APPENDIX F

Flood Mitigation Works Stakeholder Workshop Summary

Arden Macaulay Precinct

Preliminary Identification of Options – for discussion

Option	Pros	Cons	Consider Further?
Raise and extend Moonee Ponds Creek levees to contain 100 year ARI event	• Will reduce peak flood levels in low lying areas of the precinct (refer to plan) • Uses current waterway reserve for the creek	• Will increase peak flood level in Moonee Ponds Creek • High levees may be unsightly, particularly if the crest of the levee is set to contain year 2100 scenario water level in Moonee Ponds Creek	Yes, especially for events greater than exiting conditions. Could add a path onto levee structure
Widen Moonee Ponds Creek through precinct and further downstream	• Will lower the water level in Moonee Ponds Creek easing the tail water level constraint on the precinct's local drainage system • Provides an opportunity to improve amenity values of Moonee Ponds Creek	• May require extensive land acquisition (likely on western side of the creek) • Potential loss of developable land (although maybe not in net terms) • Potential constrains include existing bridges and CityLink structures	Maybe, useful information for decision making / brave option. Multiple benefits, open space, environmental corridor

Option	Pros	Cons	Consider Further?
Re-build road and rail bridges over Moonee Ponds Creek	• Could reduce hydraulic restrictions on flow in the creek and therefore reduce the peak flood level in the creek (refer to plan)	• Potential heritage constraints on some bridges • Potential high costs	Yes, combine with creek widening
Reduce outflow from Jacana Retarding Basin		• Unlikely to provide any significant impact on peak flow within the Arden Macaulay Precinct (refer to graph)	No, need to review hydrology and explain
Planning controls downstream of Jacana Basin	• Limit peak flows into Moonee Ponds Creek	• Can it be implemented? • Effectiveness?	Yes, include in design event decision
Centralised flood storage (retarding basins) in passive open space within precinct	• Potential multiple benefits from land, which would only be flooded in large storm events		Yes, maybe try a couple of sizes. MPA, Melb CC to be involved in siting / size
Flood storage under Arden Street Reserve	• Could be used as a source of water for irrigation of the reserve	• May only provide limited storage volume	No, check volume
On site storage for all / most developments within the precinct	• A distributed storage system could reduce the requirement for centralised flood storage	• Responsibility for maintenance of distributed storages • Ensuring storage is emptied prior to large storm event	Not for 100 year, Melb CC interested in 10 to 20 year level of service only
Raise buildings on stilts, with flood storage / conveyance underneath	• Potentially reduces requirement for centralised flood storage	• Access issues into elevated buildings • There could still be extreme flood hazard in roads if they are not raised as well	Yes, how high What can occur below?

Option	Pros	Cons	Consider Further?
Bottom level of car park used for flood storage, second level of car park above 10 year ARI flood level but used for 100 year ARI flood storage	• Could provide a significant volume of flood storage, reducing flooding elsewhere	• Potential safety issue if car parking is located below 100 year ARI flood level	No, comment in report about safety and depth
Green roofs to reduce fraction impervious of re-development and therefore reduce volume of runoff	• Potentially a low cost option • Good amenity and visual aspects	• May not have a significant impact on runoff volumes	One option, model by reducing Fraction Impervious, whether it was planning controls on FI or green roofs or 22 ha of permeable pavement roads
Improved pumps, high capacity, automatic switch on mechanism and reliable / backup power supply	• Does not require significant land area	• May reduce period of inundation, but it may be a challenge to significantly reduce the peak flood level • Potentially high energy consumption • Risk of failure of power / pumps during flood event	Yes
Construct flood gates on all pipe outfalls to Moonee Ponds Creek	• Prevents backflow from Moonee Ponds Creek entering the precinct	• Requires storage behind the flood gate to store runoff when flood levels in Moonee Ponds Creek exceed flood levels in the precinct	Yes, include in all options
Balance flood storage on either side of the creek using siphons		• Unless designated areas for flooding are identified, there will still be flooding of developable areas	No

Option	Pros	Cons	Consider Further?
Large pipes or overland flow path alongside Moonee Ponds Creek to convey local catchment flows	• Could hydraulically separate the precinct local drainage system from Moonee Ponds Creek • Could reduce requirements for centralised flood storage	• Lack of available grade for pipe capacity • Is likely to increase peak flow discharged from the precinct to the receiving waterway	No, unlikely to be hydraulically or physically feasible
Harvest water from local catchments		• May provide flooding benefits for more frequent events, but have limited impact on peak 100 year ARI flood levels	No
Pipes from higher up the catchment to connect directly to creek under pressure		•	Yes, improve inlet arrangement from MMR option. May combine with smaller passive open space flood storage
Fill all / most of low lying areas outside creek, with higher overland flowpaths		•	Yes, calculate volume of fill

Options still on the table:

Works on Creek:

- Raise and extend Moonee Ponds Creek levees to contain 100 year ARI event
- Widen Moonee Ponds Creek through precinct and further downstream
- Re-build road and rail bridges over Moonee Ponds Creek

Works in local catchment:

- Construct flood gates on all pipe outfalls to Moonee Ponds Creek
- Pipes from higher up the catchment to connect directly to creek under pressure
- Fill all / most of low lying areas outside creek, with higher overland flowpaths
- Improved pumps with high capacity, automatic switch on mechanism and reliable / backup power supply
- Raise buildings on stilts, with flood storage / conveyance underneath
- Centralised flood storage (retarding basins) in passive open space within precinct

Options to benefit both local catchment and Moonee Ponds Creek:

- Reduced runoff in design event through methods such as planning controls downstream of Jacana Basin, on site storage for all / most developments within the precinct or green roofs to reduce fraction impervious

Combined options to test in model:

Common elements to all options:

- Construct flood gates on all pipe outfalls to Moonee Ponds Creek
- Reduced runoff in design event through methods such as planning controls downstream of Jacana Basin, on site storage for all / most developments within the precinct, green roofs or permeable paving to reduce fraction impervious (undertake sensitivity analysis with or without this reduction in runoff)

Option A:

Works on Creek:

- Widen Moonee Ponds Creek through precinct and further downstream
- Re-build road and rail bridges over Moonee Ponds Creek

Works in local catchment:

- Fill in low lying areas outside widened creek

Option B:

Works on Creek:

- Raise and extend Moonee Ponds Creek levees to contain 100 year ARI event

Works in local catchment:

- Pipes from higher up the catchment to connect directly to creek under pressure
- Improved pumps for low lying areas, pumps to have high capacities and automatic switch on mechanisms

Option C:

Works on Creek:

- Raise and extend Moonee Ponds Creek levees to contain 100 year ARI event

Works in local catchment:

- Centralised flood storages (retarding basins) in passive open space within precinct, surrounding properties and roads filled above flood level in retarding basin, with roads to act as overland flow path to convey runoff to the retarding basins

Option D:

Works on Creek:

- Raise and extend Moonee Ponds Creek levees to contain 100 year ARI event

Works in local catchment:

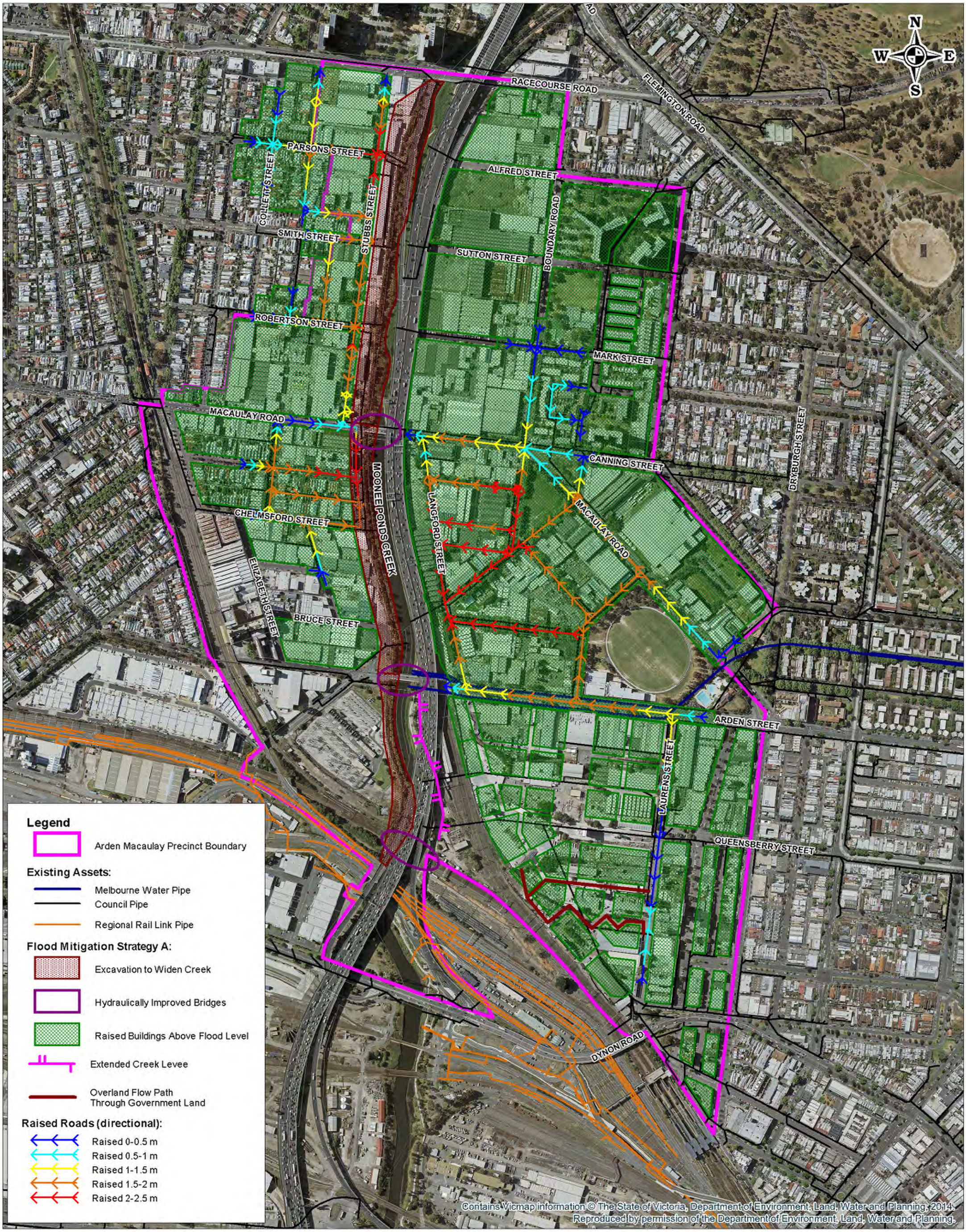
- Raise buildings on stilts, with flood storage / conveyance underneath
- Raised roads to reduce flood hazard on roads (roads will not act as overland flow paths as flow will be underneath buildings)

Each option will be analysed for the following scenarios:

- Existing conditions
- Year 2100 scenario (as per assumptions in Stage 1 report)
- Year 2100 scenario, with reduced fraction imperviousness to reflect reduction in runoff that could be achieved through potential options such as planning controls downstream of Jacana Basin, on site storage for all / most developments within the precinct, green roofs or permeable paving

APPENDIX G

Flood Mitigation Strategy A Concept Plan and Flood Maps



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ENGENY WATER MANAGEMENT

Melbourne Water

0 130 260

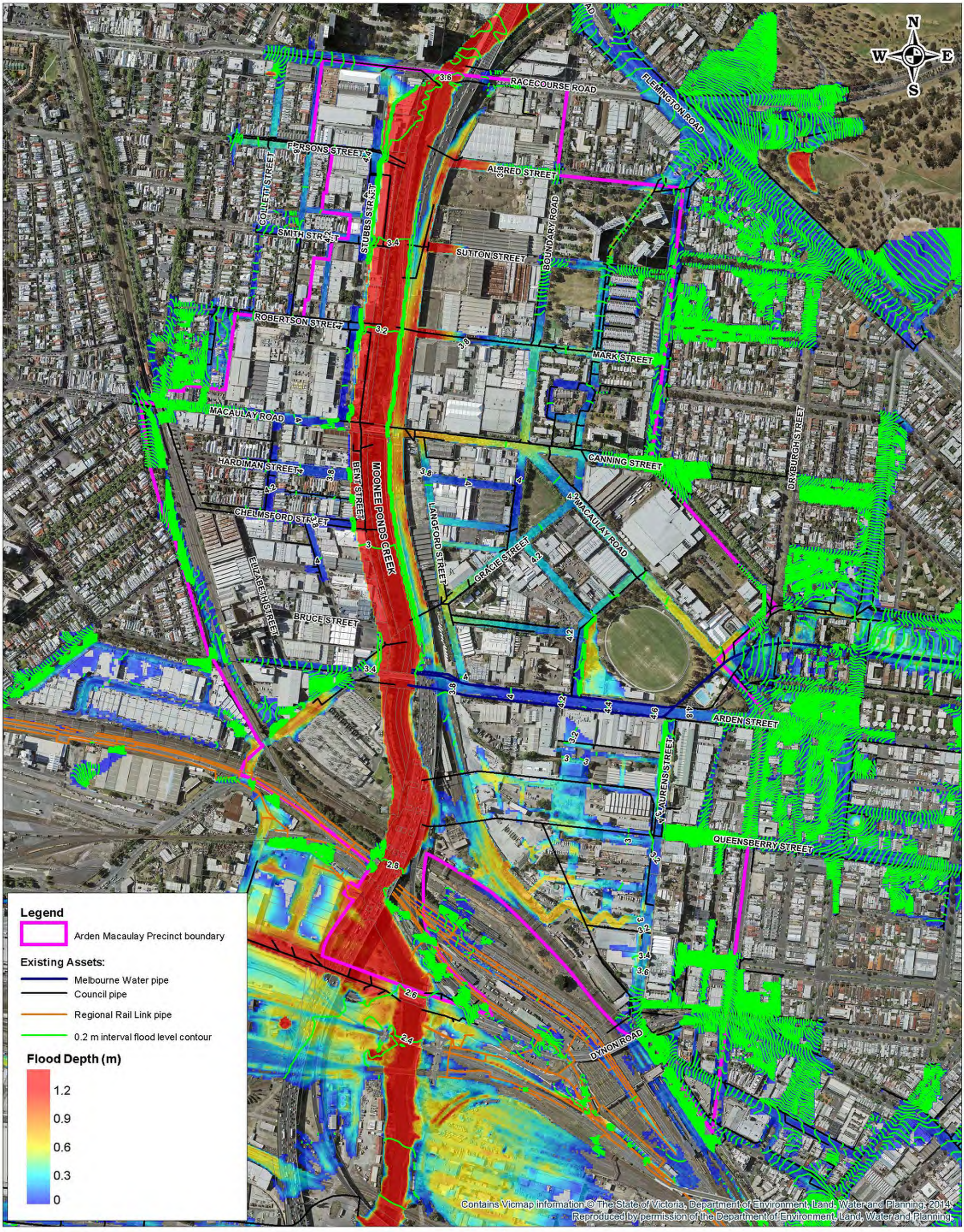
Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

Arden Macaulay Precinct

Figure G1
Flood Mitigation Strategy A

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016



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Melbourne Water

0 130 260

Scale in metres (1:6,500 @ A3)

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Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
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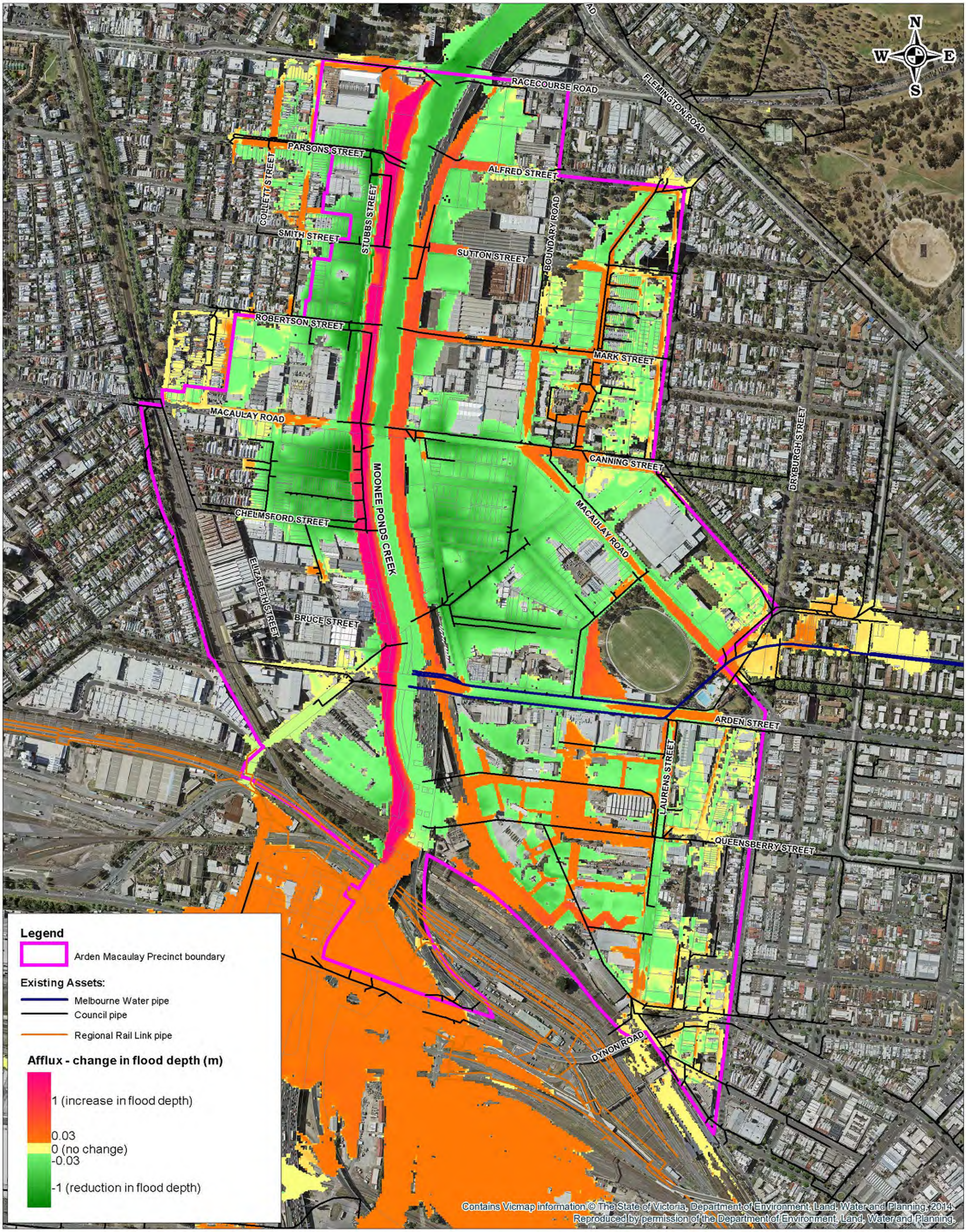
Grid: Map Grid of Australia, Zone 55

Arden Macaulay Precinct

Figure G2
1% AEP Flood Map - Flood Mitigation Strategy A for Existing Flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016



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Melbourne Water

0 130 260

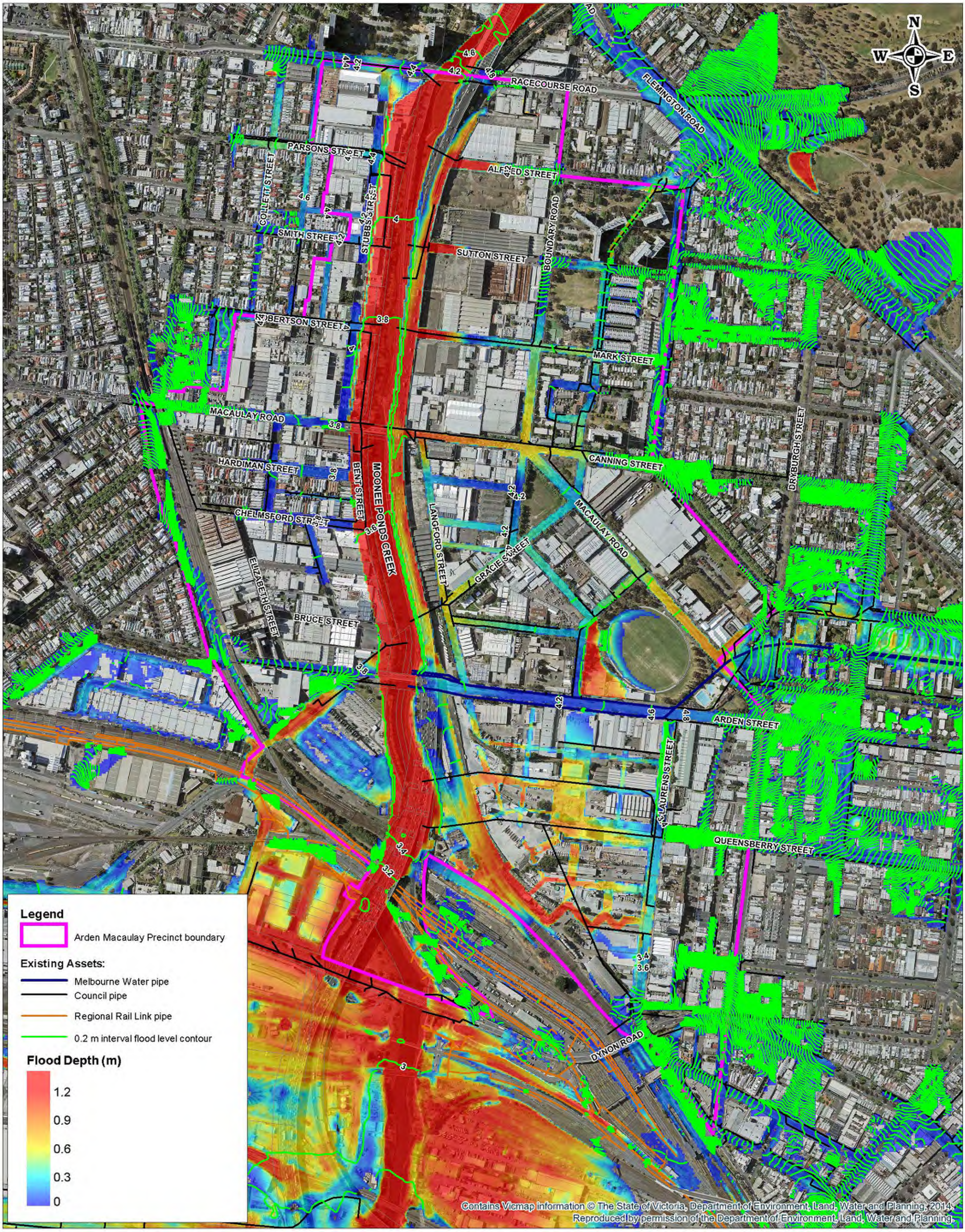
Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

Arden Macaulay Precinct

Figure G3
Change in flood depth due to flood mitigation strategy A for existing flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016



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Melbourne Water

0 130 260

Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

Arden Macaulay Precinct

Figure G4
1% AEP Flood Map - Flood Mitigation Strategy A for Year 2100 Flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016

RACECOURSE ROAD
FLEMINGTON ROAD
PARSONS STREET
ALFRED STREET
COLLETT STREET
STUBBS STREET
SMITH STREET
BOUNDARY ROAD
SUTTON STREET
ROBERTSON STREET
MARK STREET
MACAULAY ROAD
DRYBURGH STREET
CANNING STREET
MOONEE PONDS CREEK
CHELMSFORD STREET
ELIZABETH STREET
BRUCE STREET
ARDEN STREET
LAURENS STREET
QUEENSBERRY STREET
DYNON ROAD

N
W
E
S

Legend

Arden Macaulay Precinct boundary

Existing Assets:

Melbourne Water pipe
Council pipe
Regional Rail Link pipe

Afflux - change in flood depth (m)

1 (increase in flood depth)
0.03
0 (no change)
-0.03
-1 (reduction in flood depth)

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Melbourne Water

0 130 260

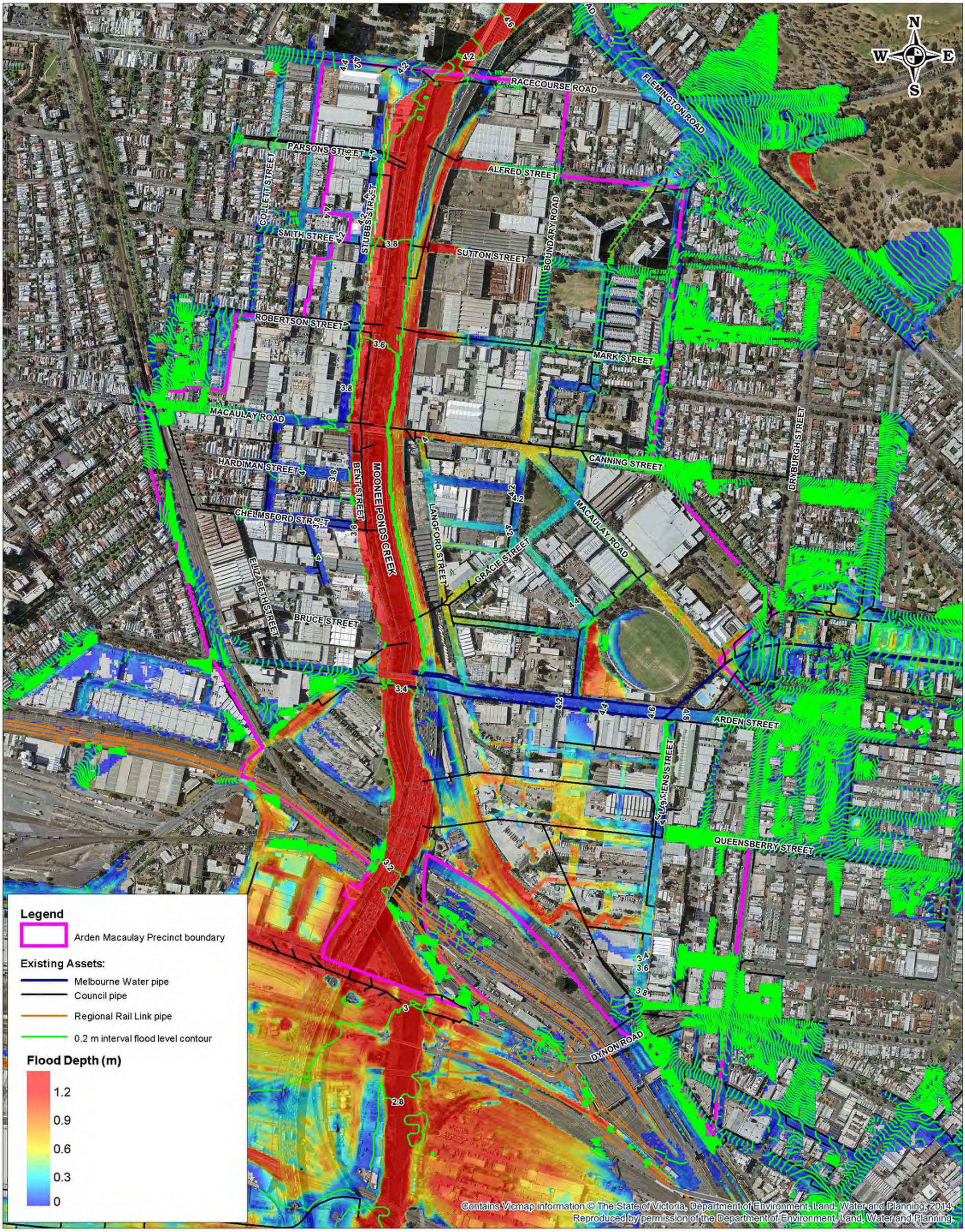
Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

Arden Macaulay Precinct

Figure G5
Change in flood depth due to flood mitigation strategy A for year 2100 flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016



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Melbourne Water

0 130 260

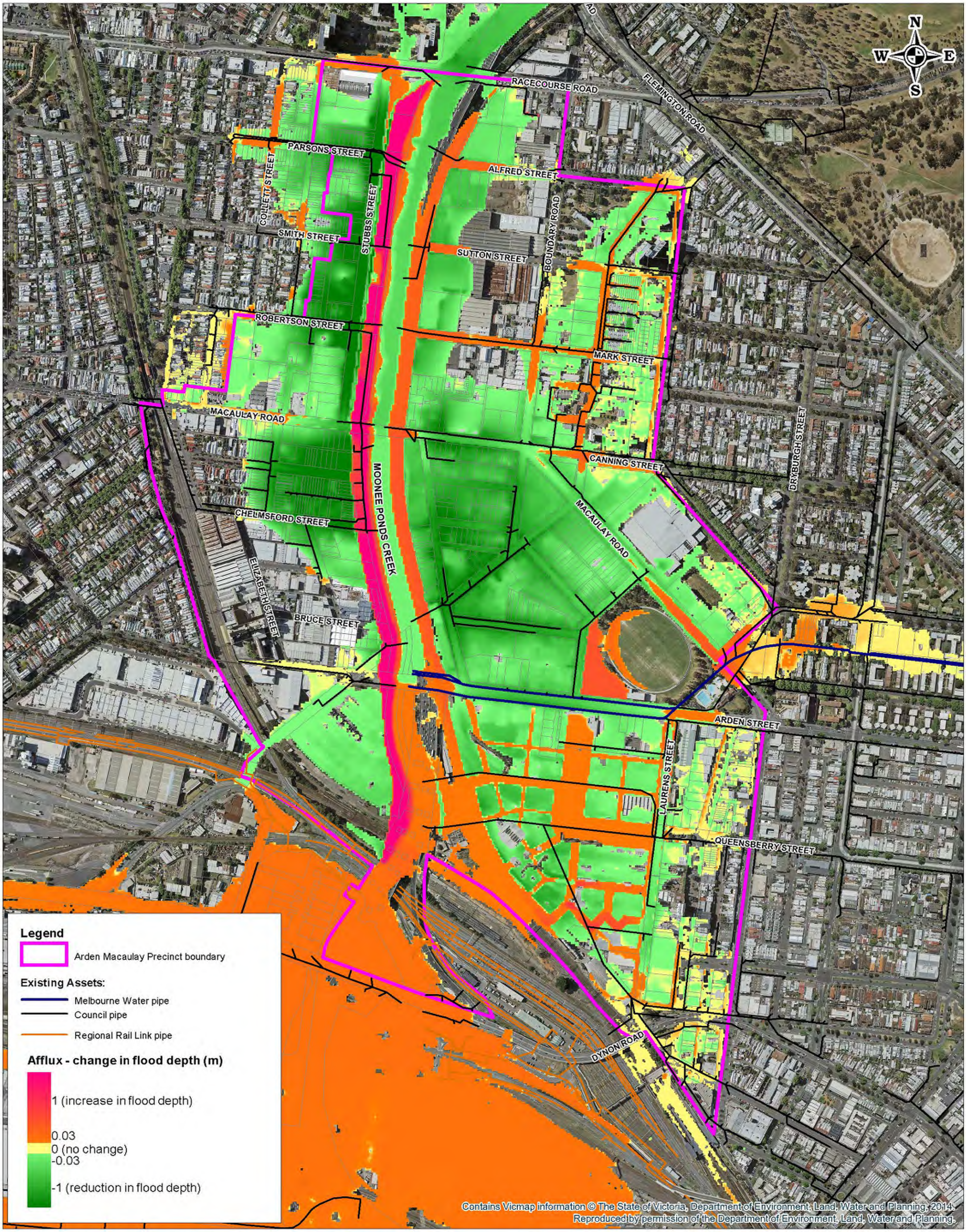
Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

Arden Macaulay Precinct

Figure G6
1% AEP Flood Map - Flood Mitigation Strategy A for Year 2100 With Planning Controls Scenario Flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016



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Melbourne Water

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Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
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Arden Macaulay Precinct

Figure G7
Change in flood depth due to flood mitigation strategy A for year 2100 with planning controls flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016

APPENDIX H

Flood Mitigation Strategy B Concept Plan and Flood Maps

RACECOURSE ROAD
FLEMINGTON ROAD
PARSONS STREET
COLLETT STREET
STUBBS STREET
ALFRED STREET
BOUNDARY ROAD
SMITH STREET
SUTTON STREET
ROBERTSON STREET
MARK STREET
MACAULAY ROAD
CANNING STREET
DRYBURGH STREET
MOONEE PONDS CREEK
LANGFORD STREET
CHELMSFORD STREET
ELIZABETH STREET
BRUCE STREET
ARDEN STREET
LAURENS STREET
QUEENSBERRY STREET
DYNON ROAD

Legend

- Arden Macaulay Precinct Boundary

Existing Assets:

- Melbourne Water Pipe
- Council Pipe
- Regional Rail Link Pipe

Flood Mitigation Strategy B:

- Extended / Raised Creek Levees
- New Pipes - under pressure
- Pump Station Pipe Connections to the Creek
- New Pump Station
- Upgraded Existing Pump Station

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ENGENY WATER MANAGEMENT

Melbourne Water

0 130 260

Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

Arden Macaulay Precinct

Figure H1
Flood Mitigation Strategy B

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016

RACECOURSE ROAD
FLEMINGTON ROAD
PARSONS STREET
COLLETT STREET
STUBBS STREET
ALFRED STREET
BOUNDARY ROAD
SMITH STREET
SUTTON STREET
ROBERTSON STREET
MARK STREET
MACAULAY ROAD
HARDIMAN STREET
BENT STREET
MOONEE PONDS CREEK
CANNING STREET
DRYBURGH STREET
CHELMSFORD STREET
LANGFORD STREET
GRACIE STREET
ELIZABETH STREET
BRUCE STREET
ARDEN STREET
LAURENS STREET
QUEENSBERRY STREET
DYNON ROAD

Legend

Arden Macaulay Precinct boundary

Existing Assets:

- Melbourne Water pipe
- Council pipe
- Regional Rail Link pipe
- 0.2 m interval flood level contour

Flood Mitigation Strategy B works:

- New Pump Station
- Upgraded Pump Statiopn
- New Pipes - under pressure
- Pump Station Pipe Connections to the Creek

Flood Depth (m)

1.2
0.9
0.6
0.3
0

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ENGENY WATER MANAGEMENT

Melbourne Water

0 130 260

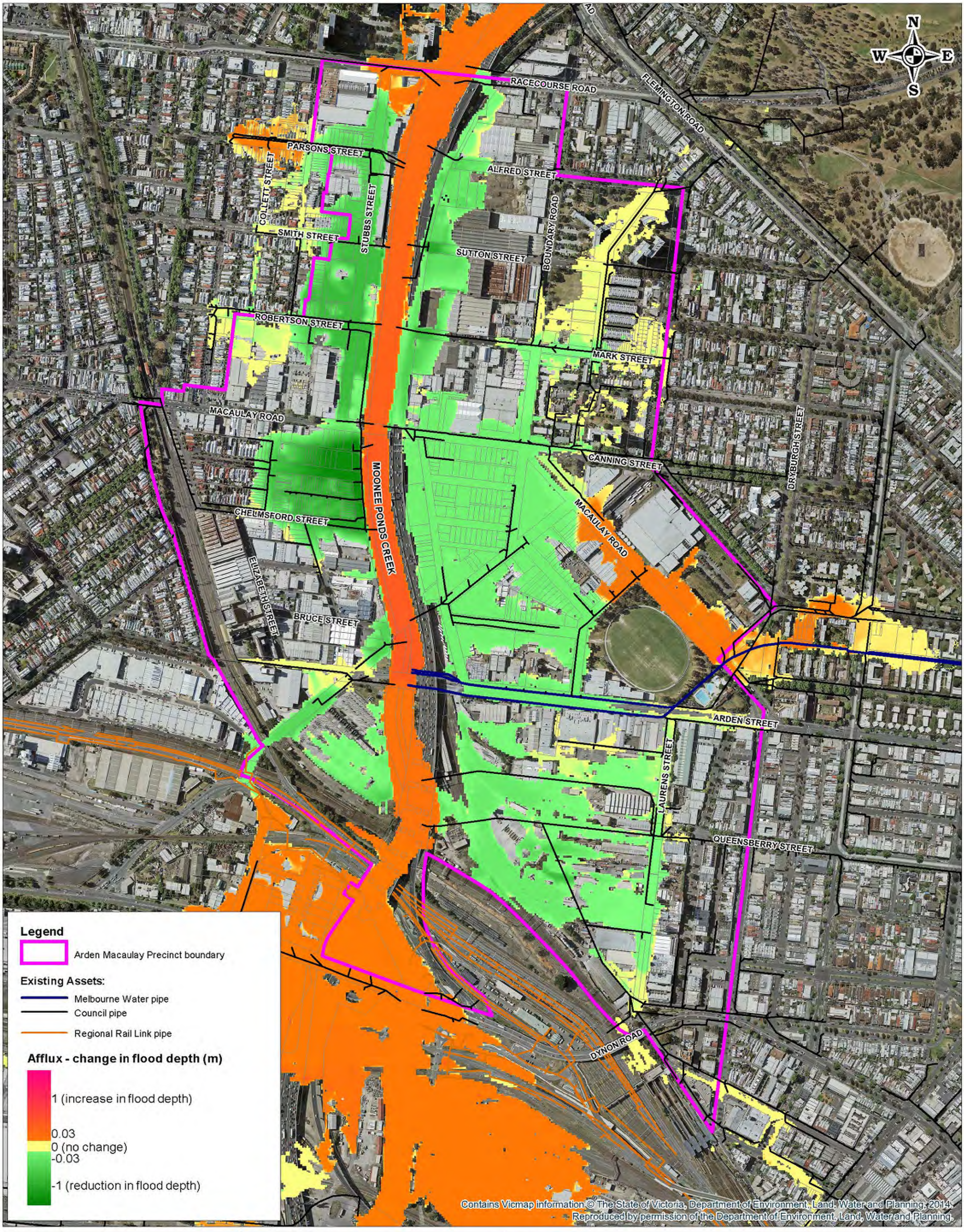
Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

Arden Macaulay Precinct

Figure H2
1% AEP Flood Map - Flood Mitigation Strategy B for Existing Flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016



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ENGENY WATER MANAGEMENT

Melbourne Water

0 130 260

Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

Arden Macaulay Precinct

Figure H3
Change in flood depth due to flood mitigation strategy B for existing flows

Job Number: V3000_052
Revision: 0
Drawn: PC
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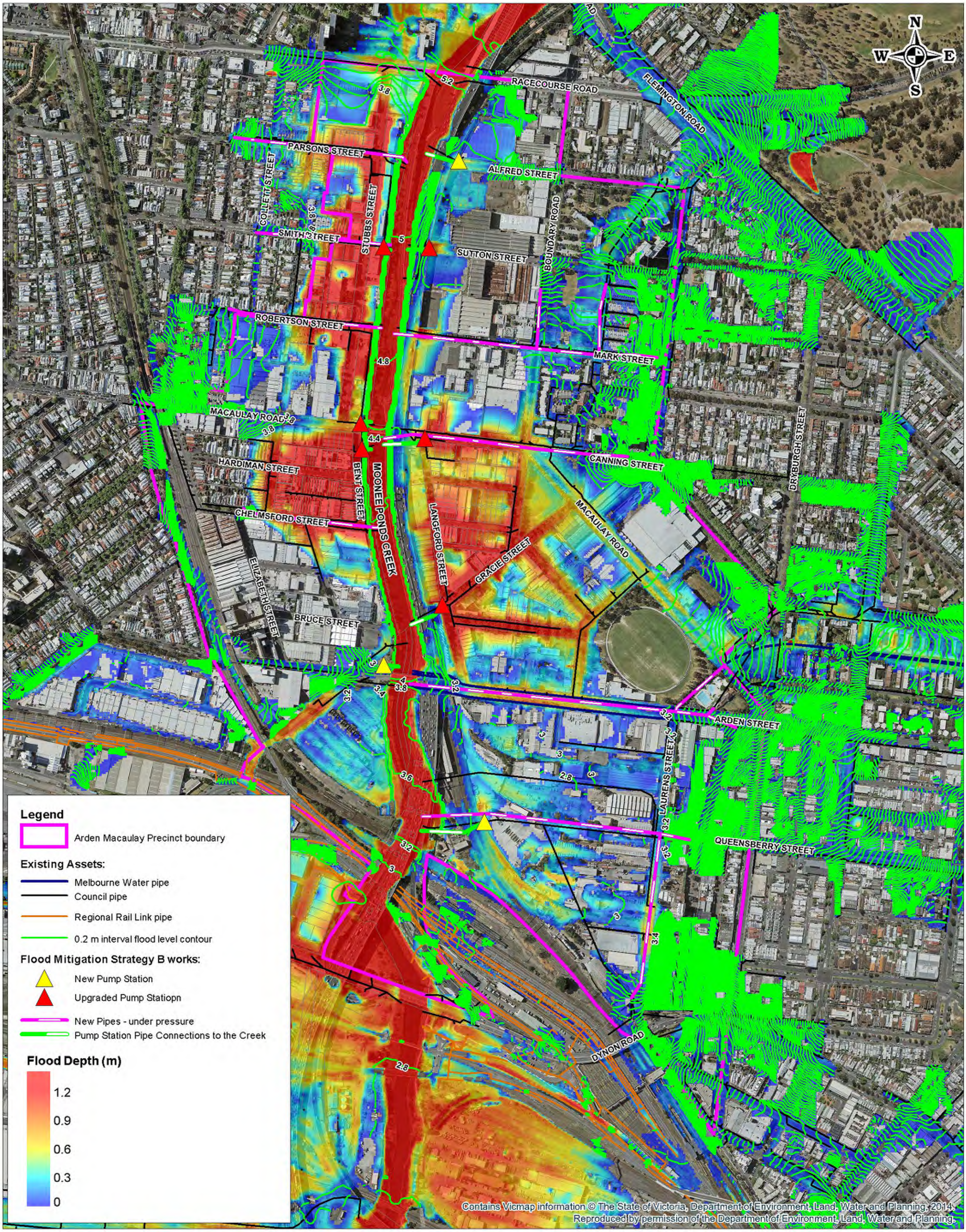
Date: 29 Feb 2016



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ENGENY WATER MANAGEMENT

Melbourne Water

0 130 260

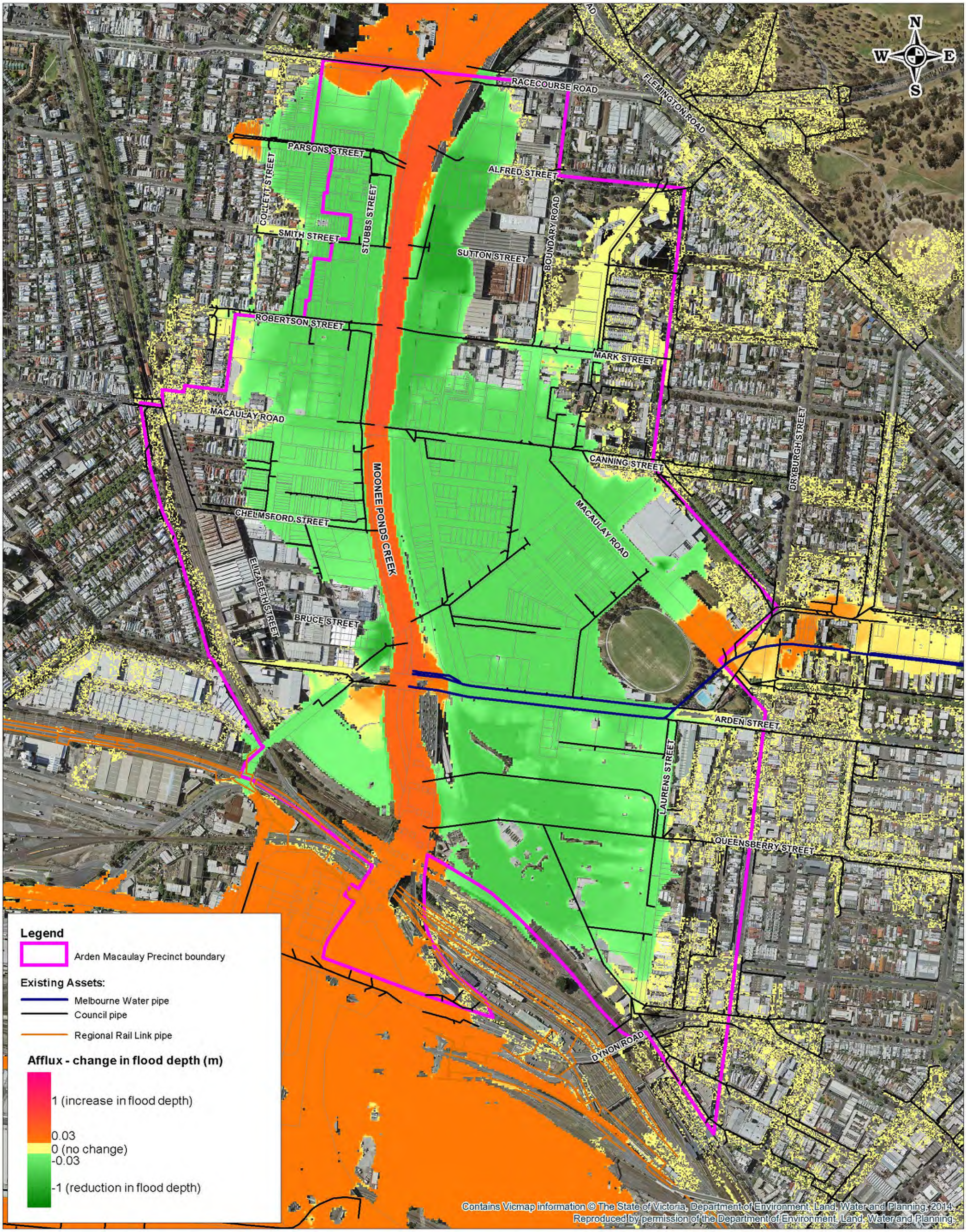
Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

Arden Macaulay Precinct

Figure H4
1% AEP Flood Map - Flood Mitigation Strategy B for Year 2100 Flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016



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ENGENY WATER MANAGEMENT

Melbourne Water

0 130 260

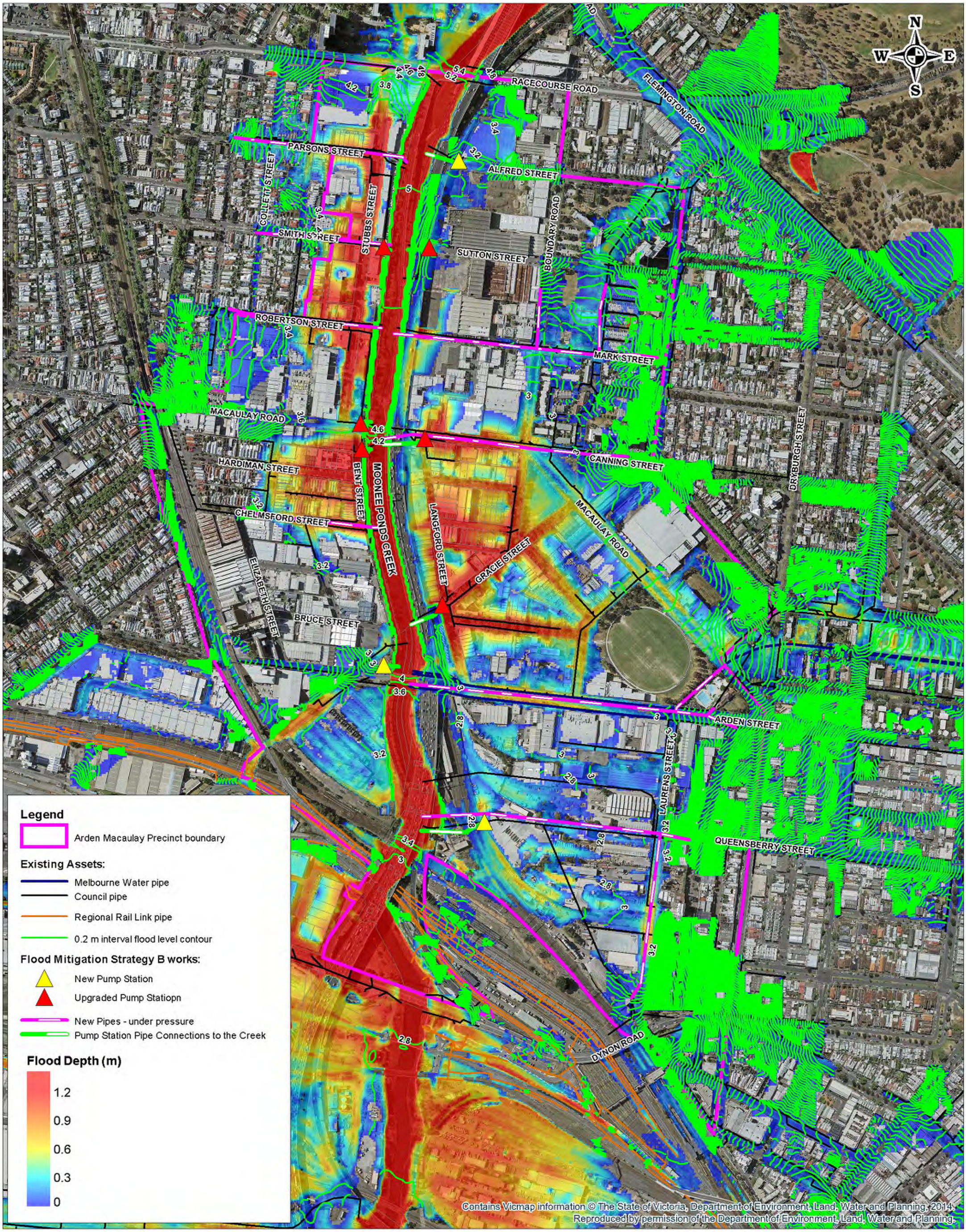
Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

Arden Macaulay Precinct

Figure H5
Change in flood depth due to flood mitigation strategy B for year 2100 flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016



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ENGENY WATER MANAGEMENT

Melbourne Water

0 130 260

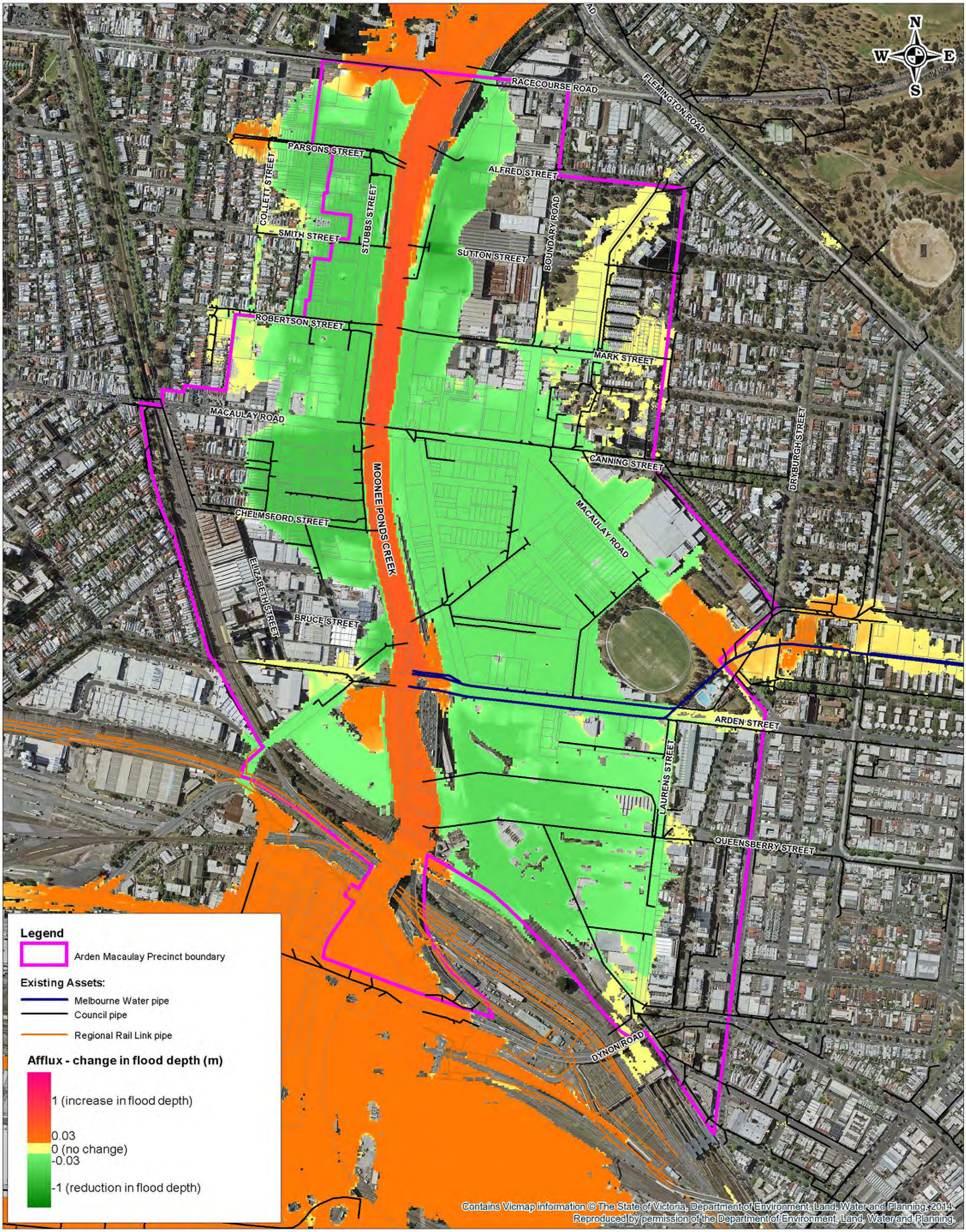
Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

Arden Macaulay Precinct

Figure H6
1% AEP Flood Map - Flood Mitigation Strategy B for Year 2100 With Planning Control Scenario Flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016



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ENGENY WATER MANAGEMENT

Melbourne Water

0 130 260

Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

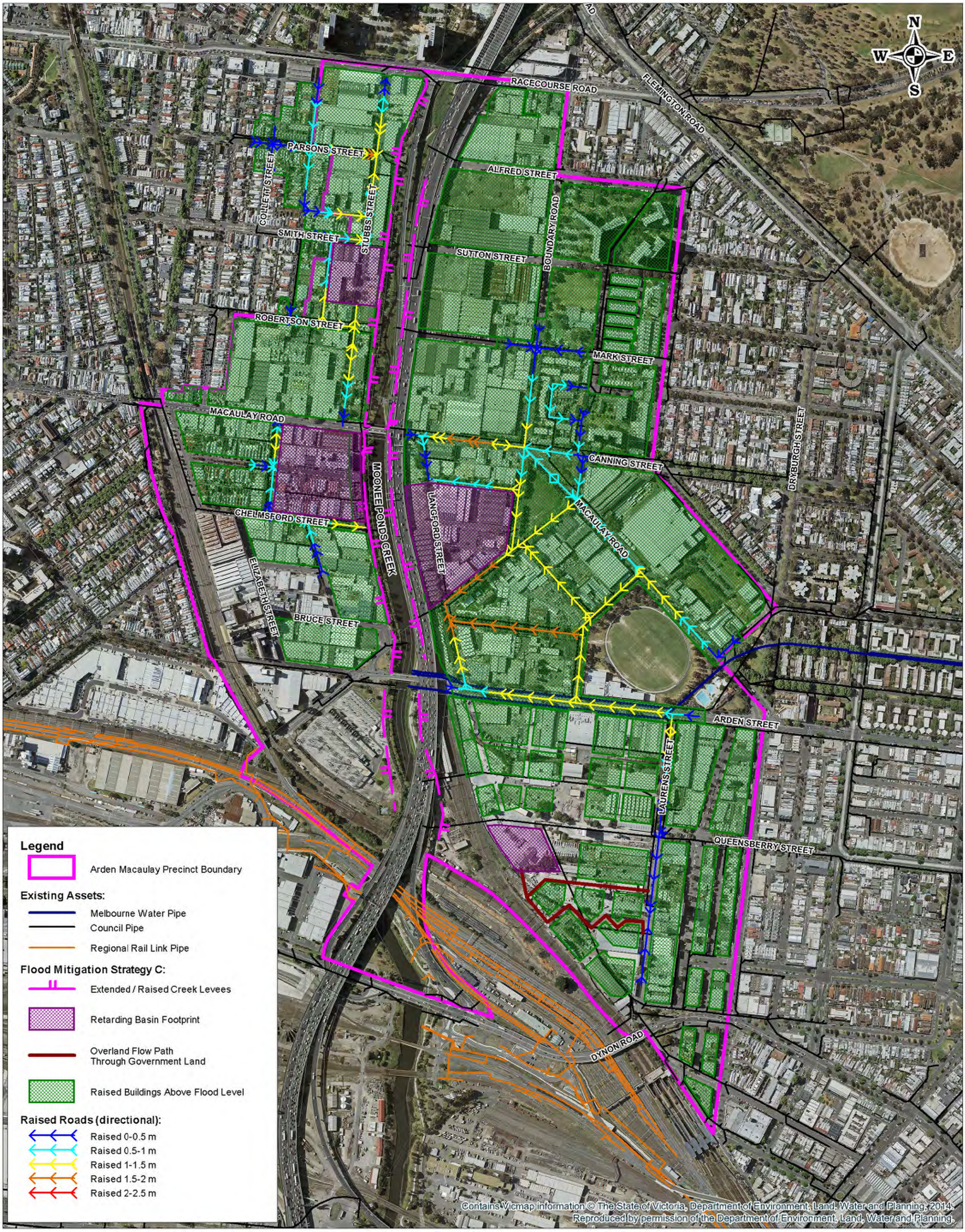
Arden Macaulay Precinct

Figure H7
Change in flood depth due to flood mitigation strategy B for year 2100 with planning controls flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016

APPENDIX I

Flood Mitigation Strategy C Concept Plan and Flood Maps



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ENGENY WATER MANAGEMENT

Melbourne Water

0 130 260

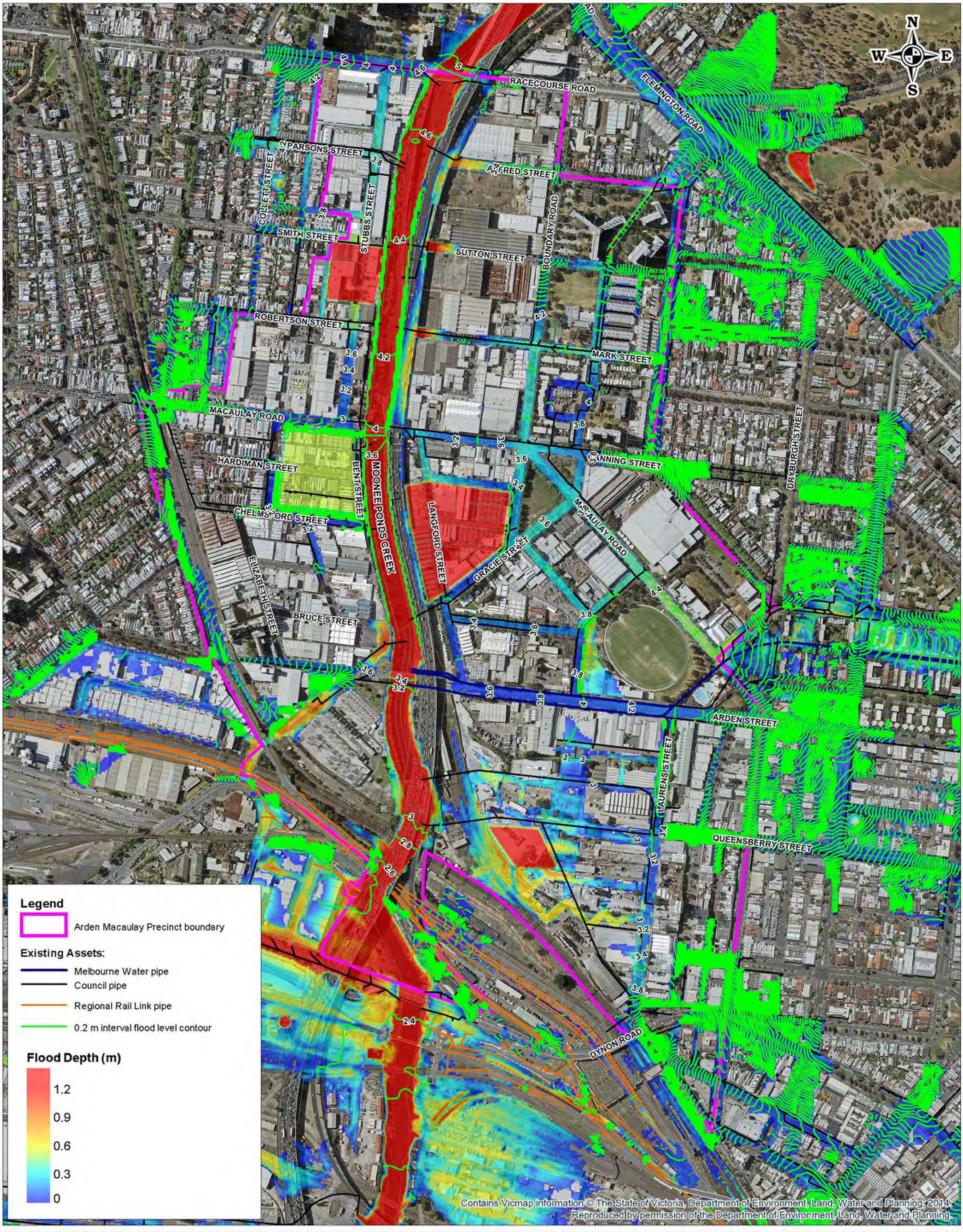
Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

Arden Macaulay Precinct

Figure I1
Flood Mitigation Strategy C

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016



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ENGENY WATER MANAGEMENT

Melbourne Water

0 130 260

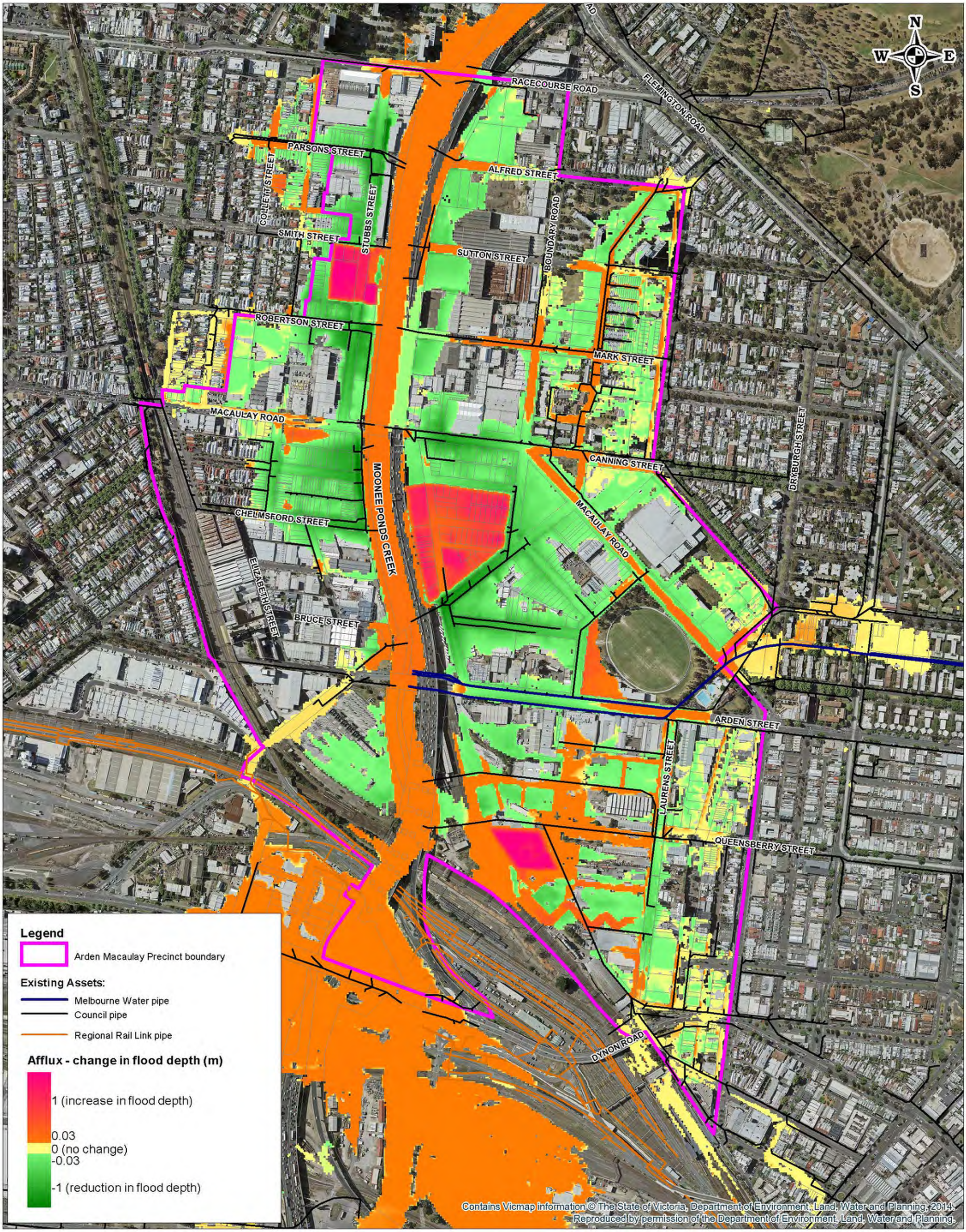
Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

Arden Macaulay Precinct

Figure I2
1% AEP Flood Map - Flood Mitigation Strategy C for Existing Flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016



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ENGENY WATER MANAGEMENT

Melbourne Water

0 130 260

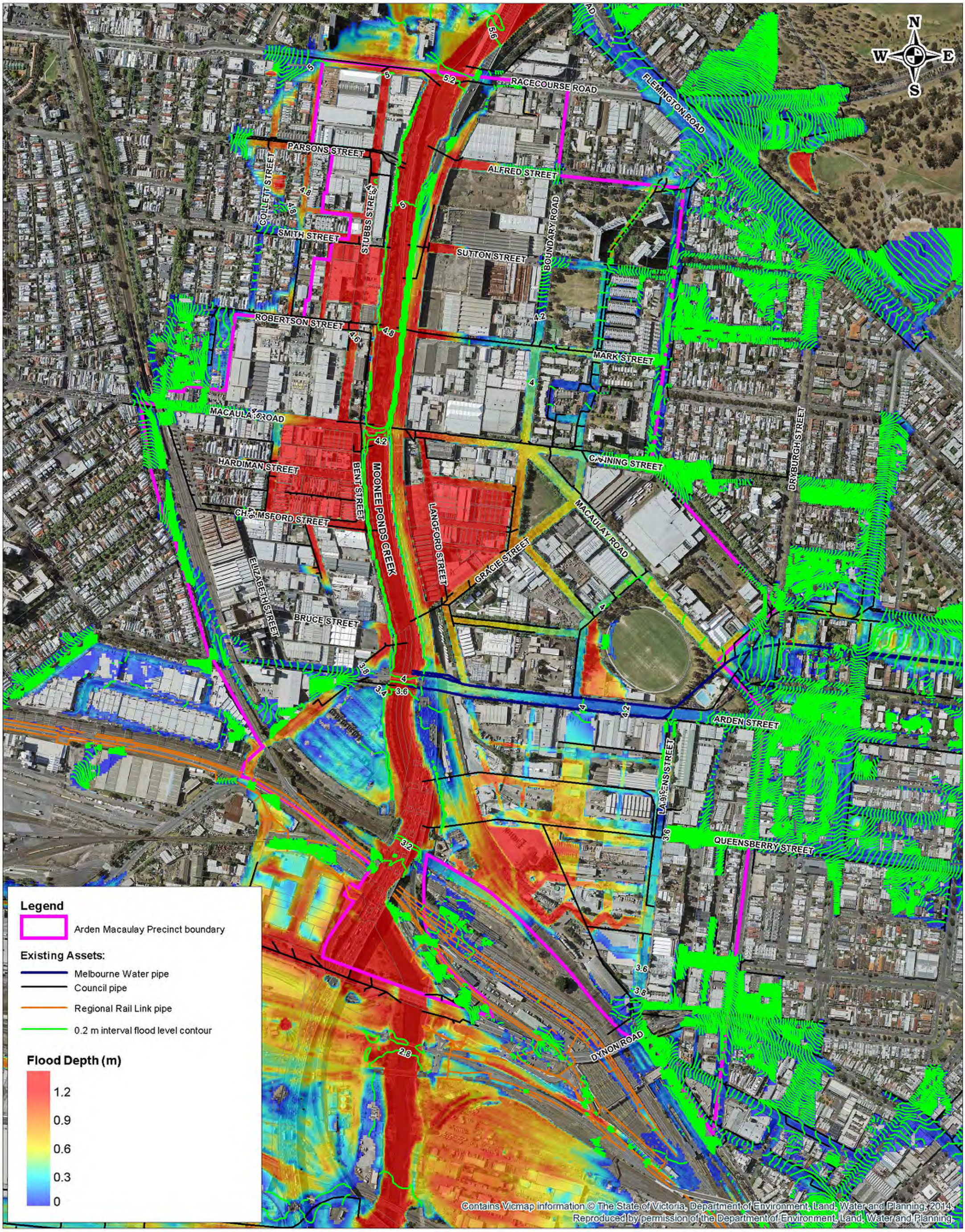
Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

Arden Macaulay Precinct

Figure I3
Change in flood depth due to flood mitigation strategy C for existing flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016



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ENGENY WATER MANAGEMENT

Melbourne Water

0 130 260

Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

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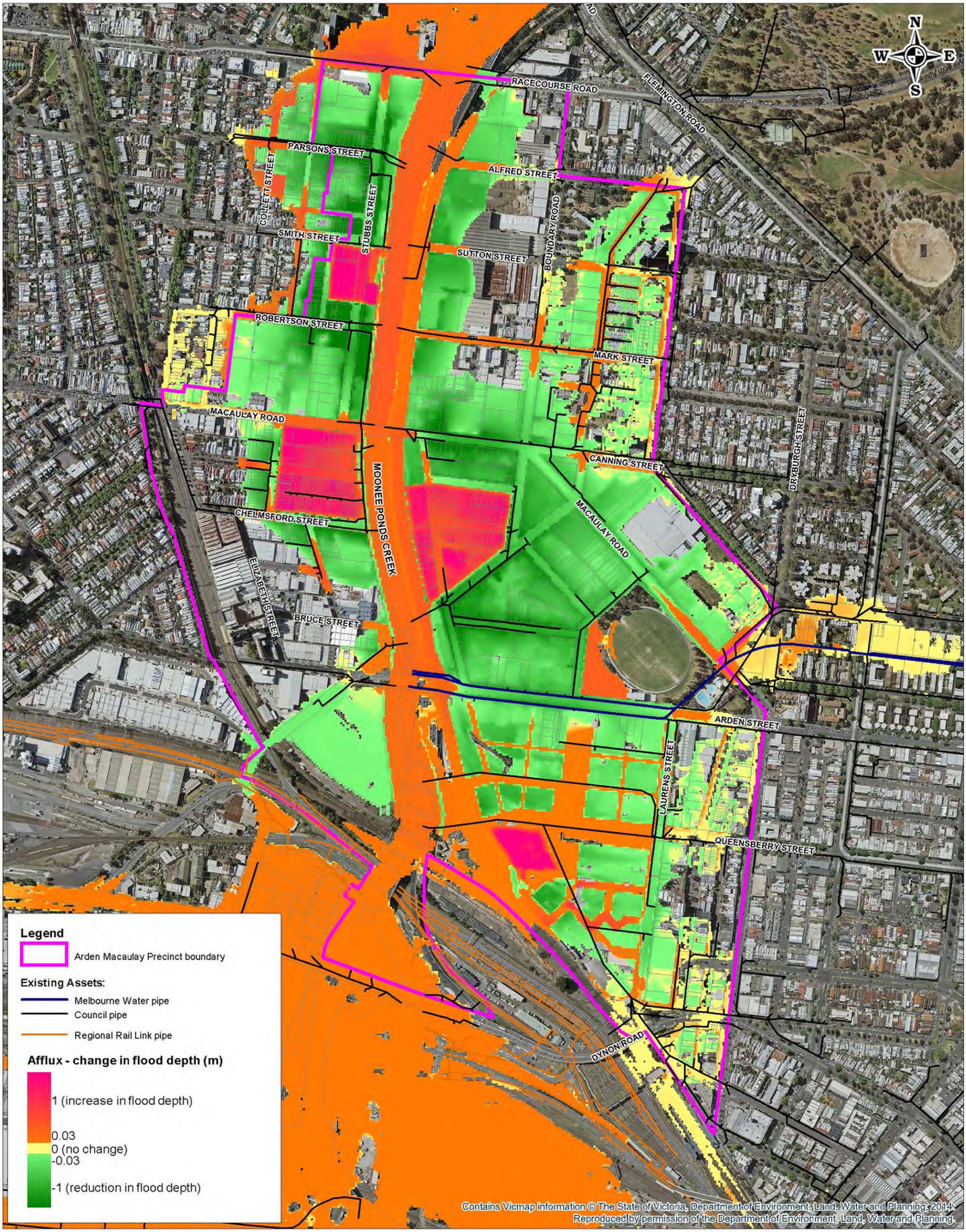
Figure I4
1% AEP Flood Map - Flood Mitigation Strategy C for Year 2100 Flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016



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ENGENY WATER MANAGEMENT

Melbourne Water

0 130 260

Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

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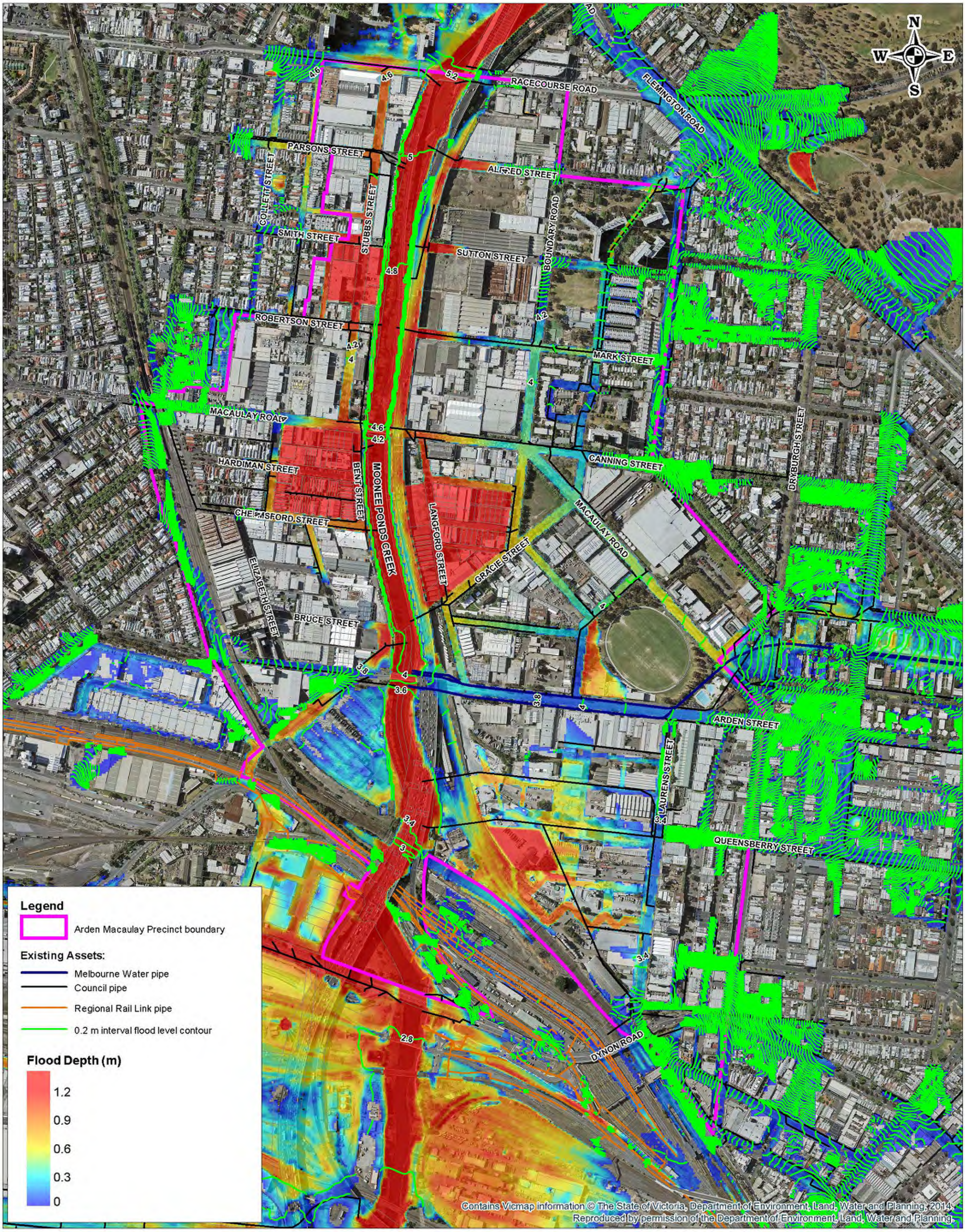
Figure I5
Change in flood depth due to flood mitigation strategy C for year 2100 flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016



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ENGENY WATER MANAGEMENT

Melbourne Water

0 130 260

Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

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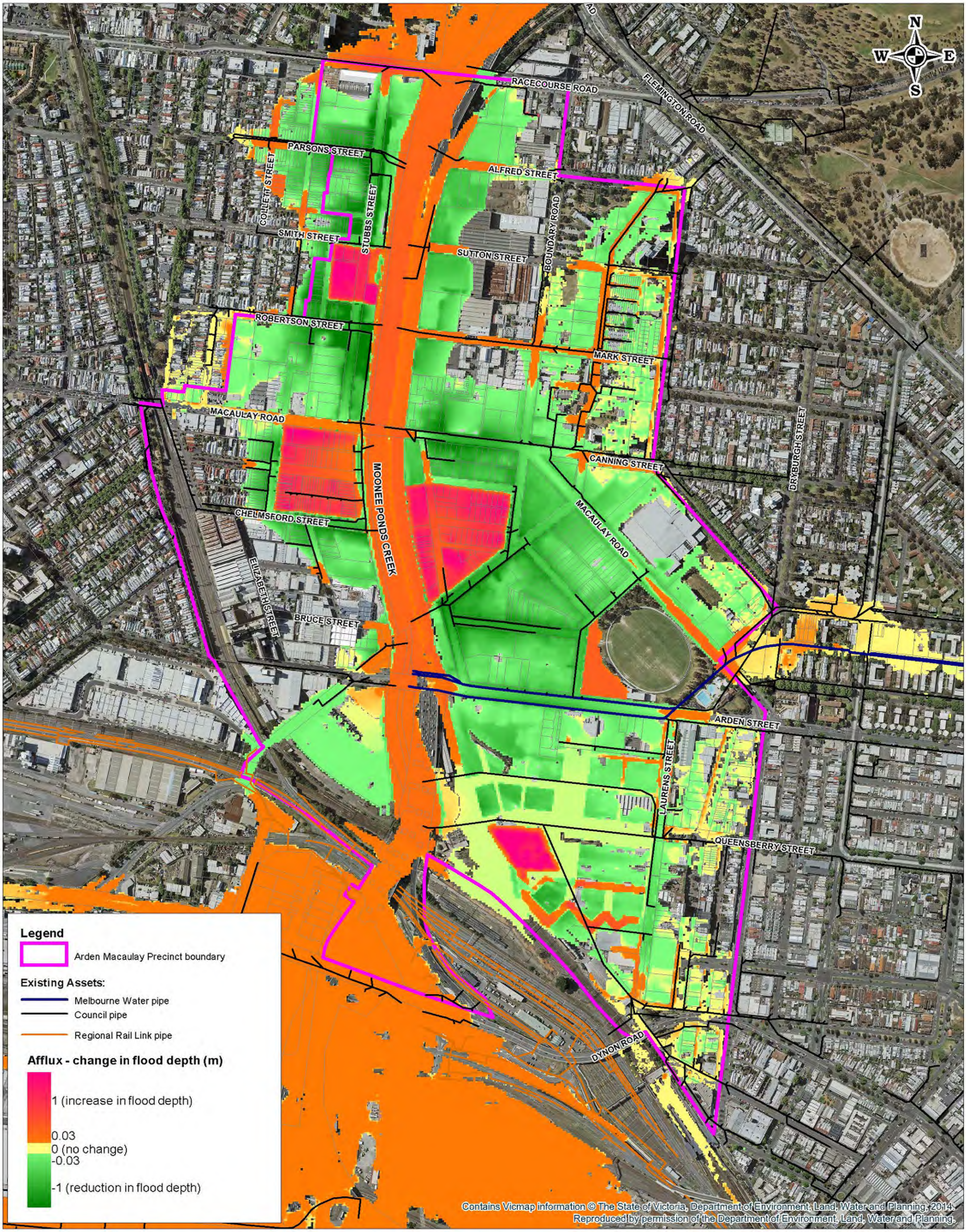
Figure I6
1% AEP Flood Map - Flood Mitigation Strategy C for Year 2100 with Planning Controls Scenario Flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016



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ENGENY WATER MANAGEMENT

Melbourne Water

0 130 260

Scale in metres (1:6,500 @ A3)

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994. (GDA94)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

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Figure I7
Change in flood depth due to flood mitigation strategy C for year 2100 with planning controls flows

Job Number: V3000_052
Revision: 0
Drawn: PC
Checked: AP
Date: 29 Feb 2016