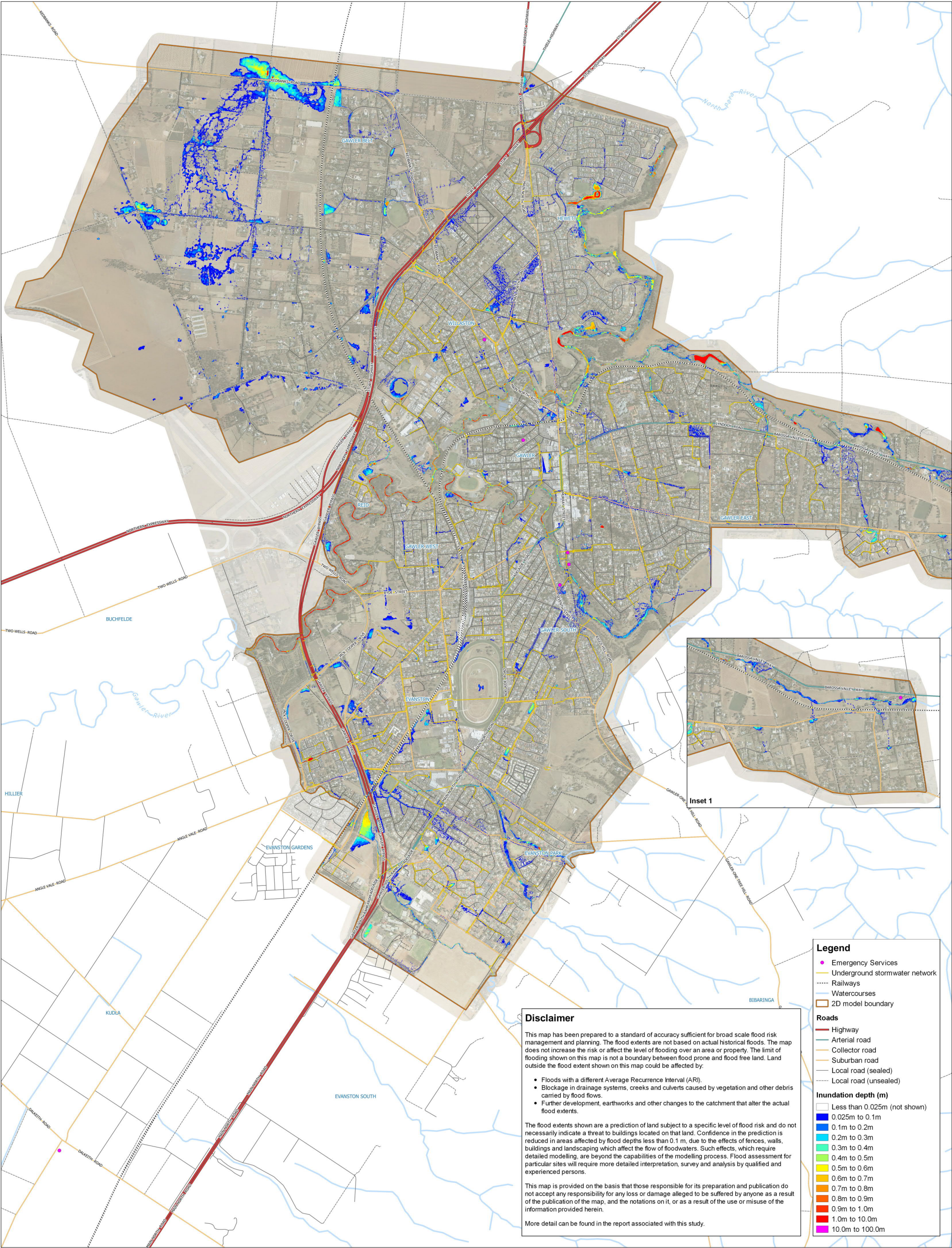




Appendix F Flood inundation and hazard maps



Disclaimer

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- Further development, earthworks and other changes to the catchment that alter the actual flood extents.

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More detail can be found in the report associated with this study.

Legend

- Emergency Services
- Underground stormwater network
- Railways
- Watercourses
- 2D model boundary

Roads

- Highway
- Arterial road
- Collector road
- Suburban road
- Local road (sealed)
- Local road (unsealed)

Inundation depth (m)

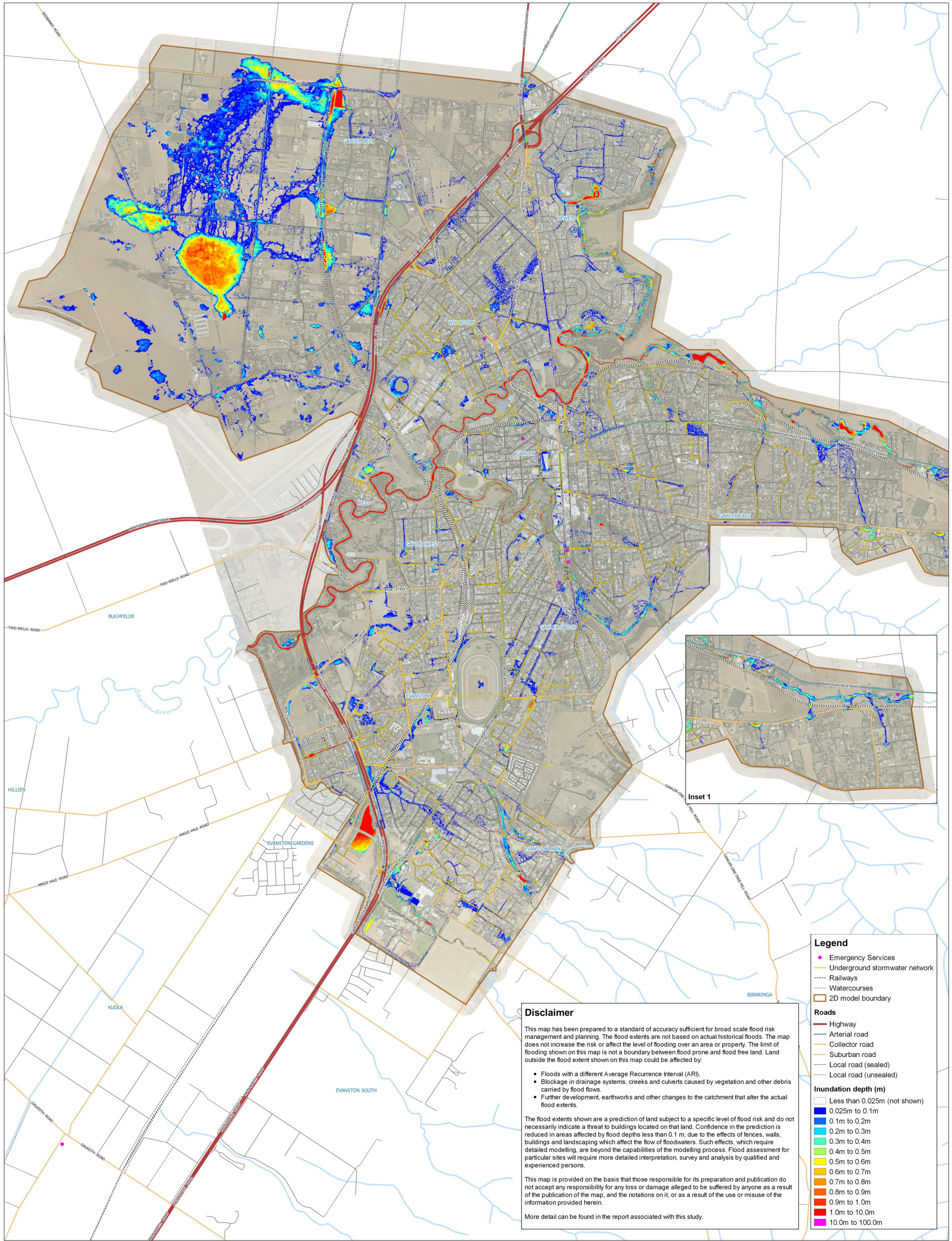
- Less than 0.025m (not shown)
- 0.025m to 0.1m
- 0.1m to 0.2m
- 0.2m to 0.3m
- 0.3m to 0.4m
- 0.4m to 0.5m
- 0.5m to 0.6m
- 0.6m to 0.7m
- 0.7m to 0.8m
- 0.8m to 0.9m
- 0.9m to 1.0m
- 1.0m to 10.0m
- 10.0m to 100.0m

Town of Gawler, Light Regional Council, and Barossa Council

GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

20% AEP flood depth existing development scenario





Disclaimer

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Legend

- Emergency Services
- Underground stormwater network
- Railways
- Watercourses
- 2D model boundary

Roads

- Highway
- Arterial road
- Collector road
- Suburban road
- Local road (sealed)
- Local road (unsealed)

Inundation depth (m)

- Less than 0.025m (not shown)
- 0.025m to 0.1m
- 0.1m to 0.2m
- 0.2m to 0.3m
- 0.3m to 0.4m
- 0.4m to 0.5m
- 0.5m to 0.6m
- 0.6m to 0.7m
- 0.7m to 0.8m
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- 1.0m to 10.0m
- 10.0m to 100.0m

Town of Gawler, Light Regional Council, and Barossa Council

0 500 1000 1500 2000 m

1:15,000
at A1

tonkin

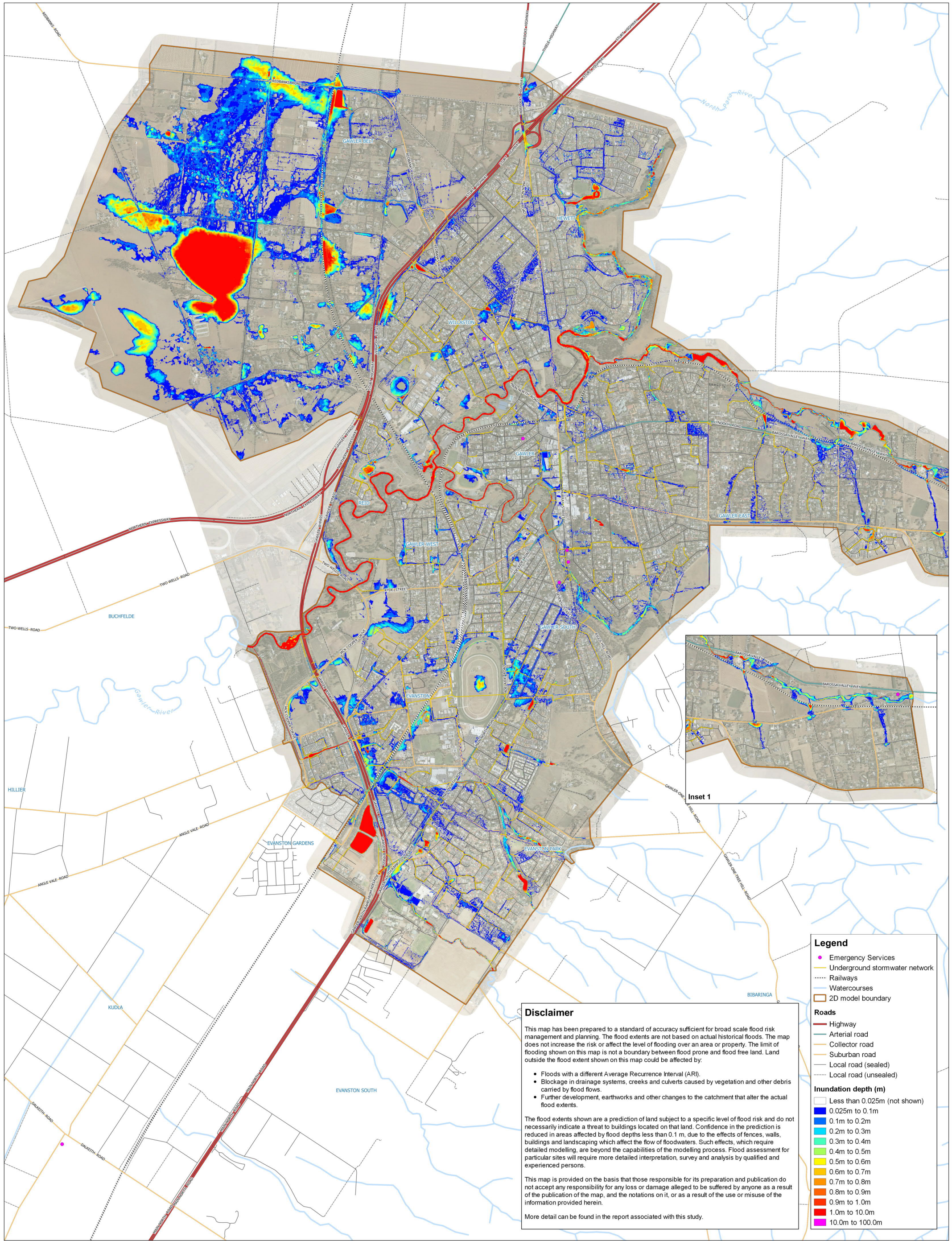
Job Number: 2014.1387
Filename: 20141387M001.qgs
Revision: E
Date: 2019-03-22
Drawn: JDN

Data Acknowledgement:
Aerial imagery provided by and used with permission of Council

GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

5% AEP flood depth existing development scenario





Disclaimer

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- Emergency Services
- Underground stormwater network
- Railways
- Watercourses
- 2D model boundary

Roads

- Highway
- Arterial road
- Collector road
- Suburban road
- Local road (sealed)
- Local road (unsealed)

Inundation depth (m)

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- 0.2m to 0.3m
- 0.3m to 0.4m
- 0.4m to 0.5m
- 0.5m to 0.6m
- 0.6m to 0.7m
- 0.7m to 0.8m
- 0.8m to 0.9m
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- 1.0m to 10.0m
- 10.0m to 100.0m

Town of Gawler, Light Regional Council, and Barossa Council



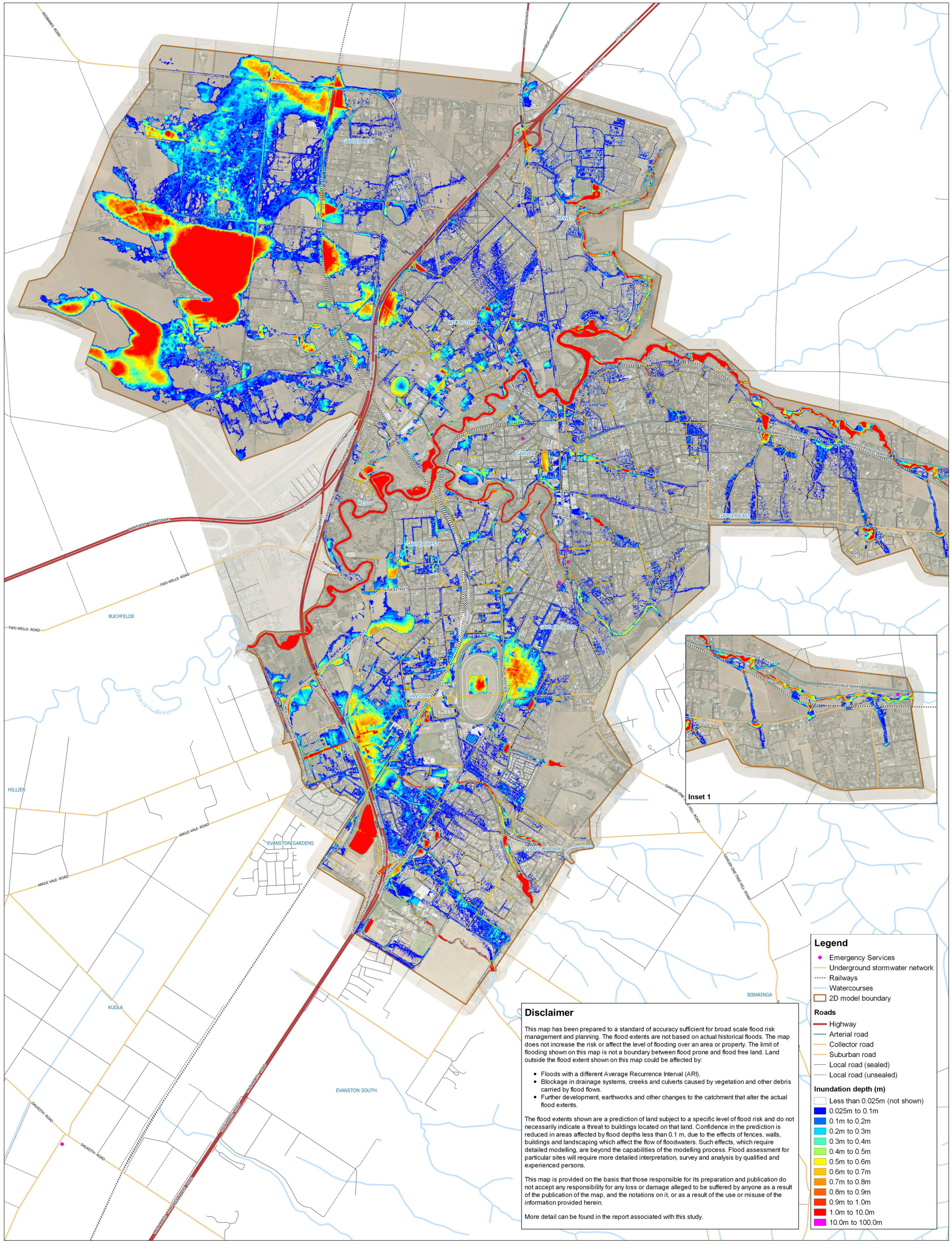
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Filename: 20141387M001.qgs
Revision: E
Date: 2019-03-22
Drawn: JDN

Data Acknowledgement:
Aerial imagery provided by and used with permission of Council

GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

1% AEP flood depth existing development scenario





Disclaimer

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- Underground stormwater network
- Railways
- Watercourses
- 2D model boundary

Roads

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- Arterial road
- Collector road
- Suburban road
- Local road (sealed)
- Local road (unsealed)

Inundation depth (m)

- Less than 0.025m (not shown)
- 0.025m to 0.1m
- 0.1m to 0.2m
- 0.2m to 0.3m
- 0.3m to 0.4m
- 0.4m to 0.5m
- 0.5m to 0.6m
- 0.6m to 0.7m
- 0.7m to 0.8m
- 0.8m to 0.9m
- 0.9m to 1.0m
- 1.0m to 10.0m
- 10.0m to 100.0m

Town of Gawler, Light Regional Council, and Barossa Council

0 500 1000 1500 2000 m

1:15,000
at A1

tonkin

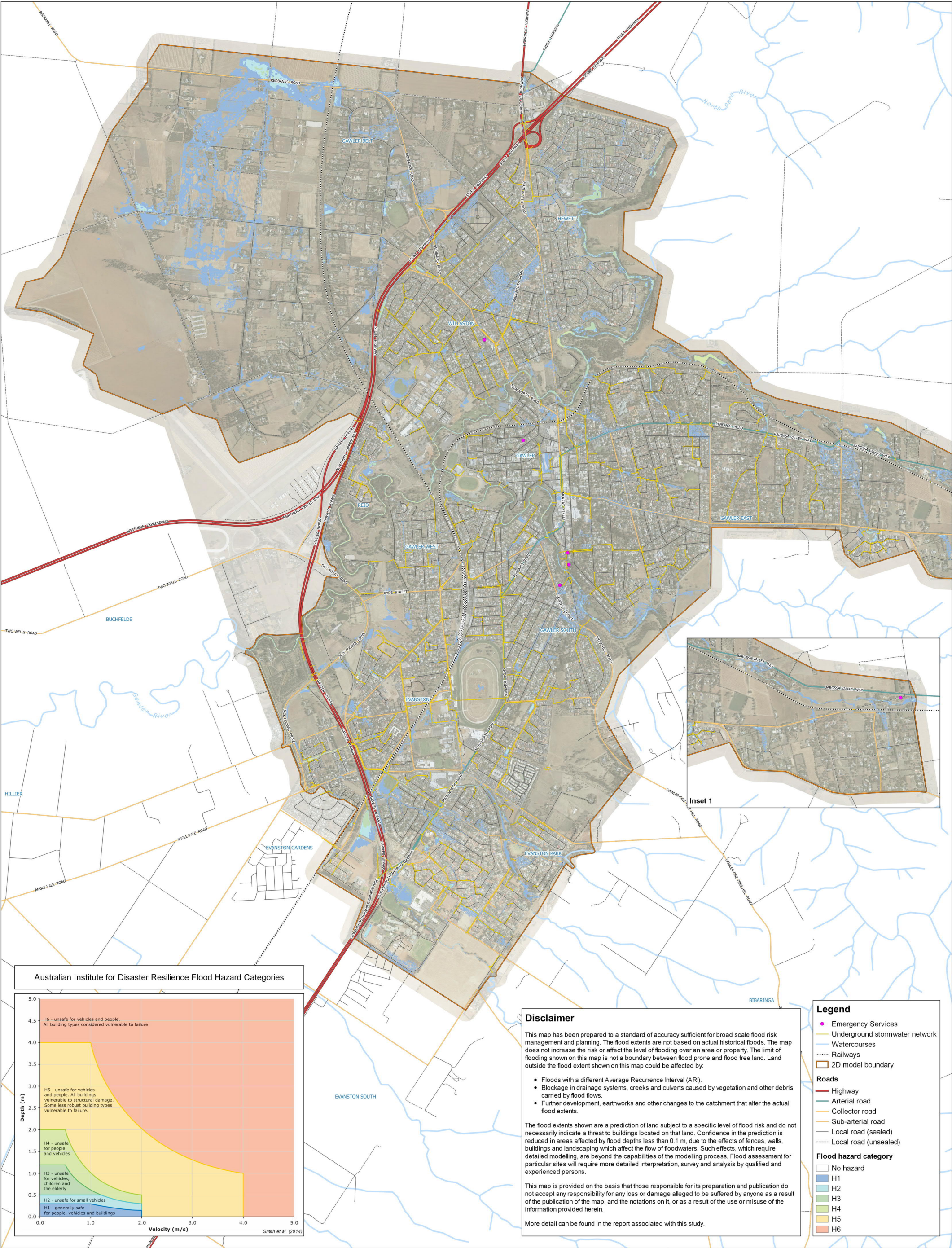
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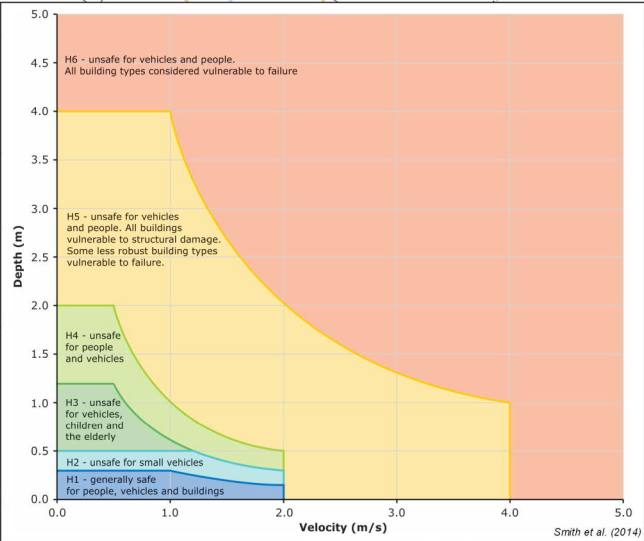
GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

0.2% AEP flood depth existing development scenario





Australian Institute for Disaster Resilience Flood Hazard Categories



Disclaimer

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Legend

- Emergency Services
 - Underground stormwater network
 - Watercourses
 - Railways
 - 2D model boundary
- Roads**
- Highway
 - Arterial road
 - Collector road
 - Sub-arterial road
 - Local road (sealed)
 - Local road (unsealed)
- Flood hazard category**
- No hazard
 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

Town of Gawler, Light Regional Council, and Barossa Council

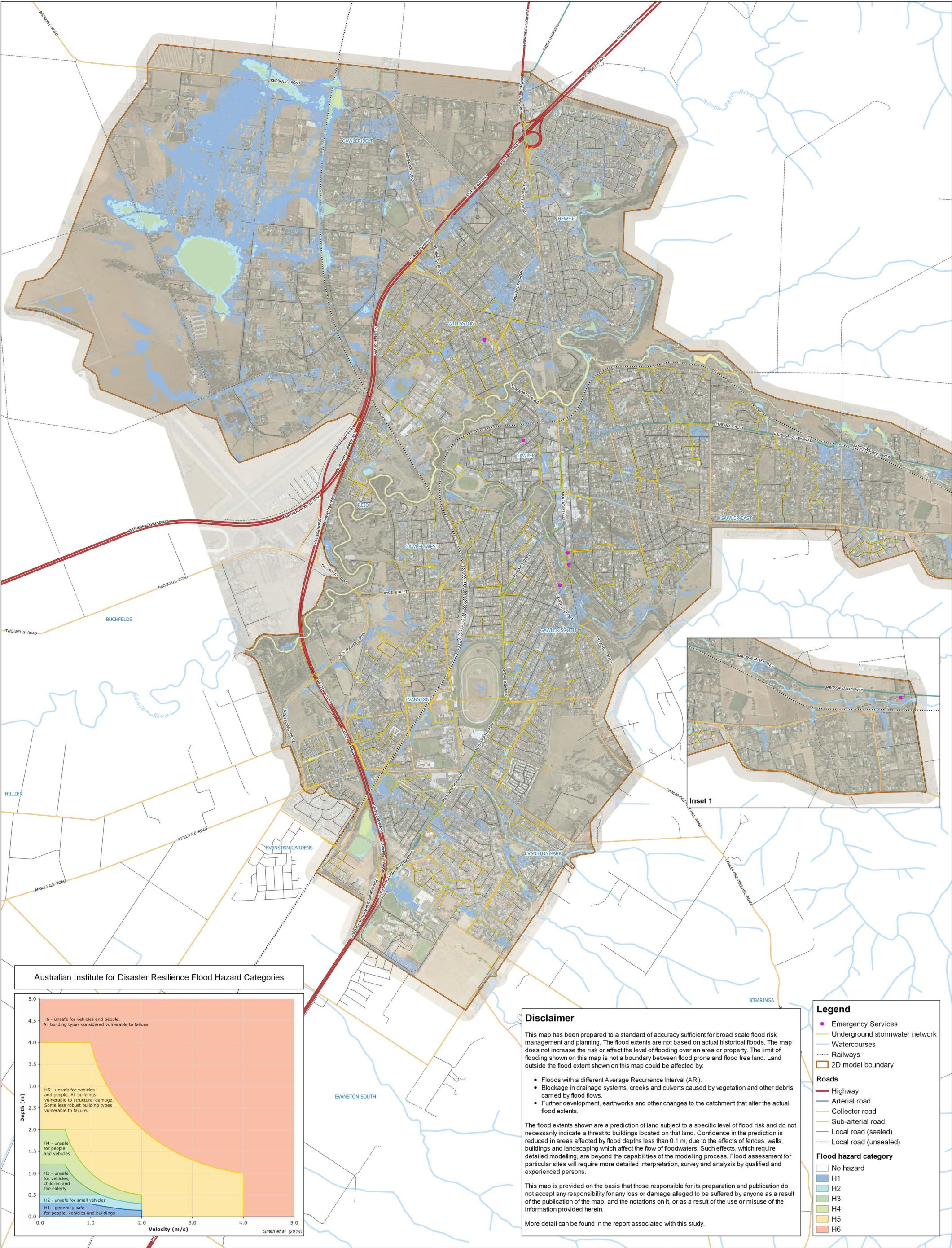


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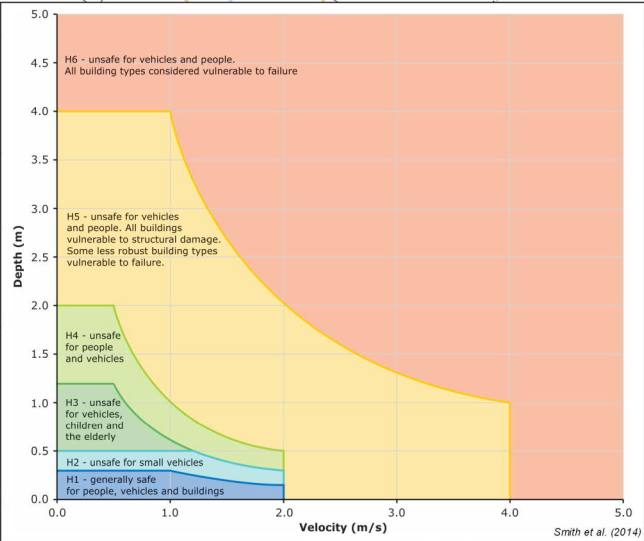
Data Acknowledgement:
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GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN
20% AEP flood hazard existing development scenario





Australian Institute for Disaster Resilience Flood Hazard Categories



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 - Underground stormwater network
 - Watercourses
 - Railways
 - 2D model boundary
- Roads**
- Highway
 - Arterial road
 - Collector road
 - Sub-arterial road
 - Local road (sealed)
 - Local road (unsealed)
- Flood hazard category**
- No hazard
 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

Town of Gawler, Light Regional Council, and Barossa Council

0 500 1000 1500 2000 m
1:15,000
at A1

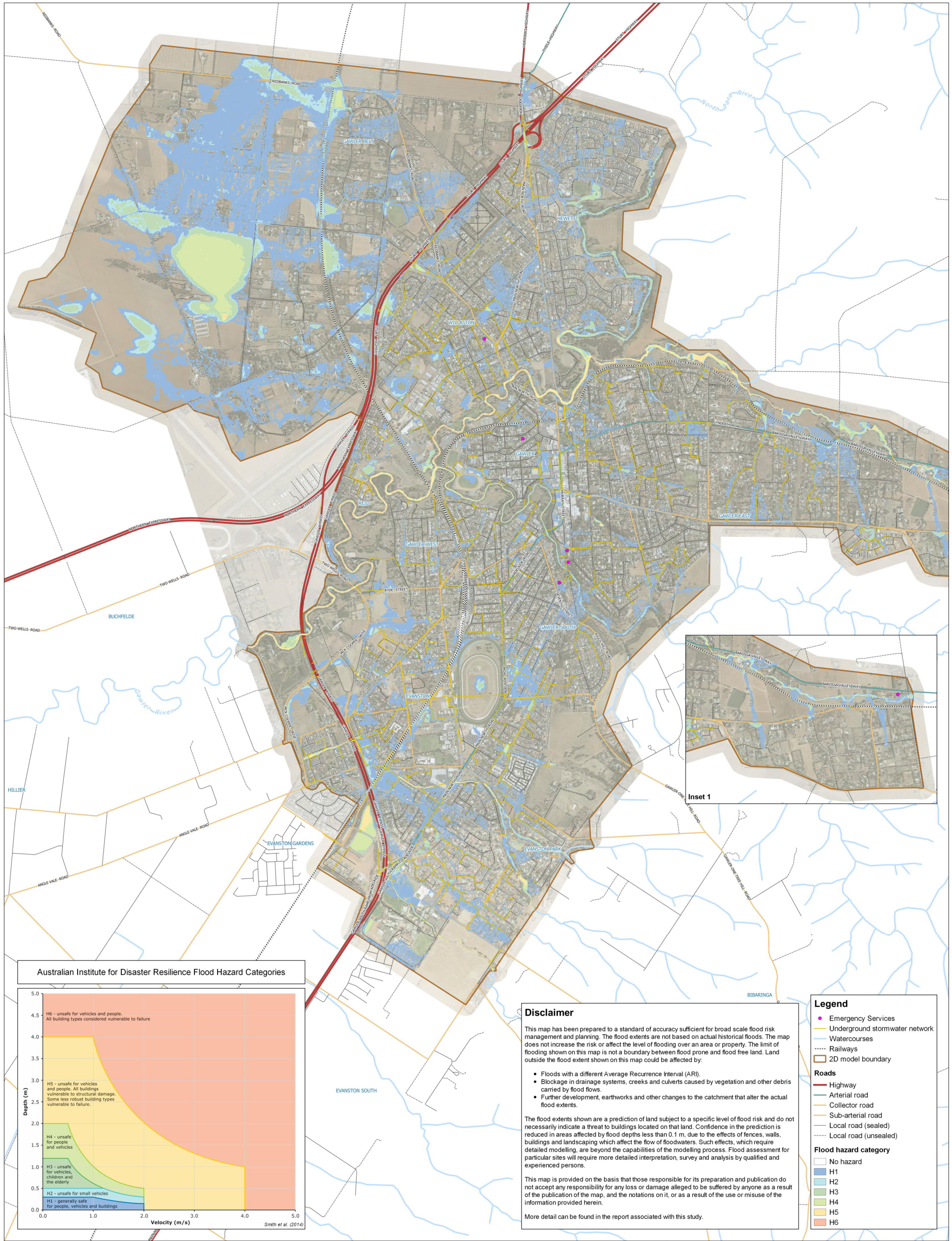


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Date: 2019-03-22
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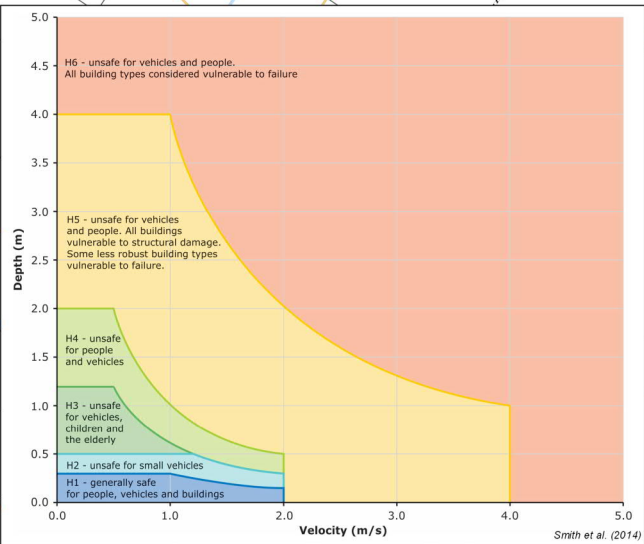
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GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN
5% AEP flood hazard existing development scenario



Australian Institute for Disaster Resilience Flood Hazard Categories



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 - 2D model boundary
- Roads**
- Highway
 - Arterial road
 - Collector road
 - Sub-arterial road
 - Local road (sealed)
 - Local road (unsealed)
- Flood hazard category**
- No hazard
 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

Town of Gawler, Light Regional Council, and Barossa Council

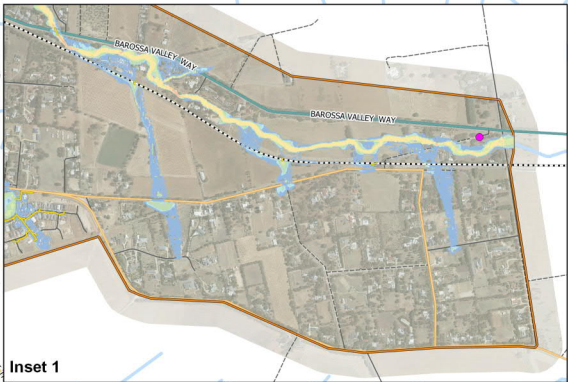
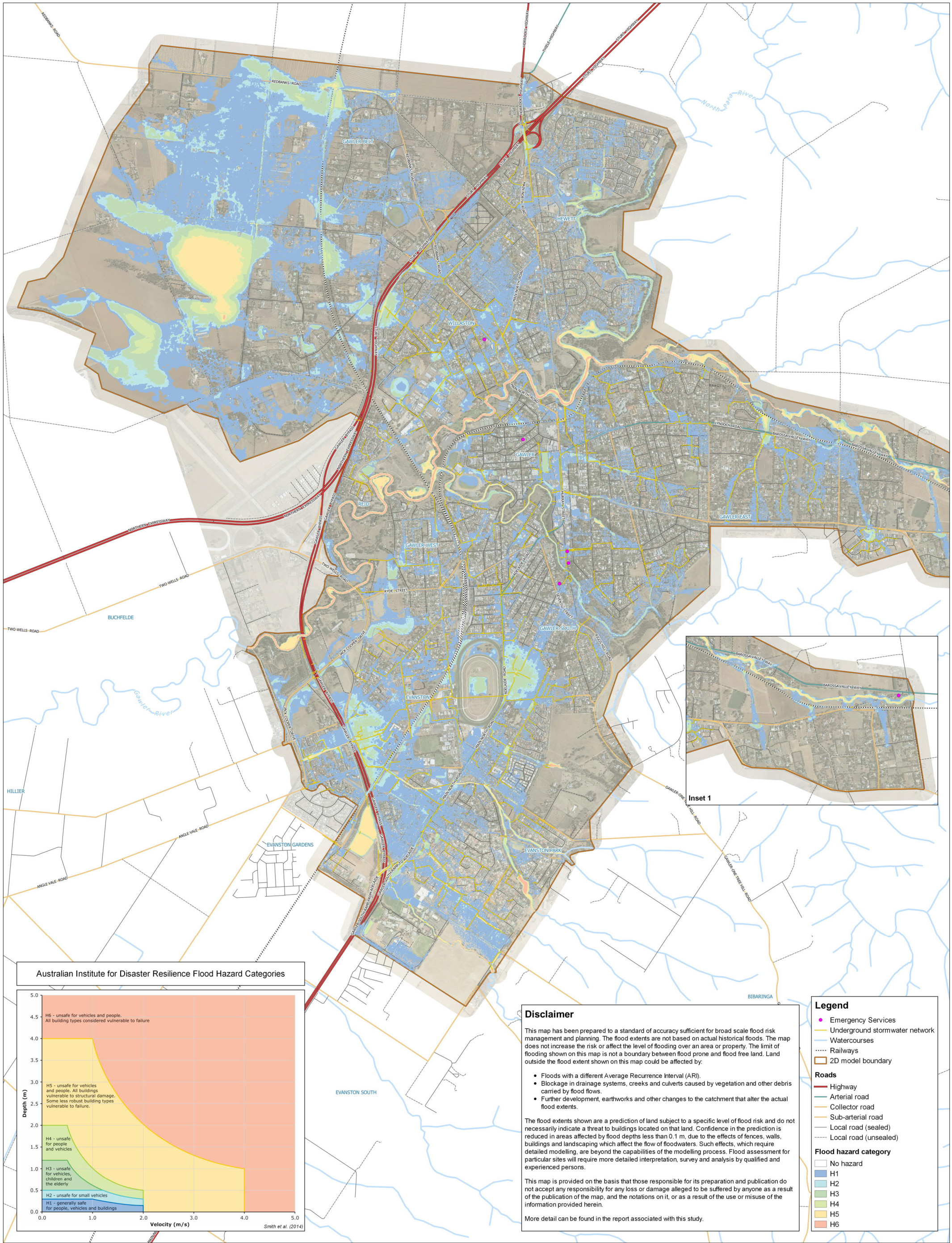
GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN
1% AEP flood hazard existing development scenario



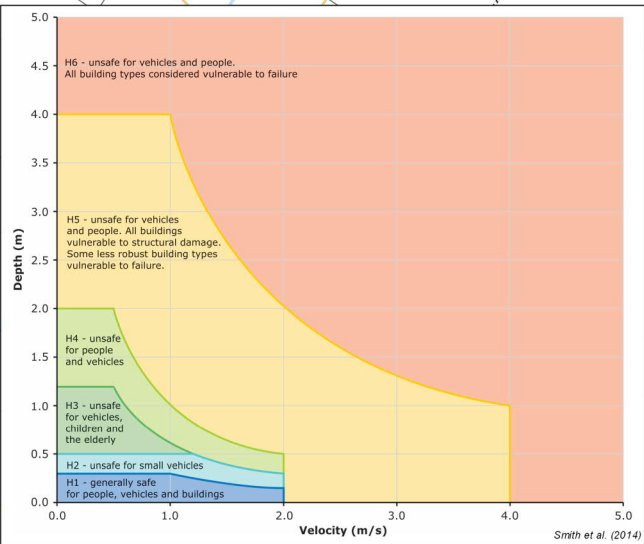
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Australian Institute for Disaster Resilience Flood Hazard Categories



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 - Railways
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- Roads**
- Highway
 - Arterial road
 - Collector road
 - Sub-arterial road
 - Local road (sealed)
 - Local road (unsealed)
- Flood hazard category**
- No hazard
 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

Town of Gawler, Light Regional Council, and Barossa Council

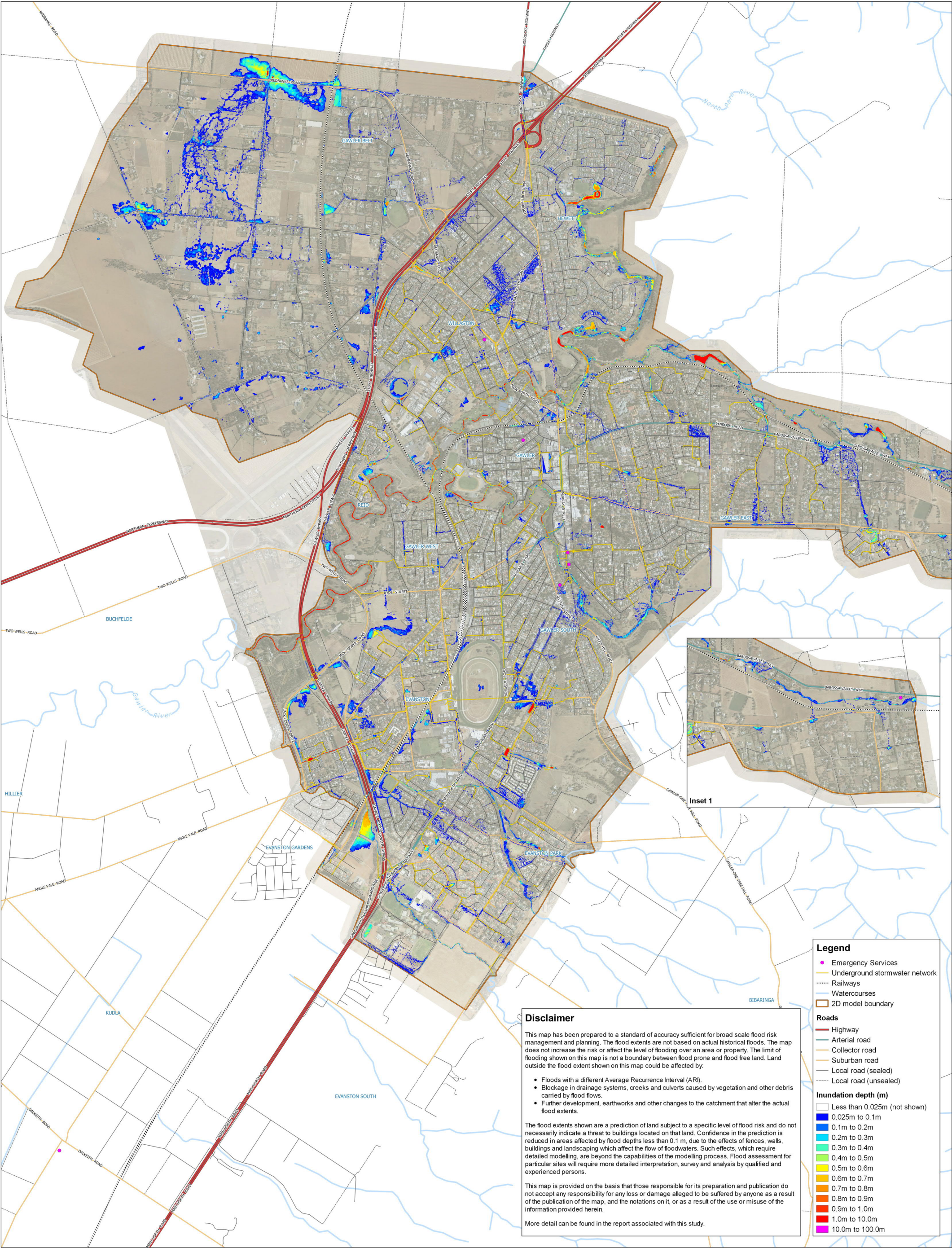
GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN
0.2% AEP flood hazard existing development scenario



Job Number: 2014.1387
Filename: 20141387M001.qgs
Revision: E
Date: 2019-03-22
Drawn: JDN

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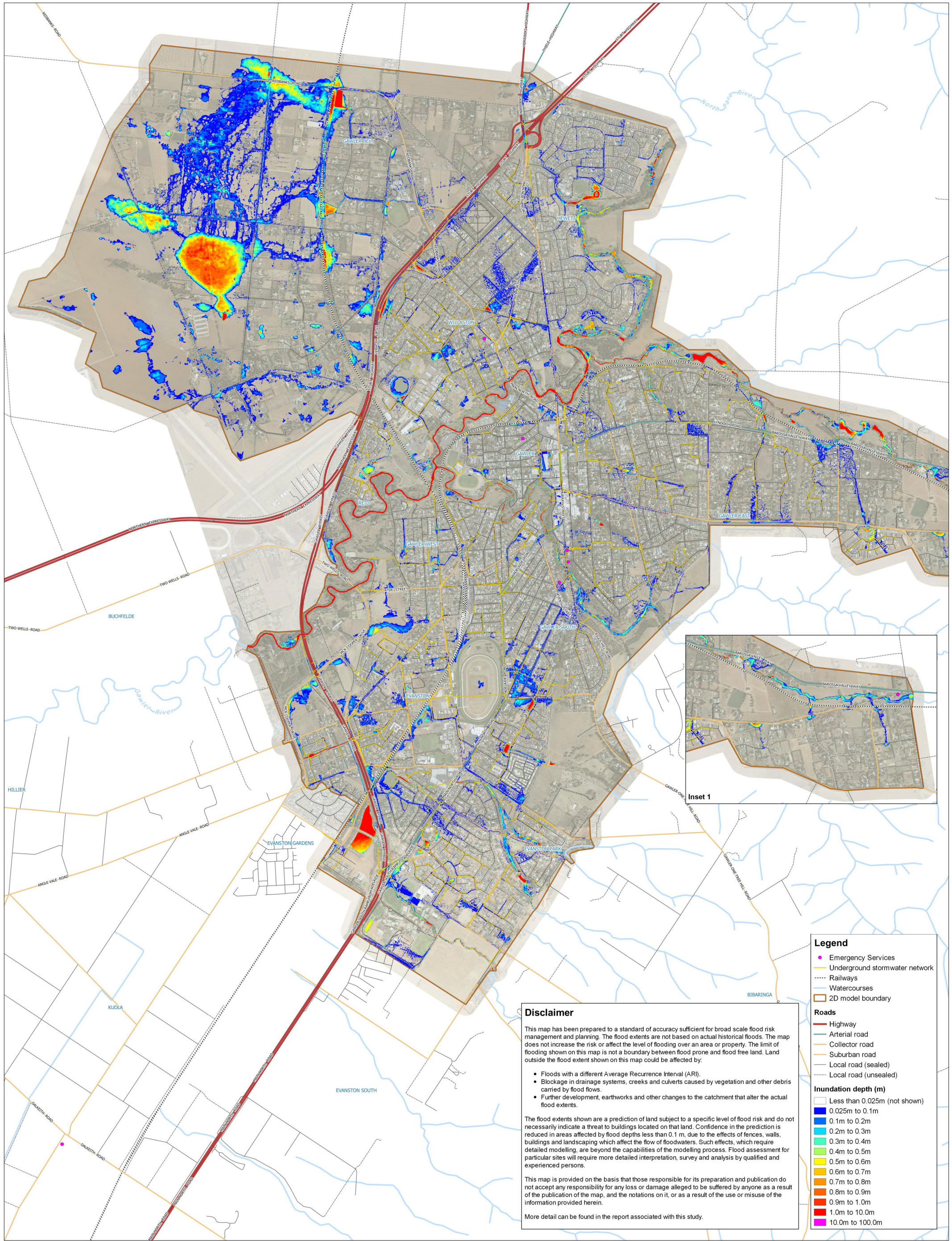


Town of Gawler, Light Regional Council, and Barossa Council

GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

20% AEP flood depth long-term development scenario

(on-site detention not included)



Disclaimer

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- Underground stormwater network
- Railways
- Watercourses
- 2D model boundary

Roads

- Highway
- Arterial road
- Collector road
- Suburban road
- Local road (sealed)
- Local road (unsealed)

Inundation depth (m)

- Less than 0.025m (not shown)
- 0.025m to 0.1m
- 0.1m to 0.2m
- 0.2m to 0.3m
- 0.3m to 0.4m
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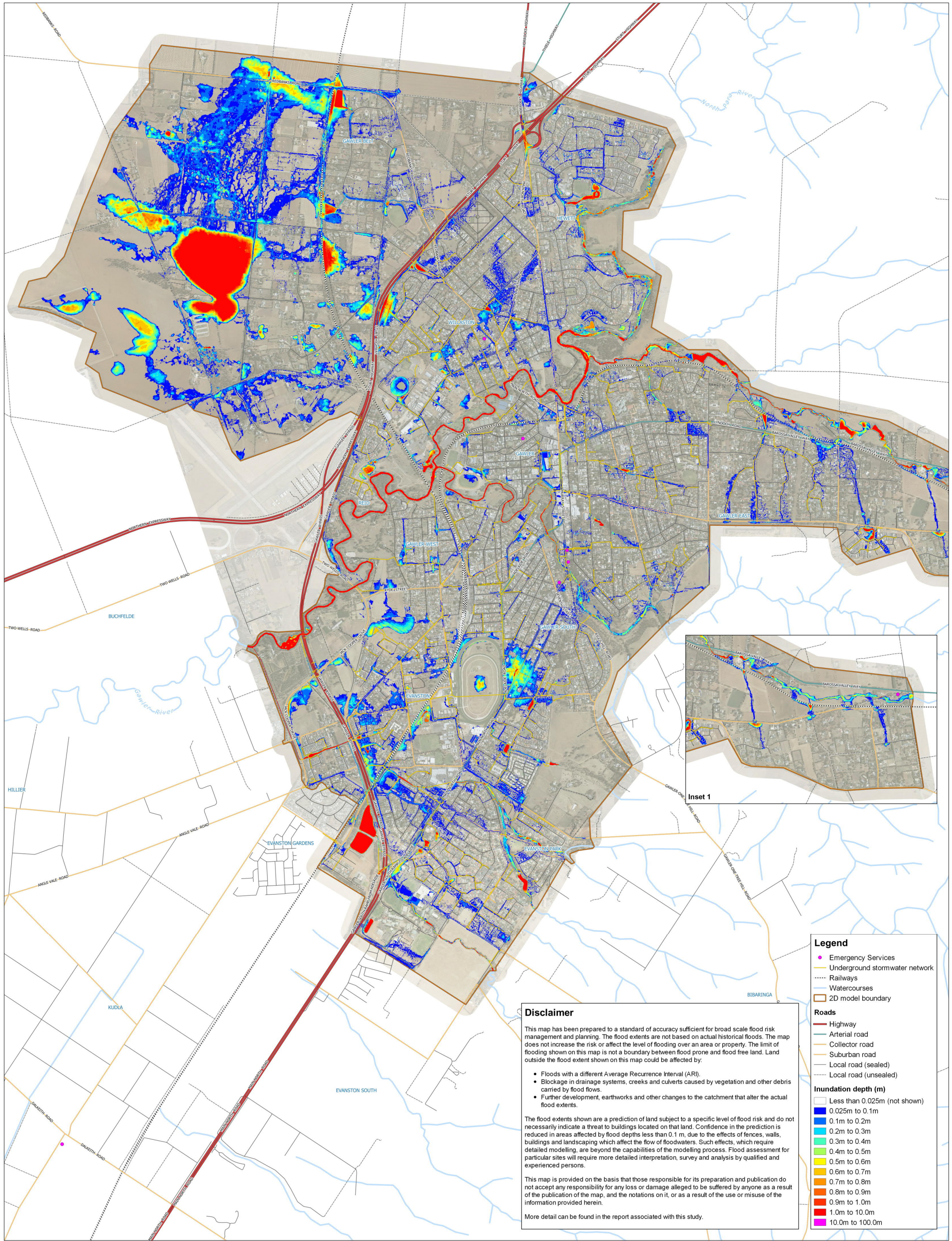
Town of Gawler, Light Regional Council, and Barossa Council

GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

5% AEP flood depth long-term development scenario

(on-site detention not included)





Disclaimer

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- Railways
- Watercourses
- 2D model boundary

Roads

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- Arterial road
- Collector road
- Suburban road
- Local road (sealed)
- Local road (unsealed)

Inundation depth (m)

- Less than 0.025m (not shown)
- 0.025m to 0.1m
- 0.1m to 0.2m
- 0.2m to 0.3m
- 0.3m to 0.4m
- 0.4m to 0.5m
- 0.5m to 0.6m
- 0.6m to 0.7m
- 0.7m to 0.8m
- 0.8m to 0.9m
- 0.9m to 1.0m
- 1.0m to 10.0m
- 10.0m to 100.0m

Town of Gawler, Light Regional Council, and Barossa Council



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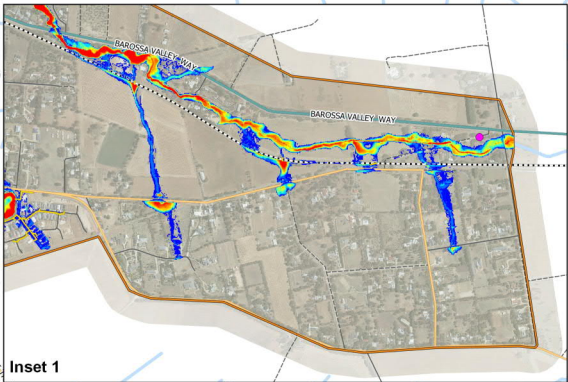
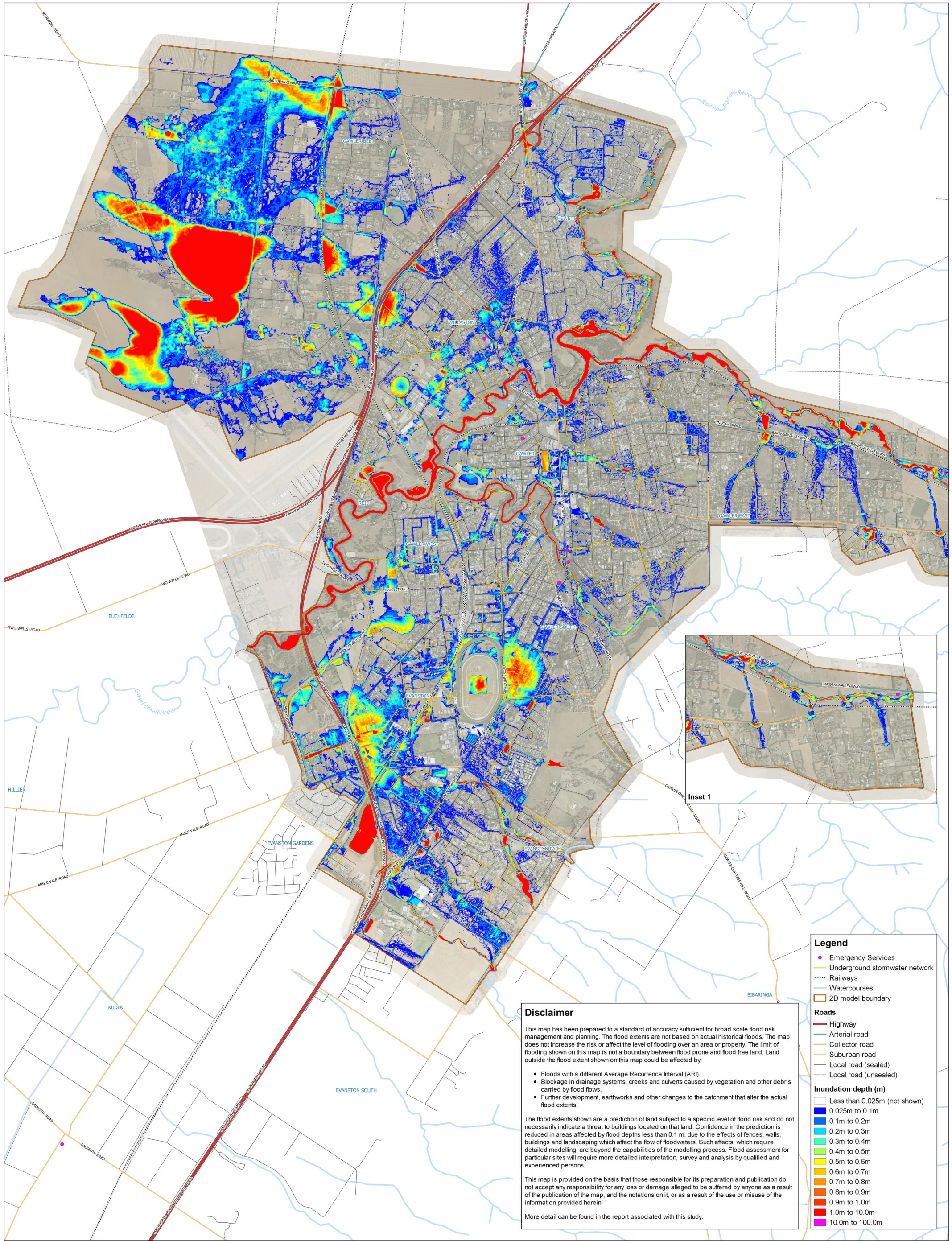
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GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

1% AEP flood depth long-term development scenario

(on-site detention not included)





Disclaimer

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More detail can be found in the report associated with this study.

Legend

- Emergency Services
- Underground stormwater network
- Railways
- Watercourses
- 2D model boundary

Roads

- Highway
- Arterial road
- Collector road
- Suburban road
- Local road (sealed)
- Local road (unsealed)

Inundation depth (m)

- Less than 0.025m (not shown)
- 0.025m to 0.1m
- 0.1m to 0.2m
- 0.2m to 0.3m
- 0.3m to 0.4m
- 0.4m to 0.5m
- 0.5m to 0.6m
- 0.6m to 0.7m
- 0.7m to 0.8m
- 0.8m to 0.9m
- 0.9m to 1.0m
- 1.0m to 10.0m
- 10.0m to 100.0m

Town of Gawler, Light Regional Council, and Barossa Council



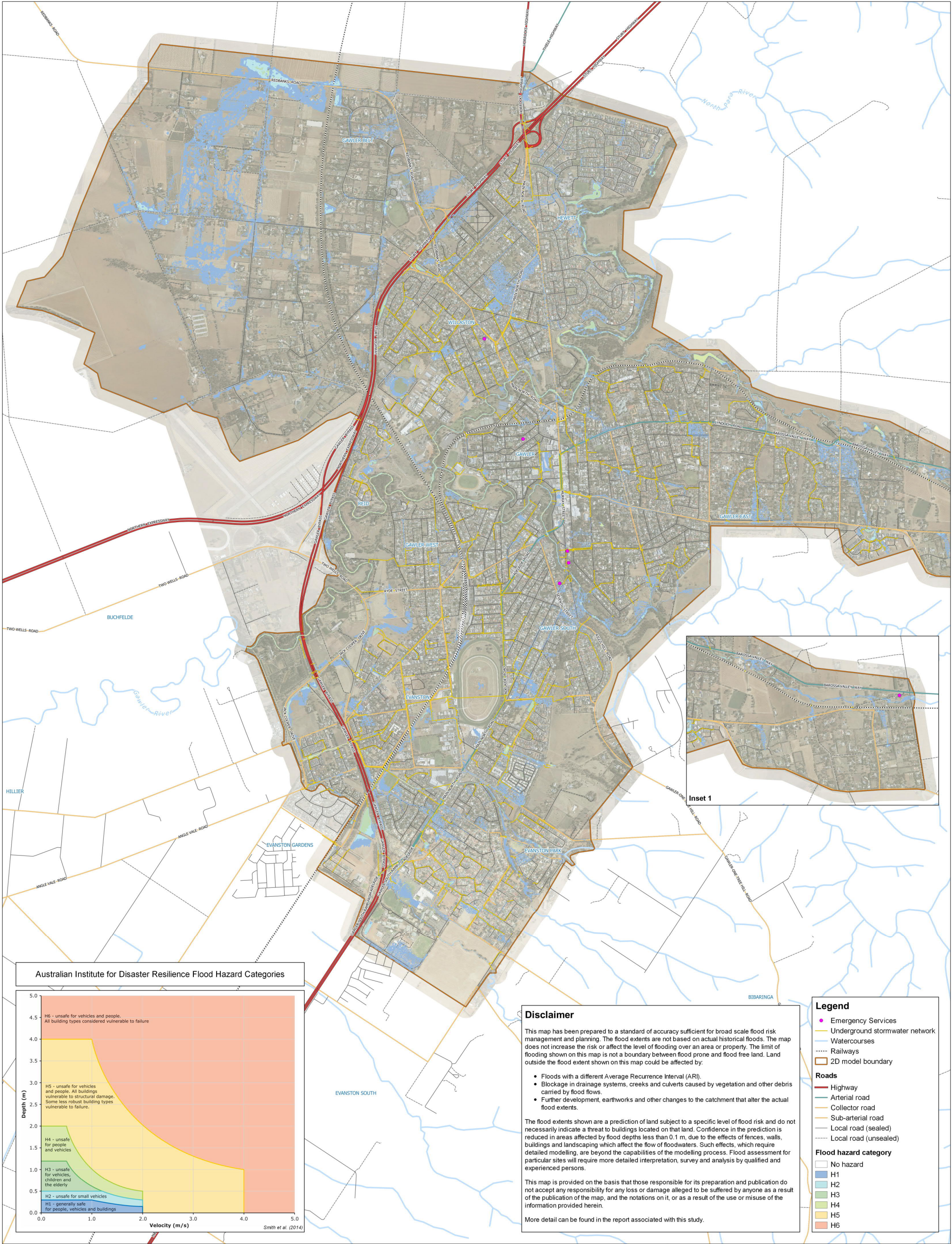
Job Number: 2014.1387
Filename: 20141387M001.qgs
Revision: E
Date: 2019-03-22
Drawn: JDN

Data Acknowledgement:
Aerial imagery provided by and used with permission of Council

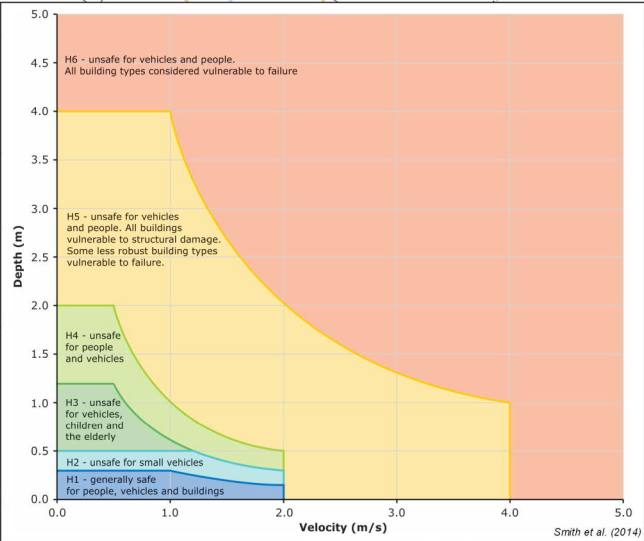
GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

0.2% AEP flood depth long-term development scenario

(on-site detention not included)



Australian Institute for Disaster Resilience Flood Hazard Categories



Disclaimer

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Legend

- Emergency Services
 - Underground stormwater network
 - Watercourses
 - Railways
 - 2D model boundary
- Roads**
- Highway
 - Arterial road
 - Collector road
 - Sub-arterial road
 - Local road (sealed)
 - Local road (unsealed)
- Flood hazard category**
- No hazard
 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

Town of Gawler, Light Regional Council, and Barossa Council

0 500 1000 1500 2000 m
1:15,000
at A1

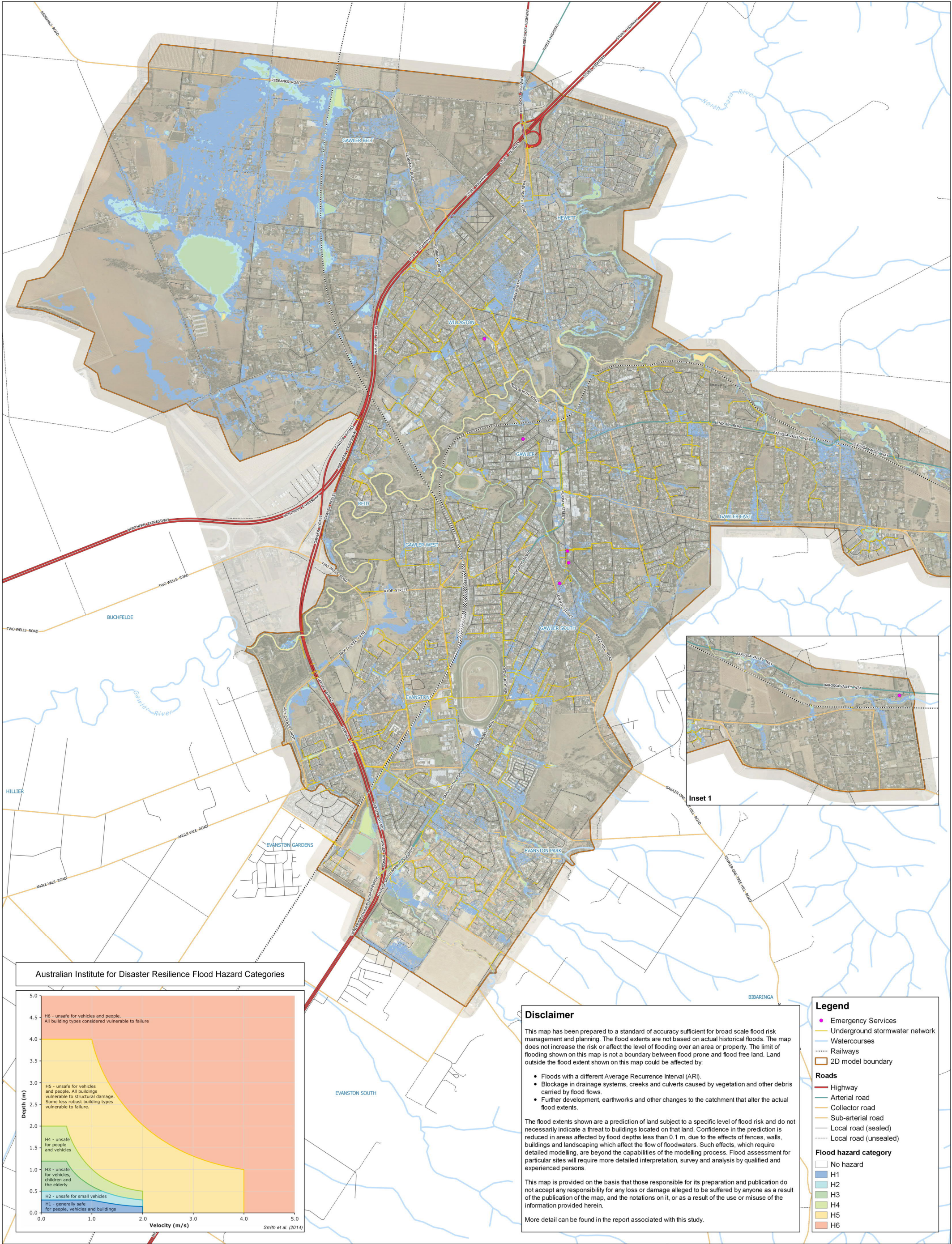


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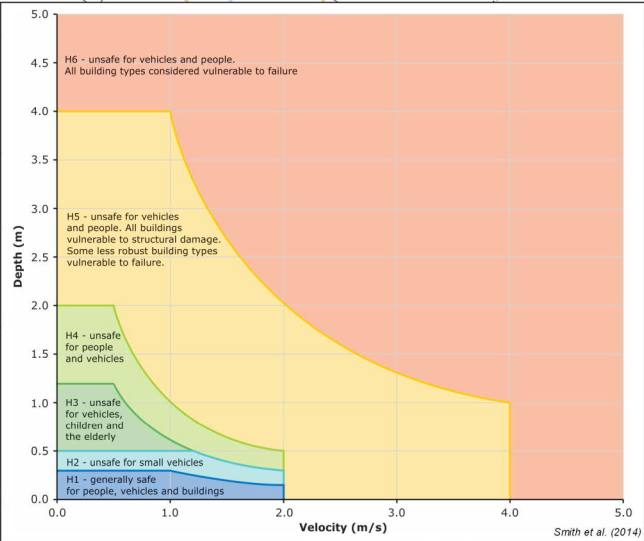
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GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN
20% AEP flood hazard long-term development scenario

(on-site detention not included)



Australian Institute for Disaster Resilience Flood Hazard Categories



Disclaimer

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Legend

- Emergency Services
 - Underground stormwater network
 - Watercourses
 - Railways
 - 2D model boundary
- Roads**
- Highway
 - Arterial road
 - Collector road
 - Sub-arterial road
 - Local road (sealed)
 - Local road (unsealed)
- Flood hazard category**
- No hazard
 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

Town of Gawler, Light Regional Council, and Barossa Council

0 500 1000 1500 2000 m
1:15,000
at A1



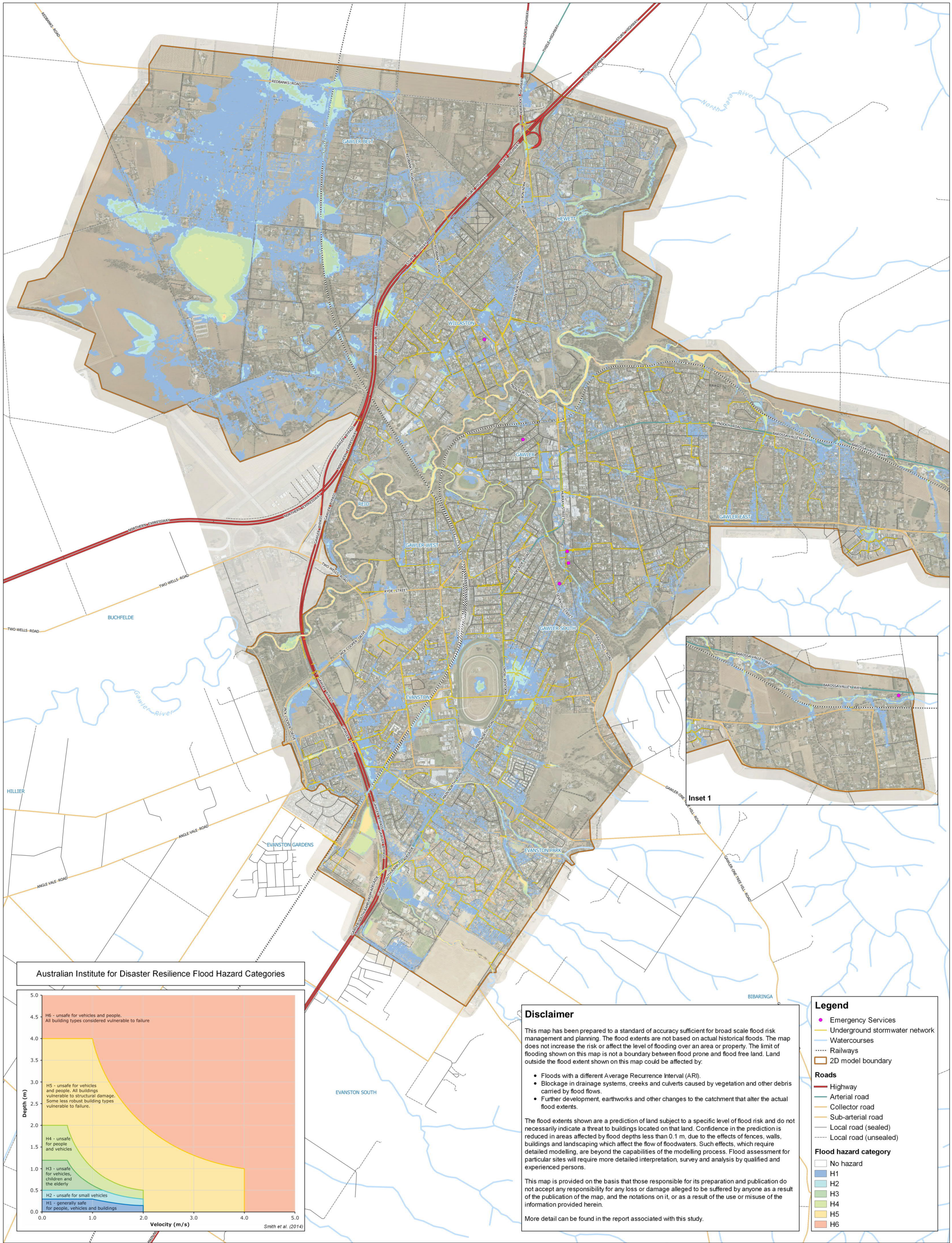
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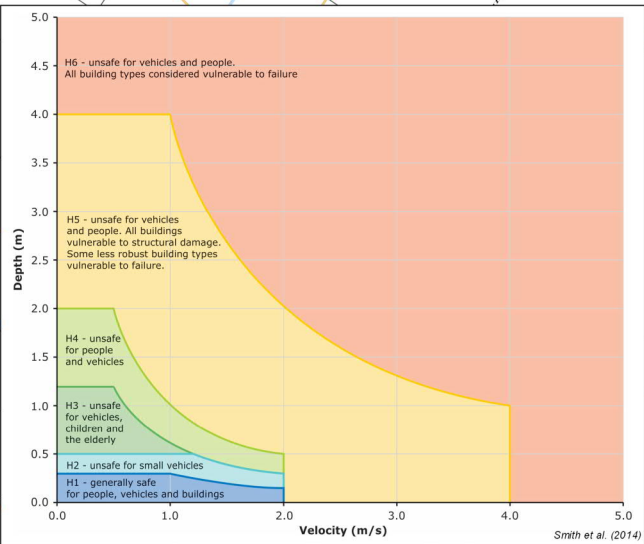
GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

5% AEP flood hazard long-term development scenario

(on-site detention not included)



Australian Institute for Disaster Resilience Flood Hazard Categories



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Legend

- Emergency Services
 - Underground stormwater network
 - Watercourses
 - Railways
 - 2D model boundary
- Roads**
- Highway
 - Arterial road
 - Collector road
 - Sub-arterial road
 - Local road (sealed)
 - Local road (unsealed)
- Flood hazard category**
- No hazard
 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

Town of Gawler, Light Regional Council, and Barossa Council

GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN
1% AEP flood hazard long-term development scenario

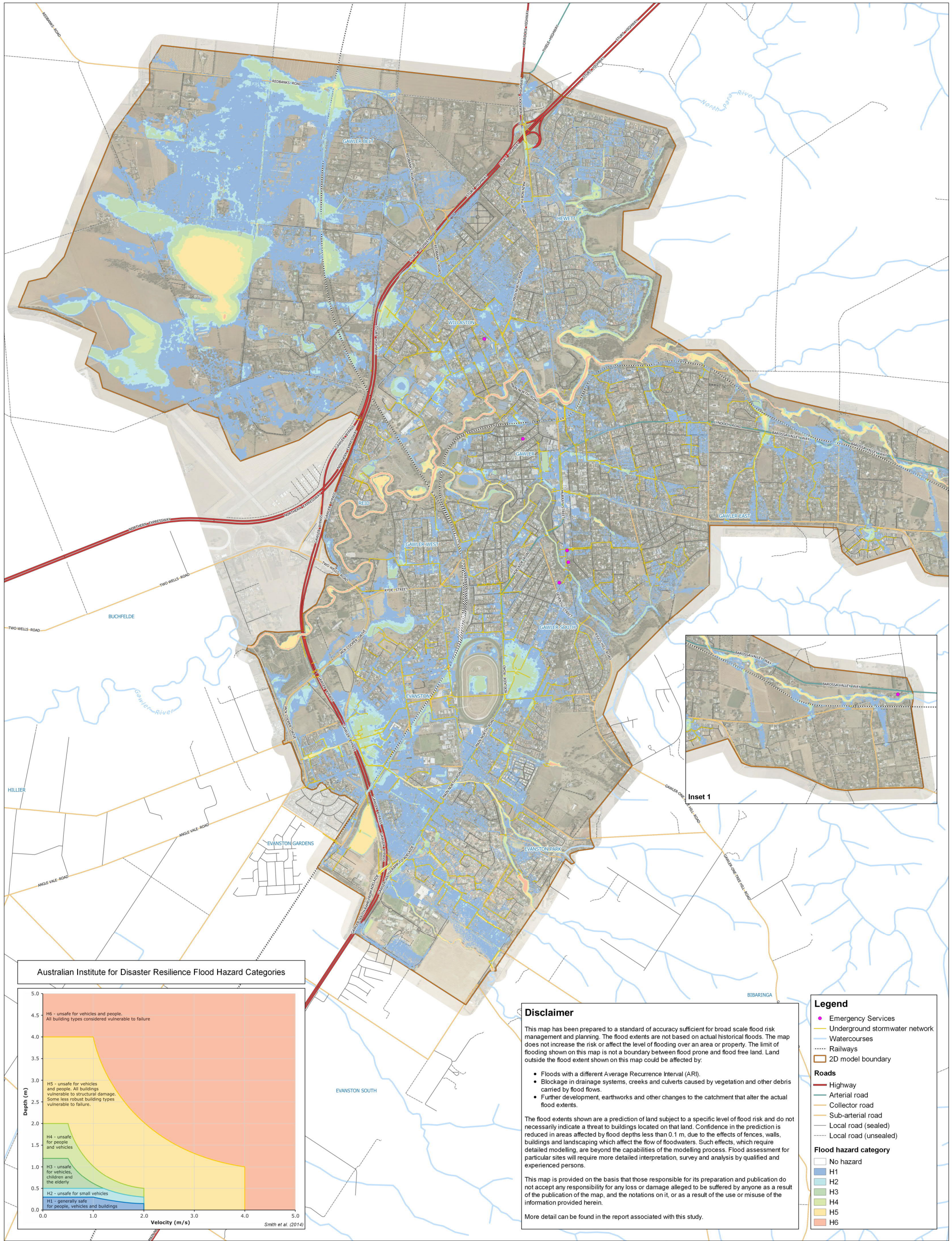
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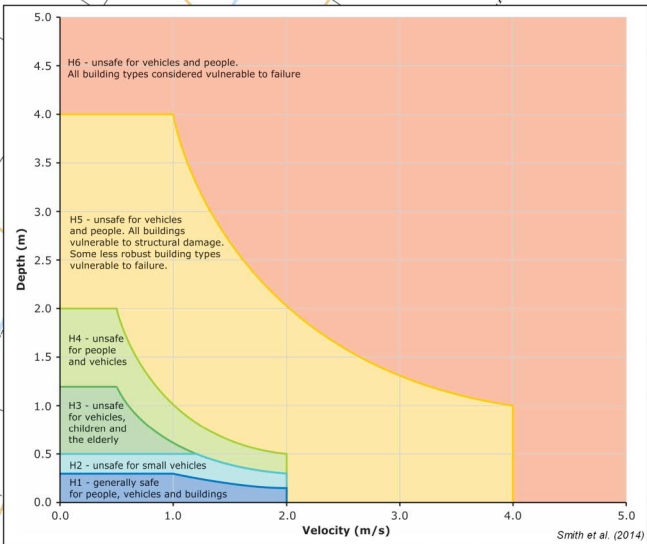
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Australian Institute for Disaster Resilience Flood Hazard Categories



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Legend

- Emergency Services
- Underground stormwater network
- Watercourses
- Railways
- 2D model boundary
- Roads**
 - Highway
 - Arterial road
 - Collector road
 - Sub-arterial road
 - Local road (sealed)
 - Local road (unsealed)
- Flood hazard category**
 - No hazard
 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

Town of Gawler, Light Regional Council, and Barossa Council

0 500 1000 1500 2000 m
1:15,000
at A1



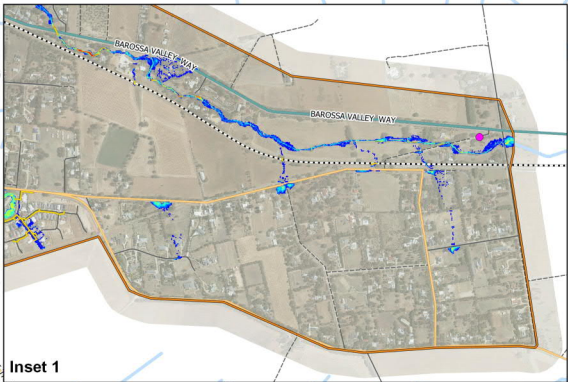
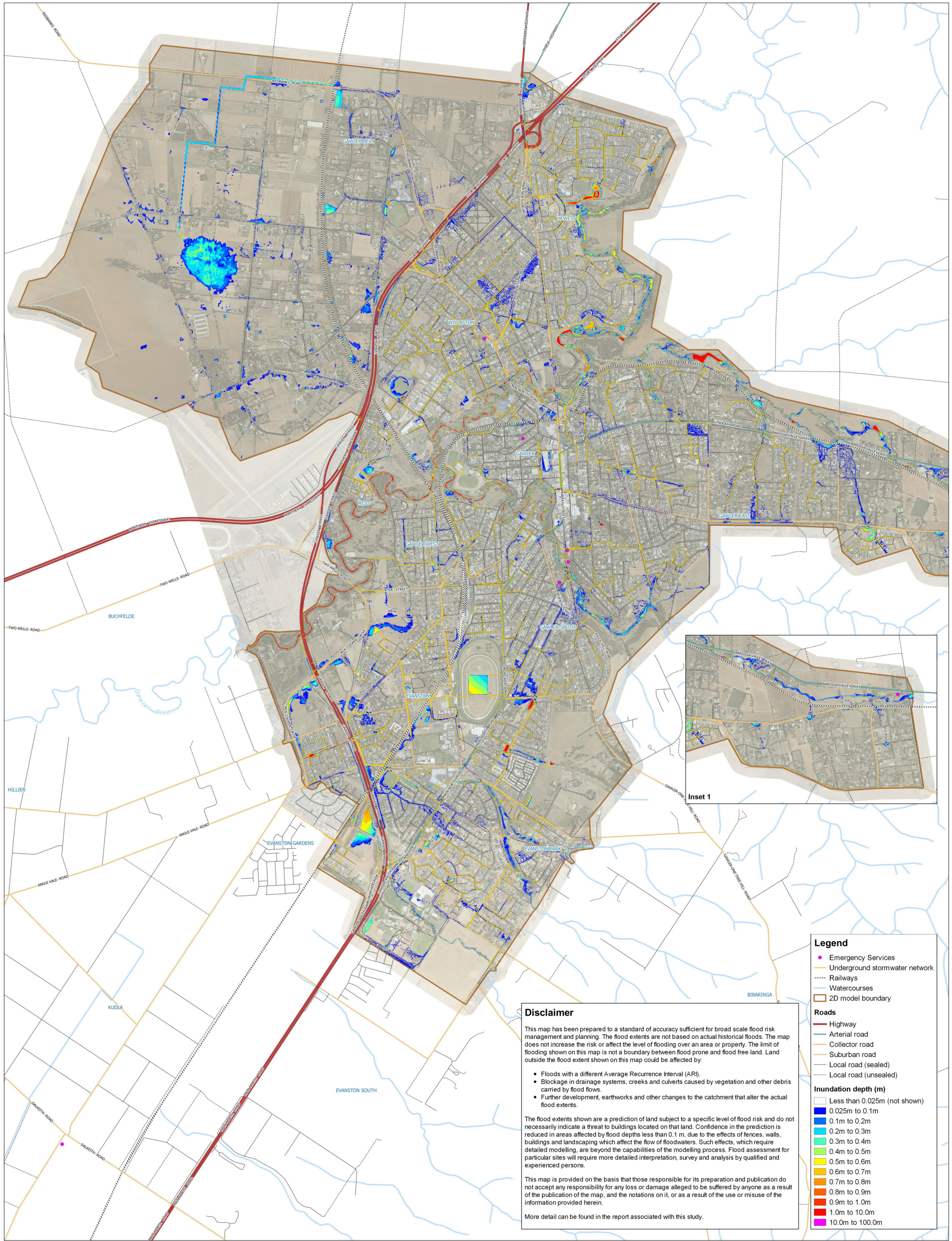
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GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

0.2% AEP flood hazard long-term development scenario

(on-site detention not included)



Disclaimer

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Legend

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- Underground stormwater network
- Railways
- Watercourses
- 2D model boundary

Roads

- Highway
- Arterial road
- Collector road
- Suburban road
- Local road (sealed)
- Local road (unsealed)

Inundation depth (m)

- Less than 0.025m (not shown)
- 0.025m to 0.1m
- 0.1m to 0.2m
- 0.2m to 0.3m
- 0.3m to 0.4m
- 0.4m to 0.5m
- 0.5m to 0.6m
- 0.6m to 0.7m
- 0.7m to 0.8m
- 0.8m to 0.9m
- 0.9m to 1.0m
- 1.0m to 10.0m
- 10.0m to 100.0m

Town of Gawler, Light Regional Council, and Barossa Council

GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

20% AEP flood depth long-term development scenario with mitigation

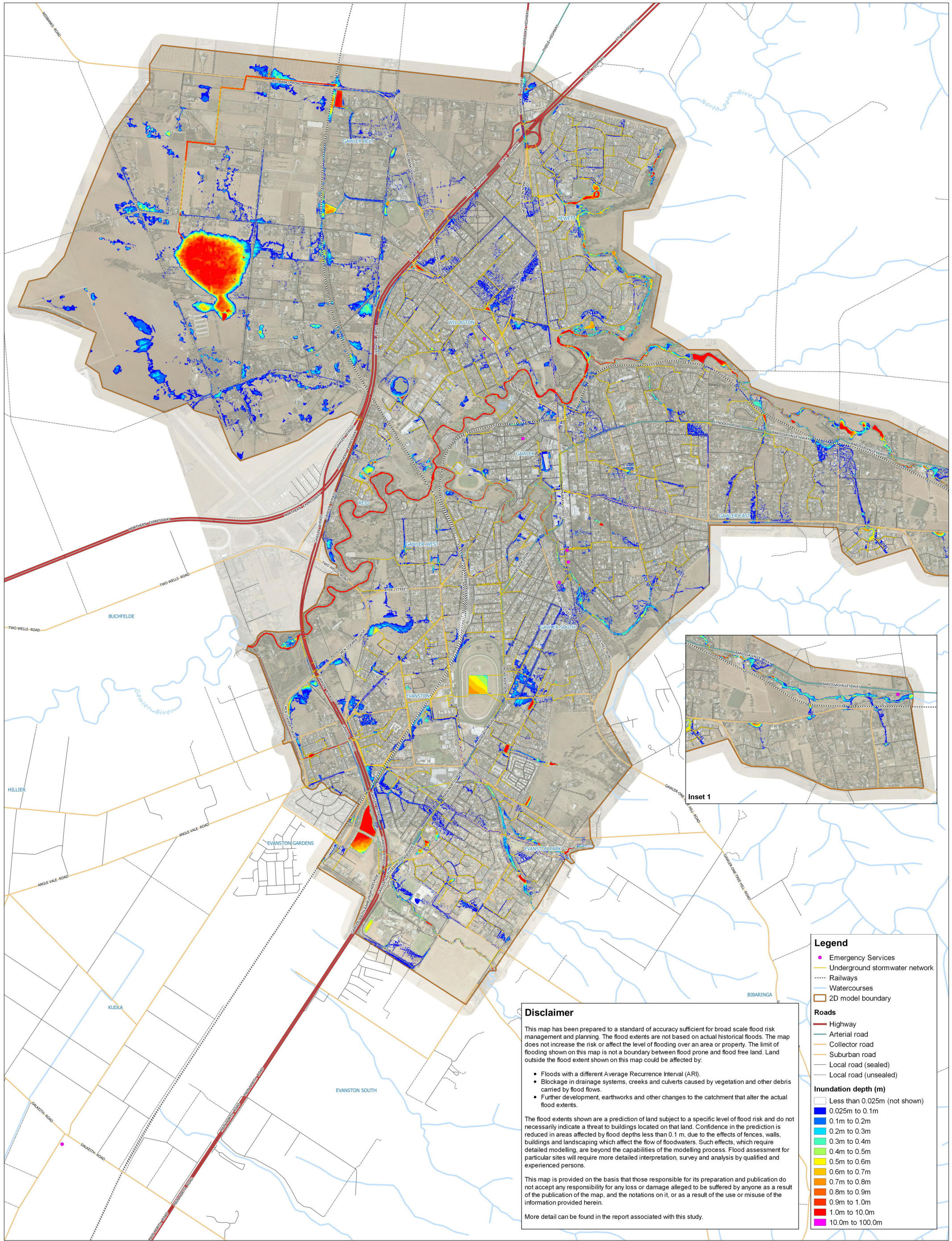
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Legend

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- Railways
- Watercourses
- 2D model boundary

Roads

- Highway
- Arterial road
- Collector road
- Suburban road
- Local road (sealed)
- Local road (unsealed)

Inundation depth (m)

- Less than 0.025m (not shown)
- 0.025m to 0.1m
- 0.1m to 0.2m
- 0.2m to 0.3m
- 0.3m to 0.4m
- 0.4m to 0.5m
- 0.5m to 0.6m
- 0.6m to 0.7m
- 0.7m to 0.8m
- 0.8m to 0.9m
- 0.9m to 1.0m
- 1.0m to 10.0m
- 10.0m to 100.0m

Town of Gawler, Light Regional Council, and Barossa Council

0 500 1000 1500 2000 m

1:15,000
at A1

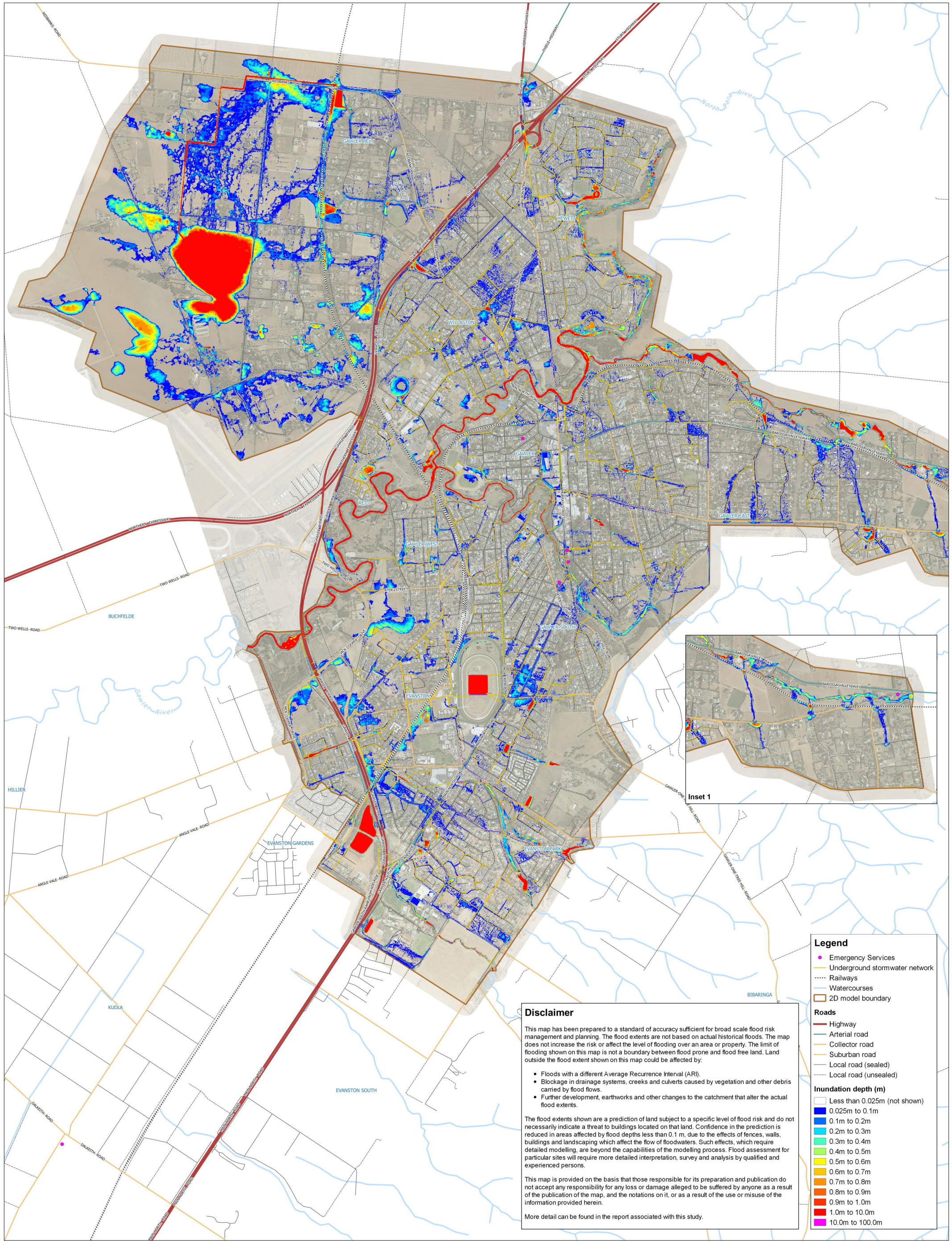
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GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN 5% AEP flood depth long-term development scenario with mitigation

(on-site detention not included)



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Legend

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- Underground stormwater network
- Railways
- Watercourses
- 2D model boundary

Roads

- Highway
- Arterial road
- Collector road
- Suburban road
- Local road (sealed)
- Local road (unsealed)

Inundation depth (m)

- Less than 0.025m (not shown)
- 0.025m to 0.1m
- 0.1m to 0.2m
- 0.2m to 0.3m
- 0.3m to 0.4m
- 0.4m to 0.5m
- 0.5m to 0.6m
- 0.6m to 0.7m
- 0.7m to 0.8m
- 0.8m to 0.9m
- 0.9m to 1.0m
- 1.0m to 10.0m
- 10.0m to 100.0m

Town of Gawler, Light Regional Council, and Barossa Council



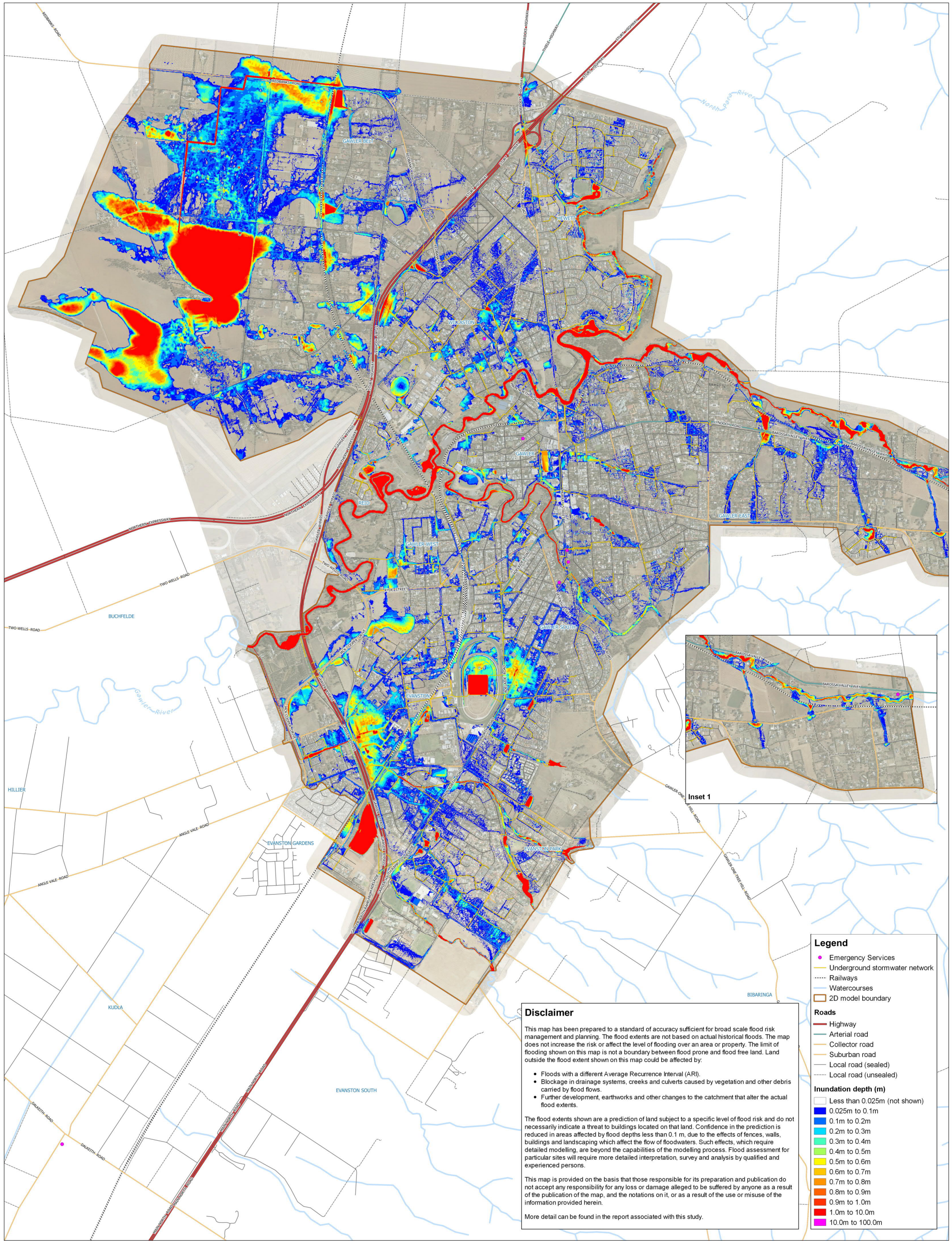
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GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

1% AEP flood depth long-term development scenario with mitigation

(on-site detention not included)



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- Railways
- Watercourses
- 2D model boundary

Roads

- Highway
- Arterial road
- Collector road
- Suburban road
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- Local road (unsealed)

Inundation depth (m)

- Less than 0.025m (not shown)
- 0.025m to 0.1m
- 0.1m to 0.2m
- 0.2m to 0.3m
- 0.3m to 0.4m
- 0.4m to 0.5m
- 0.5m to 0.6m
- 0.6m to 0.7m
- 0.7m to 0.8m
- 0.8m to 0.9m
- 0.9m to 1.0m
- 1.0m to 10.0m
- 10.0m to 100.0m

Town of Gawler, Light Regional Council, and Barossa Council

GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

0.2% AEP flood depth long-term development scenario with mitigation

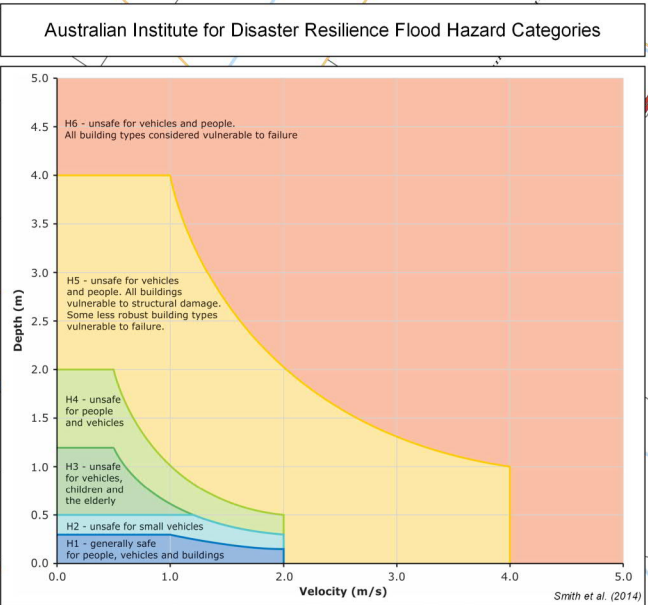
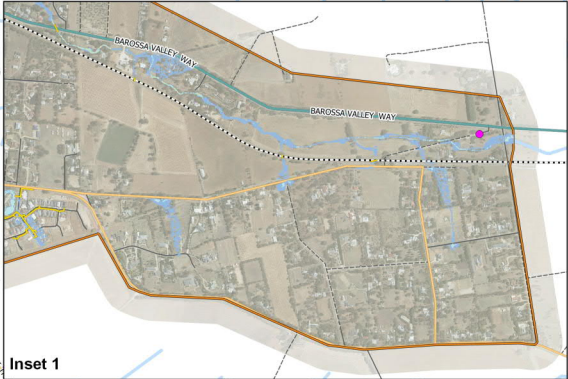
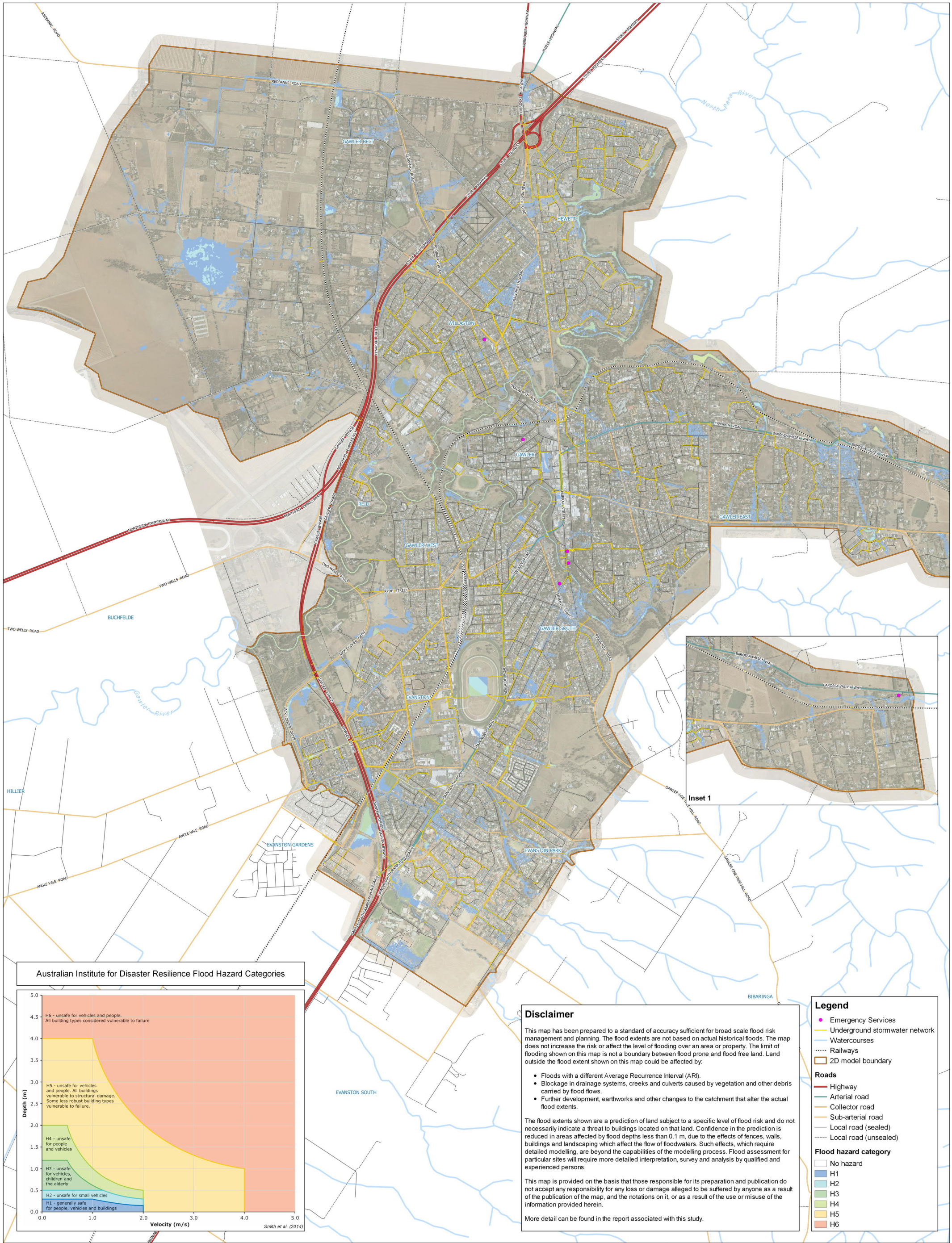
(on-site detention not included)



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Legend

- Emergency Services
- Underground stormwater network
- Watercourses
- Railways
- 2D model boundary

Roads

- Highway
- Arterial road
- Collector road
- Sub-arterial road
- Local road (sealed)
- Local road (unsealed)

Flood hazard category

- No hazard
- H1
- H2
- H3
- H4
- H5
- H6

Town of Gawler, Light Regional Council, and Barossa Council

GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

20% AEP flood hazard long-term development scenario with mitigation

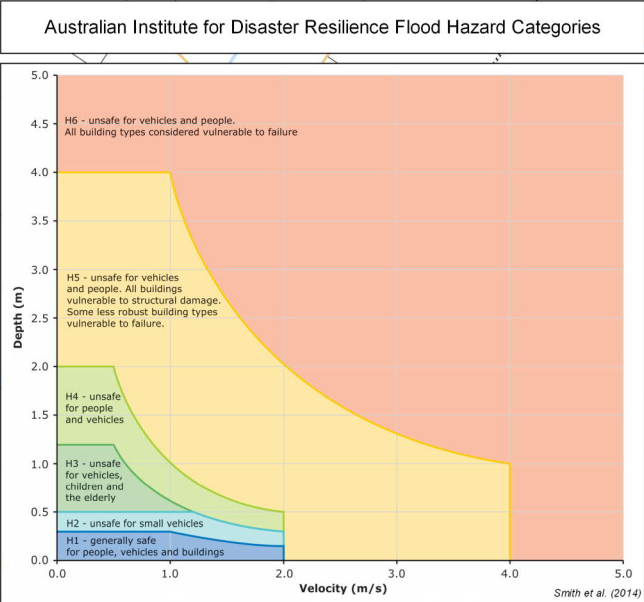
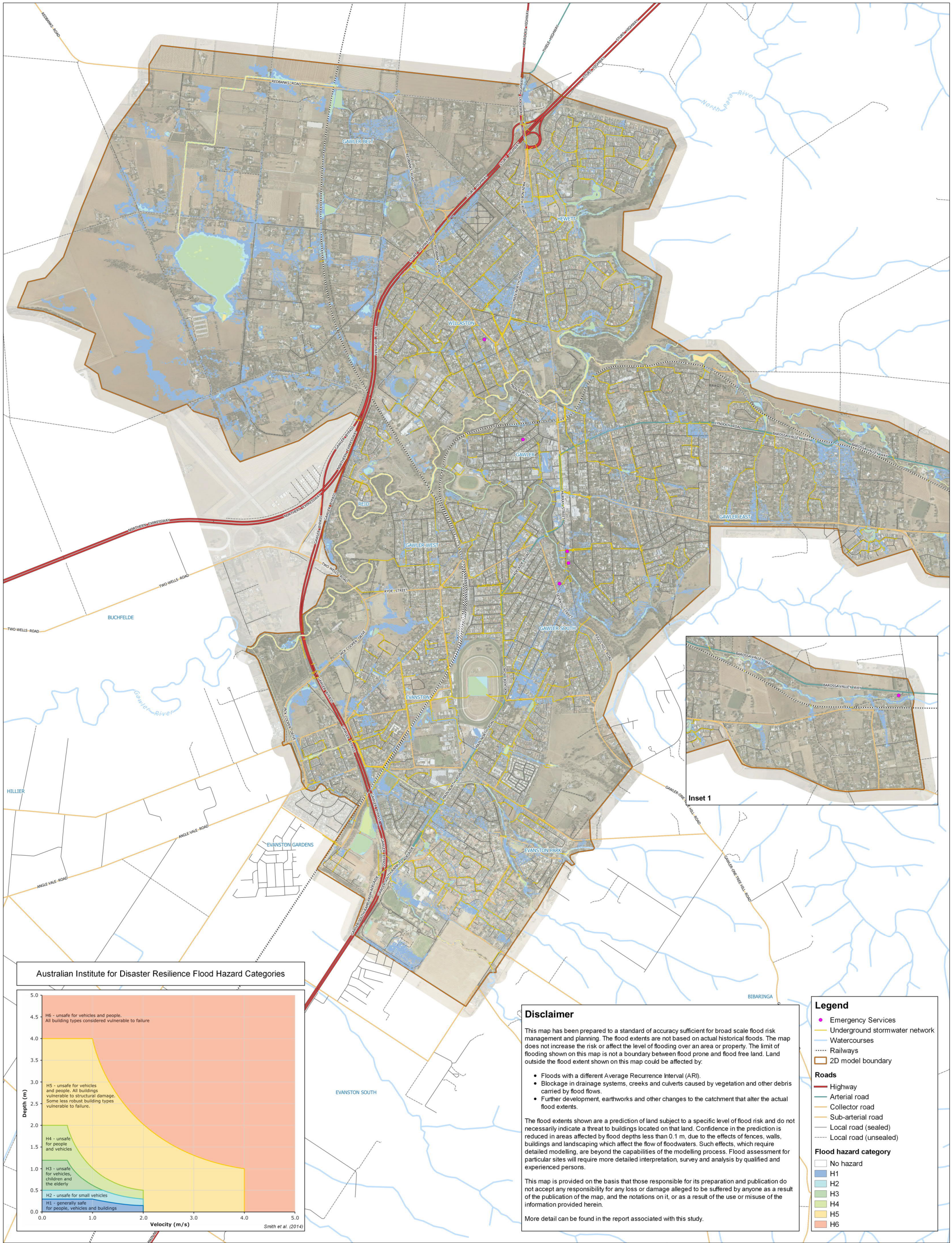
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More detail can be found in the report associated with this study.

Legend

- Emergency Services
 - Underground stormwater network
 - Watercourses
 - Railways
 - 2D model boundary
- Roads**
- Highway
 - Arterial road
 - Collector road
 - Sub-arterial road
 - Local road (sealed)
 - Local road (unsealed)
- Flood hazard category**
- No hazard
 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

Town of Gawler, Light Regional Council, and Barossa Council

GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

5% AEP flood hazard long-term development scenario with mitigation

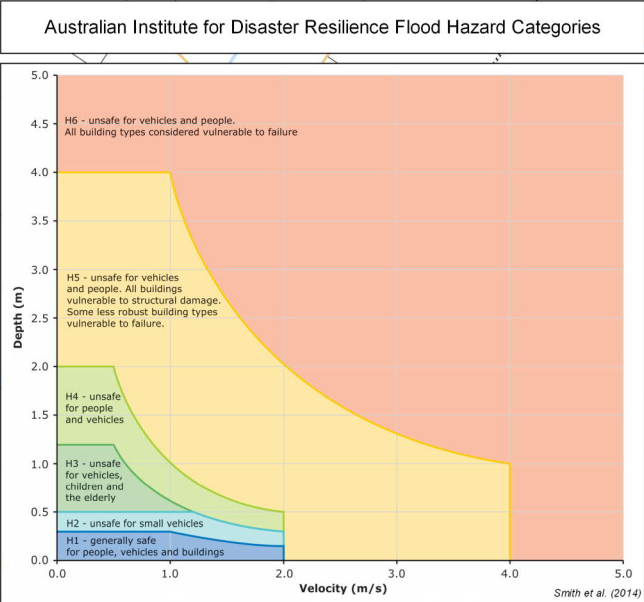
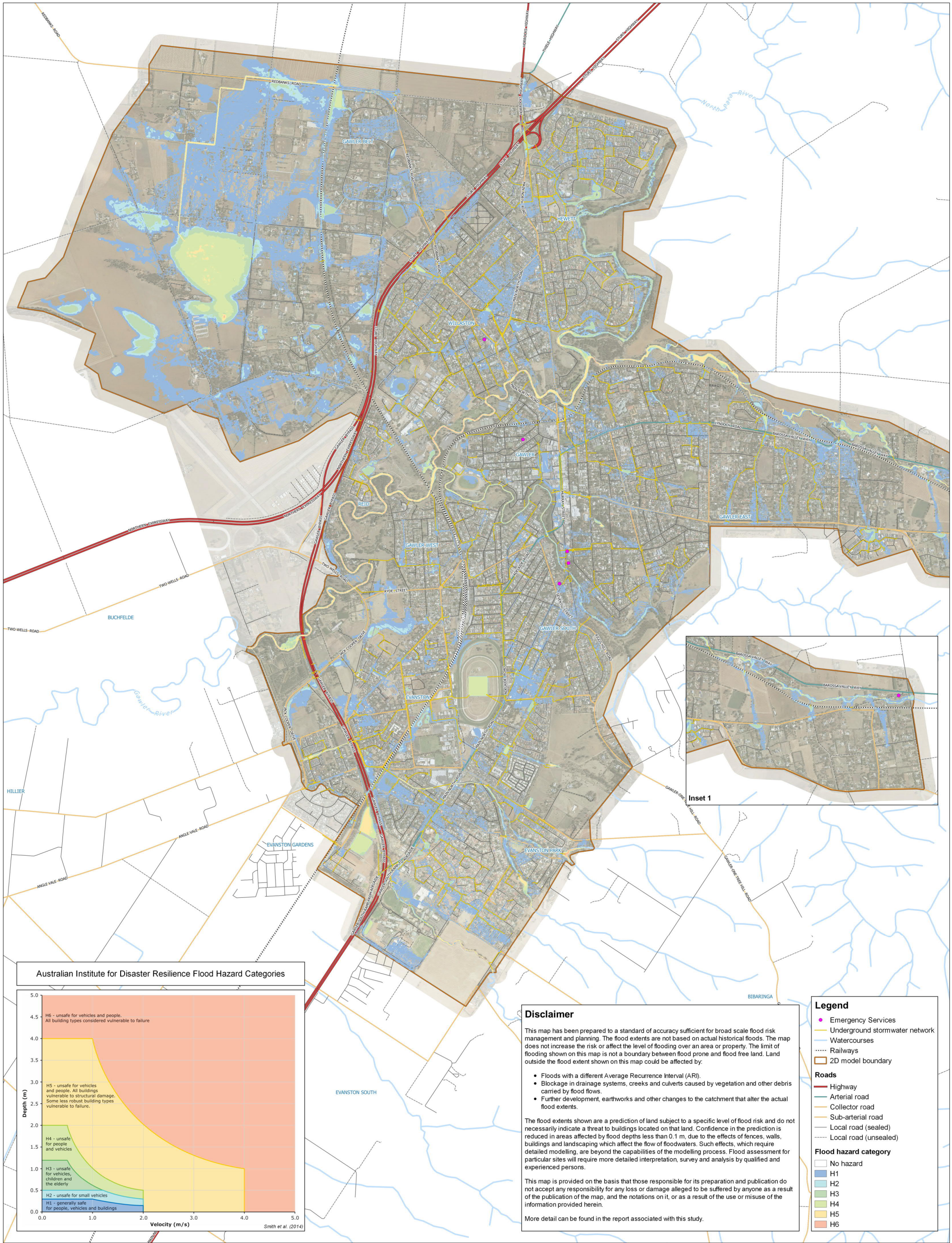
(on-site detention not included)



Job Number: 2014.1387
Filename: 20141387M001.qgs
Revision: C
Date: 2019-03-22
Drawn: JDN

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 - Watercourses
 - Railways
 - 2D model boundary
- Roads**
- Highway
 - Arterial road
 - Collector road
 - Sub-arterial road
 - Local road (sealed)
 - Local road (unsealed)
- Flood hazard category**
- No hazard
 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

Town of Gawler, Light Regional Council, and Barossa Council

GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

1% AEP flood hazard long-term development scenario with mitigation

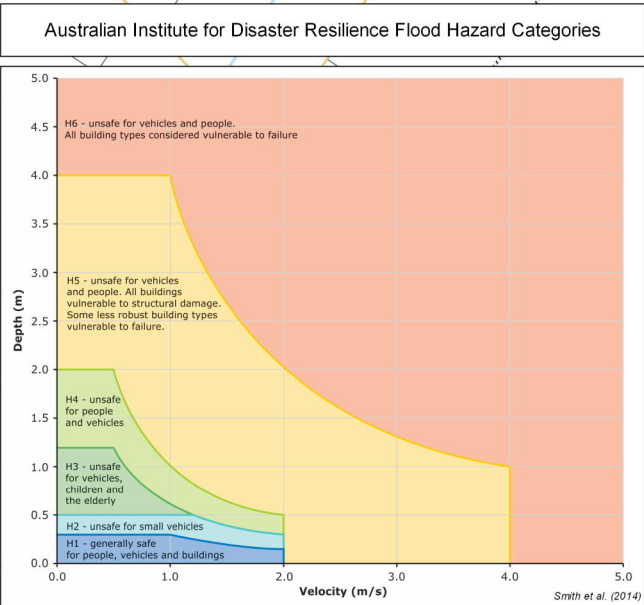
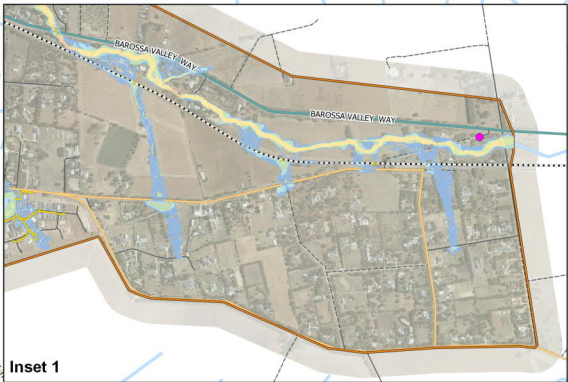
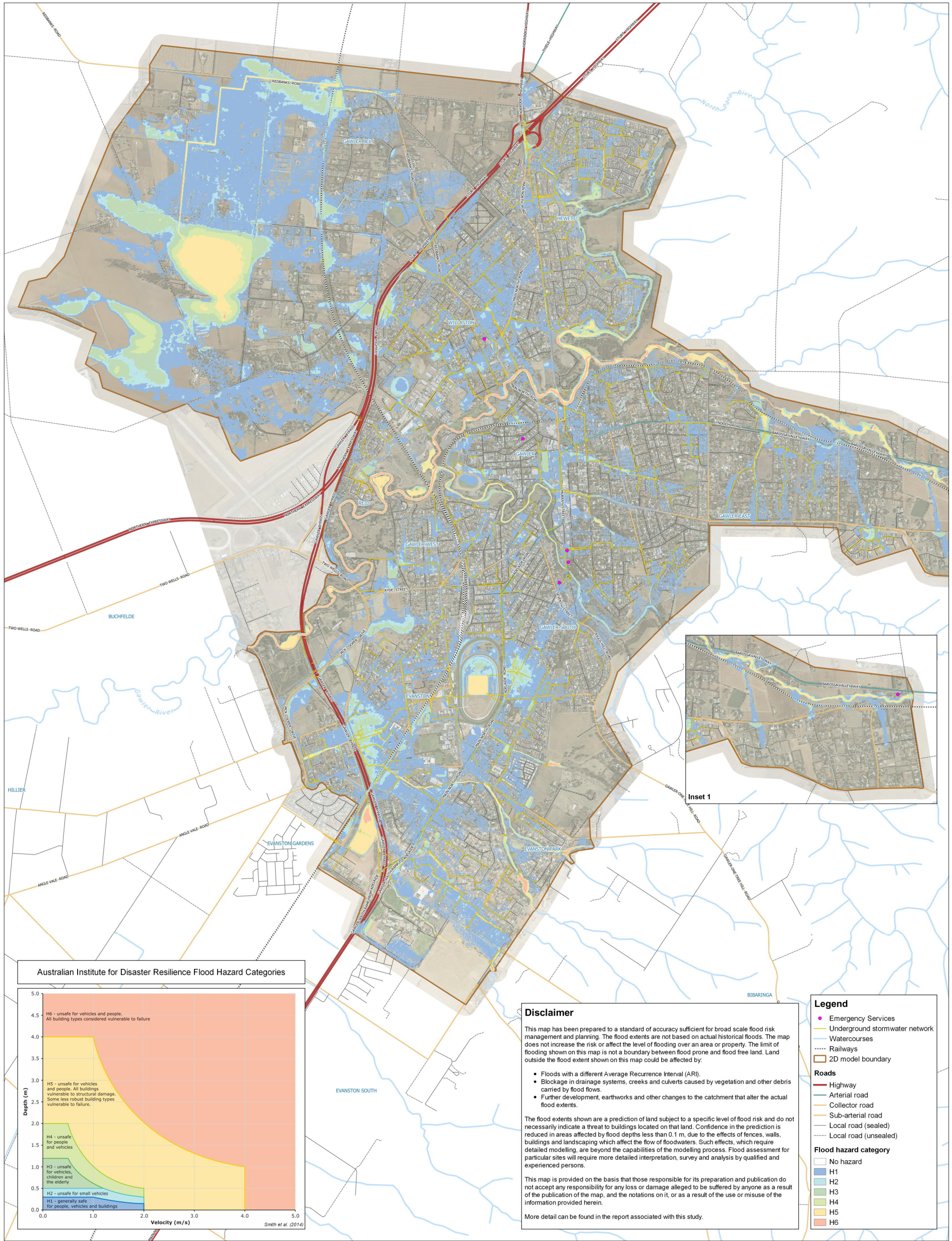
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Legend

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 - Underground stormwater network
 - Watercourses
 - Railways
 - 2D model boundary
- Roads**
- Highway
 - Arterial road
 - Collector road
 - Sub-arterial road
 - Local road (sealed)
 - Local road (unsealed)
- Flood hazard category**
- No hazard
 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

Town of Gawler, Light Regional Council, and Barossa Council

GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

0.2% AEP flood hazard long-term development scenario with mitigation

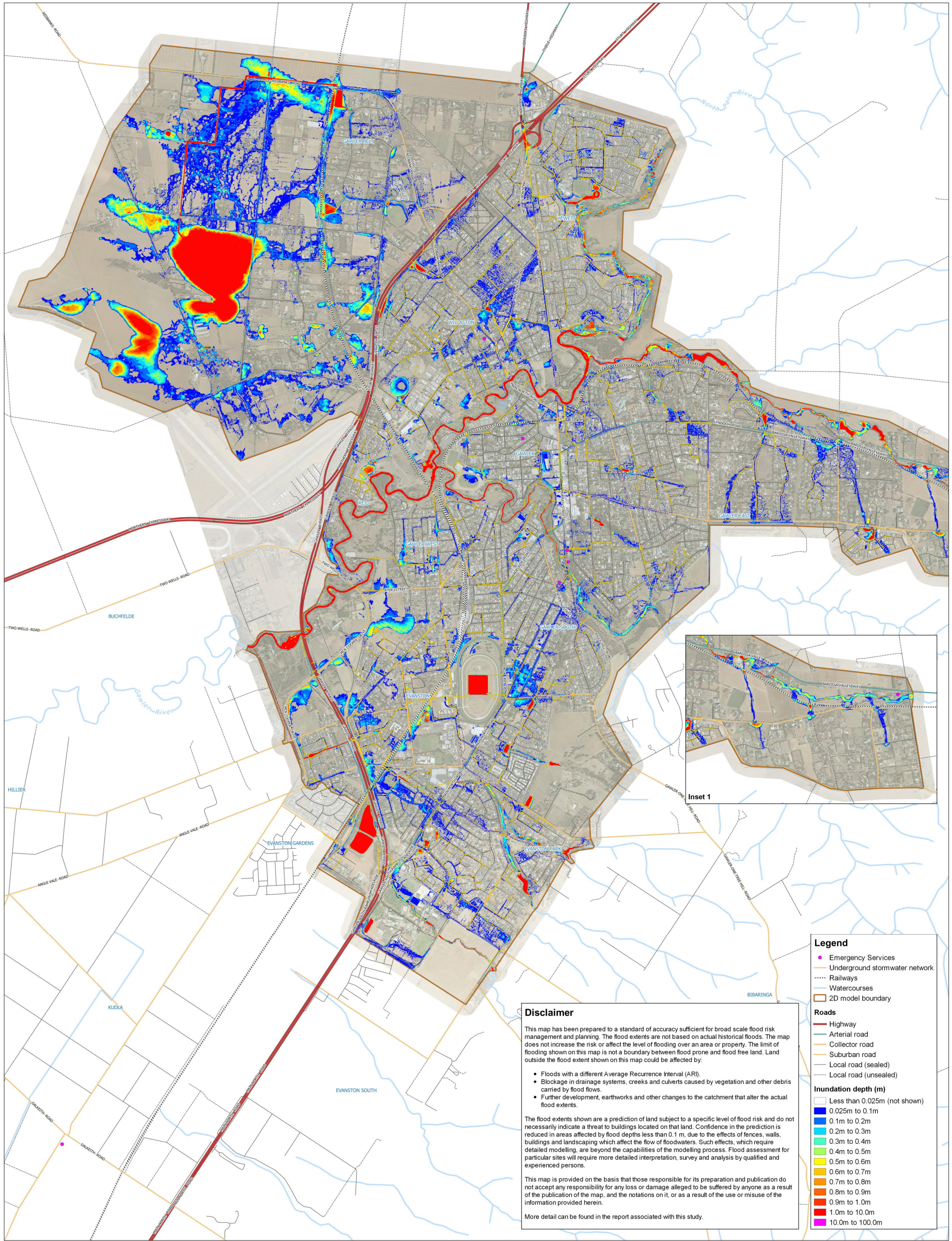
(on-site detention not included)



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Legend

- Emergency Services
- Underground stormwater network
- Railways
- Watercourses
- 2D model boundary

Roads

- Highway
- Arterial road
- Collector road
- Suburban road
- Local road (sealed)
- Local road (unsealed)

Inundation depth (m)

- Less than 0.025m (not shown)
- 0.025m to 0.1m
- 0.1m to 0.2m
- 0.2m to 0.3m
- 0.3m to 0.4m
- 0.4m to 0.5m
- 0.5m to 0.6m
- 0.6m to 0.7m
- 0.7m to 0.8m
- 0.8m to 0.9m
- 0.9m to 1.0m
- 1.0m to 10.0m
- 10.0m to 100.0m

Town of Gawler, Light Regional Council, and Barossa Council

GAWLER AND SURROUNDS STORMWATER MANAGEMENT PLAN

1% AEP flood depth long-term development scenario with mitigation and 2050 climate change (RCP 8.5)

(on-site detention not included)





Appendix G Flood damages data

Table G.1 *Number of flood damaged allotments*

AEP	Damage potential category	Existing	Long term	Management strategies
20%	Low	237	259	248
	Medium	37	38	38
	High	19	26	24
	Residential	48	96	65
5%	Low	332	359	326
	Medium	42	45	45
	High	35	44	38
	Residential	107	183	142
1%	Low	405	421	404
	Medium	48	49	49
	High	68	73	60
	Residential	323	472	302
0.2%	Low	543	548	528
	Medium	56	57	55
	High	128	129	114
	Residential	1467	1502	1351

Table G.2 Actual flood damages in million dollars for the existing scenario

		Annual Exceedance Probability			
	Flood Damage Category	20%	5%	1%	0.2%
Zone 1	Low	\$ 0.10	\$ 0.61	\$ 1.11	\$ 1.73
	Medium	\$ 0.18	\$ 0.24	\$ 0.55	\$ 1.45
	High	\$ 0.00	\$ 0.00	\$ 0.05	\$ 0.07
	Residential	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00
	Total	\$ 0.28	\$ 0.85	\$ 1.71	\$ 3.29
Zone 2	Low	\$ 0.02	\$ 0.03	\$ 0.04	\$ 0.07
	Medium	\$ 0.00	\$ 0.01	\$ 0.04	\$ 0.16
	High	\$ 0.02	\$ 0.07	\$ 0.23	\$ 0.38
	Residential	\$ 0.00	\$ 0.00	\$ 0.07	\$ 0.39
	Total	\$ 0.04	\$ 0.11	\$ 0.39	\$ 0.99
Zone 3	Low	\$ 0.04	\$ 0.07	\$ 0.18	\$ 0.33
	Medium	\$ 0.03	\$ 0.04	\$ 0.09	\$ 0.47
	High	\$ 0.22	\$ 0.25	\$ 0.48	\$ 4.01
	Residential	\$ 0.04	\$ 0.21	\$ 1.22	\$ 5.57
	Total	\$ 0.33	\$ 0.57	\$ 1.97	\$ 10.39
Zone 4	Low	\$ 0.01	\$ 0.02	\$ 0.04	\$ 0.08
	Medium	\$ 0.09	\$ 0.12	\$ 0.38	\$ 1.51
	High	\$ 0.31	\$ 0.57	\$ 0.88	\$ 4.04
	Residential	\$ 0.00	\$ 0.00	\$ 0.04	\$ 0.70
	Total	\$ 0.41	\$ 0.71	\$ 1.34	\$ 6.33
Zone 5	Low	\$ 0.01	\$ 0.01	\$ 0.02	\$ 0.06
	Medium	\$ 0.13	\$ 0.17	\$ 0.46	\$ 0.84
	High	\$ 0.00	\$ 0.00	\$ 0.01	\$ 0.12
	Residential	\$ 0.00	\$ 0.01	\$ 0.05	\$ 1.40
	Total	\$ 0.14	\$ 0.20	\$ 0.54	\$ 2.42
Zone 6	Low	\$ 0.10	\$ 0.23	\$ 0.32	\$ 0.54
	Medium	\$ 0.03	\$ 0.06	\$ 0.24	\$ 0.36
	High	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00
	Residential	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00
	Total	\$ 0.13	\$ 0.29	\$ 0.55	\$ 0.91
Zone 7	Low	\$ 0.03	\$ 0.06	\$ 0.15	\$ 0.51
	Medium	\$ 0.02	\$ 0.03	\$ 0.06	\$ 0.17
	High	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.03
	Residential	\$ 0.04	\$ 0.04	\$ 0.15	\$ 1.64
	Total	\$ 0.09	\$ 0.13	\$ 0.37	\$ 2.35
Zone 8	Low	\$ 0.02	\$ 0.03	\$ 0.15	\$ 0.53
	Medium	\$ 0.08	\$ 0.15	\$ 0.35	\$ 0.69
	High	\$ 0.00	\$ 0.12	\$ 0.39	\$ 2.93
	Residential	\$ 0.03	\$ 0.07	\$ 0.97	\$ 11.16
	Total	\$ 0.13	\$ 0.37	\$ 1.85	\$ 15.31
Zone 9	Low	\$ 0.03	\$ 0.05	\$ 0.12	\$ 0.33
	Medium	\$ 0.14	\$ 0.35	\$ 0.75	\$ 1.84
	High	\$ 0.15	\$ 0.31	\$ 0.47	\$ 4.15
	Residential	\$ 0.04	\$ 0.17	\$ 0.81	\$ 7.09
	Total	\$ 0.36	\$ 0.89	\$ 2.15	\$ 13.41
Grand Total		\$ 1.90	\$ 4.12	\$ 10.86	\$ 55.41

Table G.3 Actual flood damages in million dollars for the long term scenario

Flood Damage Category		Annual Exceedance Probability			
		20%	5%	1%	0.2%
Zone 1	Low	\$ 0.11	\$ 0.65	\$ 1.15	\$ 1.73
	Medium	\$ 0.18	\$ 0.25	\$ 0.59	\$ 1.45
	High	\$ 0.00	\$ 0.00	\$ 0.05	\$ 0.07
	Residential	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00
	Total	\$ 0.29	\$ 0.90	\$ 1.79	\$ 3.29
Zone 2	Low	\$ 0.02	\$ 0.03	\$ 0.04	\$ 0.07
	Medium	\$ 0.00	\$ 0.01	\$ 0.05	\$ 0.16
	High	\$ 0.07	\$ 0.14	\$ 0.25	\$ 0.39
	Residential	\$ 0.00	\$ 0.00	\$ 0.11	\$ 0.39
	Total	\$ 0.10	\$ 0.18	\$ 0.45	\$ 1.01
Zone 3	Low	\$ 0.04	\$ 0.09	\$ 0.19	\$ 0.34
	Medium	\$ 0.03	\$ 0.05	\$ 0.12	\$ 0.51
	High	\$ 0.22	\$ 0.25	\$ 0.53	\$ 4.64
	Residential	\$ 0.21	\$ 0.51	\$ 2.01	\$ 5.92
	Total	\$ 0.50	\$ 0.91	\$ 2.85	\$ 11.41
Zone 4	Low	\$ 0.01	\$ 0.02	\$ 0.04	\$ 0.09
	Medium	\$ 0.09	\$ 0.13	\$ 0.40	\$ 1.52
	High	\$ 0.33	\$ 0.58	\$ 0.90	\$ 4.06
	Residential	\$ 0.00	\$ 0.00	\$ 0.11	\$ 0.71
	Total	\$ 0.43	\$ 0.74	\$ 1.44	\$ 6.37
Zone 5	Low	\$ 0.01	\$ 0.02	\$ 0.02	\$ 0.06
	Medium	\$ 0.14	\$ 0.25	\$ 0.49	\$ 0.85
	High	\$ 0.00	\$ 0.00	\$ 0.01	\$ 0.12
	Residential	\$ 0.01	\$ 0.01	\$ 0.19	\$ 1.47
	Total	\$ 0.16	\$ 0.28	\$ 0.71	\$ 2.50
Zone 6	Low	\$ 0.10	\$ 0.24	\$ 0.33	\$ 0.54
	Medium	\$ 0.03	\$ 0.06	\$ 0.24	\$ 0.36
	High	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00
	Residential	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00
	Total	\$ 0.14	\$ 0.30	\$ 0.57	\$ 0.91
Zone 7	Low	\$ 0.06	\$ 0.10	\$ 0.21	\$ 0.55
	Medium	\$ 0.02	\$ 0.04	\$ 0.07	\$ 0.18
	High	\$ 0.00	\$ 0.00	\$ 0.01	\$ 0.03
	Residential	\$ 0.04	\$ 0.04	\$ 0.19	\$ 1.71
	Total	\$ 0.12	\$ 0.18	\$ 0.47	\$ 2.46
Zone 8	Low	\$ 0.05	\$ 0.10	\$ 0.21	\$ 0.57
	Medium	\$ 0.09	\$ 0.19	\$ 0.37	\$ 0.79
	High	\$ 0.12	\$ 0.29	\$ 1.02	\$ 3.03
	Residential	\$ 0.25	\$ 0.85	\$ 3.15	\$ 11.62
	Total	\$ 0.51	\$ 1.42	\$ 4.75	\$ 16.01
Zone 9	Low	\$ 0.04	\$ 0.06	\$ 0.13	\$ 0.33
	Medium	\$ 0.20	\$ 0.46	\$ 0.96	\$ 1.91
	High	\$ 0.17	\$ 0.34	\$ 0.49	\$ 4.17
	Residential	\$ 0.04	\$ 0.23	\$ 0.94	\$ 7.10
	Total	\$ 0.44	\$ 1.09	\$ 2.52	\$ 13.51
Grand Total		\$ 2.68	\$ 6.00	\$ 15.55	\$ 57.47

Table G.4 Actual flood damages in million dollars for the management strategies scenario

		Annual Exceedance Probability			
	Flood Damage Category	20%	5%	1%	0.2%
Zone 1	Low	\$ 0.10	\$ 0.36	\$ 0.89	\$ 1.52
	Medium	\$ 0.18	\$ 0.26	\$ 0.68	\$ 1.47
	High	\$ 0.00	\$ 0.00	\$ 0.05	\$ 0.07
	Residential	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00
	Total	\$ 0.28	\$ 0.62	\$ 1.61	\$ 3.10
Zone 2	Low	\$ 0.02	\$ 0.03	\$ 0.04	\$ 0.07
	Medium	\$ 0.00	\$ 0.01	\$ 0.05	\$ 0.16
	High	\$ 0.07	\$ 0.14	\$ 0.25	\$ 0.39
	Residential	\$ 0.00	\$ 0.00	\$ 0.11	\$ 0.39
	Total	\$ 0.10	\$ 0.18	\$ 0.45	\$ 1.01
Zone 3	Low	\$ 0.04	\$ 0.06	\$ 0.15	\$ 0.32
	Medium	\$ 0.03	\$ 0.05	\$ 0.11	\$ 0.36
	High	\$ 0.22	\$ 0.25	\$ 0.35	\$ 1.09
	Residential	\$ 0.04	\$ 0.18	\$ 0.82	\$ 4.60
	Total	\$ 0.32	\$ 0.54	\$ 1.42	\$ 6.37
Zone 4	Low	\$ 0.01	\$ 0.02	\$ 0.04	\$ 0.09
	Medium	\$ 0.09	\$ 0.13	\$ 0.40	\$ 1.52
	High	\$ 0.33	\$ 0.58	\$ 0.90	\$ 4.06
	Residential	\$ 0.00	\$ 0.00	\$ 0.11	\$ 0.71
	Total	\$ 0.43	\$ 0.74	\$ 1.44	\$ 6.37
Zone 5	Low	\$ 0.01	\$ 0.02	\$ 0.02	\$ 0.06
	Medium	\$ 0.14	\$ 0.25	\$ 0.49	\$ 0.85
	High	\$ 0.00	\$ 0.00	\$ 0.01	\$ 0.12
	Residential	\$ 0.01	\$ 0.01	\$ 0.19	\$ 1.47
	Total	\$ 0.16	\$ 0.28	\$ 0.71	\$ 2.50
Zone 6	Low	\$ 0.10	\$ 0.24	\$ 0.33	\$ 0.54
	Medium	\$ 0.03	\$ 0.06	\$ 0.24	\$ 0.36
	High	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00
	Residential	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00
	Total	\$ 0.14	\$ 0.30	\$ 0.57	\$ 0.91
Zone 7	Low	\$ 0.06	\$ 0.10	\$ 0.22	\$ 0.43
	Medium	\$ 0.02	\$ 0.04	\$ 0.07	\$ 0.17
	High	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.03
	Residential	\$ 0.04	\$ 0.04	\$ 0.19	\$ 1.70
	Total	\$ 0.12	\$ 0.18	\$ 0.47	\$ 2.34
Zone 8	Low	\$ 0.04	\$ 0.09	\$ 0.16	\$ 0.74
	Medium	\$ 0.09	\$ 0.18	\$ 0.36	\$ 0.65
	High	\$ 0.00	\$ 0.28	\$ 0.40	\$ 2.48
	Residential	\$ 0.07	\$ 0.53	\$ 1.09	\$ 7.87
	Total	\$ 0.21	\$ 1.08	\$ 2.01	\$ 11.73
Zone 9	Low	\$ 0.04	\$ 0.06	\$ 0.09	\$ 0.31
	Medium	\$ 0.20	\$ 0.34	\$ 0.60	\$ 1.53
	High	\$ 0.17	\$ 0.28	\$ 0.36	\$ 2.41
	Residential	\$ 0.04	\$ 0.23	\$ 0.46	\$ 6.11
	Total	\$ 0.44	\$ 0.91	\$ 1.51	\$ 10.37
Grand Total		\$ 2.19	\$ 4.83	\$ 10.19	\$ 44.69



Appendix H Consultation summary

Gawler and Surrounds Stormwater Management Plan

MINUTES OF MEETING

Key Stakeholders Workshop and Discussion

Date / Time:	TUESDAY 08 TH OF DECEMBER 2015	2.00pm-4.30pm
Location:	Gawler Sports and Community Centre	
Attendees:	Cr Keith Cowley, Barry Rolton, Scott Reid – Town of Gawler	
	Steven Kaesler, Barossa Council	
	Cr Adrian Shackley - Gawler Urban Rivers Biodiversity Working Group (GURBWG)	
	Ruth Ward - EPA	
	Scott Combridge - Gawler Community Services Forum	
	Graham Brookman - Gawler Regional Natural Resource Centre	
	Philip Humphrey - Community Alliance	
	Anne Highet, Borvin Kracman - Concordia Land	
	Tim Kerby – Tonkin Consulting	
	Melissa Bailey, Justin Clisby – Jensen Planning + Design	
Apologies:	Damien Collins – Lend Lease	

KEY OUTCOMES

1	Stormwater management is a cross-Council issue
	<ul style="list-style-type: none"> - A coordinated and collaborative approach that identifies shared issues and responsibilities is needed - Agreement between relevant parties is required upfront before implementation - Legislation and enforcement are more effective rather than guidelines and best practice - Downstream impacts need careful consideration
2	A Stormwater Management Plan needs to provide a robust framework that recognises the urgency and articulates the benefits of effective stormwater management
3	Projects should provide multiple benefits at multiple levels – adding value
	<ul style="list-style-type: none"> - Integrating stormwater retention with quality design to create places for recreation and enjoyment - A smaller number of large projects is preferred over a larger number of smaller projects from a management perspective - Preference for low maintenance landscaping using native species local to the area
4	Flood mitigation measures are paramount given the social, economic and environmental costs associated with flooding
	<ul style="list-style-type: none"> - Historical data on flooding in the Gawler region required for information and analysis - Designing for the 1 in 100 year flood event may not be conservative enough given the likelihood of an increase in the severity of storms brought on by climate change, (for example, the Barossa Valley has experienced 3 major flood events in the past 30 years) - An integrated approach is required when considering stormwater management and bush fire management, recognising the increased risk of flooding in the aftermath of a major fire - The need for greater control in preventing development from occurring in flood prone areas - Downstream risks to be considered and minimised

COMMUNITY, ENVIRONMENTAL AND ECONOMIC BENEFITS OF A ROBUST AND SUSTAINABLE STORMWATER MANAGEMENT PLAN

Community: Stormwater management is a cross-Council issue

- Improved green space and recreational space
- Mitigate flood risk to urban areas and farmland
- Health benefits – encouraging active lifestyles (improved physical health), improved well-being (improved mental health), more places to gather (improved social connections)
- Food security – at domestic and commercial scales

Environmental: Stormwater management is a cross-Council issue

- Improved water and waterways quality
- Interventions that mimic the natural hydrological system will be most effective
- Extensive tree planting and other landscaping will help to reduce higher temperatures brought on by climate change (providing a more comfortable temperature and pleasant environment) and aid carbon sequestration - reduce impact of 'heat island effect'
- Downstream benefits – slow the destruction of sea grasses. Downstream water quality is actually getting worse – a trend that needs to be reversed
- Waterways are ephemeral and provide limited year round habitat
- Creating 'green corridors' that support biodiversity by providing habitat and passage for movement for animals as well as connected green space for pedestrians and cyclists

Economic: Stormwater management is a cross-Council issue

- Supporting and creating employment growth in the food industry
- Capture and use of stormwater in public parks will reduce demand on mains supply resulting in cost savings
- Improved environment will encourage more tourism, strengthening the status of Gawler as a 'cycling hub'
- Improved environments will make new residential development (e.g. Concordia) more attractive to prospective residents and investors
- A well-considered stormwater management plan is critical to securing government funding for projects
- Maintaining the existing ageing stormwater disposal system represents a significant ongoing cost to council (and ratepayers). Could the existing infrastructure be reconfigured to incorporate a greater degree of local stormwater management?

OTHER KEY POINTS OF DISCUSSION

1 Waste water reuse

- Impacts stormwater management by reducing demand on mains water (e.g. Mount Barker)
- Current proposed wastewater reuse system for Gawler (currently all waste water discharged via SA Water sewer with future Concordia to duplicate sewer infrastructure to Bolivar)
- Concordia considering local waste water management and reuse system

2 Education

- Getting local schools involved in stormwater projects and enabling young people to take ownership of Gawler's water future is important
- Build on the momentum of general attitude and behavioural change regarding water use and conservation - reduced water use, water sensitive gardens using native species, stormwater stencils on drain covers have been low cost and effective.

PROJECT OPTIONS / STORMWATER SOLUTIONS

	OPPORTUNITIES	CHALLENGES	OBSERVATIONS/COMMENTS
AQUIFER RECHARGE	<ul style="list-style-type: none"> • Reduces pressure on existing infrastructure • Retains water as a valuable resource • Aids with flood mitigation • Learn from Salisbury's success 	<ul style="list-style-type: none"> • Dependent on local geology • High upfront costs • Private sector 'buy-in' • Re-draw from aquifer not always possible 	<ul style="list-style-type: none"> • Gawler feeds the 'T2' aquifer • Opportunities for research to better understand the 'Q4' aquifer • Current system does not allow for water to be re-drawn from aquifer (geological constraints) and creates an unsafe surface to walk on in the drier months
SURFACE RETENTION	<ul style="list-style-type: none"> • Reduced pressure on existing infrastructure • Retains water as a valuable resource for use • Aids with flood mitigation • Provides habitat and promotes biodiversity • Revegetation with native plant species • Used to create green space for public enjoyment and promotes active, healthy lifestyles 	<ul style="list-style-type: none"> • Creek banks are steep • Undulating topography requires unique and innovative solutions • High upfront costs • Minimising evaporation • On-going maintenance • Private sector 'buy-in' 	<ul style="list-style-type: none"> • Gawler Racecourse a possible site • Low maintenance, low water dependent native landscaping preferred • Small number of large sites rather than a large number of small sites considered easier to manage
ON-SITE CAPTURE & STORAGE	<ul style="list-style-type: none"> • Reduced pressure on existing infrastructure • Aids with flood mitigation • Commercial and industrial sites with large site areas and roof areas • Builds on public awareness regarding water scarcity and conservation • Low cost solution 	<ul style="list-style-type: none"> • Space requirements • High cost at the domestic level • Residents and businesses may need incentives to install storage tanks 	<ul style="list-style-type: none"> • Commercial and industrial sites produce large amounts of run-off that could be captured, stored and reused
ON-SITE SOAKAGE	<ul style="list-style-type: none"> • Reduced pressure on existing infrastructure • Recharges ground water • Aids with flood mitigation • Low cost solution 	<ul style="list-style-type: none"> • Generally small scale, low impact • Ponding and localised flooding may occur without careful consideration to design 	

Gawler and Surrounds Stormwater Management Plan _ Stakeholder workshop meeting notes

7 June 2018

Attendees

Organisation	Person
Rachel Murchland	DEWNR / NRM
Philip Humphrey	Gawler Community Forum
David Hitchcock	Gawler River Floodplain Management Authority
Cr Paul Koch	Town of Gawler
Cr Adrian Shackley	Town of Gawler
Ruch Ward	EPA
Richard Dodson	Light Regional Council
Corey	SES
David Pedler	Gawler Urban rivers Biodiversity Working Group
Clayton	SES
Graham Brookes	Food Forrest
Keith Cowley	Gawler Urban rivers Biodiversity Working Group
Anthony Andolfatto	Springwood
Grant Howley	Town of Gawler
Stephen Rossier	Trinity College
Shane	Depot, Town of Gawler
Peter Young	Town of Gawler
Sam Dillon	Town of Gawler
Steve Kaesler	Barossa Council
Gary	SA Police
Bill Zhang	Light Regional Council
Martin Fitch	DPTI
David P	Town of Gawler
David	Town of Gawler
Tim Kerby	Tonkin Consulting
Olivia Oliver	Tonkin Consulting
Jason	Tonkin Consulting
Michael McKeown	Jensen PLUS
David Barone	Jensen PLUS

Questions Following Tim Kerby's presentation

1. Cr Adrian Shackley – The DPA for Roseworthy includes construction of a 1 metre diameter pipeline from Roseworthy into the Gawler Belt Area. Has this been considered in the modelling and have opportunities up catchment (in Roseworthy also been considered?

Answer: Tonkin will check this pipe, however it is not likely to be in the study area.

2. Bill Zhang – With the site suggestions provided, have all stormwater management options been considered or just the most cost effective?

Answer: DRAINS modelling has been completed on various options, however the mitigation options proposed and presented are considered the most beneficial to reduce flooding.

3. David Hitchcock – Will the magnitude of stormwater modelled from the catchments have an impact on flooding in the Gawler River downstream?

It is likely that the impact will not be significant due to the difference in the timing of peak flows between the Gawler River system and the local catchments of Gawler. Tonkin will consider and potentially include reference in the SMP.

4. Sam Dilella - What is the expected impact of climate change and have other Stormwater Management Plans for surrounding catchments included this in their modelling?

Answer: The changes in land use planning likely to have more of an impact on flooding scenario than climate change, but collectively then yes that would increase flooding potential and extent. The modelling can potentially include scenarios around climate change impacts, however this was not part of the brief provided by Council, - potentially can be included prior to further consultation.

5. Cr Adrian Shackley – Flooding seems to occur more frequently in Gawler than the 1 in 100 year event.

Answer: The 1%AEP mapping is the currently commonly accepted standard for larger scale events. As they are an average, the events can occur frequently in quick succession and then not for a long time and it is impossible to forecast. Other mapping scales (20%AEP and 5%AEP) provide guidance for other more frequent events.

6. Ruth Ward – Water quality is an important consideration in flood mitigation. Has it been integrated into the modelling and consideration of the preferred mitigation measures?

Answer: Multi-criteria analysis was undertaken to select the option with qualitative criteria included in the scoring. Tonkin will consider included a recommendation around water quality in Council's future development strategies.

7. Keith Cowley - The original watercourse assessment in Gawler East does not provide a reliable assessment of biodiversity / native grasses in the area. Is reference made to the Biodiversity Management Plan from the SMP in this regard? Will future upgrades / mitigation measures take this into account?

Answer: The SMP includes an erosion potential assessment based on observations made for various sections of the river, however the SMP will be updated to reflect the Town of Gawler Biodiversity Management Plan for specific guidance on biodiversity outcomes for these watercourses.

Summary of Discussion from table activity

1. Which proposed mitigation options will provide the most positive benefit? Why?

- Education – good cost benefit
- Raingardens – also provide amenity
- Gawler East Flower paths
- Rainwater tank subsidies / promotion
- Retain water on site
- ASR schemes
- Racecourse basin – safety / emergency access to Gawler important for emergency services during a flood event, proximity to Main North road, extent of private property inundation, wetland provides opportunity to increase use of space, integrate with re-use to the south, reduces flooding upstream and downstream significantly **(x4)**
- Jarvis Street system – depth and extent of private property affected **(x2)**
- Tingara basin
- Trinity College – hazard and flows through houses **(x2)**
- Roseworthy plans

2. Can you identify any gaps, expansion opportunities, or alternative solutions (eg different designs or locations)?

- ASR schemes
- Challenge the Water Allocation Plan – re-assess options to harvest more water
- Using racecourse wetlands as an education program
- Tingara Basin to move further upstream and split into two basins – also consider other options **(x2)**
- Funding frameworks and sources – state and federal sources – not enough available, ‘Green bonds’ – funding for green infrastructure projects **(x2)**
- Identify current versus future problems
- Political pressure governs outcomes – this needs to be recognised
- Realign drainage at Evanston Oval to re-route around – storage and water quality opportunities **(x2)**
- Identifying other raingarden opportunities
- Simpler WSUD options rather than inline / on road solutions (what are other end of line swale options)
- Gawler East flow path – focus on natural channel with biodiversity
- Trinity native vegetation, storage / diversion opportunities
- Provision of large scale detention/retention basin in north
- River restoration work – South Para, North Para – removal of fallen trees etc
- Interface with Smith Creek study
- Climate change

3. Which of the mitigation options should be the highest priority?

- Racecourse basin – access to Gawler a consideration, proximity to Main North road, extent of private property inundation, wetland provides opportunity to increase use of space – examine also financial opportunities **(x3)**
- Jarvis Street system – depth and extent of private property affected **(x2)**
- Tingara / Trinity Oval



- Those that impact zones 8 and 9 – due to population density and emergency access impacts
- First Street

4. What else should be considered by the draft plan?

- Level of control over infill development run-off (% coverage in SMP)
- How is flood data being considered in planning context (liability)
- Flood mitigation options seem to provide little improvement to long term outcome vs existing
- External funding opportunities (SMA, DEWNR, Feds etc) **(x2)**
- Climate change impacts **(x2)**
- Integration with asset management / planning
- Reference to other regional SMPs – integrate / align
- Partnership opportunities for Council, developers and state agencies
- Reference to Biodiversity Plan
- Reference to Gawler River Flooding / flood model and considerations (AWE TufLOW)
- Water quality – WSUD – consider policy for any new or upgrade of infrastructure – integrating water quality with water management and asset management
- Open space opportunities
- Roseworthy plans

Additional Notations and mark ups on plans

- Fig 5.4 Tingara Road Flood Basin – Evanston Park basin may need concrete spillway; inherent risk of failing when full?
- Fig 5.5 – Proposed Trinity College Upgrades – need more holistic upgrade including WSUD, nature play, retention of trees for area adjacent to and south of oval? Can stormwater be sent to u/g drainage or storage? Culvert area next to oval is high native veg. biodiversity area
- Fig 5.6 Jarvis St Upgrades- consider blocking off Holmes St flow to Jarvis St and diverting down Panter Street; low spot around intersection of Jarvis and Panter Sts; divert water straight down Bywaters Ave to Holmes St
- Fig 5.7 – Gawler East Flow path Improvements – opportunities to focus on erosion/water quality issues south of balmoral Road, checking dams, billabongs on private properties, seek easements; also consider billabongs/basins for flows north from Galton Road to area around Barossa valley Way; some flooding occurs in vicinity of Sunnydale Ave/Barossa Valley Way
- Map 11 - 1% AEP flood depth long term dev scenario – can area in Willaston adjacent to NExy be drained into NExy swales, through sound mounds?
- Fig 5.8 – Potts Road Detention Basin – make it into wetlands, extend area?
- Fig. 5.9 - Gawler Belt Railway Culvert – consider basin to minimise channel width west of Atyeo Road/ rail easement
- Fig 5.10 – Gawler Belt Interception drain alignment – suggested basin locations either side of Redbanks Road south of Krieg Road to minimise channel widths?
- Fig 5.12 – Evanston Oval parallel pipe upgrade – is the Oval meant to act as a basin because of single pipe?

Gawler and Surrounds Stormwater Management Plan _ Elected Member Workshop #2

29 January 2019

Notes from discussion and questions

- The SMP does not appear to reference some forms of legislation of relevance, such as the NRM Act, Native Vegetation Act, Development Act/PDI Act and the EPBC Act
 - Noted there are components of activities that influence stormwater management that need to run through or are influenced by the suggested acts, but those acts alone do not warrant the need to prepare a Stormwater Management Plan. We can address how they interact with Stormwater Management

Action: Briefly address how the above Acts interact with Stormwater Management measures and requirements.

- What is Council's liability once the Stormwater Management Plan is finalised and actions are identified but not yet implemented?
 - The Stormwater Management Plan identifies the issues and suggested actions. It is recognised that not all actions can be completed at once and that there will be priorities. As long as priorities are identified and rational in their determination, and Council adequately plans for and progressively budgeted and programs the works, then liability is unlikely to fall on Council in the event of damages from an event.
- Did WSUD and raingardens rank highly in the stakeholder engagement workshop. Grants in Kapunda to complete works.
 - Water Quality through WSUD was identified as an important part of stormwater management, although specific WSUD treatments will need to be site and circumstance specific. Raingardens are only suitable where land is flat and there is room to accommodate them. They also have ongoing maintenance resourcing implications for Council and so need to be balanced with other catchment level approaches to managing water quality and improving amenity.
- It is important to have stormwater infrastructure upfront as part of development. Do developers have to contribute to stormwater drainage?
 - Agreed and this is an essential component of assessing new developments such as greenfield and brownfield sites where a coordinated approach can and should be adopted. There is sufficient policy coverage and the planning system allows for the contribution by developers to this where it is on site. Beyond the site requires a Deed of Agreement between council and the developer which is typically negotiated outside of the planning system, but concurrently with either rezoning or development applications.
 - New Basic and Special Infrastructure Schemes within the new Planning, Development and Infrastructure Act do provide some additional flexibility for the management and equalisation of these costs to those who will benefit more broadly to the development outcomes.
 - For individual dwelling sites / minor infill, developers contribute to stormwater management through their detention responsibilities (ie rainwater tanks, oversized pipes, basins etc).
- How was the change in impervious areas surfaces determined? It seems there will be increase in development in most places



- Darker blue locations represent the areas of biggest change and are the areas currently vacant to be developed for urban growth – eg Gawler East
- Other areas still show growth in imperviousness due to infill development, as well as trends for larger dwellings, dwelling additions, changes in surface treatments which result in more paved areas
- The assumptions about imperviousness increases are based on worst case development scenarios (ie sites developed to their full potential and complete development across zoned urban areas)
- Roseworthy development has potential to significantly increase flood potential in catchment. How is that development being managed / has this been taken into consideration?
 - Roseworthy is outside of the study area. It has been assumed that all stormwater flows from the Roseworthy development area will be accommodated to match pre-development flows – and be managed on site.

Action: Stormwater Management Plan to document assumptions around Roseworthy and Concordia developments managing flows to pre-development flows on their own sites and identify risk should this not occur.

- The Gawler College has a wetland system not far from the Gawler Racecourse. Has this been considered and is there capacity to use this as well? This and the MAR scheme need to be referenced in the SMP.
 - This wetland is not Council infrastructure and Tonkin were given direction to not assess it. It was noted that it is likely to be at capacity based on treating the school catchment and would not be large enough to take the catchment to the east of the racecourse.
- The Tingara Road basin option would potentially impact on Native Vegetation and there may also be culturally significant sites. There does not appear to be any mention / consideration of this in the assessment. There may be scope to also consider future road connection link (Tiver Road) as part of any design solution?
 - Noted. The options presented are only high-level solutions identified and would need to be subject to further scoping and design development to address these issues. Variations of the design may be considered here, such as two separate upstream basins, however this is likely to be less cost effective. Other considerations of road connections can be investigated separately as part of the scheme's further development.
- Trinity College channel widening would need to consider vegetation implications
 - Agree. This is something that would require further consideration and discussion with the College and a strategy formed as part of concept design.
- Jarvis Street Drain Upgrade has the potential to seek to install water quality devices as well as pipe upgrade (i.e. this has potential for WSUD raingardens to be added to the future detailed design of the trunk drainage system).
 - Agree and noted.
- Potts Road Basin needs to have a regional approach to stormwater management with the future development of this location of Gawler East. The SMP should consider how best to achieve this within existing / future planning systems.
 - Agree. There is limited scope to enforce this given fragmented nature of land ownership, however a structure plan in the Development Plan could assist in providing policy support, along with potential limitations on the development of certain land parcels until agreements are in place for the provision of the basin (noting that this requires any land owners / future developers to agree to this)
 - Mt Barker has adopted a charging system for infrastructure under the Local Government Act (as an additional charge to rates for specific properties), but there may be better options under the new Planning System's Infrastructure Schemes to achieve this.

- Council needs to have a strategy about how best to achieve this outcome – this may include purchasing the land from DPTI.

Action: Provide some additional commentary on planning options for this basin within the SMP

- Can Council refuse maximum site cover for new development that is inconsistent with the new Code?
 - If the site coverage is a deemed-to-satisfy provision within the new Code, then no they can't. The new Code is still being drafted, so there is uncertainty around how this will be specifically addressed. However, the existing Residential Code (complying) provisions within the legislation allow for 60% site coverage for new residential development and it is expected that this would be translated across into the new code.
 - Further consultation on the Code is likely to occur later in 2019 and there will be an opportunity to address this issue (along with others) as part of Council's feedback.
 - It is likely that those locations that are able to be mapped as being subject to flooding would be exempt from the Deemed-to-satisfy provisions and require a performance assessment (but this does not apply more broadly).
- Are we enforcing rainwater tanks for new development at the moment?
 - Yes there is a mandated 1kL plumbed rainwater tank requirements under the Building Code, but this generally cannot be counted as contributing to flow reductions (as tanks could be full). Council also has a requirement for 3kL tank for new development be installed to address detention of stormwater.
 - The Development Plan does have policies which call for water retention and management to avoid downstream flows and all Councils in Adelaide translate this to achieving pre-development flows. For land divisions and larger scale developments, this is more readily enforced through land division requirements and more holistically approached, but tanks are relied upon for small scale 1 in 2 type developments.
- Federal parties are establishing policies for next election and the Labor party has announced \$200 million for watercourse protection.
 - Noted and this points to need to finalise the SMP as quickly as possible so that there is a clear strategy for seeking funding for projects to tap into this available money.
 - Question appropriateness of coverage of this in SMP as it is only an election promise at this point in time.
- Most ovals appear to be subject to flooding – is this a design issue with our ovals?
 - Unsure if specific design issues. Ovals are flat by their nature and so are likely to be subject to shallow sheeting of water over the surface. This is not necessarily a problem and is preferable than provide housing and commercial and industrial developments.
 - There is potential to utilise the Trinity site or to pursue small scale investigations to localised flooding around the township, which the SMP maps will assist with identification of. The SMP will focus on the higher priority works, however there will definitely be smaller scale works to investigate further that the maps being produced will show.
- There are big opportunities for water harvesting in the catchment. The southern urban areas are an example of this (despite being outside of the catchment). There needs to be a bigger focus on the opportunities for this in the SMP.
 - Noted. The ability to undertake this is limited by the existing Water Allocation Plan, as well as limitations in available locations to do it as large areas are required to store and treat the water. The Gawler Racecourse is the only real viable location to do this within the catchment. This is also costly and unless cost effective for someone like the Jockey Club (through reduced water costs – ie cheaper than mains water), unlikely to be viable generally.

Action: Provide more coverage of the issues surrounding water harvesting (and in particular limitations) within the SMP

Gawler and Surrounds Stormwater Management Plan _ Light Regional Council Elected Member Workshop #2

13 February 2019

Notes from discussion and questions

- There needs to be clarity on who is notified directly about the stormwater management plan, particularly those who are directly affected and the logistics of doing this.
- Ideally all of those properties identified as being subject to flooding should in the very least be directly notified and invited to comment. This has been done with other Councils and in the majority of cases has not resulted in panic from the public (as residents are likely to already know the flood potential of their properties)

Action: The consultation of the Stormwater Management Plan should consider how best to distribute information about the flood potential and other mitigation measures. Aside from letters to those directly affected, this will include use of social media, Council's website, notices in newsletters and Council's advertisements in local papers, as well as an open day where people can speak to the project team and Council staff about the plan and what is proposed.

- It is understood that some recommended engineering solutions could have significant implications / impact on a small number of property owners, such as residents within the red zone of the Gawler Belt area (eg an interception channel). Has the Stormwater Management Plan considered other localised treatment options to minimise the risk of property damage and potential life-threatening situations.
- Various solutions are available to each of the flood prone areas. The mitigation measures recommended were determined based on the biggest and most cost-effective benefit for the greatest number of properties and residents. Note that these then underwent further multi-criteria analysis.
- The priority projects will need to be balanced with Light Regional Council's priorities within other catchments which may have a higher benefit and impact more people. This should be reflected in the consultation material distributed to the public.
- Noted and agreed that the Stormwater Management Plan is but one that covers the different catchments across the Council area. This will be documented within the engagement material.

Action: Include specific text for each Council about catchment extent and how it relates to other catchments and priorities within the entire Council area.

- Roseworthy is likely to generate significant stormwater and we need to make sure that this will be managed so it does not have impacts downstream. If there is significant water harvesting and re-use in this location would this reduce the potential for flooding (both extent and depth) in the Gawler Belt area?
- Stormwater management has been a significant part of the planning for Roseworthy, including potential harvesting and re-use. This has been designed to the pre-development outflow requirements from the entire master planned area, and therefore should not have downstream impacts on the flatter flood prone areas of Gawler Belt. The Stormwater Management Deeds are available to the public online. The Stormwater Management Plan has assumed that there will be no additional stormwater run-off as a result of the redevelopment, which represents the worst-case scenario based on known design criteria likely to be achieved in this location.



- There needs to be an understanding of the water harvesting opportunities at Roseworthy (including the Silo's Dam Aquifer) as well as for the flood prone areas at Gawler Belt
- The flood prone areas at Gawler Belt do not inundate sufficiently and frequently enough to justify the cost of establishing a Aquifer Recharge Scheme in this location.
- Mitigation measures and priorities seem to focus on property damage and costs associated with this. Has a triple bottom line assessment be done to understand the potential impacts more broadly a this might change the costs and project priorities.
- A multi-criteria analysis was adopted in the benchmarking / scoring of the individual mitigation measures. The criteria included a series of social, environmental and economic aspects and weightings so a balanced approach to priorities for mitigation measures is achieved.



Appendix I Optimised Decision Making Methodology scoring spreadsheet

Gawler SMP

				Option Subject to Assessment																			
				Gawler Racecourse flood control basin and wetland		Tingara Road flood control basin		Trinity College creek upgrades		Jarvis Street drain upgrades		Gawler East flow path improvements		Potts Road detention basin		Gawler Belt railway culvert		Gawler Belt interception drain		Evanston Oval parallel pipe upgrade		Localised drainage upgrades	
Criteria	Criteria Weighting	Sub-Criteria	Sub-criteria Weighting	Score (max=4)	Weighted Score	Score (max=4)	Weighted Score	Score (max=4)	Weighted Score	Score (max=4)	Weighted Score	Score (max=4)	Weighted Score	Score (max=4)	Weighted Score	Score (max=4)	Weighted Score	Score (max=4)	Weighted Score	Score (max=4)	Weighted Score	Score (max=4)	Weighted Score
Flood Protection of Development	25	Improved flood protection	100	3	18.75	3	18.75	3	18.75	4	25	3	18.75	4	25	3	18.75	3	18.75	3	18.75	2	12.5
		Weighted Score sub-total	100	18.75		18.75		18.75		25		18.75		25		18.75		18.75		18.75		12.5	
Runoff Quality and Effect on Receiving Waters	20																						
		Reduction in gross pollutants	25	4	5	1	1.25	0	0	0	0	1	1.25	3	3.75	0	0	1	1.25	0	0	0	0
		Reduction in suspended solids	25	3	3.75	1	1.25	1	1.25	0	0	1	1.25	3	3.75	0	0	1	1.25	0	0	0	0
		Reduction in nutrients	25	3	3.75	1	1.25	0	0	0	0	1	1.25	1	1.25	0	0	1	1.25	0	0	0	0
		Reduction in phosphorus	25	3	3.75	1	1.25	0	0	0	0	1	1.25	1	1.25	0	0	1	1.25	0	0	0	0
Weighted Score sub-total	100	16.25		5		1.25		0		5		10		0		5		0		0			
Beneficial Use of Stormwater	10	Direct Infiltration	40	4	4.00	1	1.00	1	1	0	0	1	1	1	1	1	1	1	1	0	0	0	0
		Storage and Reuse	60	0	0.00	0	0.00	0	0	0	0.00	0	0	0	0	0	0	0	0	0	0	0	
		Weighted Score sub-total	100	4.00		1.00		1		0		1		1		1		1		0		0	
Social values	10	Improved visual amenity	35	3	2.63	1	0.875	2	1.75	0	0.00	1	0.875	1	0.875	0	0	1	0.875	0	0	0	0
		Improved public safety	20	3	1.5	2	1	2	1	2	1	1	0.5	3	1.5	3	1.5	3	1.5	2	1	2	1
		Additional useful open space	35	1	0.875	0	0	1	0.875	0	0	0	0	1	0.875	0	0	1	0.875	0	0	0	0
		Disruption during implementation	10	0	0.00	2	0.5	1	0.25	0	0.00	1	0.25	2	0.50	2	0.50	1	0.25	2	0.50	2	0.50
		Weighted Score sub-total	100	5.00		2.375		3.875		1.00		1.63		3.75		2.00		3.50		1.50		1.50	
Environmental Benefit	10	Habitat creation	70	3	5.25	0	0	1	1.75	0	0.00	1	1.75	1	1.75	0	0	1	1.75	0	0	0	0
		Increased biodiversity	30	3	2.25	0	0	1	0.75	0	0.00	1	0.75	1	0.75	0	0	0	0	0	0	0	0
		Weighted Score sub-total	100	7.50		0		2.5		0.00		2.5		2.5		0		1.75		0		0	
Capital, Benefit Cost Ratio and Maintenance Cost	25	Capital Cost	45	0	0.00	1	2.81	1	2.81	0	0.00	1	2.8125	0	0	2	5.625	0	0	2	5.625	3	8.4375
		Economic viability	45	1	2.81	2	5.63	2	5.63	2	5.63	0	0	2	5.625	0	0	0	0	1	2.8125	1	2.8125
		Recurring / Maintenance Cost	10	0	0.0	3	1.875	2	1.25	4	2.50	2	1.25	1	0.63	2	1.25	1	0.63	4	2.50	3	1.88
		Weighted Score sub-total	100	2.81		10.31		9.6875		8.13		4.06		6.25		6.88		0.63		10.94		13.13	
Total Criteria Weighting	100	Total Weighted Score / 100		54.3		37.4		37.1		34.1		32.9		48.5		28.6		30.6		31.2		27.1	
Capital Cost Estimate (\$Millions)				\$5.55		\$0.71		\$0.39		\$3.39		\$0.80		\$2.48		\$0.24		\$5.41		\$0.24		Not costed	

