

Cadastre

M6/M8 Permanent Facilities

Development Buildings

Extent of Development Footprint

Giovanni Brunetti Bridge

Peak Design Impacts (mm)

< -10

No change

10 - 20

20 - 50


50 - 100

100 - 200

> 200

Was wet now dry

Was dry now wet

Project Title Cooks Cove Planning Proposal				
Drawing Title Design Case Afflux (1% AEP + Climate Change)				
Job No 252942		Figure No B-43		
Coordinate System GDA 1994 MGA ZONE 56		Drawing Status FINAL		
Scale <div>04080120160200 m</div> 				
A	19/09/23	JO	GR	GR
Issue	Date	By	Chkd	Appd

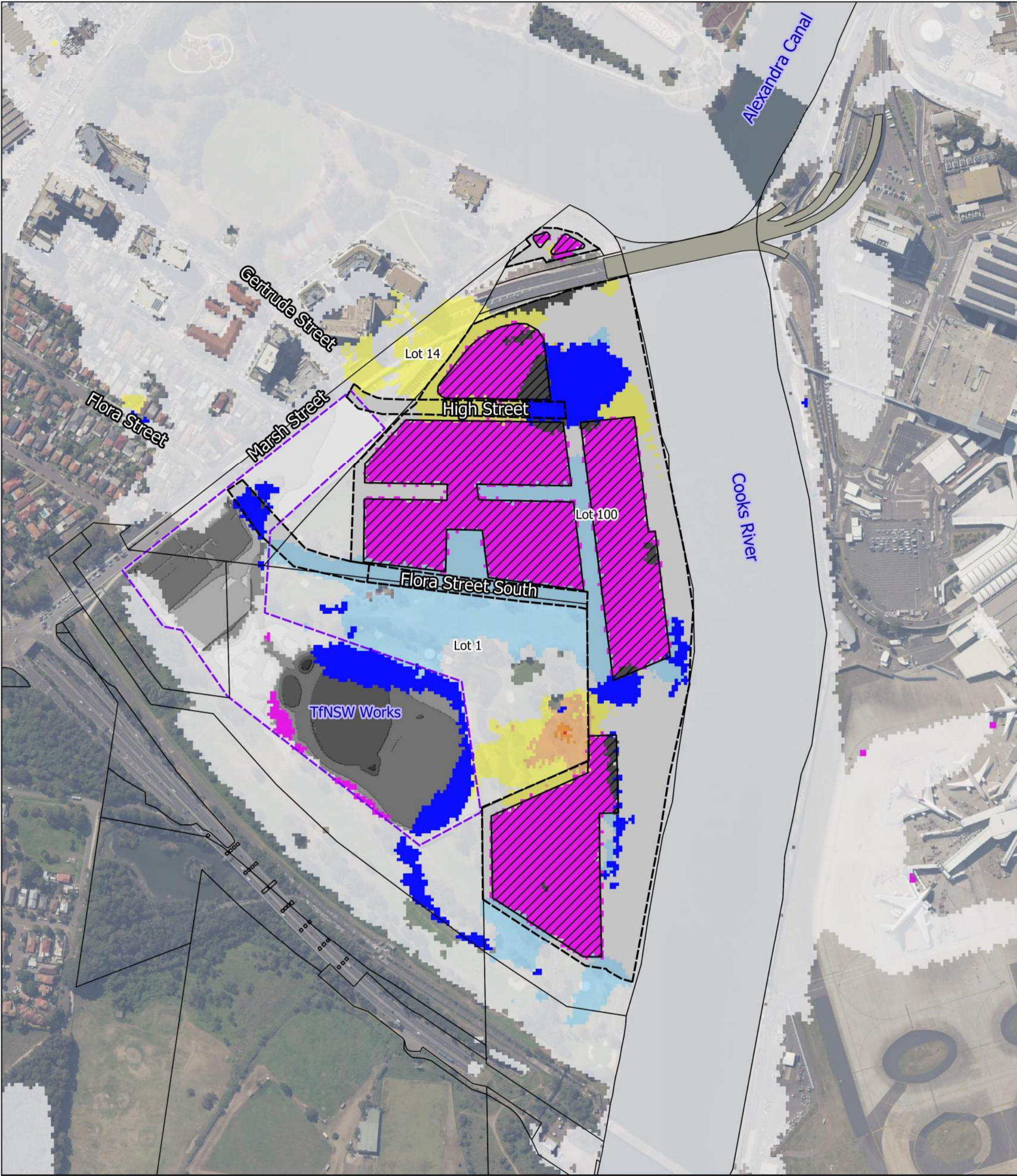
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Sources: Google Maps, CNES/Airbus, Landsat/Copernicus, Maxar Technologies

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Legend

Cadastre

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Project Title Cooks Cove Planning Proposal				
Drawing Title Design Case Afflux (0.2% AEP + Climate Change)				
Job No 252942		Figure No B-45		
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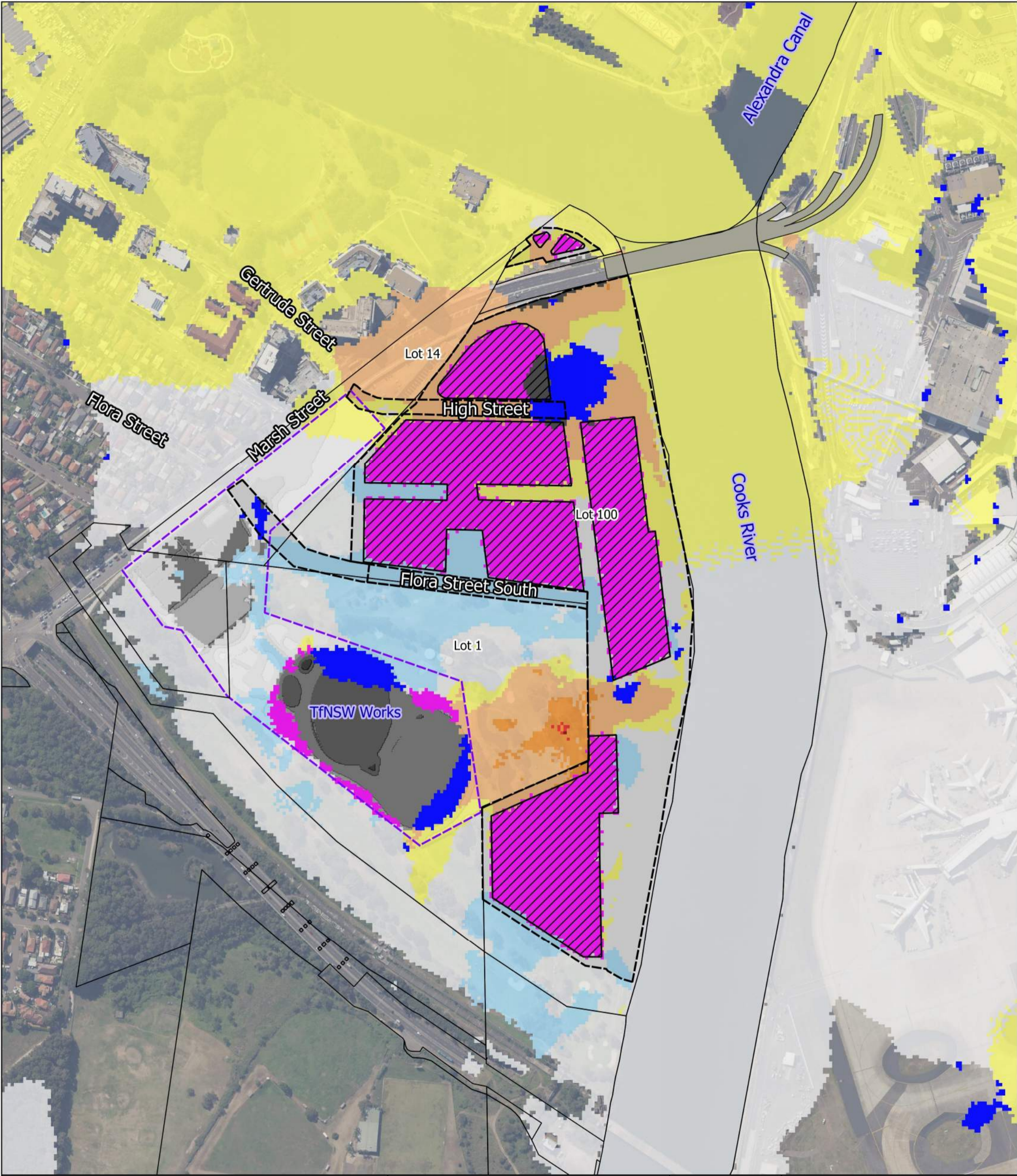
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Project Title Cooks Cove Planning Proposal				
Drawing Title Design Case Afflux (PMF + Climate Change)				
Job No 252942		Figure No B-46		
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Scale <div>04080120160200 m</div> 				
A	19/09/23	JO	GR	GR
Issue	Date	By	Chkd	Appd

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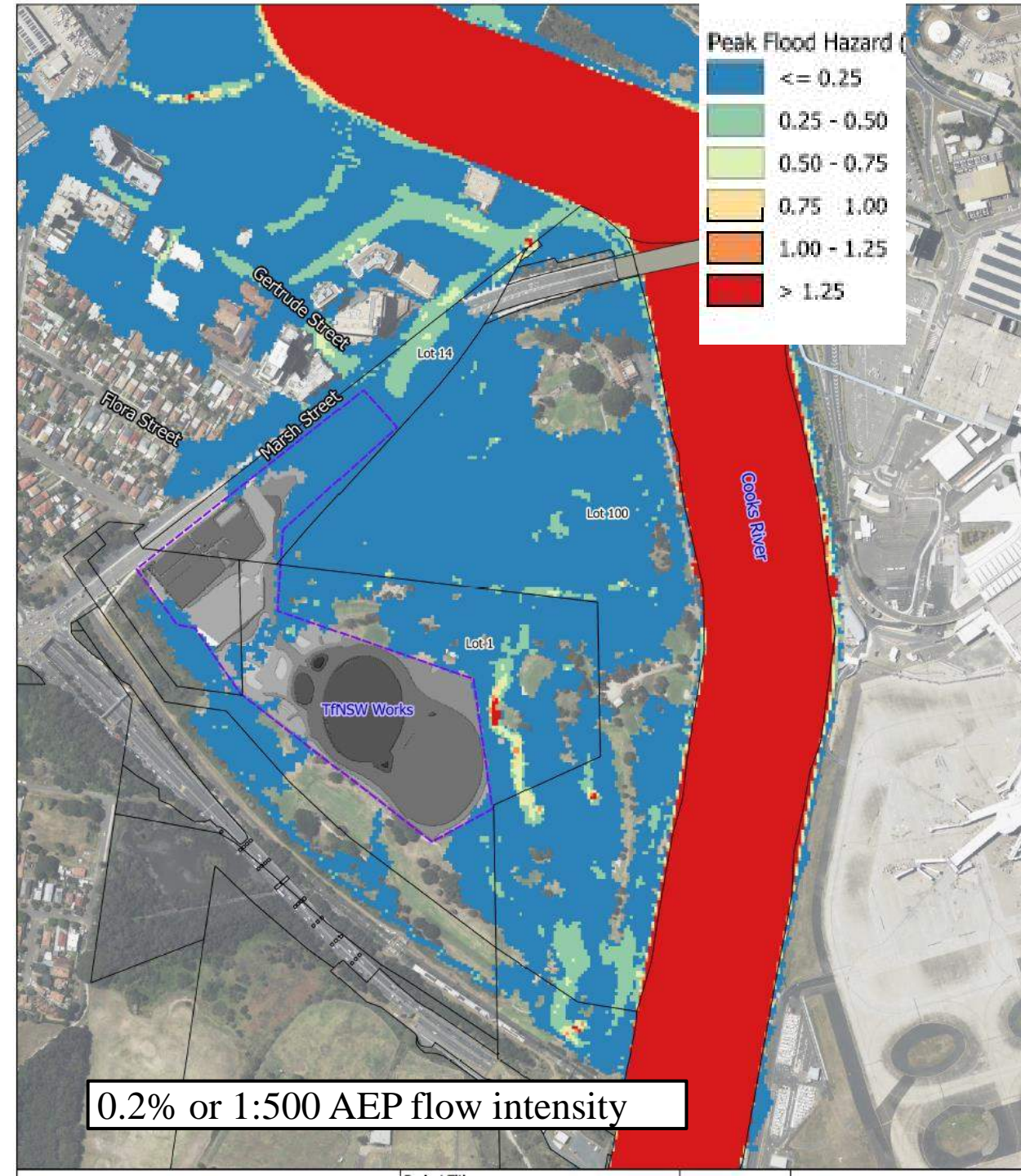
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Appendix C: Information Pack from 27/11/23 Workshop

Appendix C.1: PowerPoint Presentation from 27/11/23 Workshop

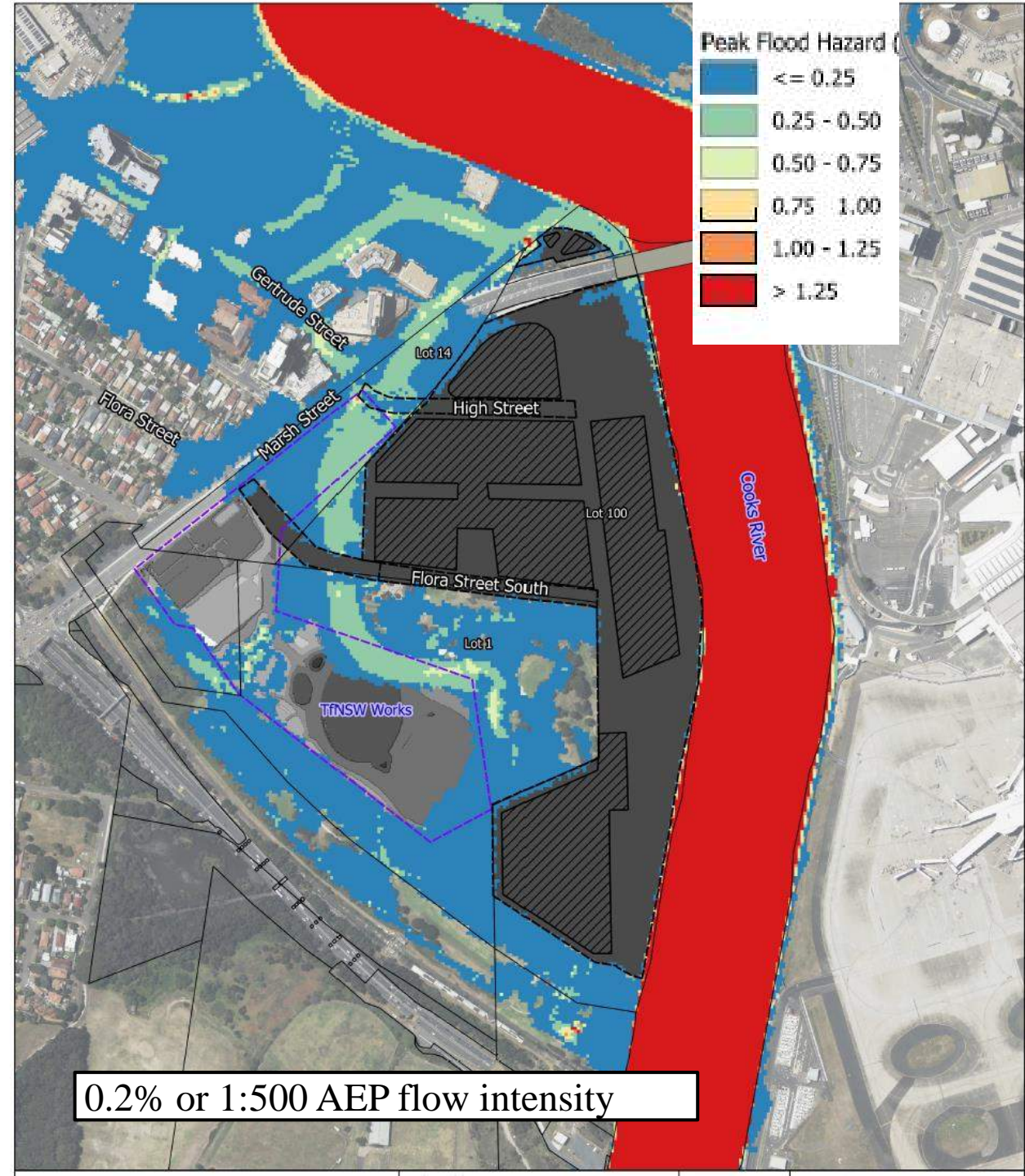
Base Case Flood Behaviour

- Cooks River flows over Marsh St
- Flows through golf Course
(Lot 14 / Lot 100 / Lot 1 / Lot 100)
- Generally flowing NW to SE
- Frequency of flooding is low
- No evidence of the flowpath over Marsh St activating in last 60 years
- Flowpath not fully active in 1% (1:100) AEP flood
- Flowpath fully active in 0.2% (1:500) AEP flood



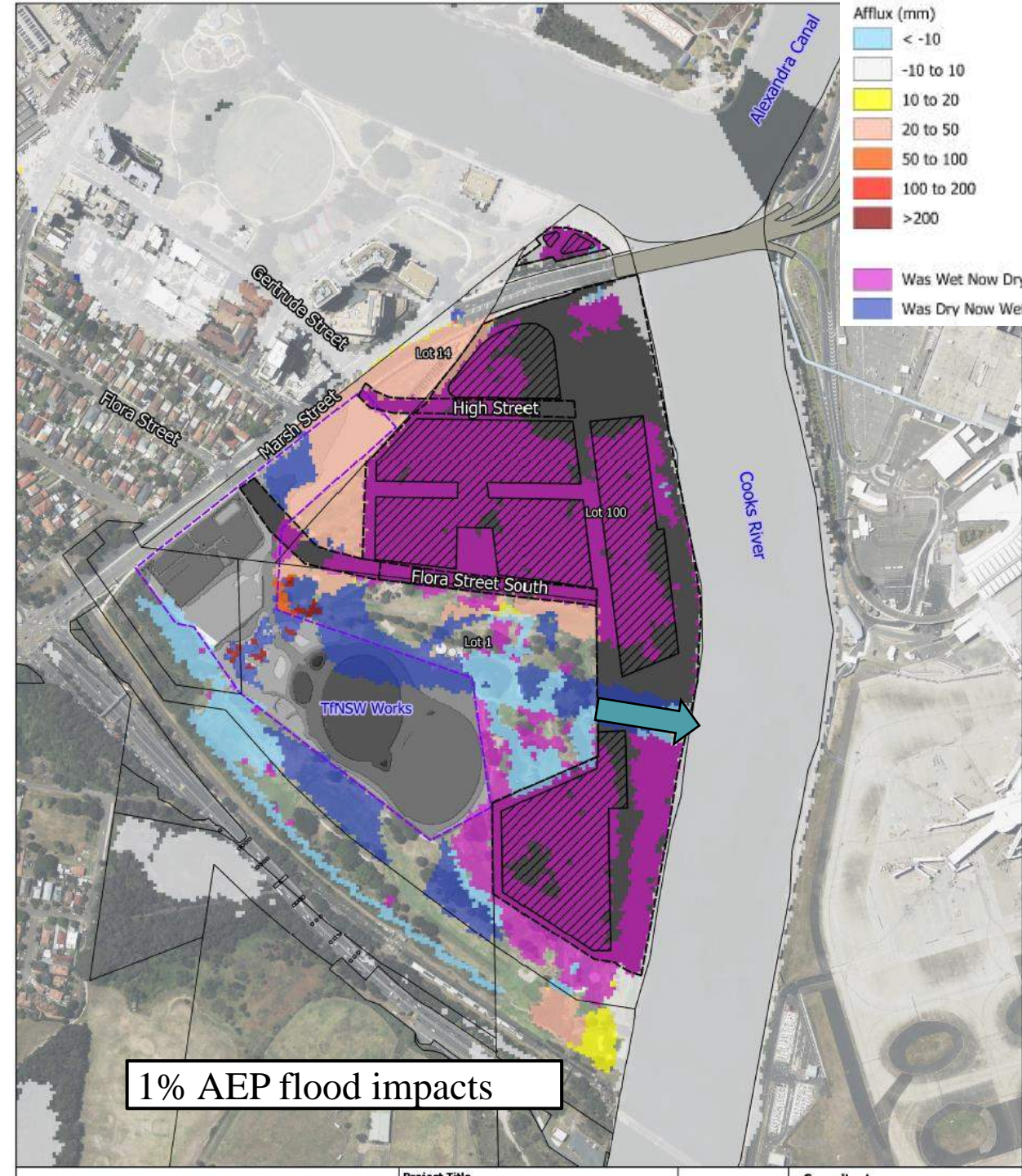
Overview Flood Strategy in FIRA (Sept 2023)

- Cooks River flows over Marsh St
- Flows across Lot 14
(and under two local streets in Cooks Cove Planning Proposal)
- Flows through public open space on Lot 1
- Requires changes to Pemulwuy Park terrain on TfNSW compound



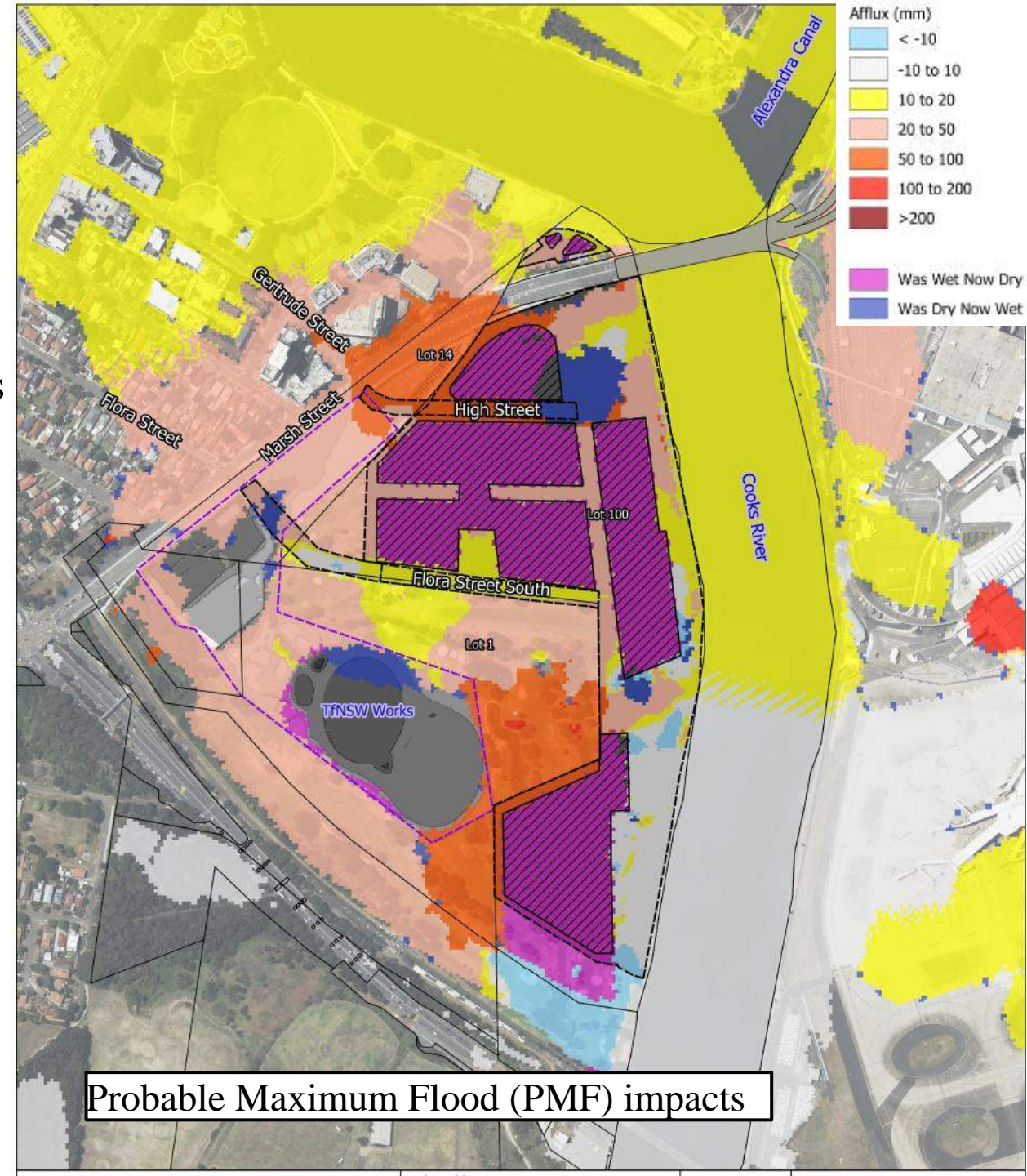
Option of Diverting Flow Between Blocks 3B and 3C

- Have assessed option of taking flow into river further upstream
- Flood gradients not favourable
- Large channel between 3B and 3C
- 1% AEP Flood results in impacts of more than 20mm on Marsh St



Option of Diverting Flow Between Blocks 3B and 3C

- PMF = 50mm impact on MOC site
- In summary of this option, it creates negative impacts and is worse than the Sept 23 FIRA arrangement
- Hence, this option was discounted



Possible Refinements to FIRA

Flood Strategy (Dec 2023)

AIM 1:

- Minimise intrusion into TfNSW Pemulwuy Park
- Possible to place flowpath outside of TfNSW Pemulwuy Park

AIM 2:

- Accommodate more of the flowpath on Lot 100 development zone
- Possible to build part of Block 3C with undercroft
- Provide flowpath under part of Block 3C buildings
- Recognise that need to fence and visually screen undercroft

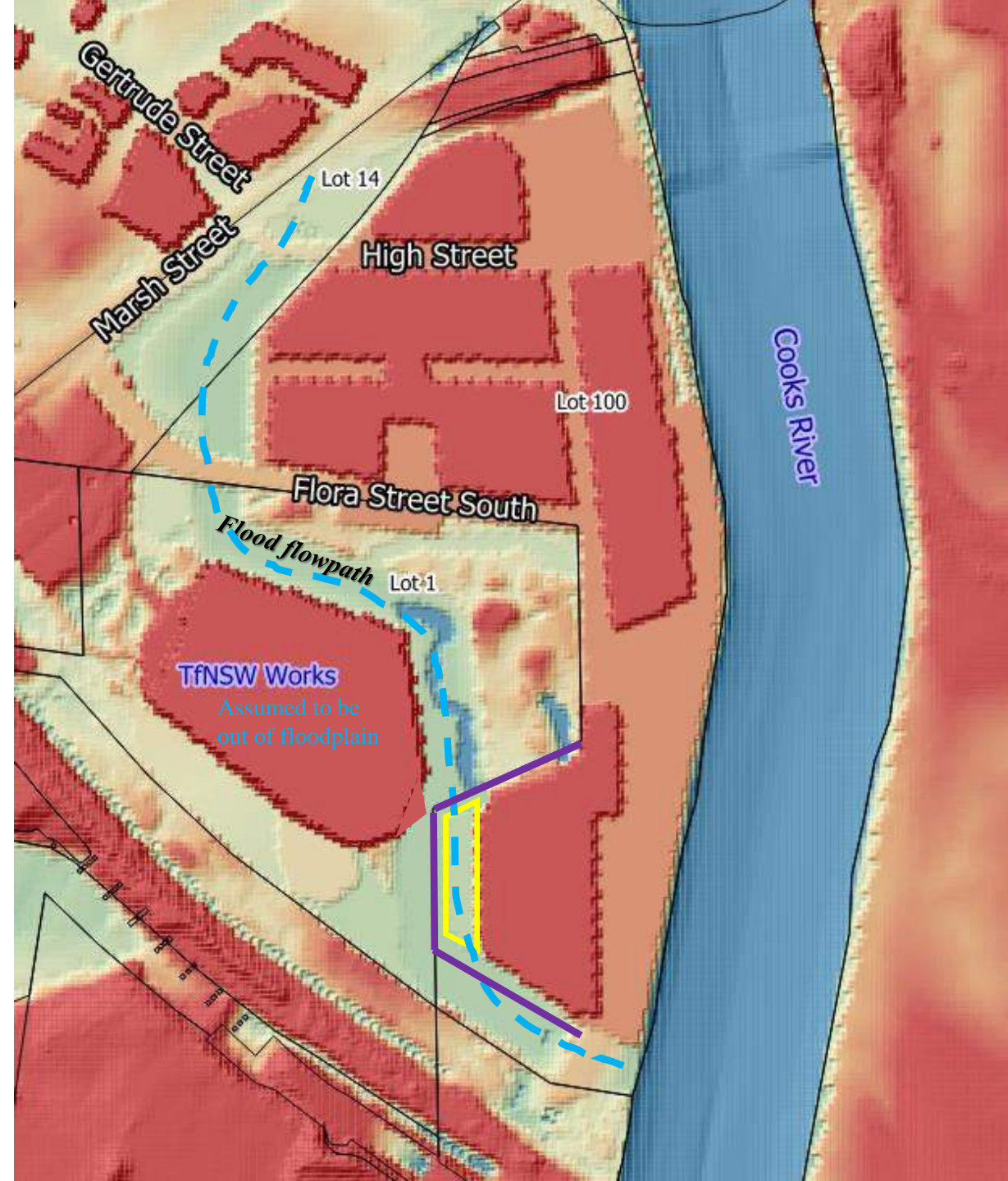
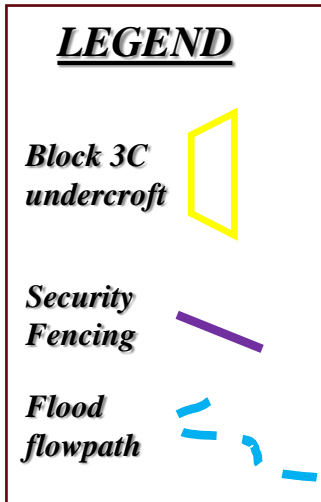


Possible Refinements to FIRA

Flood Strategy (Dec 2023)

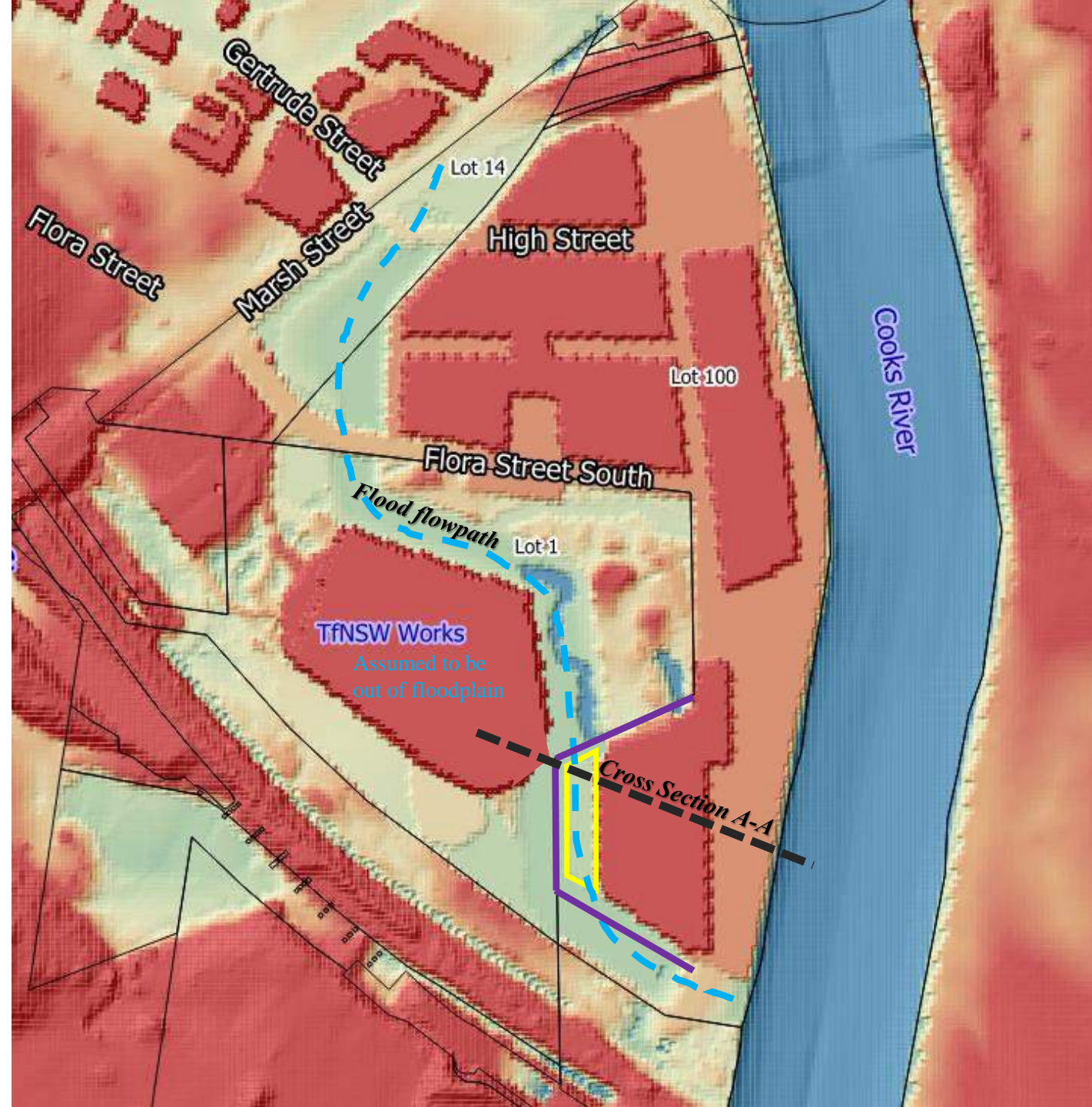
Conceptual physical elements included for flood modelling

- Flowpath outside of TfNSW Pemulwuy Park
- Block 3C with undercroft
- 28m wide undercroft
- Security fence on three sides (200m long)
- **Assumed 3.5m wide vegetation zone along fence for screening of building**



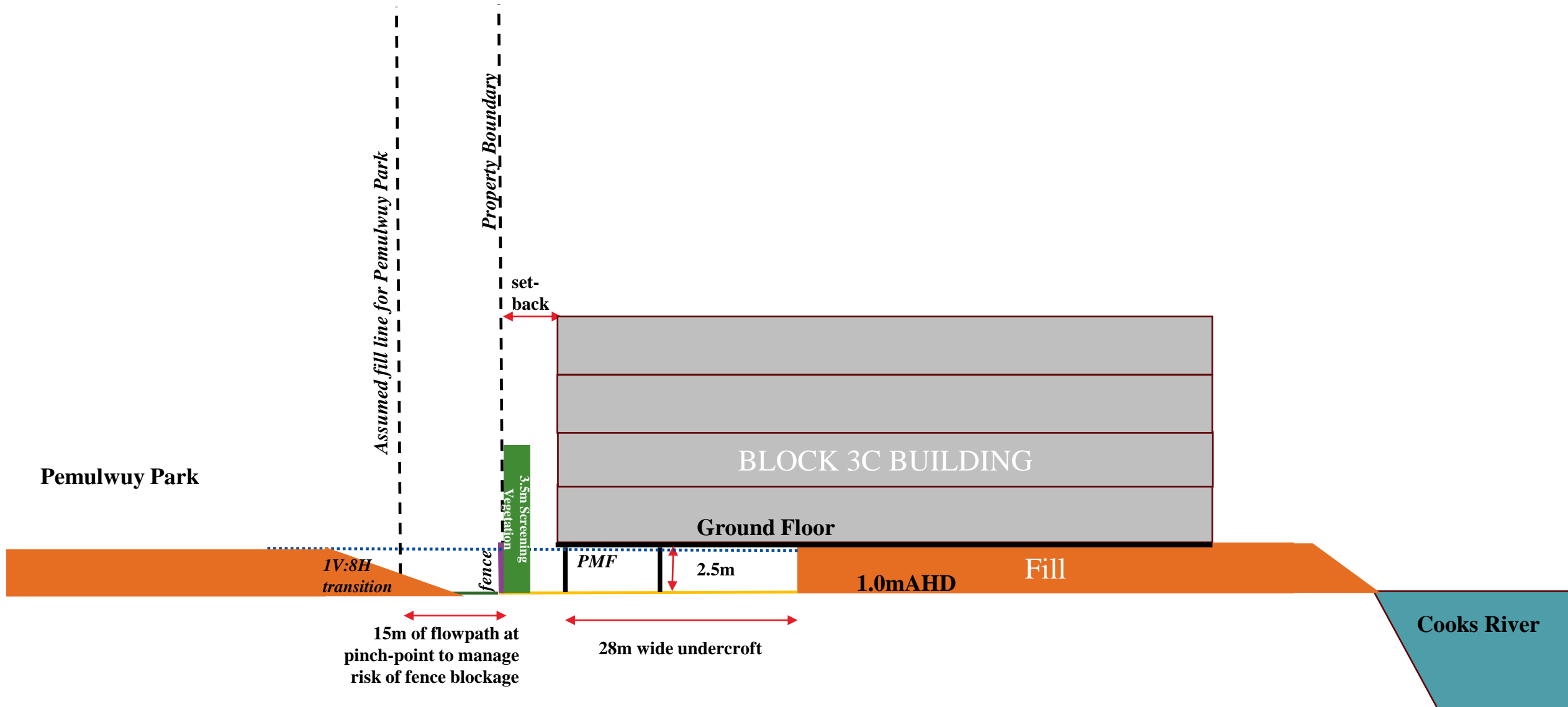
Possible Refinements to FIRA Flood Strategy

- Total flowpath length = 980m
- 200m on Lot 14 = 20%
- 420m on Lot 100 = 43%
- 360m on Lot 1 = 37%
- About 50% of Lot 1 length (180m) would be existing pond/lake through intent to retain existing open space landform



Undercroft Flowpath

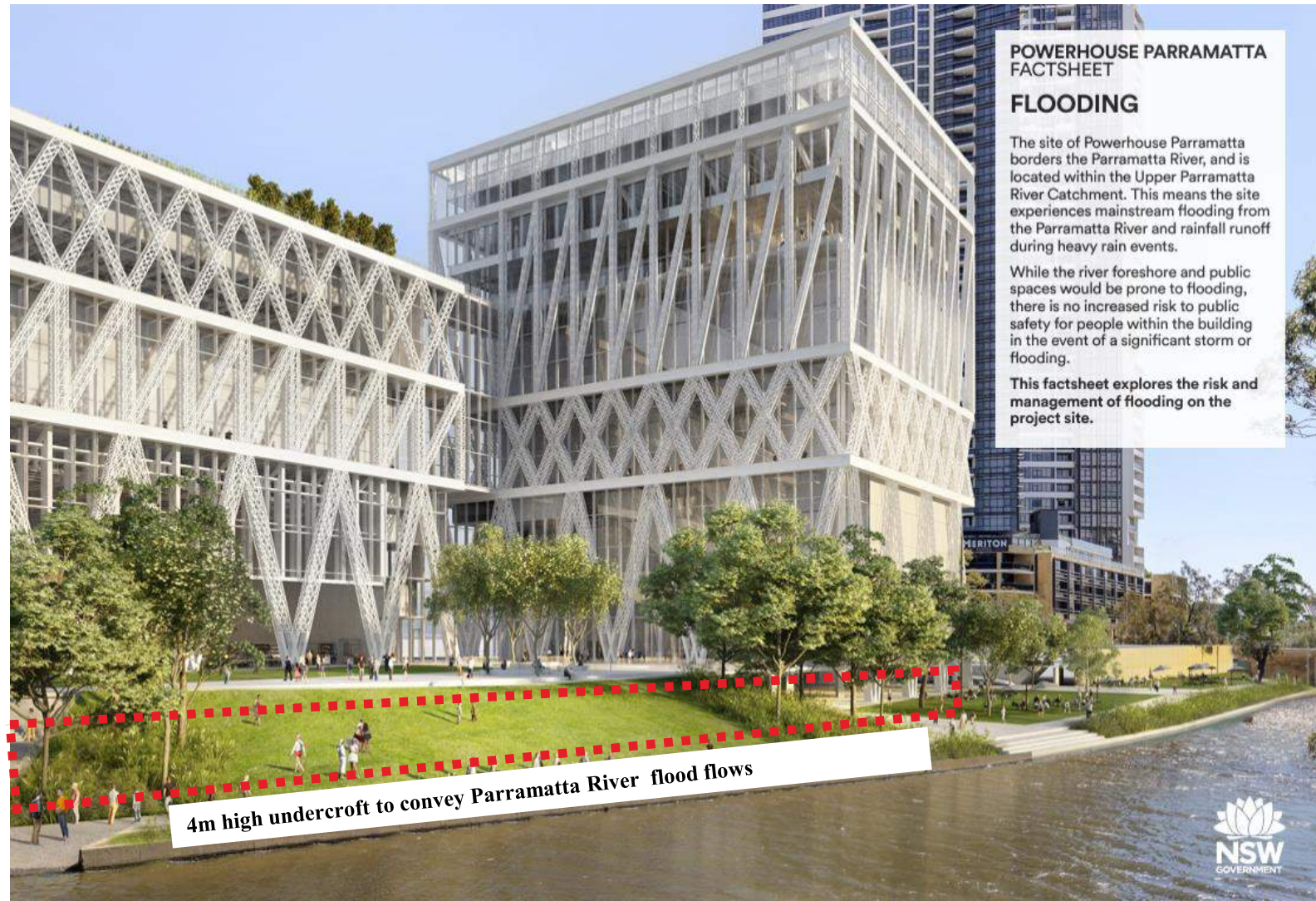
ARUP



Undercroft Flowpath Concept

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Recently used in Parramatta Powerhouse: undercroft conveys portion of total Parramatta River flows (most of right bank floodplain)



Undercroft Flowpath

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Recently used in Parramatta Powerhouse: undercroft conveys portion of total Parramatta River flows (most of right bank floodplain)

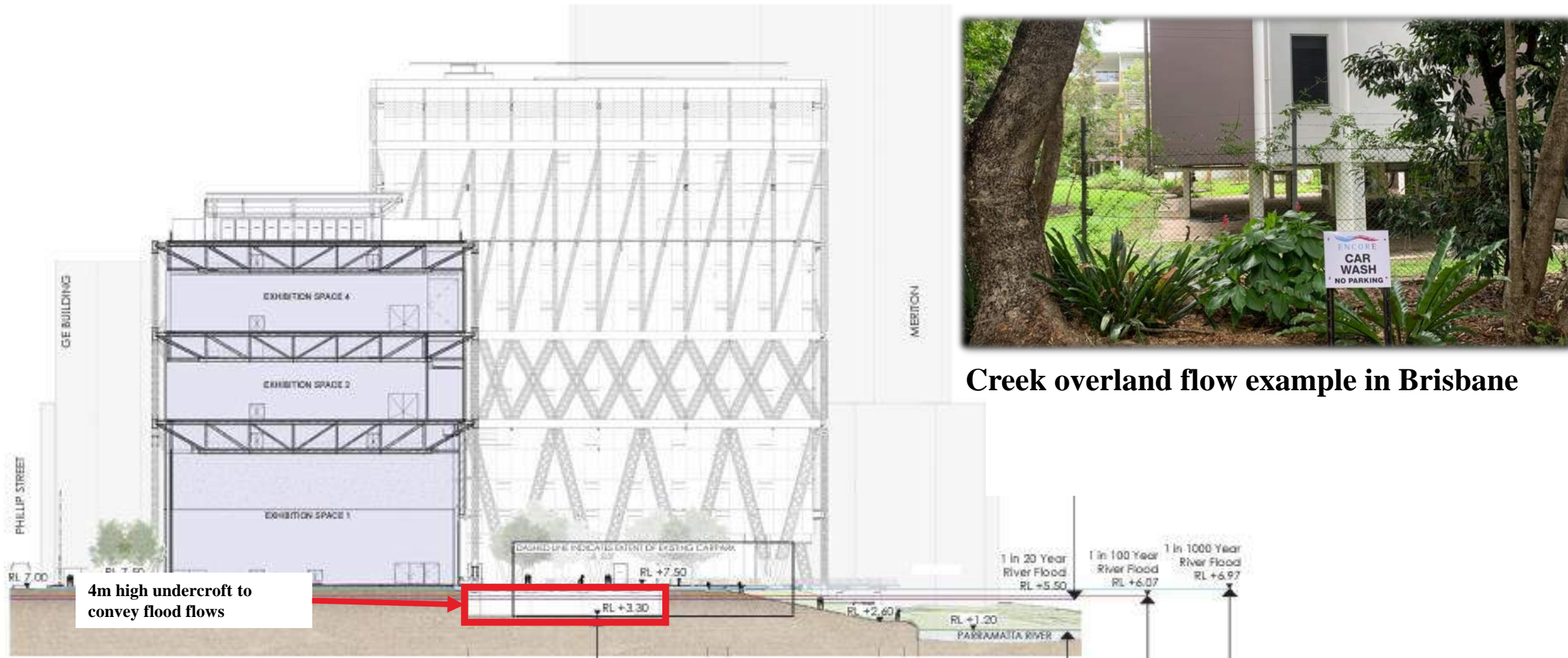


4m high undercroft to convey Parramatta River flood flows

Undercroft Flowpath

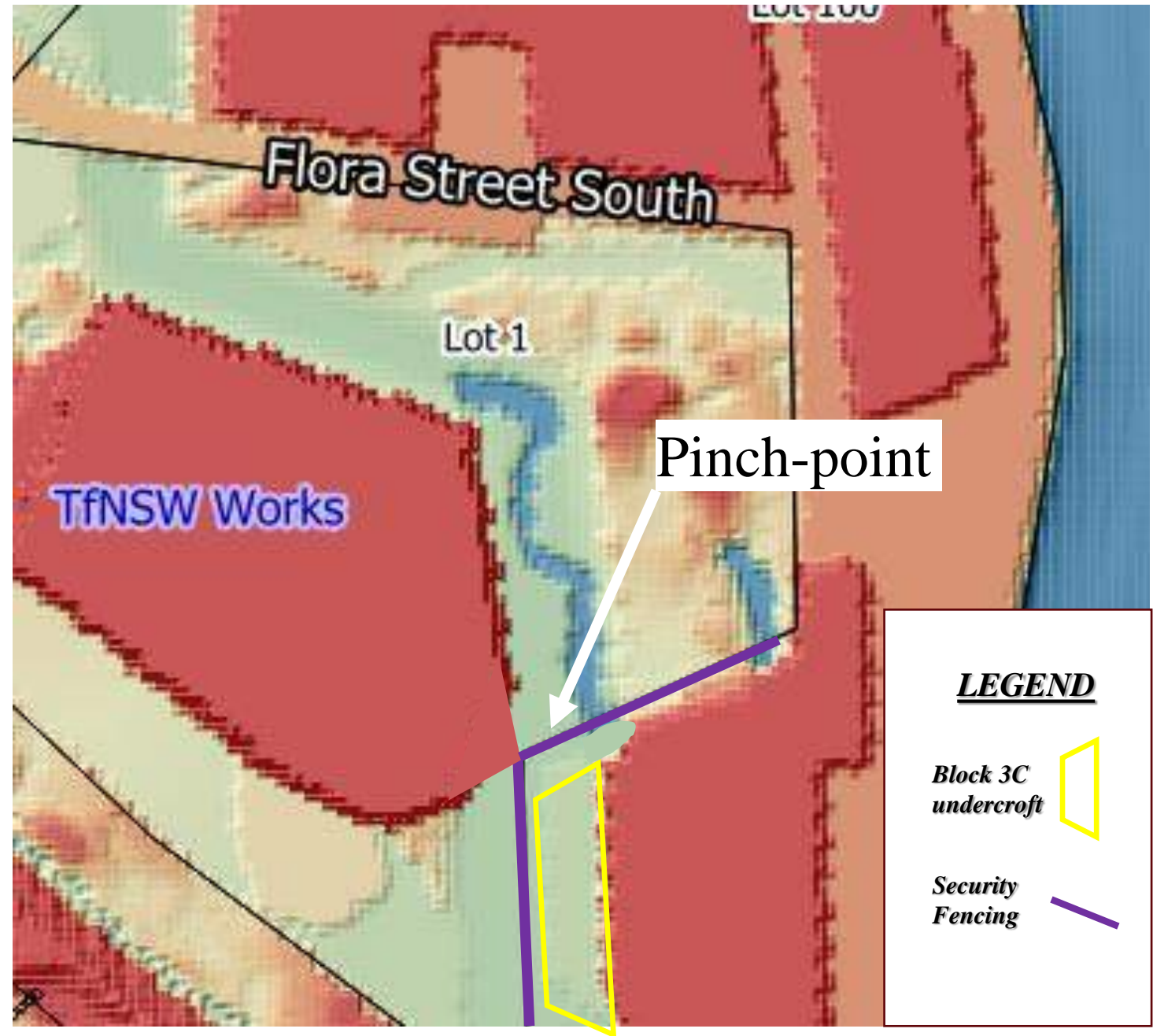
ARUP

Recently used in Parramatta Powerhouse: undercroft conveys portion of total Parramatta River flows (most of right bank floodplain)



Possible Refinements to FIRA Flood Strategy

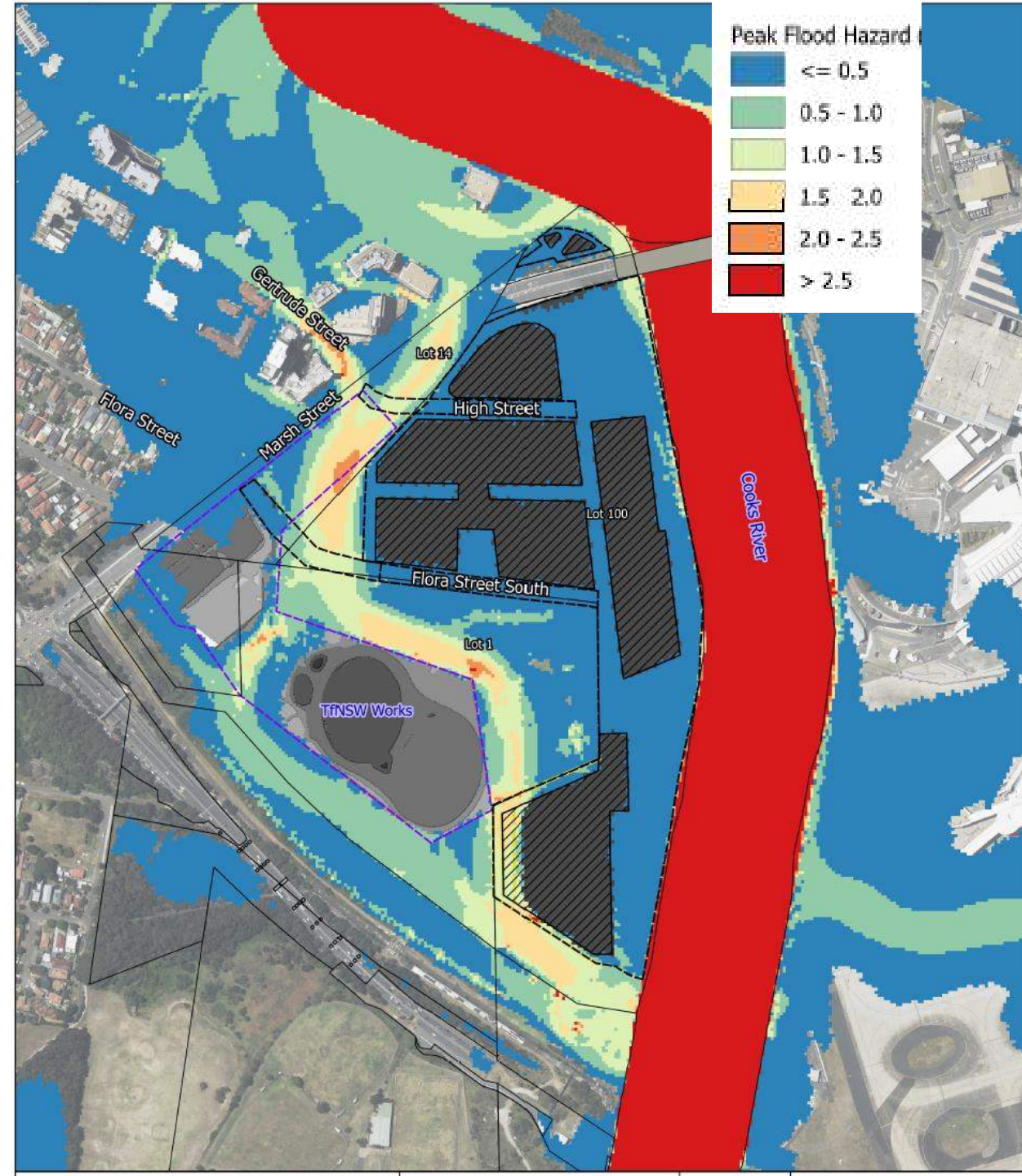
- Flow needs to pass through security fence
- Pinch-point between Lot 1 and Lot 100
- Possibility of debris blockage



Possible Refinements to FIRA

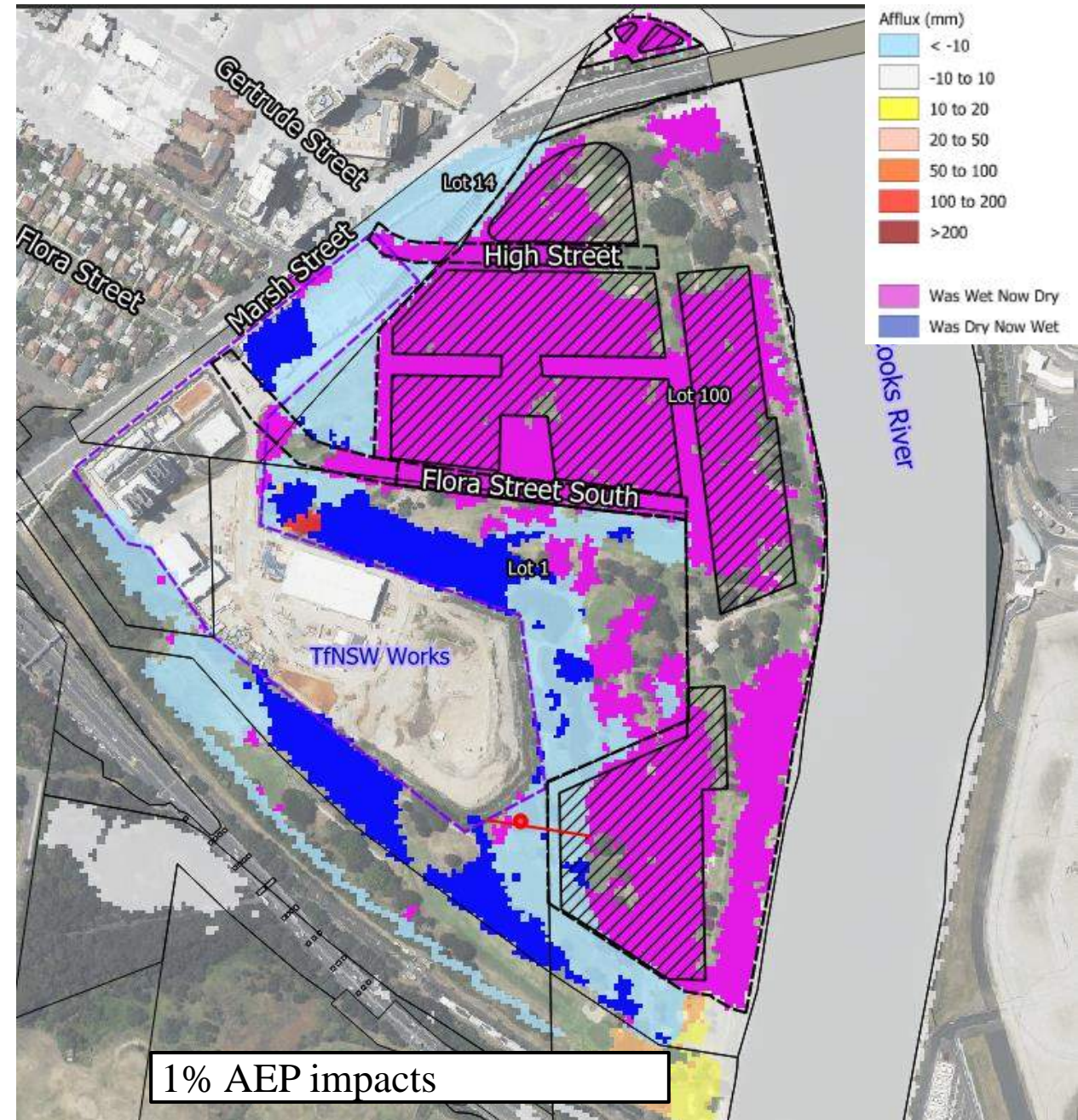
Flood Strategy

- Key flood is PMF (MOC impacts)
- No change in afflux / behaviour from FIRA for 1% AEP or 0.2% AEP floods
- Flow passes through Lot 14, Lot 1, Lot 100 then Lot 1
- Fence assumed to have 24% bar blockage
- Range of fence blockages assumed for debris allowance during flood



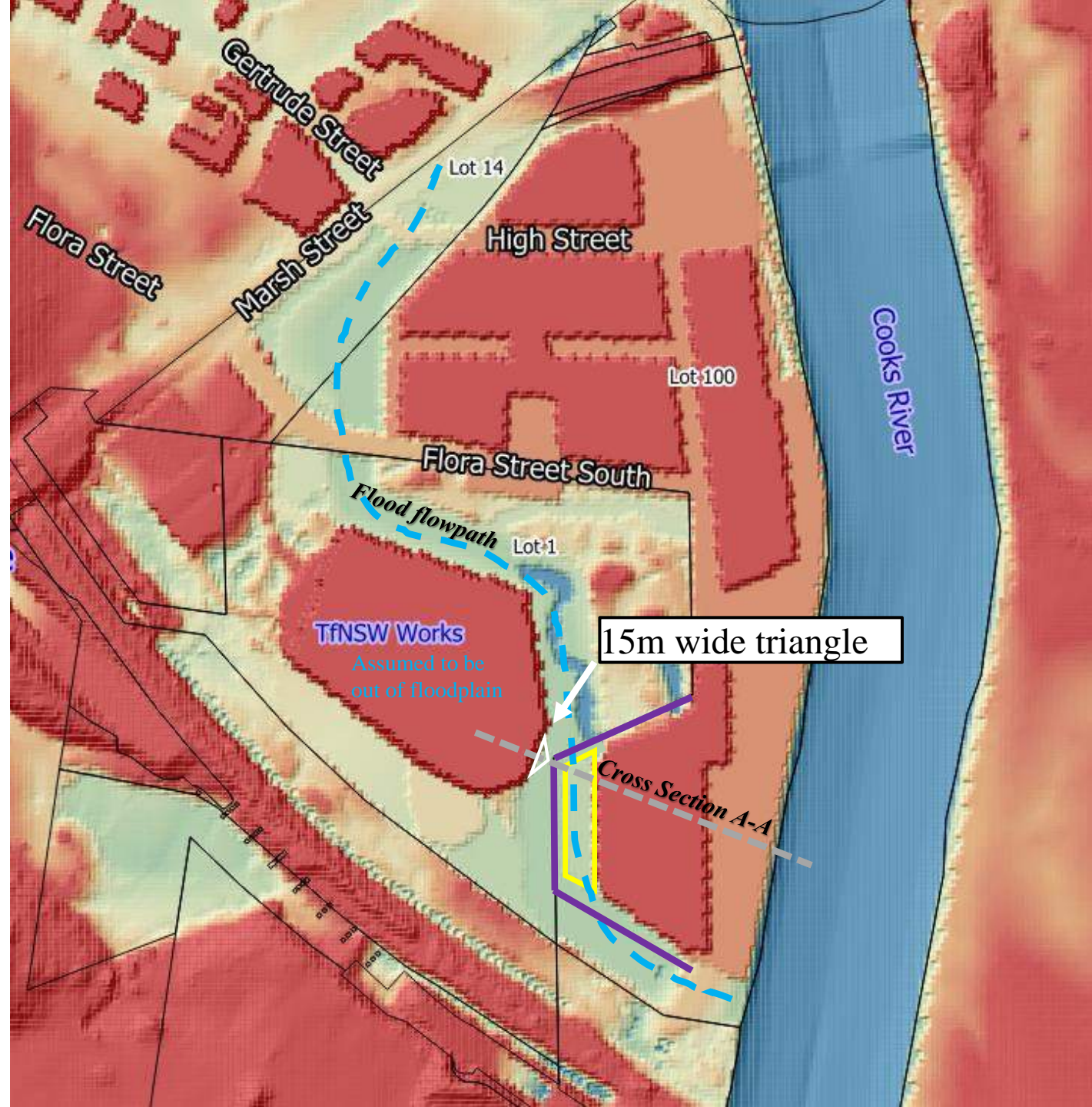
Impacts of Refinements to FIRA Flood Strategy

- Flood impact maps for full range of AEP's in Appendix A for this alternative design
- Impacts assessed with and without climate change
- Climate change impact assessment uses 0.9m sea level rise (instead of 0.8m used in FIRA)
- Climate change impact assessment also includes allowance for 20% increase in rainfall (as in FIRA)
- Impacts very similar to that shown in FIRA
- Afflux with 50% fence blockage also compliant (for all floods up to PMF)



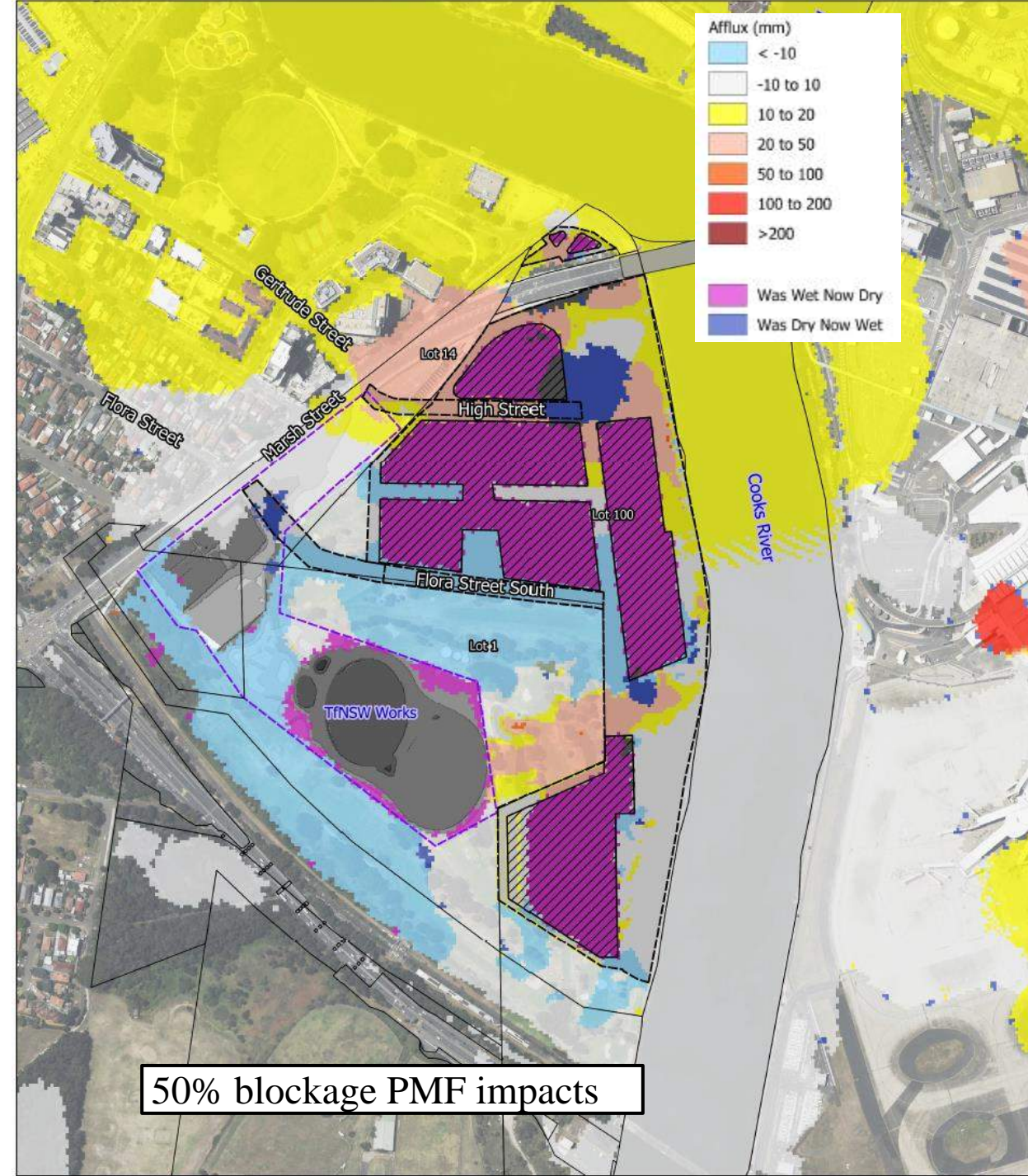
Possible Refinements to FIRA Flood Strategy

- Undercroft has sufficient capacity (ie compliant PMF afflux) even assuming 50% fence blockage
- To manage risk associated with higher fence blockage, a small triangle of Pemulwuy Park could be lowered to allow flood flows
- Complete blockage of fence is not a realistic outcome over complete length and height (as fence would collapse in that scenario)
- Conservative 70% fence blockage value used (i.e. 70% of entire 2.5m height and 200m length)
- Assumed 15m intrusion and area of 400m²



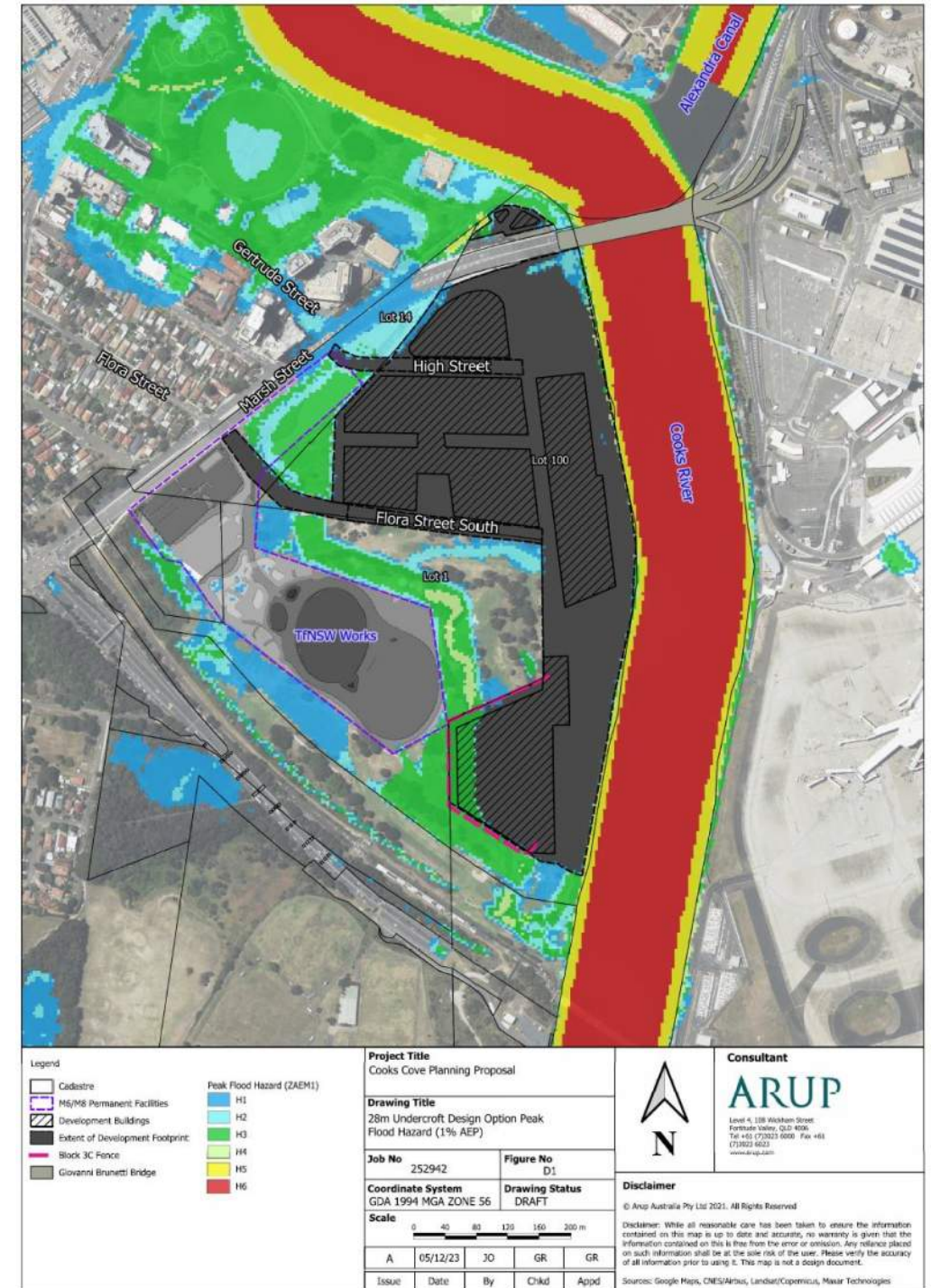
Possible Refinements to FIRA Flood Strategy

- Fence assumed to have 24% bar blockage
- Need to also assume debris blockage
- Afflux in PMF at MOC is:
 - 6mm with 0% fence blockage
 - 9mm with 50% fence blockage
 - 10mm with 70% fence blockage



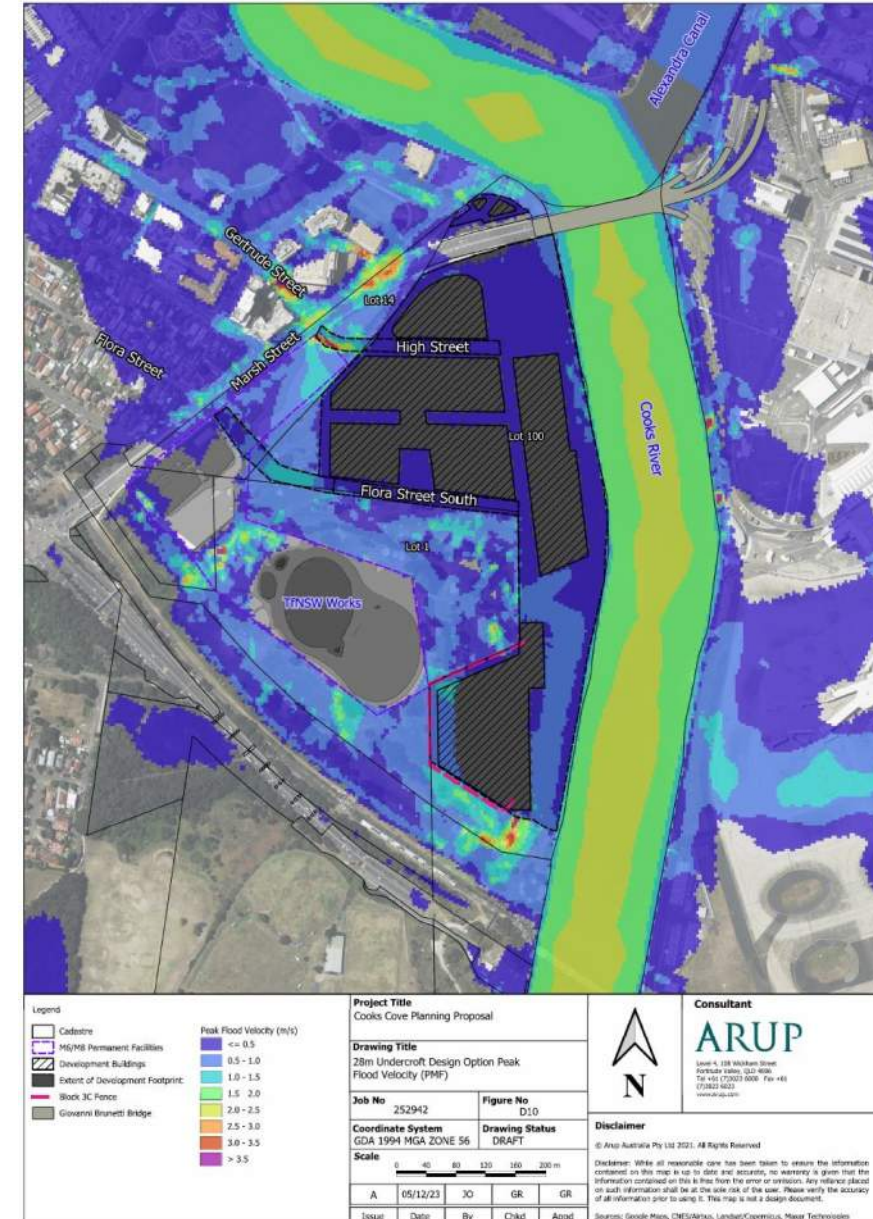
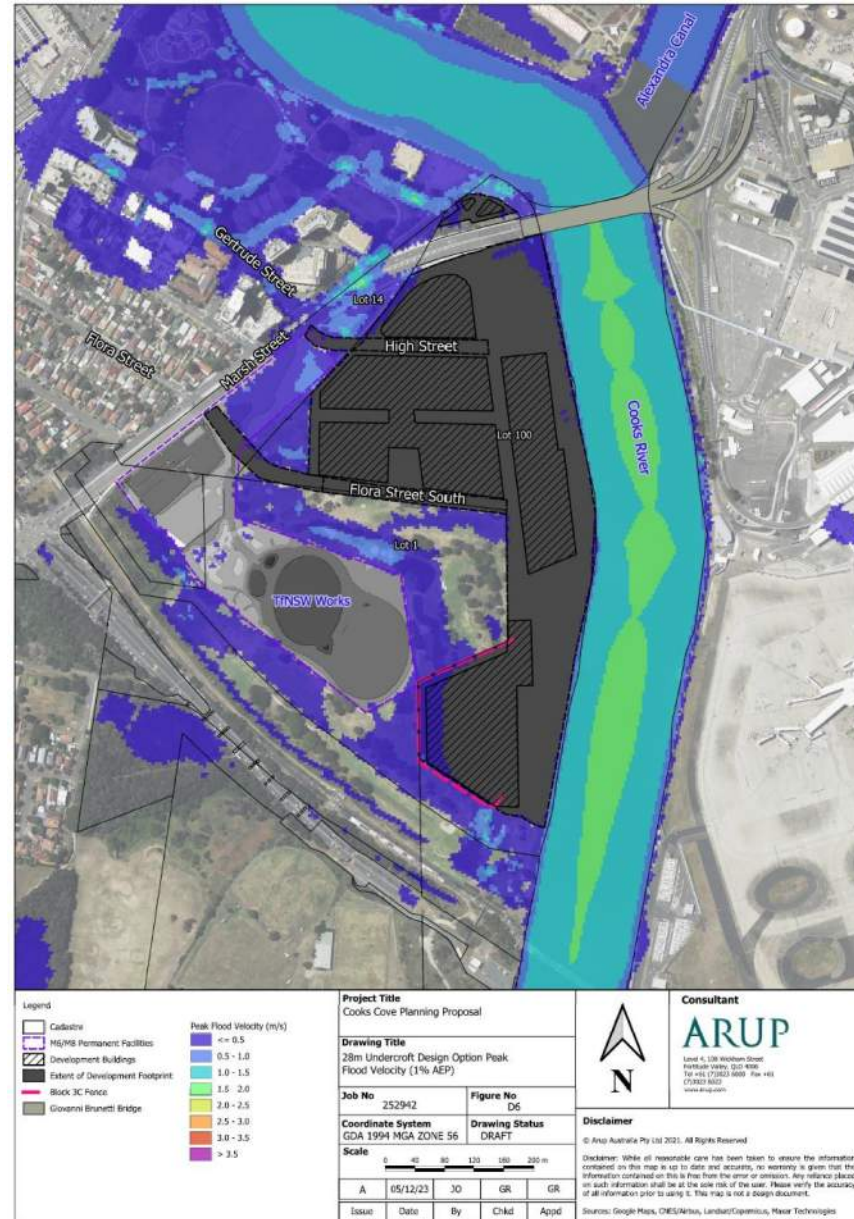
Resulting Peak Flood Hazards

- No change in hazards from when a golf course
- 1% AEP flood has up to H3 hazard (same as golf course and Cahill Park)
- PMF hazards up to H5 (due to depths > 2m)
- Overall, the flood hazards similar to that of Cahill Park
- Consistent with hazards in most public open spaces
- Relatively flood immune public open space (greater than 5% AEP)
- No need for fencing of open space as a result of flood hazards
- Peak hazard maps for full range of AEP's in App C



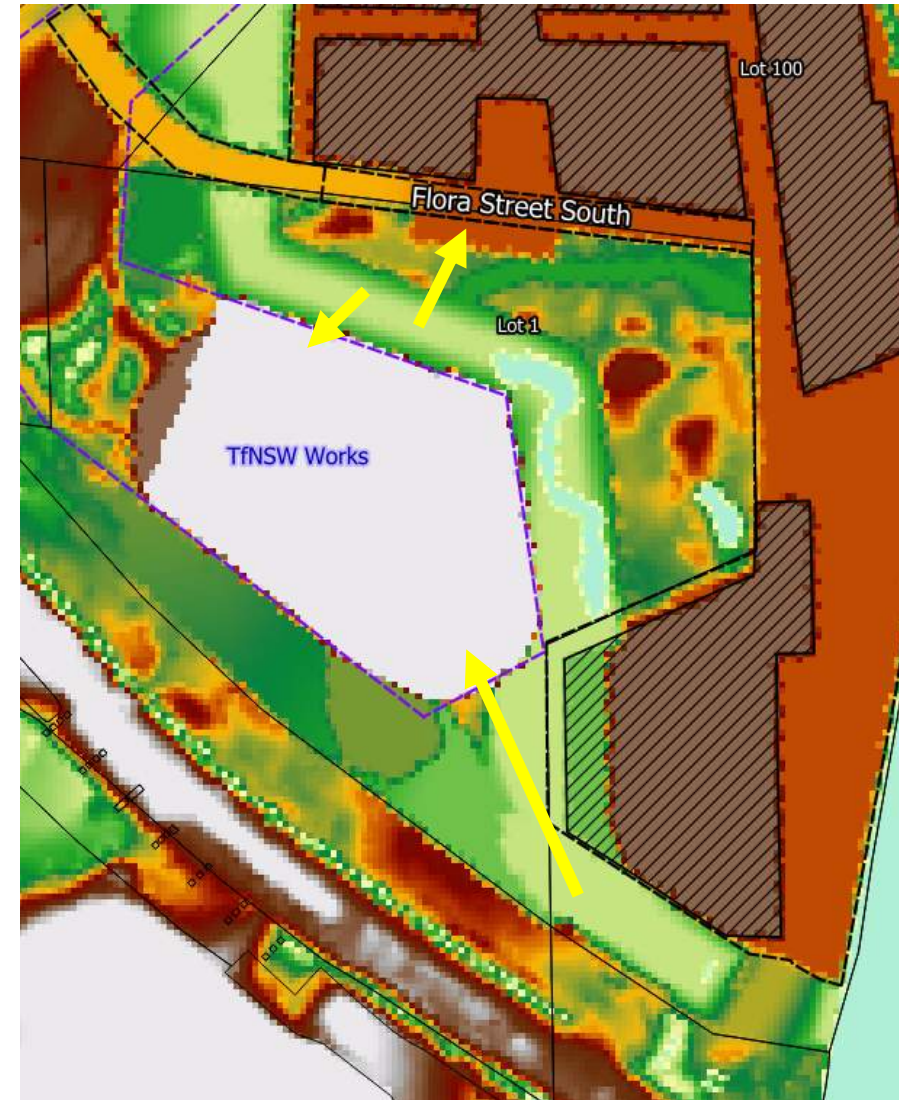
Resulting Peak Flood Velocities

- Flood gradient is flat
- Velocities are not high, even in PMF
- Maximum 1% AEP velocities less than 1.0m/s
- Maximum PMF velocities in order of 1.5m/s
- Peak velocity maps for full range of AEP's in App D



Flood Evacuation for Open Space Areas

- Animation shows PMF and 0.2% / 1:500 AEP flood progression at 60 x real time (video starts at start of rainfall event)
- Rate of floodwater rise is not rapid (about 1.0m/h)
- Quick access to land above PMF (eg parts Pemulwuy Park or Cooks Cove development area)
- **Longest** distance to walk to high ground is 200m (can be covered in 6 minutes at very slow walking speed of 2km/h)
- In that 6 minutes, flood level rise of about 0.1m
- Floods enter park area after one hour of rain (43mm) falls in 1% AEP flood – so not without some indication of flood event
- Expected that few (if any) people in park during flooding rains (not a thunderstorm as needs one hour of very heavy rain to start flooding)
- Given large areas of land higher than PMF and short distances to walk across flat grades, flood risk of people in open space is very low.



Local Catchment Stormwater Management

- All developed areas (buildings, local roads, car parking) will flow towards river
- No discharge of site stormwater (Lot 100) onto Pemulwuy Park / public open space
- Lot 1 runoff will flow towards lakes / ponds and then piped to river

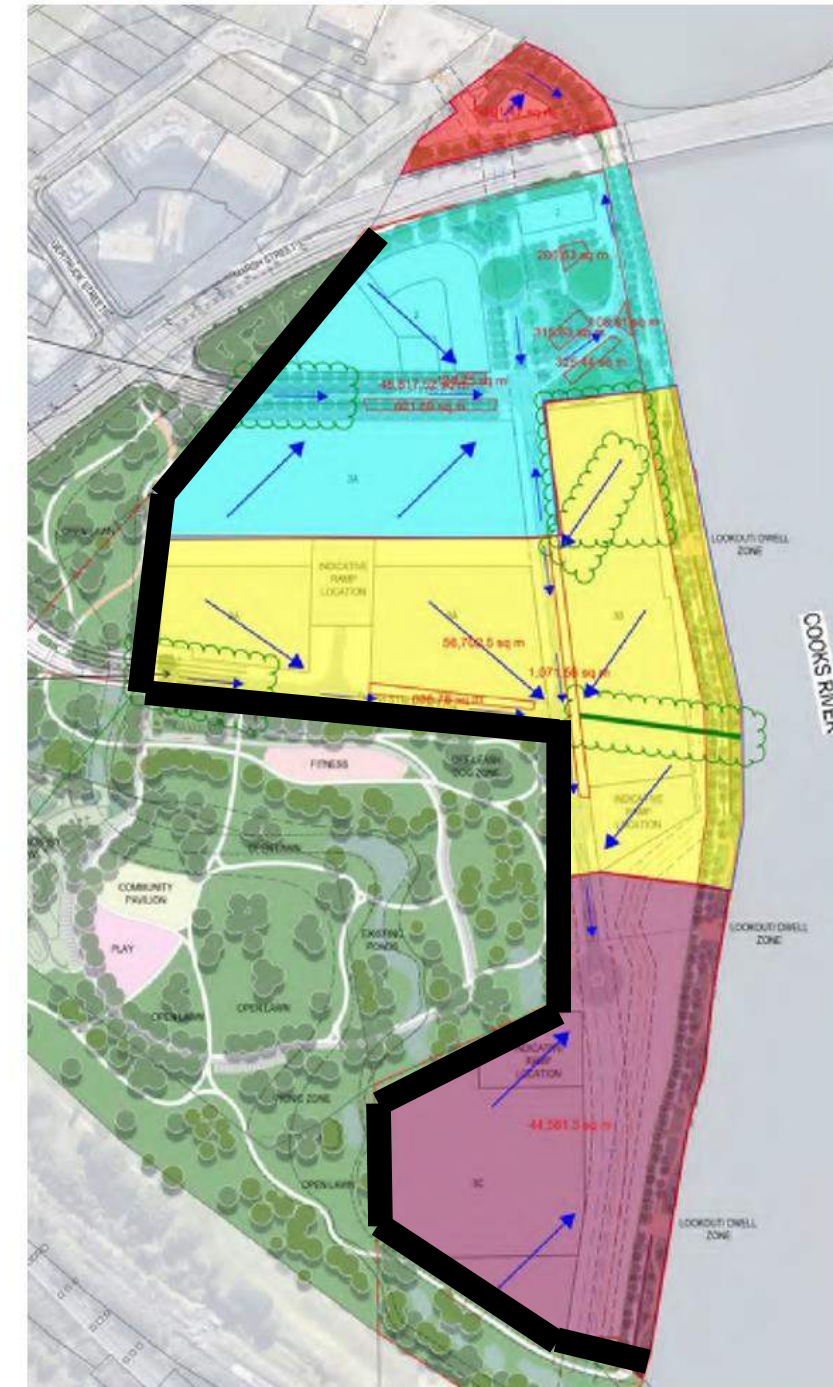


Figure 27: Division of sub-catchments within the development area

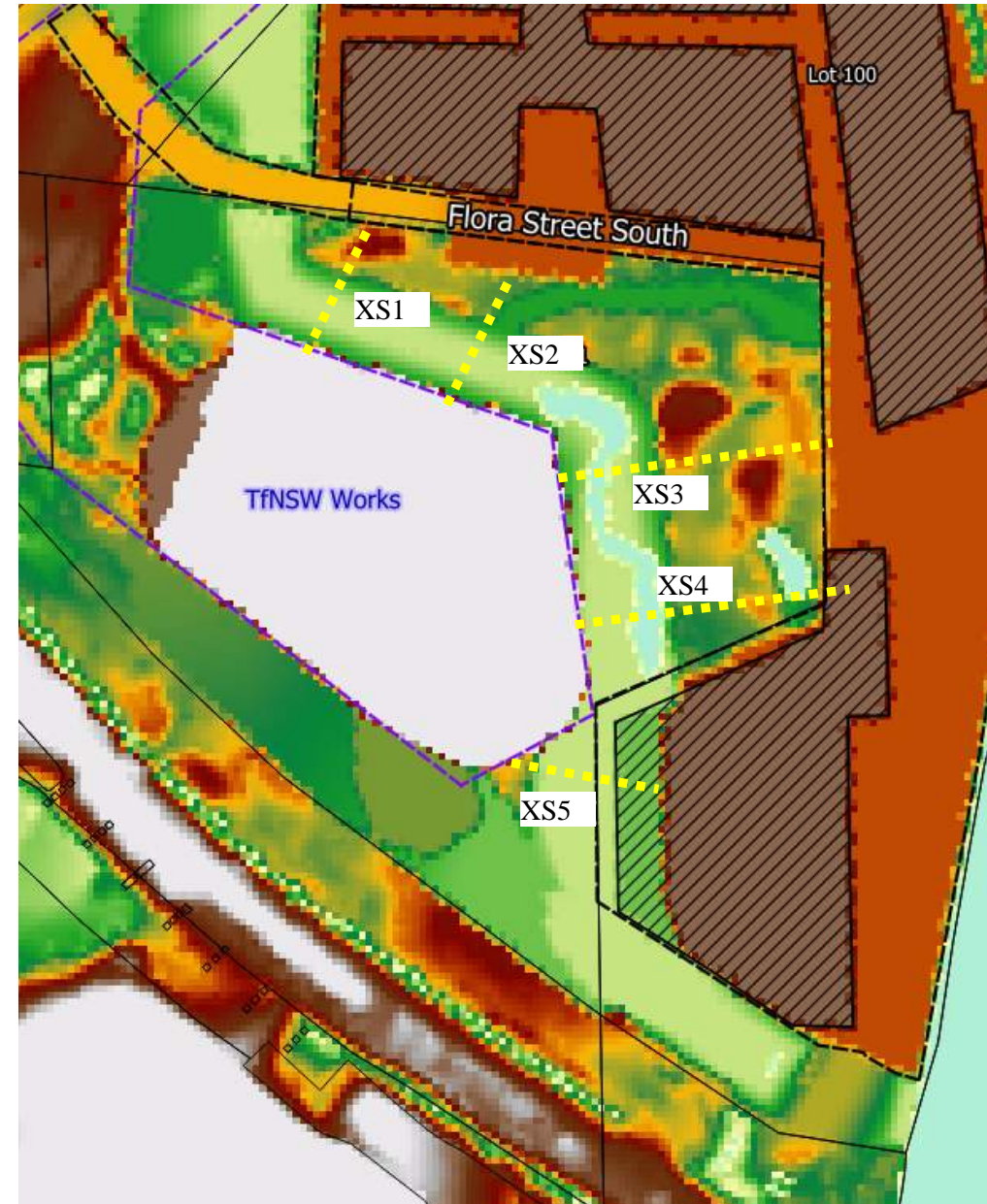
Area of Pemulwuy Park Required

- Small area of 400m² : see blue triangle
- Proposed to be at 1.0mAHD
- Will need to transition to TfNSW park levels at about 1:8 grade
- Will likely need transition zone to extend beyond 15m width
- CCI liability for future re-design and adjustment cost acknowledged

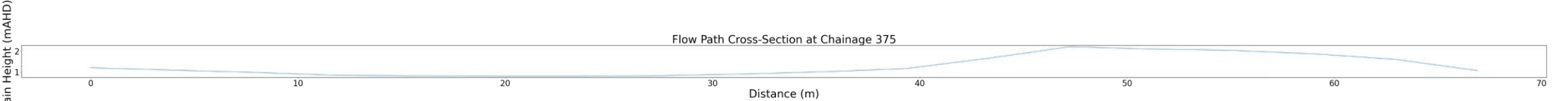


Cross Sections / Contours of Open-space Landform

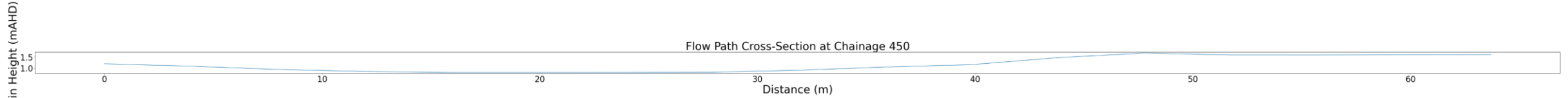
- Five (5) cross-sections provided on next slide
- Locations shown in right image
- Plotted with same vertical and horizontal scale (so no distortion)
- Grades very flat at about 2% to 3%



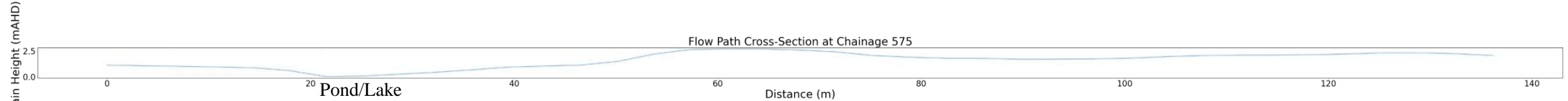
Cross Sections / Contours of Open-space Landform



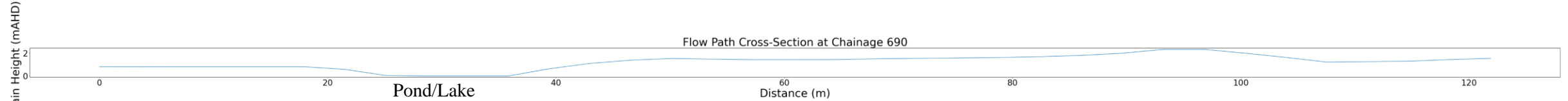
Cross Section 1



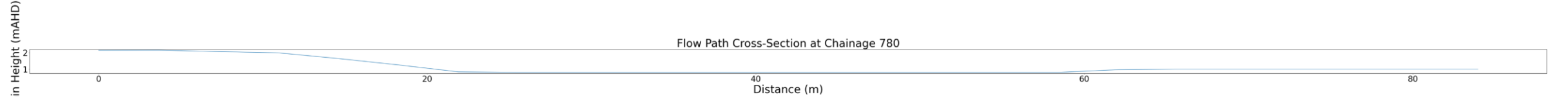
Cross Section 2



Cross Section 3



Cross Section 4



Cross Section 5

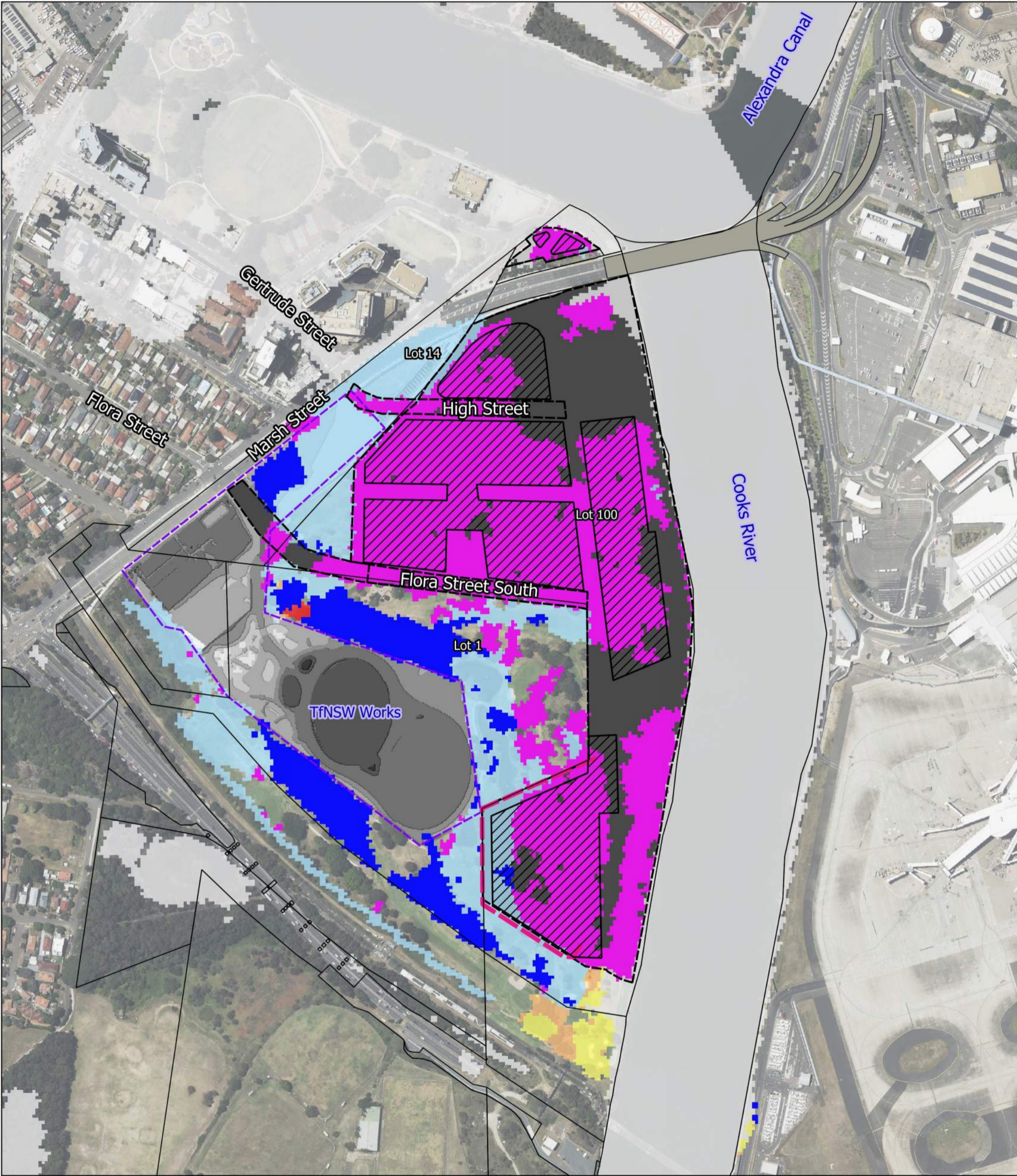
Summary of Proposed Refinements

- Use of undercroft for flowpath (in large/ rare floods)
- Compliant afflux
- Manages risk for debris on fence
- Resulting flood hazards similar to Cahill Park
- Only 37% of flowpath on Lot 1
- Car park access to Marsh St in 1:500 AEP flood along Flora Street East
- No change to the GGBF habitat area
- Recommended to proceed as this is the optimal solution for stakeholders



Appendix C.2

Flood Impact Maps for Alternative Design with Undercroft



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Extent of Development Footprint

Block 3C Fence

Giovanni Brunetti Bridge

Afflux (mm)

< -10

No change

10 - 20

20 - 50

50 - 100

100 - 200

> 200

Was Wet Now Dry

Was Dry Now Wet

Project Title Cooks Cove Planning Proposal				
Drawing Title 28m Undercroft Design Option Afflux (1% AEP) (0% Blockage)				
Job No 252942		Figure No C.2.1		
Coordinate System GDA 1994 MGA ZONE 56		Drawing Status DRAFT		
Scale <div><div>04080120160200 m</div></div>				
A	06/12/23	JO	GR	GR
Issue	Date	By	Chkd	Appd

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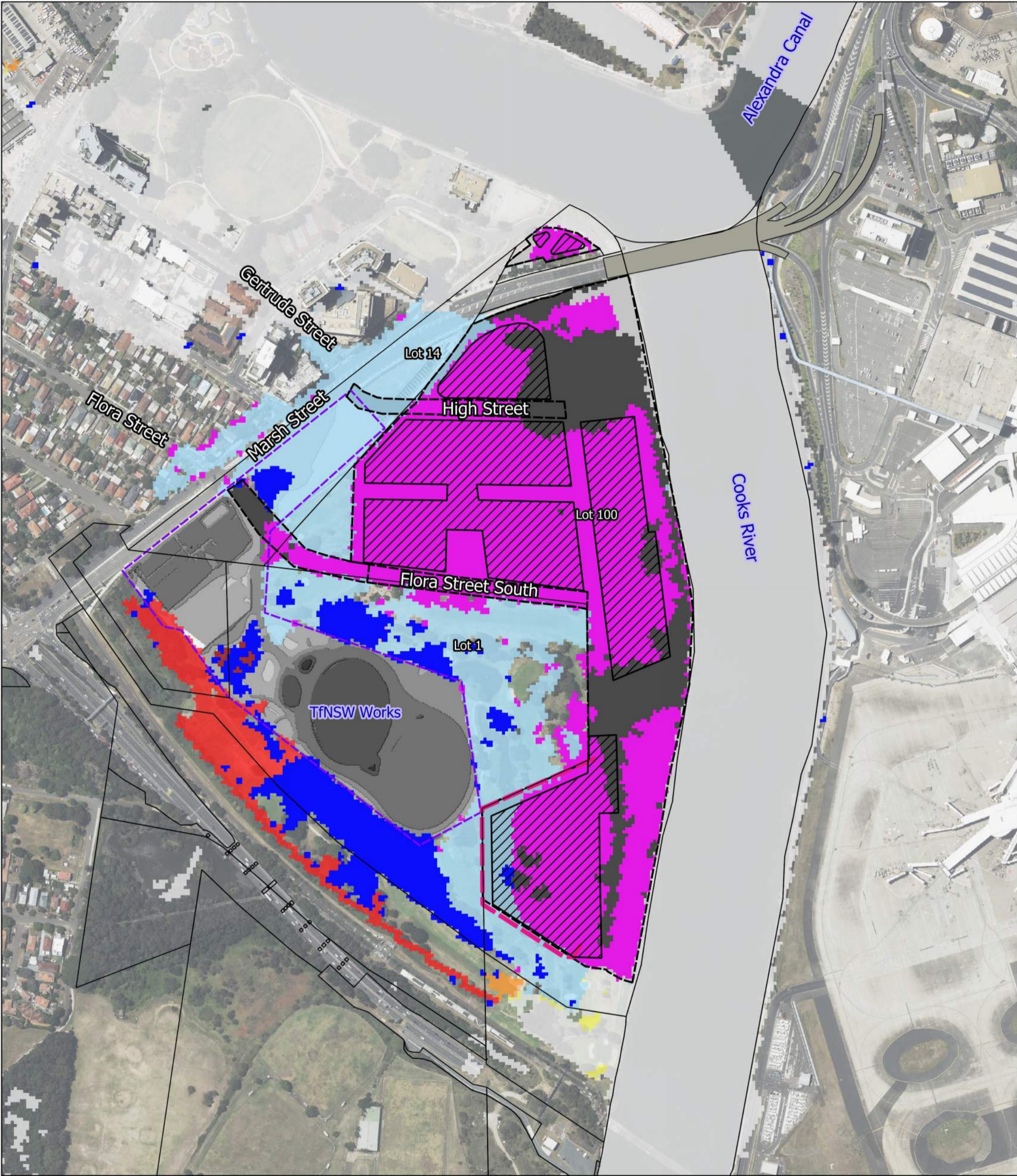
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Was Dry Now Wet

Project Title Cooks Cove Planning Proposal				
Drawing Title 28m Undercroft Design Option Afflux (0.5% AEP) (0% Blockage)				
Job No 252942		Figure No C.2.2		
Coordinate System GDA 1994 MGA ZONE 56		Drawing Status DRAFT		
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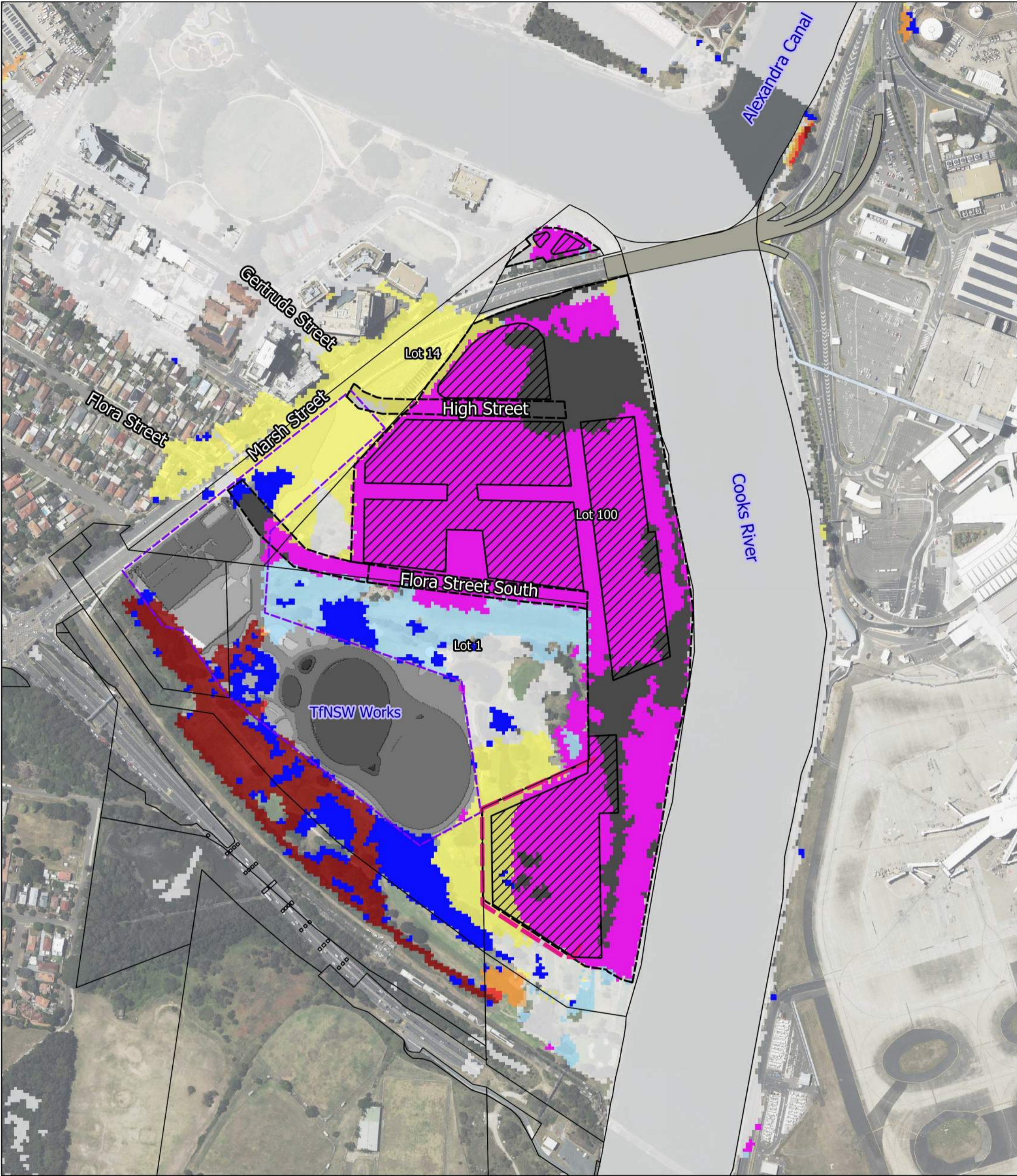
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Project Title Cooks Cove Planning Proposal				
Drawing Title 28m Undercroft Design Option Afflux (0.2% AEP) (0% Blockage)				
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Issue	Date	By	Chkd	Appd

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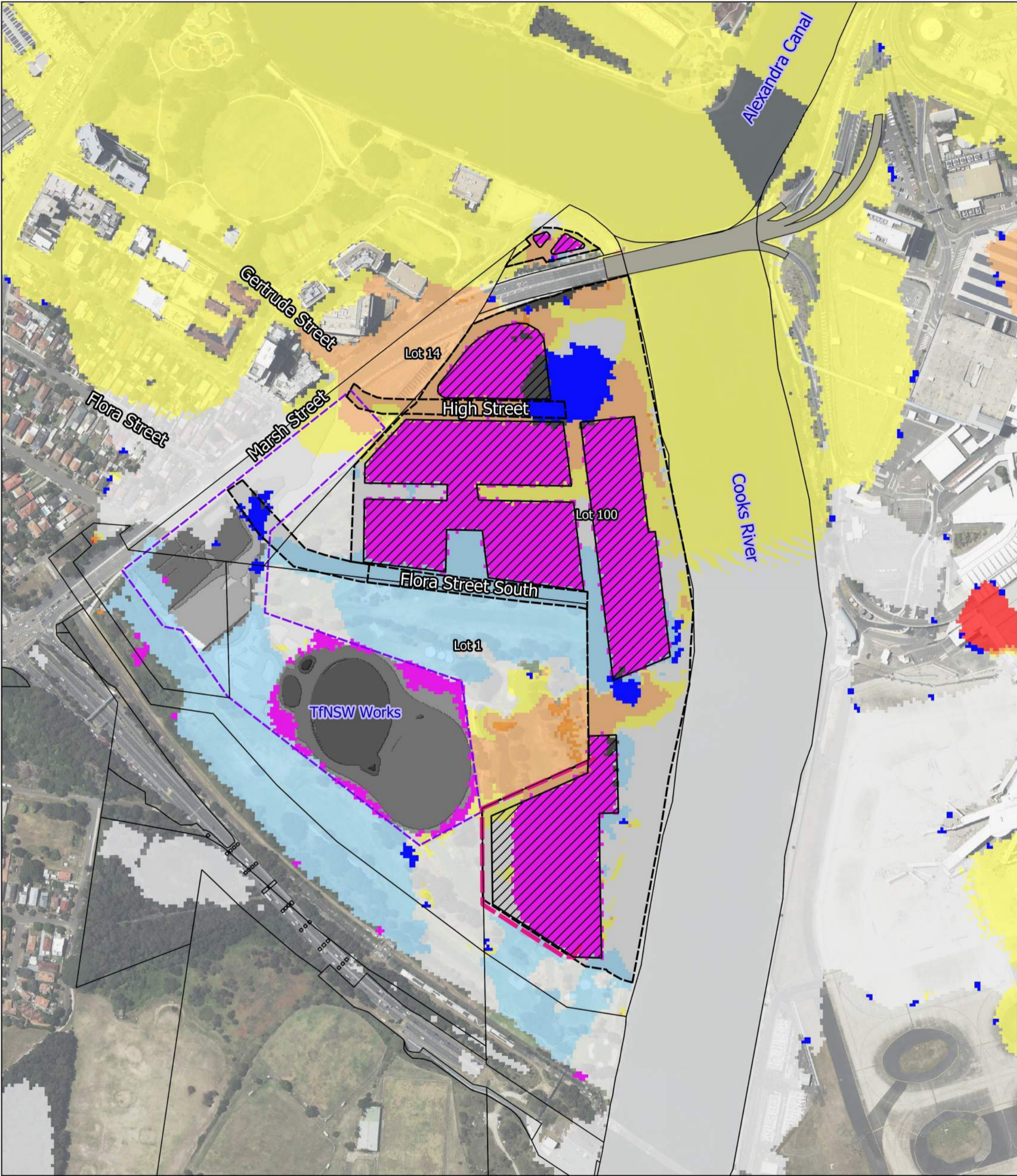
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Project Title Cooks Cove Planning Proposal				
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A	06/12/23	JO	GR	GR
Issue	Date	By	Chkd	Appd

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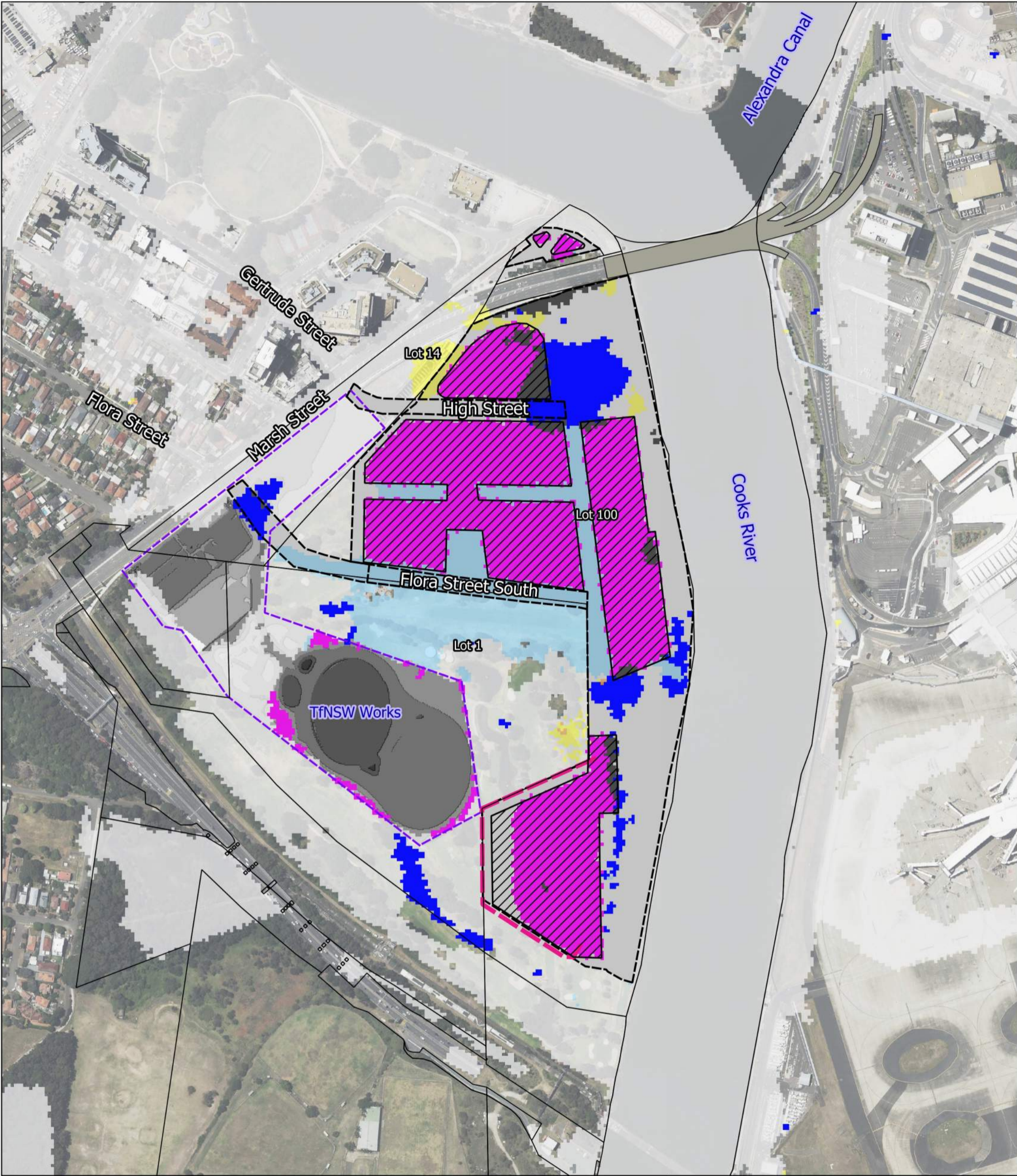
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Appendix C.3

Flood Impact Maps
(with 0.9m SLR climate change) for
Alternative Design with Undercroft



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Extent of Development Footprint

Block 3C Fence

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Project Title Cooks Cove Planning Proposal				
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Issue	Date	By	Chkd	Appd

N

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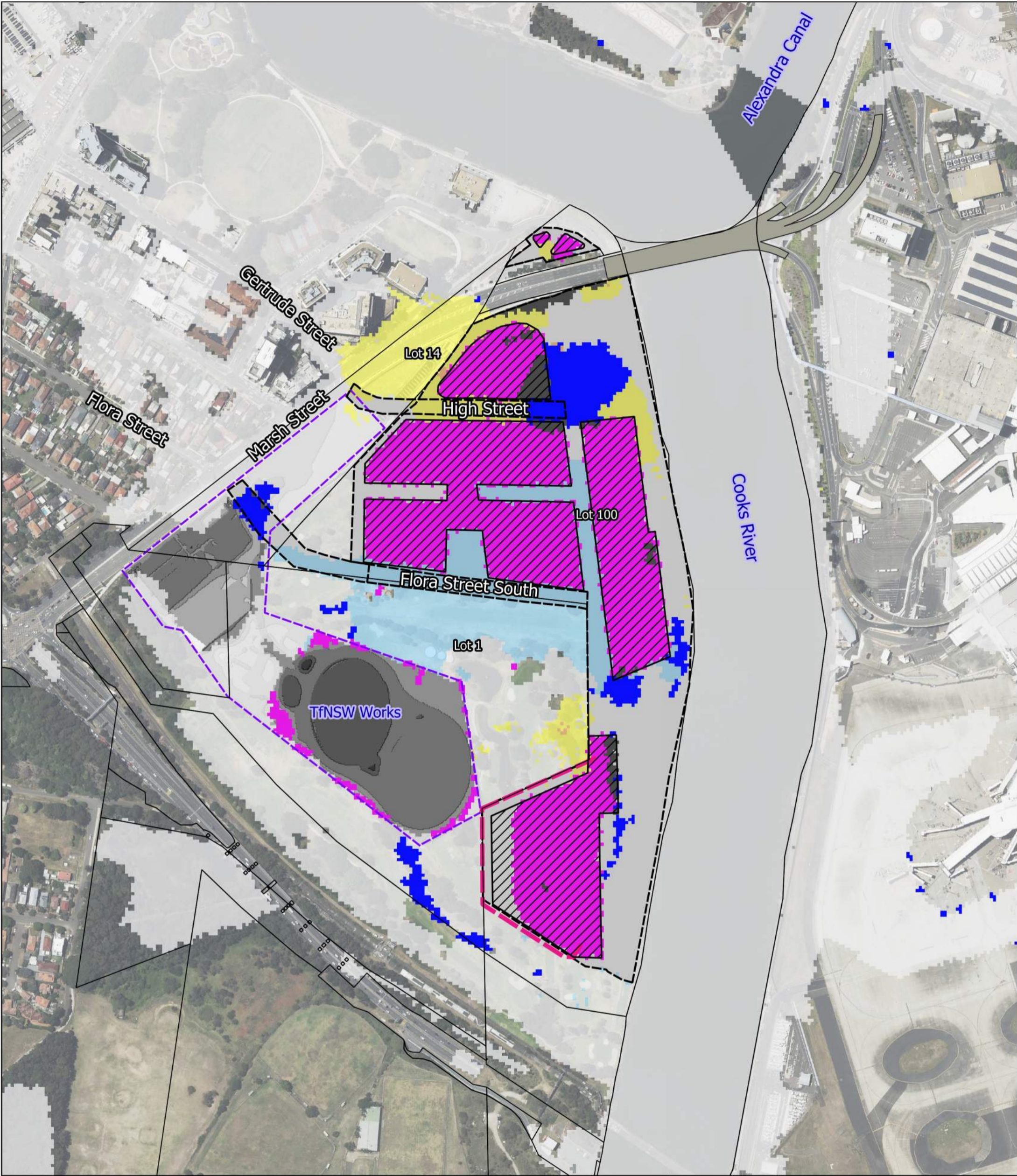
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Sources: Google Maps, CNES/Airbus, Landsat/Copernicus, Maxar Technologies



Cadastre

M6/M8 Permanent Facilities

Development Buildings

Extent of Development Footprint

Block 3C Fence

Giovanni Brunetti Bridge

Afflux (mm)

< -10

No change

10 - 20

20 - 50

50 - 100

100 - 200

> 200

Was Wet Now Dry

Was Dry Now Wet

Project Title Cooks Cove Planning Proposal				
Drawing Title 28m Undercroft Design Option Afflux (0.5% AEP + Climate Change) (0% Blockage)				
Job No 252942		Figure No C.3.2		
Coordinate System GDA 1994 MGA ZONE 56		Drawing Status DRAFT		
Scale <div><div>04080120160200 m</div></div>				
A	06/12/23	JO	GR	GR
Issue	Date	By	Chkd	Appd

N

Consultant

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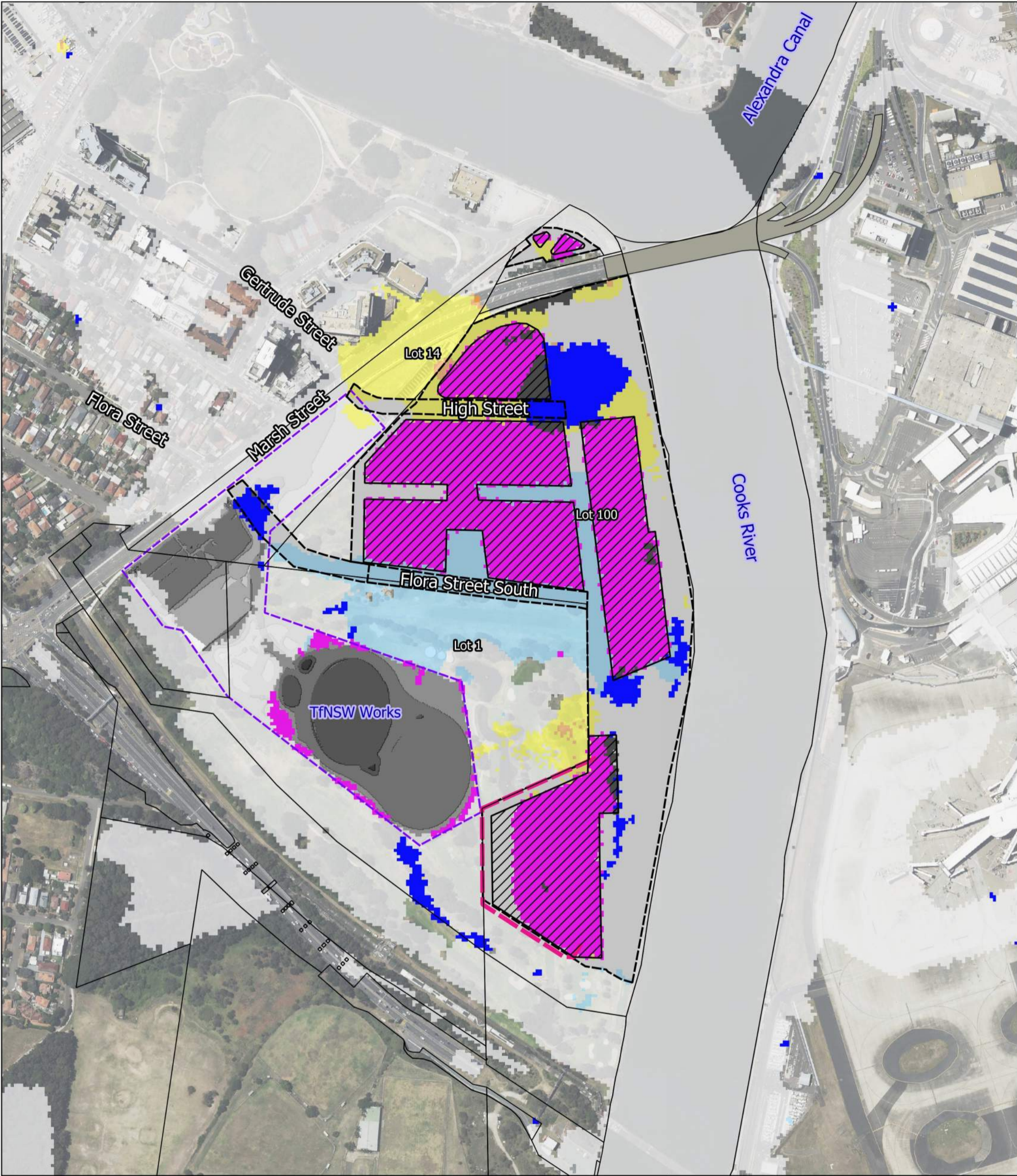
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Sources: Google Maps, CNES/Airbus, Landsat/Copernicus, Maxar Technologies



Cadastre

M6/M8 Permanent Facilities

Development Buildings

Extent of Development Footprint

Block 3C Fence

Giovanni Brunetti Bridge

Afflux (mm)

< -10

No change

10 - 20

20 - 50

50 - 100

100 - 200

> 200

Was Wet Now Dry

Was Dry Now Wet

Project Title Cooks Cove Planning Proposal				
Drawing Title 28m Undercroft Design Option Afflux (0.2% AEP + Climate Change) (0% Blockage)				
Job No 252942	Figure No C.3.3			
Coordinate System GDA 1994 MGA ZONE 56		Drawing Status DRAFT		
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A	06/12/23	JO	GR	GR
Issue	Date	By	Chkd	Appd

N

Consultant

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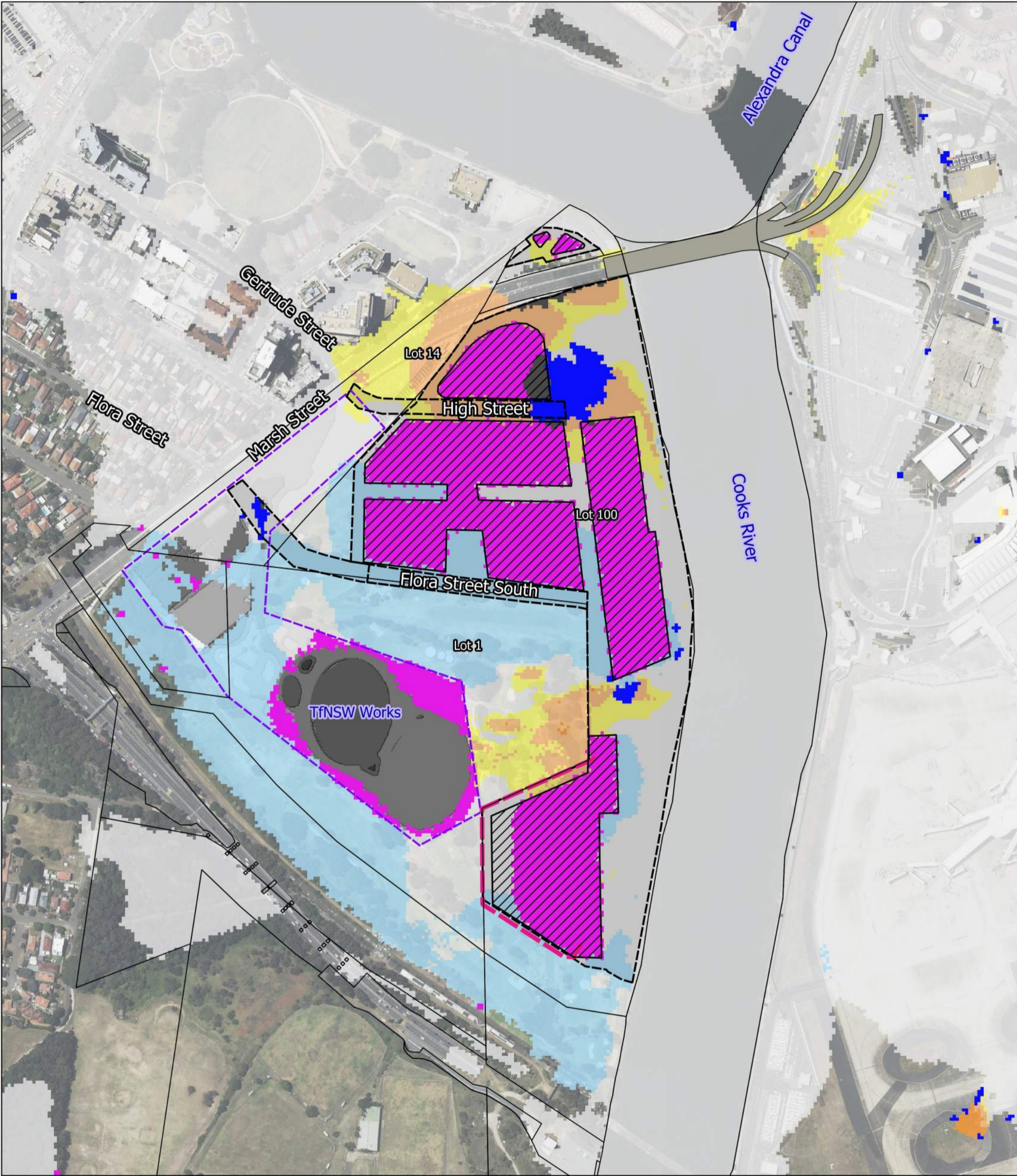
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Sources: Google Maps, CNES/Airbus, Landsat/Copernicus, Maxar Technologies



Cadastre

M6/M8 Permanent Facilities

Development Buildings

Extent of Development Footprint

Block 3C Fence

Giovanni Brunetti Bridge

Afflux (mm)

< -10

No change

10 - 20

20 - 50


50 - 100

100 - 200

> 200

Was Wet Now Dry

Was Dry Now Wet

Project Title Cooks Cove Planning Proposal				
Drawing Title 28m Undercroft Design Option Afflux (PMF + Climate Change) (50% Blockage)				
Job No 252942		Figure No C.3.4		
Coordinate System GDA 1994 MGA ZONE 56		Drawing Status DRAFT		
Scale <div>04080120160200 m</div> 				
A	06/12/23	JO	GR	GR
Issue	Date	By	Chkd	Appd

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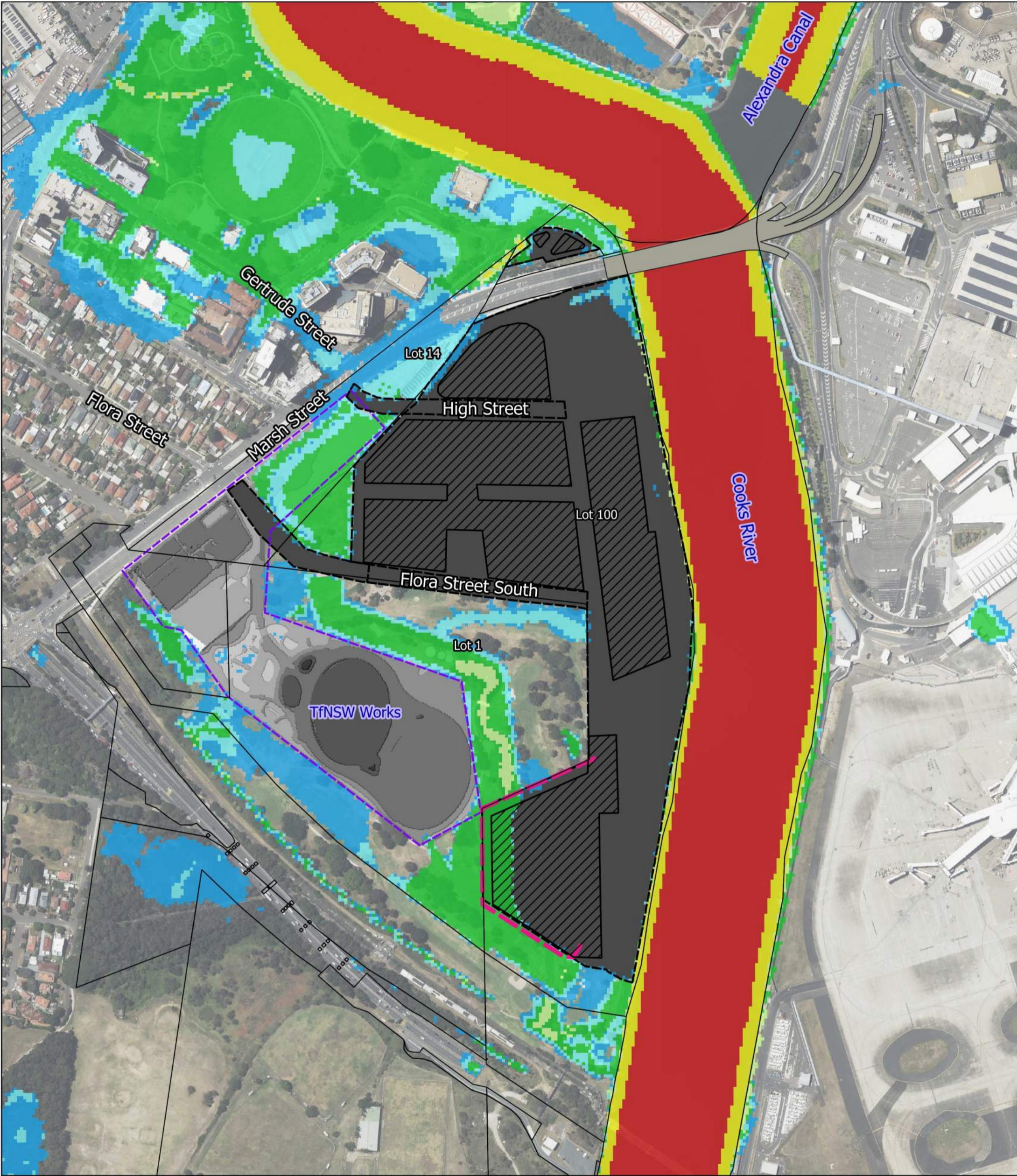
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Sources: Google Maps, CNES/Airbus, Landsat/Copernicus, Maxar Technologies

Appendix C.4

Flood Hazard Maps for Alternative Design with Undercroft



- Legend

Cadastre

M6/M8 Permanent Facilities

Development Buildings

Extent of Development Footprint

Block 3C Fence

Giovanni Brunetti Bridge

Peak Flood Hazard (ZAEM1)

H1

H2

H3

H4

H5

H6

Project Title Cooks Cove Planning Proposal				
Drawing Title 28m Undercroft Design Option Peak Flood Hazard (1% AEP)				
Job No 252942		Figure No C.4.1		
Coordinate System GDA 1994 MGA ZONE 56		Drawing Status DRAFT		
Scale <div><div>04080120160200 m</div></div>				
A	05/12/23	JO	GR	GR
Issue	Date	By	Chkd	Appd

N

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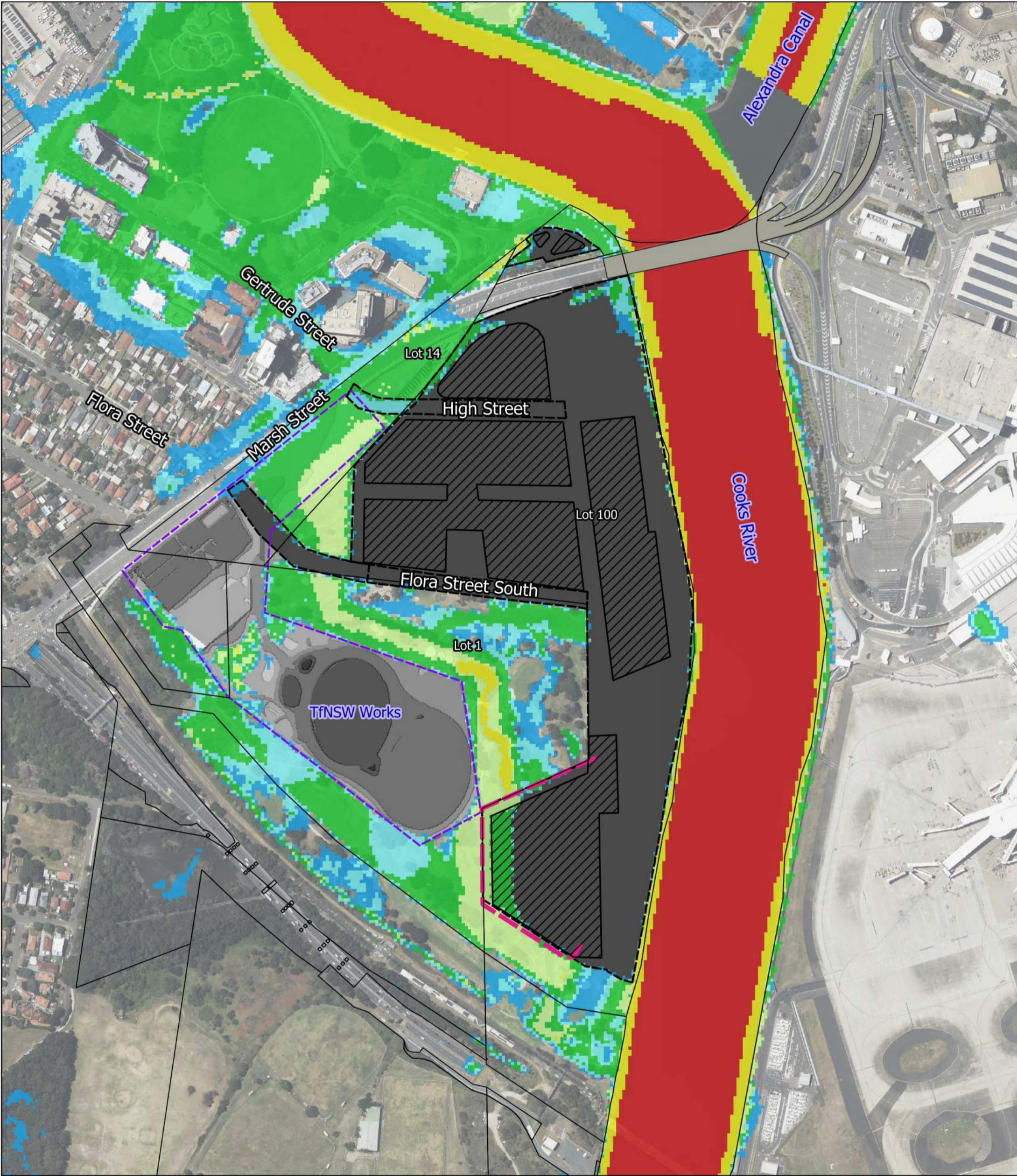
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Sources: Google Maps, CNES/Airbus, Landsat/Copernicus, Maxar Technologies



- Legend

 - Cadastre
 - M6/M8 Permanent Facilities
 - Development Buildings
 - Extent of Development Footprint
 - Block 3C Fence
 - Giovanni Brunetti Bridge
- Peak Flood Hazard (ZAEM1)

 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

Project Title
Cooks Cove Planning Proposal

Drawing Title
28m Undercroft Design Option Peak
Flood Hazard (0.5% AEP)

Job No 252942 **Figure No** C.4.2

Coordinate System GDA 1994 MGA ZONE 56 **Drawing Status** DRAFT

Scale
0 40 80 120 160 200 m

A	05/12/23	JO	GR	GR
Issue	Date	By	Chkd	Appd

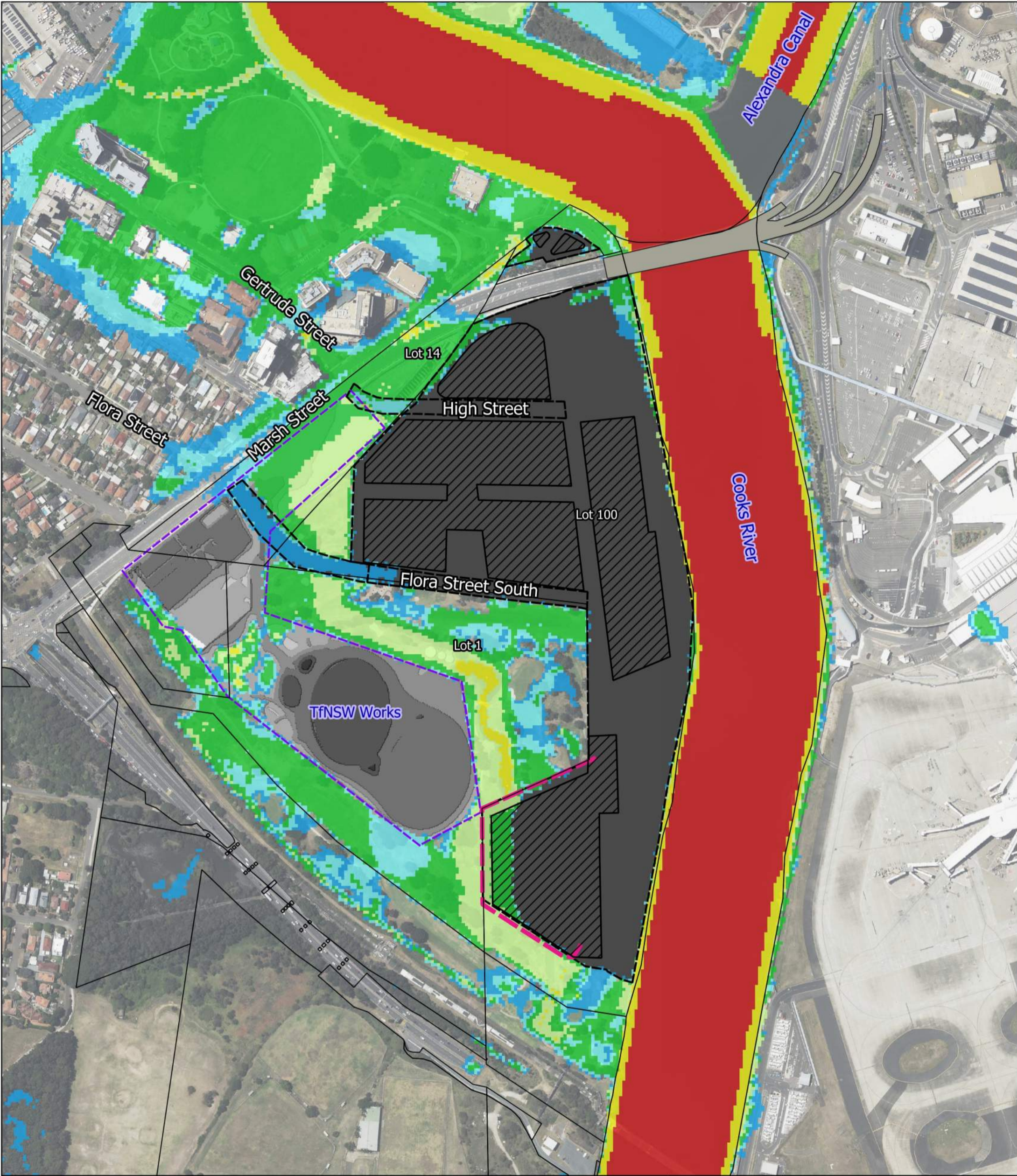


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Sources: Google Maps, CNES/Airbus, Landsat/Copernicus, Maxar Technologies



- Legend

 - Cadastre
 - M6/M8 Permanent Facilities
 - Development Buildings
 - Extent of Development Footprint
 - Block 3C Fence
 - Giovanni Brunetti Bridge
- Peak Flood Hazard (ZAEM1)

 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

Project Title
Cooks Cove Planning Proposal

Drawing Title
28m Undercroft Design Option Peak
Flood Hazard (0.2% AEP)

Job No 252942 **Figure No** C.4.3

Coordinate System GDA 1994 MGA ZONE 56 **Drawing Status** DRAFT

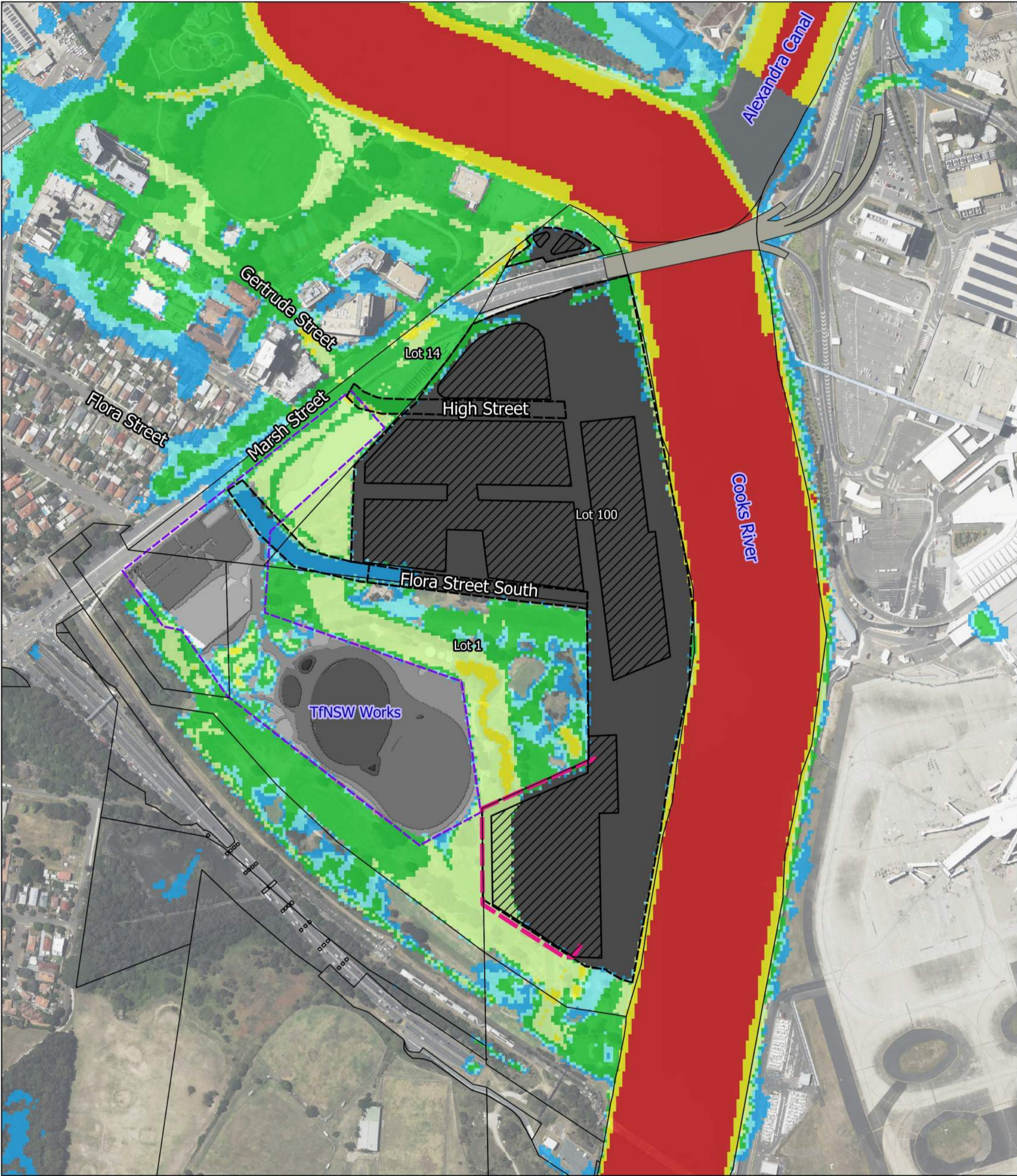
Scale
0 40 80 120 160 200 m

A	05/12/23	JO	GR	GR
Issue	Date	By	Chkd	Appd



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Sources: Google Maps, CNES/Airbus, Landsat/Copernicus, Maxar Technologies



- Legend

 - Cadastre
 - M6/M8 Permanent Facilities
 - Development Buildings
 - Extent of Development Footprint
 - Block 3C Fence
 - Giovanni Brunetti Bridge
- Peak Flood Hazard (ZAEM1)

 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

Project Title
Cooks Cove Planning Proposal

Drawing Title
28m Undercroft Design Option Peak
Flood Hazard (0.05% AEP)

Job No
252942

Figure No
C.4.4

Coordinate System
GDA 1994 MGA ZONE 56

Drawing Status
DRAFT

Scale
0 40 80 120 160 200 m

A	05/12/23	JO	GR	GR
Issue	Date	By	Chkd	Appd

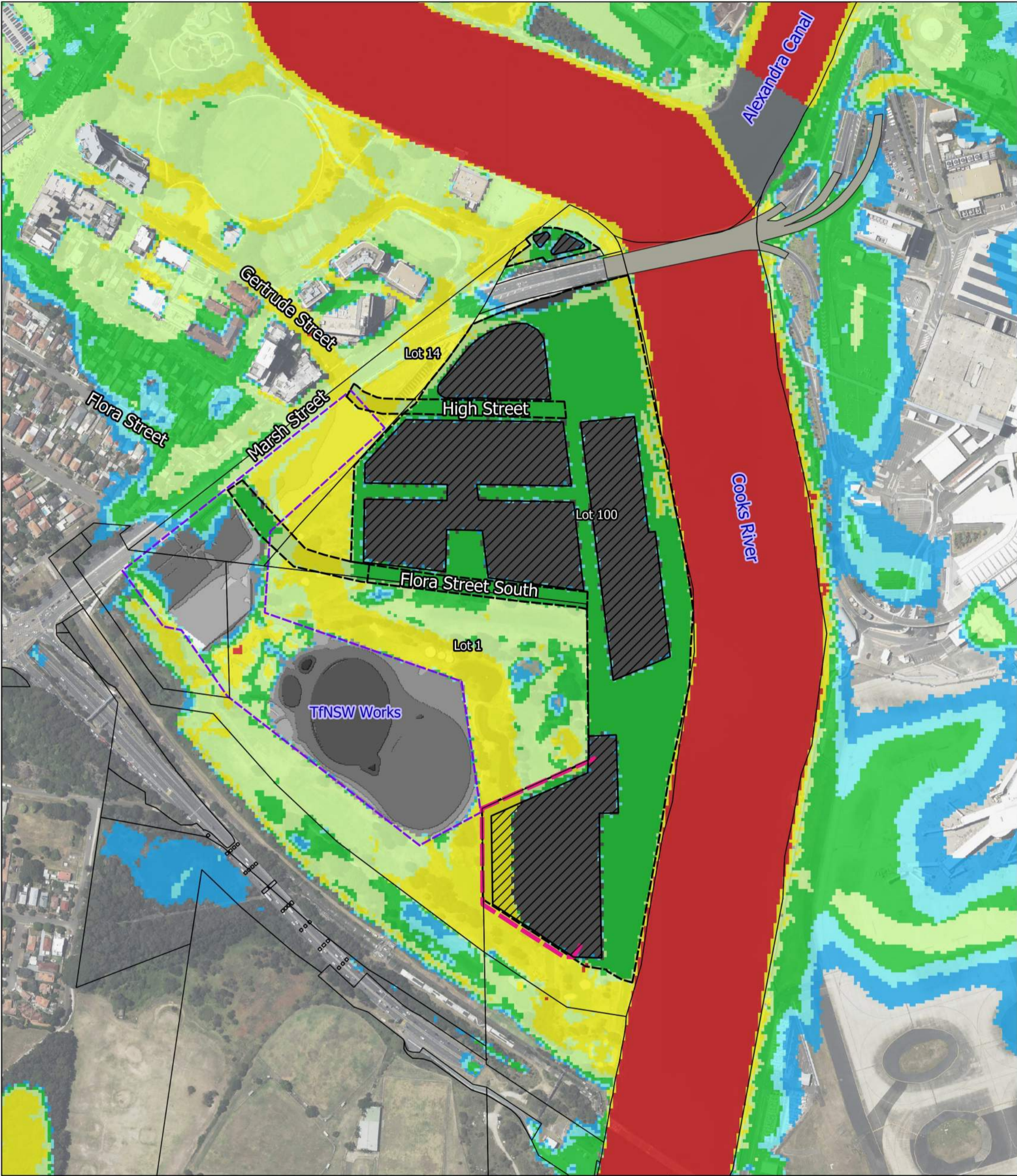


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- Legend

 - Cadastre
 - M6/M8 Permanent Facilities
 - Development Buildings
 - Extent of Development Footprint
 - Block 3C Fence
 - Giovanni Brunetti Bridge
- Peak Flood Hazard (ZAEM1)

 - H1
 - H2
 - H3
 - H4
 - H5
 - H6

Project Title
Cooks Cove Planning Proposal

Drawing Title
28m Undercroft Design Option Peak
Flood Hazard (PMF)

Job No 252942 **Figure No** C.4.5

Coordinate System GDA 1994 MGA ZONE 56 **Drawing Status** DRAFT

Scale
0 40 80 120 160 200 m

A	05/12/23	JO	GR	GR
Issue	Date	By	Chkd	Appd

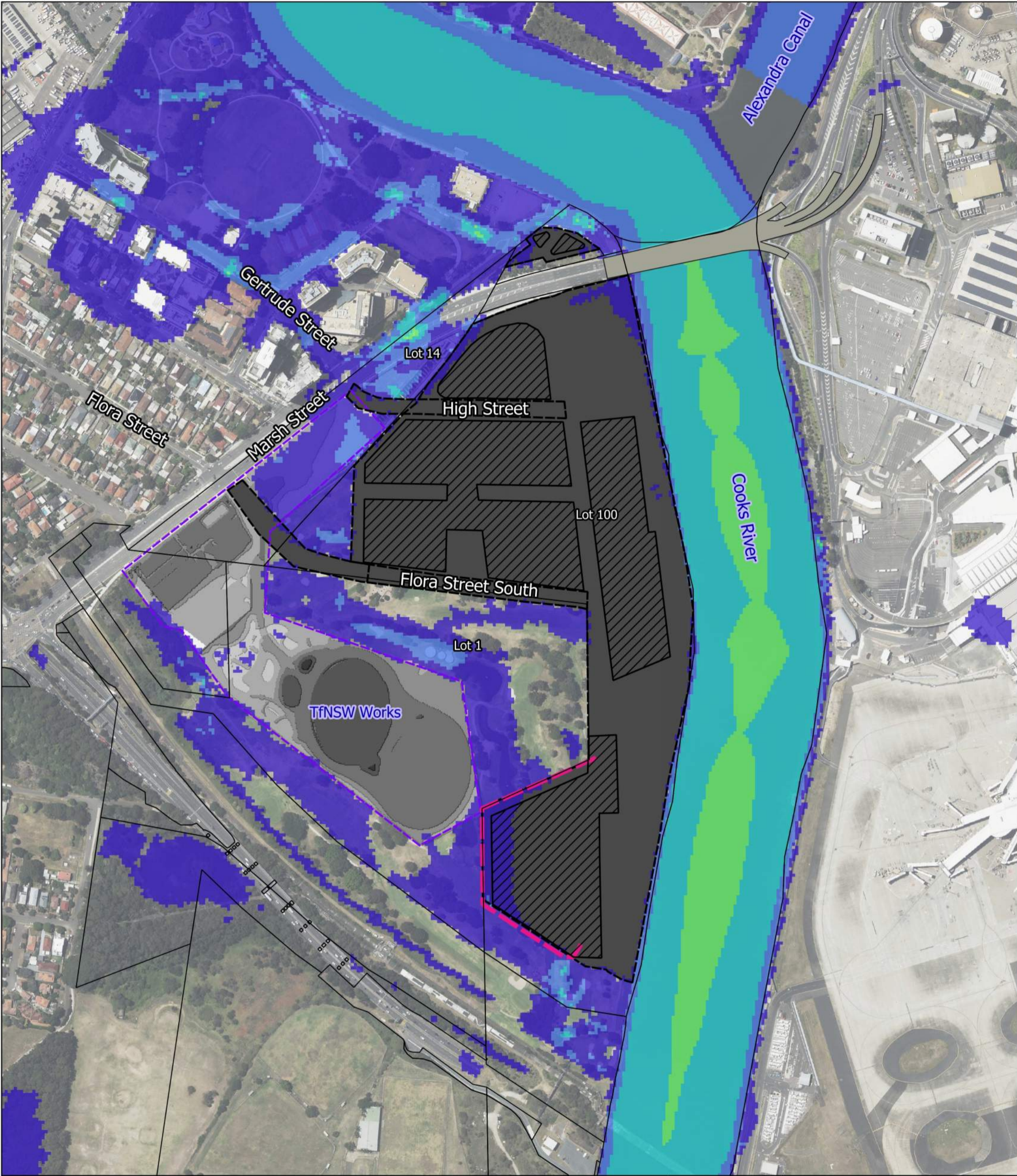


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Sources: Google Maps, CNES/Airbus, Landsat/Copernicus, Maxar Technologies

Appendix C.5

Flood Velocity Maps for Alternative Design with Undercroft



Cadastre

M6/M8 Permanent Facilities

Development Buildings

Extent of Development Footprint

Block 3C Fence

Giovanni Brunetti Bridge

Peak Flood Velocity (m/s)

<= 0.5

0.5 - 1.0

1.0 - 1.5

1.5 - 2.0

2.0 - 2.5

2.5 - 3.0

3.0 - 3.5

> 3.5

Project Title Cooks Cove Planning Proposal				
Drawing Title 28m Undercroft Design Option Peak Flood Velocity (1% AEP)				
Job No 252942		Figure No C.5.1		
Coordinate System GDA 1994 MGA ZONE 56		Drawing Status DRAFT		
Scale <div><div>04080120160200 m</div></div>				
A	05/12/23	JO	GR	GR
Issue	Date	By	Chkd	Appd

N

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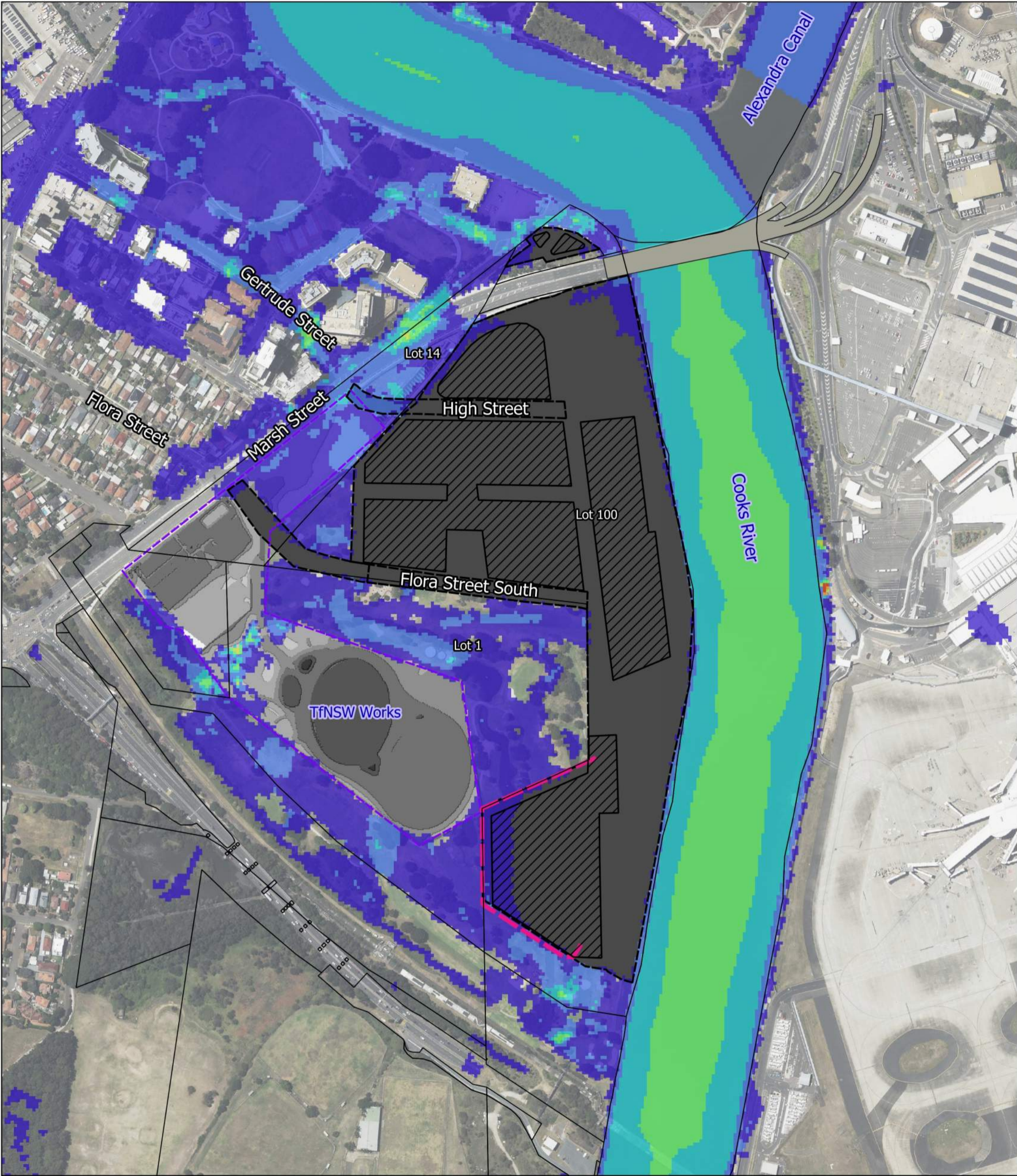
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Sources: Google Maps, CNES/Airbus, Landsat/Copernicus, Maxar Technologies



Cadastre

M6/M8 Permanent Facilities

Development Buildings

Extent of Development Footprint

Block 3C Fence

Giovanni Brunetti Bridge

Peak Flood Velocity (m/s)

<= 0.5

0.5 - 1.0

1.0 - 1.5

1.5 - 2.0

2.0 - 2.5

2.5 - 3.0

3.0 - 3.5

> 3.5

Project Title Cooks Cove Planning Proposal				
Drawing Title 28m Undercroft Design Option Peak Flood Velocity (0.5% AEP)				
Job No 252942		Figure No C.5.2		
Coordinate System GDA 1994 MGA ZONE 56		Drawing Status DRAFT		
Scale <div><div>04080120160200 m</div></div>				
A	05/12/23	JO	GR	GR
Issue	Date	By	Chkd	Appd

N

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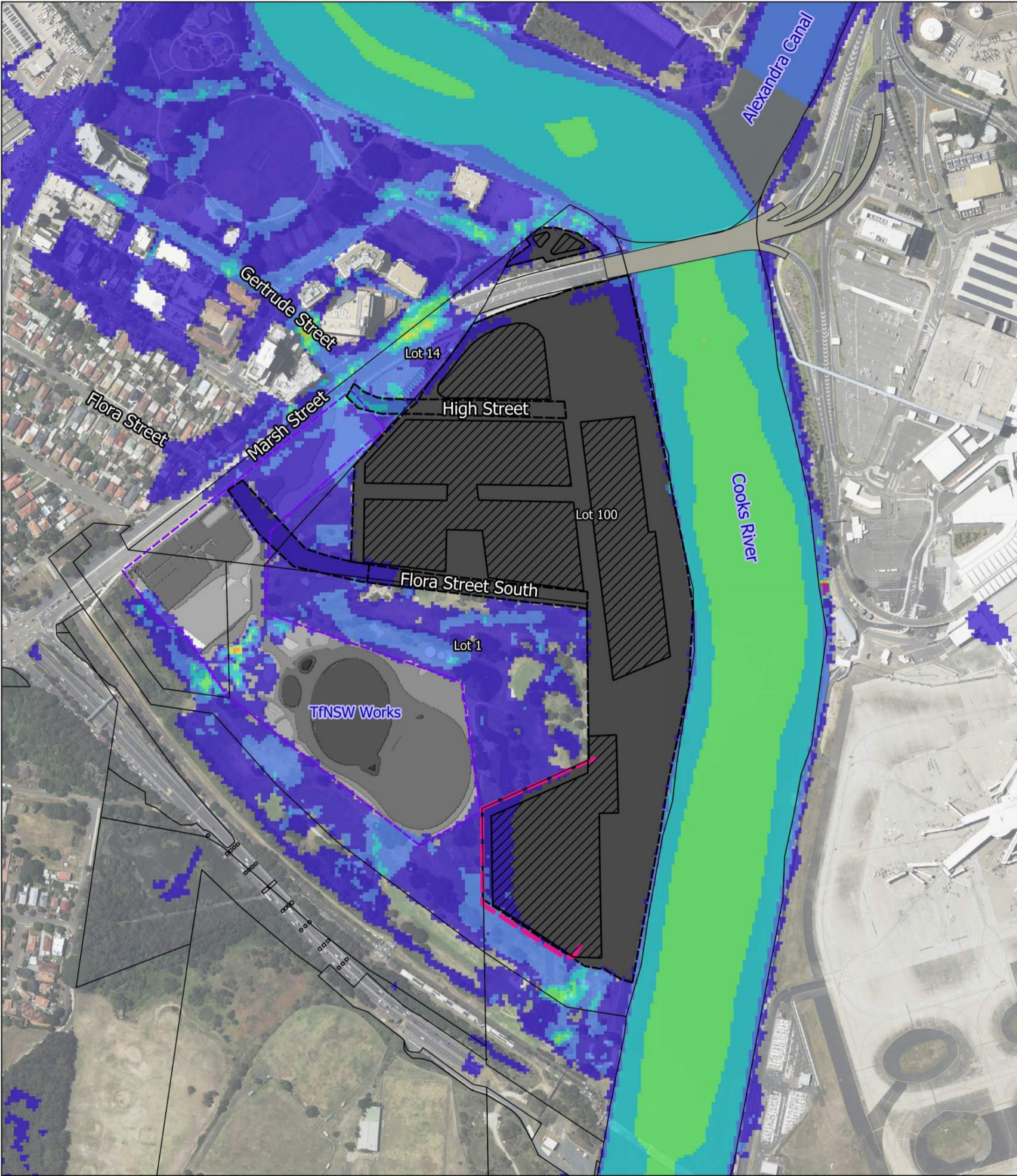
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Cadastre

M6/M8 Permanent Facilities

Development Buildings

Extent of Development Footprint

Block 3C Fence

Giovanni Brunetti Bridge

Peak Flood Velocity (m/s)

<= 0.5

0.5 - 1.0

1.0 - 1.5

1.5 - 2.0

2.0 - 2.5

2.5 - 3.0

3.0 - 3.5

> 3.5

Project Title
Cooks Cove Planning Proposal

Drawing Title
28m Undercroft Design Option Peak
Flood Velocity (0.2% AEP)

Job No	Figure No
252942	C.5.3

Coordinate System	Drawing Status
GDA 1994 MGA ZONE 56	DRAFT

Scale

A	05/12/23	JO	GR	GR
Issue	Date	By	Chkd	Appd

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