Rhelm

engineering | environmental | economics | engagement

MAPS

Rhelm
engineering | environmental | economics | engagement

Scale : 1:20000@A3
Date : 19 November 2019
Revision : C
Created by : LRE
Coordinate System : MGA 55

0.25 0 0.25 0.5 0.75 km

- Existing FPA (2018)
- 0.4m SLR FPA (2050)
- 0.9m SLR FPA (2100)
- PMF (Special Flood Consideration Area) (2018)

N
W E
S

Map G601
FPL Comparison

Rhelm
engineering | environmental | economics | engagement

Scale : 1:20000@A3
Date : 19 November 2019
Revision : C
Created by : LRE
Coordinate System : MGA 55

0.25 0 0.25 0.5 0.75 km

0.9m SLR FPA (2100)
PMF (Special Flood Consideration Area) (2018)

N
W E
S

Map G602
FPL Recommendation
1% AEP with 0.9 SLR +0.5m

Rhelm

Scale : 1:25000@A3
Date : 28 August 2020
Revision : A
Created by : JS
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend

Cadastre

Flood Planning Constraint Categories

FPCC1
FPCC2
FPCC3
FPCC4

N
W E
S

G603

Flood Planning Constraint Categories (FPCC)

Rhelm

Scale : 1:15000@A3
Date : 12 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z56

0 250 500 m

Legend

- Cadastre
- Model Area
- Downstream Boundary
- Pipes / Culverts
- Pits
- SA Polygon for upstream flows
- Building roughness layer
- Road roughness layer
- Urban roughness layer
- Water roughness layer

N
W E
S

G701
Overland Flow Tuflow Model

CBD Flooding Inset

1% AEP Overland Flow Depth (m)
- 0 - 0.15
- 0.15 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- >4

Rhelm

Scale : 1:12500@A3 (1:4000 inset)
Date : 26 July 2019
Revision : A
Created by : LRE
Coordinate System : Map Grid of Australia 94

0 250 500 m

Legend
- Cadastre
- Overland Model Downstream Boundary
- 1% AEP Lake Flooding Extent

N
W E
S

G702
1% AEP Overland Flow Depth

CBD Flooding Inset

5% AEP Overland Flow Depth (m)
- 0 - 0.15
- 0.15 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- >4

Rhelm

Scale : 1:12500@A3 (1:4000 inset)
Date : 26 July 2019
Revision : A
Created by : LRE
Coordinate System : Map Grid of Australia 94

0 250 500 m

Legend
- Cadastre
- Overland Model Downstream Boundary
- 5% AEP Lake Flooding Extent

N
W E
S

G703
5% AEP Overland Flow Depth

Rhelm

Scale : 1:400@A3
Date : 15 June 2020
Revision : A
Created by : LRE
Coordinate System : Map Grid of Australia 94

50 0 50 100 150 m

Model Extent
Culverts
Boundaries
Downstream
Upstream

N
W E
S

G704
Culvert Assessment - Model Layout

Depth (m)
- 0 - 0.15
- 0.15 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- >4

Rhelm

Scale : 1:400@A3
Date : 15 June 2020
Revision : A
Created by : LRE
Coordinate System : Map Grid of Australia 94

50 0 50 100 150 m

Model Extent

N
W E
S

G705
Culvert Assessment - 20% AEP Depths

Depth (m)
- 0 - 0.15
- 0.15 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- >4

Rhelm

Scale : 1:400@A3
Date : 15 June 2020
Revision : A
Created by : LRE
Coordinate System : Map Grid of Australia 94

50 0 50 100 150 m

Model Extent

N
W E
S

G706
Culvert Assessment -5% AEP Depths

Depth (m)
- 0 - 0.15
- 0.15 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- >4

Rhelm

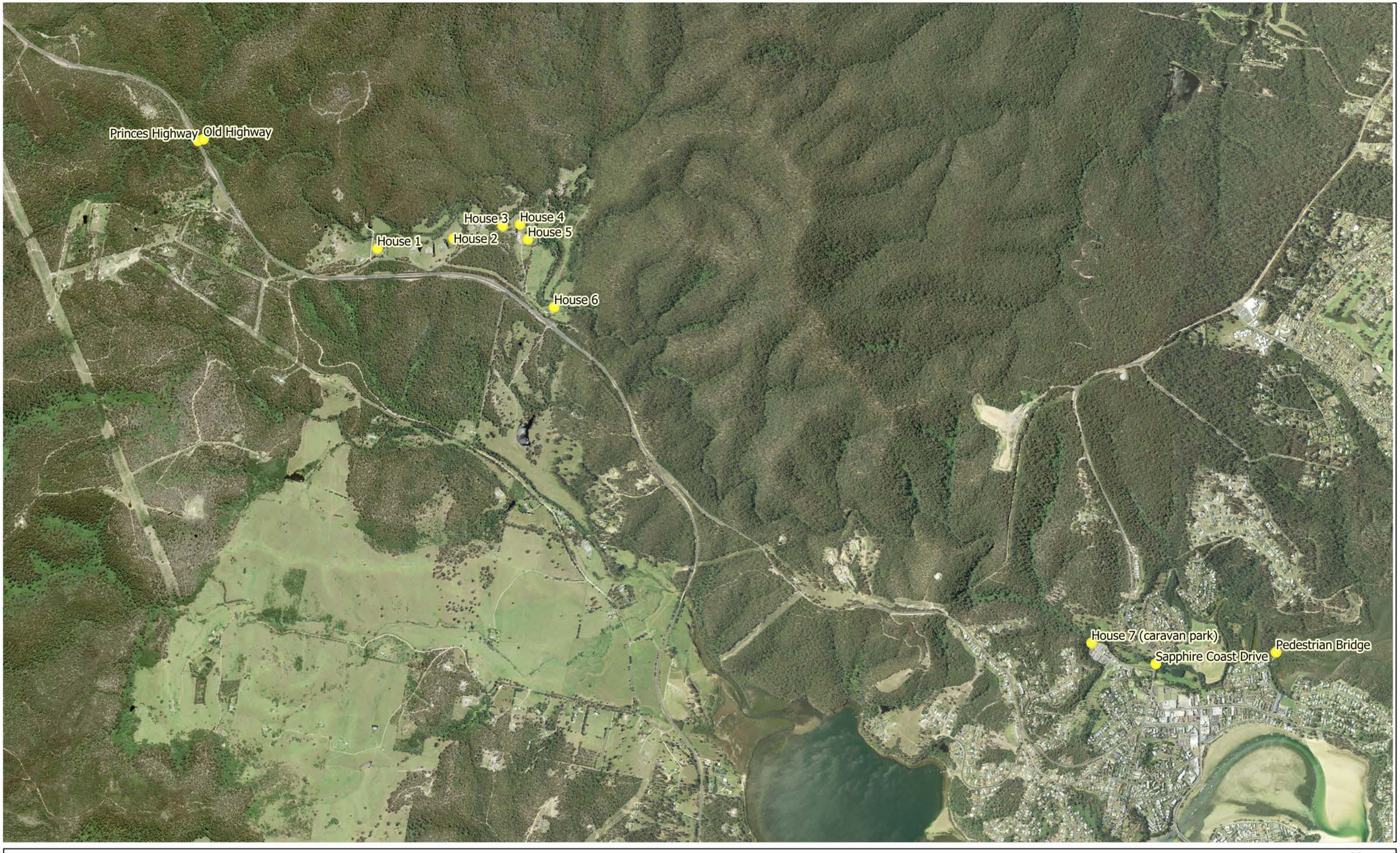
Scale : 1:400@A3
Date : 15 June 2020
Revision : A
Created by : LRE
Coordinate System : Map Grid of Australia 94

50 0 50 100 150 m

Model Extent

N
W E
S

G707
Culvert Assessment -1% AEP Depths



Rhelm

Scale : 1:25000@A3
Date : 13 September 2019
Revision : A
Created by : LRE
Coordinate System : Map Grid of Australia 94

0 250 500 750 1000 m

Legend

- Yellow Pinch Dam failure affected locations

N
W E
S

G708
Dam Break Affected Properties and

Hazard

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

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend

- Cadastre

N
W E
S

G801-1
PMF Hazard

Hazard

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

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend

- Cadastre

N
W E
S

G801-3
0.5% AEP Hazard

Hazard

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

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend

Cadastre

N
W E
S

G801-4
1% AEP Hazard

Hazard

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

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend

Cadastre

N
W E
S

G801-5
2% AEP Hazard

Hazard

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

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend

- Cadastre

N
W E
S

G801-6
5% AEP Hazard

Hazard

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

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend

- Cadastre

N
W E
S

G801-7
10% AEP Hazard

Hazard

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

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend

Cadastre

N
W E
S

G801-8
5% AEP Hazard

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend

Cadastre

Flood Function

Floodway

Storage

Fringe

N
W E
S

G802-1
PMF Flood Function

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend

Cadastre

Flood Function

Floodway

Storage

Fringe

N
W E
S

G802-3
0.5% AEP Flood Function

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend

Cadastre

Flood Function

Floodway

Storage

Fringe

N
W E
S

G802-4
1% AEP Flood Function

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend

Cadastre

Flood Function

Floodway

Storage

Fringe

N
W E
S

G802-5
20% AEP Flood Function

Flood Emergency Response Classifictions
- Not Flooded, Indirect Consequence
- Flooded Rising Road
- Flooded Overland Escape
- Flooded, Isolated, Elevated
- Flooded, Isolated, Submerged
- Lake Flooding

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend
- Cadastre

N
W E
S

G803-1
PMF Flood Emergency Response Classifications

Flood Emergency Response Classifictions
- Not Flooded, Indirect Consequence
- Flooded Rising Road
- Flooded Overland Escape
- Flooded, Isolated, Elevated
- Flooded, Isolated, Submerged
- Lake Flooding

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend
- Cadastre

N
W E
S

G803-2
1% AEP Flood Emergency Response Classifications

Flood Emergency Response Classifictions
- Not Flooded, Indirect Consequence
- Flooded Rising Road
- Flooded Overland Escape
- Flooded, Isolated, Elevated
- Flooded, Isolated, Submerged
- Lake Flooding

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend
- Cadastre

N
W E
S

G803-3
20% AEP Flood Emergency Response Classifications

[ID]	Road Name	20yr	100yr	PMF
1	Millingandi Rd	0	0	1.3
2	Millingandi Rd	0.91	1.06	1.4
3	Princes Hwy*	0	0	0.32
4	Berrambool Dr	0	0	0.26
5	Berrambool Dr	0	0	0.39
6	Sapphire Coast Dr	0	0	0.35
7	Market St	0	0.03	0.41
8	Beach St	0	0	0.41
9	Beach St	0	0.09	0.34
10	Beach St	0	0	0.57
11	Beach St	0	0	0.25
12	Arthur Kaine Dr	0	0	0.15
13	Elizabeth St	0	0.26	0.45
14	Marine Pde	0	0	0.32
15	Chapman Ave	0	0	0.48
16	Burton Ave	0.29	0.57	0.76
17	Calendo Ct	0.21	0.53	0.68
18	Fishpen Rd	0.22	0.49	0.68
19	Princes Highway	0	0	0
20	Arthur Kaine Dr	0	0	0.16
21	Arthur Kaine Dr	0	0.3	0.71

* The [3] Princes Highway has not been sampled above the bridge, due to an inaccurate reading as a result of Boggy Creek flooding. It has been sampled approximately 150m south of the bridge, adjacent to the northbound road shoulder.

Note that a depth of 0 in any event indicates that the road is not flooded.

Scale : 1:25000@A3
Date : 20 November 2019
Revision : A
Created by : AXS
Coordinate System : MGA94 Z55

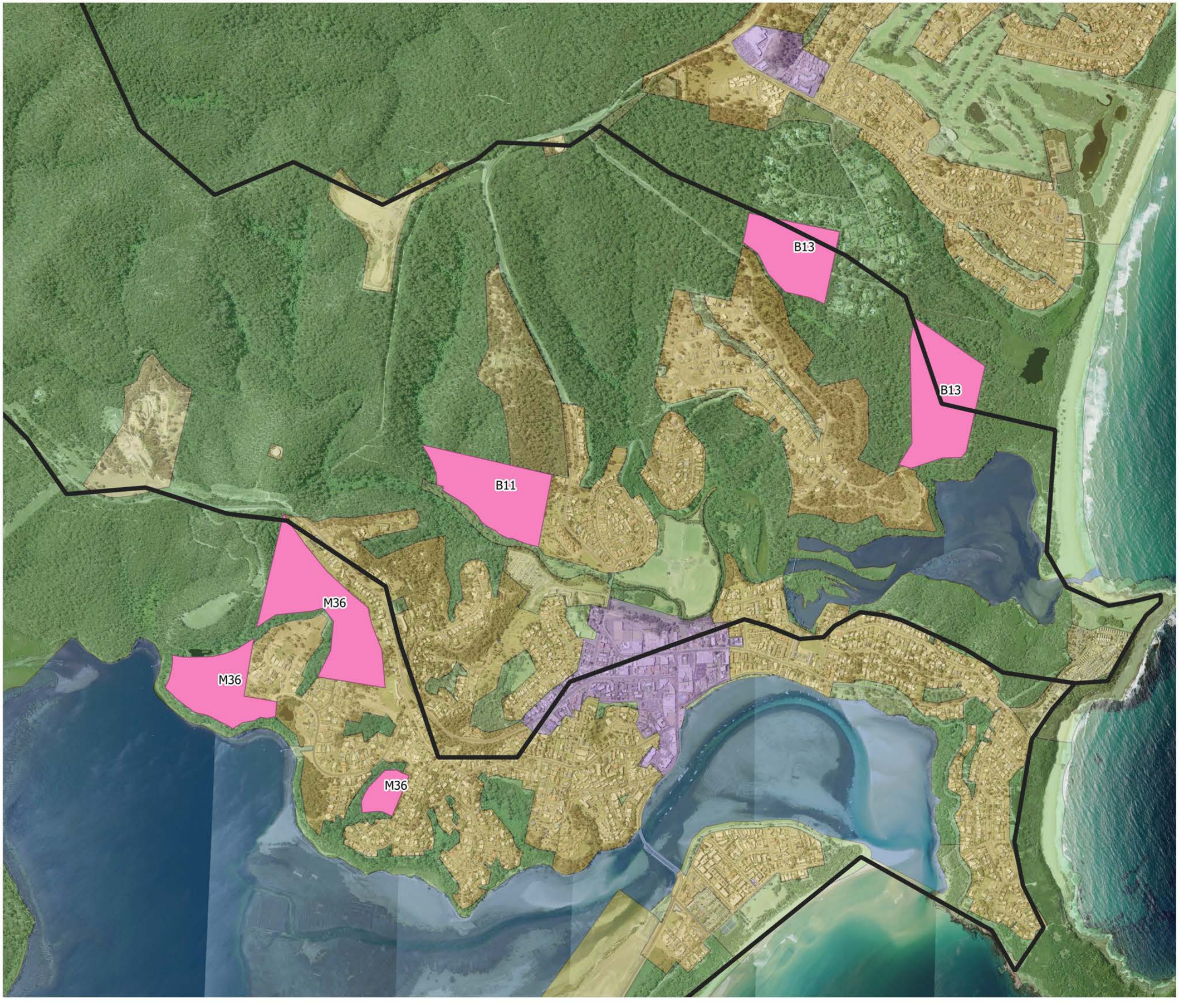
0 250 500 750 1000 m

Legend
- Key Infrastructure
- Overtopped Roads (with ID)
- PMF Extent

N W E S

G804

Flood Impact on Transport and Infrastructure



N

W E

S

Figure G805

Future Development Areas

Catchment Boundary

Possible development areas (noting RAFTS catchment)

Current Zoning

- Business
- Environmental
- Residential
- Recreation
- Primary Production
- Rural Landscape
- Forestry
- Primary Producton small lots
- Village
- Water

Scale : 1:4000@A3
Date : 28 May 2017
Revision :
Created by : RST
Coordinate System : MGA 56

Rhelm

Difference (m)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0+

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend
Cadastre
Newly flooded areas under climate change scenario

N
W E
S

G806-1
1% AEP 0.4m SLR Impacts

Difference (m)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0+

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend
Cadastre
Newly flooded areas under climate change scenario

N
W E
S

G806-2
0.5% AEP 0.4m SLR Impacts

Difference (m)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0+

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend
Cadastre
Newly flooded areas under climate change scenario

N
W E
S

G806-3
0.2% AEP 0.4m SLR Impacts

Difference (m)
- 0.1
- 0.2
- 0.3
- 0.4
- 0.5
- 0.6
- 0.7
- 0.8
- 0.9
- 1.0+

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend

- Cadastre
- Newly flooded areas under climate change scenario

N
W E
S

G806-4
PMF 0.4m SLR Impacts

Difference (m)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0+

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend
Cadastre
Newly flooded areas under cliamte change scenario

N
W E
S

G806-5
1% AEP 0.9m SLR Impacts

Difference (m)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0+

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend
Cadastre
Newly flooded areas under cliamte change scenario

N
W E
S

G806-6
0.5% AEP 0.9m SLR Impacts

Difference (m)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0+

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend
Cadastre
Newly flooded areas under cliamte change scenario

N
W E
S

G806-7
0.2% AEP 0.9m SLR Impacts

Difference (m)
- 0.1
- 0.2
- 0.3
- 0.4
- 0.5
- 0.6
- 0.7
- 0.8
- 0.9
- 1.0+

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend
- Cadastre
- Newly flooded areas under cliamte change scenario

N
W E
S

G806-8
PMF 0.9m SLR Impacts

Difference (m)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0+

Rhelm

Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend
Cadastre
Newly flooded areas under cliamte change scenario

N
W E
S

G806-9
1% AEP 0.4m SLR 10% Rainfall

Difference (m)
- 0.1
- 0.2
- 0.3
- 0.4
- 0.5
- 0.6
- 0.7
- 0.8
- 0.9
- 1.0+

Rhelm

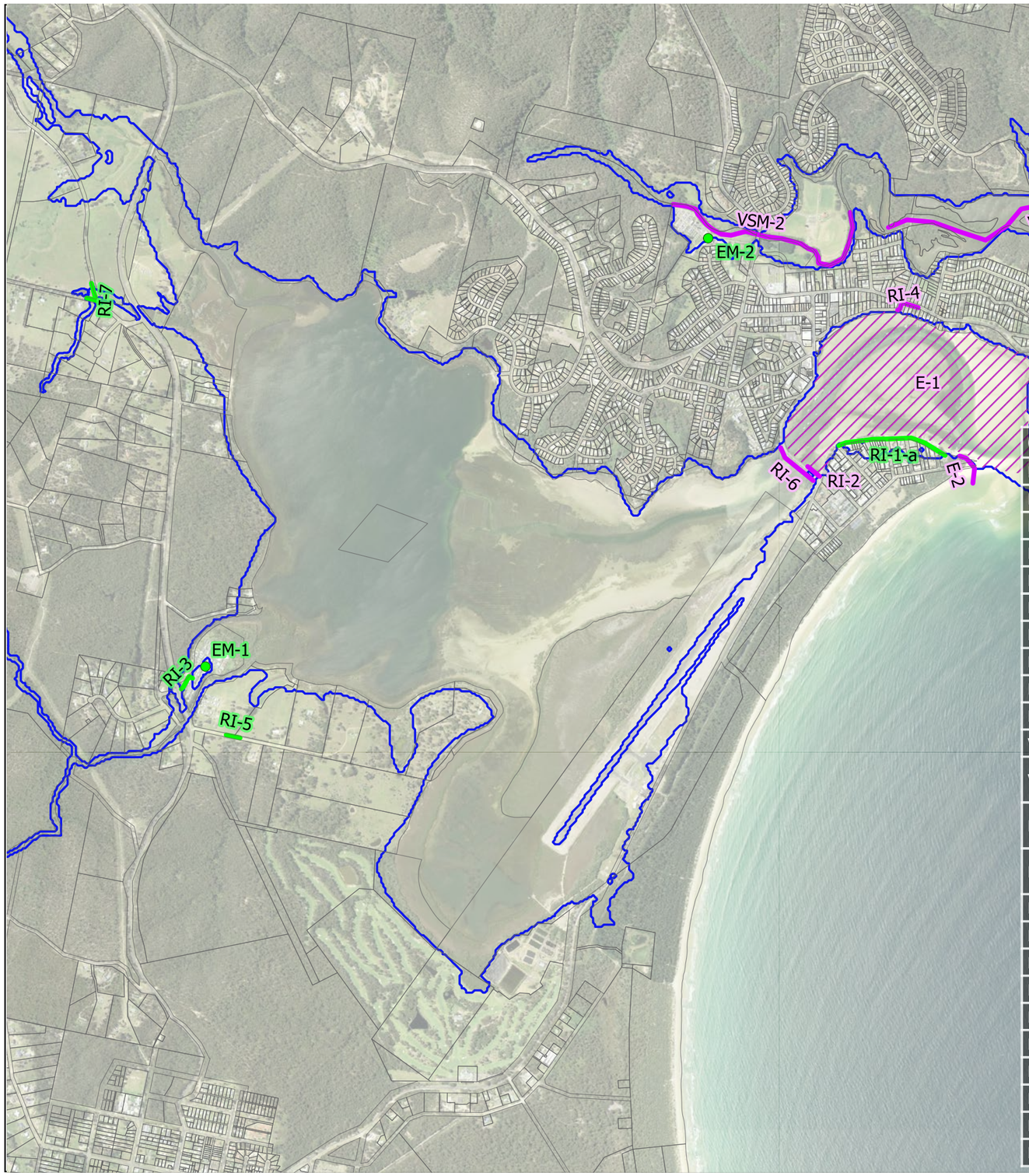
Scale : 1:25000@A3
Date : 16 September 2019
Revision : A
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend
- Cadastre
- Newly flooded areas under cliamte change scenario

N
W E
S

G806-10
1% AEP 0.9m SLR 30% Rainfall



Option ID	Name	Recommendation
RI-1-a	Raising of Fishpen Road by 0.4m (5% AEP immunity)	Recommended
RI-1-b	Raising of Fishpen Road by 0.5m (2% AEP immunity)	Not Recommended
RI-1-c	Raising of Fishpen Road by 0.6m (1% AEP immunity)	Not Recommended
RI-1-d	Raising of Fishpen Road by 0.2m (10% AEP immunity)	Not Recommended
RI-2	Provision of second bridge (or opening) on Market Street causeway.	Not Recommended
RI-3	Raising of access road to Acacia Ponds Village	Recommended
RI-4	Raising of footpath at Main St - Beach St intersection (raised 0.2m to achieve 1% AEP level)	Not Recommended
RI-5	Green Point Road Raising and Culvert Augmentation	Recommended
RI-6	Replace the causeway with an open span bridge	Not Recommended
RI-7	Millingandi Road Raising and Culvert Augmentation	Recommended
VSM-1	Removal of sediment from within Merimbula Creek	Not Recommended
VSM-2	Vegetation management along Merimbula Creek (between Sapphire Valley Caravan Park and Munn Street)	Not Recommended
E-1	Wide scale dredging across Merimbula Lake entrance - reduce bed levels by 0.5m across whole area downstream of Market Street Bridge.	Not Recommended
E-2	Permanently open the entrance of Merimbula Lake (e.g. training wall along western side of channel)	Not Recommended
E-3	Review of Back Lack Entrance Management Policy	Recommended
EM-1	Emergency response for Acacia Ponds	Recommended
EM-2	Emergency Response Plan for Sapphire Coast Caravan Park	Recommended
EM-3	Flood Warning System (No location associated with option)	Recommended
EM-4	Flood Education (No location associated with option)	Recommended
EM-6	Information Transfer (No location associated with option)	Recommended
PM-1	Land use planning and building control updates (No location associated with option)	Recommended
PM-2	Flood proofing guidelines (No location associated with option)	Recommended
PM-3	Voluntary House Purchase (No location associated with option)	Not Recommended
PM-4	Voluntary House Raising (No location associated with option)	Not Recommended

Rhelm

Scale : 1:25000@A3
Date : 01 October 2020
Revision : C
Created by : LRE
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

1% AEP Extent

Flood Risk Management Options

Recommended

Recommended

Not Recommended

Not Recommended

N
W E
S

G901

Flood Risk Management Options

[ID]	Road Name	20yr	100yr	PMF
1	Millingandi Rd	0	0	1.3
2	Millingandi Rd	0.91	1.06	1.4
3	Princes Hwy*	0	0	0.32
4	Berrambool Dr	0	0	0.26
5	Berrambool Dr	0	0	0.39
6	Sapphire Coast Dr	0	0	0.35
7	Market St	0	0.03	0.41
8	Beach St	0	0	0.41
9	Beach St	0	0.09	0.34
10	Beach St	0	0	0.57
11	Beach St	0	0	0.25
12	Arthur Kaine Dr	0	0	0.15
13	Elizabeth St	0	0.26	0.45
14	Marine Pde	0	0	0.32
15	Chapman Ave	0	0	0.48
16	Burton Ave	0.29	0.57	0.76
17	Calendo Ct	0.21	0.53	0.68
18	Fishpen Rd	0.22	0.49	0.68
19	Princes Highway	0	0	0
20	Arthur Kaine Dr	0	0	0.16

* The [3] Princes Highway has not been sampled above the bridge, due to an inaccurate reading as a result of Boggy Creek flooding. It has been sampled approximately 150m south of the bridge, adjacent to the northbound road shoulder.

Note that a depth of 0 in any event indicates that the road is not flooded.

Inset 1

Inset 2

Inset 3

Inset 4

Merimbula-Tura Kindergarten
Sapphire Valley Caravan Park
Berrambool Sports Field
Main Street Medical Centre
Merimbula Police Station
Merimbula Public School
Merimbula Medical Centre
Marine Rescue
Merimbula Fire Station
Acacia Ponds (retirement village)
Merimbula Lake Holiday Park
Merimbula Airport
Stormwater Treatment Plant

Scale : 1:10000@A3
Date : 02 September 2020
Revision : A
Created by : JS
Coordinate System : MGA94 Z55

0 250 500 750 1000 m

Legend
Cadastre
Key Infrastructure
Overtopped Roads (with ID)
PMF Extent
1% AEP Extent
20% AEP Extent

N W E S

G902

Flood Impact on Transport and Infrastructure

Rhelm

Scale : 1:25000@A3
Date : 02 September 2020
Revision : A
Created by : JS
Coordinate System : MGA94 Z55

0 250 500 750 1,000 m

Legend

- Cadastre
- 1% AEP
- 1% AEP - 0.4m Sea Level Rise
- 1% AEP - 0.4m Sea Level Rise + 10% Increase in Rainfall
- 1% AEP - 0.9m Sea Level Rise
- 1% AEP - 0.9m Sea Level Rise + 30% Increase in Rainfall

N
W E
S

G903
Climate Change Impacts