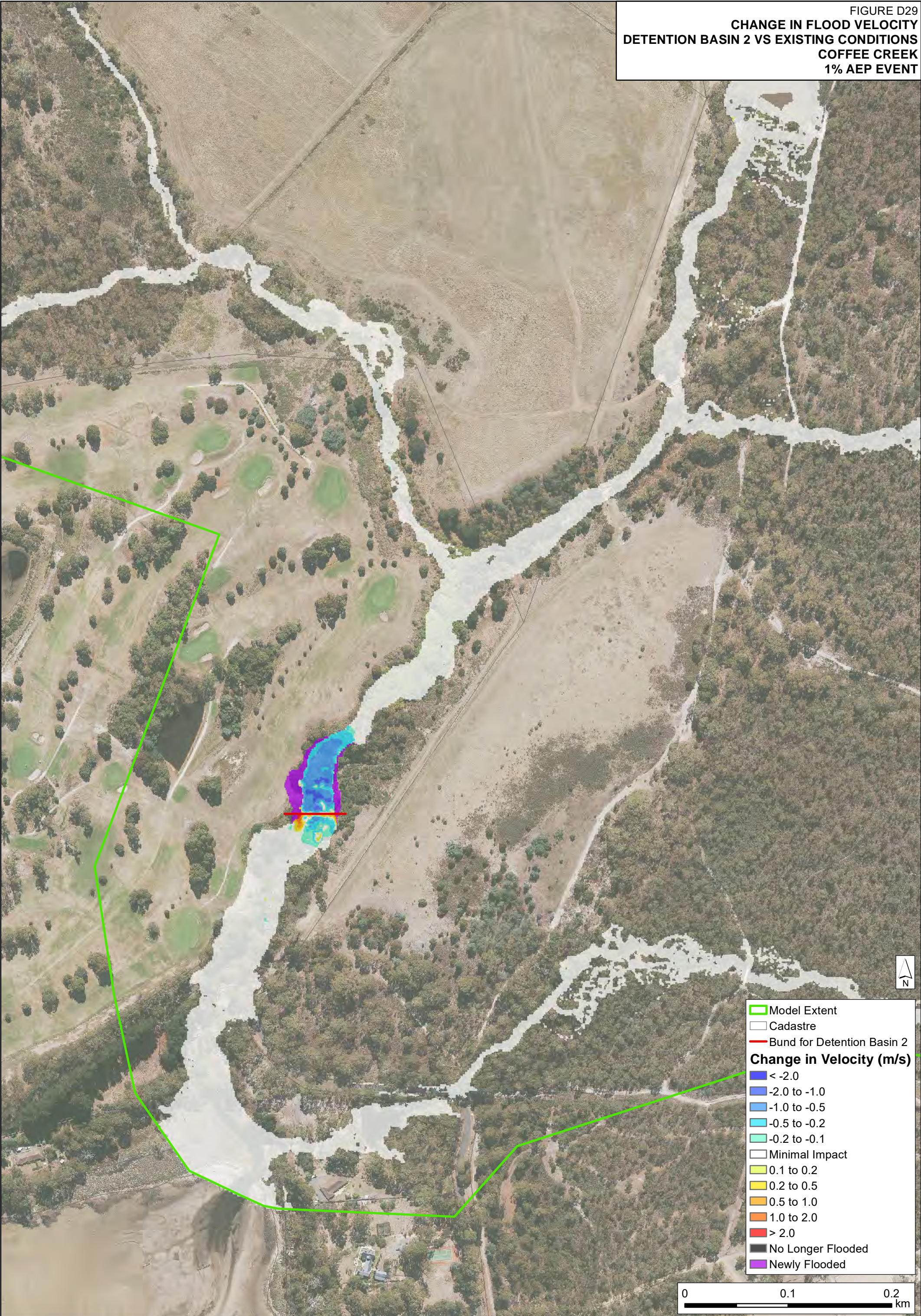


FIGURE D30
CHANGE IN FLOOD VELOCITY
DETENTION BASIN 2 VS EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT

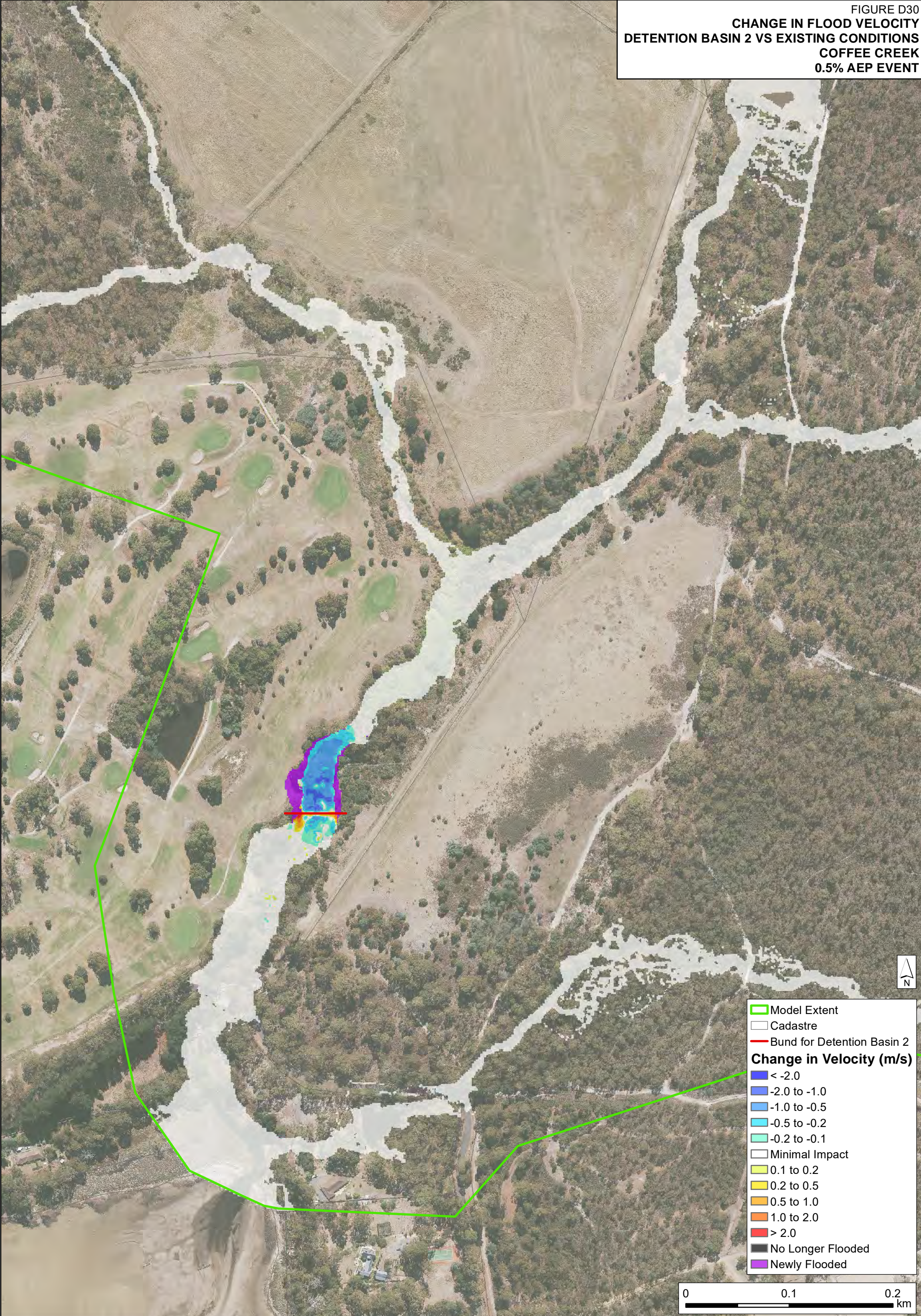


FIGURE D31
CHANGE IN FLOOD HEIGHT
DETENTION BASINS 1 & 2 VS EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT

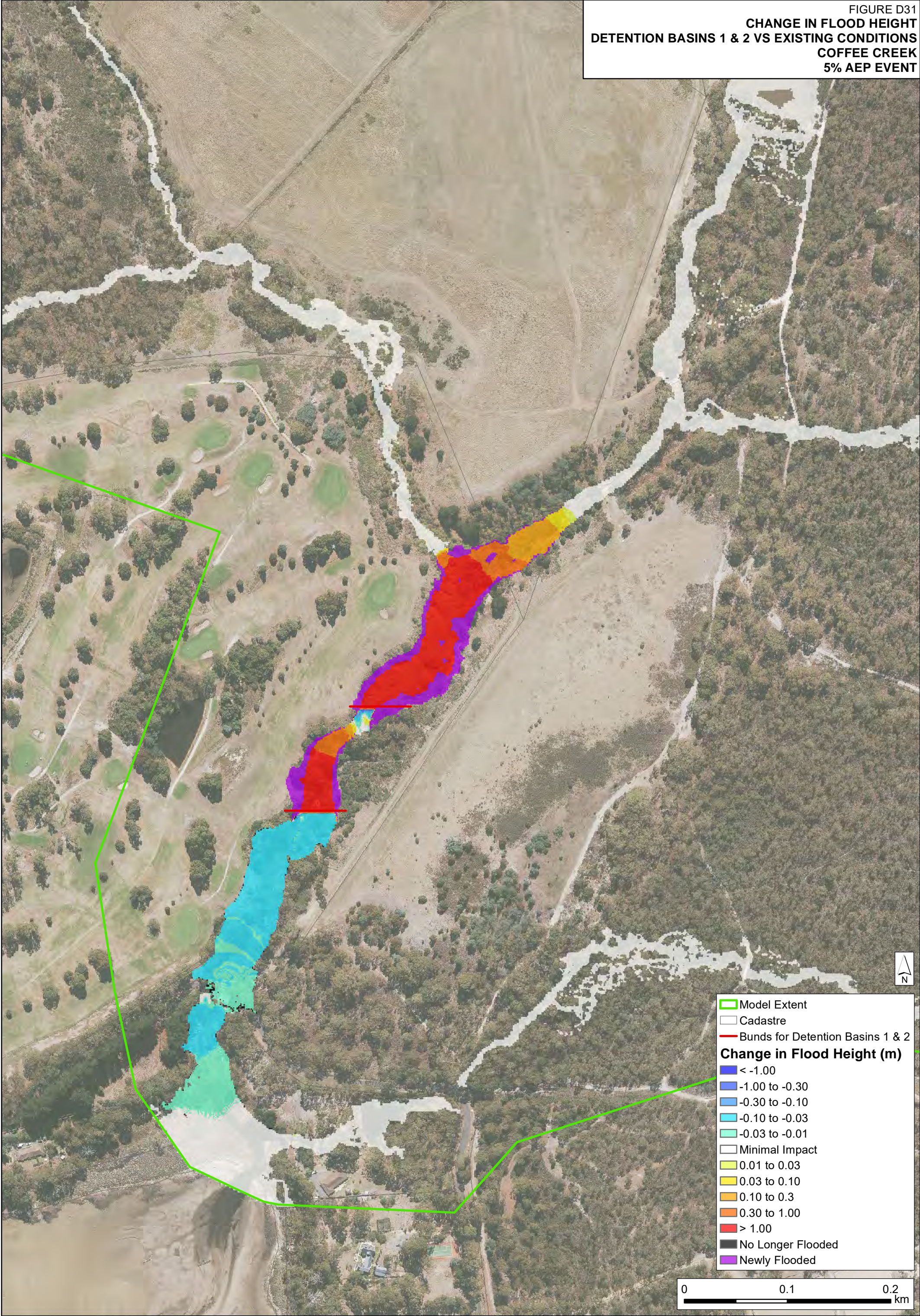


FIGURE D32
CHANGE IN FLOOD HEIGHT
DETENTION BASINS 1 & 2 VS EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

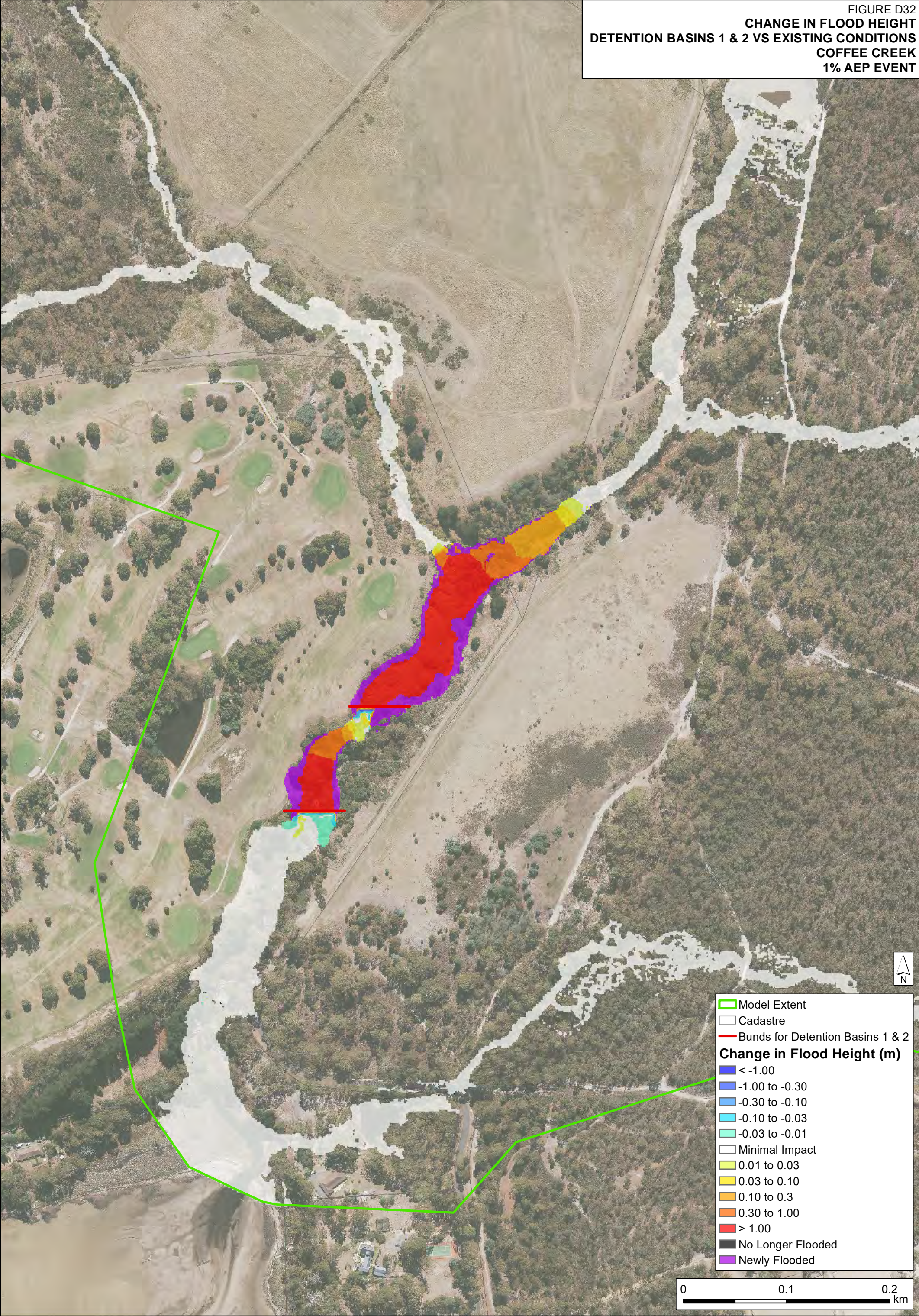


FIGURE D33
CHANGE IN FLOOD HEIGHT
DETENTION BASINS 1 & 2 VS EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT

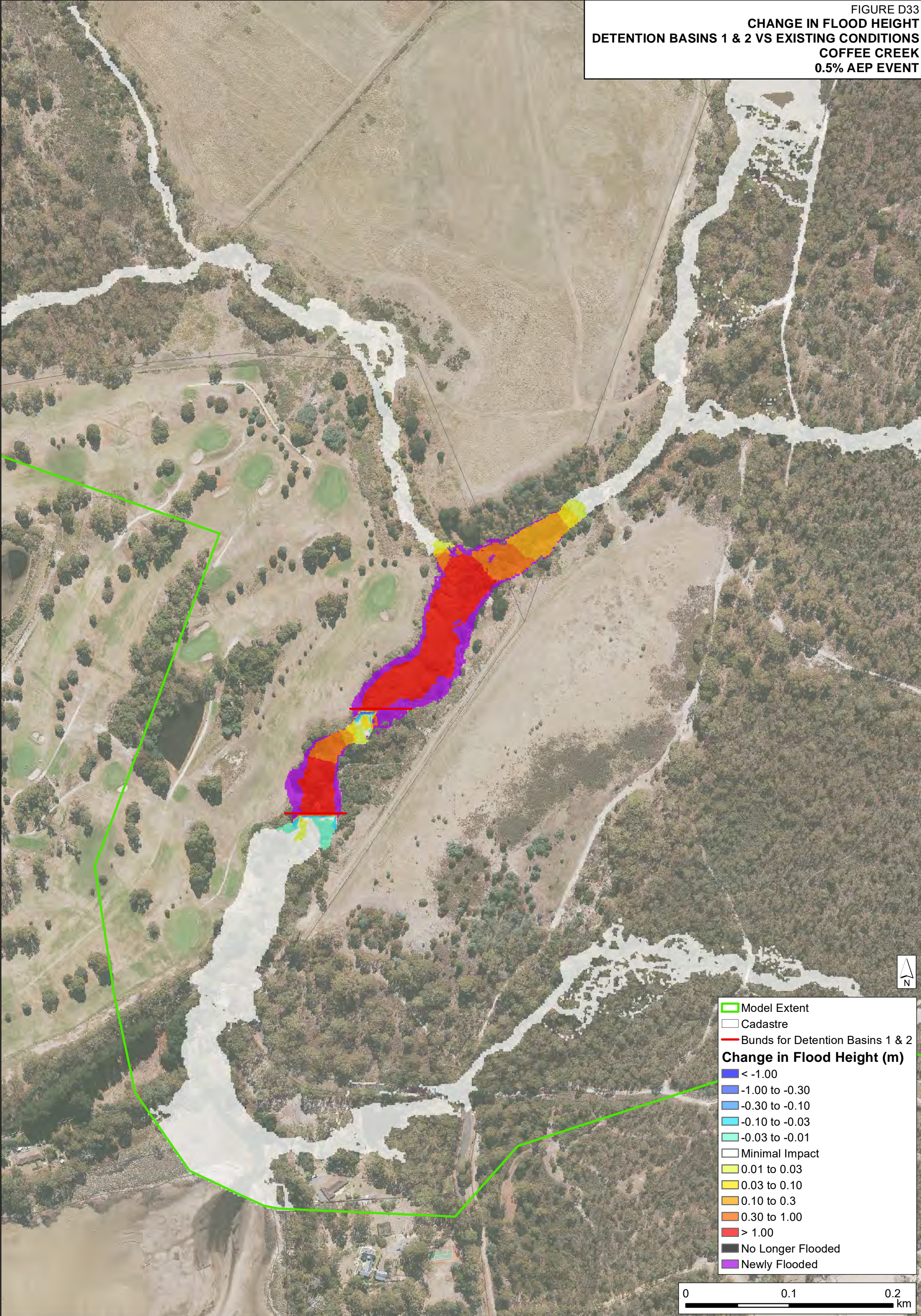


FIGURE D34
CHANGE IN FLOOD VELOCITY
DETENTION BASINS 1 & 2 VS EXISTING CONDITIONS
COFFEE CREEK
5% AEP EVENT

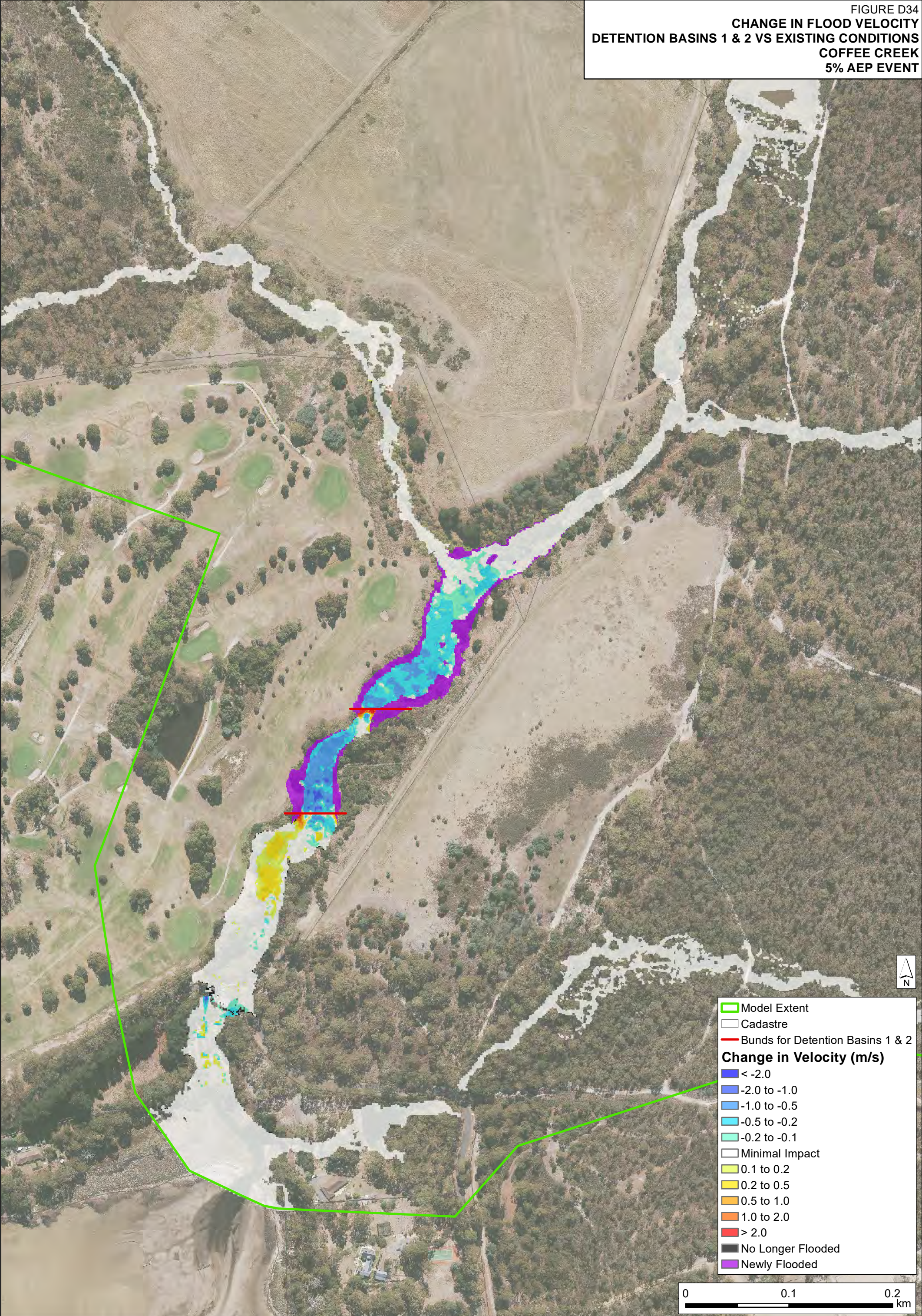


FIGURE D35
CHANGE IN FLOOD VELOCITY
DETENTION BASINS 1 & 2 VS EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

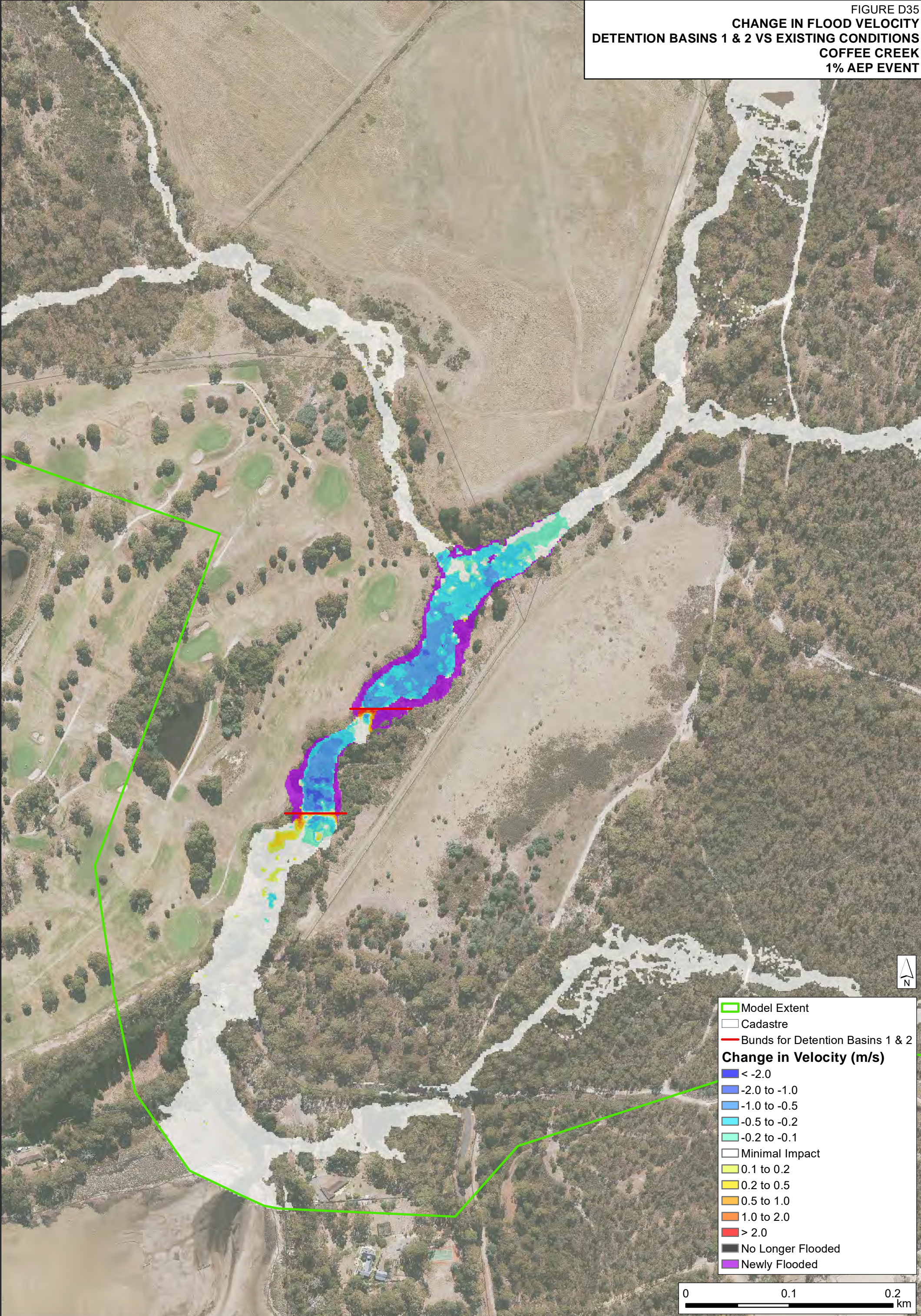


FIGURE D36
CHANGE IN FLOOD VELOCITY
DETENTION BASINS 1 & 2 VS EXISTING CONDITIONS
COFFEE CREEK
0.5% AEP EVENT

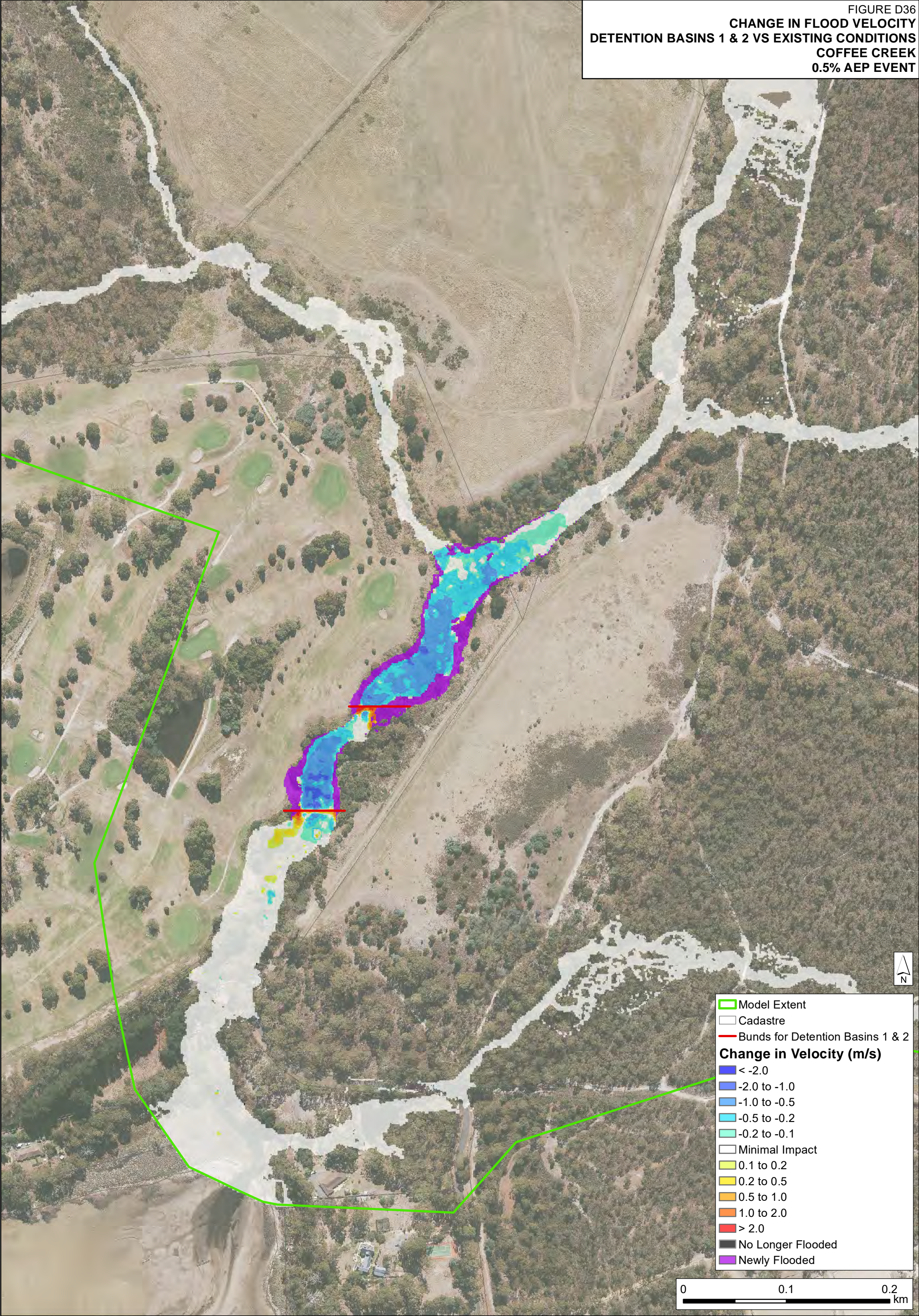


FIGURE D37
CHANGE IN FLOOD HEIGHT
ULTIMATE DEVELOPED CONDITIONS VS EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

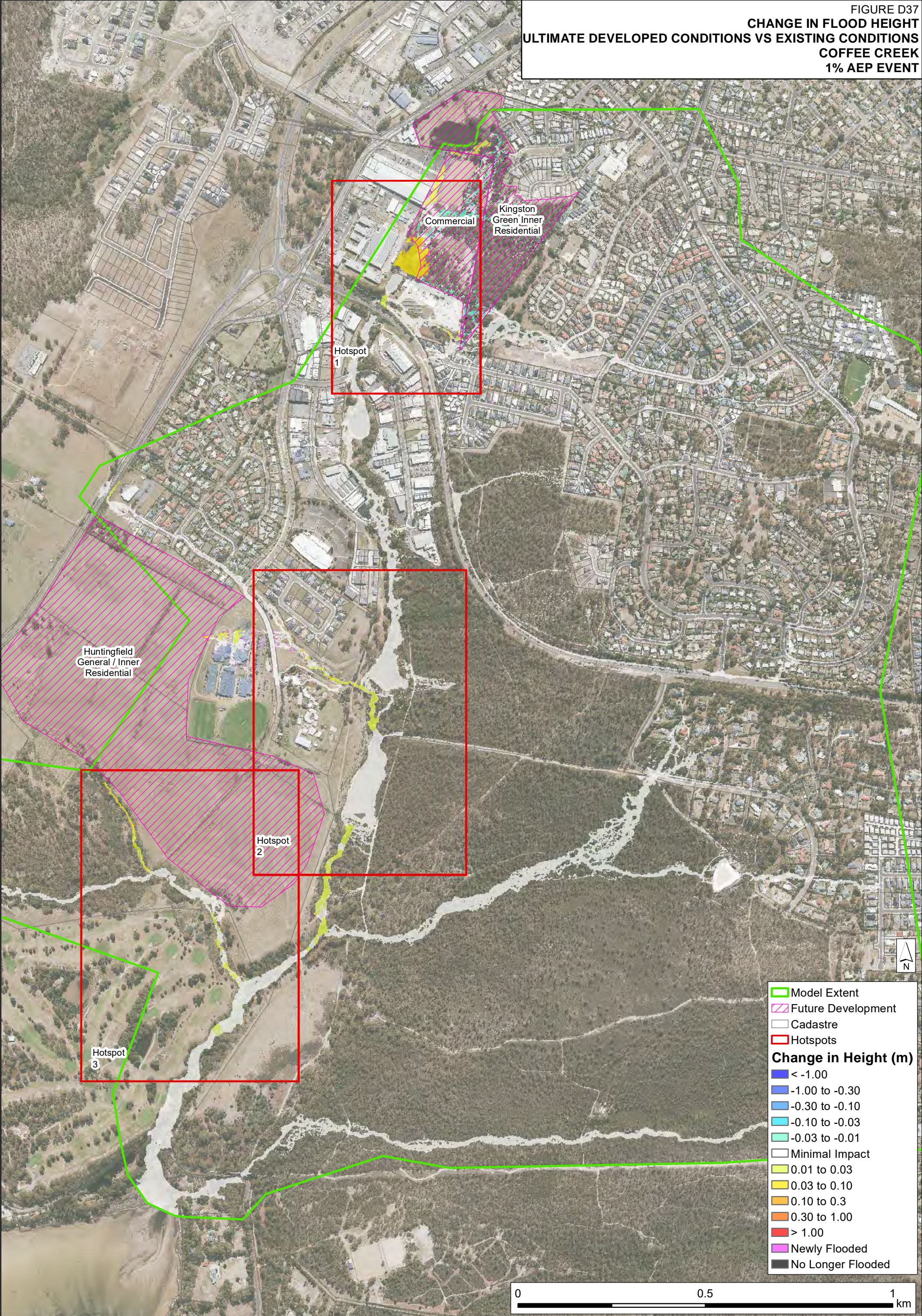


FIGURE D38
CHANGE IN FLOOD HEIGHT
ULTIMATE DEVELOPED CONDITIONS VS EXISTING CONDITIONS
HOTSPOT 1
COFFEE CREEK
1% AEP EVENT

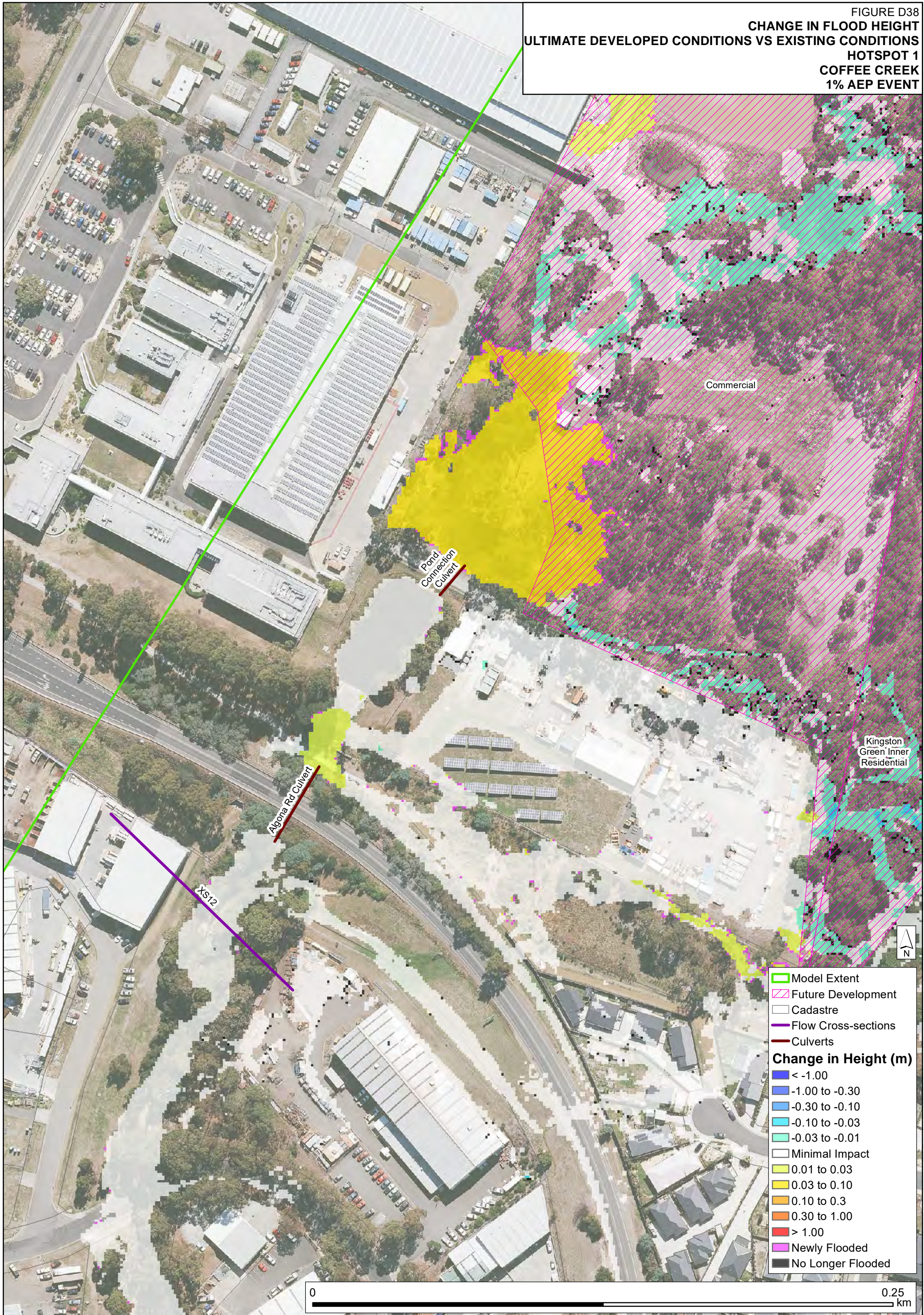


FIGURE D39
CHANGE IN FLOOD HEIGHT
ULTIMATE DEVELOPED CONDITIONS VS EXISTING CONDITIONS
HOTSPOT 2
COFFEE CREEK
1% AEP EVENT

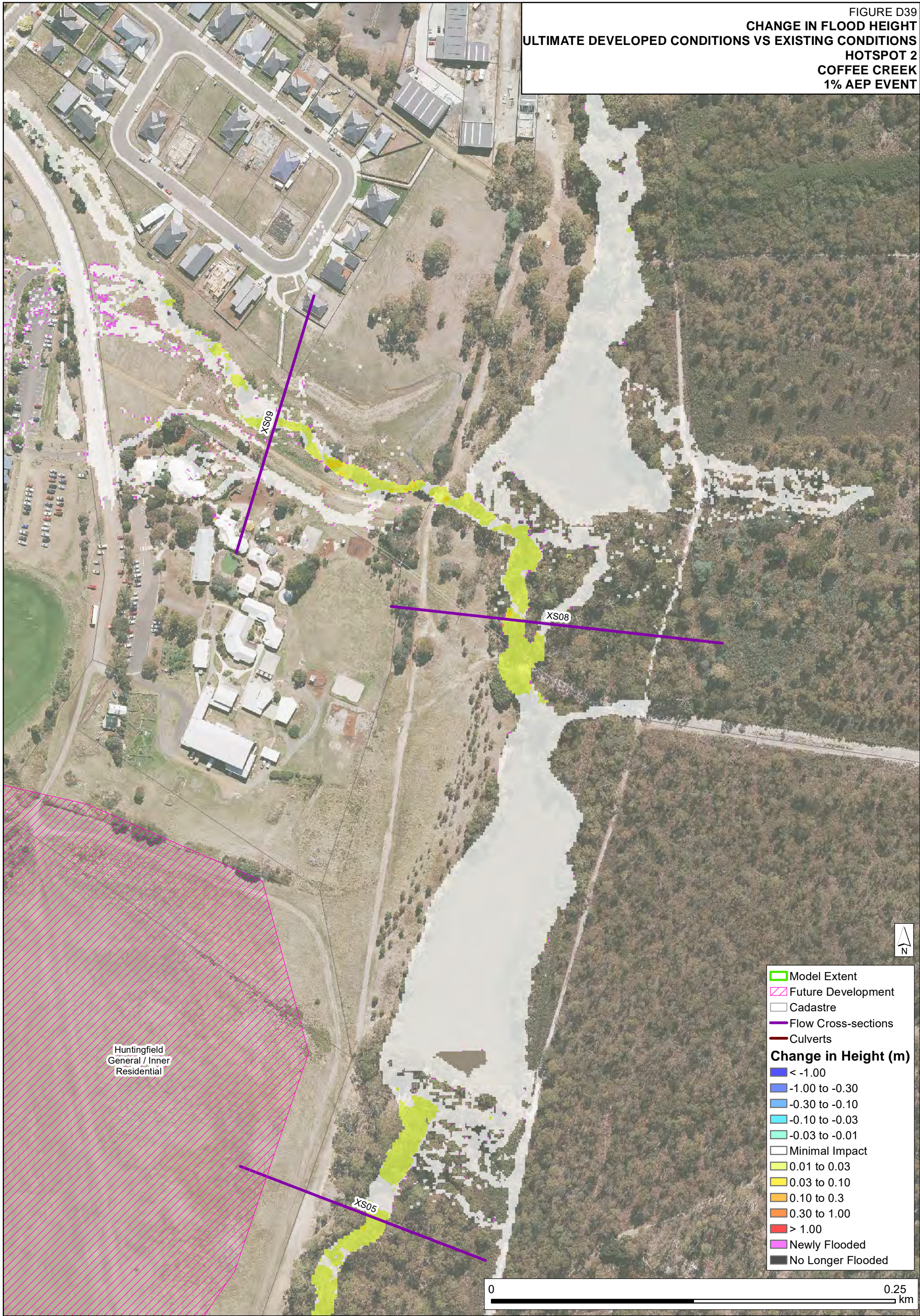


FIGURE D40
CHANGE IN FLOOD HEIGHT
ULTIMATE DEVELOPED CONDITIONS VS EXISTING CONDITIONS
HOTSPOT 3
COFFEE CREEK
1% AEP EVENT

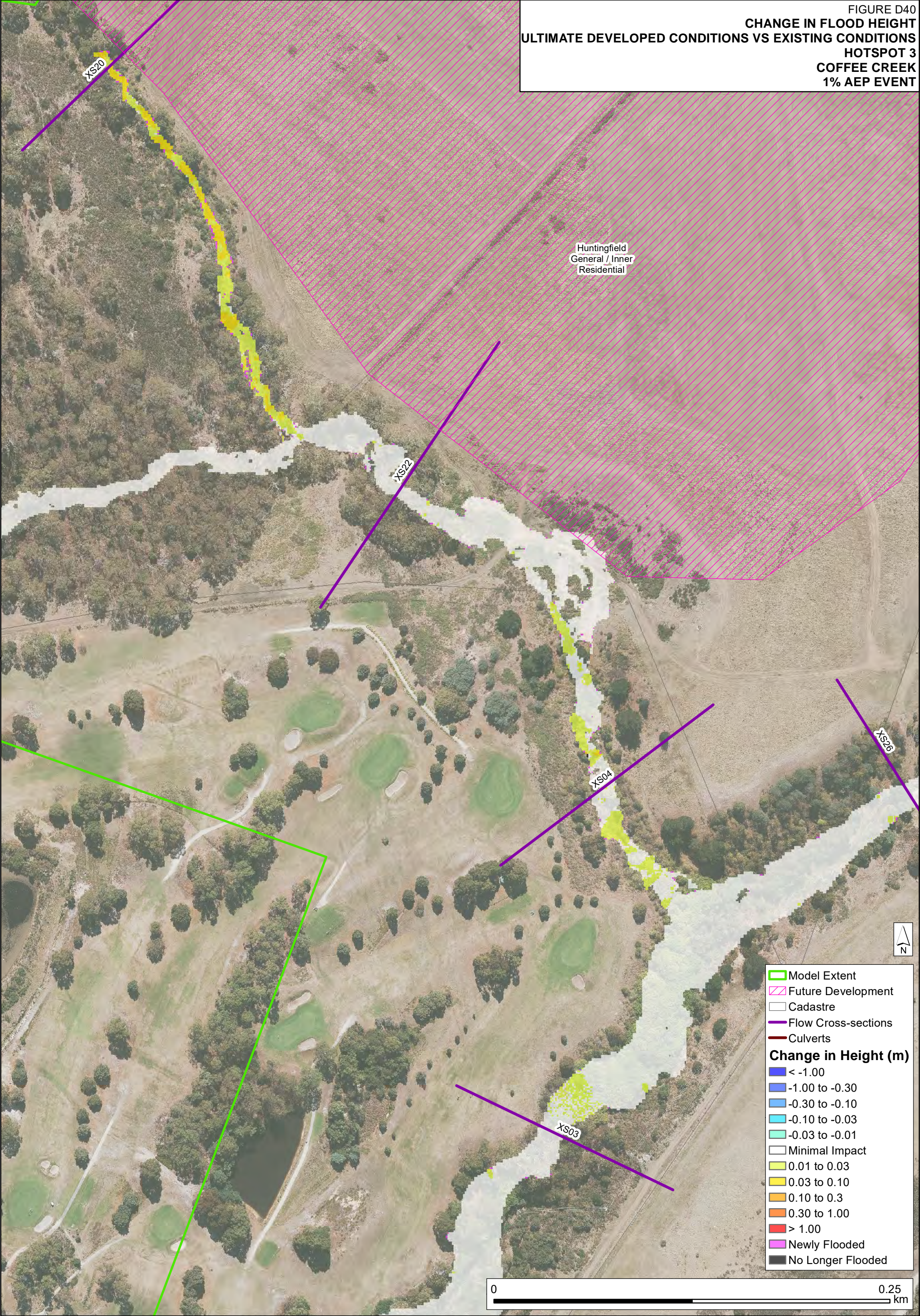


FIGURE D41
CHANGE IN FLOOD VELOCITY
ULTIMATE DEVELOPED CONDITIONS VS EXISTING CONDITIONS
COFFEE CREEK
1% AEP EVENT

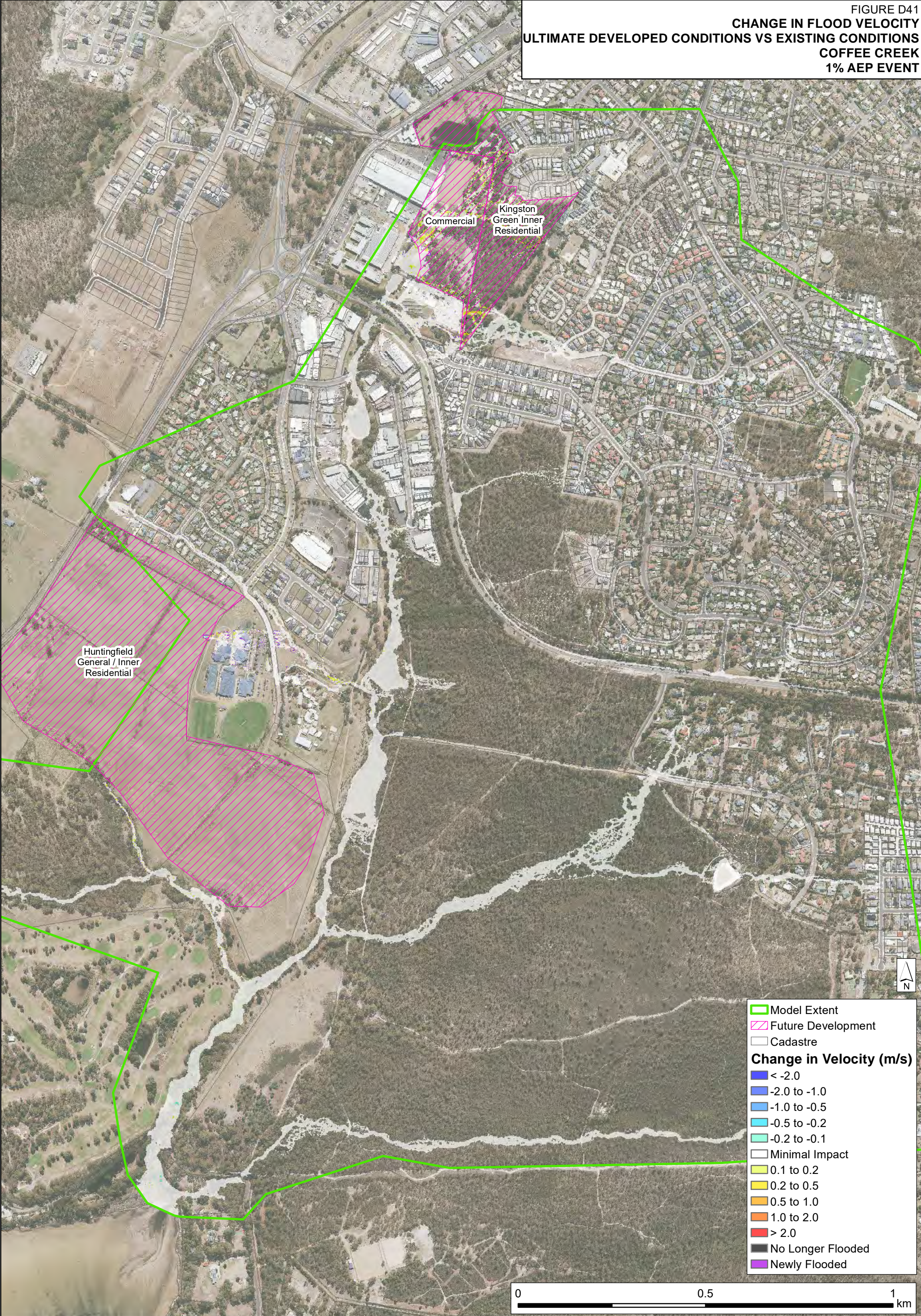


FIGURE D42
CHANGE IN FLOOD VELOCITY
ULTIMATE DEVELOPED CONDITIONS VS EXISTING CONDITIONS
HOTSPOT 1
COFFEE CREEK
1% AEP EVENT

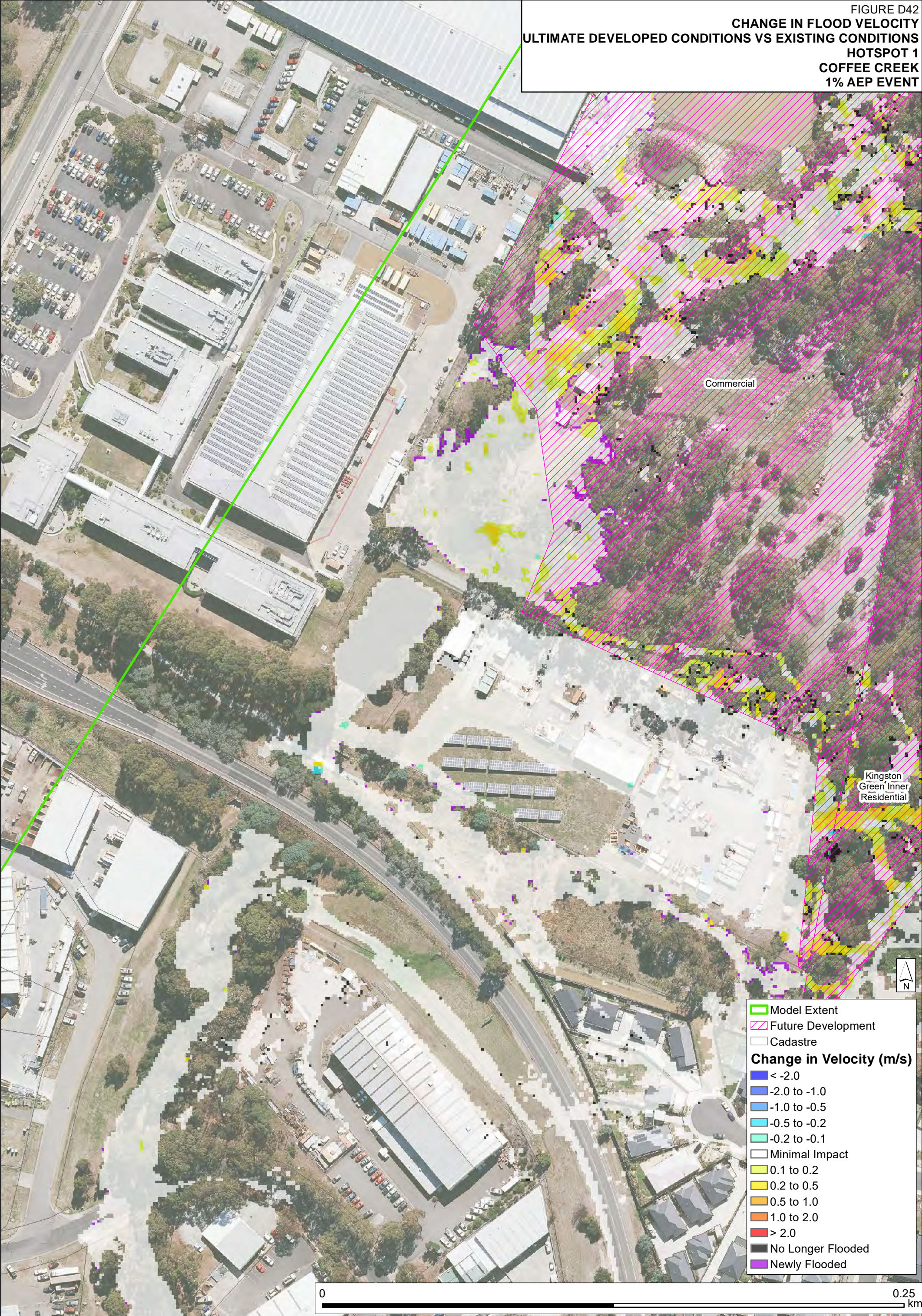


FIGURE D43
CHANGE IN FLOOD VELOCITY
ULTIMATE DEVELOPED CONDITIONS VS EXISTING CONDITIONS
HOTSPOT 2
COFFEE CREEK
1% AEP EVENT

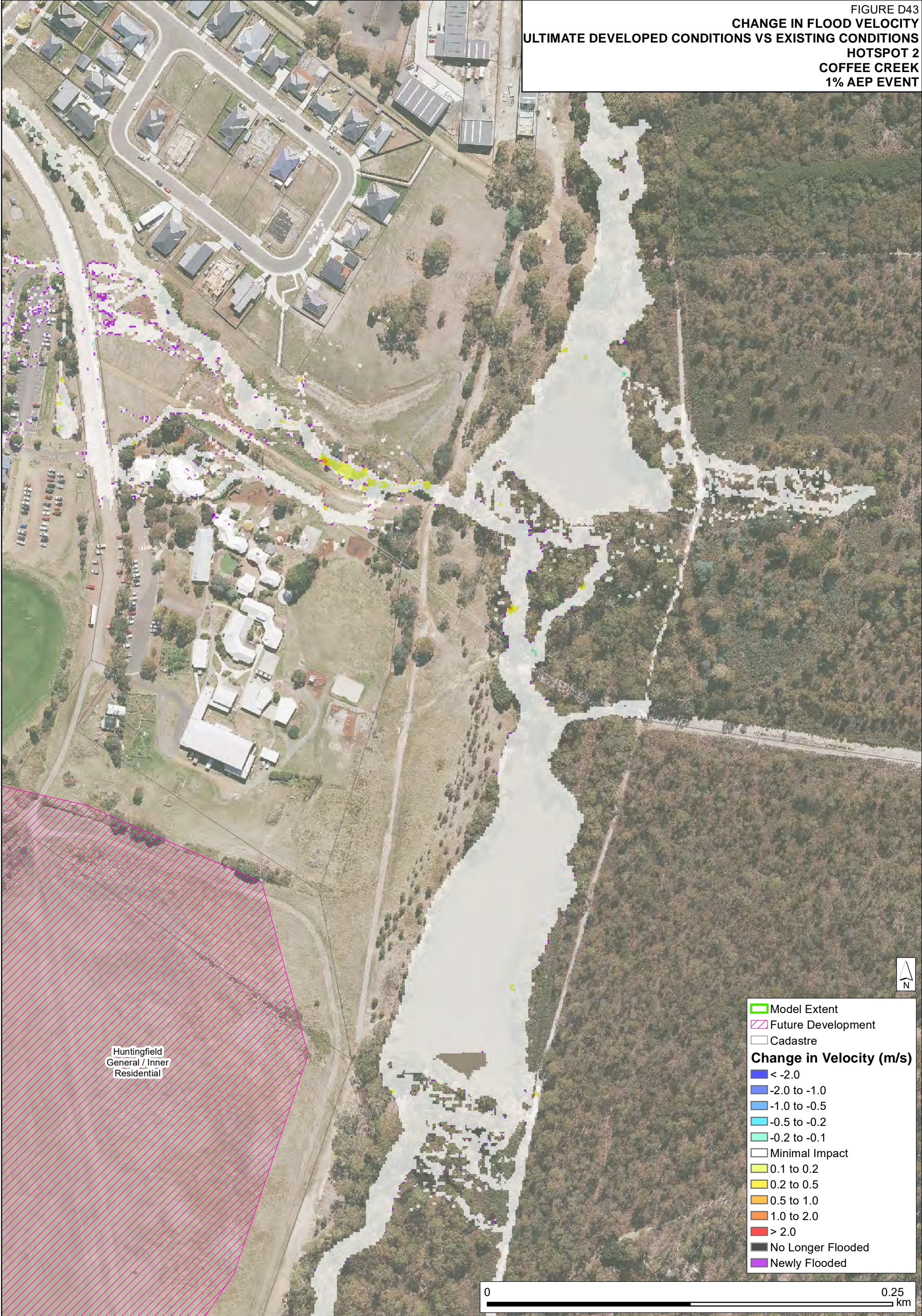
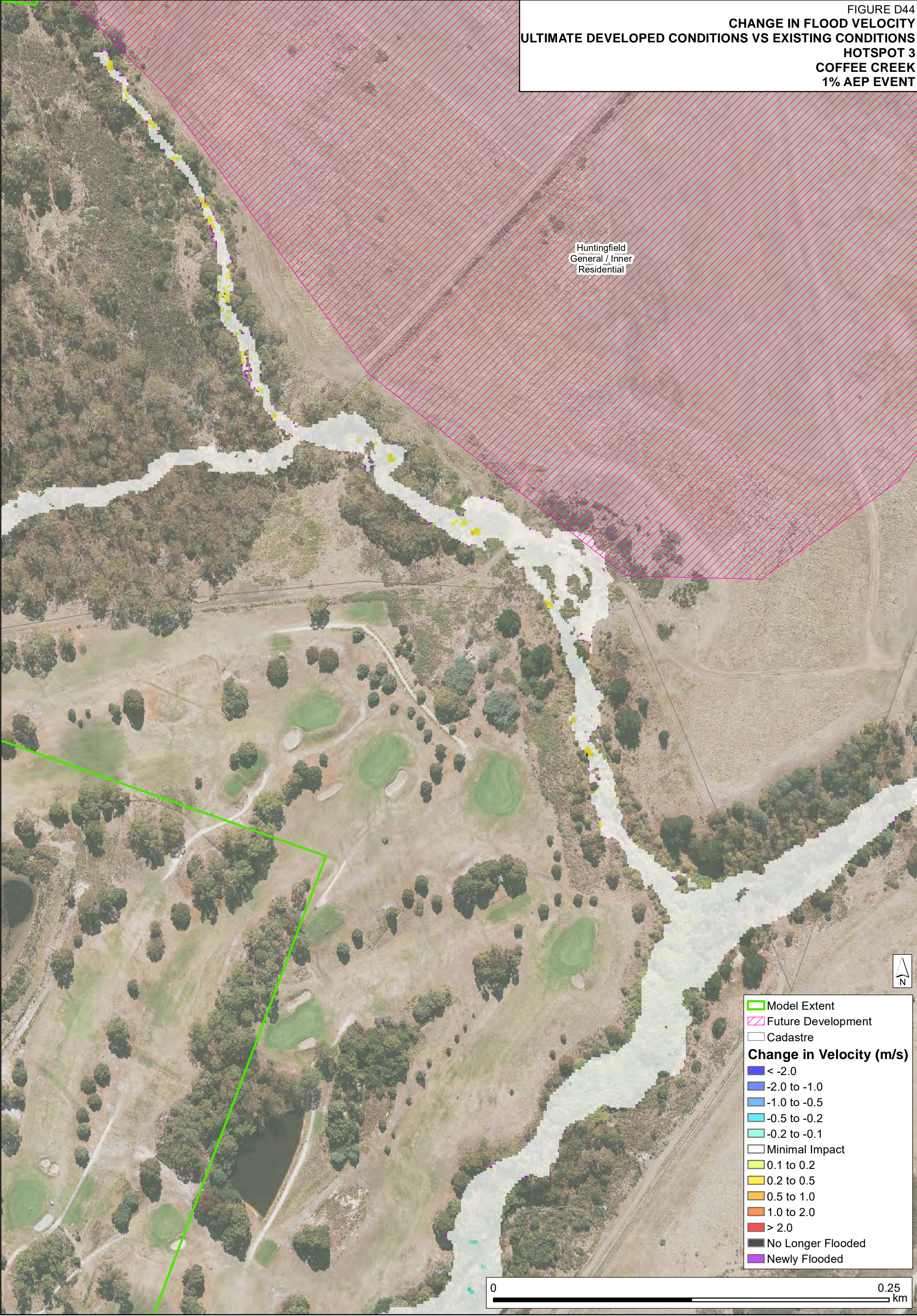


FIGURE D44
CHANGE IN FLOOD VELOCITY
ULTIMATE DEVELOPED CONDITIONS VS EXISTING CONDITIONS
HOTSPOT 3
COFFEE CREEK
1% AEP EVENT



APPENDIX E. COSTING



Appendix E

| Flow Control Dam 1 / Detention Basin 1 | | | | | | |
|--|---|------|----------------|-------------|---------------------|--------------------------|
| Item No | Description | QTY | Unit | Rate | Amount (Dam) | Amount (Detention Basin) |
| A | CIVIL WORKS | | | | | |
| 1.1 | Site establishment, Construction Management Plan and Environmental management Plan | 1 | Item | \$10,000.00 | \$10,000.00 | \$10,000.00 |
| 1.3 | Survey | 1 | Item | \$8,000.00 | \$8,000.00 | \$8,000.00 |
| 1.6 | Construction of bund/dam wall | 1563 | m ³ | \$50.00 | \$78,145.83 | \$78,145.83 |
| 1.9 | 450mm dia. RCP Low flow pipe | 30 | m | \$500.00 | \$15,000.00 | |
| 1.13 | Concrete spillway channel and install rock beaching downstream of spillway outlet, inclusive of excavation and disposal of spoil (size and area of rock to be confirmed). | 1 | Item | \$20,000.00 | \$20,000.00 | \$20,000.00 |
| 1.15 | Removal of existing trees as required | 1 | Item | \$4,000.00 | \$4,000.00 | \$4,000.00 |
| 1.16 | Re-instatement of landscaping | 1 | Item | \$4,000.00 | \$4,000.00 | \$4,000.00 |
| | TOTAL CIVIL WORKS | | | | \$139,145.83 | \$124,145.83 |
| B | PROVISIONAL ITEMS AND CONTINGENCIES | | | | | |
| 2.1 | PROVISIONAL ITEM Contingencies (30%) | 1 | Item | | \$41,743.75 | \$37,243.75 |
| 2.2 | PROVISIONAL ITEM Design, documentation, contract administration and supervision of works (10%) | 1 | Item | | \$13,914.58 | \$12,414.58 |
| | TOTAL CONTINGENCIES | | | | \$55,658.33 | \$49,658.33 |
| A | CIVIL WORKS | | | | \$139,145.83 | \$124,145.83 |
| B | PROVISIONAL ITEMS AND CONTINGENCIES | | | | \$55,658.33 | \$49,658.33 |

SUBTOTAL: \$194,804.17 \$173,804.17

GST: \$19,480.42 \$17,380.42

TOTAL AMOUNT (Including GST): \$214,284.58 \$191,184.58

Notes: Assumptions
Bund Crest - 3-meter wide
Bund side slope -1:2 (V:H)

| Flow Control Dam 2 / Detention Basin 2 | | | | | | |
|--|---|-----|----------------|-------------|--------------------|--------------------------|
| Item No | Description | QTY | Unit | Rate | Amount (Dam) | Amount (Detention Basin) |
| A | CIVIL WORKS | | | | | |
| 1.1 | Site establishment, Construction Management Plan and Environmental management Plan | 1 | Item | \$8,000.00 | \$8,000.00 | \$8,000.00 |
| 1.3 | Survey | 1 | Item | \$7,000.00 | \$7,000.00 | \$7,000.00 |
| 1.6 | Construction of bund/dam wall | 767 | m ³ | \$50.00 | \$38,333.33 | \$38,333.33 |
| 1.9 | 225mm dia. RCP Low flow pipe | 24 | m | \$400.00 | \$9,600.00 | |
| 1.13 | Concrete spillway channel and install rock beaching downstream of spillway outlet, inclusive of excavation and disposal of spoil (size and area of rock to be confirmed). | 1 | Item | \$16,000.00 | \$16,000.00 | \$16,000.00 |
| 1.15 | Removal of existing trees as required | 1 | Item | \$3,000.00 | \$3,000.00 | \$3,000.00 |
| 1.16 | Re-instatement of landscaping | 1 | Item | \$3,000.00 | \$3,000.00 | \$3,000.00 |
| | TOTAL CIVIL WORKS | | | | \$84,933.33 | \$75,333.33 |
| B | PROVISIONAL ITEMS AND CONTINGENCIES | | | | | |
| 2.1 | PROVISIONAL ITEM Contingencies (30%) | 1 | Item | | \$25,480.00 | \$22,600.00 |
| 2.2 | PROVISIONAL ITEM Design, documentation, contract administration and supervision of works (10%) | 1 | Item | | \$8,493.33 | \$7,533.33 |
| | TOTAL CONTINGENCIES | | | | \$33,973.33 | \$30,133.33 |
| A | CIVIL WORKS | | | | \$84,933.33 | \$75,333.33 |
| B | PROVISIONAL ITEMS AND CONTINGENCIES | | | | \$33,973.33 | \$30,133.33 |

SUBTOTAL: \$118,906.67 \$105,466.67

GST: \$11,890.67 \$10,546.67

TOTAL AMOUNT (Including GST): \$130,797.33 \$116,013.33

Notes: Assumptions
Bund Crest - 3-meter wide
Bund side slope -1:2 (V:H)

APPENDIX F. EROSION SITE INSPECTION NOTES



Appendix F

Location Number: 1a

Site Photo:

Velocities:

| Location | Velocity (m/s) | | |
|----------|----------------|-----------|-----------|
| | 0.5% AEP | 1% AEP | 5% AEP |
| 01a | 3.04 | 2.95 | 2.73 |
| 01b | 2.76 | 2.58 | 2.36 |

Soil:

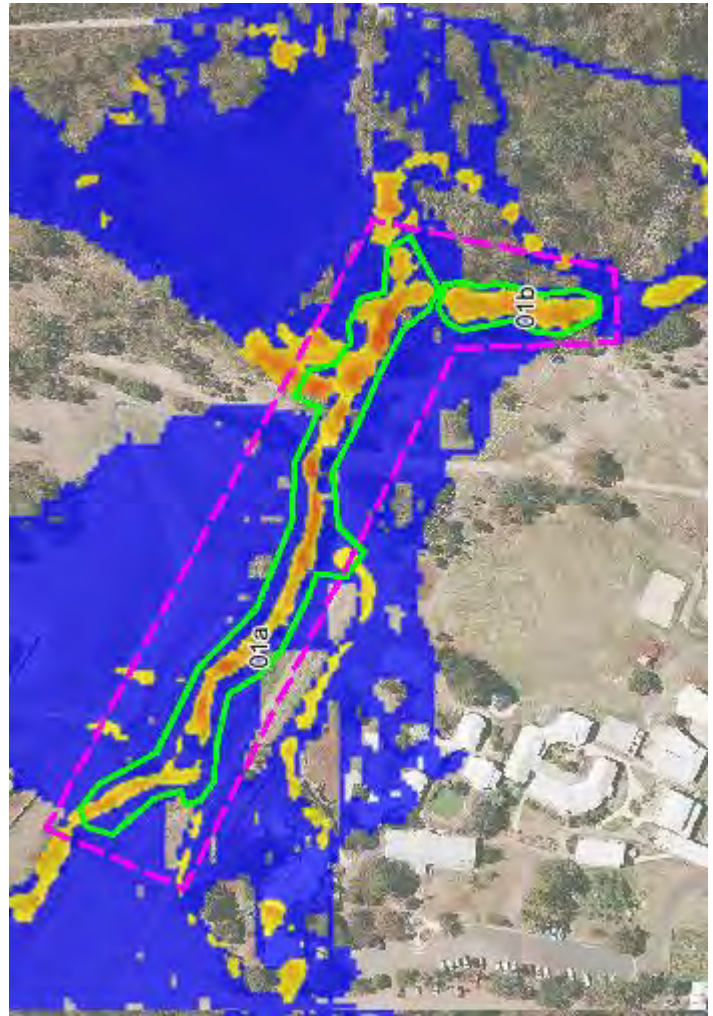
Fine Sand to Silt overlain on Sandstone <1m.

Uncompacted fill material present in the upper reaches of 1a. Fill material appears to be imported and illegally dumped – not reflective of site characteristics.

Vegetation:

Well vegetated with grasses/reeds

Planted areas spread along banks (see photos)



Notes:

- Gradual – steep slope
- Residential on one side with a school located on the other.
- Relatively straight with minor deviations in stream
- Minor undercutting present in some locations
- Consistent morphology

Location 1a



Location Number: 1b

Site Photo:

Velocities:

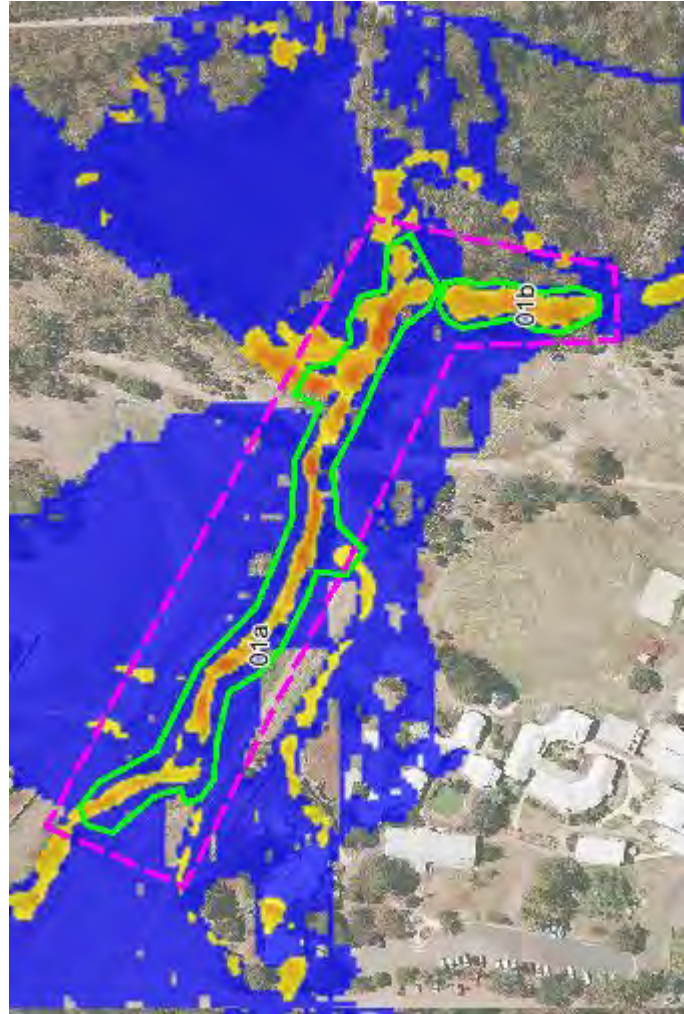
| Location | Velocity (m/s) | | |
|----------|----------------|-----------|-----------|
| | 0.5% AEP | 1% AEP | 5% AEP |
| 01a | 3.04 | 2.95 | 2.73 |
| 01b | 2.76 | 2.58 | 2.36 |

Soil:

Sandstone invert and banks

Vegetation:

vegetated with grasses/reeds
sporadic on top of banks



Notes:

- steep slope
- bushland on one side with a school located on the other.
- Relatively straight with minor deviations in stream
- No visible signs of erosion issues

Location 1b



Location Number: 2

Site Photo:

Velocities:

| Location | Velocity (m/s) | | |
|----------|----------------|-----------|-----------|
| | 0.5% AEP | 1% AEP | 5% AEP |
| 02a | 3.14 | 3.10 | 2.89 |
| 02b | 2.64 | 2.60 | 2.47 |
| 02c | 2.63 | 2.54 | 2.23 |

Soil:

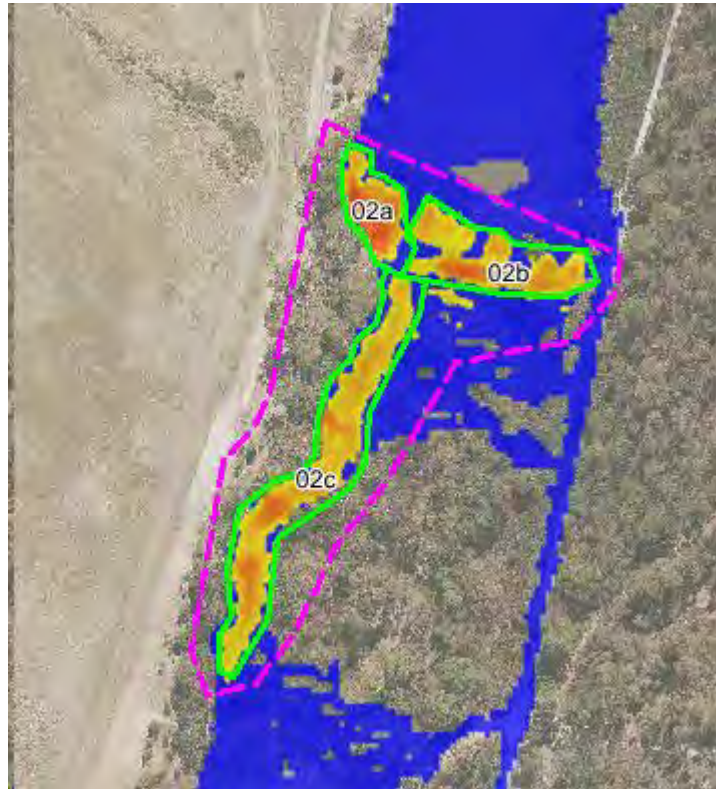
2a – Concrete/stone invert with bluestone cage gabions.

2b – Topsoil fill recently disturbed by works

2c – coarse fill conglomerate material overlain on fine sands to weathered sandstone

Vegetation:

Sporadic grasses and ferns becoming denser further down the stream.



Notes:

- Steep slope
- Reserve and farmland bordering this section, farmland earmarked for development.
- Some evidence of minor channel erosion/undercutting
- Sediment deposition apparent at lower sections
- Steep banks difficult access to lower sections of 2c.

Location 2a



Location 2b



Location 2c



Location Number: 3

Site Photo:

Velocities:

| Location | Velocity (m/s) | | |
|----------|----------------|--------|--------|
| | 0.5% AEP | 1% AEP | 5% AEP |
| 03a | 4.17 | 4.06 | 3.82 |
| 03b | 3.89 | 3.79 | 3.60 |

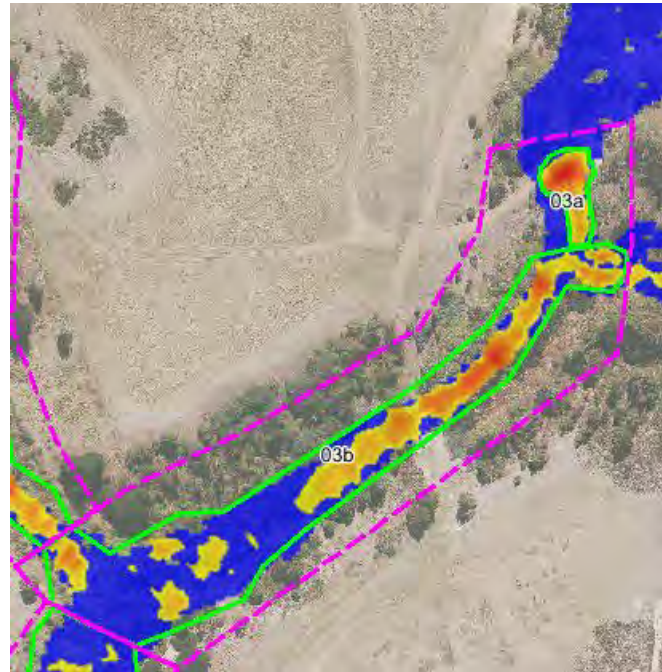
Soil:

3a –stone invert bolder apron

3b – Sandstone Invert and banks in upper regions with a gradual med-fine sand overlain on sandstone (outcrops)

Vegetation:

Sporadic grasses and ferns becoming denser further down the stream. Tree and shrub density increases as transverse downstream.



Notes:

- 3a has a large concrete crossing with 3x300mm pvc (blackmax) pipes for low flow.
- Reserve and farmland bordering this section, farmland earmarked for development.
- Moderate tree/shrub density and very steep banks - difficult access
- Some evidence of minor channel erosion/undercutting.

Location 3a



Location 3b

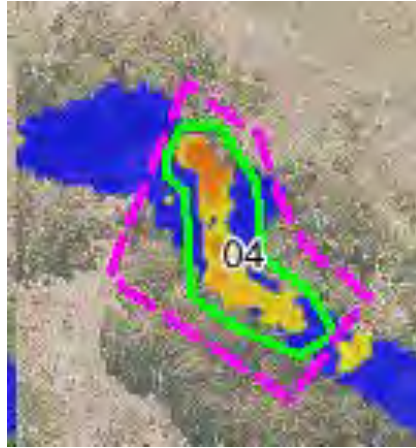


Location Number: 4

Site Photo:

Velocities:

| Location | Velocity (m/s) | | |
|----------|----------------|-----------|-----------|
| | 0.5% AEP | 1% AEP | 5% AEP |
| 4 | 2.47 | 2.36 | 2.22 |



Soil:
Unknown

Vegetation:
Dense Blackberries

Notes:

- Could not access stream due to dense blackberries from top of bank to top of bank.
- On the edge of proposed development and golf course.

Location 4



Location Number: 5

Site Photo:

Velocities:

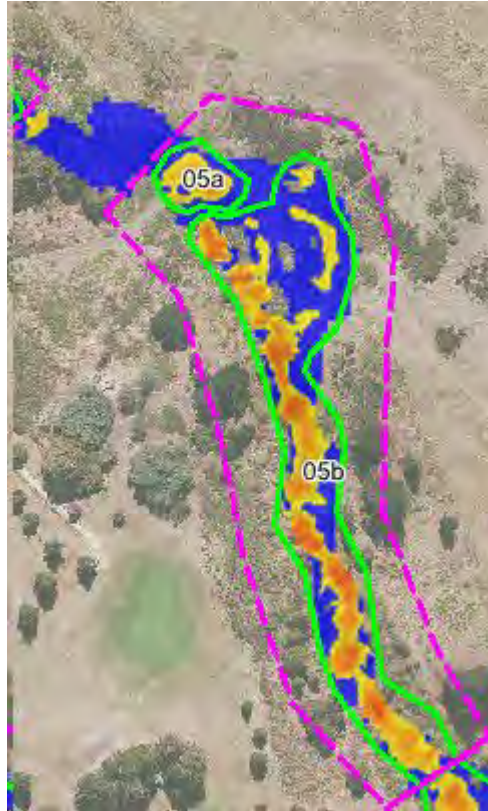
| Location | Velocity (m/s) | | |
|----------|----------------|-----------|-----------|
| | 0.5% AEP | 1% AEP | 5% AEP |
| 05a | 1.93 | 1.85 | 1.63 |
| 05b | 3.07 | 3.07 | 3.05 |

Soil:

Med-fine sands, no rock outcrops visible

Vegetation:

Grasses ferns and blackberries cover a large portion of the banks.
Well established mature trees spread throughout



Notes:

- Blackberries made access to the majority of the creek inaccessible.
- Small section of creek able to access showed little evidence of erosion.
- Disposed car parts found in creek
- On the edge of proposed development and golf course.

Location 5



Location Number: 6

Site Photo:

Velocities:

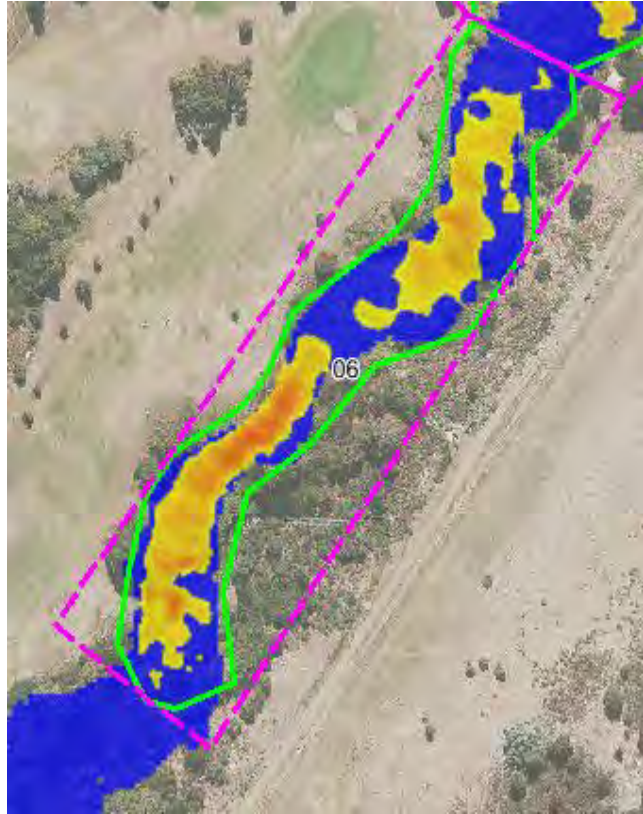
| Location | Velocity (m/s) | | |
|----------|----------------|--------|--------|
| | 0.5% AEP | 1% AEP | 5% AEP |
| 6 | 2.70 | 2.61 | 2.23 |

Soil:

Fine sands deep grass root matrix.
Minor dolerite outcrops.

Vegetation:

Well covered grass, marsh area with
decent spread of mature trees.



Notes:

- Heavy shrub and blackberry coverage along with very steep banks made access difficult.
- Single access point showed a large marsh area under dense canopy.
- Gullies present throughout accessible area.
- Downstream channel becomes steeper and more defined.
- Minor evidence of bank erosion as you move downstream

Location 6



Location Number: 7

Site Photo:

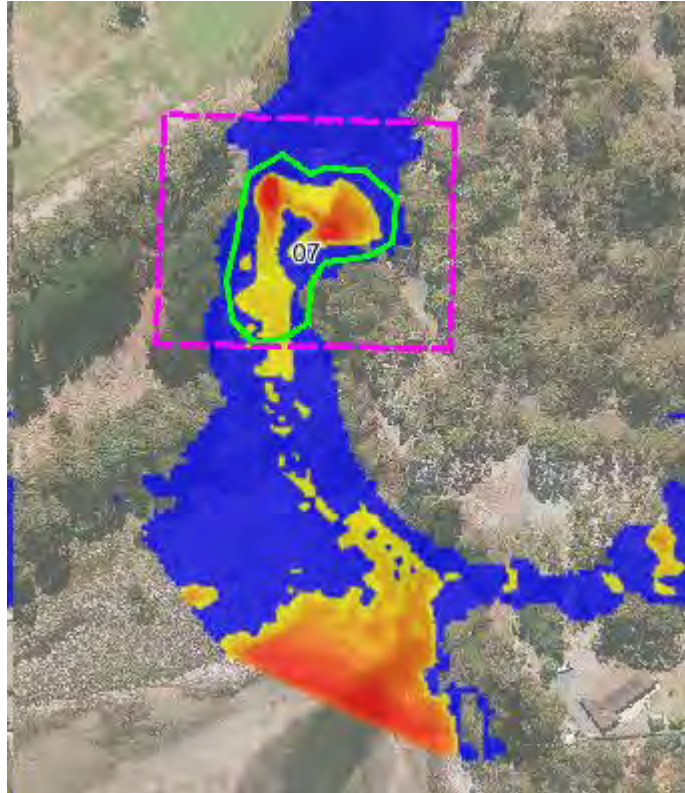
| Location | Velocity (m/s) | | |
|----------|----------------|--------|--------|
| | 0.5% AEP | 1% AEP | 5% AEP |
| 7 | 10.16 | 10.16 | 6.72 |

Soil:

Coarse conglomerate fill overlain on Medium to fine sands. Fine sands to silt on top side of culvert.

Vegetation:

Various Grasses and weeds, moderate coverage, mature trees present on top of bank.



Notes:

Inlet:

- Water and Sewer main present at approximately 3.0m and 1.8m invert to invert.
- Abutments for sewer pipe present on banks.
- Various placed dry stacked rock embankments, no consistency to design or material.
- Erosion present around sewer and water abutments and around various placed rock embankments
- Deposition of sands and vegetation present.
- Flat lying

Outlet:

- Tidal influenced
- Flat lying
- Minor embankment erosion (unsure of source)
- Deposition of sands and vegetation present.

Location 7



Location Number: 8

Site Photo:

| Location | Velocity (m/s) | | |
|----------|----------------|--------|--------|
| | 0.5% AEP | 1% AEP | 5% AEP |
| 08a | 2.80 | 2.72 | 2.55 |
| 08b | 2.43 | 2.36 | 2.14 |
| 08c | 2.35 | 2.26 | 2.11 |
| 08d | 2.05 | 2.03 | 1.96 |
| 08e | 1.70 | 1.65 | 1.44 |
| 08f | 2.07 | 2.03 | 1.91 |
| 08g | 1.76 | 1.75 | 1.67 |
| 08h | 2.50 | 2.45 | 2.34 |
| 08i | 1.85 | 1.84 | 1.85 |
| 08j | 2.04 | 1.97 | 1.76 |
| 08k | 2.09 | 2.03 | 1.88 |
| 08l | 1.59 | 1.57 | 1.52 |

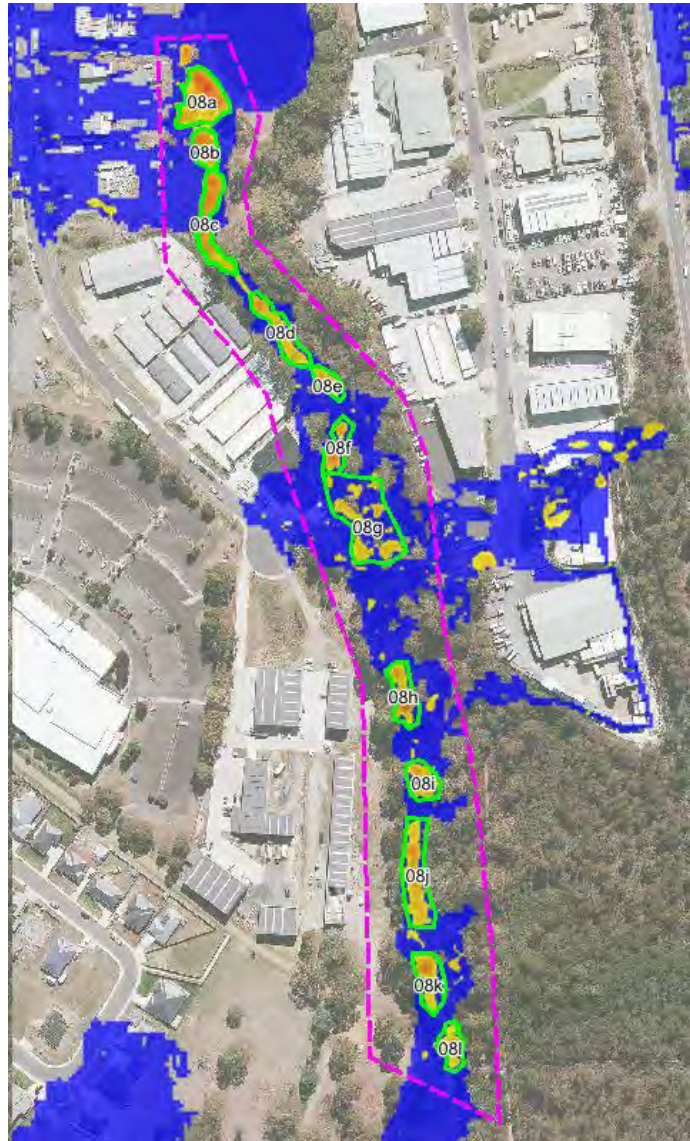
Soil:

Medium to fine sands

Vegetation:

Various Grasses and trees planted between 8a to 8e (not established yet)

From 8e onwards natural grasses and ferns present mostly on top of banks little to no vegetation in invert or on banks.



Notes:

- Extensive erosion throughout the entire length, largely bank undercutting/erosion.
- Multiple and extensive attempts to mitigate against erosion including:
 - Large sandstone bolder placement (single layer on banks)
 - Geomesh placement on banks to assist plant growth
 - Rock weirs placed down channel
 - Smaller bluestone placement on bends
- Majority of mitigation attempts failed, rock placement moved, geomesh destroyed etc.
- Large industrial area large impervious area on both sides of rivulet.
- Gradual slope getting steeper as you traverse down the creek

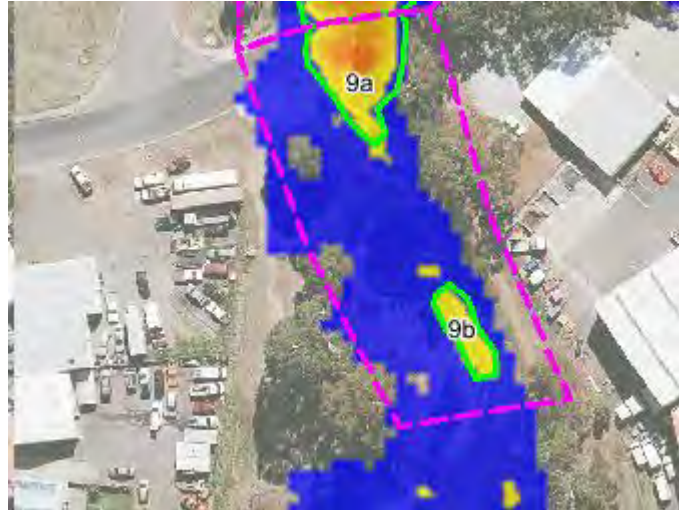
Location 8



Location Number: 9

Site Photo:

| Location | Velocity (m/s) | | |
|----------|----------------|--------|--------|
| | 0.5% AEP | 1% AEP | 5% AEP |
| 9a | 2.45 | 2.39 | 2.30 |
| 9b | 1.28 | 1.21 | 1.08 |



Soil:

Coarse sandy soil no visible hard rock outcrops

Vegetation:

Various Grasses and reeds throughout.

Notes:

- Mostly depositional sediments
- No obvious erosion present.
- Flat lying topography
- Well planted

Location 9



Location Number: 10

Site Photo:

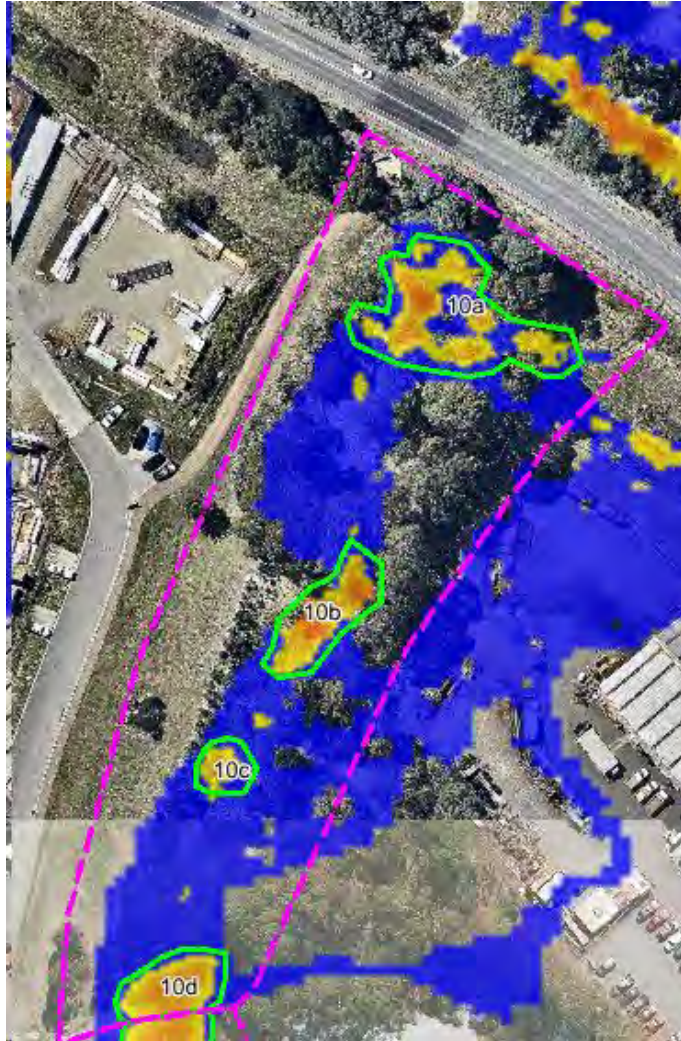
| Location | Velocity (m/s) | | |
|----------|----------------|--------|--------|
| | 0.5% AEP | 1% AEP | 5% AEP |
| 10a | 2.38 | 2.31 | 2.15 |
| 10b | 2.55 | 2.52 | 2.33 |
| 10c | 1.54 | 1.53 | 1.52 |
| 10d | 2.00 | 1.91 | 1.65 |

Soil:

Coarse sandy soil no visible hard rock outcrops

Vegetation:

Various Grasses and reeds throughout.



Notes:

- Winding stream low flow stream with secondary floodplain before reaching top of banks
- Very coarse sands show little compaction and highly susceptible to erosion.
- Extensive bank (low flow channel) undercutting, major bank collapse on bend (10b).
- Flood plain section better vegetated less extensive erosion present.
- Relatively flat lying
- High imperious industrial area surrounding

Location 10



APPENDIX G. EROSION ASSESSMENT



Appendix G

| Location 1 | | | | | | | | | |
|----------------------|---|----------------------|--------------|---|------------------|---|-----------|---|---------|
| Cause of Erosion | | Erosion Class Rating | | | | | | | |
| Cause | Comments based on pictures and site notes | Sub-Location | Erosion Head | | Waterway Channel | | Sidewalls | | Class |
| Runoff and base flow | Located below Penrhyn Dam. Contribution from urban area including a school and residential area and Penrhyn Dam overflow. | 1a | INACTIVE | COMMENT: Vegetation present along banks. No loose soil visible. Large sandstone rocks line the banks. | STABLE | COMMENT: Well vegetated banks with grass and reeds. Planted areas along the banks | STABLE | COMMENT: Minor undercutting visible. Root structure of native grasses would stabilise bank. | CLASS 8 |
| Soil type | Banks are lined with sandstone rocks. Soil is sand to silt on sandstone below 1m (medium to low erodibility). | | | | | | | | |
| Slope | Gradual steepening slope and narrow stream (medium risk). | 1b | INACTIVE | COMMENT: Vegetation present along banks. No loose soil visible | STABLE | COMMENT: Sandstone lined channel | STABLE | Comment: No visible signs of erosion | |
| Land Use | Planted areas along the banks (low erodibility). Conservation area surrounding 1b (low impact runoff). Surrounding residential area and school (high impact runoff). Huntingfield Development also contribute to potential runoff increase (high impact potential). | | | | | | | | |

| Location 2 | | | | | | | | | |
|----------------------|--|----------------------|--------------|---|------------------|--|-----------|---|---------|
| Cause of Erosion | | Erosion Class Rating | | | | | | | |
| Cause | Comments based on pictures and site notes | Sub-Location | Erosion Head | | Waterway Channel | | Sidewalls | | Class |
| Runoff and base flow | Located immediately below Heron Dam. Contribution from Huntingfield urban area, farmland, and Heron Dam overflow. | 2a | INACTIVE | COMMENT: mitigation measure have been integrated - Rock chute, gabion structures at Head, rock rip rap and concrete aggregate. Head has been stabilised | UNSTABLE | COMMENT: exposed topsoil, unvegetated. Highly erodible. | ERODING | COMMENT: Exposed soil, undermining of stream bank. Attempted localised mitigation with concrete aggregate covering and bluestone rock | CLASS 5 |
| Soil type | Sands and sandstone evident in the loose topsoil. Vegetated cover removed along channel, exposing topsoil from recent works. (high erodibility) | | | | | | | | |
| Slope | Steep channel grade and sidewall slopes (high risk) | 2b | ACTIVE | COMMENT: Top soil distributed by recent works. Loose soil. Conglomerate rock surrounded by fine sands. | UNSTABLE | COMMENT: unvegetated top soil. Erodible | ERODING | COMMENT: Fine sand with grasses found along the banks | CLASS 1 |
| | | 2c | INACTIVE | COMMENT: Vegetation higher along the banks. Mature trees. | UNSTABLE | COMMENT: denser vegetated outcrops further downstream. Loose sand present on slopped banks | ERODING | COMMENT: Evidence of undercutting. Visible roots along bank edges. Trees logs/ branches fallen across the river | CLASS 5 |
| Land Use | Low density vegetation downstream of spillway (high erodibility) but denser further down the stream (median erodibility). Immediately downstream of Huntingfiled development. Existing neighbouring farmland has been earmarked for development. (high impact potential) | | | | | | | | |

| Location 3 | | | | | | | | | |
|----------------------|---|----------------------|--------------|---|------------------|---|-----------|--|---------|
| Cause of Erosion | | Erosion Class Rating | | | | | | | |
| Cause | Comments based on pictures and site notes | Sub- Locations | Erosion Head | | Waterway Channel | | Sidewalls | | Class |
| Runoff and base flow | Contribution from erosion zone 2 and proposed development. | 3a | INACTIVE | COMMENT: Formed concrete weir (access crossing) v-notch invert and rock bolder apron. Concrete crossing with 3x300mm PVC low flow pipes | STABLE | COMMENT: Steep Grade. Rocky channel. Weir and rock rip rap structure (apron) to control flows. | ERODING | COMMENT: recent bank failure. Loose soil, tree roots and debris visible | CLASS 7 |
| Soil type | Large sandstone rock outcrops. Fine to medium sands (medium to low erodibility). | | | | | | | | |
| Slope | Steep graded banks (high risk). | 3b | INACTIVE | COMMENT: Densely vegetated upper banks | STABLE | COMMENT: rock lined creek bed. Some sediment deposits from upper reaches. Exposed granite rocks and formations forming stable channels. Constructed granite rock weir | ERODING | COMMENT: Evidence of minor undercutting. Exposed soil and Root structure. Fallen tree causing hydraulic obstructions and blockage. Signs of flows being diverted and erosion forming (see picture) | |
| Land Use | On the edge of Huntingfiled development. Existing neighbouring farmland has been earmarked for development (high impact potential). | | | | | | | | |

| Cause of Erosion | | Location 4 | | | | | | |
|----------------------|---|----------------------|---|------------------|---|-----------|--|---------|
| | | Erosion Class Rating | | | | | | |
| Cause | Comments based on pictures and site notes | Erosion Head | | Waterway Channel | | Sidewalls | | Class |
| Runoff and base flow | Contribution from main channel . Fed from the confluence of Coffee Creek and east tributary. | INACTIVE | COMMENT: Dense Vegetation. No visible signs of erosion activity | STABLE | COMMENT: densely vegetated. Channel appears to be a deeply incised. | STABLE | COMMENT: Densely Vegetated with blackberry bushes. Blackberry bushes have a fibrous root system that extends 300-400 mm below the surface. This type of root system is good at stabilising topsoil. Steep sidewall can lead to sidewall gully formation with increased and uncontrolled overland flows. It is noted that the neighbouring land area has been earmarked for development. Suitable stormwater management should be adopted for stormwater discharges entering this section | CLASS 8 |
| Soil type | Assumed due to inaccessibility: Medium to Fine Sands (based on geology soil maps and consistent with Location 5) (high erodibility). | | | | | | | |
| Slope | Steep grade sidewall (high risk). | | | | | | | |
| Land Use | Dense vegetation on banks and along the Creek (low erodibility). Golf Course (low impact runoff) and Future Development Zone around (high impact potential). | | | | | | | |

| Location 5 | | | | | | | | |
|----------------------|---|----------------------|---|------------------|--|-----------|--|---------|
| Cause of Erosion | | Erosion Class Rating | | | | | | |
| Cause | Comments based on pictures and site notes | Erosion Head | | Waterway Channel | | Sidewalls | | Class |
| Runoff and base flow | Contribution from erosion zone 4 , proposed inner residential area and golf course . | INACTIVE | COMMENT: Densely Vegetated with grasses, shrubs and established trees | STABLE | COMMENT: Densely vegetated. Broad channel. A lot of debris that could create obstructions and increase hydraulic resistance. | STABLE | COMMENT: densely vegetated banks. Medium to low bank grade profile | CLASS 8 |
| Soil type | Medium to fine sands (high erodibility). | | | | | | | |
| Slope | Medium grade sidewalls and channel - broad flow path (low risk). | | | | | | | |
| Land Use | Dense vegetation on banks and along the Creek (low erodibility). Golf Course (low impact runoff) and Future Development Zone around (high impact potential). | | | | | | | |

| Location 6 | | | | | | | | |
|----------------------|--|----------------------|--|------------------|--|-----------|--|---------|
| Cause of Erosion | | Erosion Class Rating | | | | | | |
| Cause | Comments based on pictures and site notes | Erosion Head | | Waterway Channel | | Sidewalls | | Class |
| Runoff and base flow | Runoff and base flow consists of channel flow from Location 3, 4 and 5. | INACTIVE | COMMENT: Well vegetated with good cover and established rooted plants. | STABLE | COMMENT: well defined and incised channel. Vegetated cover to channel. Willows within channel alignment increase hydraulic resistances, may cause channel diversion if left unchecked. | ERODING | COMMENT: Undercutting visible along the banks. Gullies visible. Banks have undergone scouring to reveal rock underneath. Shear sidewalls susceptible to undermining and erosion growth. Prevalent grasses have shallow root system does not provide durable stability. Animal walking trails have exposed topsoil and may be susceptible to erosion. | CLASS 7 |
| Soil type | Fine sands - clay with some dolerite/basalt/granite outcrops (medium to low erodibility) . | | | | | | | |
| Slope | Steep sidewalls with formed gullies. Steep and defined channel (high risk potential). | | | | | | | |
| Land Use | Dense vegetation on banks and along the Creek (low erodibility). Forest, Golf Course (low impact runoff) and Future Development Zone around (high impact potential). | | | | | | | |

| Location 7 | | | | | | | | |
|----------------------|--|----------------------|--|------------------|---|-----------|--|---------|
| Cause of Erosion | | Erosion Class Rating | | | | | | |
| Cause | Comments based on pictures and site notes | Erosion Head | | Waterway Channel | | Sidewalls | | Class |
| Runoff and base flow | Base flow continuation from upper catchment. Increased in flow rate and concentration through Culvert structure. Stormwater runoff from golf course and Howden Road discharges to this location. | INACTIVE | COMMENT: Heavily modified head. Urban Infrastructure and associated form work. Rock aprons and embankments present to stabilise the channel and embankments around head. | UNSTABLE | COMMENT: Heavy sediment deposition creates a 'shifting' waterway alignment within the main channel. Rock lined in key locations, however, scouring around rocks can be observed. Channel clogged with debris. | ERODING | COMMENT: Stormwater outlet, sewer and water main infrastructure present. Gullies present, vegetation cover sparse. Tufted grasses and established trees. Susceptible to gully erosion. | CLASS 5 |
| Soil type | Fine sands, silts and conglomerate fill (sediment deposition) (medium to low erodibility) | | | | | | | |
| Slope | Flattening channel grade, steep sloped sidewalls/embankments (high risk) | | | | | | | |
| Land Use | Coffee Creek Outlet. Tidal influenced (low risk) | | | | | | | |

| Cause of Erosion | | Location 8 | | | | | | |
|----------------------|--|--------------|--|------------------|--|-----------|--|---------|
| Cause | Comments based on pictures and site notes | Erosion Head | | Waterway Channel | | Sidewalls | | Class |
| Runoff and base flow | Located immediately below Huntingfield Dam. Contribution from Huntingfield industrial area, location 9 and Huntingfield Dam overflow. | ACTIVE | COMMENT: large industrial area along both sides of the bank. Various mitigation method utilised; rock weirs, bluestone placement, geomesh and sandstone bolder placement. The rocks used have displaced. | UNSTABLE | COMMENT: Vegetation has not established. Sparsely found on banks. Loose sands present. | ERODING | COMMENT: Extensive erosion and undercutting. Scouring visible along banks. | CLASS 1 |
| Soil type | Fine to medium sands, siltstone and clays (high erodibility) | | | | | | | |
| Slope | Steepening Channel grade. Steep sidewalls (high risk) | | | | | | | |
| Land Use | Development along and some within Waterway Protection Area (high erodibility) and vegetation not established (high erodibility). Upper section receives flow from industrial area (high impact runoff). Lower section receives flow from both Industrial and conservation area. (medium impact runoff) | | | | | | | |

| Location 9 | | | | | | | | |
|----------------------|---|----------------------|---|------------------|--|-----------|-------------------------------------|---------|
| Cause of Erosion | | Erosion Class Rating | | | | | | |
| Cause | Comments based on pictures and site notes | Erosion Head | | Waterway Channel | | Sidewalls | | Class |
| Runoff and base flow | Contribution from industrial area. | INACTIVE | COMMENT: soil is coarse, deposition evident | STABLE | COMMENT: sediment deposited. Well vegetated banks. | STABLE | COMMENT: no obvious erosion present | CLASS 8 |
| Soil type | Coarse sandy soil (high erodibility). | | | | | | | |
| Slope | Broad flow path, flat lying wide channel grade (low risk) | | | | | | | |
| Land Use | Well vegetated banks (low erodibility). Runoff from industrial area (high impact runoff) | | | | | | | |

| Location 10 | | | | | | | | |
|----------------------|---|----------------------|--|------------------|---|-----------|---|---------|
| Cause of Erosion | | Erosion Class Rating | | | | | | |
| Cause | Comments based on pictures and site notes | Erosion Head | | Waterway Channel | | Sidewalls | | Class |
| Runoff and base flow | Contribution from industrial area and upper catchment. | Active | COMMENT: Concentrated flow (discharge) via stormwater culvert. Results in visible bank erosion. Shallow rooted grasses, exposed soils. | UNSTABLE | COMMENT: Soil profile visible along the upper banks. Tree found in the river. | ERODING | COMMENT: Grasses along bank. Undercutting and scouring visible. | CLASS 1 |
| Soil type | Very course sandy soil (high erodibility) | | | | | | | |
| Slope | Wide channel, gradually sloped sidewalls (low risk) | | | | | | | |
| Land Use | Various vegetation along the Creek (median erodibility). Runoff from industrial area (High impact runoff) | | | | | | | |