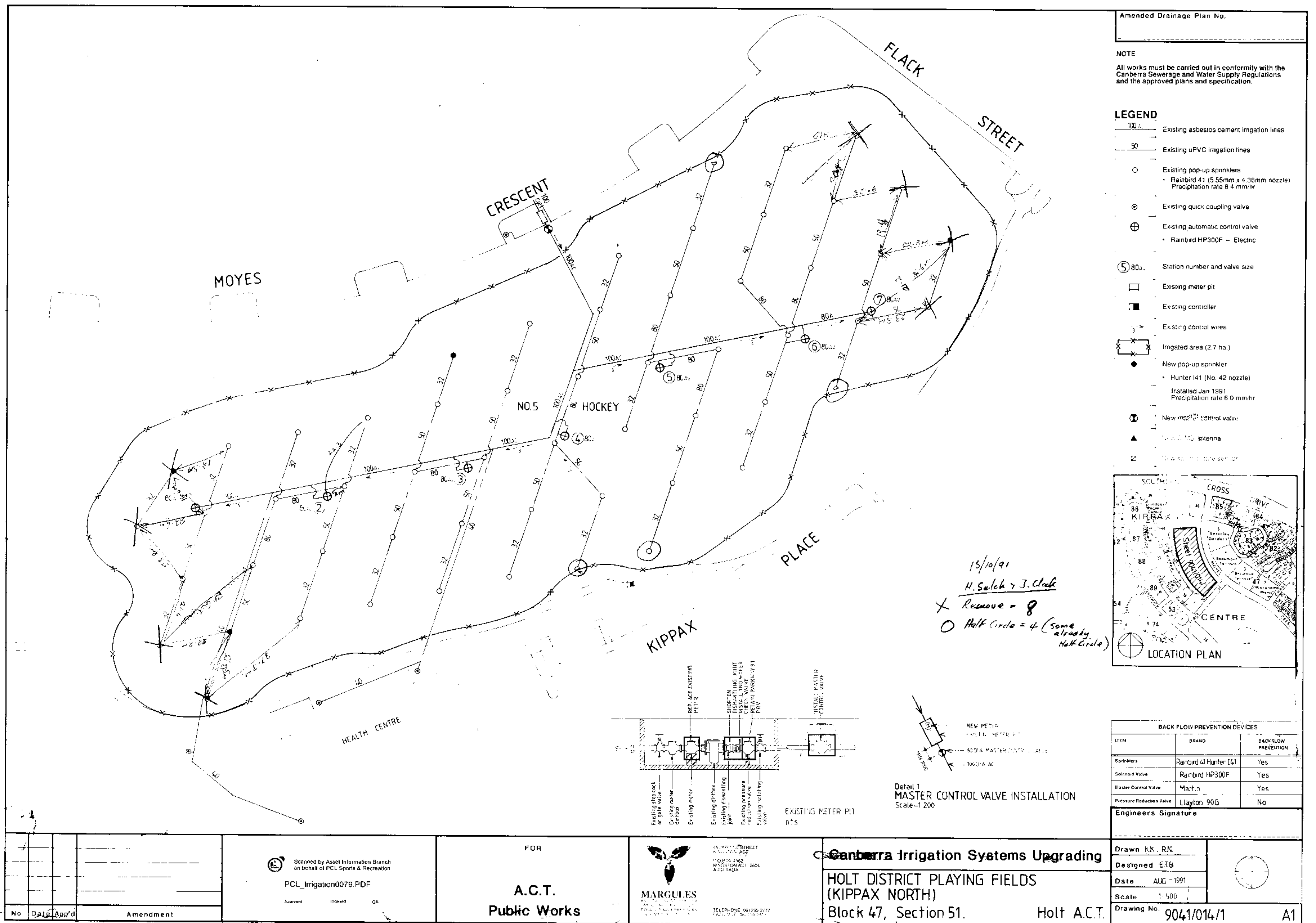

Appendix D

*DBYD and Work as
Executed Information*



HOLT
P/L



Job No 20015134

Phone: 1100
www.1100.com.au

Caller Details

Contact: Ms Mana Naghshgar
Company: Not Supplied
Address: 4 Lidgett Place
Florey ACT 2615

Caller Id: 2212242
Mobile: Not Supplied
Email: m.naghshgar@gmail.com
Phone: 0420215440
Fax: Not Supplied

Dig Site and Enquiry Details

WARNING: The map below only displays the location of the proposed dig site and does not display any asset owners' pipe or cables. The area highlighted has been used only to identify the participating asset owners, who will send information to you directly.



User Reference: Not Supplied
Working on Behalf of: ACT Government
Enquiry Date: 06/08/2020
Start Date: 01/12/2020
End Date: 31/08/2021
Address: Kippax Place
Holt ACT 2615
Job Purpose: Excavation
Location of Workplace: Both
Onsite Activity: Mechanical Excavation
Location in Road: CarriageWay, Footpath, Nature Strip

- Check the location of the dig site is correct. If not submit a new enquiry.
- If the scope of works change, or plan validity dates expire, resubmit your enquiry.
- Do NOT dig without plans. Safe excavation is your responsibility. If you do not understand the plans or how to proceed safely, please contact the relevant asset owners.

Notes/Description of Works:

Your Responsibilities and Duty of Care

- The lodgement of an enquiry does not authorise the project to commence. You must obtain all necessary information from any and all likely impacted asset owners prior to excavation.
- If plans are not received within 2 working days, contact the asset owners directly & quote their Sequence No.
- ALWAYS perform an onsite inspection for the presence of assets. Should you require an onsite location, contact the asset owners directly. Please remember, plans do not detail the exact location of assets.
- Pothole to establish the exact location of all underground assets using a hand shovel, before using heavy machinery.
- Ensure you adhere to any State legislative requirements regarding Duty of Care and safe digging requirements.
- If you damage an underground asset you MUST advise the asset owner immediately.
- By using this service, you agree to Privacy Policy and the terms and disclaimers set out at www.1100.com.au
- For more information on safe excavation practices, visit www.1100.com.au

Asset Owner Details

The assets owners listed below have been requested to contact you with information about their asset locations within 2 working days. Additional time should be allowed for information issued by post. It is **your responsibility** to identify the presence of any underground assets in and around your proposed dig site. Please be aware, that not all asset owners are registered with the Dial Before You Dig service, so it is **your responsibility** to identify and contact any asset owners not listed here directly.

** Asset owners highlighted by asterisks ** require that you visit their offices to collect plans.



Asset owners highlighted with a hash require that you call them to discuss your enquiry or to obtain plans.

Seq. No.	Authority Name	Phone	Status
100461568	Department of Finance	0262263869	NOTIFIED
100461571	Evoenergy/Icon Water	0262935770	NOTIFIED
100461572	NBN Co, NswAct	1800626329	NOTIFIED
100461570	Telstra NSW, South	1800653935	NOTIFIED
100461569	Transact Communications	1800786306	NOTIFIED
100461573	TransGrid	0296200422	NOTIFIED
100461574	Transport Canberra and City Services	0278013960	NOTIFIED












END OF UTILITIES LIST

Icon Water: Effluent Re-use Network Legend




Hydrant

-  Overhead Filling Point
-  Mill Cock
-  Pillar Hydrant
-  High Capacity
-  Spring Hydrant



Fitting

-  Outlet
-  Inlet
-  Blank Flange
-  Dual Service Tee
-  End Cap
-  Gibault Joint
-  Maintenance Hole
-  Open End
-  Orifice Plate
-  Reducer
-  Tapping Band Bend


Service Connection (Meter)

-  Flow Element
-  Billing Large Diameter
-  Billing Small Diameter

Test Station

-  Flow Recording Device
-  Sampling Point







Pump

-  Pump



System Valve

-  <all other values>
-  Ball Valve
-  Butterfly Valve
-  Cone Valve
-  Gate Valve
-  Globe Valve
-  Needle Valve
-  Scour Valve

Control (Protection) Valve

-  Double Check
-  Reflux Valve
-  Single Air Valve
-  Double Air Valve
-  Enhanced Double Air Valve
-  Reduced Pressure Zone Valve
-  Pressure Relief Valve
-  Float Valve





Curb Stop Valve

-  Main Cock Valve
-  Tapping Band Valve






Reservoir Supply

-  Reservoir Supply






Main

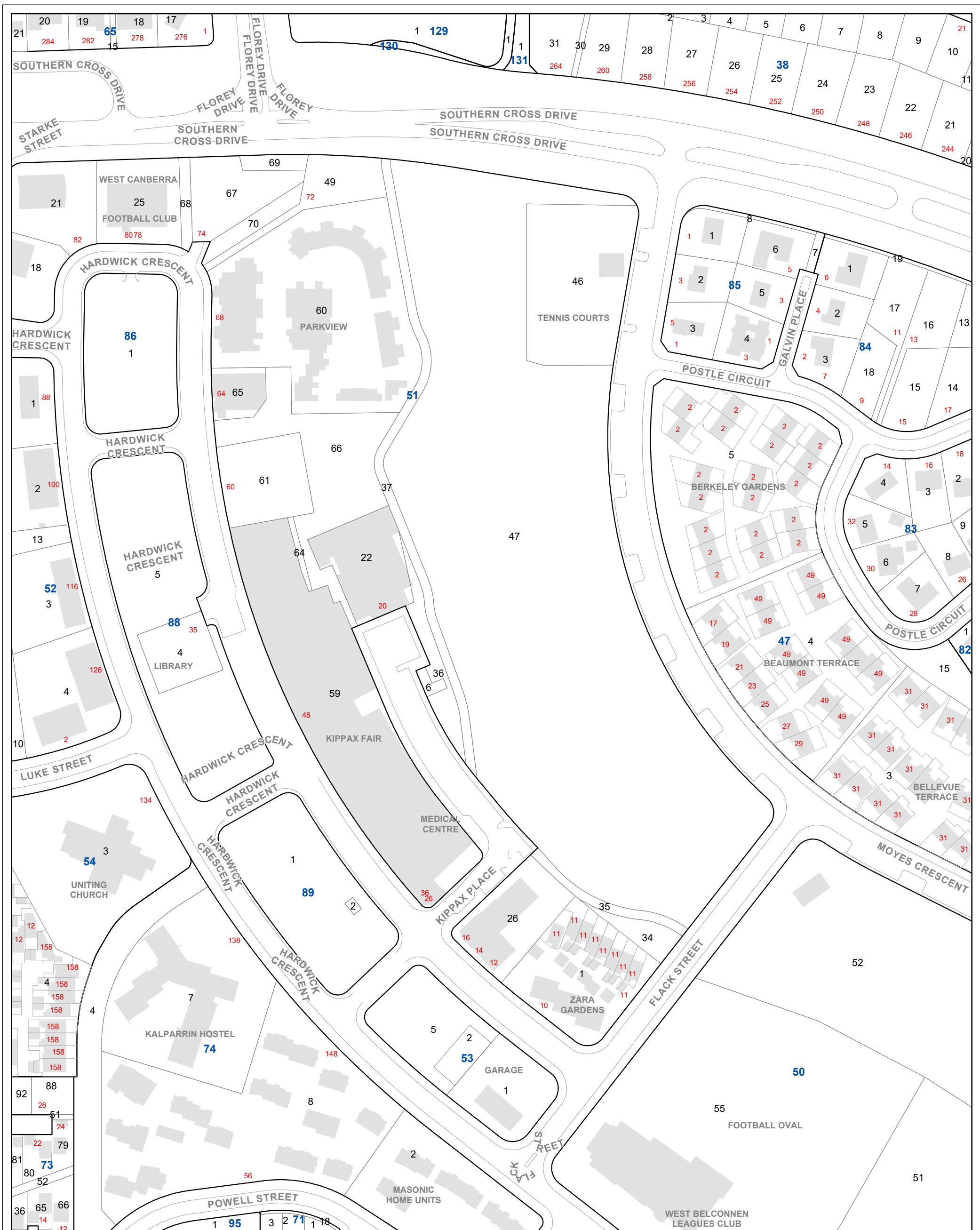
-  Rising Main
-  Bulk Supply
-  Distribution Main
-  Reticulation

Lateral Line

-  Irrigation
-  Wash Down
-  Overflow
-  Scour
-  Drain

Effluent Structure

-  Dam
-  Pump Station
-  Reservoir Structure
-  Treatment Plant
-  Valve Chamber



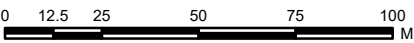
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Seq #: 100461571
Kippax Place, Holt



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ELECTRICITY NETWORK LEGEND

Support Structure (Distribution)

- Pole
- Streetlight-Only Pole

Support Structure (Transmission)

- Pole
- Tower
- Yard Structure

Underground Structure

- ⊠ Pit

Recloser

- ⊠ Recloser

Transmission Line

- Overhead Transmission Line
- - - Underground Transmission Line, In Service
- - - - - Underground Transmission Line, Abandoned

Building

- Zone Building
- Standalone Chamber

Switches

- ⊠ Air Break
- ⊠ Load Break
- ⊠ Overhead Link

Fuse

- ⊠ Drop Out Fuse

HV Electric Lines

- Overhead HV Electric Line
- - - Underground HV Electric Line, In Service
- - - - - Underground HV Electric Line, Abandoned

LV Electric Lines

- Overhead LV Electric Line
- - - Underground LV Electric Line, In Service
- - - - - Underground LV Electric Line, Abandoned

Streetlight

- ☀ Streetlight
- Streetlight Controller
- ⊗ Streetlight Photoelectric Controller
- Other Streetlight Support
- Streetlight Column

Streetlight Cable

- Overhead Streetlight Line
- - - Underground Streetlight Line, In Service
- - - - - Underground Streetlight Line, Abandoned

Joint

- × Cable Joint

Service Lines

- Overhead Service Line
- - - Underground Service Line, In Service
- - - - - Underground Service Line, Abandoned

Service Point

- Service Point

Fibre Communication Cable

- Fibre Communication Cable

Copper Communication Cable

- Pilot Cable

Underground Earth Cable

- Underground Earth Cable

Ground Mounted Structure

- Streetlight Control Cubicle
- Distribution Box
- Point-Of-Entry Cubicle
- HV Switching Station
- Kiosk
- Padmount
- Link Pillar
- Micro Pillar
- Mini Pillar
- Pregnant Column
- Communication Cubicle
- SCADA Cubicle

Electric Supply Site

- 132kV Switching Station
- Bulk Supply Station
- Mobile Zone Substation
- Zone Substation
- Overhead Substation
- Chamber Substation
- Stockade

IMPORTANT NOTE:

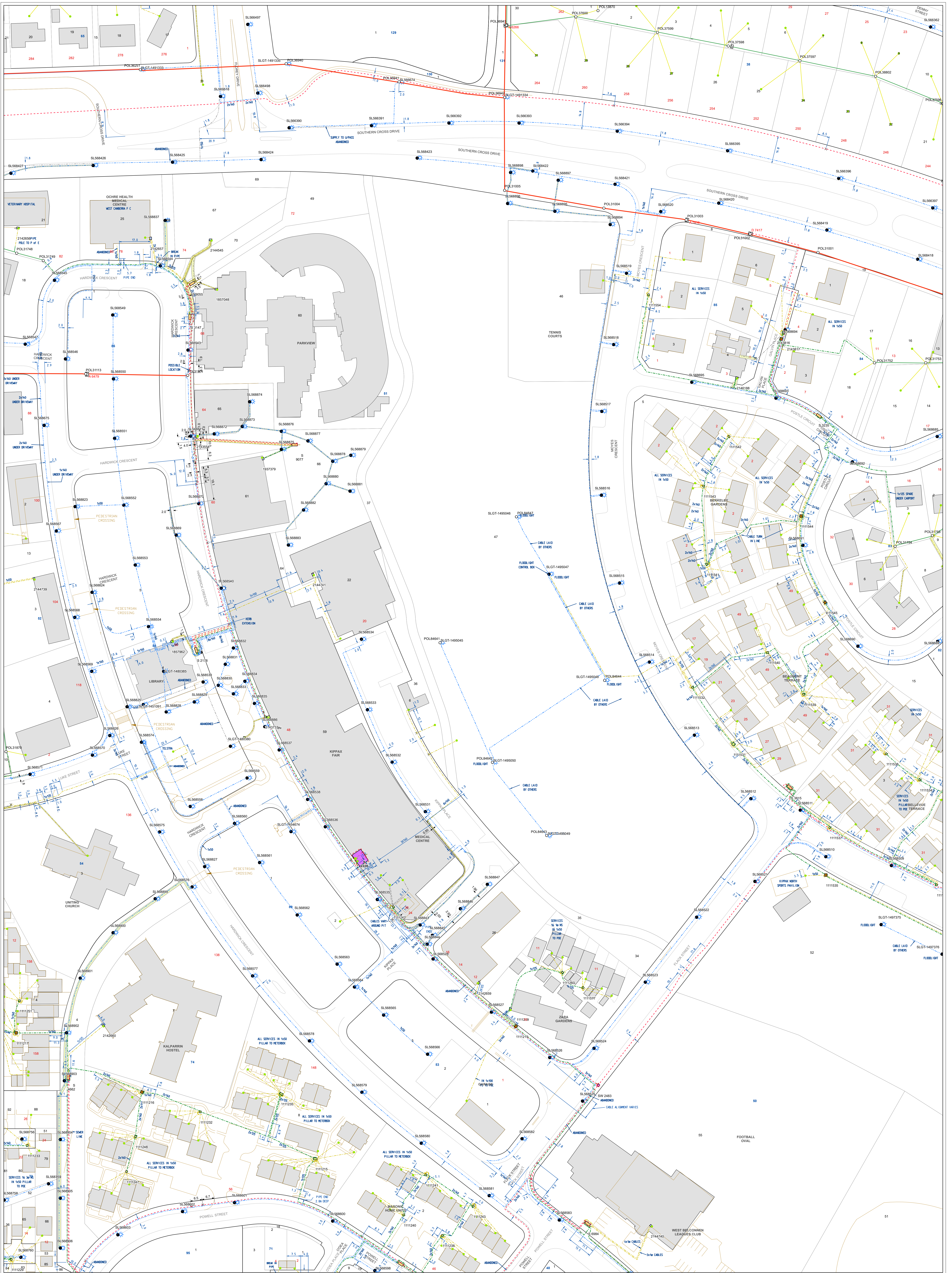
- The term 'ABANDONED' is utilised to identify an underground cable that has been physically disconnected from the Evoenergy electricity network, is not in service and cannot readily be put back into service without specific augmentation and/or reconnection works. Cable(s) identified by Evoenergy as 'ABANDONED' have been discarded in-situ by Evoenergy. ALL cables should be treated as 'LIVE' and Dangerous until proven de-energised and safe.

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GAS NETWORK LEGEND

GasStation CRITICAL

-  DistrictRegulator
-  TrunkReceivingStation
-  PrimaryRegulatingStation
-  BulkMeteringStation
-  PressureMonitoringStation
-  ScraperStation
-  BoundaryRegulatorSet
-  SecondaryBoundaryRegulatorSet
-  ValveStation




GasDevice

-  <all other values>
-  IsolationValve
-  Odouriser
-  Siphon
-  WaterbathHeater
-  Filter
-  Catalyst Heater
-  Silencer
-  Regulator










GasDevice High Risk Valve CRITICAL

-  HighRiskAreaIsolation



GasMeter

-  DomesticMeter
-  IndustCommMeter
-  SecondaryMeterSet

GasFitting

-  EndCap
-  Tee
-  ExpansionJoint
-  Flange
-  Reducer
-  Cross
-  ServiceSaddle
-  InsulationJoint
-  GaugingPoint

CPAnode

-  AnodeGroundBed
-  SacrificialAnode

CPRectifier

-  TransformerRectifier





CPCable

-  CPRectifierCable
-  CPGroundBedCable




Conduit

-  Conduit



GasStructure

-  <all other values>
-  CPKiosk
-  Pit
-  StationStructure






GasService

-  <all other values>
-  Gas Service IN USE
-  Gas Service NOT IN USE










GasService STEEL or MAOP>=1050 OR DIA >=75mm CRITICAL

-  Gas Service IN SERVICE
-  Gas Service NOT IN SERVICE

GasPipe

-  <all other values>
-  DistributionMain, Nylon, InService
-  Gas Pipe NOT IN USE
-  DistributionMain, PE, InService
-  DistributionMain, Copper, InService

GasPipe STEEL OR MAOP>=1050 OR DIA>=75mm CRITICAL

-  DistributionMain, Copper, InService
-  DistributionMain, Nylon, InService
-  DistributionMain, PE, InService
-  PrimaryMain, Steel, InService
-  PrimaryMain, Steel, Proposed
-  SecondaryMain, Steel, InService
-  SecondaryMain, Steel, Proposed
-  TransmissionMain, Steel, InService
-  Gas Pipe NOT IN USE

R 10.0 = DISTANCE TO ROAD
 B 10.0 = DISTANCE TO BOUNDARY
 E 10.0 = DISTANCE TO END
 C 10.0 = DISTANCE TO CHANGE OF DIRECTION

 = DISTANCE FROM MAIN TO KERB
 = DISTANCE FROM MAIN TO BOUNDARY

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Icon Water: Sewer Network Legend

Abandoned Point

- ✕ Abandoned Point

Maintenance Hole

- Active
- De-Commissioned

Fitting

- ^{BVR} Buried Vertical Riser
- Dead End
- Reducer
- Riser
- Tee

Service Connection

- Service Connection

DischargePoint

- ⌋ DischargePoint

Gauging Point / Test Station

- ◆ ChemicalTransducer
- ◆ ElectroMagnetic
- ◆ Flume
- ◆ PressureTransducer
- ◆ Sonic
- ◆ Venturi
- ◆ WeirGauge

Inspection Shaft

- ^{SIS} ● Special Inspection Shaft
- ^{SMS} ● Standard 225 Inspection Shaft

Clean Out Point

- ^{RP} ● Rodding Point

Control (Protection) Valve

- ◇ Air Valve
- ↶ Reflux Valve

Pump

- Pump

Storage Tank / Vault

- Storage Tank / Vault

SystemControlValve

- ^{SCOUR} ⚡ Scour Valve
- ⊗ Ball Valve
- ^{PLUG} ⚡ Plug
- ⚡ Gate Valve
- ^{SL} ⚡ Stop Log
- ^P ⚡ Penstock

Sewer Structures

- ◇ Odour Scrubber
- ⊕ Sewer Fan
- ^{SVE} ● Vent

Vertical Drop

- ^{SVD} ● Vertical Drop

VortexDrop

- ^V ▼ VortexDrop

Weir

- ^W ● Weir

Gravity Main

- Vent Pipe
- Reticulation Main
- Trunk Main
- Tunnel
- Siphon
- Overflow Pipe
- Inline Storage

Pressure Main

- Pressure Main

Lateral Line

- Property Service Line
- Scour Line

De-Commissioned Mains

- De-Commissioned Mains

Abandoned Mains

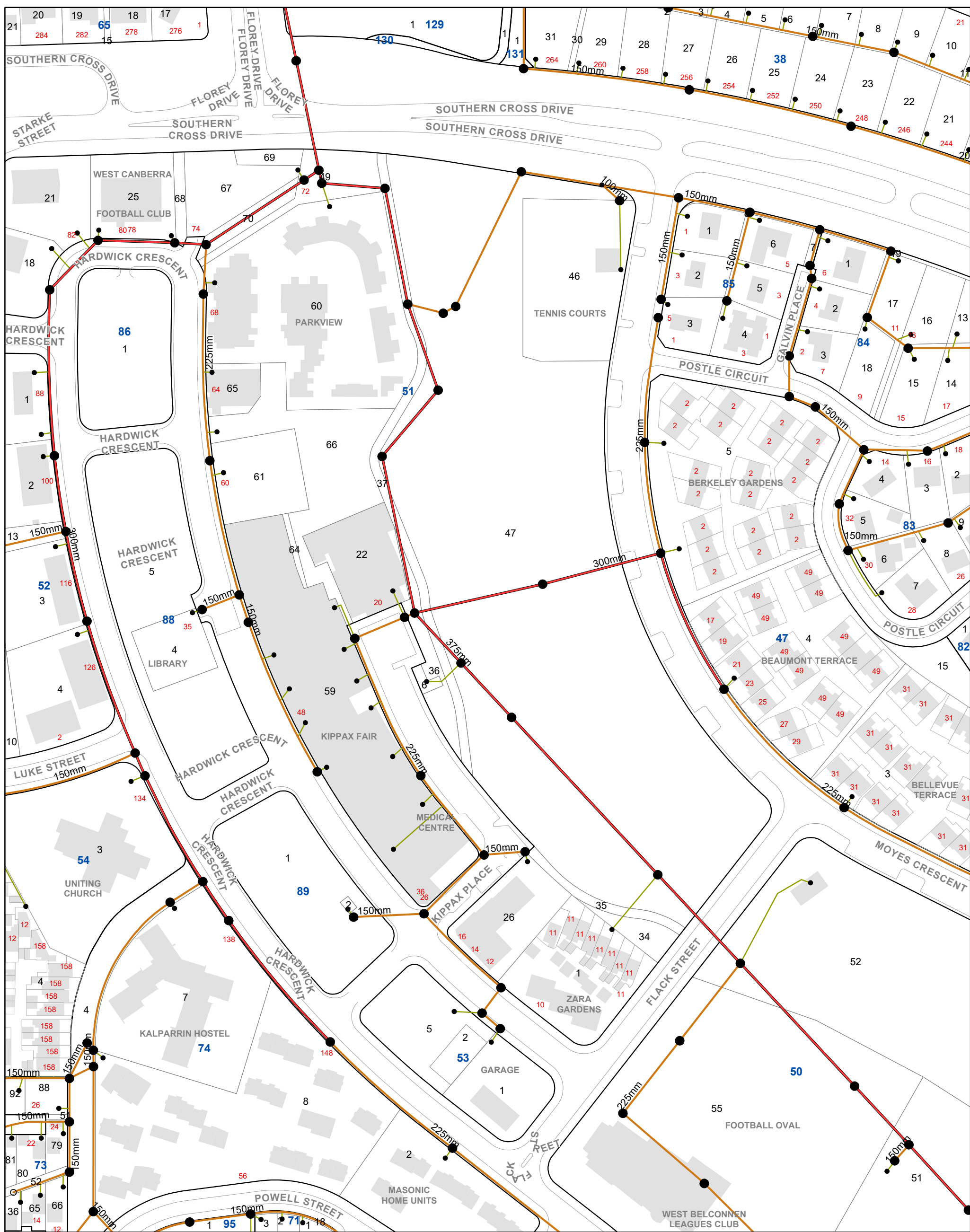
- Abandoned Mains

Sewer Structure

- DiversionChamber
- DiversionPoint
- PumpStation
- SplitManhole
- StorageBasin
- TreatmentPlant
- DischargeStructure
- PipeBridge
- SeptageFacility
- ValveChamber

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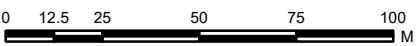
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Seq #: 100461571
Kippax Place, Holt








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NSW Cadastre © Land and Property Information (a division of the Department of Finance and Services) 2020.






Icon Water: Water Network Legend




Hydrant

-  HighCapacity
-  MillCock
-  OverheadFillingP...
-  PillarHydrant
-  SpringHydrant

Service Connection (Meter)

-  Flow Element
-  Billing Large Diameter
-  Billing Small Diameter


Test Station

-  Pressure Recording Device
-  Flow Recording Device
-  Sampling Point









Pump

-  Pump









System Valve: Ball

-  Ball Valve











System Valve: Butterfly

-  Altitude Inlet Control
-  Back Up
-  DualFlowRate
-  Flow Altitude
-  Flow Rate Control
-  Isolation
-  Normally Closed Isolation
-  Pump Control



System Valve: Butterfly Motorised

-  Altitude Inlet Control
-  Back Up
-  DualFlowRate
-  Flow Altitude
-  Flow Rate Control
-  Isolation
-  Normally Closed Isolation
-  Pump Control







Control (Protection) Valve

-  Double Air
-  Double Check
-  Enhanced Double Air Valve
-  Float Valve
-  Pressure Relief Valve
-  Reduced Pressure Zone
-  Reflux Valve
-  Single Air
-  Altitude Inlet Control
-  Outlet Control

System Valve: Cone

-  Altitude Inlet Control
-  Outlet Control









System Valve: Gate

-  Zone Valve
-  Normally Closed Isolation
-  Isolation
-  Flow Rate Control
-  Back Up
-  Altitude Inlet Control


System Valve: Gate Motorised

-  Isolation


System Valve: Globe

-  Pump Control
-  Pressure Sustaining
-  Pressure Reducing
-  Flow Rate Control
-  Flow Altitude
-  Outlet Control
-  Back Up
-  Altitude Inlet Control

System Valve: Needle

-  System Valve: Needle





System Valve: Scour

-  System Valve: Scour






Network Structure

-  Service Reservoir
-  Treatment Plant Reservoir
-  NonPotable Water Reservoir
-  Minor Tanks


Main

-  Reticulation Main
-  Distribution Main
-  Bulk Supply Main
-  Rising Main







Lateral Line

-  Domestic Service
-  Fire Service
-  Overflow
-  Wash Down
-  Scour
-  Drain

Abandoned Mains and Lateral Lines

-  Abandoned Mains and Lateral Lines

Water Structure

-  Dam
-  Pipe Bridge
-  Pump Station
-  Reservoir Structure
-  Treatment Plant
-  Valve Chamber

Warning Zone:
Contact Icon Water
before any
excavation in this
area 62483111



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Date: 06/08/2020

Enquirer Name: Ms Mana Naghshgar
Enquirer Address: 4 Lidgett Place
Email: m.naghshgar@gmail.com
Phone: 0420215440

Dear Ms Mana Naghshgar

The following is our response on behalf of each of the TPG carriers (listed below) to your Dial Before You Dig enquiry – Sequence 100461569. It is provided to you on a confidential basis under the following conditions and must be shredded or securely disposed of after use.

Assets Affected:

Carriers (each a "TPG carrier") and assets affected:

TransACT

Location: Kippax Place

According to our records, the underground assets in the vicinity of the location stated in your enquiry are **AFFECTED**. Please read the below information and disclaimers in addition to the any attached plans provided prior to any construction activities.

IMPORTANT INFORMATION

- The information provided is valid for 30 days from the date of this response. If your work site area changes or your construction activity is beyond 30 days please contact Dial Before You Dig on 1100 or www.1100.com.au to re-submit a new enquiry.
- Due to the nature of underground assets and the age of some assets and records, our plans are indicative of the general location only and may not show all assets in the location. You should not solely rely on these plans when undertaking construction works. It is also inaccurate to assume depth or that underground network conduit and cables follow straight lines, and careful on-site investigations are essential to locate an asset's exact position prior to excavation. It is your responsibility to locate and confirm the exact location of our infrastructure using non-destructive techniques. We make no warranty or guarantee that our plans are complete, current or error free, and to the maximum extent permitted by law we exclude all liability to you, your employees, agents and contractors for any loss, damage or claim arising out of or in connection with using our plans.
- Please note that some of our conduits carry electrical cables and gas pipes. Please exercise extreme care when working within the vicinity of these conduit and take into account the minimum clearance distances under Duty Of Care below.
- You (and your employee and contractors) must not open, move, interfere, alter or relocate any of our assets without our prior approval.
- **Note** It is a criminal offence under the *Criminal Code Act 1995 (Cth)* to tamper or interfere with communication facilities owned by a carrier. Heavy penalties may apply for breach of this prohibition, and any damages suffered, or costs incurred by us as a result of such unauthorised works may be claimed against you.

DAMAGE

- You must report immediately any damage to our network on **1800 786 306** (24hrs). We will hold you liable and seek compensation for any loss or damage to our network, our property and our customers that is caused by or arises out of your activities.

DUTY OF CARE

You have a duty of care to carefully locate, validate and protect our assets when carrying out works near our infrastructure. For construction activities that may impact on or interfere with our network, you will need to call us on **1800 786 306** to discuss a suitable engineering solution, lead time and cost involved. The below precautions must be taken when working in the vicinity of our network:

- Contact us on **1800 786 306** to discuss and obtain relevant information and plans on our infrastructure in a particular location if the information provided in this response is insufficient.
- Physically locate and mark on-site our network infrastructure using non-destructive techniques i.e. pot holing or hand digging every 5 metres prior to commencing any construction activities. Assets located must be marked to AS5488 standard. **NO CONSTRUCTION WORK IS ALLOWED UNTIL THIS STEP IS COMPLETED.** You must use an approved telecommunications accredited locator, or we can provide a locator for you at your expense. If we provide you with a locator, and this locator attended the site and is proven to be grossly negligent in physically locating and marking our infrastructure, then to the extent any TPG carrier is liable for this locator's negligence, acts and omissions, the total liability aggregated for all TPG carriers is limited, at our option, to attend the site and re-mark the infrastructure or to pay for a third party to re-mark the infrastructure.
- If you require us to locate or monitor our infrastructure, please allow five business days' notice for us to respond.
- Ensure all information, including our network requirements and any associated plans provided by us are kept confidential and remain on-site throughout your construction works.

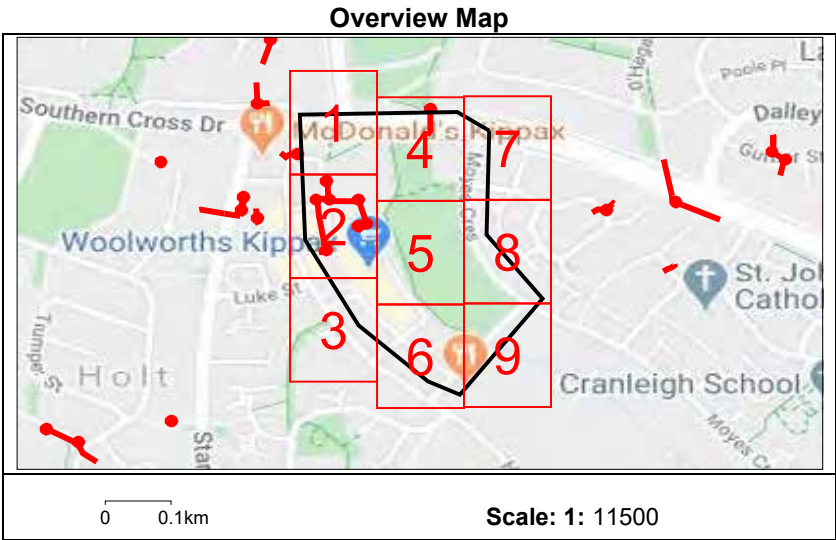
- Use suitably qualified and supervised professionals, particularly if you are working near assets that contain electricity cables or gas pipes.
- Ensure the below minimum clearance distances between the construction activities and the actual location of our assets are met. If you need clearance distances for our above ground assets, or if the below distances cannot be met, call **1800 786 306** to discuss.

Minimum assets clearance distances.

- 300mm when laying asset inline, horizontal or vertical.
 - 1000mm when operating vibrating equipment. Eg: vibrating plates. No vibrating equipment on top of asset.
 - 1000mm when operating mechanical excavators or jackhammers/pneumatic breakers.
 - 2000mm when performing directional bore in-line, horizontal and vertical.
 - No heavy vehicle over 3 tonnes to be driven over asset with less than 600mm of cover.
- Reinstate exposed TPG network infrastructure back to original state.

PRIVACY & CONFIDENTIALITY

- Privacy Notice – Your information has been provided to us by Dial Before You Dig to respond to your Dial Before You Dig enquiry. We will keep your personal information in accordance with AAPT’s privacy policy, see aapt.com.au/privacy.
- Confidentiality – The information we have provided to you is confidential and is to be used only for planning and designing purposes in connection with your Dial Before You Dig enquiry. Please dispose of the information by shredding or other secure disposal method after use. We retain all intellectual property rights (including copyrights) in all our documents and plans.



TPG Corporation Limited



Enquiry Number: 100461569

Map Sheet: 1

Scale: 1: 750

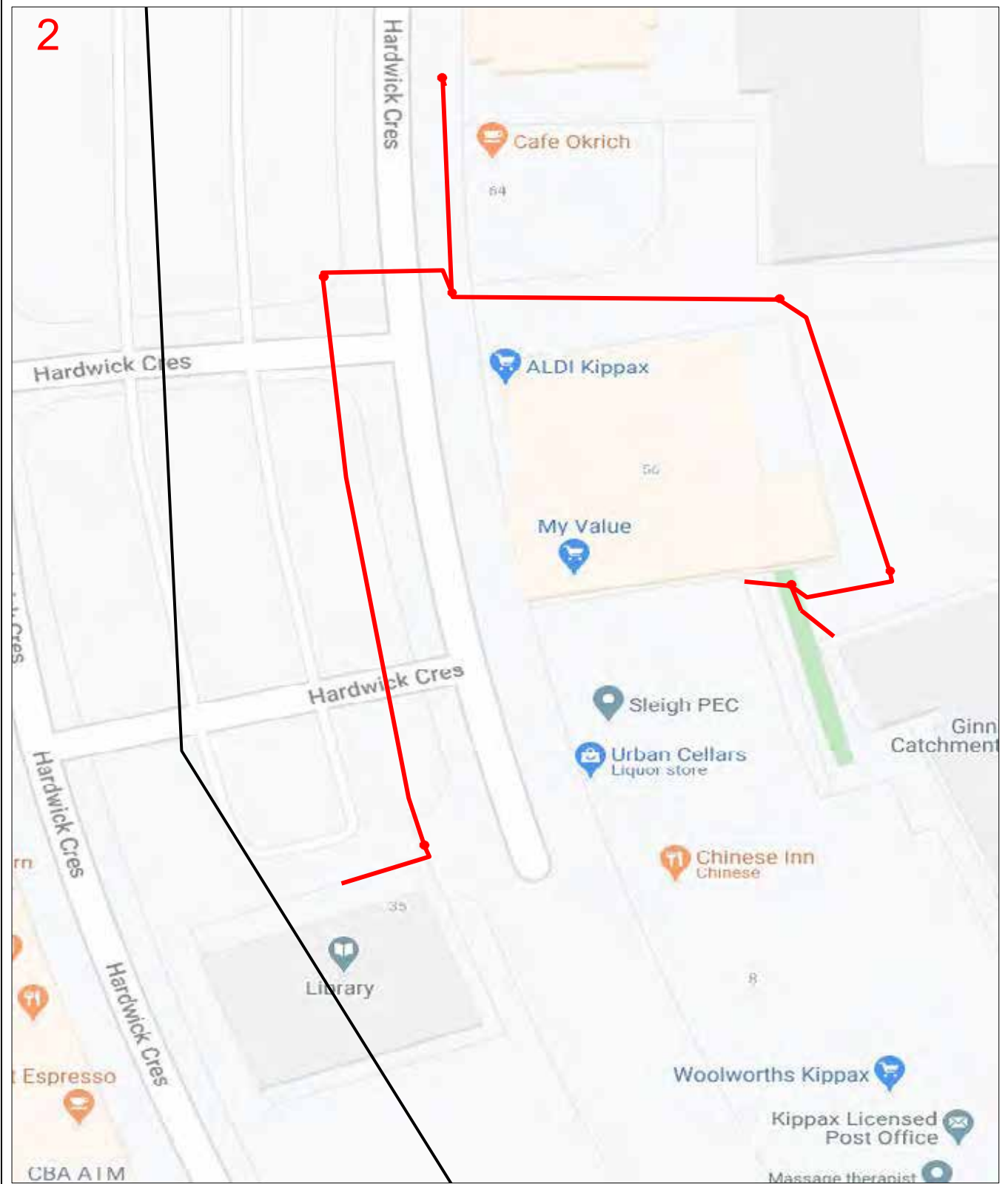
0 0.008km

LEGEND

DBYD Work Area

AAPT/PowerTel Pit		TransACT Pit	
AAPT/PowerTel Duct		TransACT Duct	
DDA Pit		SOUL Pattinson Telecoms Pit	
DDA Duct		SOUL Pattinson Telecoms Duct	
Agile/Adam Pit		PIPE Networks Pit	
Agile/Adam Duct		PIPE Networks Duct	

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Enquiry Number: 100461569

Map Sheet: 2

Scale: 1: 750

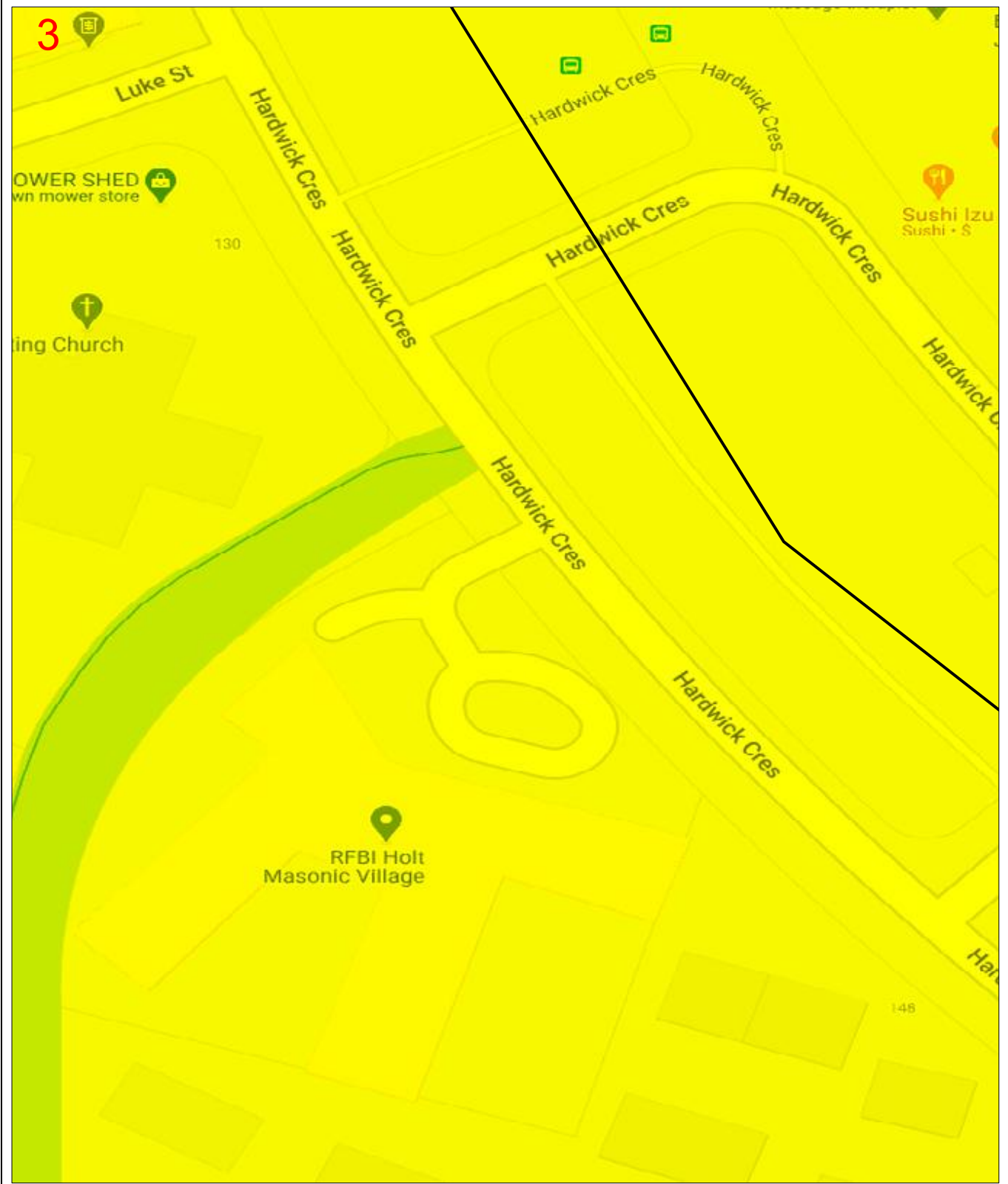
0 0.008km

LEGEND

DBYD Work Area

AAPT/PowerTel Pit		TransACT Pit	
AAPT/PowerTel Duct		TransACT Duct	
DDA Pit		SOUL Pattinson Telecoms Pit	
DDA Duct		SOUL Pattinson Telecoms Duct	
Agile/Adam Pit		PIPE Networks Pit	
Agile/Adam Duct		PIPE Networks Duct	

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Enquiry Number: 100461569

Map Sheet: 3

Scale: 1: 750

0 0.008km

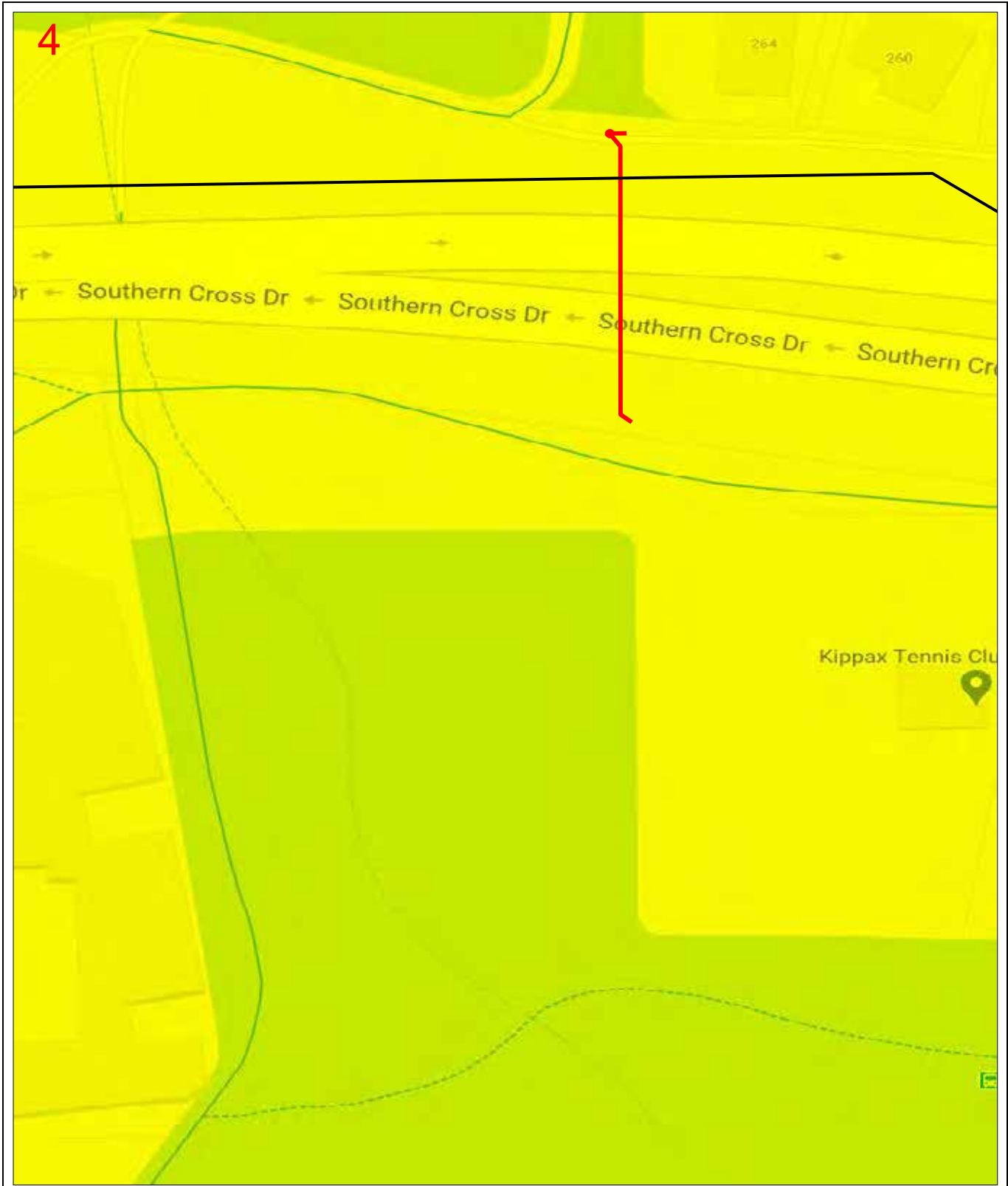
N

LEGEND

DBYD Work Area

AAPT/PowerTel Pit	●	TransACT Pit	●
AAPT/PowerTel Duct	—	TransACT Duct	—
DDA Pit	●	SOUL Pattinson Telecoms Pit	●
DDA Duct	—	SOUL Pattinson Telecoms Duct	—
Agile/Adam Pit	●	PIPE Networks Pit	●
Agile/Adam Duct	—	PIPE Networks Duct	—

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Enquiry Number: 100461569

Map Sheet: 4

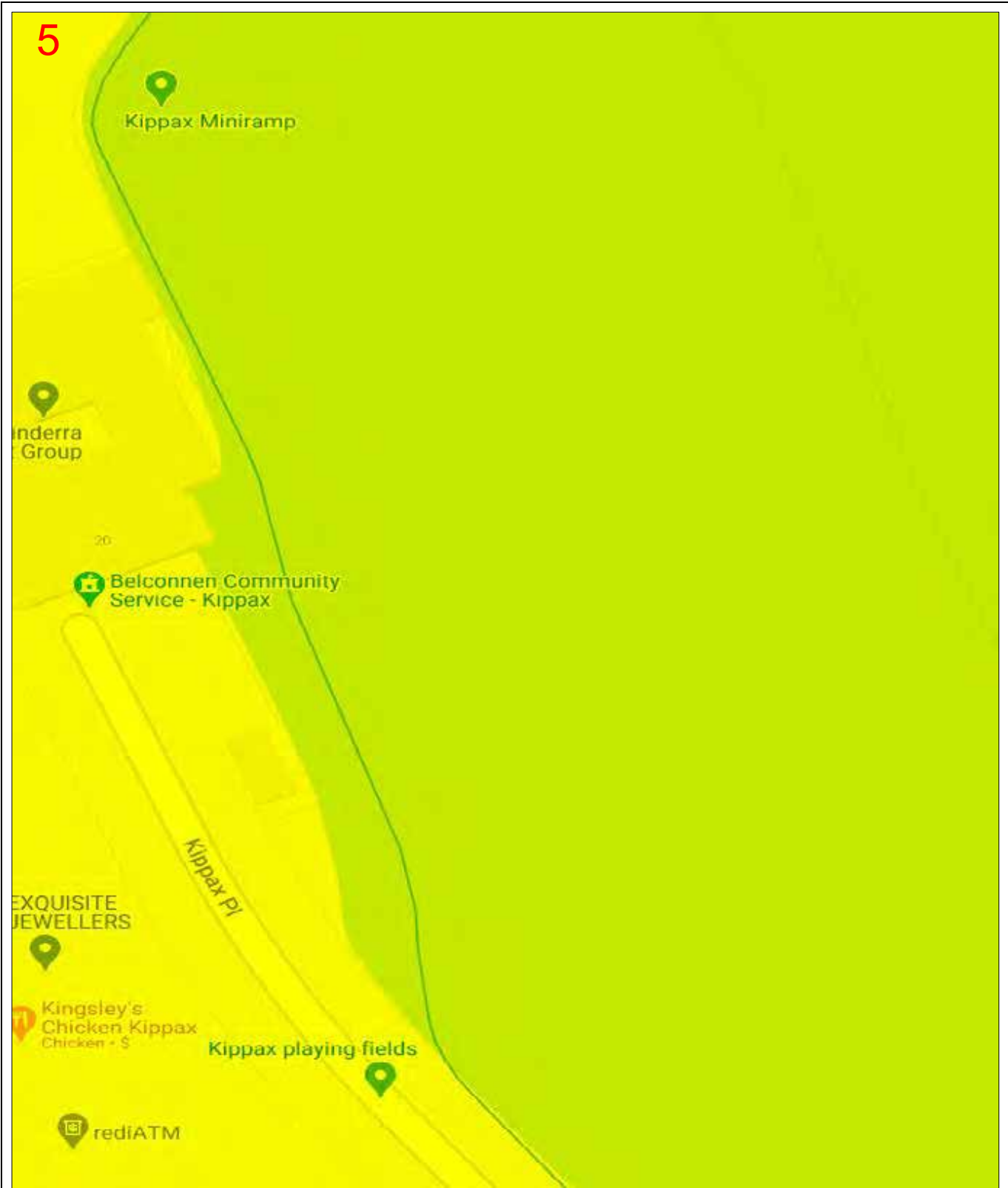
Scale: 1: 750

00.008km

LEGEND

DBYD Work Area			
AAPT/PowerTel Pit		TransACT Pit	
AAPT/PowerTel Duct		TransACT Duct	
DDA Pit		SOUL Pattinson Telecoms Pit	
DDA Duct		SOUL Pattinson Telecoms Duct	
Agile/Adam Pit		PIPE Networks Pit	
Agile/Adam Duct		PIPE Networks Duct	

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Enquiry Number: 100461569

Map Sheet: 5

Scale: 1: 750

0 0.008km

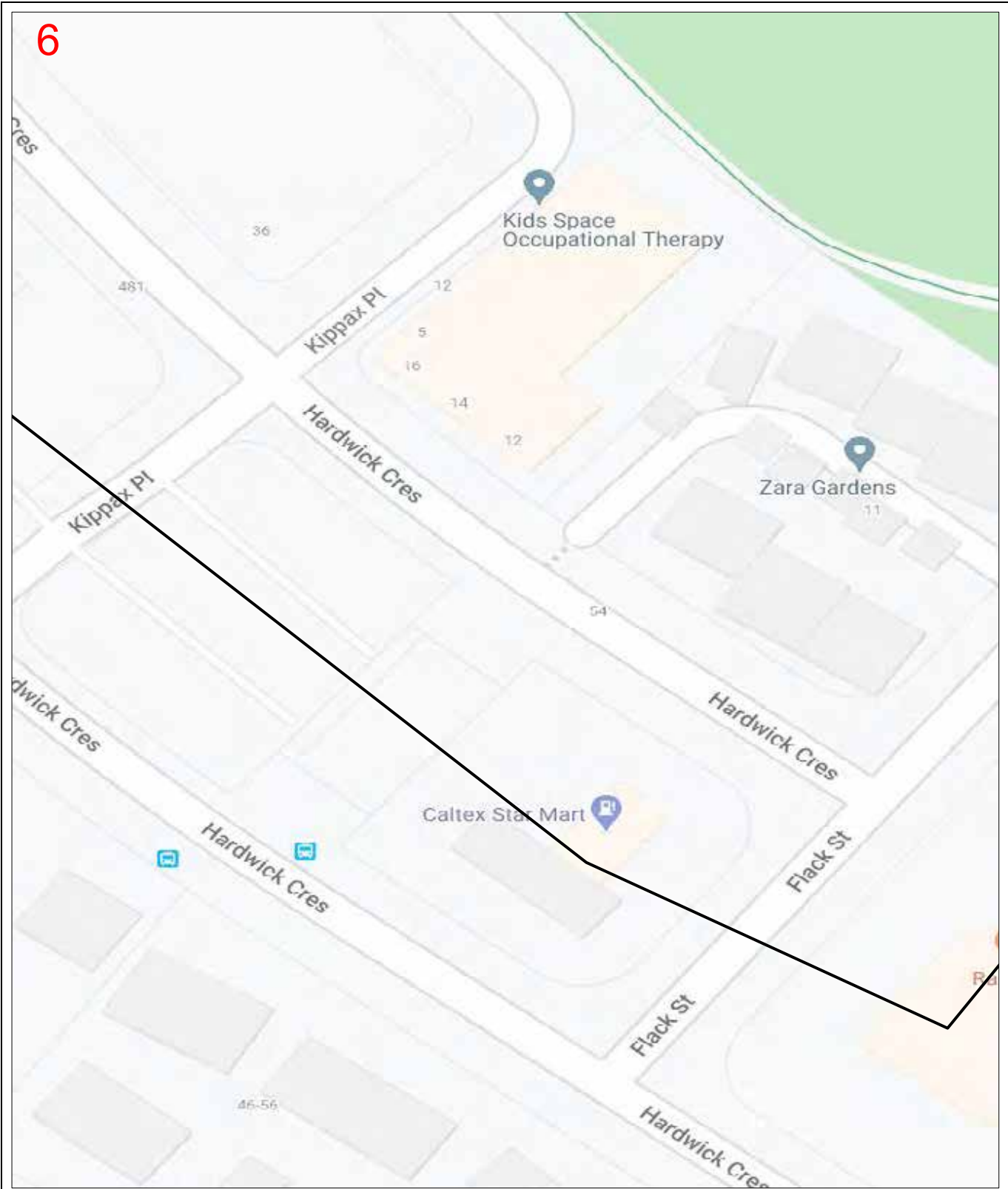
N

LEGEND

DBYD Work Area

AAPT/PowerTel Pit	●	TransACT Pit	●
AAPT/PowerTel Duct	—	TransACT Duct	—
DDA Pit	●	SOUL Pattinson Telecoms Pit	●
DDA Duct	—	SOUL Pattinson Telecoms Duct	—
Agile/Adam Pit	●	PIPE Networks Pit	●
Agile/Adam Duct	—	PIPE Networks Duct	—

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Enquiry Number: 100461569

Map Sheet: 6

Scale: 1: 750

00.008km

N

LEGEND

DBYD Work Area

AAPT/PowerTel Pit

AAPT/PowerTel Duct

DDA Pit

DDA Duct

Agile/Adam Pit

Agile/Adam Duct

TransACT Pit

TransACT Duct

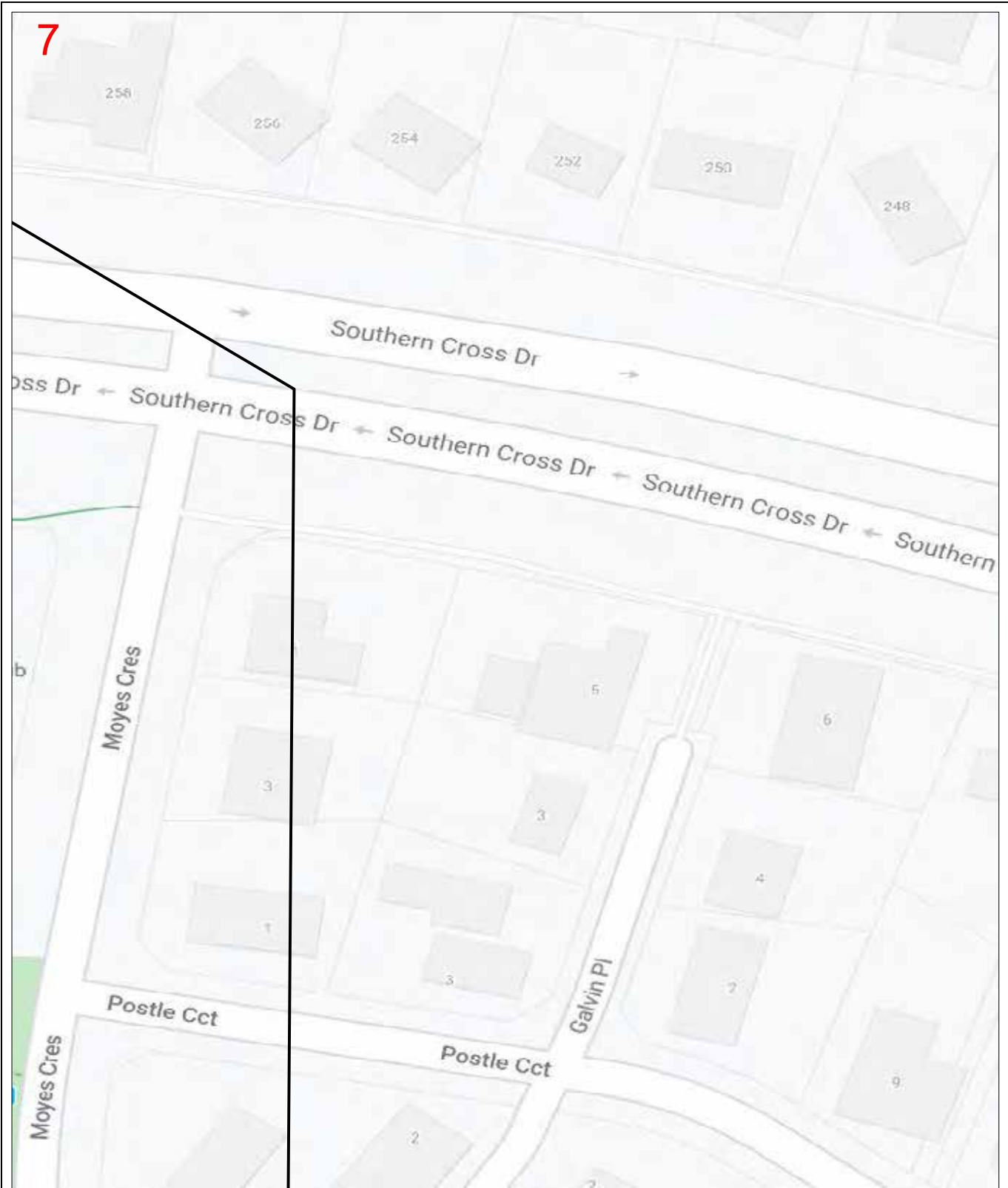
SOUL Pattinson Telecoms Pit

SOUL Pattinson Telecoms Duct

PIPE Networks Pit

PIPE Networks Duct

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Enquiry Number: 100461569

Map Sheet: 7

Scale: 1: 750

0 0.008km

LEGEND

DBYD Work Area

AAPT/PowerTel Pit		TransACT Pit	
AAPT/PowerTel Duct		TransACT Duct	
DDA Pit		SOUL Pattinson Telecoms Pit	
DDA Duct		SOUL Pattinson Telecoms Duct	
Agile/Adam Pit		PIPE Networks Pit	
Agile/Adam Duct		PIPE Networks Duct	

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Enquiry Number: 100461569

Map Sheet: 8

Scale: 1: 750

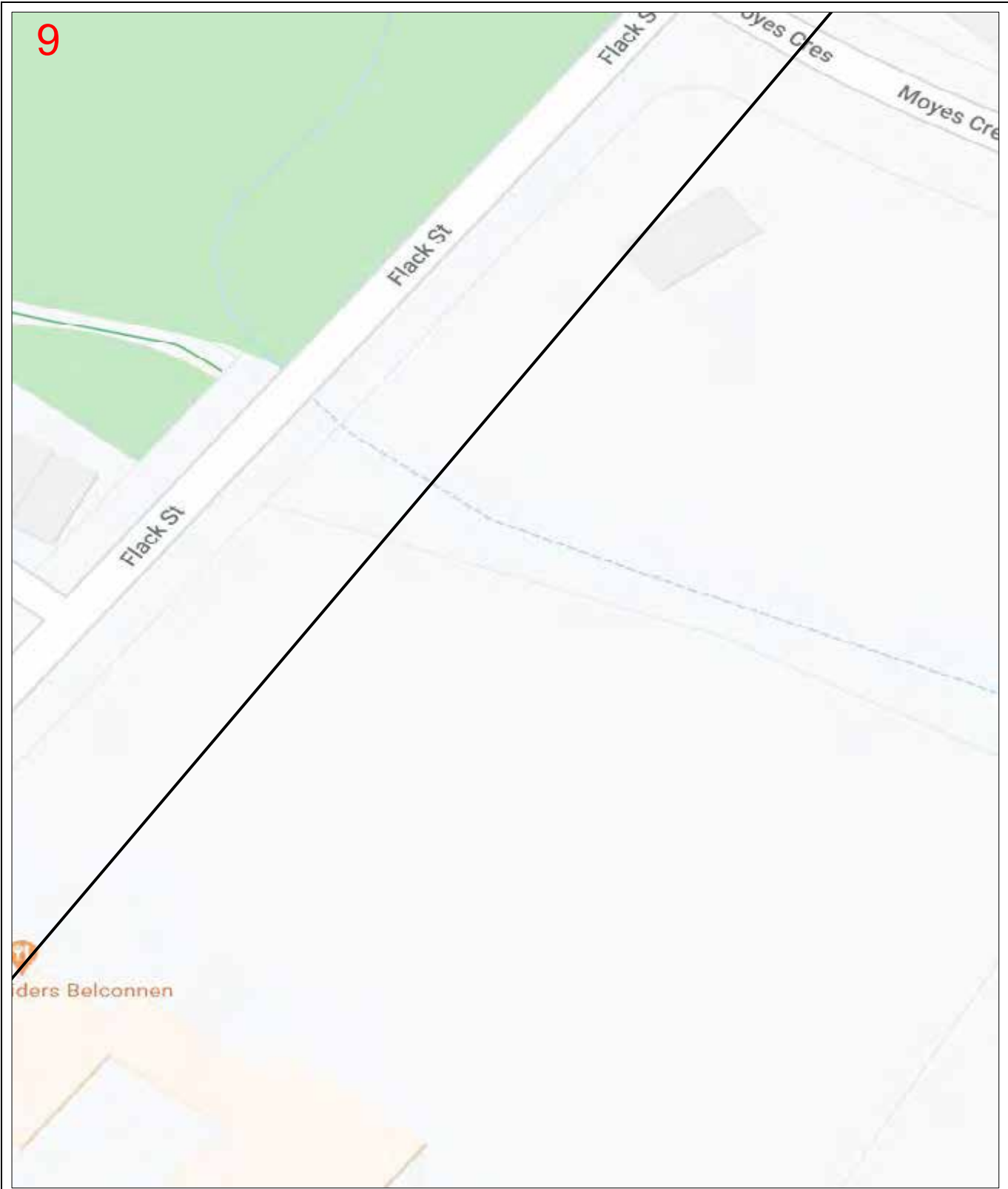
00.008km

N

LEGEND

DBYD Work Area			
AAPT/PowerTel Pit		TransACT Pit	
AAPT/PowerTel Duct		TransACT Duct	
DDA Pit		SOUL Pattinson Telecoms Pit	
DDA Duct		SOUL Pattinson Telecoms Duct	
Agile/Adam Pit		PIPE Networks Pit	
Agile/Adam Duct		PIPE Networks Duct	

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Enquiry Number: 100461569

Map Sheet: 9

Scale: 1: 750

00.008km

N

LEGEND

DBYD Work Area

AAPT/PowerTel Pit

AAPT/PowerTel Duct

DDA Pit

DDA Duct

Agile/Adam Pit

Agile/Adam Duct

TransACT Pit

TransACT Duct

SOUL Pattinson Telecoms Pit

SOUL Pattinson Telecoms Duct

PIPE Networks Pit

PIPE Networks Duct

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Page 11

Dial Before You Dig (DBYD)

Location Information

Assets owner

Transport Canberra and City Services
GPO Box 158
Fyshwick ACT 2601

Service provider

Electrix – Omexom ACT
PO Box 218
Mitchell ACT 2911

To:

Ms Mana Naghshgar
4 Lidgett Place
Florey

ACT

2615

Enquiry Details

Utility ID	90520
Job Number	20015134
Sequence Number	100461574
Enquiry Date	06/08/2020 11:26
Response	AFFECTED
Address	Kippax Place Holt
Location in Road	CarriageWay, Footpath, Nature Strip
Activity	Mechanical Excavation

Enquirer Details

Customer ID	2212242		
Contact	Ms Mana Naghshgar		
Company			
Email	m.naghshgar@gmail.com		
Phone	0420215440	Mobile	Not Supplied

Disclaimer

PLEASE READ ALL THE INFORMATION AND DISCLAIMERS PROVIDED ON THE ATTACHED PAGES

General location only

- The approximate location of Street Light Network assets (**the Assets**) in the nominated area are shown on the attached maps (**the Asset Plan**).
- The Asset locations provided with this response are based on the information available at the time and are only an indication of the presence of Assets within the nominated location. If the nominated area is not what you require, please resubmit another inquiry.
- The Asset Plans provided do not show the presence of any other assets, including private property assets.
- Please be aware that the location of the Assets may change to those indicated on the Asset Plan. The Asset locations shown on the attached Asset Plan are indicative only. Due to changes in surface levels and surrounding infrastructure, and works undertaken by other parties, Asset location may differ to those shown on the Asset Plan.
- *It is your responsibility to verify the location of the Assets shown on the Asset Plan through positive identification process*
- A new Asset Plan should be obtained every 28 days to ensure currency and accuracy. It is your responsibility to obtain a new Asset Plan if required.
- While every endeavour has been made to provide information that is accurate and reliable, complete accuracy cannot be guaranteed. Electrix does not represent or warrant that you or any user of the Asset Plan will achieve any particular objective or guarantee any outcome.

Limitation of Liability

To the maximum extent permitted by law, Electrix and its officers, employees, contractors and agents accept no liability and are not responsible for any actions, liabilities, losses, damages (including consequential damages), costs, claims or expenses of whatever nature and regardless of the cause of action, whether in contract, tort (including negligence) or otherwise, arising out of or in connection with or as a consequence of any inaccuracies in the Asset Plan or the use of the information contained in the Asset Plan.

Without limiting the above, Electrix and its officers, employees, contractors and agents are not responsible to any person for:

- (a) The currency, accuracy or completeness of the information provided in the Asset Plan; or
- (b) Any delays in respect of delivery or supply by Electrix of the information sought in connection with the location of the Assets.

To the maximum extent permitted by law, Electrix specifically excludes any conditions, terms or warranties that may be implied into, or in respect of the provision of the Asset Plan and to the extent that any such condition, term or warranty or liability cannot be excluded, Electrix's liability for breach of such implied term, condition or warranty is limited to the resupply of the Asset Plan provided by Electrix or the payment of the reasonable costs of having the Asset Plan supplied again.

Work to be carried out without interference or damage to Assets

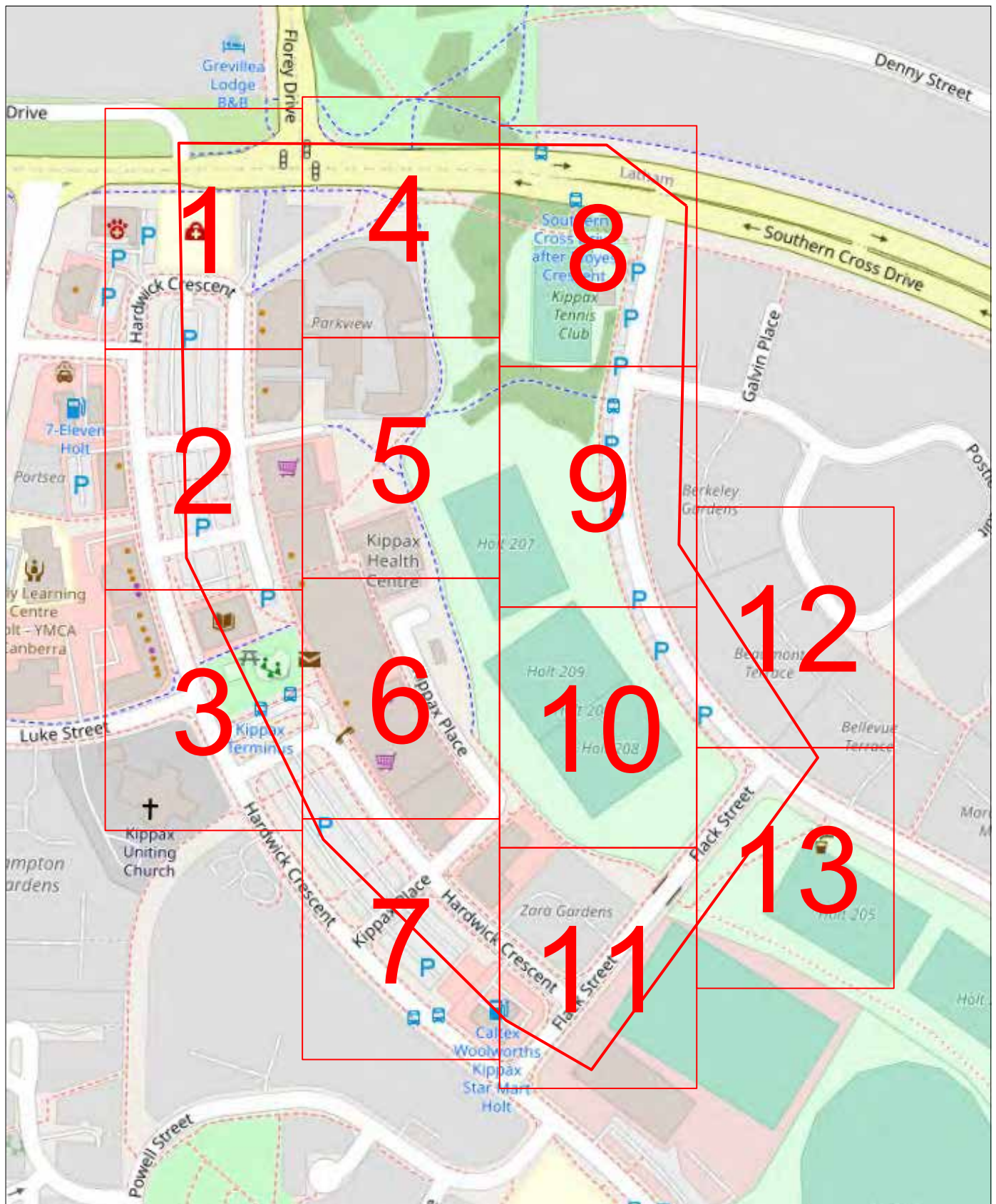
Any work undertaken near the Assets, must be performed in a way that does not interfere with the reliability of or access to the Assets. Any work carried out that includes changing the surface level in any area where Assets are indicated must be carried out with care and you will be responsible for any damage caused through failure to exercise such care. Electrix may pursue the person or organisation responsible for causing any damage or interference to the Assets.



Overview Map

Sequence No: 100461574

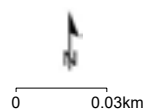
Kippax Place Holt



Supplied Maps and Plans should only be used as a guide and are indicative only.

- Street light cable can be direct buried or in conduit, determination being made on site
- Street light cables are to be treated as permanently alive for work purposes.

Imagery sourced from Open StreetMaps



LEGEND:

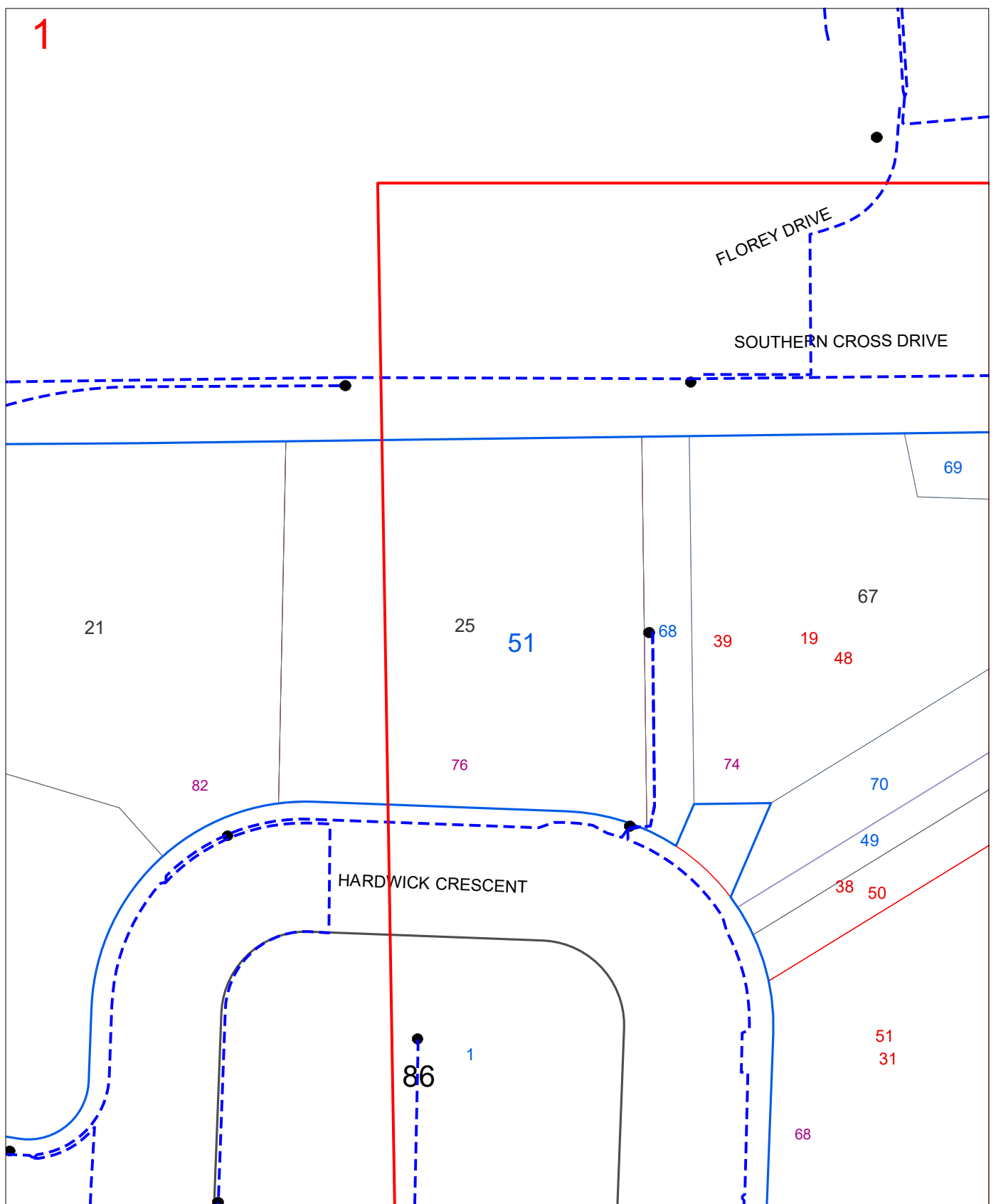
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|---|------------|--|-------------------------|
| 1 | Detail Map | | Affected DBYD Work Area |
|---|------------|--|-------------------------|



Map 1

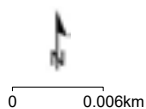
Sequence No: 100461574

Kippax Place Holt



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Imagery sourced from Open StreetMaps

LEGEND:

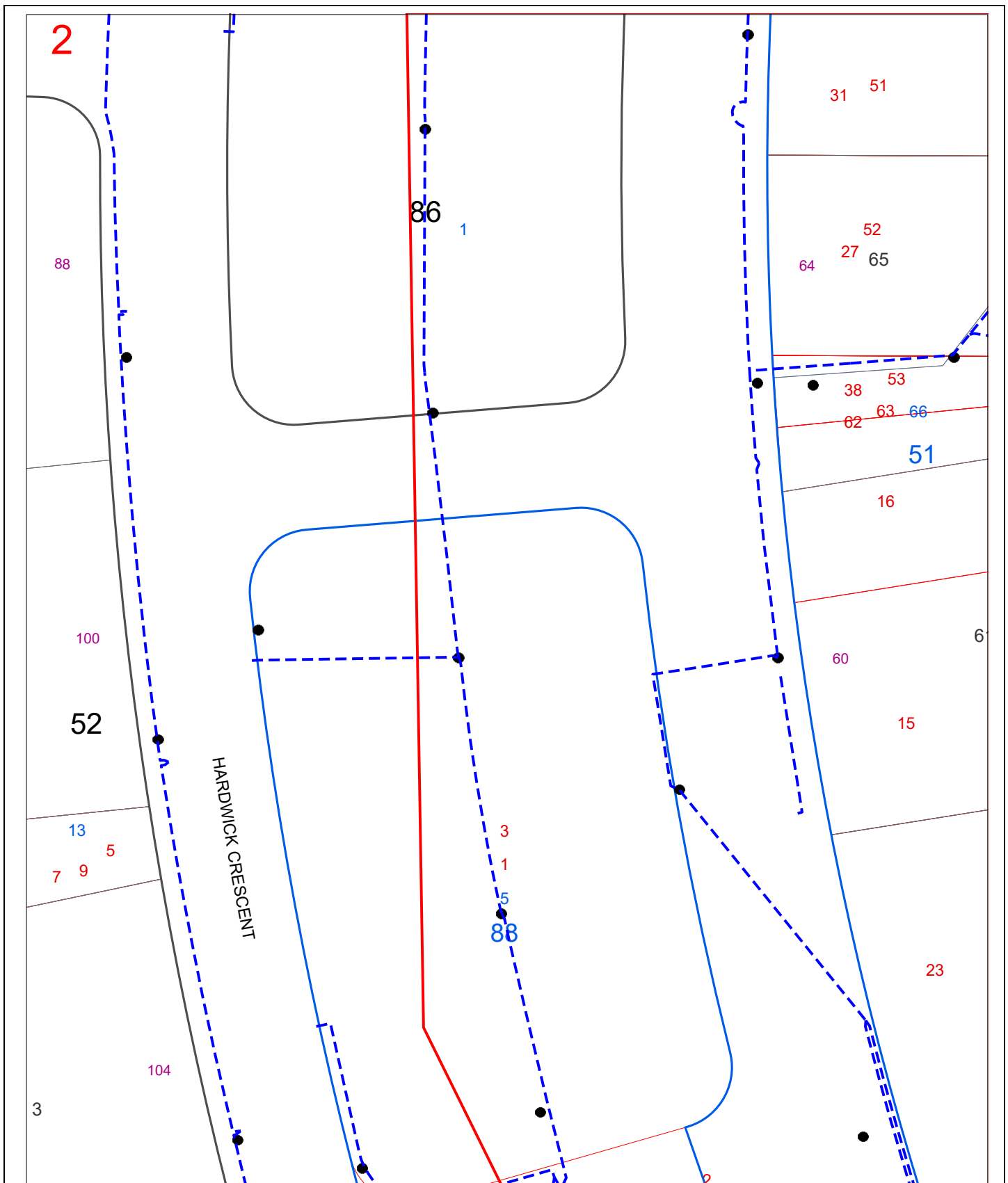
- | | | | |
|--|-------------------------|--|--------------------------------|
| | Affected DBYD Work Area | | Overhead Cable – In Service |
| | Streetlight | | Overhead Cable – Abandoned |
| | Column | | Underground Cable – In Service |
| | Controller Box | | Underground Cable – Abandoned |



Map 2

Sequence No: 100461574

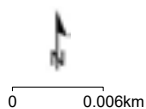
Kippax Place Holt



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Imagery sourced from Open StreetMaps



LEGEND:

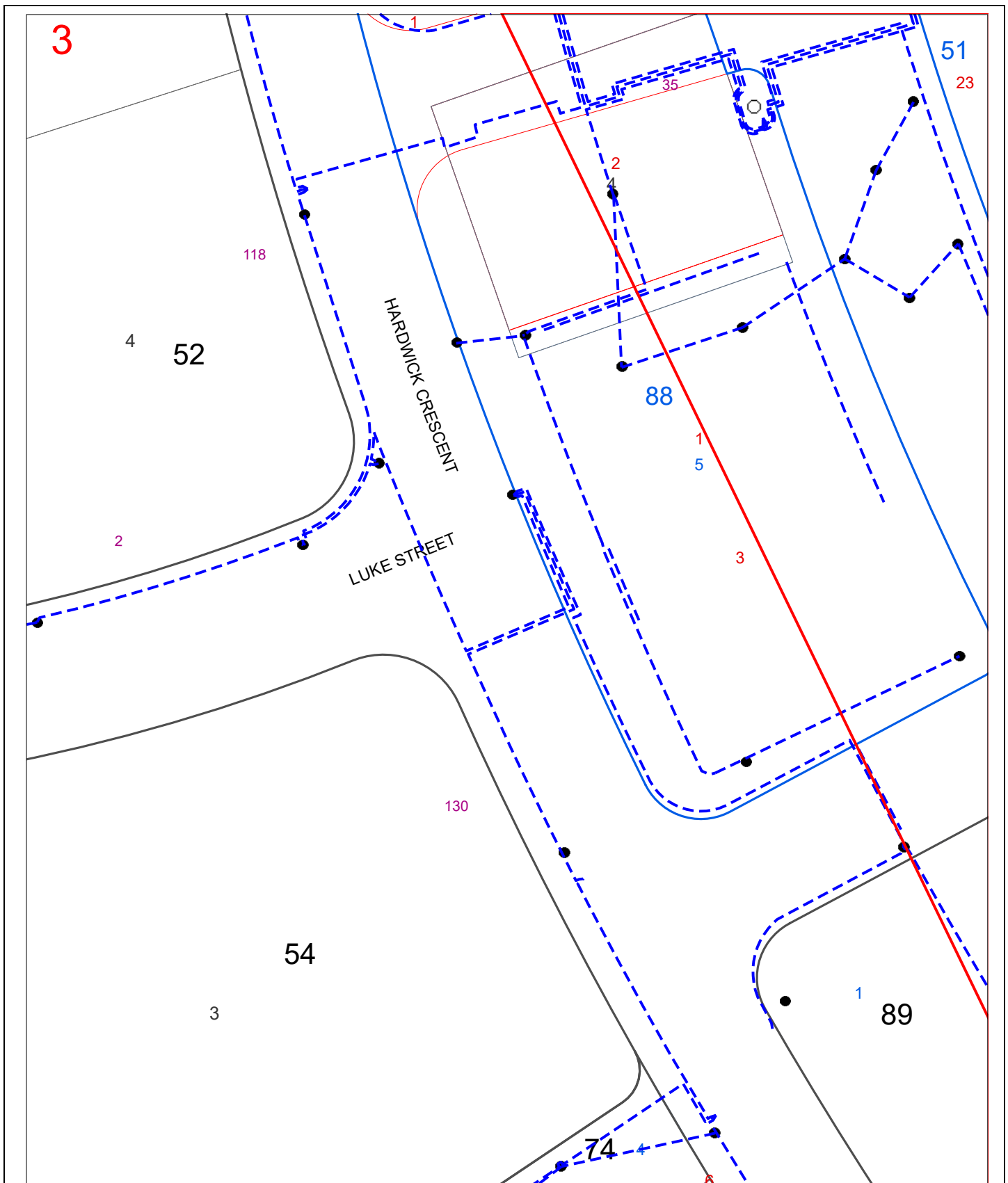
- | | | | |
|--|-------------------------|---|--------------------------------|
| | Affected DBYD Work Area | — | Overhead Cable – In Service |
| ⚙️ | Streetlight | - - - | Overhead Cable - Abandoned |
| ● | Column | ⋯ | Underground Cable – In Service |
| | Controller Box | - - - | Underground Cable - Abandoned |



Map 3

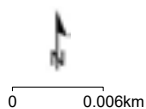
Sequence No: 100461574

Kippax Place Holt



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Imagery sourced from Open StreetMaps

LEGEND:

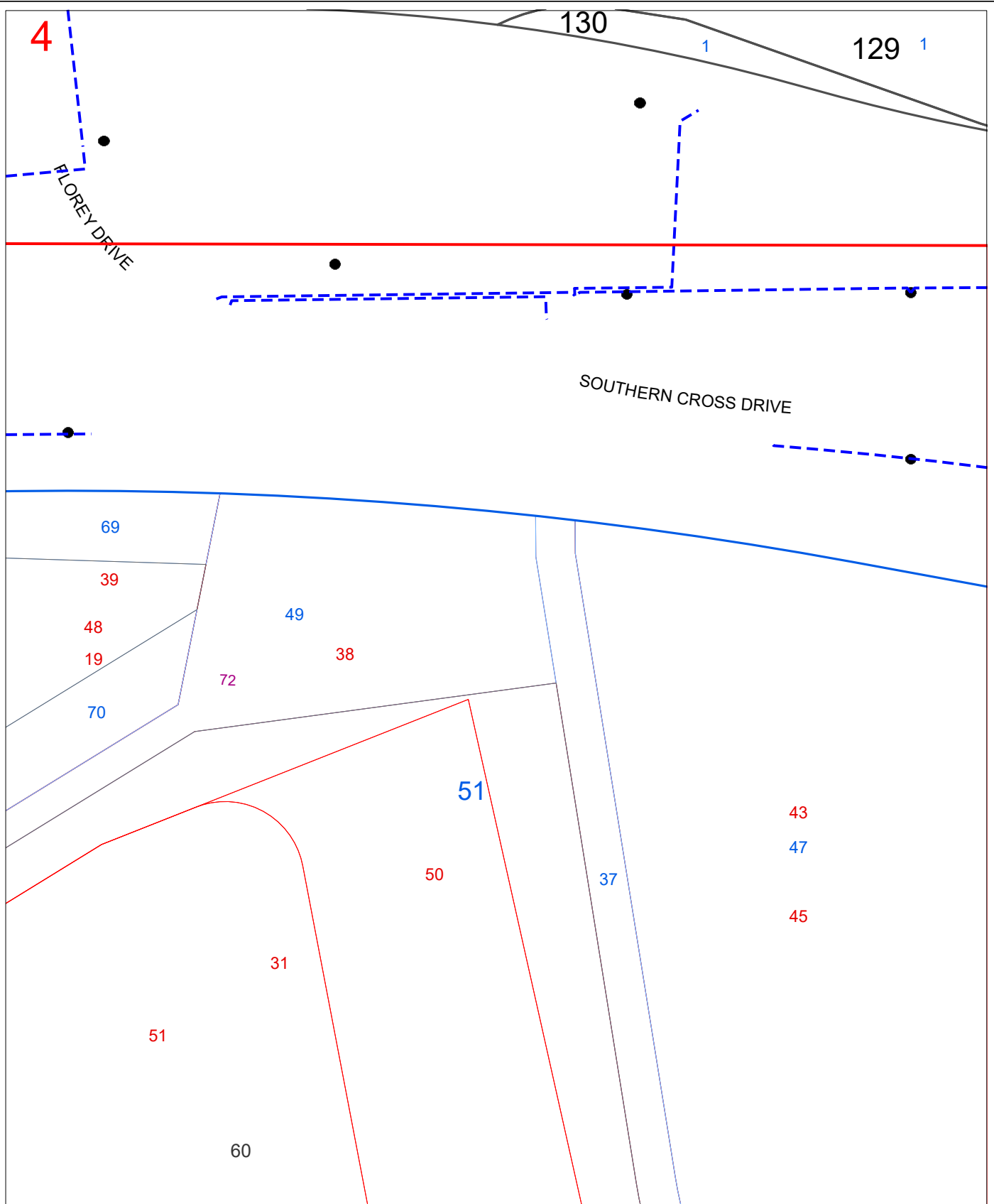
- | | | | |
|--|-------------------------|--|--------------------------------|
| | Affected DBYD Work Area | — | Overhead Cable – In Service |
| | Streetlight | --- | Overhead Cable – Abandoned |
| | Column | ... | Underground Cable – In Service |
| | Controller Box | --- | Underground Cable – Abandoned |



Map 4

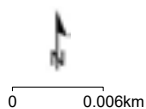
Sequence No: 100461574

Kippax Place Holt



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Imagery sourced from Open StreetMaps

LEGEND:

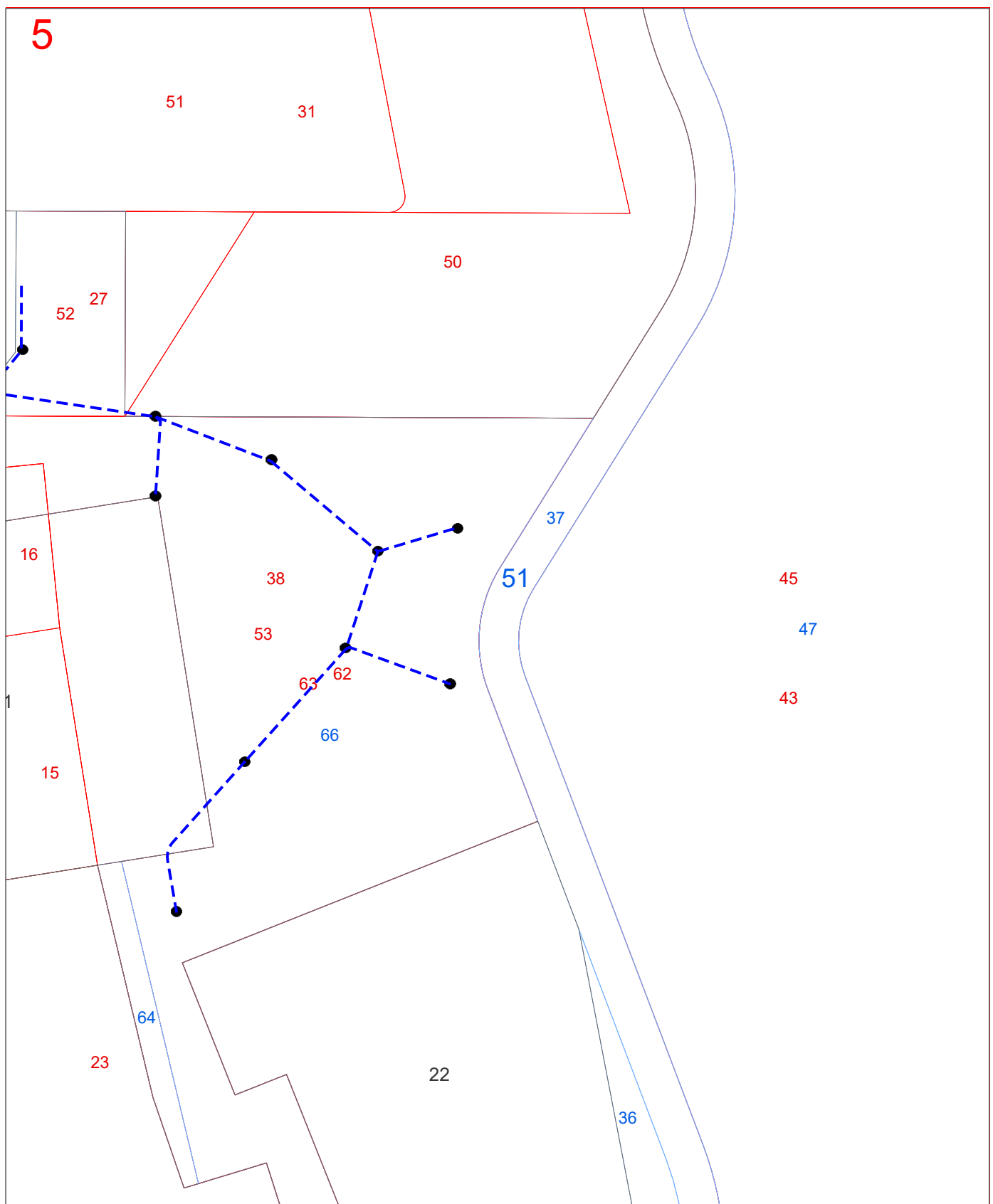
- | | | | |
|--|-------------------------|--|--------------------------------|
| | Affected DBYD Work Area | — | Overhead Cable – In Service |
| | Streetlight | — | Overhead Cable - Abandoned |
| | Column | - - - - | Underground Cable – In Service |
| | Controller Box | - - - - | Underground Cable - Abandoned |



Map 5

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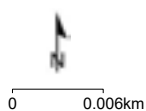
Kippax Place Holt



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- Street light cable can be direct buried or in conduit, determination being made on site
- Street light cables are to be treated as permanently alive for work purposes.

Imagery sourced from Open StreetMaps



LEGEND:

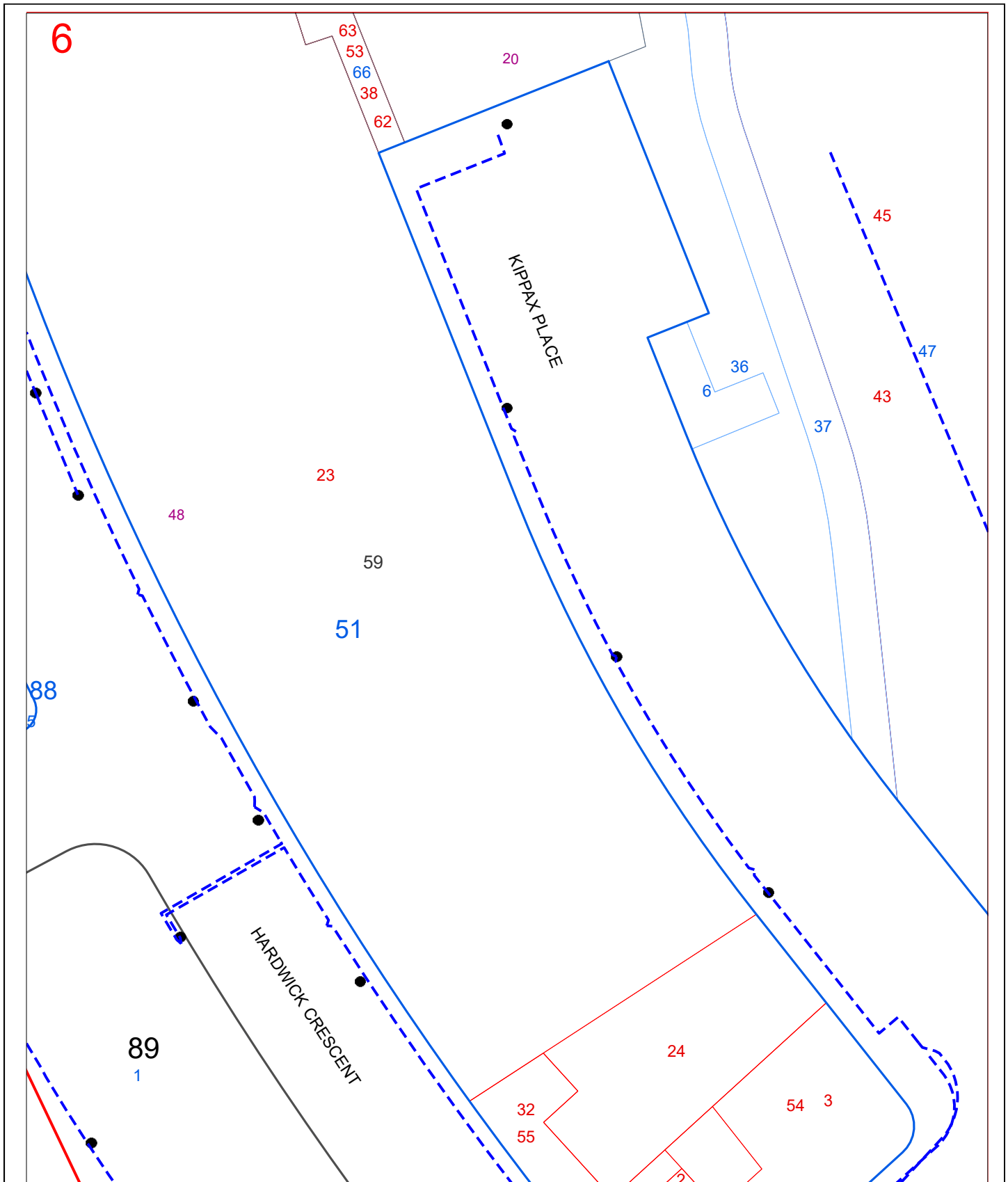
- | | | | |
|--|-------------------------|--|--------------------------------|
| | Affected DBYD Work Area | | Overhead Cable - In Service |
| | Streetlight | | Overhead Cable - Abandoned |
| | Column | | Underground Cable - In Service |
| | Controller Box | | Underground Cable - Abandoned |



Map 6

Sequence No: 100461574

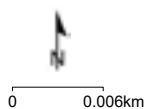
Kippax Place Holt



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- Street light cables are to be treated as permanently alive for work purposes.

Imagery sourced from Open StreetMaps



LEGEND:

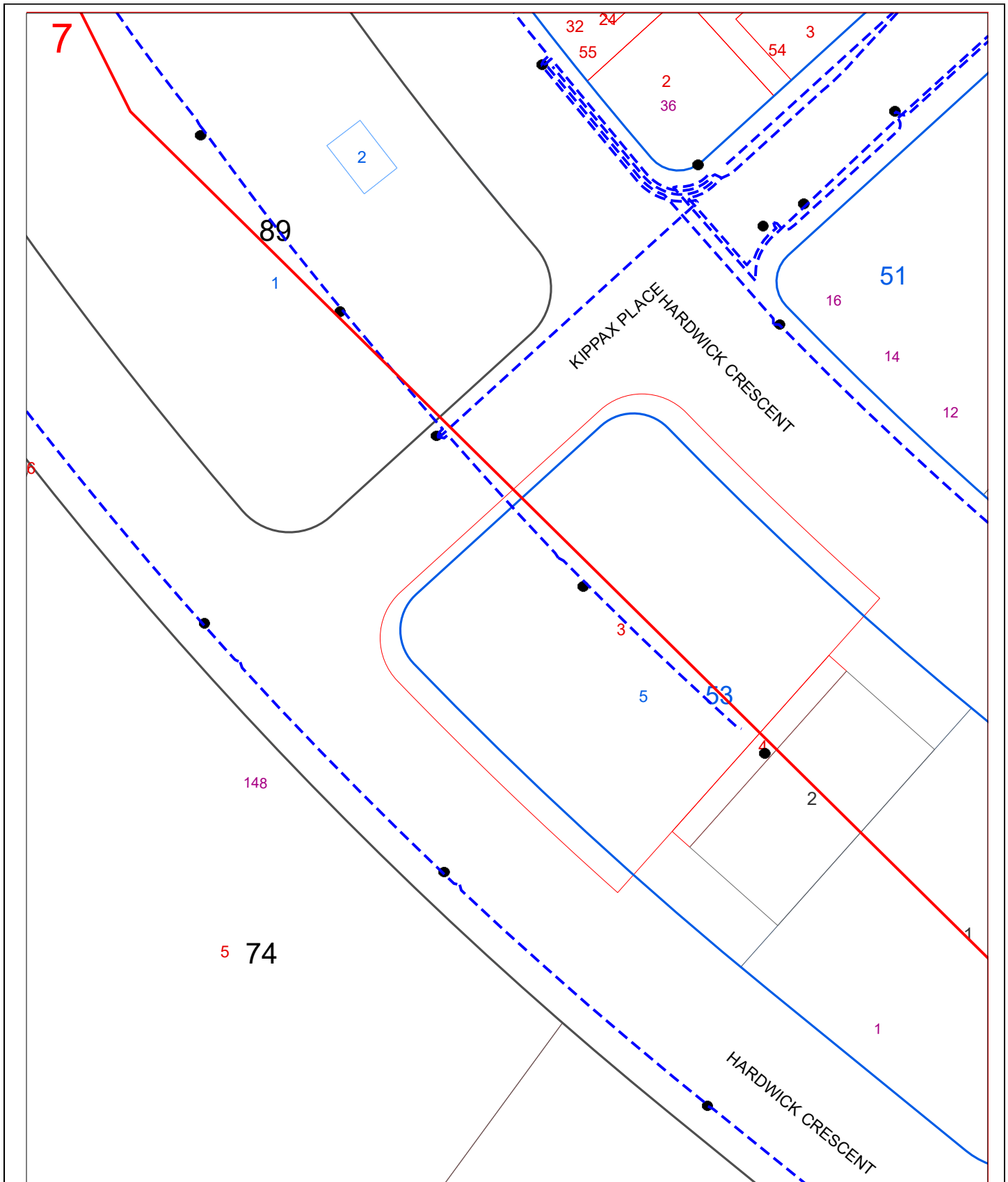
- | | | | |
|--|-------------------------|---|--------------------------------|
| | Affected DBYD Work Area | — | Overhead Cable – In Service |
| | Streetlight | --- | Overhead Cable - Abandoned |
| | Column | ---- | Underground Cable – In Service |
| | Controller Box | ----- | Underground Cable - Abandoned |



Map 7

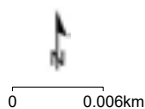
Sequence No: 100461574

Kippax Place Holt



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- Street light cables are to be treated as permanently alive for work purposes.



LEGEND:

- | | | | |
|--|-------------------------|---|--------------------------------|
| | Affected DBYD Work Area | — | Overhead Cable – In Service |
| ⚙ | Streetlight | - - - | Overhead Cable - Abandoned |
| ● | Column | ... | Underground Cable – In Service |
| | Controller Box | - - - | Underground Cable - Abandoned |

Imagery sourced from Open StreetMaps

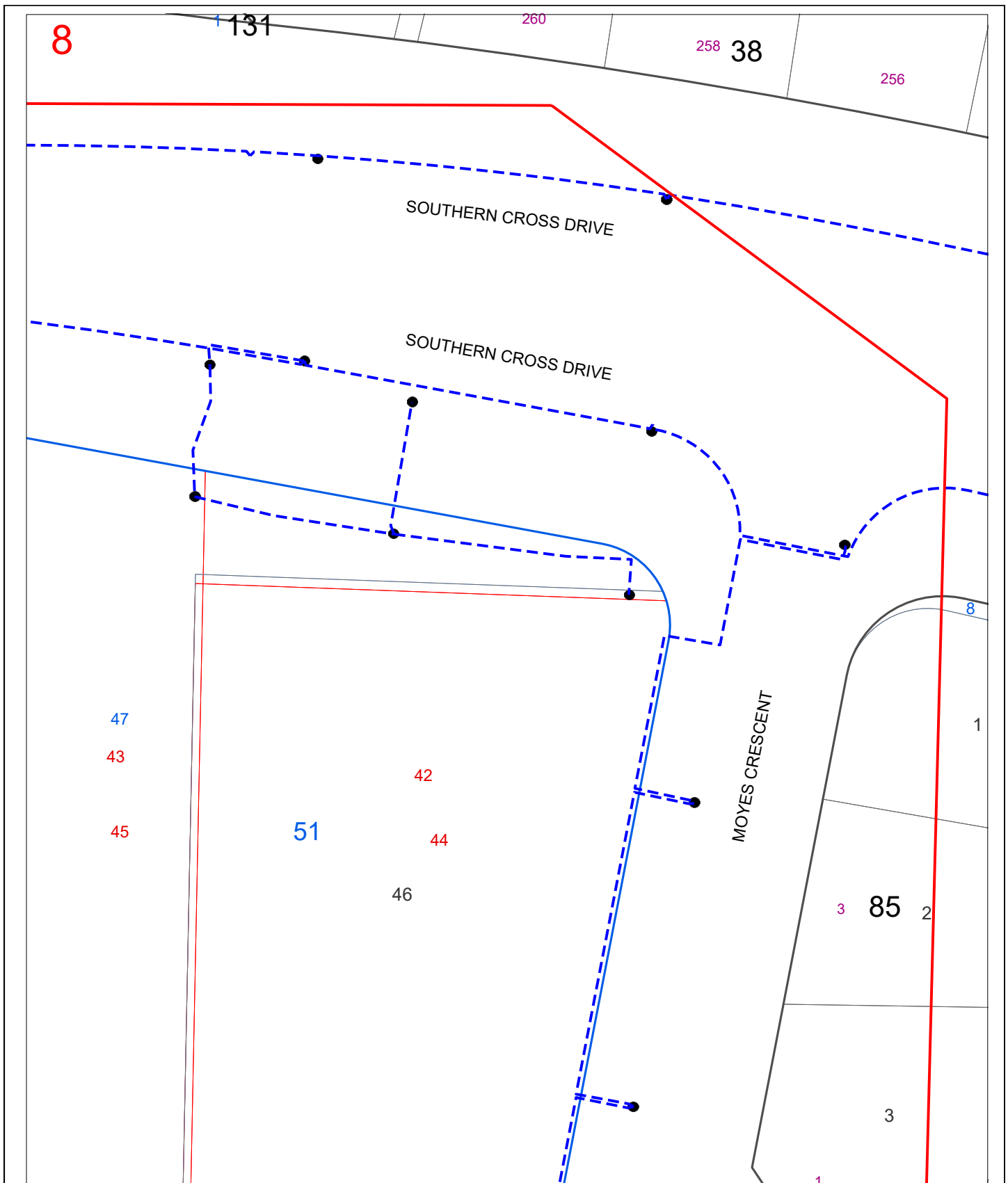


ACT
Government
Transport Canberra and
City Services

Map 8

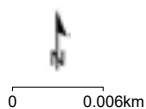
Sequence No: 100461574

Kippax Place Holt



Supplied Maps and Plans should only be used as a guide and are indicative only.

- Street light cable can be direct buried or in conduit, determination being made on site
- Street light cables are to be treated as permanently alive for work purposes.



Imagery sourced from Open StreetMaps

LEGEND:



Affected DBYD Work Area



Streetlight



Column



Controller Box

Overhead Cable – In Service

Overhead Cable – Abandoned

Underground Cable – In Service

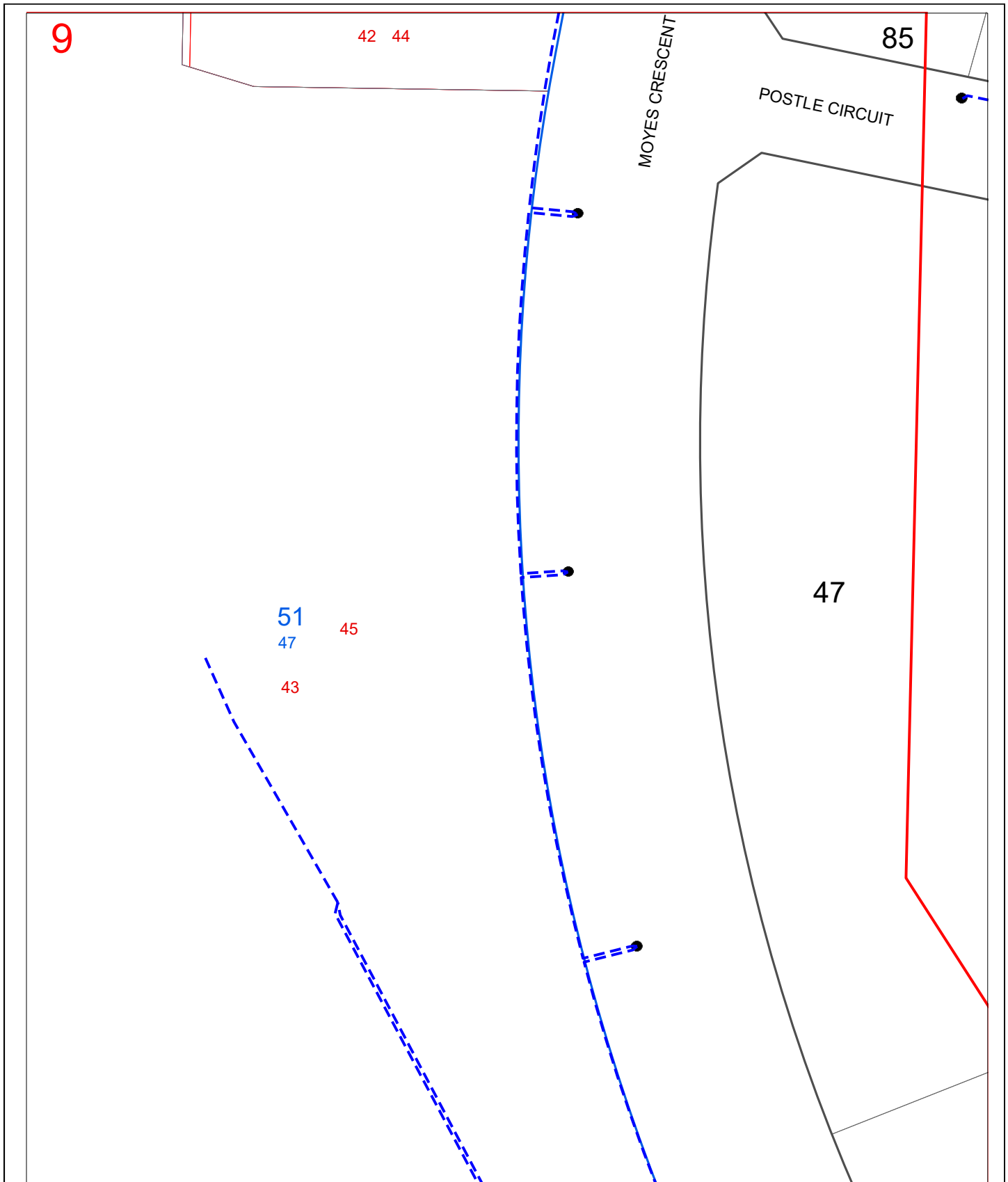
Underground Cable – Abandoned



Map 9

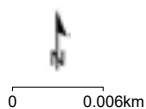
Sequence No: 100461574

Kippax Place Holt



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- Street light cables are to be treated as permanently alive for work purposes.



Imagery sourced from Open StreetMaps

LEGEND:

- | | | | |
|--|-------------------------|--|--------------------------------|
| | Affected DBYD Work Area | | Overhead Cable – In Service |
| | Streetlight | | Overhead Cable - Abandoned |
| | Column | | Underground Cable – In Service |
| | Controller Box | | Underground Cable - Abandoned |

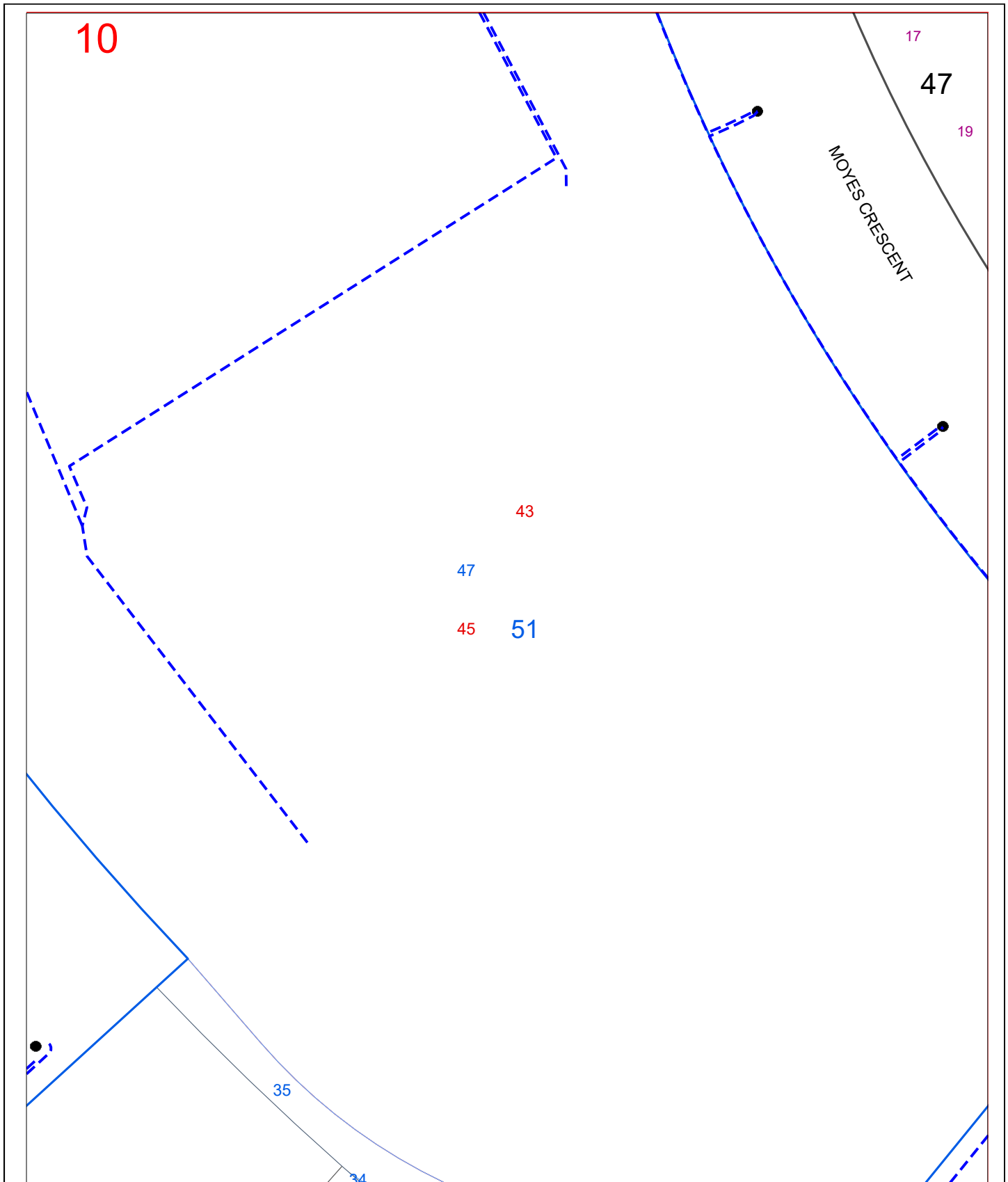


ACT
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City Services

Map 10

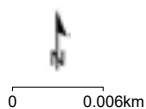
Sequence No: 100461574

Kippax Place Holt



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- Street light cables are to be treated as permanently alive for work purposes.



Imagery sourced from Open StreetMaps

LEGEND:

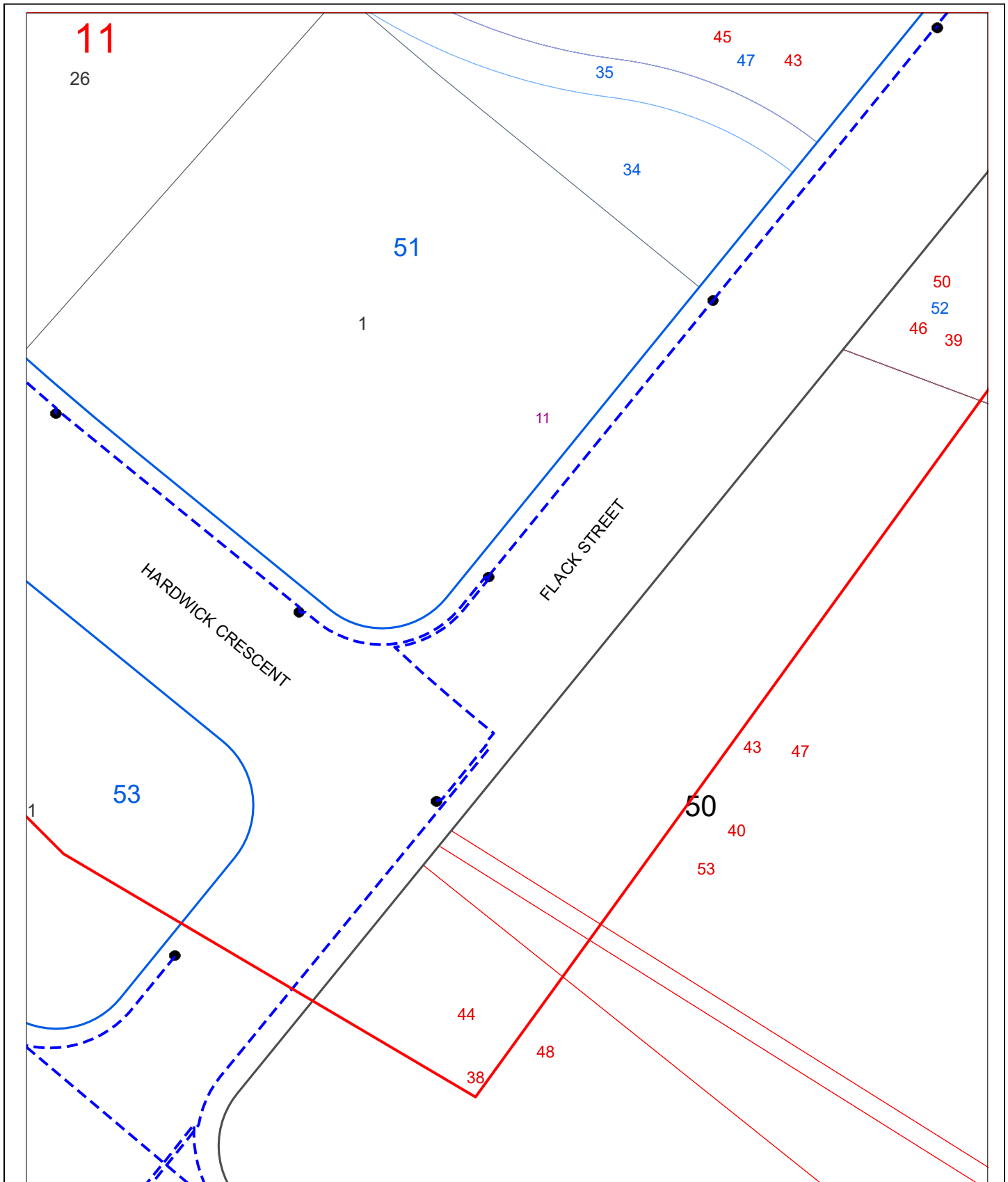
- | | | | |
|--|-------------------------|--|--------------------------------|
| | Affected DBYD Work Area | | Overhead Cable – In Service |
| | Streetlight | | Overhead Cable - Abandoned |
| | Column | | Underground Cable – In Service |
| | Controller Box | | Underground Cable - Abandoned |



Map 11

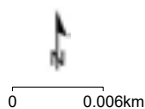
Sequence No: 100461574

Kippax Place Holt



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- Street light cable can be direct buried or in conduit, determination being made on site
- Street light cables are to be treated as permanently alive for work purposes.



Imagery sourced from Open StreetMaps

LEGEND:

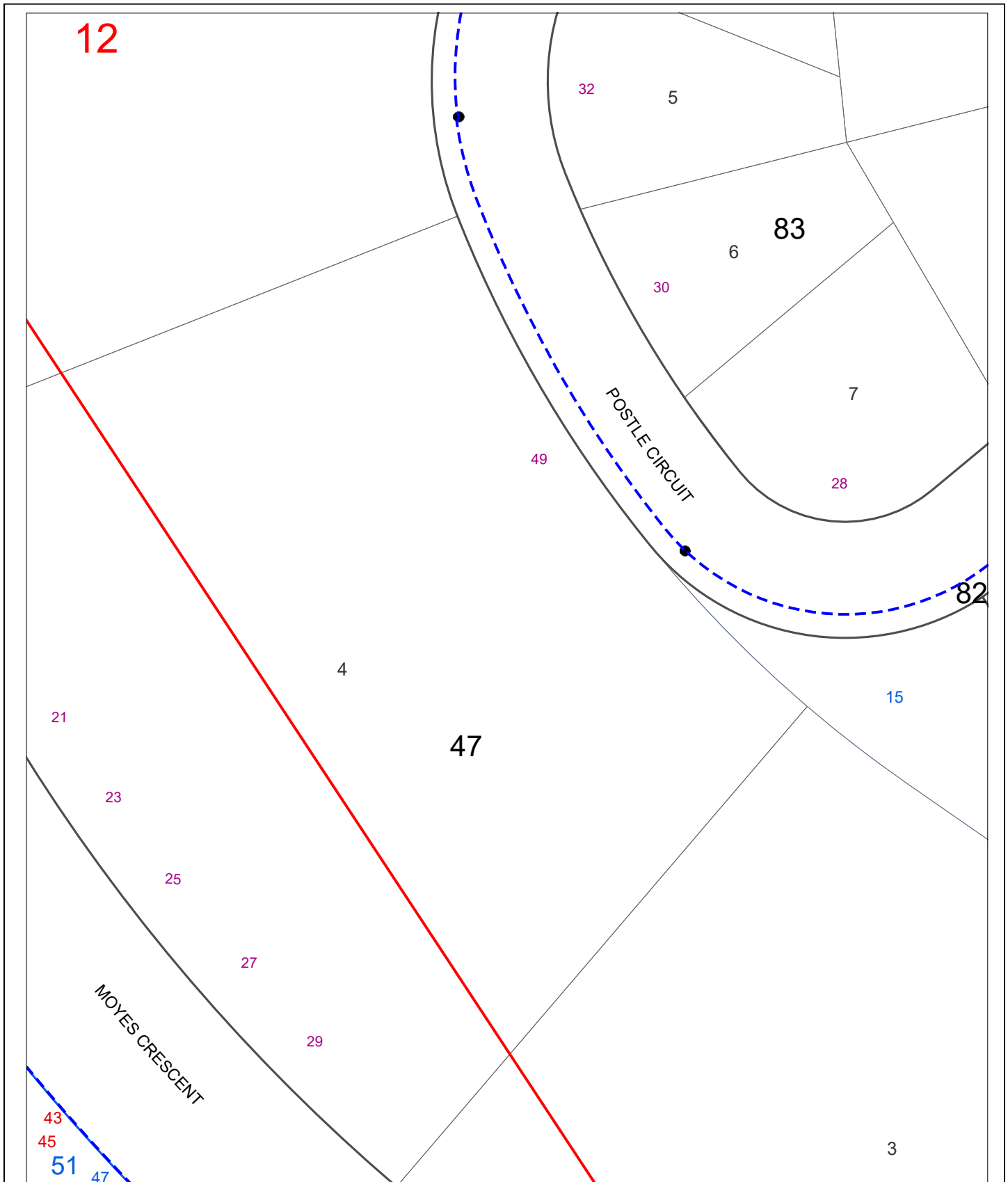
- | | | | |
|--|-------------------------|--|--------------------------------|
| | Affected DBYD Work Area | | Overhead Cable - In Service |
| | Streetlight | | Overhead Cable - Abandoned |
| | Column | | Underground Cable - In Service |
| | Controller Box | | Underground Cable - Abandoned |



Map 12

Sequence No: 100461574

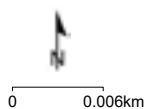
Kippax Place Holt



Supplied Maps and Plans should only be used as a guide and are indicative only.

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- Street light cables are to be treated as permanently alive for work purposes.

Imagery sourced from Open StreetMaps



LEGEND:

- Affected DBYD Work Area
- Streetlight
- Column
- Controller Box

- Overhead Cable – In Service
- Overhead Cable - Abandoned
- - - - Underground Cable – In Service
- - - - Underground Cable - Abandoned

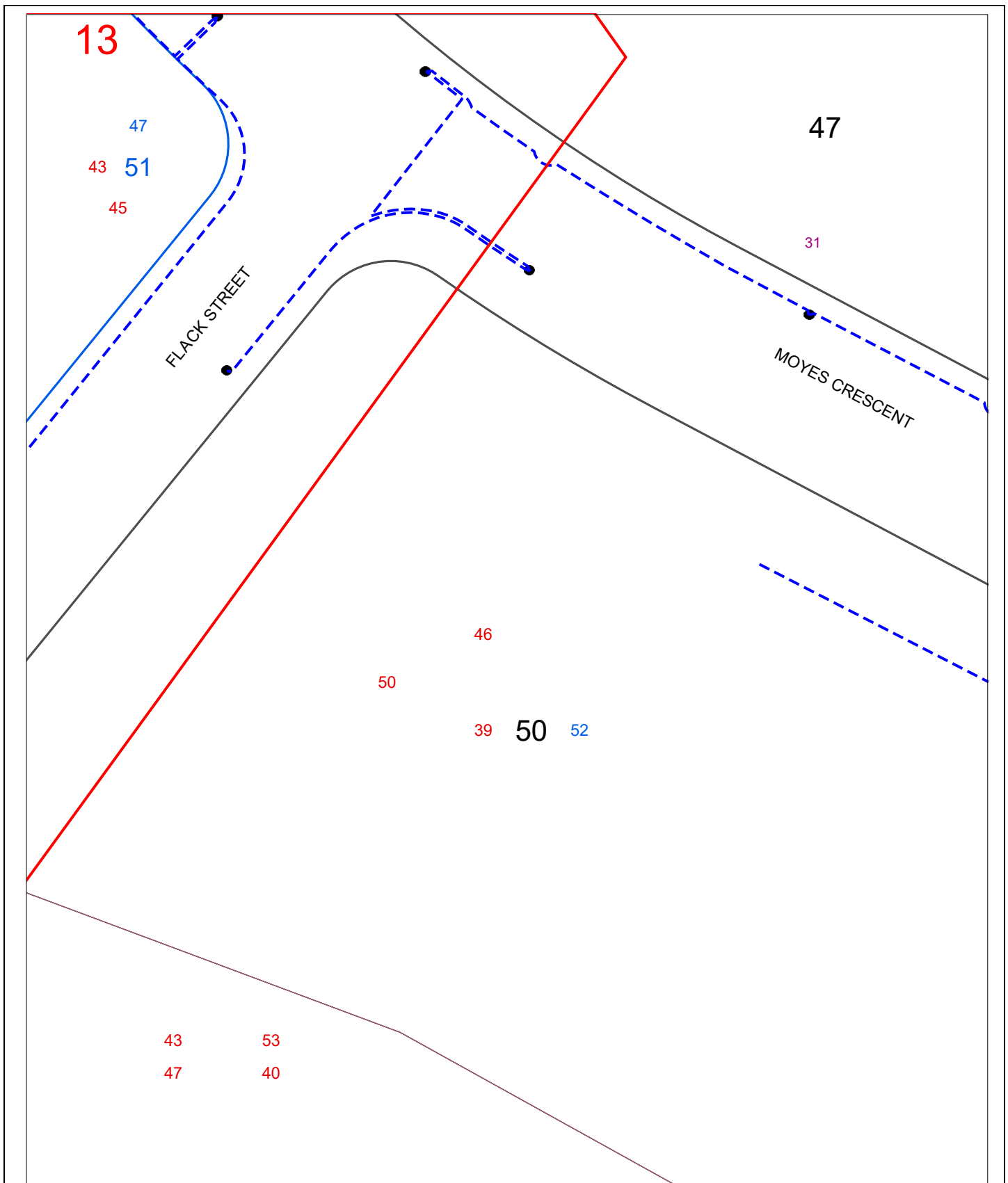


ACT
Government
Transport Canberra and
City Services

Map 13

Sequence No: 100461574

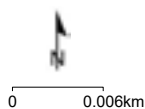
Kippax Place Holt



Supplied Maps and Plans should only be used as a guide and are indicative only.

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- Street light cables are to be treated as permanently alive for work purposes.

Imagery sourced from Open StreetMaps



LEGEND:

- Affected DBYD Work Area
- Streetlight
- Column
- Controller Box

- Overhead Cable – In Service
- Overhead Cable - Abandoned
- Underground Cable – In Service
- Underground Cable - Abandoned

ON SITE BOOKING REQUIRED- PLEASE CALL

Subject: Dial Before You Dig Request – Government Fibre Optic Network

Date: 6 August 2020

Attention: Ms Mana Naghshgar

Email: m.naghshgar@gmail.com

Site Address: Kippax Place Holt ACT 2615

DBYD Sequence #: 100461568

From: Simone Blayden

Thank you for conducting a Dial Before You Dig request. We manage the
Government Fibre Optic Network.

**THERE IS CRITICAL GOVERNMENT FIBRE OPTIC NETWORK ASSET IN
ALL OF YOUR PROPOSED AREA- ONSITE BOOKING REQUIRED**

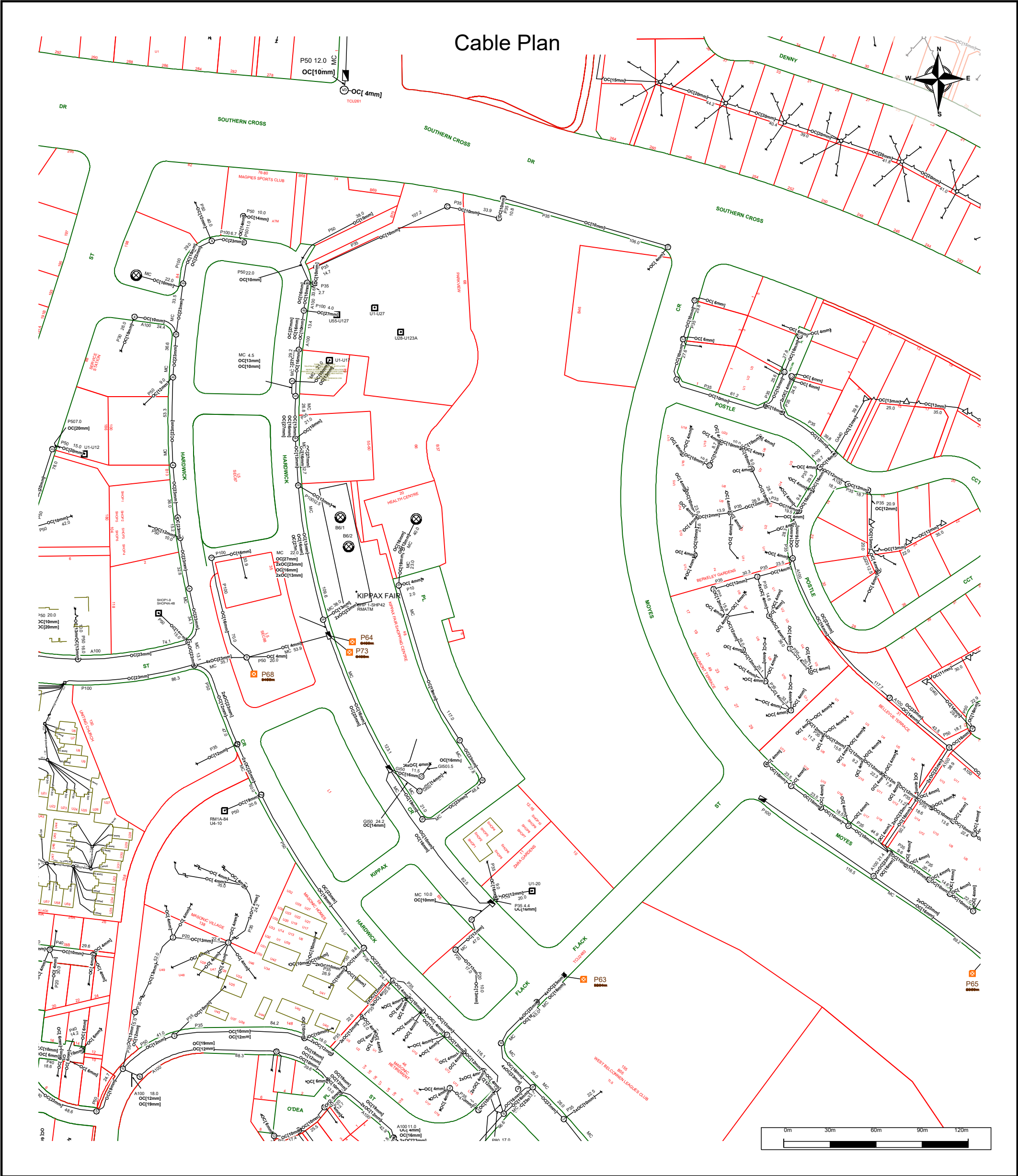
We are writing to confirm an onsite service locate is required prior to your
excavation commencing.

Please call Commence Communications on 02 6226 3869 to confirm a time for an on-
site appointment prior to any works commencing.

Kind regards



Simone Blayden
Commence Communications



	<p>For all Telstra DBYD plan enquiries - email - Telstra.Plans@team.telstra.com For urgent onsite contact only - ph 1800 653 935 (bus hrs)</p>	<p>Sequence Number: 100461570</p>
<p>TELSTRA CORPORATION LIMITED A.C.N. 051 775 556</p> <p>Generated On 06/08/2020 11:32:40</p>		<p>CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.</p>

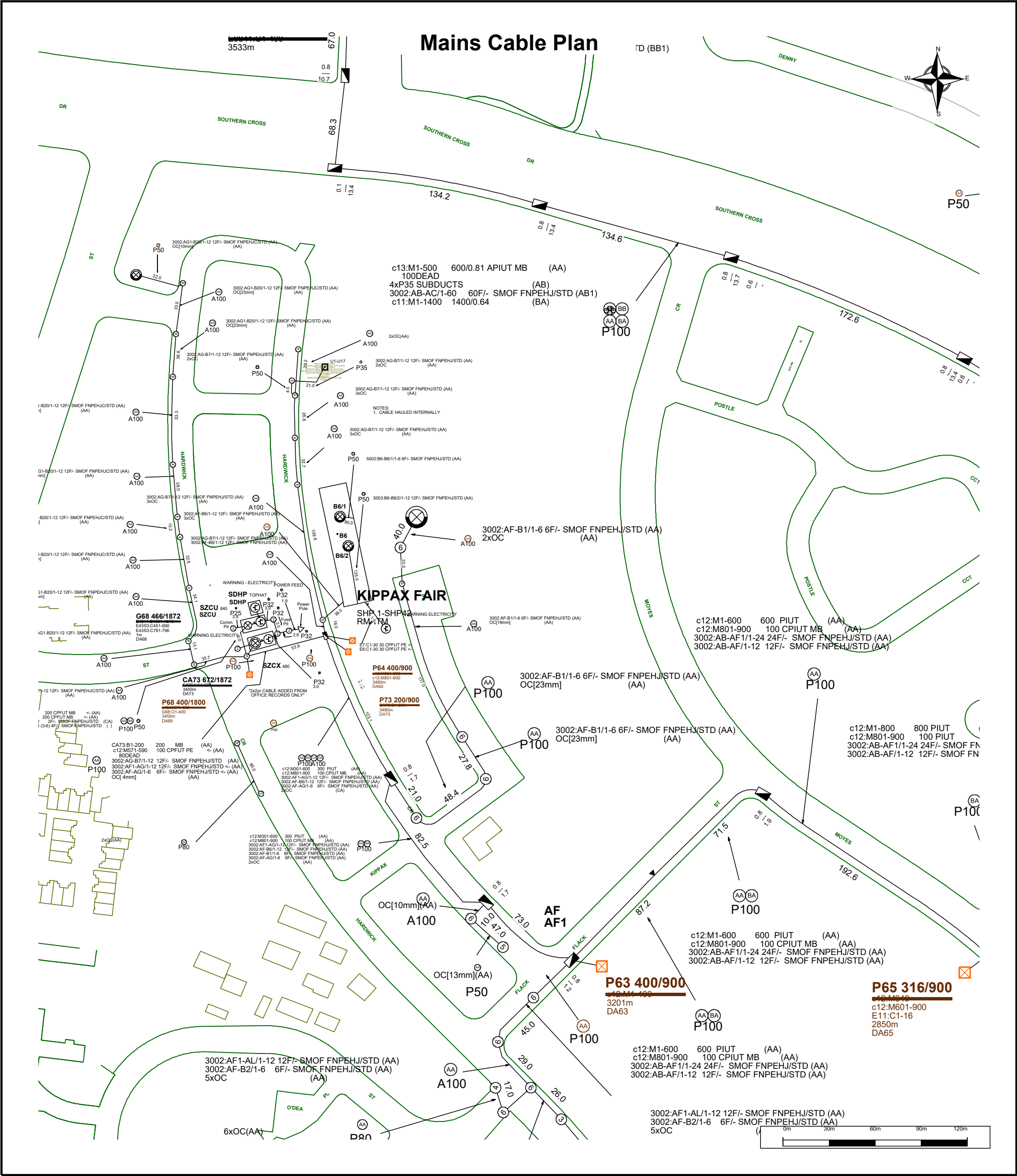
The above plan must be viewed in conjunction with the Mains Cable Plan on the following page


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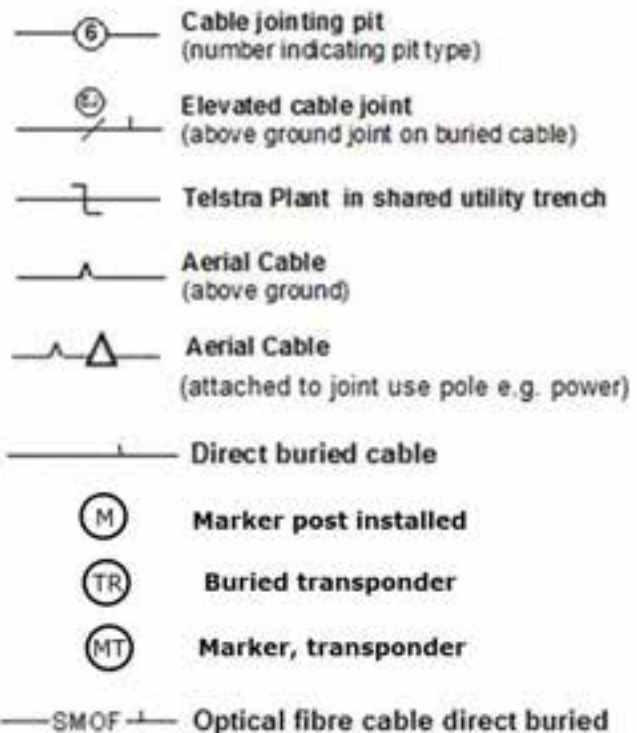
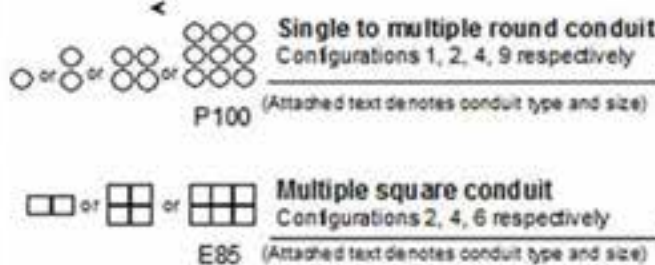
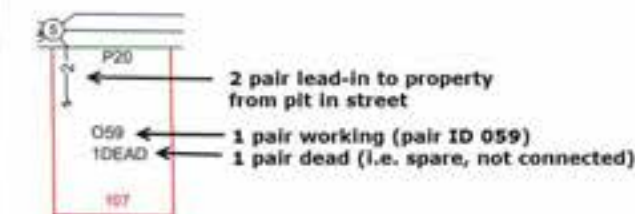
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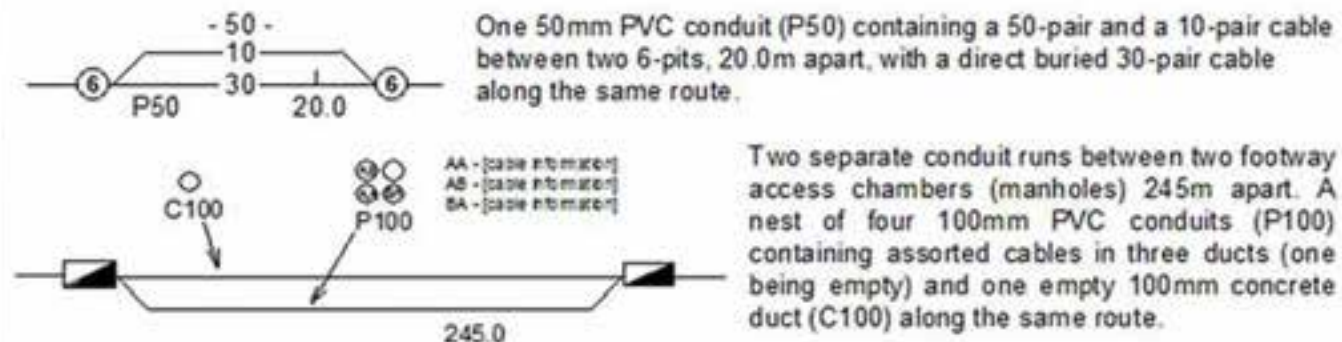
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Some examples of conduit type and size:
A - Asbestos cement, P - PVC / plastic, C - Concrete, GI - Galvanised iron, E - Earthenware.
Conduit sizes *nominally* range from 20mm to 100mm.

P50	50mm PVC conduit
P100	100mm PVC conduit
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06/08/2020

Ms Mana Naghshgar,
Not Supplied
4 Lidgett Place
Florey, 2615

Dear Ms Mana Naghshgar

Dial Before You Dig Enquiry 100461573

Thank you for your enquiry regarding the following detail:

Mechanical Excavation at
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commencing on 01/12/2020

TransGrid **does** have underground assets in the vicinity of this location, as shown on the attached plan. Please be aware that you may be financially liable for damage to any underground cable assets. TransGrid reserves all rights to recover compensation for loss or damage to its assets including:

- > The costs incurred in replacing any of TransGrid's assets destroyed by the excavation work.
- > The costs incurred in repairing any damage to TransGrid's assets caused by the excavation work.
- > The costs incurred in remedying or mitigating any interference with TransGrid's network.
- > Any consequential losses

It is your responsibility to confirm the location of any cables using service location techniques or non-destructive hand digging. Any further information or detail you may require in addition to that provided here can be obtained by calling TransGrid on the phone number below during business hours. A site meeting, if necessary, can be arranged at your cost.

Optic Fibre Cable: (02) 9620 0164

You must:

- > Not modify the extent of work in the vicinity of the cable without prior notification to TransGrid.
- > Ensure information provided in this response remains on-site at all times throughout your construction phase.
- > Notify TransGrid of any damage to its infrastructure that occurs as a result of your work, by telephoning the emergency contact number 1800 027 253.

For New South Wales:

TransGrid draws your attention to the WorkCover “Work Near Underground Assets Guide 2007” a copy of which can be obtained from the NSW WorkCover Authority or at this web link: http://www.workcover.nsw.gov.au/data/assets/pdf_file/0018/24408/work_near_underground_assets_1419.pdf In particular, the following items relate specifically to TransGrid’s cables:

1. Section 4.9, Table A: The Installation of Various Types of Underground Assets.
2. Section 5.1.2: Safety considerations for Low, High or Extra High Voltage electrical cables.
3. Section 5.2, Table B: Types of Assets and Limits of Underground Approach.
4. Section 6.1.3: Consultation with Relevant Parties Prior to Commencing Work.
5. Section 6.10: Directional Boring.
6. Section 7.2.1: Accidental Contact with Underground Assets – Electrical Assets.
7. Section 7.2.5: Accidental Contact with Underground Assets – Telecommunications Assets.
8. Section 7.6: Asset Owner Plans and ‘Dial Before You Dig’.

These sections shall be read in conjunction with the entire guide.

For Victoria:

TransGrid draws your attention to the Work Safe Victoria “Guide for Undertaking Work Near Underground Assets” a copy of which can be obtained from the Work Safe Victoria or at this web link:

https://www.worksafe.vic.gov.au/data/assets/pdf_file/0019/21808/ngz_guide_under.pdf.

Please find attached drawings showing the location of TransGrid’s cable in this vicinity. The provision of these drawings does not provide approval for your proposed works or diminish your obligations to locate the cable before you start work.

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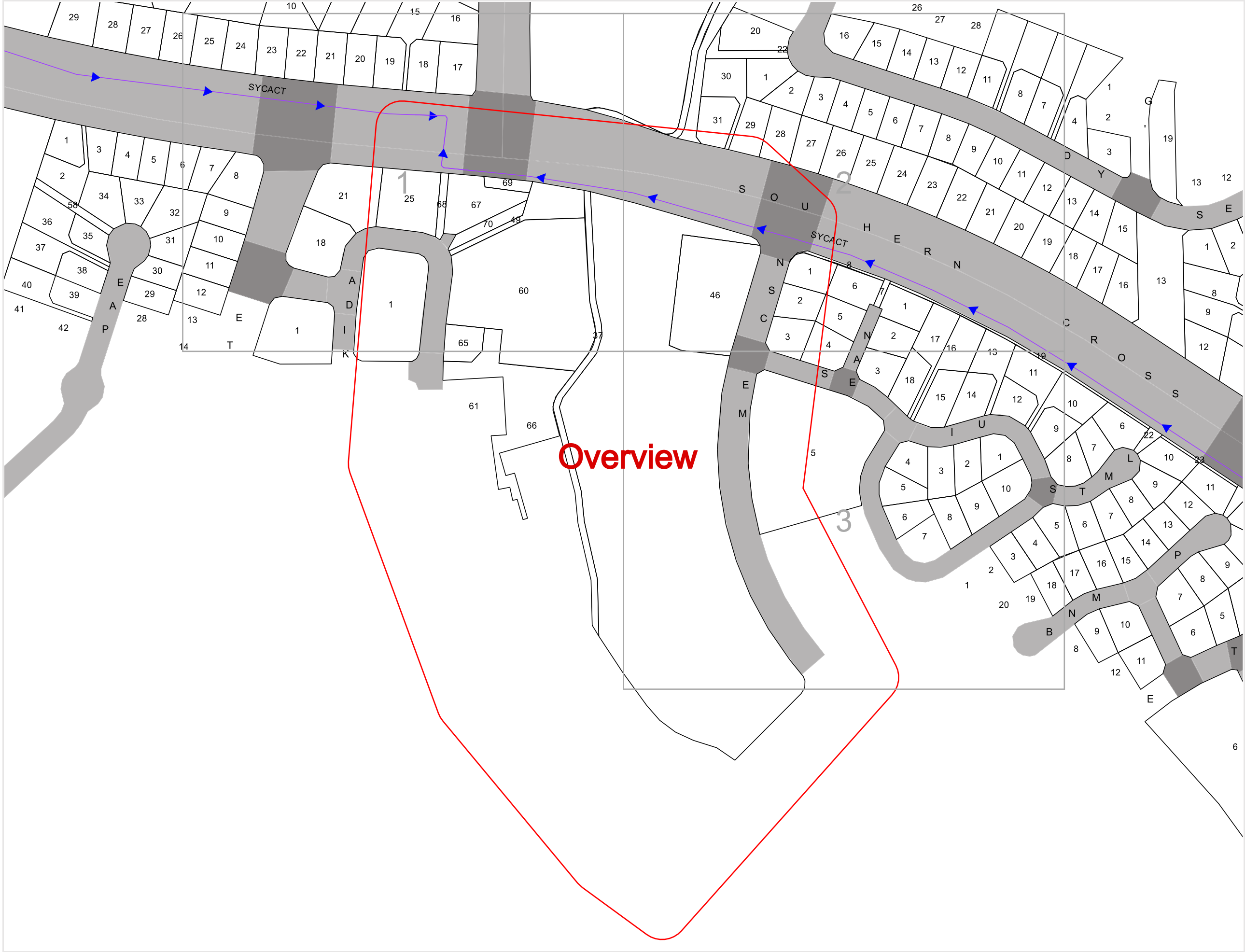
TransGrid is a separate organisation to ActewAGL, Ausgrid, Endeavour Energy and Essential Energy (formerly Country Energy), and does not represent the views or opinions of these other entities.

Yours faithfully

TransGrid Cables Maintenance Team



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Legend:

- DBYD Enquiry
- Cable Assets
- Communication Cable
- Tunnel Assets

Scale: 1:2809



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Legend:

- DBYD Enquiry
- Cable Assets
- Communication Cable
- Tunnel Assets

Scale: 1:1000



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- Cable Assets
- Communication Cable
- Tunnel Assets

Scale: 1:1000



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Legend:

-  DBYD Enquiry
-  Cable Assets
-  Communication Cable
-  Tunnel Assets

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ACT	COUNCIL			
DRAWING No.			SHEET	
CCS - TRG - S1 - E			3	17

Appendix E

*Background Studies (Flood Report
and Traffic Assessment Report)*



PREPARED FOR ENVIRONMENT, PLANNING AND SUSTAINABLE DEVELOPMENT DIRECTORATE (EPSDD)
15/07/2020
20-000198
FINAL
WATER & ENVIRONMENT

Revised Kippax Group Centre Flood Study Report

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Issue	Date	Issue Details	Author	Checked	Approved
1	08/05/2020	Draft Report	NL	APL	APL
2	15/07/2020	Final Report	NL	APL	APL

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1 EXECUTIVE SUMMARY

The Environment, Planning and Sustainable Development Directorate (EPSDD) has engaged Calibre Professional Services in 2015 to undertake a detailed two-dimensional flood study for the Kippax Group Centre that is located in the suburb of Holt, Canberra. This study updates the original flood study using the current available LiDAR and rainfall data, and methodology of ARR 2019.

The EPSDD has completed the master plan for the Kippax Group Centre and has received a number of comments from agencies and the community on the proposals. The master plan incorporates and builds upon work carried out by the Riverview Group in 2014, as part of a strategic planning review. The planning review was undertaken by the Riverview Group in anticipation of demand on Kippax that will be generated by the future Ginninderry community.

The Kippax Group Master Plan addresses actions outlined in the ACT Planning Strategy (2012). This includes identifying opportunities for urban intensification and providing new opportunities for employment and mixed use development. There is also a strong focus on the provision of recreational and social amenity.

The key objective of this revised flood study is to update the Kippax Group Flood Study prepared by Calibre in 2015, which developed a detailed two-dimensional flood model that was used to inform the master planning of the Kippax Group Centre.

The primary objectives for the 2015 and 2020 Flood Studies are listed below.

The primary objectives for the 2015 Flood Study were to:

- Inform the Kippax Group Centre Master Plan;
- Determine the current and future flood characteristics of the Kippax Group Centre study area;
- Use the latest available data, hydrological and hydraulic techniques to determine flood levels and extents;
- Provide flood models that will inform consideration of new land use opportunities and development opportunities, as well as potential changes to services and floodway infrastructure;
- Produce accurate and reliable flood mapping for the 20%, 10% and 1% AEP events with consideration to blockage factors and increased rainfall due to climate change; and
- Provide advice and recommendations to mitigate or eliminate flood risks to make land suitable for future development and/or redevelopment purposes.

The primary objectives for the revised Flood Study are to:

- Update the 2015 XPRAFTS and TUFLOW models developed for the Kippax Group Centre to ARR 2019 using the latest BOM rainfall data and ACT LiDAR Data;
- Model the 20%, 10%, 1% AEP events with consideration for blockage factors and climate change effects;
- Include any additional stormwater drainage infrastructure constructed since 2015 into the TUFLOW model;
- Include any new developments since 2015 into the TUFLOW model. Assess if the childcare centre at Holt Block 67, Section 51 constitutes a land use hazard as well as any critical infrastructure located within the study area;
- Review and revise the mitigation measures proposed in the 2015 flood study and clarification on the recommendation provided for the retardation basin downstream of Southern Cross Drive;
- Assess existing breakout flows through the urban open space areas overland flow paths and at the intersection of Flack Street and Moyes Crescent;
- Assess whether any of the overland flow path capacity issues identified in the 2015 Kippax Stormwater Report are related in any way to the Kippax Masterplan and in particular the Kippax Fair redevelopment;
- Produce flood maps for the 20%, 10%, 1% AEP events for the existing condition and with mitigation options, and with consideration for blockage factors and climate change effects; and
- Produce a revised Flood Study Report incorporating the previous report information and all changes resulting from the updated hydrology and hydraulic modelling.

The existing topography within the Kippax District Playing Fields currently grades from Starke Street to Southern Cross Drive. Flood modelling software TUFLOW was used to model the existing condition of the Kippax Group Centre study area and the proposed mitigation options to alleviate the existing flooding issues. Terrain modifications such as the regrading of overland flow paths and constructing a levee were prepared in 12d and read into TUFLOW as additional DEMs over the existing LiDAR data. This ensures a high level of detail for the resulting flood levels obtained, which can be used to inform the detailed design of the mitigation options discussed in this report and to inform building floor levels for future development within the Kippax Group study area.

This flood study confirms the findings of the 2015 Kippax Group flood study that the existing overland flow paths within the Kippax Group Centre study area do not have sufficient capacity to fully convey the 1% AEP flood event.

Figure 1-1 shows the hydraulic constraints in the existing condition of the study area that are inhibiting the flow of stormwater from the upstream Higgins catchment through the Kippax Group Centre study area. These include:

- a trap low point at the Starke Street Underpass;
- an overgrown vegetated swale directly downstream of the Starke Street Underpass;
- a grassed swale directly upstream of the Flack Street Underpass with very limited hydraulic capacity; and
- an underpass underneath Southern Cross Drive that limits the conveyance of stormwater during the 1% AEP storm.



Figure 1-1: Hydraulic Constraints within Kippax Group Centre

The 2015 flood study previously concluded that improving the overland flow paths and constructing a levee on the corner of Flack Street and Moyes Crescent resolves the breakout flows within the urban open space areas, which are confirmed in this study by re-running the TUFLOW models with updated LiDAR and rainfall data. It was noted that more stormwater is conveyed towards the Flack Street Underpass and the overland flow is contained within the improved channel throughout the urban open space area. The proposed levee has been modelled as an earth embankment with 1:4 batters and aligned to avoid the existing toilet/changing rooms located on the northeast corner of the open space. Details of the levee can be further refined during the detailed design stage of the project.

However, the retardation basin located downstream of Southern Cross Drive previously identified in the 2015 flood study as a source of flooding issue was further investigated in this updated flood study. It was found that modifications on the retardation basin have very little effect to the flooding upstream of Southern Cross Drive Underpass, which has been concluded to be controlled by the hydraulic capacity of the underpass. Therefore, this study recommends increasing the capacity of the existing Southern Cross Drive Underpass to allow more flows during a 1% AEP storm. Furthermore, it was also confirmed from Icon Water that a 1500mm diameter trunk sewer runs underneath the embankment of the retardation basin, which will render any major modification to the embankment not feasible.

The recommended mitigation measures to alleviate existing flooding problems within and adjacent to the Kippax Group Centre study area are summarised below. We note that these mitigation options will be required with or without expansion to the Kippax Fair proceeding. Refer to Figure 1-2 for the recommended mitigation measures.

- Regrade the trap low point at the Starke Street Underpass;
- Clear out and regrade the overgrown vegetated swale from the Starke Street Underpass, running parallel with Starke Street;
- Construct a levee with an inlet into the existing stormwater network on the corner of Flack Street and Moyes Crescent;
- Regrade the existing grassed swale downstream of the Flack Street Underpass; and
- Double the width of Southern Cross Drive Underpass to increase the hydraulic capacity.



Figure 1-2: Recommended Mitigation Measures to Alleviate Existing Flooding

Priority should be given to all of the flood mitigation works as the flood study results indicate that without implementing all of the above options existing blocks have the potential of flooding during a 1% AEP storm event. While flooding issues were identified in the existing condition of the study area, further development of the Kippax Group may exacerbate these existing flooding issues and introduce more people closer to the flooding risks if the recommended mitigation measures are not undertaken.

TUFLOW results show that the eastern block of the existing residential development (Block 50 & 51, Section 51, Holt ACT) located on the upstream side of Southern Cross Drive and adjacent to the floodway has 300mm freeboard during a 1% AEP storm. Widening of the Southern Cross Drive Underpass results in an 800mm flood reduction in this area that ensures the existing development is protected from flood level increase resulting from climate change.

Climate change effects have been included in this study as additional modelling scenarios. Allowance for climate change should be considered as part of the detailed design of the mitigation options to ensure flood immunity to blocks due to climate change.

2 INTRODUCTION

The Environment, Planning and Sustainable Development Directorate (EPSDD) has engaged Calibre Professional Services in 2015 to undertake a detailed two-dimensional flood study for the Kippax Group Centre which is located in the suburb of Holt, Canberra. This study updates the original flood study using the current available LiDAR and rainfall data, and methodology of ARR 2019.

The EPSDD has completed the master plan for the Kippax Group Centre and has received a number of comments from agencies and the community on the proposals. The master plan incorporates and builds upon work carried out by the Riverview Group in 2014, as part of a strategic planning review. The planning review was undertaken by the Riverview Group in anticipation of demand on Kippax that will be generated by the future Ginninderry community.

The Kippax Group Centre Master Plan addresses actions outlined in the ACT Planning Strategy (2012). This includes identifying opportunities for urban intensification and providing new opportunities for employment and mixed use development. There is also a strong focus on the provision of recreational and social amenity.

An increase in urbanisation within and around the Kippax Group Centre may encroach upon flood levels, due to changes in impervious areas and increasing building footprints on open space areas. The Kippax Group Centre Master Plan study area is shown in Figure 2-1. The current Territory Plan for the study area is displayed in Figure 2-2.



Figure 2-1 Kippax Group Master Plan Study Area

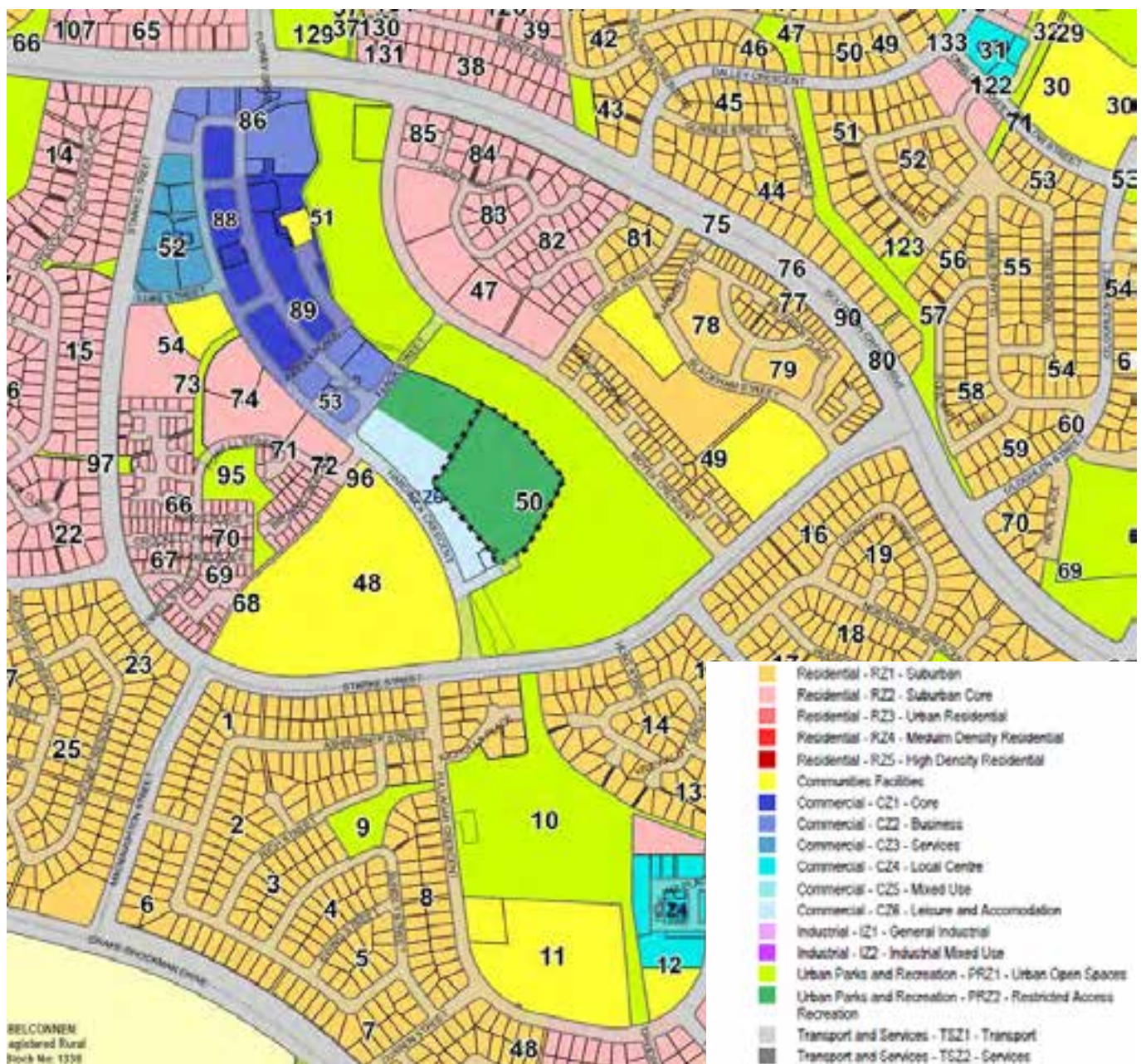


Figure 2-2 Territory Plan Map from ACTMAPi

3 OBJECTIVES

The key objective of this Flood Study is to update the original Kippax Group Flood Study prepared by Calibre in 2015, which developed a detailed two-dimensional flood model that was used to inform the master planning of the Kippax Group Centre. The primary objectives for the 2015 and 2020 Flood Studies are listed below.

The primary objectives of the 2015 Flood Study were to:

- Inform the Kippax Group Master Plan;
- Determine the current and future flood characteristics of the Kippax Group study area;

- Use the latest available data, hydrological and hydraulic techniques to determine flood levels and extents;
- Provide flood models that will inform consideration of new land use opportunities and development opportunities, as well as potential changes to services and floodway infrastructure;
- Produce accurate and reliable flood mapping for the 20%, 10% and 1% AEP events with consideration to blockage factors and increased rainfall due to climate change; and.
- Provide advice and recommendations to mitigate or eliminate flood risks to make land suitable for future development and/or redevelopment purposes.

The primary objectives of the revised Flood Study are to:

- Update the 2015 XPRAFTS and TUFLOW model developed for the Kippax Group to ARR 2019 using the latest BOM rainfall data and ACT LiDAR Data;
- Model the 20%, 10%, 1% AEP events with consideration for blockage factors and climate change effects;
- Include any additional stormwater drainage infrastructure constructed since 2015 into the TUFLOW model;
- Include any new developments since 2015 into the TUFLOW model. Assess if the childcare centre at Holt Block 67, Section 51 constitutes a land use hazard as well as any critical infrastructure located within the study area;
- Review and revise the mitigation measures proposed in the 2015 flood study and clarification on the recommendation provided for the retardation basin downstream of Southern Cross Drive;
- Assess existing breakout flows through the urban open space areas overland flow paths and at the intersection of Flack Street and Moyes Crescent;
- Assess whether any of the overland flow path capacity issues identified in the 2015 Kippax Stormwater Report are related in any way to the Kippax Masterplan and in particular the Kippax Fair redevelopment;
- Produce flood maps for the 20%, 10%, 1% AEP events for the existing condition and with mitigation options, and with consideration for blockage factors and climate change effects; and
- Produce a revised Flood Study Report incorporating the previous report information and all changes resulting from the updated hydrology and hydraulic modelling.

Calibre's 2015 flood study has built on previous preliminary studies to refine pipe flows and overland flows within the Kippax Group Centre study area. This revised study will confirm the advice and design information provided by the 2015 flood study to EPSDD.

4 CATCHMENT DESCRIPTION

The Kippax Group Centre Master Plan study area shown in Figure 2-1 is approximately 5.2km north-west of the centre of Belconnen. It is bounded by Southern Cross Drive to the north, Moyes Crescent to the east, Starke Street to the south and Hardwick Crescent to the west. The study area consists of urban open space (grassed ovals), with commercial and mixed use zones. Upstream of the catchment area is the suburb of Higgins, which is mostly medium density residential blocks with some open space. The total contributing catchment area is approximately 166Ha shown in Figure 4-1.

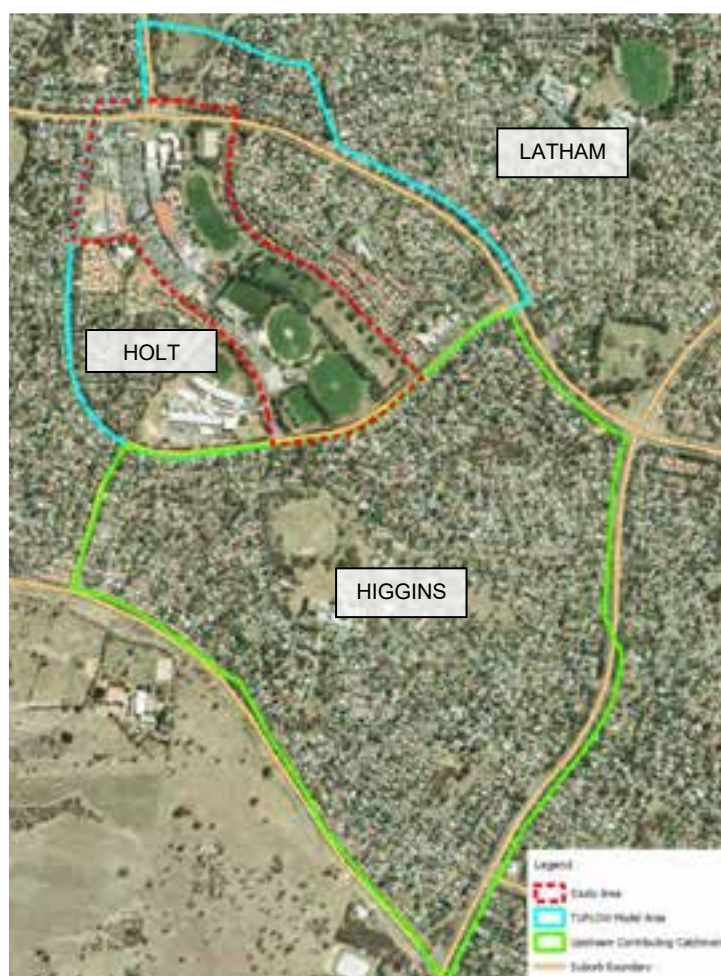


Figure 4-1: Upstream Contributing Catchment Area

5 AVAILABLE DATA

The data available for use in this study is summarised in Table 5.1 and discussed in the following sections

Table 5.1: Available Data and Reports

Description	Date Received/Obtained
Ginninderra Creek Flooding and Dams Assessment Report by Jacobs	03/06/2015
Ginninderra Creek Flooding and Dams Assessment RORB Model	02/06/2015
Review of sporting demand at Kippax – Holt Fields Report by Strategic Leisure Group	18/05/2015
Overland Flow Study Block 48 Section 51 Holt Report by Indesco	18/05/2015
Interim Sullivan's Creek Flood Study Report by GHD	18/05/2015
Yarralumla Creek and Long Gully Flood Study Report by Jacobs	18/05/2015
Kippax Updated Stormwater Network GIS	27/05/2015
Kippax Road and Block GIS	21/05/2015
Survey of Missing GIS Stormwater Data	17/06/2015
2015 ACT LiDAR Data	16/03/2020
BOM Rainfall Data	16/03/2020
2020 Aerial Imagery	16/03/2020

Description	Date Received/Obtained
TCCS Works-as-Executed Drawings	16/03/2020
Planning and Development Draft Variation No 369 (2019)	06/04/2020
Kippax Group Masterplan (March 2019)	06/04/2019
Icon Water Trunk Sewer Information	08/04/2020
DA Block 60 Section 51 Kippax	23/04/2020

5.1 TOPOGRAPHIC DATA

The latest ACT LiDAR data (2015) that includes the catchment and its immediate surroundings was sourced from ELVIS (Elevation Information System) website from Geosciences Australia. The accuracy of this data can be influenced by the presence of open water or vegetation (tree or shrub canopy) at the time of the survey.

A map of the catchment area was put together in QGIS mapping software that includes the latest aerial imagery (2020) of the study area sourced from Nearmap and the digital elevation model (DEM) created from the obtained LiDAR data. This DEM formed the basis of the two-dimensional hydraulic modelling for the study (shown in Figure 5-1).

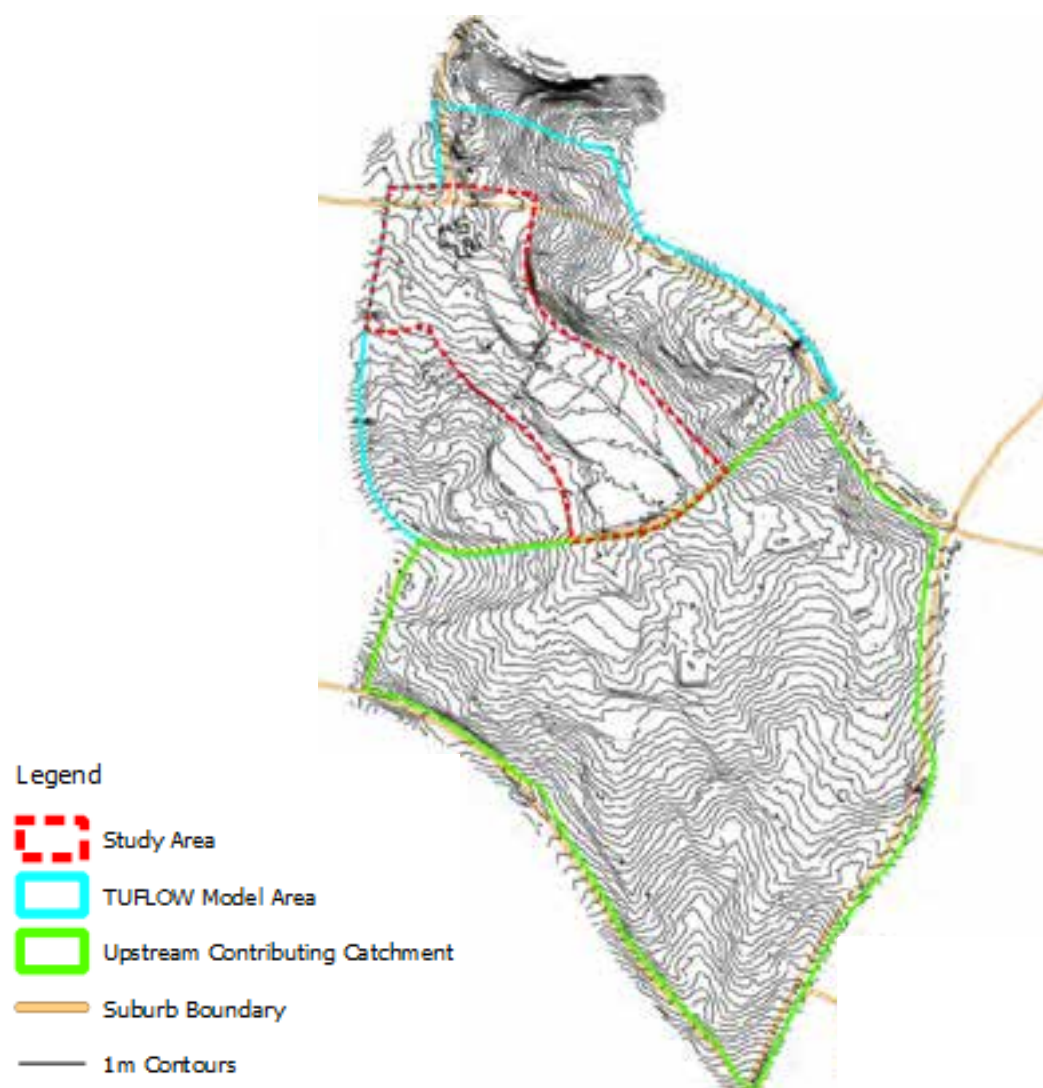


Figure 5-1: LiDAR to DEM Topographic Map

5.2 DETAILED SURVEY OF STORMWATER PIT AND PIPE DATA

Stormwater Pit and Pipe data was provided by EPSDD and Transport Canberra and City Services (TCCS) in 2015 and was used in the original 2015 Calibre Flood Study. A thorough review of this data in 2015 revealed some missing information regarding pipe diameters, invert levels, and locations.

ACT Survey was engaged in 2015 to obtain the missing data. The stormwater network for 375mm diameter pipes or greater were added to the TUFLOW model within the TUFLOW Model Area in 2015. The extent of the minor network used in the 2015 Calibre Flood Study is displayed in Figure 5-2.

TCCS confirmed that there are no new stormwater infrastructure constructed within the model area since 2015. However, additional pits and pipes (smaller than 375mm diameter) sourced from ACT ProjectWise data were included in this 2020 study for Moyes Crescent and Hardwick Crescent.



Figure 5-2: Minor Stormwater Network

5.3 VISUAL FIELD INSPECTION

A visual inspection of the catchment was undertaken to confirm the geometry of key hydraulic structures and to gain an appreciation of the characteristics of the catchment. The dimensions of the three Underpasses located at Southern Cross

Drive, Flack Street and Starke Street were measured on site in 2015. Vegetation were inspected at several cross-sections along the overland flow paths, which influences the conveyance of runoff through the overland flow paths.



Figure 5-3 Heavily vegetated swale along Starke Street downstream of Starke Street Underpass



Figure 5-4 Trap low point at Starke Street Underpass



Figure 5-5 Grassed Swale upstream of Flack Steet Underpass



Figure 5-6: Flack Street Underpass

5.4 HISTORICAL FLOOD LEVEL DATA

A detailed review of all previous flood studies provided by EPSDD was undertaken in 2015. This is to ensure that this study is consistent with other flood studies carried out within the ACT. The *Ginninderra Creek Flooding and Dams Assessment* carried out by Jacobs in May 2015, has provided this flood study with a downstream boundary condition at the confluence with Ginninderra Creek. Calibre has been informed that no new flood studies relevant to the catchment were undertaken since 2015.

5.5 DESIGN RAINFALL DATA

The 1%, 10% and 20% AEP Rainfall Intensity Frequency Duration (IFD) Design Rainfall Depth data and ARR 2019 Temporal Patterns for the study area have been taken from BOM and ARR Data Hub.

6 XP – RAFTS HYDROLOGIC MODELLING

XP-RAFTS was used to simulate the upstream hydrologic component of this study. XP-RAFTS is a Laurensen non-linear runoff routing model used extensively throughout Australasia. XP-RAFTS has been an industry standard for modelling catchments ranging in size from a few square metres to thousands of square kilometres in both urban and rural nature and includes the ability to model attenuation basins. As part of this study, the XPRAFTS model used in 2015 has been updated with the current IFD Design Rainfall Depth data from BOM and ARR 2019 Temporal Patterns. The ARR 2019 methodology of running ensemble of storms was also used in the analysis of critical storms, which is discussed in Section 6.3.

6.1 CATCHMENT DELINIATION

Determining the catchment extents can be a slightly subjective process, particularly in urban areas where localised features such as kerbs and walls can result in different catchment extents than the natural ground topography would suggest. For this study, catchments (displayed in Figure 6-1) were delineated taking into consideration the following factors:

- Ground topography (using contours generated from aerial survey data);
- Arrangement of street kerb and pit/pipe systems; and
- Observations from a detailed site inspection

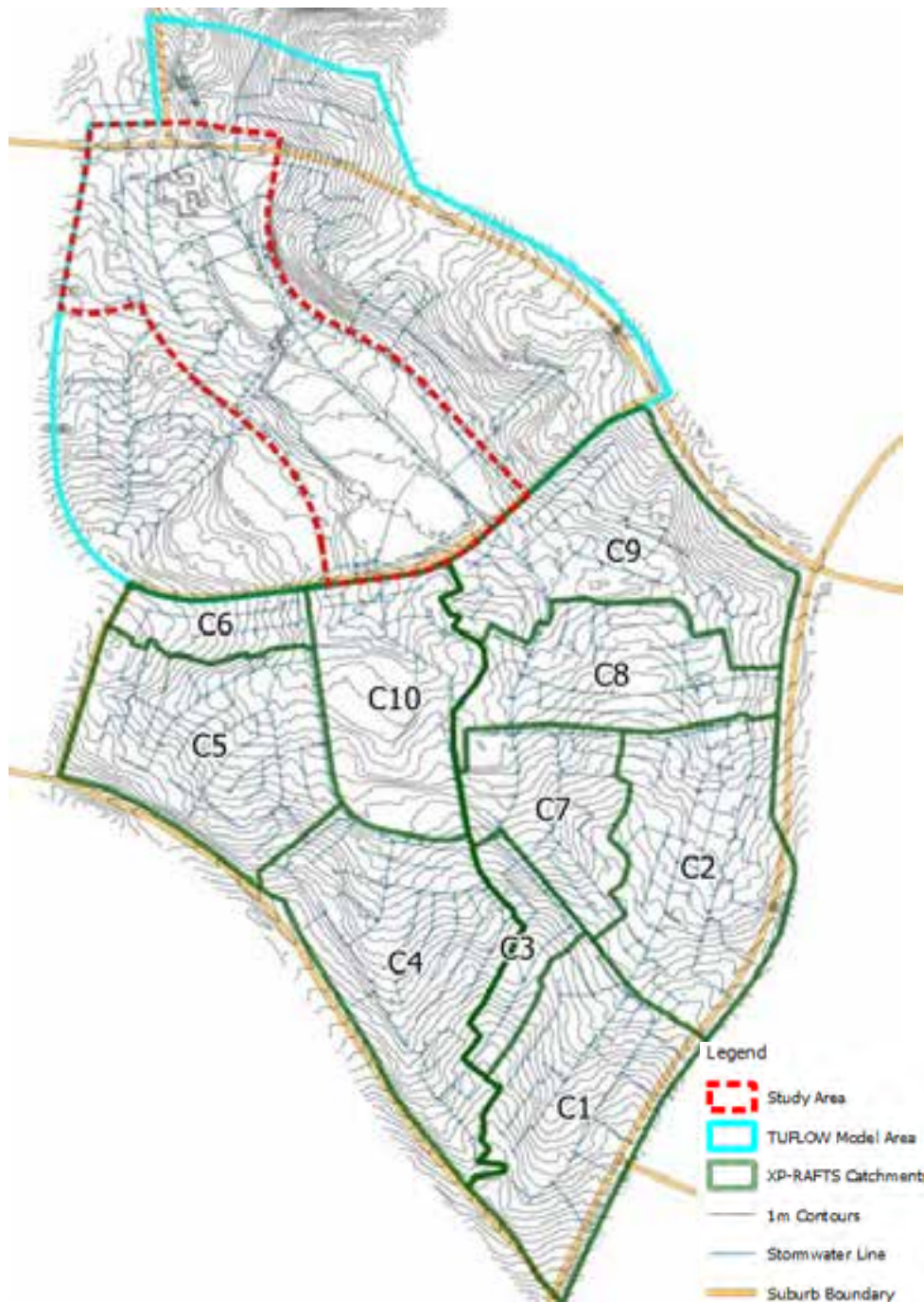


Figure 6-1: XP-RAFTS Catchment Areas

The XP-RAFTS catchment areas as shown in Figure 6-1 are summarised in Table 6.1.

Table 6.1: XP-RAFTS Catchment Areas

Catchment Number	Catchment Area
1	20.37
2	21.89
3	5.85
4	23.19
5	21.44
6	6.67
7	11.42
8	14.59
9	22.70
10	17.88

As stated in the 2015 flood study, stormwater collected from the upstream catchments enter the Kippax Group study area at the low points of Catchment 9 (total 90.97ha, contributing catchments 1, 2, 7, 8 and 9) and Catchment 10 (total 75.03ha, contributing catchments 3, 4, 5, 6 and 10) along Starke Street. These locations are displayed in Figure 6-2.



Figure 6-2 Locations of upstream Stormwater catchments entering the study area

6.2 MODEL PARAMETERS

The following model parameters have been used in developing the 2020 XP-RAFTS Model, building on the 2015 model parameters that were confirmed applicable according to current standards:

- 60% imperviousness has been taken for residential areas. This is in accordance with ACT Municipal Infrastructure Standards (MIS) 08 and the *Ginninderra Creek Flooding and Dams Assessment* Report prepared by Jacobs in May 2015.
- Impervious surface roughness value (n) of 0.015.
- Pervious surface roughness value (n) of 0.040.
- Rainfall losses have been determined using the Australian Representative Basins Model (ARBM) for ACT's MIS 08.
- BOM Rainfall IFD Data and ARR 2019 Temporal Pattern Data
- Lag times between nodes have been determined from an estimated velocity of 2m/s.
- Two major flow paths at XP-Rafts Catchments 9 and 10 were found to enter the TUFLOW model area along Starke Street. These entering points were taken as the upstream hydraulic control points for the TUFLOW Model.

6.3 DESIGN EVENT MODELLING

Hydrologic modelling in accordance with ARR 2019, which identifies the critical storm as the median temporal pattern that generates the maximum flow across all storm durations, have been undertaken for the 20% AEP, 10% AEP and 1% AEP events using XP-RAFTS. Several storm durations ranging from 10 minutes to 9 hours were considered. It was found that the critical storm duration varies as a result of running ten different temporal patterns for each storm duration considered. Peak flow values generated by the critical storms are displayed in Table 6.2.

Table 6.2: Peak Flow Values from XP-RAFTS entering the TUFLOW Model Area

AEP	Catchment Area 9 Peak Flow (m ³ /s)	Catchment Area 10 Peak Flow (m ³ /s)
20% AEP	9.40	9.95
10% AEP	11.51	12.03
1% AEP	18.26	19.49

The hydrographs generated for Catchment Area 9 and 10 are applied to TUFLOW as upstream flow boundary conditions.

6.4 ALLOWANCE FOR CLIMATE CHANGE

ARR 2019 discusses the guidelines on projecting climate change through the use of Representative Concentration Pathways (RCP), which describes the trajectory of greenhouse gas and aerosol concentrations. ARR 2019 states that the expected change for heavy rainfalls including the 1% AEP storm ranges from 2% to 15% per degree Celsius of warming and that a minimum RCP of 4.5, where concentration levels peak at year 2070 then declines, is recommended to be used as basis in predicting climate change effects.

The IPCC Fifth Assessment Report projects that it is possible to have a 1.4 degree Celsius rise in global temperatures which corresponds to a 20% increase in 1% AEP rainfall intensities if an RCP of 4.5 is assumed. Adopting this information, Calibre applied a 20% increase to the hydrographs at Catchment Area 9 and 10 as well as to the rainfall intensities within the study area, which were used as TUFLOW modelling inputs in simulating the climate change effects to flooding.

7 TUFLOW 1D/2D HYDRAULIC MODEL

TUFLOW is a one and two-dimensional flood and tide simulation software package that simulates the complex hydrodynamics of floods and tides using the full one-dimensional St Venant equations and the full two-dimensional free-surface shallow water equations. TUFLOW is the most widely used flood modelling software in Australia.

7.1 MODEL COVERAGE

The TUFLOW Model extent for this flood study is shown in Figure 7-1. The model boundary was established upstream of the Kippax Group Study Area to ensure that flow paths were accurately modelled at the boundaries of the study area.



Figure 7-1: TUFLOW Model Extent

7.2 MODEL COORDINATES

Due to the TUFLOW program not being able to read in the ACT Grid projection, the MGA Zone 55, AHD 94 projection was used for this study.

7.3 GRID SIZE

A grid size of 1m x 1m has been chosen for the TUFLOW modelling area to obtain the highest level of accuracy. The newer version of TUFLOW, TUFLOW HPC was used for the project as it is able to solve finer resolution models at shorter run times compared to TUFLOW Classic.

7.4 BUILDING FOOTPRINTS

Building footprints were modelled in accordance with the Australian Rainfall and Runoff's (AR&R) *Project 15: Two-Dimensional Modelling in Urban and Rural Floodplains* report. It recommends that all large buildings should be nulled, leaving a void in the model. This approach was adopted in this study with TUFLOW directing all surface runoff around the void areas to better simulate the depth and velocity of flood waters around buildings within the TUFLOW model area.

7.5 STRUCTURES AND BLOCKAGE FACTORS

Structures within the TUFLOW modelling area were modelled as one dimensional (1D). Structures modelled in 1D include underpasses and pipes within the TUFLOW modelling area. The structures were modelled by using the nested ESTRY model function in TUFLOW which allows the user to model small scale drainage elements within the floodplain such as underpasses, culverts and channels (Figure 7-2). Invert levels were determined by inspecting the LiDAR DEM with widths of structures either measured on site or obtained from the additional survey data.

The extent of the 1D pit and pipe network used in this study are shown in Figure 5-2.

A blockage factor of 0.5 was adopted for the minor stormwater network, and a blockage factor of 0.2 was adopted for all major culverts (including underpasses).

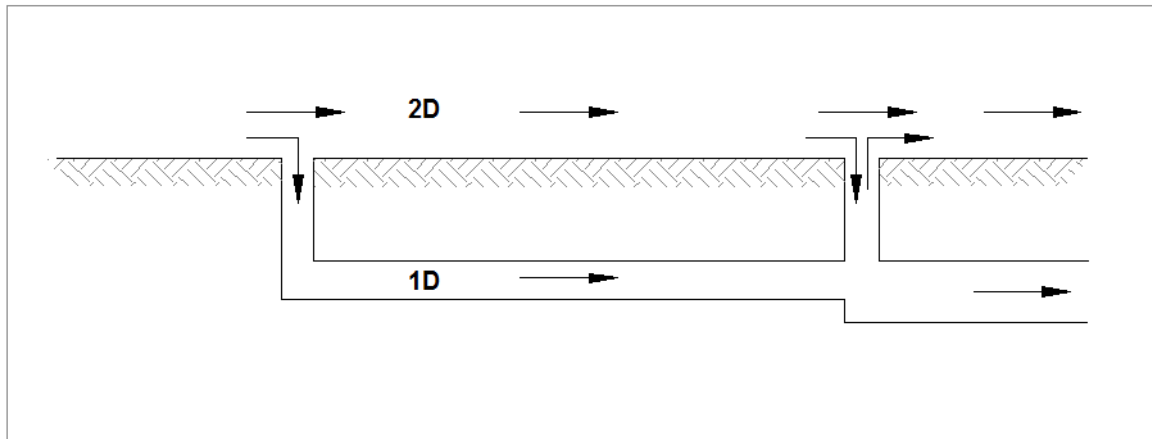


Figure 7-2: Modelling a Pipe System in 1D underneath a 2D Domain (Source: TUFLOW)

7.6 MODEL ROUGHNESS

For the materials data set, the following manning's 'n' values were used:

- $n = 0.1$ for low to medium density residential areas
- $n = 0.03$ for road pavements
- $n = 0.035$ for grassed areas

The grassed and residential roughness values have been adopted in accordance with values used in the *AR&R Project 15: Two-Dimensional Modelling in Urban and Rural Floodplains* report.

Large buildings along Kippax Fair have been completely removed from the grid. This ensures all overland flows are diverted around the large buildings.

7.7 BOUNDARY CONDITIONS

7.7.1 UPSTREAM CONDITION

Upstream hydraulic control points have been determined in delineating catchments for the XP-RAFTS Model. Two control points are located along Starke Street (Catchments 9 and 10 as shown in Figure 6-2). The flow rates at these locations have been obtained from XP-RAFTS at 1 minute intervals and entered as an upstream boundary condition in TUFLOW.

7.7.2 DOWNSTREAM CONDITION

For the downstream hydraulic control point the confluence with Ginninderra Creek was used. The Jacobs Report – *Ginninderra Creek Flooding and Dam Assessment* determined that the 1% AEP flood level at this point is 550.51m AHD.

7.7.3 DIRECT RAINFALL

The direct rainfall method, or rainfall-on-the-grid, was used for the TUFLOW modelling area. BOM's Rainfall hyetographs (rainfall intensities) of the ten temporal patterns for each AEP and duration have been taken as input for this method. The critical storm duration for the study area has been identified to be the 25 minute storm for the 20%, 10% and 1% AEP storm events. Rainfall hyetographs used in the rainfall-on-the-grid modelling are summarised in the tables below.

Table 7.1 Rainfall hyetographs for 1% AEP 25 minute storm

Time (hour)	TP01	TP02	TP03	TP04	TP05	TP06	TP07	TP08	TP09	TP10
0	0	0	0	0	0	0	0	0	0	0
0.083333	6.624233	5.167046	13.9644	9.885727	7.003897	8.692497	6.143325	4.801845	6.418129	6.736324
0.166667	8.215205	9.91827	7.087061	9.133631	12.81818	3.453134	11.34291	11.29229	3.887036	2.303295
0.25	7.260622	9.296344	4.078676	6.797793	7.228079	7.376329	6.617001	8.537016	6.414513	4.451108
0.333333	5.908295	7.437798	4.50173	2.621489	5.138119	10.82946	5.673265	4.169072	9.914654	13.51604
0.416667	8.15012	4.339017	6.526605	7.719834	3.970201	5.807051	6.381971	7.35825	9.524142	9.15171
0.5	0	0	0	0	0	0	0	0	0	0

Table 7.2 Rainfall hyetographs for 10% AEP 25 minute storm

Time (hour)	TP01	TP02	TP03	TP04	TP05	TP06	TP07	TP08	TP09	TP10
0	0	0	0	0	0	0	0	0	0	0
0.083333	3.730828	5.383756	6.146826	6.679801	4.538508	3.310552	4.585467	3.540647	7.553224	2.892624
0.166667	3.949183	6.442663	7.879583	5.156008	4.259107	5.005742	2.934886	7.013205	1.359439	2.894972
0.25	5.484716	3.355162	4.726341	4.646512	5.188879	7.203385	7.70349	5.113746	2.401911	5.146617
0.333333	7.461655	4.414069	2.678964	3.484297	4.968176	5.341493	5.503499	2.528698	5.811075	8.684916
0.416667	2.85271	3.883442	2.047377	3.512472	4.524421	2.617919	2.751749	5.282796	6.353442	3.859963
0.5	0	0	0	0	0	0	0	0	0	0

Table 7.3 Rainfall hyetographs for 20% AEP 25 minute storm

Time (hour)	TP01	TP02	TP03	TP04	TP05	TP06	TP07	TP08	TP09	TP10
0	0	0	0	0	0	0	0	0	0	0
0.083333	5.848116	7.570466	4.730065	3.991915	3.302975	2.889611	4.83439	1.812896	3.214397	2.793159
0.166667	4.092303	3.460447	5.539077	1.42709	5.045009	6.041019	2.974252	5.210354	2.923074	3.310849
0.25	2.533331	0.458637	3.688781	4.564719	3.017557	4.720223	3.373837	4.426931	2.86599	2.895516
0.333333	1.948716	4.523383	3.680908	5.420973	4.930842	3.696655	5.385542	2.85418	5.596161	8.155081
0.416667	5.261533	3.671066	2.045167	4.279301	3.387616	2.336491	3.115977	5.379637	5.084377	2.529394
0.5	0	0	0	0	0	0	0	0	0	0

7.8 SIMULATION TIMES

All TUFLOW models have been run for 1.5 hours. This simulation time for the TUFLOW modelling area is considered appropriate and allows suitable propagation of surface water flow paths for each of the models.

8 RESULTS

8.1 GENERAL

This flood study confirms the findings of the 2015 Kippax Group Centre flood study that a significant amount of flow from the upstream Higgins catchment enters the Kippax Group Centre study area at two concentrated locations along Starke Street. These flows are then conveyed via the underground pipe network and overland flow paths through the Kippax Group Centre study area to the detention basin and GPT located north of Southern Cross Drive (Figure 8-1), from where it discharges into Ginninderra Creek.

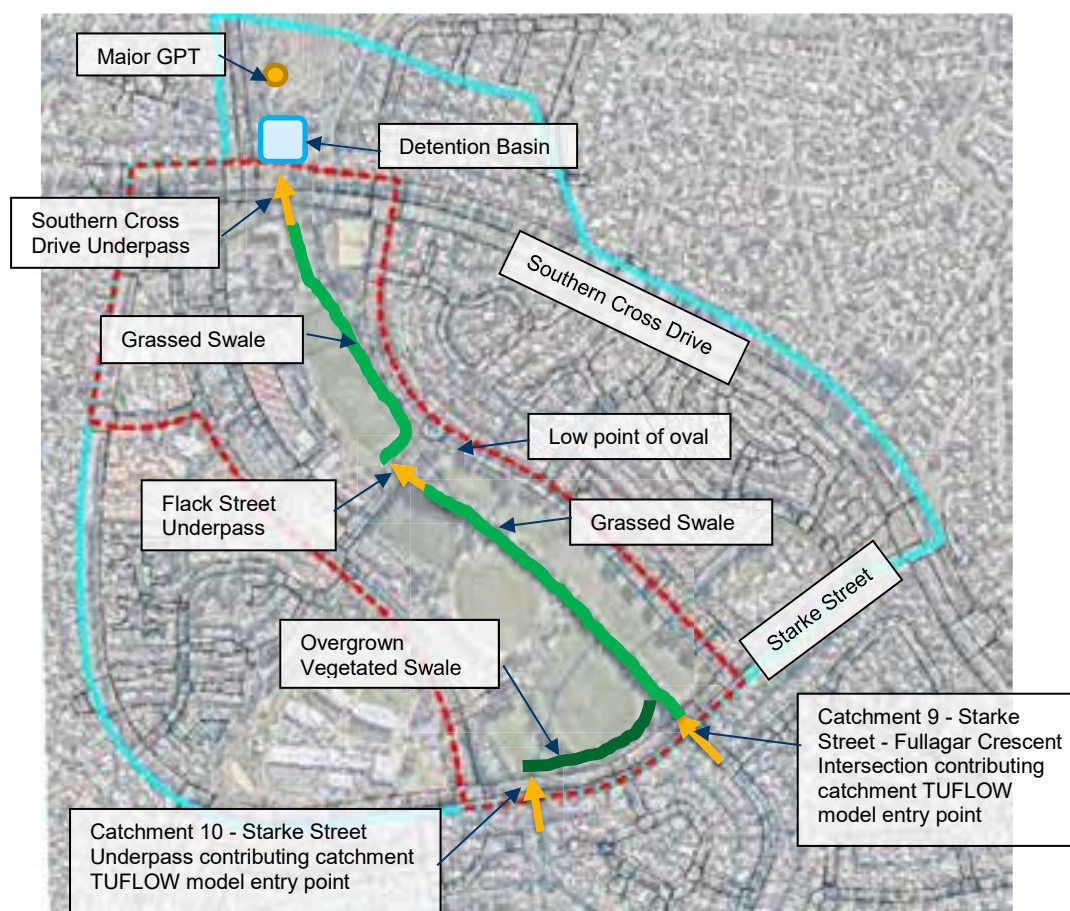


Figure 8-1 Major Stormwater Infrastructure

8.2 FLOOD MAPS

Flood maps for the 20%, 10% and 1% AEP events and the 20% increase due to climate change (with blockage) are within **Appendix A**.

Flood maps for the 20%, 10% and 1% AEP events with blockage and mitigation works are within **Appendix B**.

8.3 MINOR STORMWATER NETWORK RESULTS

8.3.1 HARDWICK CRESCENT

Minor flooding exists along Hardwick Crescent for all storm events studied. Figure 8-2, Figure 8-3 and Figure 8-4 show the extent of flooding along Hardwick Crescent for the 20%, 10% and 1% AEP events respectively.



Figure 8-2 Peak flood extents along Hardwick Crescent during a 20% AEP 25 minute storm event



Figure 8-3 Peak flood extents along Hardwick Crescent during a 10% AEP 25 minute storm event



Figure 8-4 Peak flood extents along Hardwick Crescent during a 1% AEP 25 minute storm event

8.3.2 URBAN OPEN SPACE

The minor stormwater network that conveys stormwater flows from the upstream Higgins catchment through the urban open space areas is running at full capacity during the 1% AEP event. Table 8.1 shows the flow through the pipe network for each storm event at critical points within the Kippax Group Centre study area.

Table 8.1 Minor stormwater network flow rates (playing fields)

Storm Event	Pipe Flows at Locations (m ³ /s)				
	Starke Street Underpass (1x1200mm diameter)	Starke Street – Fullagar Crescent intersection (1x1350mm diameter)	Flack Street Underpass (1x1800mm diameter)	Southern Cross Drive Underpass (2x1650mm diameter)	Southern Cross Drive Detention Basin Outlet (2x1200mm diameter)
20% AEP 25 minute storm event	3.05	1.62	5.77	7.35	12.84
10% AEP 25 minute storm event	3.31	1.64	5.86	7.76	13.72
1% AEP 25 minute storm event	3.94	1.66	6.04	8.50	14.42

8.4 MAJOR STORMWATER NETWORK RESULTS

8.4.1 STARKE STREET UNDERPASS

Overland flow entering the Kippax Group Centre study area from Catchment 10 through the Starke Street Underpass is conveyed through a heavily vegetated channel. This vegetation obstructs the flow of the water causing stormwater to overtop the channel and into the oval located on the urban open space downstream of the Starke Street Underpass (Figure 8-5).



Figure 8-5: Peak flood levels of upstream and downstream of Starke Street Underpass during a 1% AEP 25 minute storm event

8.4.2 FLACK STREET UNDERPASS

The flow conveyance capacity of the underpass located on Flack Street is currently limited by the capacity of the upstream overland flow path. Currently water overtops the upstream grassed swale and flows to the north eastern corner of the playing fields. The current flow rate through the Underpass in a 1% AEP event is only 5.73m³/s. The Underpass currently does not convey the entire flow and flood waters are inundating the intersection of Flack St and Moyes Crescent and re-entering the reserve approximately 55m north of the intersection. This is causing localised flooding approximately 550mm deep in the middle of the south bound lane of Moyes Crescent opposite the Flack Street centreline. The maximum flow velocity at the Flack Street and Moyes Crescent intersection is approximately 2.5m/s. Therefore, if this intersection is flooded it will pose a significant risk to pedestrians and motorists. See Figure 8-6 for the extent of flooding at this intersection.



Figure 8-6: Peak flood levels at Flack Street during a 1% AEP 25 minute storm event

8.4.3 SOUTHERN CROSS DRIVE UNDERPASS

The underpass located on Southern Cross Drive will be inundated in a 1% AEP event. In this event the maximum flow rate modelled through the underpass is approximately 30.32m³/s. The afflux is controlled by the capacity of the underpass to convey flows. Widening of this underpass has been investigated as one of the proposed mitigation options and is discussed in Section 10.3. The flood extent in this area is shown in Figure 8-7 and Figure 8-8.

Also shown in Figure 8-7 and Figure 8-8 that a retardation downstream is located downstream of the Southern Cross Drive Underpass. Following the recommendation of the 2015 flood study, lowering of the retardation basin's downstream embankment height to allow more flows to pass during a 1% AEP storm has been investigated but the results show that modifications on the retardation basin have very little effect to the flooding upstream of Southern Cross Drive Underpass. This shows that the hydraulic capacity of the underpass controls the flooding observed in the area.



Figure 8-7: Peak flood levels at Southern Cross Drive during a 1% AEP 25 minute storm event



Figure 8-8: Flooding extent around buildings near Southern Cross Drive during a 1% AEP 25 minute storm event

8.4.4 HARDWICK CRESCENT

Flooding to a depth of 375mm is occurring on the north eastern part of Hardwick Crescent during a 1% AEP event as shown in Figure 8-7. This is to be expected given that Hardwick Crescent is the major overland flow path for the catchment west of the Kippax Shopping Centre.

9 SENSITIVITY ANALYSIS

A number of runs were undertaken to assess the sensitivity of the TUFLOW model, as outlined in the following sections. Maps showing the results from the sensitivity simulations are included in **Appendix A** and **Appendix B**.

9.1.1 HYDRAULICS

TUFLOW was run for the 1% AEP event and climate change event with the following blockage factors applied to hydraulic structures within the model:

- Underpass = 20% Blockage
- Large culvert = 20% Blockage
- Pit inlet = 50% Blockage

The blockage factors were adopted in accordance with AR&R Project 11: Blockage of Hydraulic Structures. This document recommends a blockage factor of 20% for kerb inlets. However, a more conservative blockage factor of 50% has been adopted in accordance with TCCS MIS 08 Stormwater for the pit inlets.

9.1.2 HYDROLOGY

A 20% increase in rainfall intensity was simulated for the 1% AEP event with the above blockage factors applied. The 20% increase is in line with values suggested by ARR 2019.

9.2 RESULTS

9.2.1 ALLOWANCE FOR BLOCKAGE

A blockage scenario has been run for the 1% AEP event with the blockage factors outlined in Section 9.1.1. Applying these blockage factors results to minimal increase in the 1% AEP flooding depth at the main flooding points (Starke Street Underpass, Flack Street Underpass, Hardwick Crescent and Southern Cross Drive Underpass) by approximately 0.05m.

9.2.2 ALLOWANCE FOR CLIMATE CHANGE

It was found that the 1% AEP flood levels with blockage increase by a maximum of 250mm due to the 20% climate change increase in rainfall intensities. The extent of the 1% AEP flooding due to a 20% increase in rainfall intensity with blockages is shown in Figure 9-1.

Allowance for climate change should be considered as part of future development on the urban open space areas within the Kippax Group Centre study area if the development is to be located adjacent to the major overland flow paths.



Figure 9-1: Peak flood levels with 20% increase to 1% AEP 25 minute storm event due to climate change

10 RECOMMENDATIONS

10.1 MANAGEMENT

This flood study confirms the findings of the 2015 Kippax flood study that there are currently existing flooding problems within the Kippax Group Centre study area, and directly adjacent areas. These flooding issues need to be addressed with or without the expansion of the Kippax Fair proceeding. These works recommended, or a portion of them, could be included within any significant development proposal for the area. Possible mitigation options are outlined in Section 10.3.

10.2 PLANNING

10.2.1 DEVELOPMENT OPPORTUNITIES WITHOUT MITIGATION

The carpark areas located along the eastern side of Hardwick Crescent between Flack Street and Southern Cross Drive currently provide development opportunities. The car park areas experience zero to minor flooding during the storm events studied.

10.2.2 DEVELOPMENT CONSTRAINTS WITHOUT MITIGATION

The Urban Open Space areas within the Kippax Group Centre study area currently provide limited development opportunities due to the uncontrolled flooding experienced throughout these areas during the 1% AEP flood event.

10.2.3 DEVELOPMENT OPPORTUNITIES WITH MITIGATION

Implementing the mitigation options as discussed in this report will provide a more controlled flood extent on the Urban Open Space areas within the Kippax Group Centre study area, which will increase development opportunities within this area. Such as the ovals north of the Starke Street and Flack Street Underpasses.

10.3 FLOOD MITIGATION

The flood mitigation options provided in the 2015 flood study were assessed using the updated TUFLOW model. It was found that the 2015 recommendation of channel works and regrading of the overland flow paths, constructing a levee on the intersection of Flack Street and Moyes Crescent are still applicable. The updated TUFLOW model has found that doubling the width of Southern Cross Drive Underpass provides significant flood reduction and is recommended in this report. The recommended mitigation options to alleviate existing flooding problems within and adjacent to the Kippax Group Centre study area are summarised below. We note that these mitigation options will be required with or without the expansion of the Kippax Fair proceeding. Refer to Figure 10-1 and Figure 10-2 for recommended mitigation options.

- Regrade the trap low point at the Starke Street Underpass;
- Clear out and regrade the overgrown vegetated swale from the Starke Street Underpass, running parallel with Starke Street;
- Construct a levee with an inlet into the existing stormwater network on the corner of Flack Street and Moyes Crescent;
- Regrade the existing grassed swale downstream of the Flack Street Underpass; and.
- Double the width of Southern Cross Drive Underpass to increase the hydraulic capacity.

Priority should be given to all of the flood mitigation works as the flood study results indicate that without implementing all of the above options existing blocks have the potential of flooding during a 1% AEP storm event.

Allowance for climate change should be considered as a part of the detailed design of the mitigation options to ensure flood immunity to blocks due to climate change.



Figure 10-1 Mitigation Option – Channel regrading, and levee at Flack Street and Moyes Crescent Intersection



Figure 10-2 Mitigation Option – Clearing and regrading channel along Starke Street

10.4 FLOOD MITIGATION RESULTS

The TUFLOW model was re-run to include the mitigation options proposed in the preceding section. Terrain modifications such as the regraded overland flow paths and levee were prepared in 12d and read into TUFLOW as additional DEMs over the existing LiDAR data. This ensures a high level of detail for the resulting flood levels obtained, which can be used to inform the detailed design of the mitigation options discussed in this report and to inform building floor levels for future development within the Kippax Group Centre study area.

Results confirm the findings of the 2015 flood study that regrading the open space overland flow paths and constructing the proposed levee resolves the breakout flows observed in the overland flow paths, and at the intersection of Flack Street and Moyes Crescent. The deepest observed flooding along Moyes Crescent was reduced to 250mm and it was noted from the flood maps that no properties are flooded along Moyes Crescent. More stormwater is conveyed towards the Flack Street Underpass and the overland flow is contained within the improved channel throughout the urban open space area. The proposed levee has been modelled as an earth embankment with 1:4 batters and aligned to avoid the existing toilet/changing rooms located on the northeast corner of the open space. However, details of the levee can be further refined during the detailed design stage of the project.



Figure 10-3 Mitigated 1% AEP flooding with 50% blockage



Figure 10-4 Fifty-metre block setback from Moyes Crescent and 1% AEP flooding extents

Doubling the width of Southern Cross Drive Underpass to increase its existing hydraulic capacity reduces the afflux by 800mm, ensuring the nearby residential development is not flooded during the 1% AEP storm. Following the recommendation of the 2015 flood study, the impact to flooding of the retardation basin located downstream of Southern Cross Drive was also investigated. It was concluded from the models that lowering the embankment height or increasing the outlet capacity of the retardation basin has no effect to the existing flooding observed upstream of Southern Cross Drive, which proves that the flooding is controlled by the capacity of Southern Cross Drive Underpass. It was also confirmed from Icon Water that a 1500mm diameter trunk sewer runs underneath the embankment of the retardation basin, which will render any major modification to the embankment not feasible.

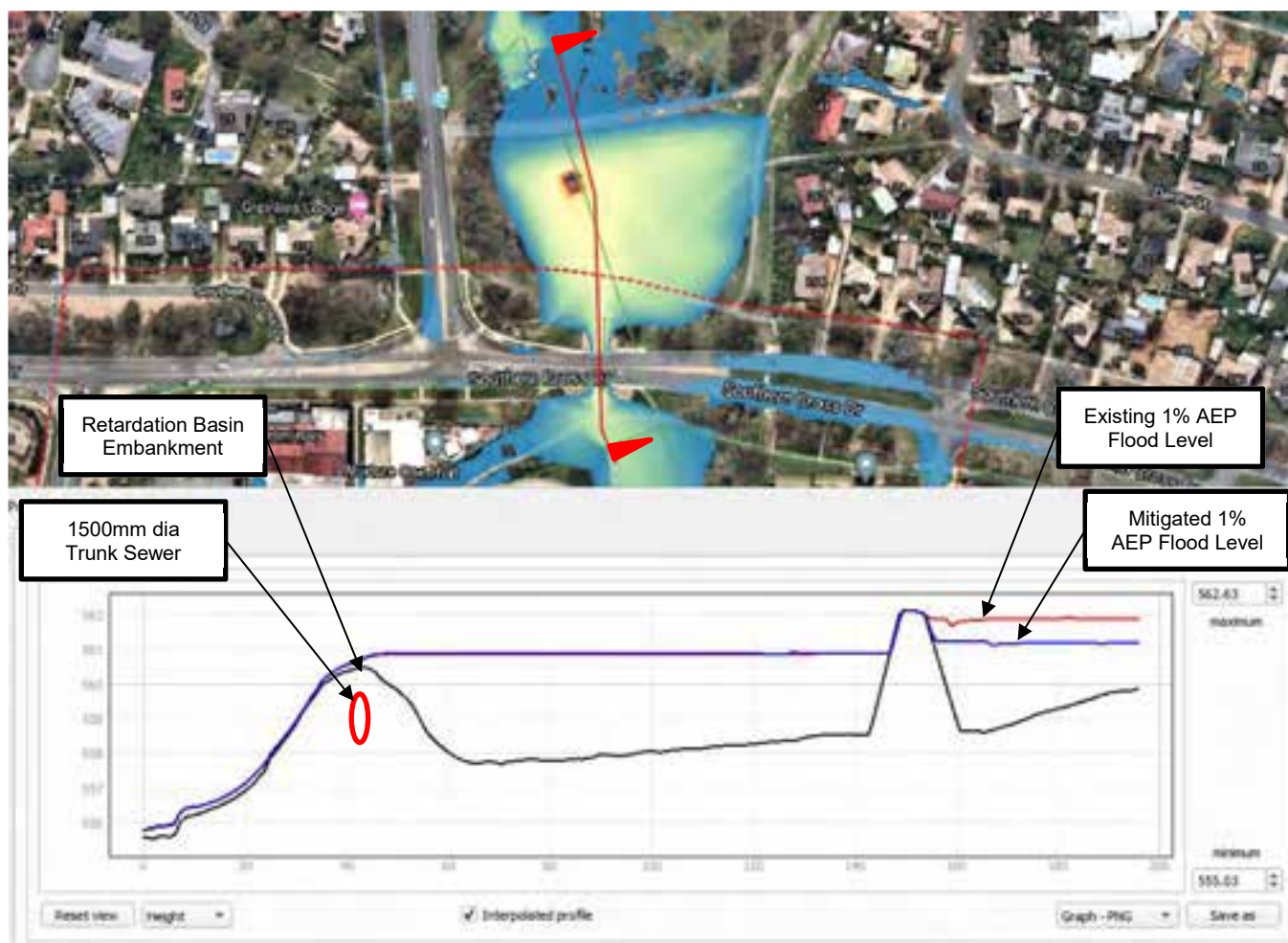


Figure 10-5 Afflux reduction resulting from widening of Southern Cross Drive Underpass

Development Application plans for the existing residential development (Block 50 & 51, Section 51, Holt ACT) located on the upstream side of Southern Cross Drive has been provided to Calibre by EPSDD. The plans show that the design floor level of the eastern block that is adjacent to the Kippax Group Centre overland flow path is 562.30m. The existing 1% AEP flood level in that location was noted to be at approximately 562.0m, which is reduced to 561.20m as a result of widening the Southern Cross Drive Underpass. This ensures that the existing development is protected from flood level increase resulting from climate change.

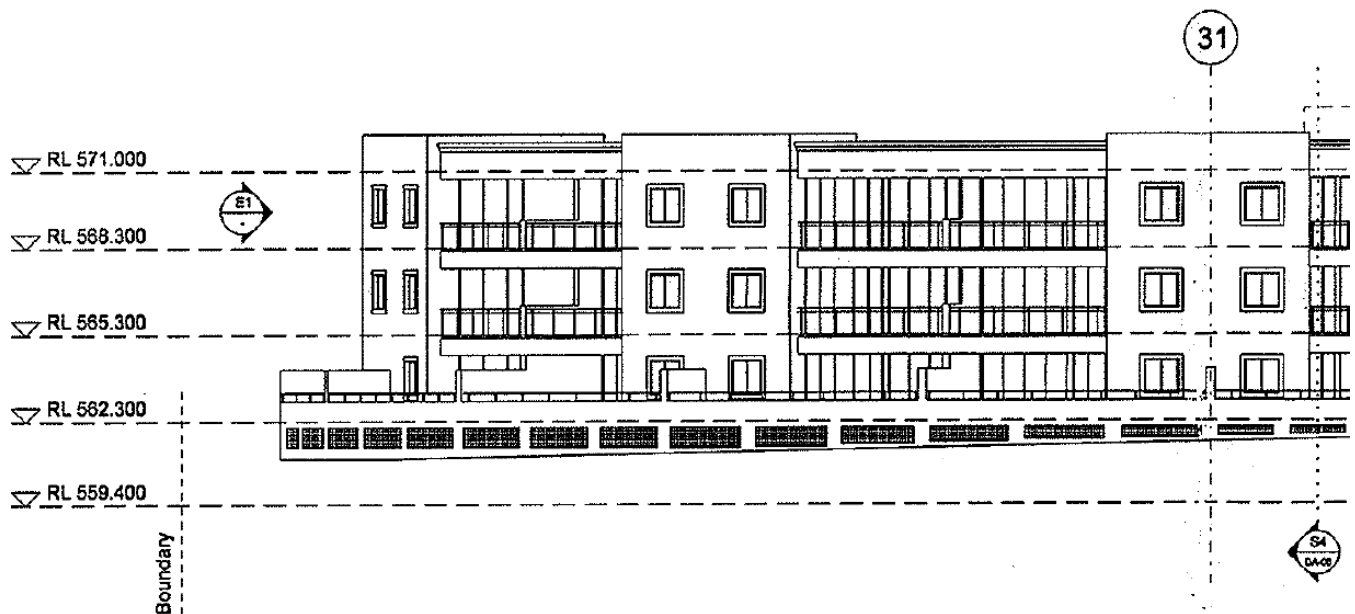


Figure 10-6 Eastern block floor levels for Block 50 & 51, Section 51, Holt ACT

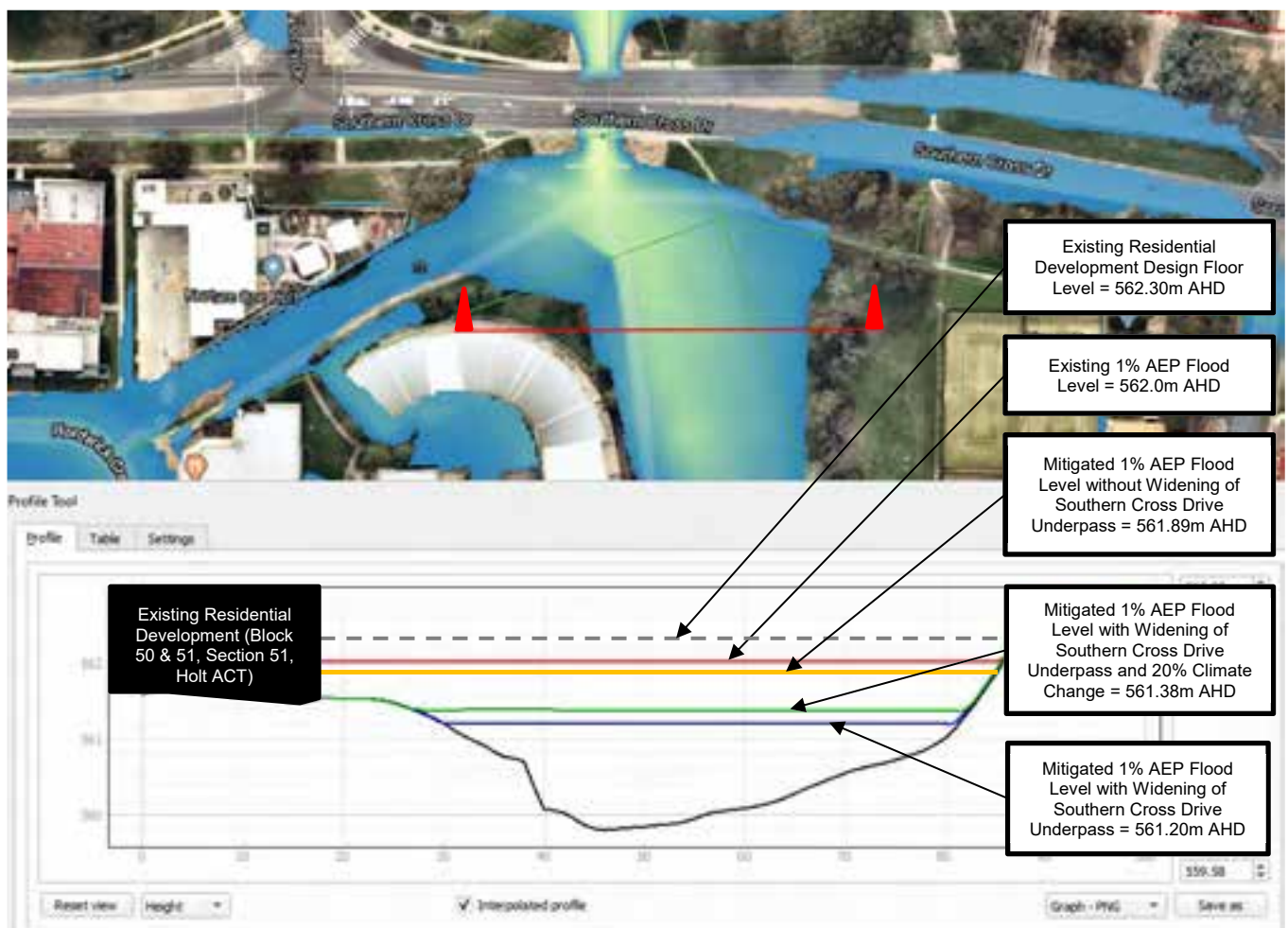


Figure 10-7 Flood depths adjacent the existing residential development

Flood maps of the mitigation options with consideration for 50% blockage factors and climate change are shown in Appendix B.

11 OPINION OF COSTS

A summary of the opinion of costs for the flood mitigation options within the study area are presented in sections below.

The costs provided exclude the additional project costs associated with:

- Procurement;
- Insurance;
- Obtaining Approvals;
- Environmental Assessments;
- Consultation; and
- Preparation of the Capital Works Documentation, etc.

11.1 OVERLAND FLOW PATH BETWEEN STARKE STREET AND FLACK STREET

The construction cost in Table 11.1 includes the following:

- Clearing of overgrown vegetation
- Regrading of the overland flow path including removal of trap low point downstream of Starke Street
- Improving the overland flow path cross section
- Landscape works for the overland flow path

The consultancy cost in Table 11.2 includes the cost associated with the design, documentation and construction phase services to deliver the proposed overland flow path between Starke Street and Flack Street.

Table 11.1 Construction Cost of Overland Flow Path between Starke Street and Flack Street

No.	Description	Amount (GST Inclusive)
0	Preliminaries	\$43,100
1	Provision For Traffic	\$5,000
2	Earthworks	\$104,444
9	Landscape	\$37,125
	SUB-TOTAL	\$189,669
	CONTINGENCY @ 30%	\$56,901
	TOTAL	\$246,569

Table 11.2 Consultancy Cost of Overland Flow Path between Starke Street and Flack Street

No.	Description	Amount (GST Inclusive)
1	Design/Documentation Cost	\$22,000
2	Construction Phase Services	\$8,000

11.2 OVERLAND FLOW PATH BETWEEN FLACK STREET AND SOUTHERN CROSS DRIVE

The construction cost in Table 11.3 includes the following:

- Construction of levee downstream of Flack Street Underpass
- Regrading of the overland flow path downstream of Flack Street Underpass to Southern Cross Drive Underpass
- Improving the overland flow path cross section
- Landscape works for the overland flow path

The consultancy cost in Table 11.4 includes the cost associated with the design, documentation and construction phase services to deliver the proposed overland flow path between Flack Street and Southern Cross Drive.

Table 11.3 Construction Cost of Overland Flow Path between Flack Street and Southern Cross Drive

No.	Description	Amount (GST Inclusive)
0	Preliminaries	\$43,100
1	Provision For Traffic	\$5,000
2	Earthworks	\$55,270
9	Landscape	\$27,000
	SUB-TOTAL	\$128,570
	CONTINGENCY @ 30%	\$38,571
	TOTAL	\$167,141

Table 11.4 Consultancy Cost of Overland Flow Path between Flack Street and Southern Cross Drive

No.	Description	Amount (GST Inclusive)
1	Design/Documentation Cost	\$16,000
2	Construction Phase Services	\$6,000

11.3 LEVEE AT THE INTERSECTION OF FLACK STREET AND MOYES CRESCENT

The construction cost in Table 11.5 includes the following:

- Construction of levee on the intersection of Flack Street and Moyes Crescent with inlet to the existing stormwater network
- Landscape works for the playing fields

The consultancy cost in Table 11.6 includes the cost associated with the design, documentation and construction phase services to deliver the proposed levee at the intersection of Flack Street and Moyes Crescent.

Table 11.5 Construction Cost of Levee at the Intersection of Flack Street and Moyes Crescent

No.	Description	Amount (GST Inclusive)
0	Preliminaries	\$36,900
1	Provision For Traffic	\$5,000
2	Earthworks	\$87,510
3	Underground Services	\$45,446
9	Landscape	\$74,740
	SUB-TOTAL	\$249,596

No.	Description	Amount (GST Inclusive)
	CONTINGENCY @ 30%	\$74,879
	TOTAL	\$324,474

Table 11.6 Consultancy Cost of Levee at the Intersection of Flack Street and Moyes Crescent

No.	Description	Amount (GST Inclusive)
1	Design/Documentation Cost	\$25,000
2	Construction Phase Services	\$10,000

11.4 WIDENING OF SOUTHERN CROSS DRIVE UNDERPASS

The construction cost in Table 11.7 includes the following:

- Doubling the width of the existing Southern Cross Drive Underpass
- Removal and reinstating of footpaths
- Roadworks for Southern Cross Drive
- Landscape works for the floodway

The consultancy cost in Table 11.8 includes the cost associated with the design, documentation and construction phase services to deliver the proposed widening of Southern Cross Drive Underpass.

Table 11.7 Construction Cost of Widening of Southern Cross Drive Underpass

No.	Description	Amount (GST Inclusive)
0	Preliminaries	\$178,508
1	Provision For Traffic	\$22,000
2	Earthworks	\$151,910
4	Flexible Pavement Construction	\$17,509
6	Concrete Kerbs, Footpaths and Minor Works	\$27,168
7	Road Furniture	\$2,191
8	Incidental Works	\$154,000
9	Landscape	\$5,500
11	Pavement Marking	\$22,000
15	Major Concrete Works	\$384,615
	SUB-TOTAL	\$965,402
	CONTINGENCY @ 30%	\$289,621
	TOTAL	\$1,255,023

Table 11.8 Consultancy Cost of Widening of Southern Cross Drive Underpass

No.	Description	Amount (GST Inclusive)
1	Design/Documentation Cost	\$110,000
2	Construction Phase Services	\$40,000

12 RISKS

The following have been identified as possible risks during the project lifetime, which need to be considered and managed in order to avoid possible project delays and cost blow outs.

12.1 DURING DETAIL DESIGN

- Integration of the widened underpass with Southern Cross Drive.
- Integration of the proposed levee with Flack Street and Moyes Crescent.
- Integration of regraded overland flow path with the existing footpath parallel to Starke Street.
- Agreement of design aspects and coordination between stakeholders.

12.2 DURING CONSTRUCTION

- Management of erosion control during construction in an overland flow path.
- Possible unknown existing services within the brownfield environment that may clash with design elements, which may cause time delays and unforeseen increase in construction costs.
- Existing decommissioned services may have remained in the ground and may need to be removed as part of regrading the overland flow paths.
- Lost time and costs due to above average rainfall.
- Public interruption in the urban open space areas that are used as playing fields.

12.3 MAINTENANCE AND PUBLIC ACCESS

- Maintenance and monitoring for signs of erosion if the levee on the intersection of Flack Street and Moyes Crescent is constructed as an earth levee.
- Public access to the playing fields over the levee should be considered in the detailed design. It is recommended that appropriate flood warning signage be included as part of the detailed design to warn the public that they are approaching a floodway.

13 MATTERS TO BE FURTHER CONSIDERED

The following need to be considered at the next stage of design:

- Detailed survey and potholing of existing services and site constraints.
- Refining the proposed levee design.

14 CONCLUSION

This revised flood study confirms the findings of Calibre's 2015 Kippax Group Centre flood study that the existing overland flow paths within the Kippax Group Centre study area do not have sufficient capacity to fully convey the 1% AEP flood event.

There are a number of hydraulic constraints within the existing condition of the study area that are inhibiting the flow of stormwater from the upstream Higgins catchment through the Kippax Group Centre study area. These include:

- a trap low point at the Starke Street Underpass;
- an overgrown vegetated swale directly downstream of the Starke Street Underpass;
- a grassed swale directly upstream of the Flack Street Underpass with very limited hydraulic capacity; and
- an underpass underneath Southern Cross Drive that limits the conveyance of stormwater during the 1% AEP storm.

The 2015 flood study previously concluded that improving the overland flow paths and constructing a levee on the corner of Flack Street and Moyes Crescent resolves the breakout flows within the urban open space areas. This was confirmed in this study by re-running the TUFLOW models with updated LiDAR and rainfall data. The proposed levee has been modelled as an earth embankment with 1:4 batters and aligned to avoid the existing toilet/changing rooms located on the

northeast corner of the open space. Details of the levee can be further refined during the detailed design stage of the project to ensure improved connectivity with the existing site constraints.

The retardation basin located downstream of Southern Cross Drive, which was identified in the 2015 flood study as a source of flooding issue was further investigated in this revised flood study. It was found that modifications to the retardation basin have very little effect on the flooding upstream of Southern Cross Drive Underpass. This revised flood study concluded that the flooding immediately upstream of Southern Cross Drive is controlled by the hydraulic capacity of the underpass. Therefore, this study recommends widening the capacity of the Southern Cross Drive Underpass to allow more flows through the underpass during a 1% AEP storm. Furthermore, it was also confirmed from Icon Water that a 1500mm diameter trunk sewer runs through the embankment of the retardation basin, which will render any major modification to the embankment not feasible.

The recommended high-level mitigation options to alleviate existing 1% AEP flooding problems within and adjacent to the Kippax Group Centre study area are summarised below. We note that these mitigation options will be required with or without the expansion of the Kippax Fair proceeding. Refer to Figure 10-1 and Figure 10-2 for recommended mitigation options.

- Regrade the trap low point at the Starke Street Underpass;
- Clear out and regrade the overgrown vegetated swale from the Starke Street Underpass, running parallel with Starke Street;
- Construct a levee with an inlet into the existing stormwater network on the corner of Flack Street and Moyes Crescent;
- Regrade the existing grassed swale downstream of the Flack Street Underpass; and
- Double the width of Southern Cross Drive Underpass to increase the hydraulic capacity.

Priority should be given to all of the flood mitigation works as the flood study results indicate that without implementing all of the above options existing blocks have the potential of flooding during a 1% AEP storm event. While flooding issues were identified in the existing condition of the study area, further development of the Kippax Group Centre may exacerbate these existing flooding issues and introduce more people into the proximity of flooding risks if the recommended mitigation measures are not undertaken.

TUFLOW results show that the eastern block of the existing residential development (Block 50 & 51, Section 51, Holt ACT) located on the upstream side of Southern Cross Drive and adjacent to the floodway has 300mm freeboard during a 1% AEP storm. Widening of the Southern Cross Drive Underpass results in an 800mm flood reduction in this area that ensures the existing development is protected from flood level increase resulting from climate change.

Climate change effects have been included in this study as additional modelling scenarios. Allowance for climate change should be considered as part of the detailed design of the mitigation measures to ensure flood immunity to blocks due to climate change.

APPENDIX A

20%, 10% and 1% AEP Events Flood Maps without Mitigation

Climate Change Flood Maps with Blockage



Legend

Flood Depths

- 0.1 - 1.5
- 1.5 - 3
- 3 - 4.5
- 4.5 - 6
- > 6

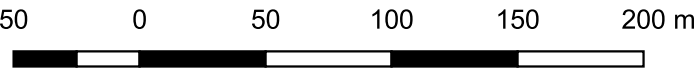
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- Study Area
- TUFLOW_Model_Extent
- SW Sumps
- SW Pipes

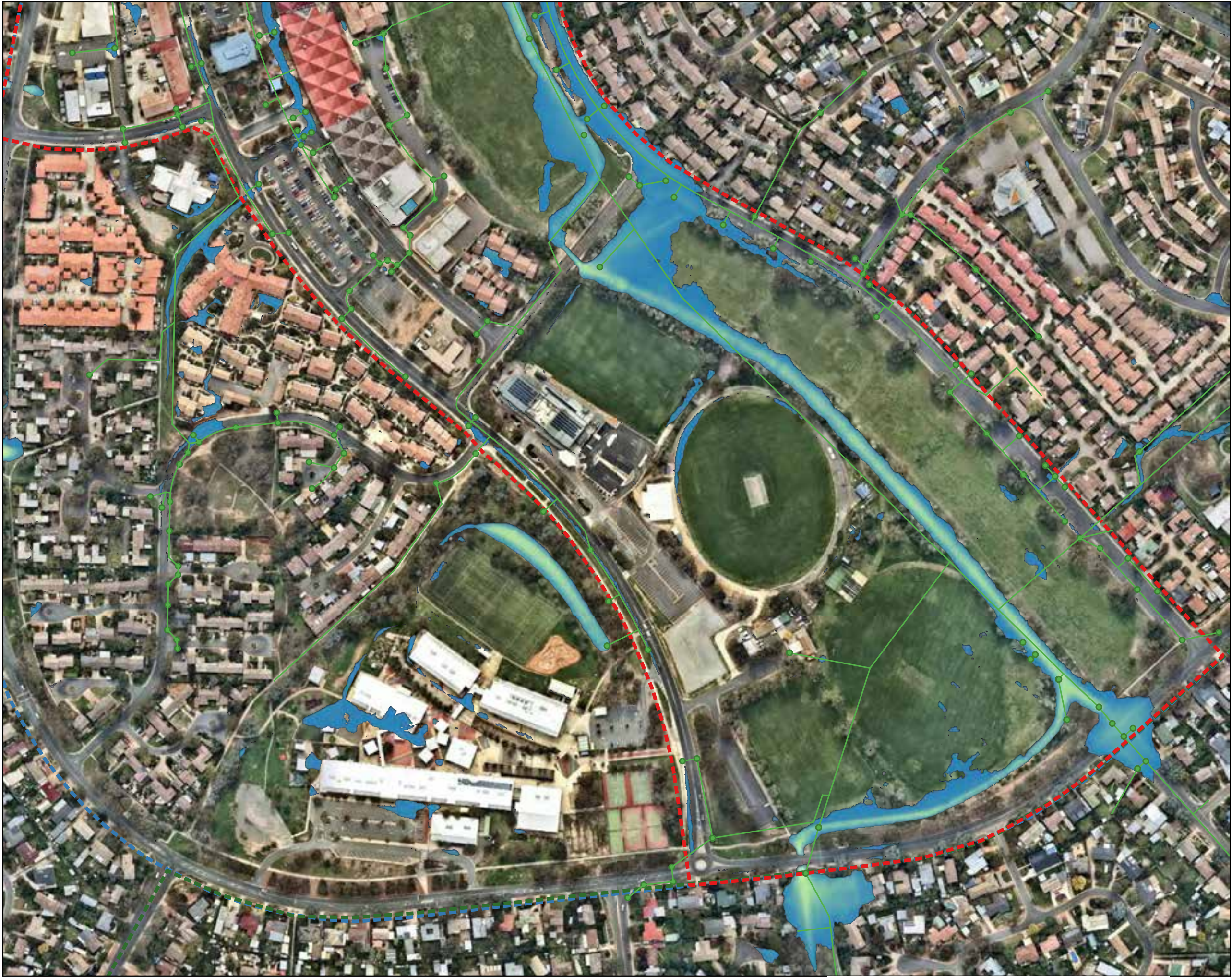
Rev	Amendment	Date
A	Draft	08/05/2020
B	Final	15/07/2020

Project:
**Kippax Group Centre Flood Study
2020 Update**

Drawing Title:
**1% AEP without Blockage. Existing
Condition**

Scale	1:3000 @A3
Drawn	NL
Checked	APL
Job No.	20-000198
Figure	E1 1%AEP 1
Issue	B





Legend

Flood Depths

- 0.1 - 1.5
- 1.5 - 3
- 3 - 4.5
- 4.5 - 6
- > 6

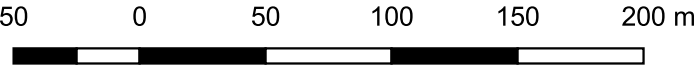
- Catchment Upstream
- Study Area
- TUFLOW_Model_Extent
- SW Sumps
- SW Pipes

Rev	Amendment	Date
A	Draft	08/05/2020
B	Final	15/07/2020

Project:
**Kippax Group Centre Flood Study
2020 Update**

Drawing Title:
**1% AEP without Blockage. Existing
Condition**

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Drawn	NL
Checked	APL
Job No.	20-000198
Figure	E1 1%AEP 2
Issue	B





Legend

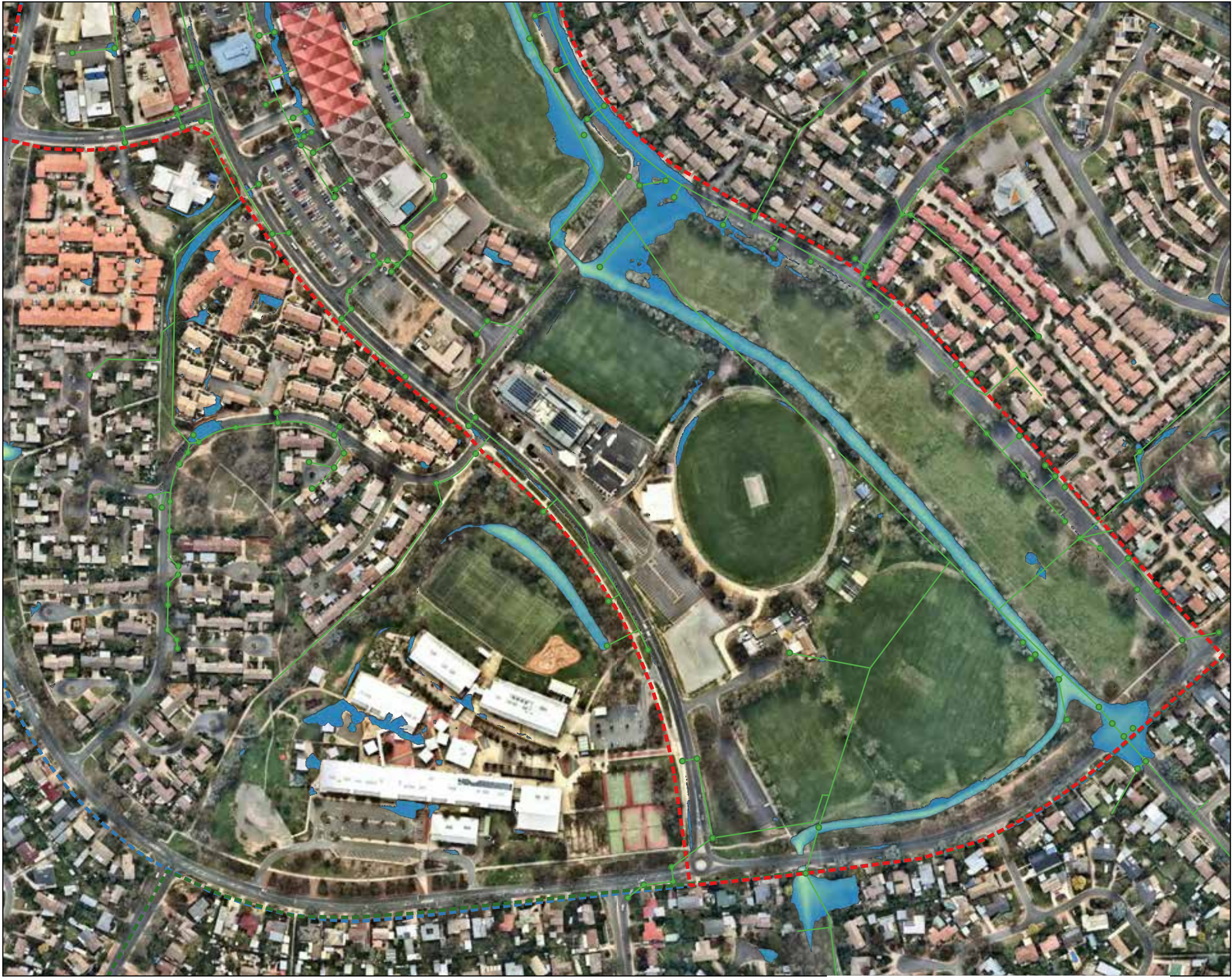
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- 0.1 - 1.5
 - 1.5 - 3
 - 3 - 4.5
 - 4.5 - 6
 - > 6
- Catchment Upstream
- Study Area
- TUFLOW_Model_Extent
- SW Sumps
- SW Pipes

Rev	Amendment	Date
A	Draft	08/05/2020
B	Final	15/07/2020

Project:
**Kippax Group Centre Flood Study
2020 Update**

Drawing Title:
**10% AEP without Blockage. Existing
Condition**

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Drawn	NL
Checked	APL
Job No.	20-000198
Figure	E1 10%AEP 1
Issue	B



Legend

Flood Depths

- 0.1 - 1.5
- 1.5 - 3
- 3 - 4.5
- 4.5 - 6
- > 6

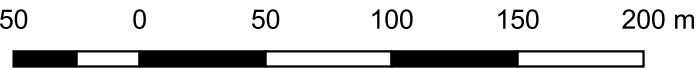
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- Study Area
- TUFLOW_Model_Extent
- SW Sumps
- SW Pipes

Rev	Amendment	Date
A	Draft	08/05/2020
B	Final	15/07/2020

Project:
**Kippax Group Centre Flood Study
2020 Update**

Drawing Title:
**10% AEP without Blockage. Existing
Condition**

Scale	1:3000 @A3
Drawn	NL
Checked	APL
Job No.	20-000198
Figure	E1 10%AEP 2
Issue	B





Legend

Flood Depths

- 0.1 - 1.5
- 1.5 - 3
- 3 - 4.5
- 4.5 - 6
- > 6

Catchment Upstream

Study Area

TUFLOW_Model_Extent

SW Sumps

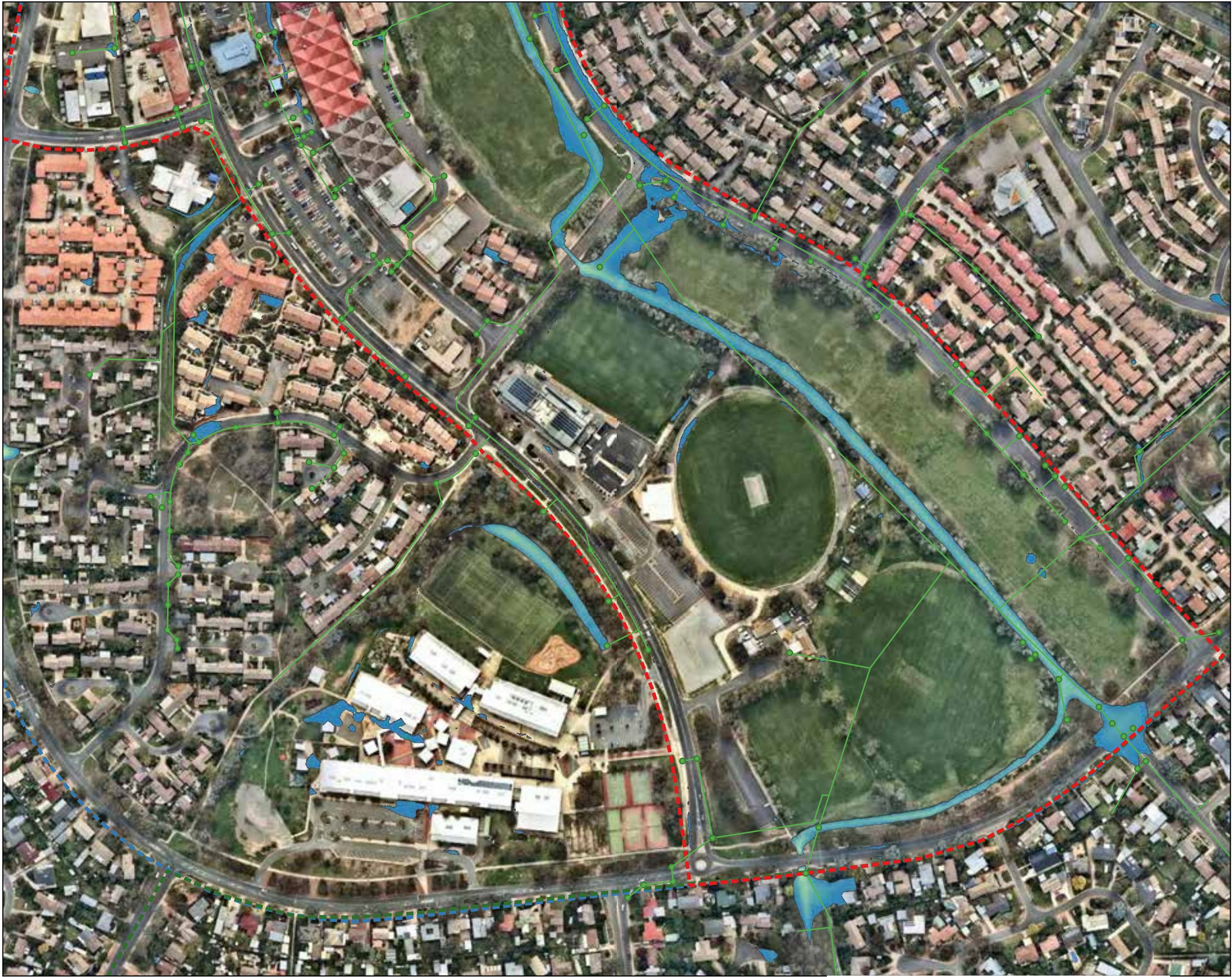
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Rev	Amendment	Date
A	Draft	08/05/2020
B	Final	15/07/2020

Project:
**Kippax Group Centre Flood Study
2020 Update**

Drawing Title:
**20% AEP without Blockage. Existing
Condition**

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Drawn	NL
Checked	APL
Job No.	20-000198
Figure	E1 20%AEP 1
Issue	B



Legend

Flood Depths

- 0.1 - 1.5
- 1.5 - 3
- 3 - 4.5
- 4.5 - 6
- > 6

- Catchment Upstream
- Study Area
- TUFLOW_Model_Extent
- SW Sumps
- SW Pipes

Rev	Amendment	Date
A	Draft	08/05/2020
B	Final	15/07/2020

Project:
**Kippax Group Centre Flood Study
2020 Update**

Drawing Title:
**20% AEP without Blockage. Existing
Condition**

Scale	1:3000 @A3
Drawn	NL
Checked	APL
Job No.	20-000198
Figure	E1 20%AEP 2
Issue	B



Legend

Flood Depths

- 0.1 - 1.5
- 1.5 - 3
- 3 - 4.5
- 4.5 - 6
- > 6

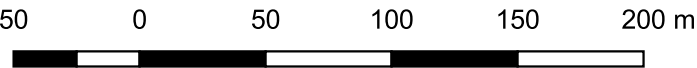
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- Study Area
- TUFLOW_Model_Extent
- SW Sumps
- SW Pipes

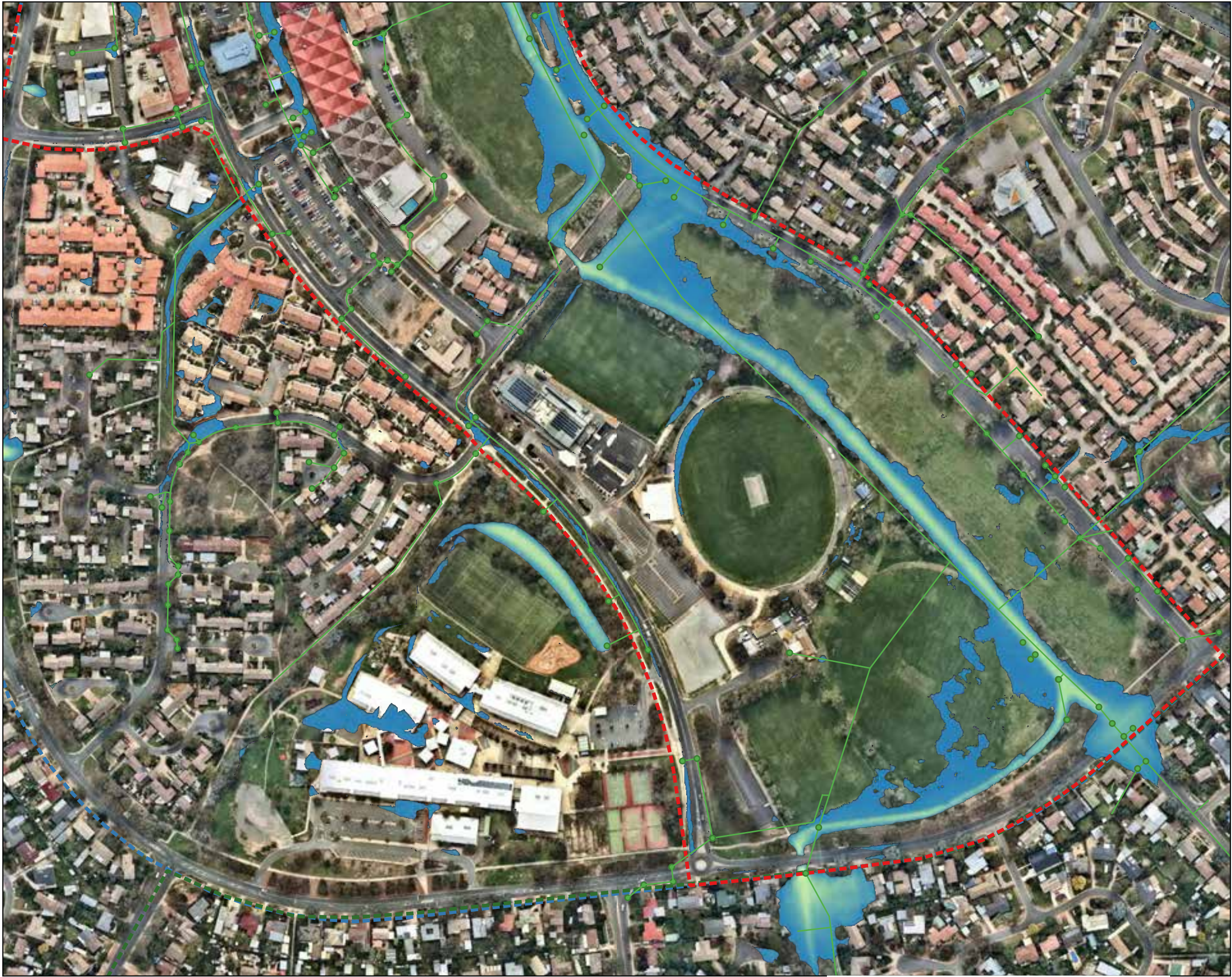
Rev	Amendment	Date
A	Draft	08/05/2020
B	Final	15/07/2020

Project:
**Kippax Group Centre Flood Study
2020 Update**

Drawing Title:
**1% AEP without Blockage. Existing
Condition with 20% Climate Change**

Scale	1:3000 @A3
Drawn	NL
Checked	APL
Job No.	20-000198
Figure	E2 1%AEP 1
Issue	B





Legend

Flood Depths

- 0.1 - 1.5
- 1.5 - 3
- 3 - 4.5
- 4.5 - 6
- > 6

- Catchment Upstream
- Study Area
- TUFLOW_Model_Extent
- SW Sumps
- SW Pipes

Rev	Amendment	Date
A	Draft	08/05/2020
B	Final	15/07/2020

Project:
**Kippax Group Centre Flood Study
2020 Update**

Drawing Title:
**1% AEP without Blockage. Existing
Condition with 20% Climate Change**

Scale	1:3000 @A3
Drawn	NL
Checked	APL
Job No.	20-000198
Figure	E2 1%AEP 2
Issue	B



Legend

Flood Depths

- 0.1 - 1.5
- 1.5 - 3
- 3 - 4.5
- 4.5 - 6
- > 6

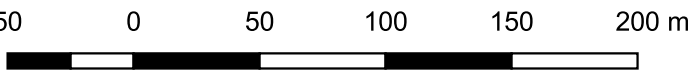
- Catchment Upstream
- Study Area
- TUFLOW_Model_Extent
- SW Sumps
- SW Pipes

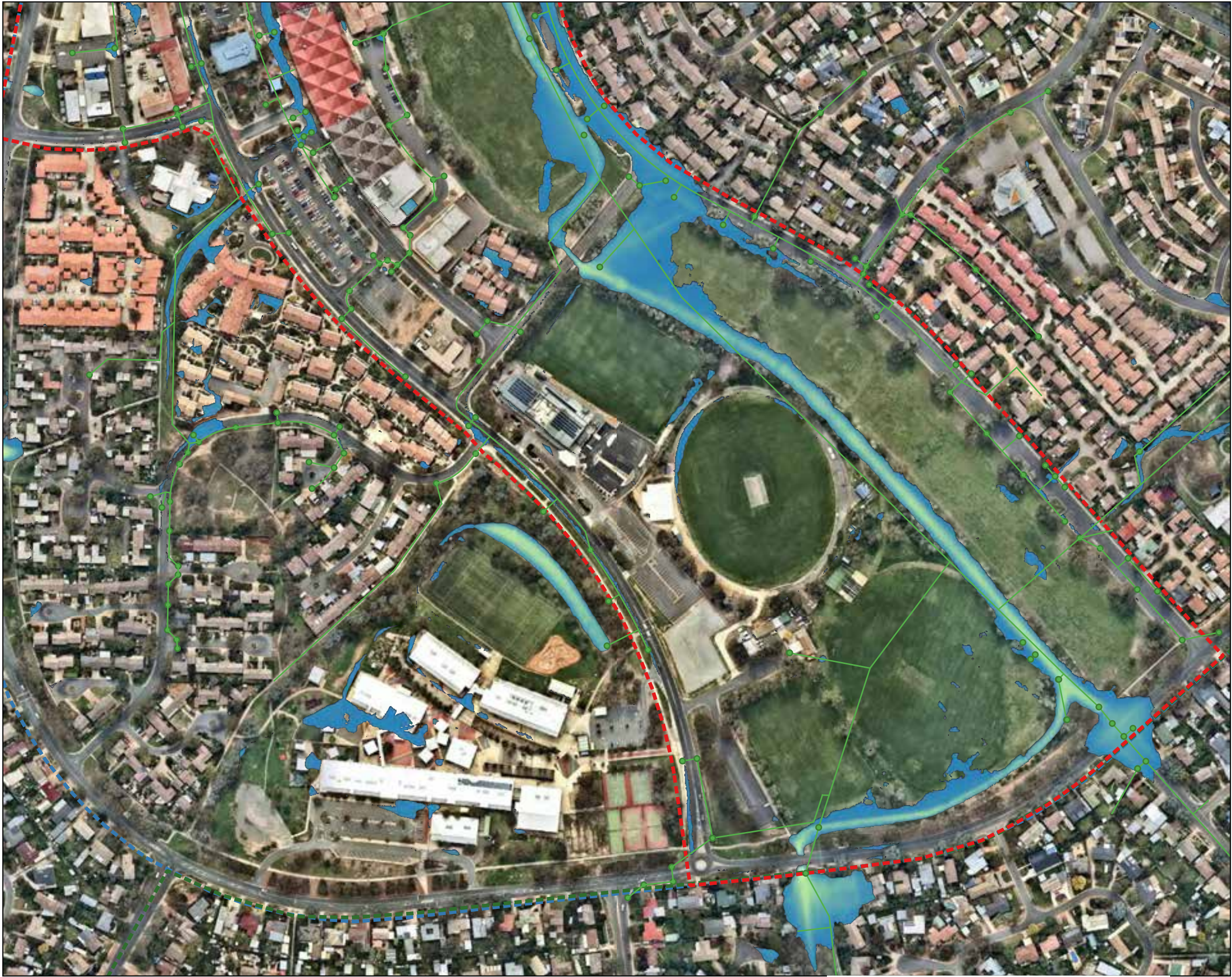
Rev	Amendment	Date
A	Draft	08/05/2020
B	Final	15/07/2020

Project:
**Kippax Group Centre Flood Study
2020 Update**

Drawing Title:
**1% AEP with 50% Blockage. Existing
Condition**

Scale	1:3000 @A3
Drawn	NL
Checked	APL
Job No.	20-000198
Figure	E3 1%AEP 1
Issue	B





Legend

Flood Depths

- 0.1 - 1.5
- 1.5 - 3
- 3 - 4.5
- 4.5 - 6
- > 6

- Catchment Upstream
- Study Area
- TUFLOW_Model_Extent
- SW Sumps
- SW Pipes

Rev	Amendment	Date
A	Draft	08/05/2020
B	Final	15/07/2020

Project:
**Kippax Group Centre Flood Study
2020 Update**

Drawing Title:
**1% AEP with 50% Blockage. Existing
Condition**

Scale	1:3000 @A3
Drawn	NL
Checked	APL
Job No.	20-000198
Figure	E3 1%AEP 2
Issue	B



Legend

Flood Depths

- 0.1 - 1.5
- 1.5 - 3
- 3 - 4.5
- 4.5 - 6
- > 6

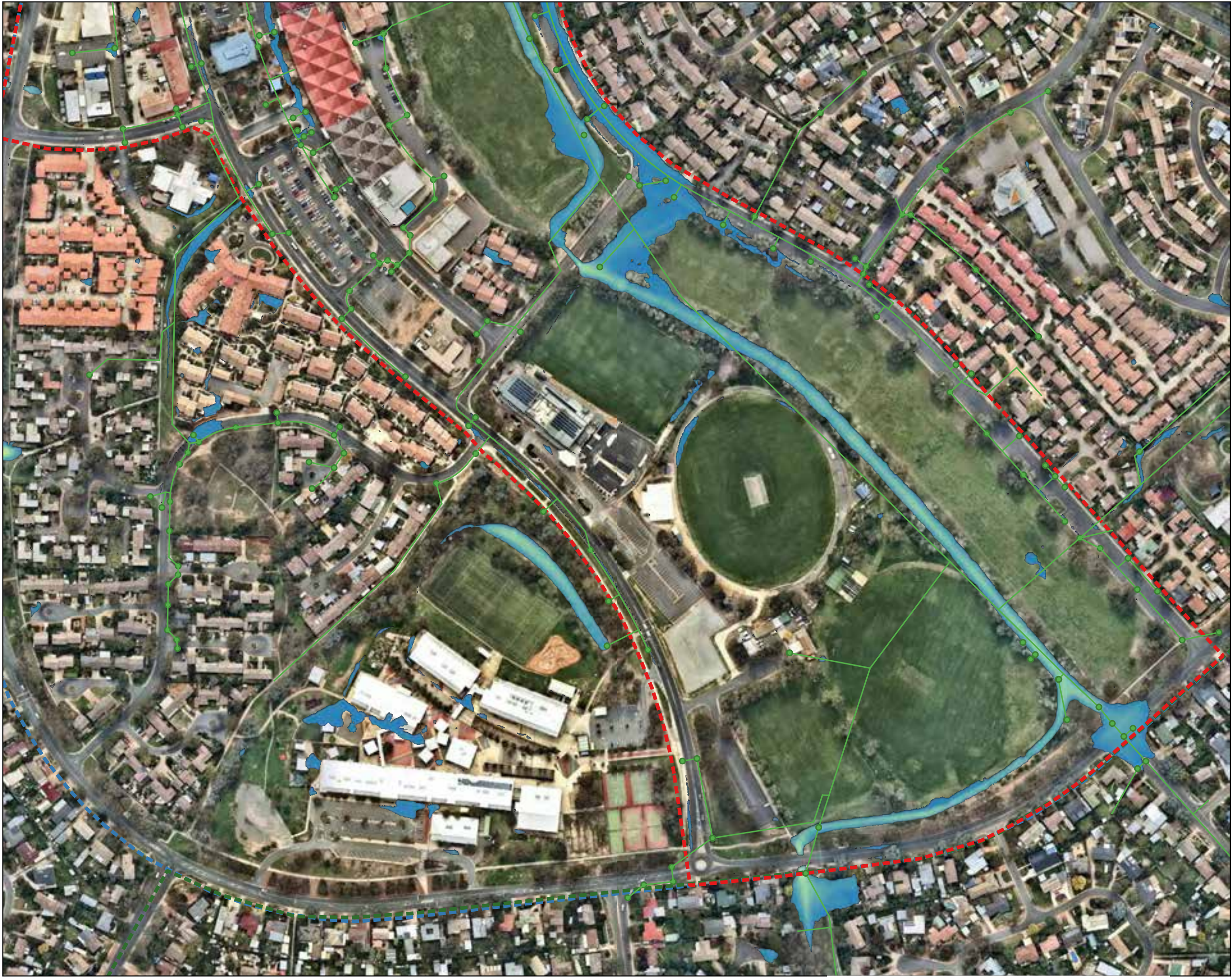
- Catchment Upstream
- Study Area
- TUFLOW_Model_Extent
- SW Sumps
- SW Pipes

Rev	Amendment	Date
A	Draft	08/05/2020
B	Final	15/07/2020

Project:
**Kippax Group Centre Flood Study
2020 Update**

Drawing Title:
**10% AEP with 50% Blockage. Existing
Condition**

Scale	1:3000 @A3
Drawn	NL
Checked	APL
Job No.	20-000198
Figure	E3 10%AEP 1
Issue	B



Legend

- Flood Depths
- 0.1 - 1.5
 - 1.5 - 3
 - 3 - 4.5
 - 4.5 - 6
 - > 6
- Catchment Upstream
- Study Area
- TUFLOW_Model_Extent
- SW Sumps
- SW Pipes

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**Kippax Group Centre Flood Study
2020 Update**

Drawing Title:
**10% AEP with 50% Blockage. Existing
Condition**

Scale	1:3000 @A3
Drawn	NL
Checked	APL
Job No.	20-000198
Figure	E3 10%AEP 2
Issue	B



Legend

Flood Depths

- 0.1 - 1.5
- 1.5 - 3
- 3 - 4.5
- 4.5 - 6
- > 6

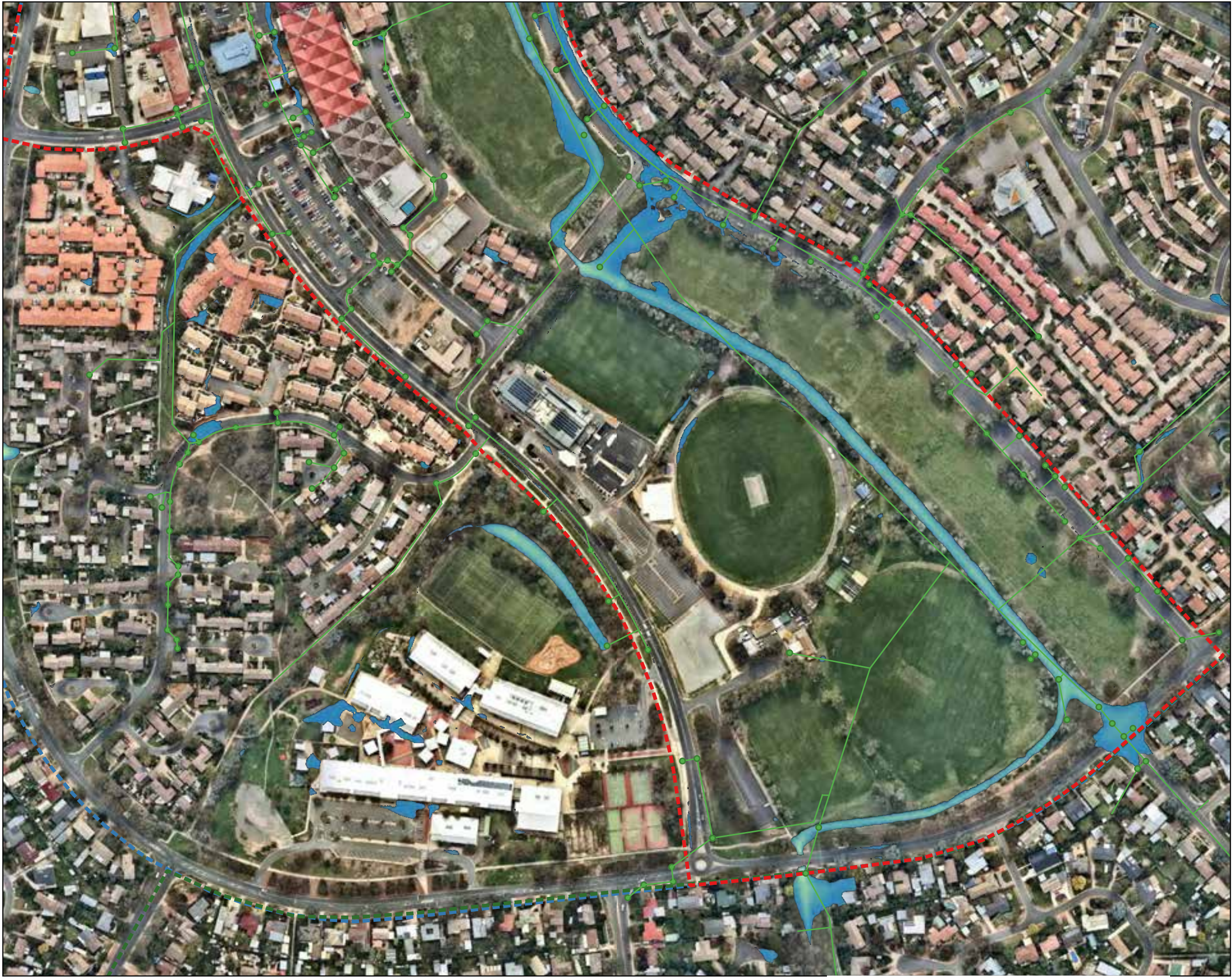
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- Study Area
- TUFLOW_Model_Extent
- SW Sumps
- SW Pipes

Rev	Amendment	Date
A	Draft	08/05/2020
B	Final	15/07/2020

Project:
**Kippax Group Centre Flood Study
2020 Update**

Drawing Title:
**20% AEP with 50% Blockage. Existing
Condition**

Scale	1:3000 @A3
Drawn	NL
Checked	APL
Job No.	20-000198
Figure	E3 20%AEP 1
Issue	B



Legend

Flood Depths

- 0.1 - 1.5
- 1.5 - 3
- 3 - 4.5
- 4.5 - 6
- > 6

- Catchment Upstream
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Drawn	NL
Checked	APL
Job No.	20-000198
Figure	E3 20%AEP 2
Issue	B



Legend

Flood Depths

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- 3 - 4.5
- 4.5 - 6
- > 6

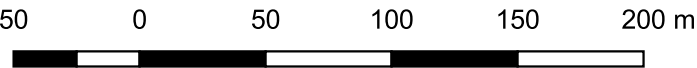
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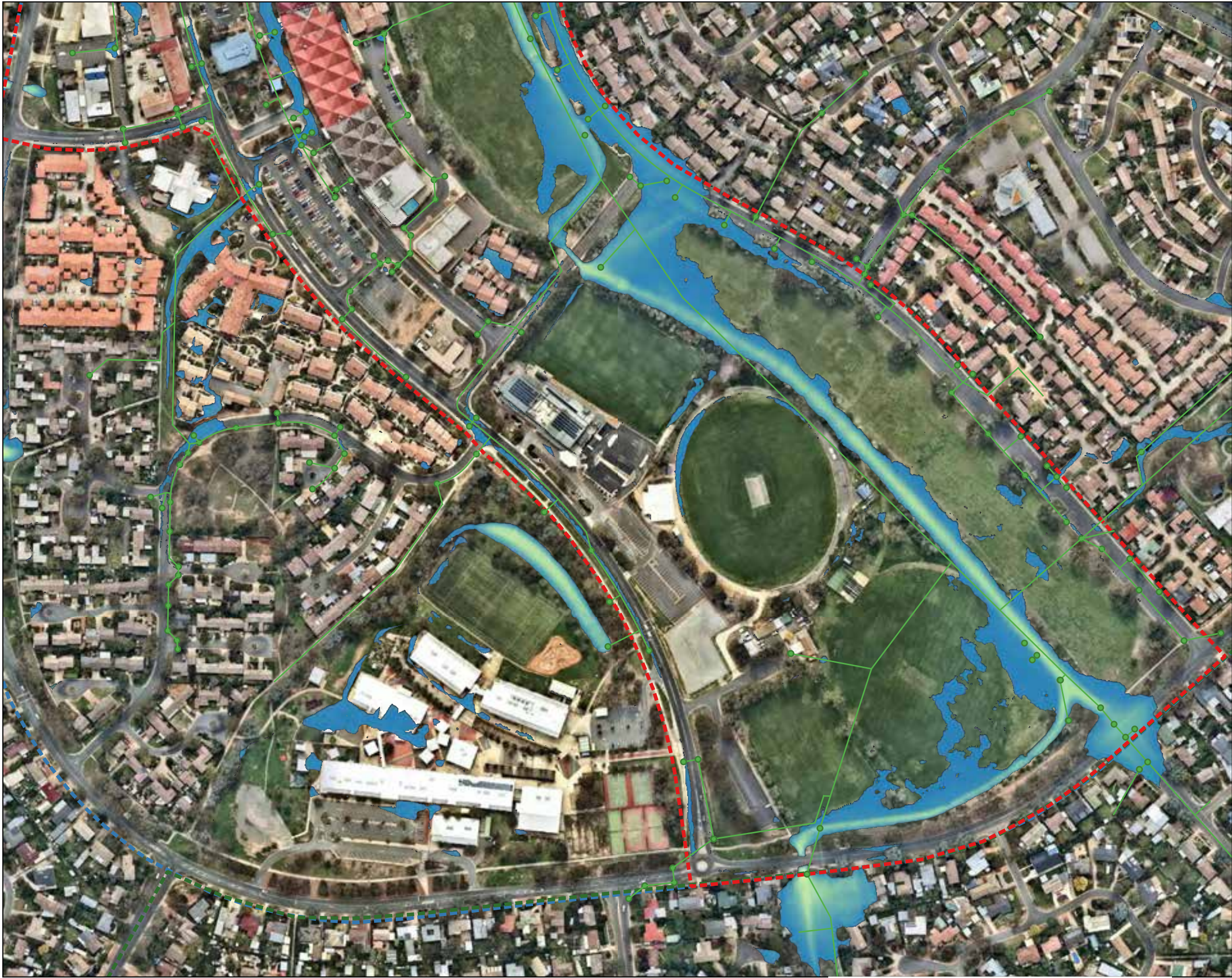
Rev	Amendment	Date
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Project:
**Kippax Group Centre Flood Study
2020 Update**

Drawing Title:
**1% AEP with 50% Blockage. Existing
Condition with 20% Climate Change**

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Drawn	NL
Checked	APL
Job No.	20-000198
Figure	E4 1%AEP 1
Issue	B





Legend

Flood Depths

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- 1.5 - 3
- 3 - 4.5
- 4.5 - 6
- > 6

- Catchment Upstream
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Drawn	NL
Checked	APL
Job No.	20-000198
Figure	E4 1%AEP 2
Issue	B

APPENDIX B

20%, 10% and 1% AEP Events Flood Maps with Mitigation

Climate Change Flood Maps with Blockage



Legend

Flood Depths

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- 1.5 - 3
- 3 - 4.5
- 4.5 - 6
- > 6

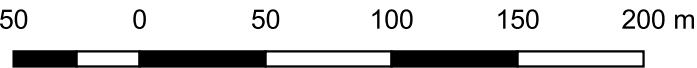
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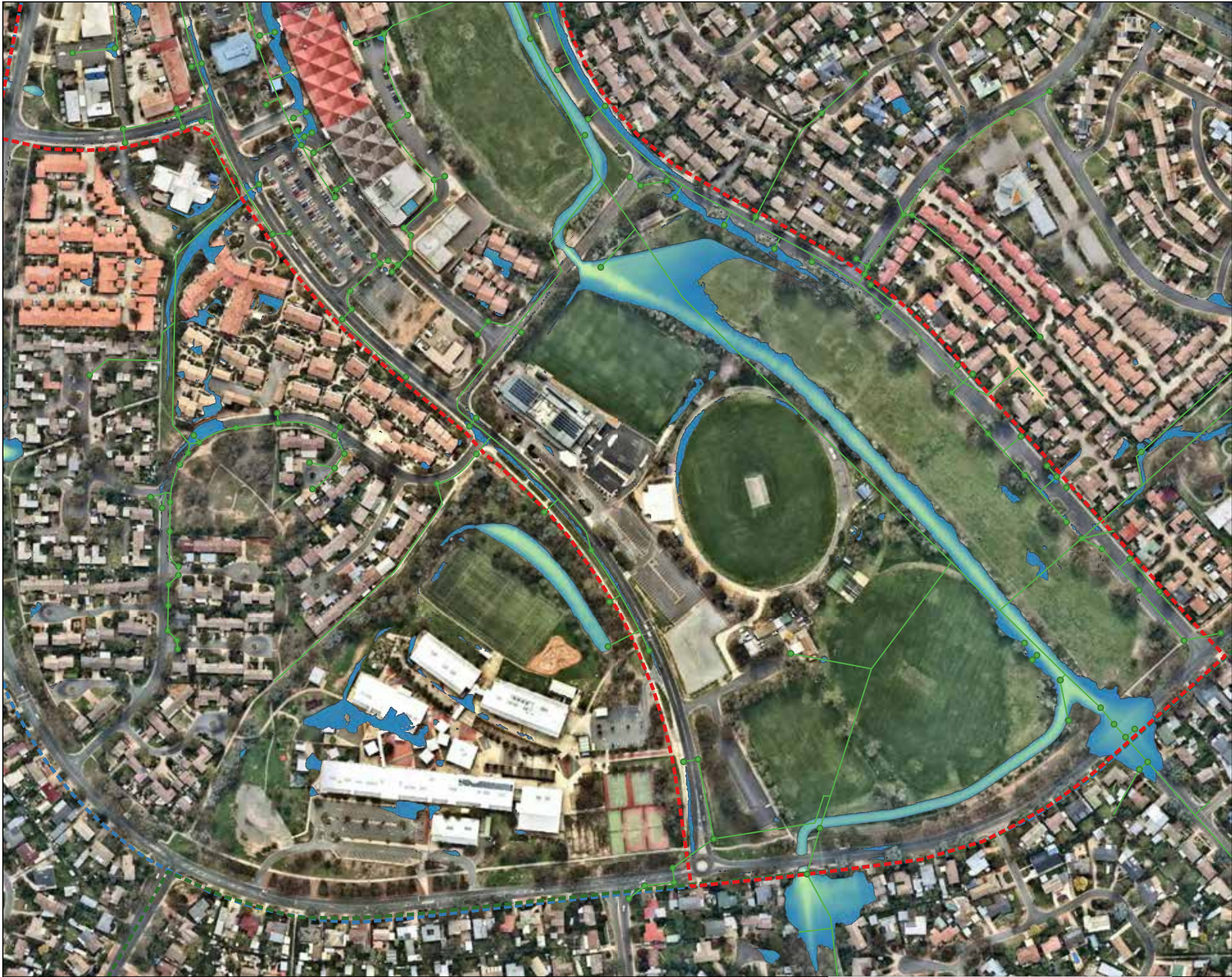
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Checked	APL
Job No.	20-000198
Figure	M1 1%AEP 1
Issue	B





Legend

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- 4.5 - 6
- > 6

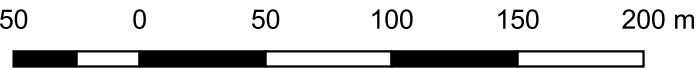
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Job No.	20-000198
Figure	M1 1%AEP 2
Issue	B





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Legend

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- > 6

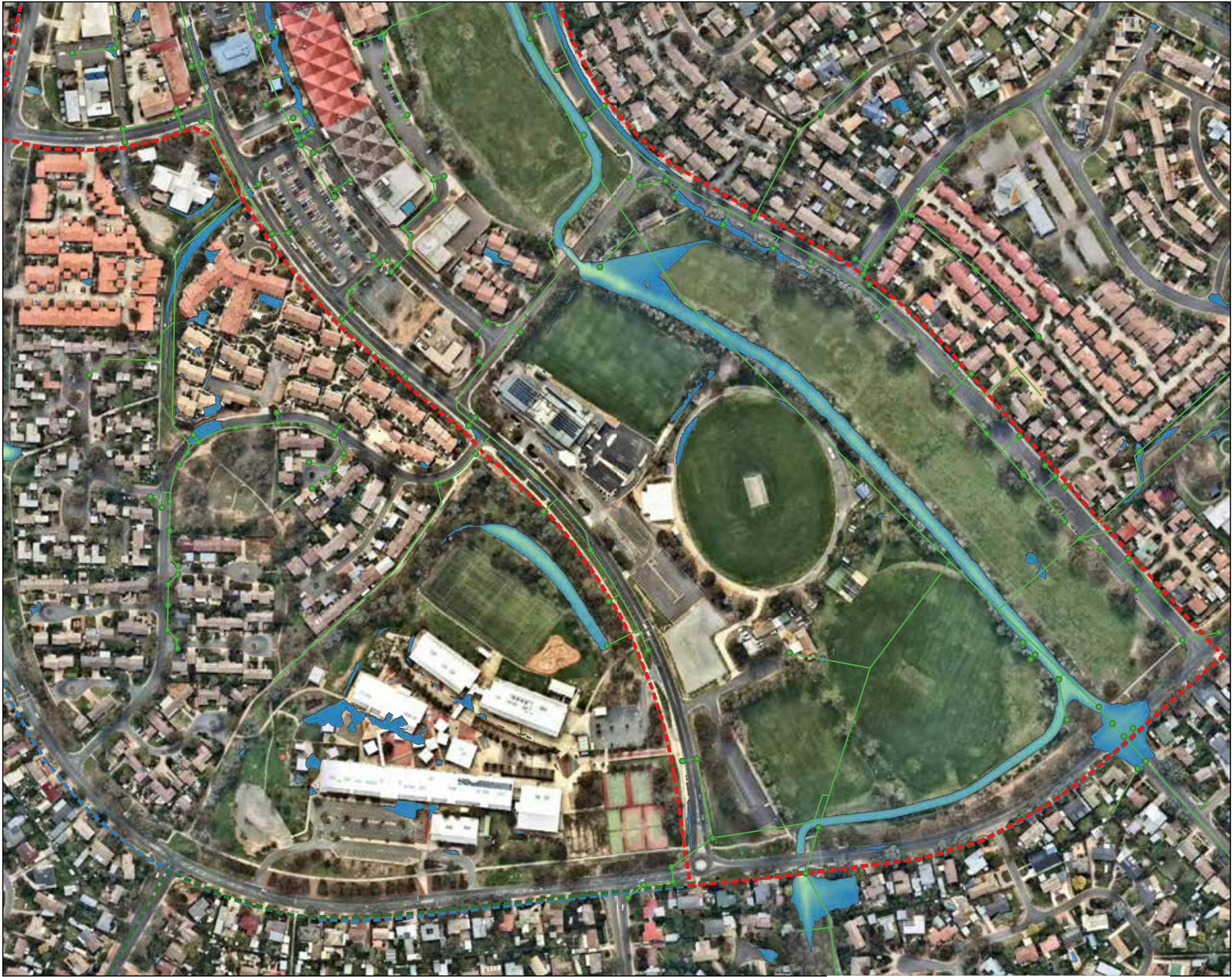
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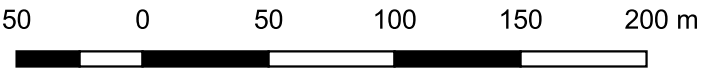
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Issue	B





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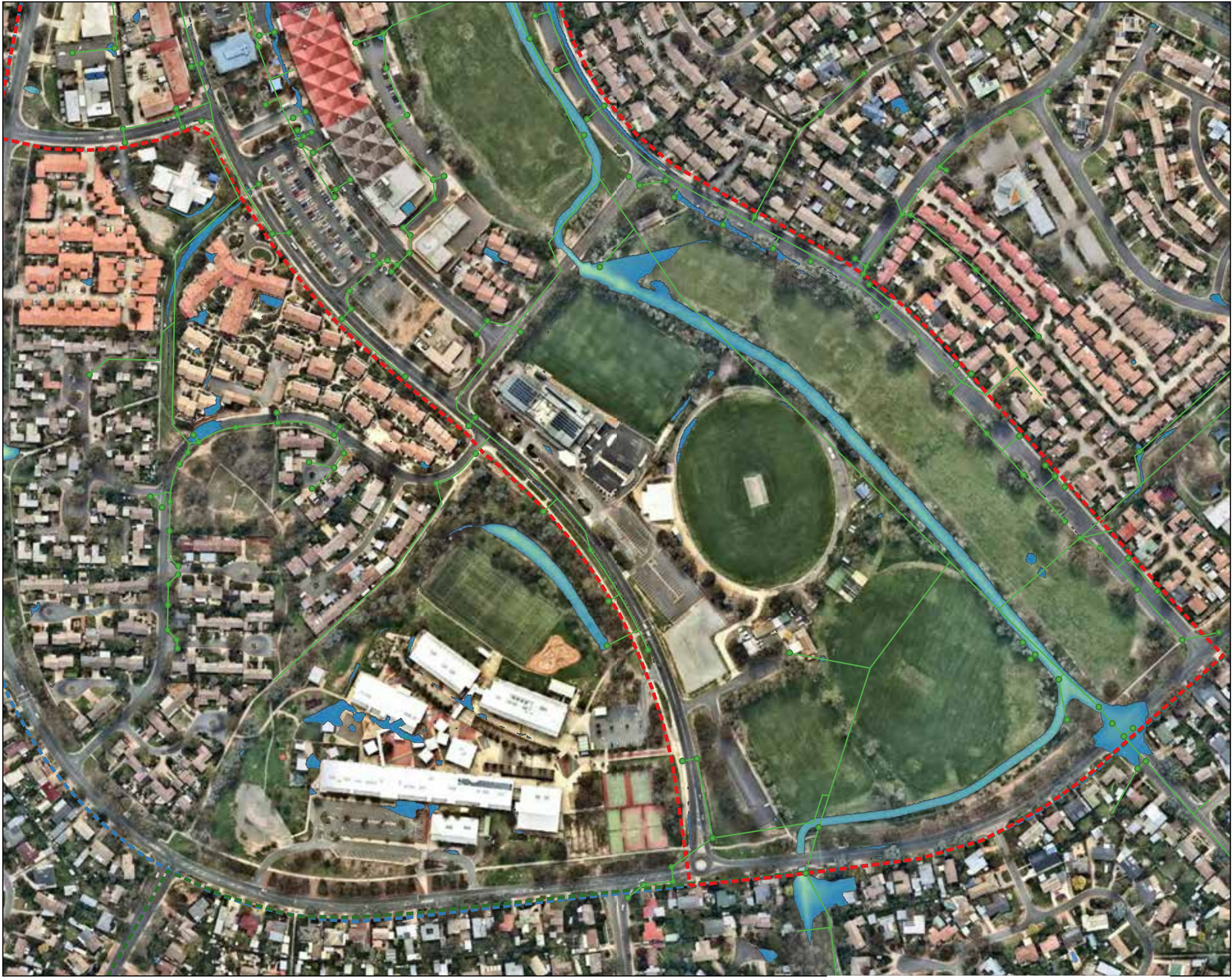
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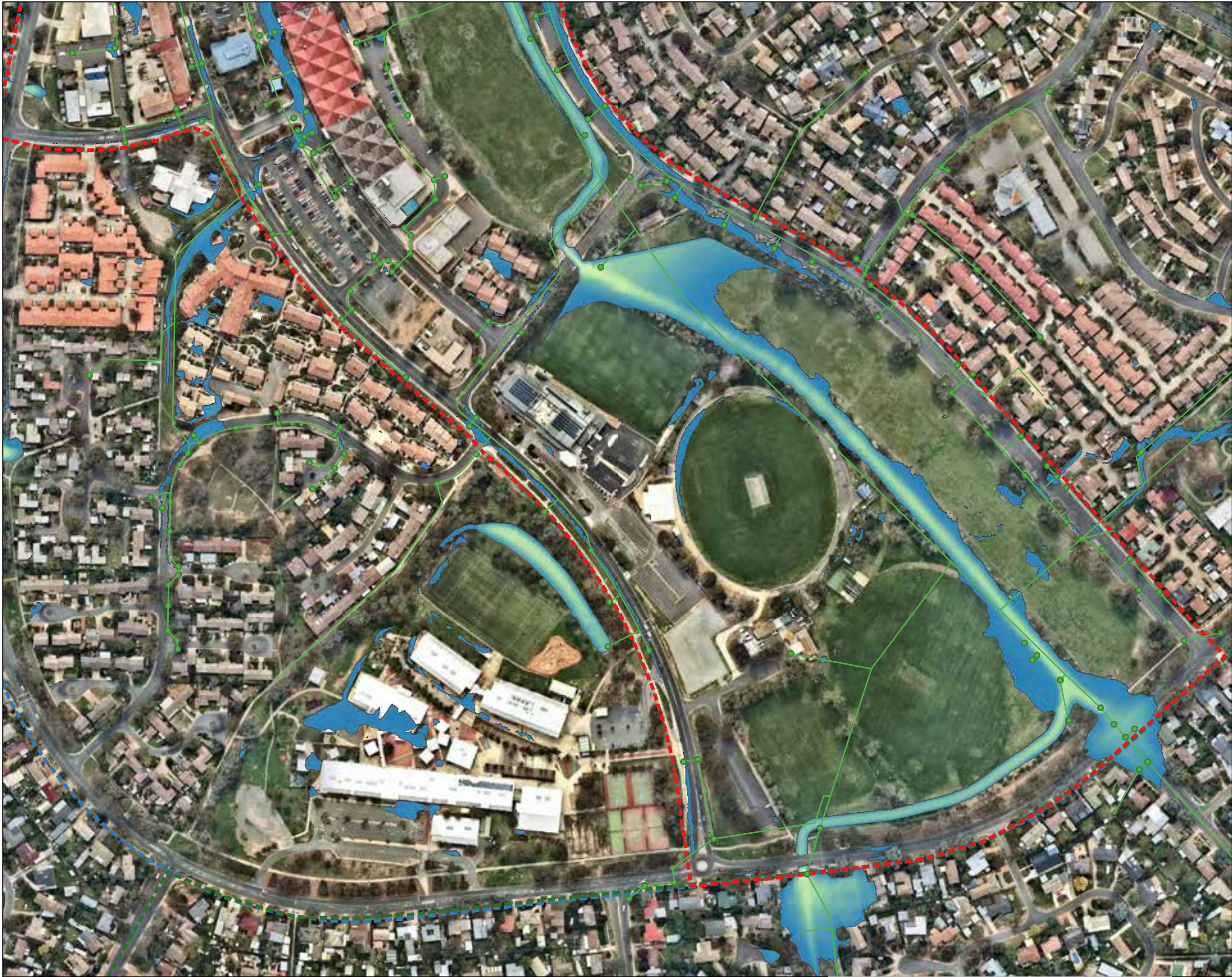
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Climate Change. Mitigation Option
M1: Clear and Regrade Grassed
Swales, Construct Retardation Basin
on the Corner of Flack St and Moyes
Cres**

Scale	1:3000 @A3
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Job No.	20-000198
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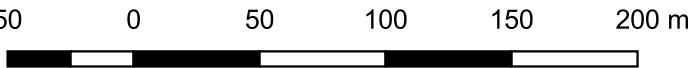
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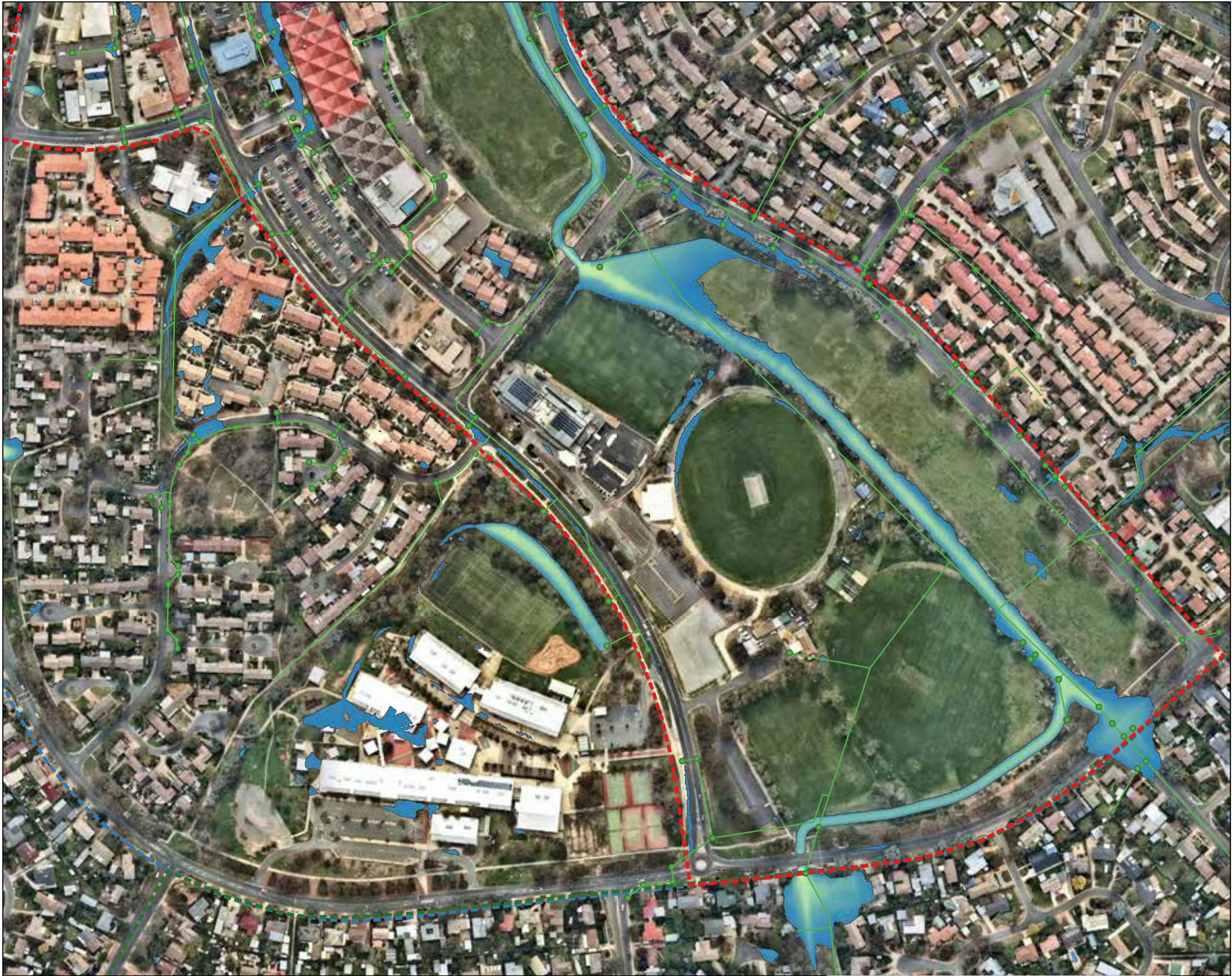
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**Kippax Group Centre Flood Study
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**1% AEP with 50% Blockage.
Mitigation Option M3: Clear and
Regrade Grassed Swales, Construct
Retardation Basin on the Corner of
Flack St and Moyes Cres, Widen
Southern Cross Dr Underpass**

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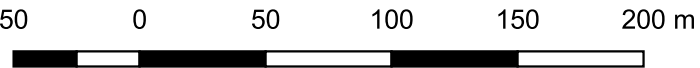
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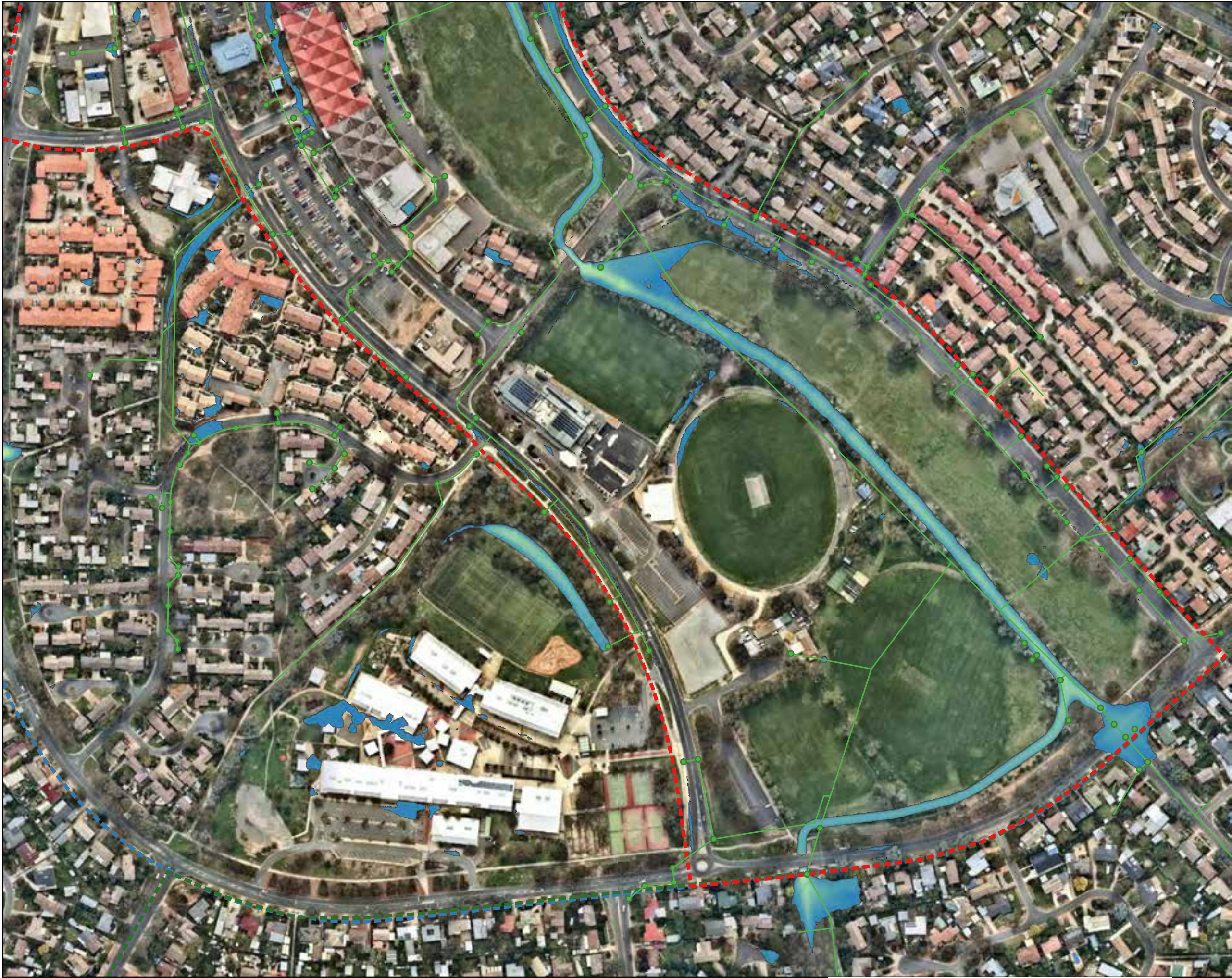
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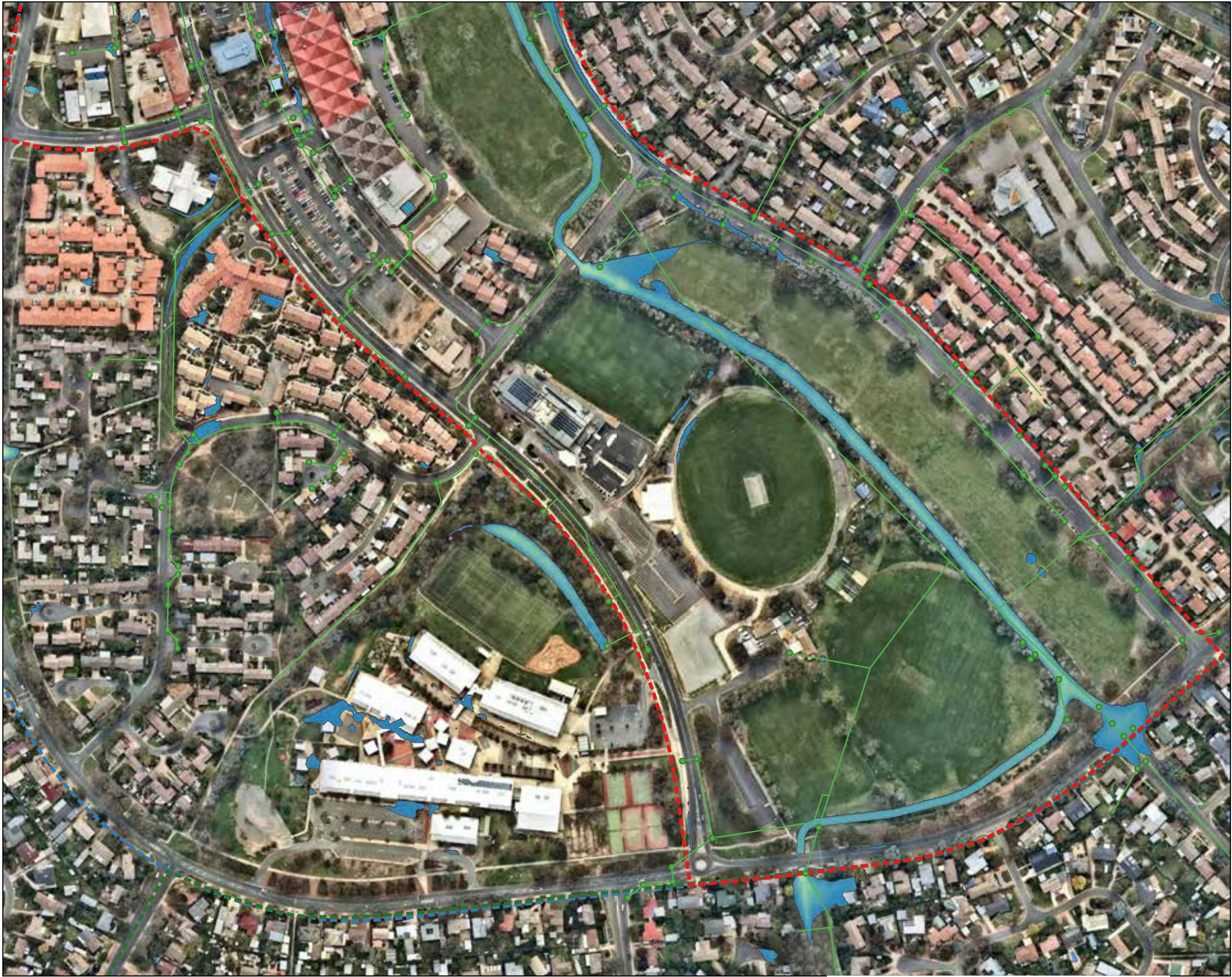
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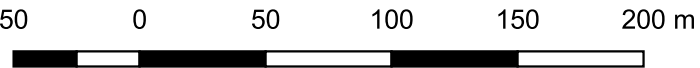
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Catchment Upstream

Study Area

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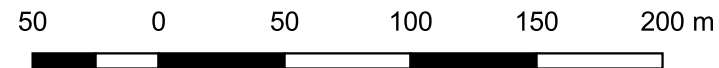
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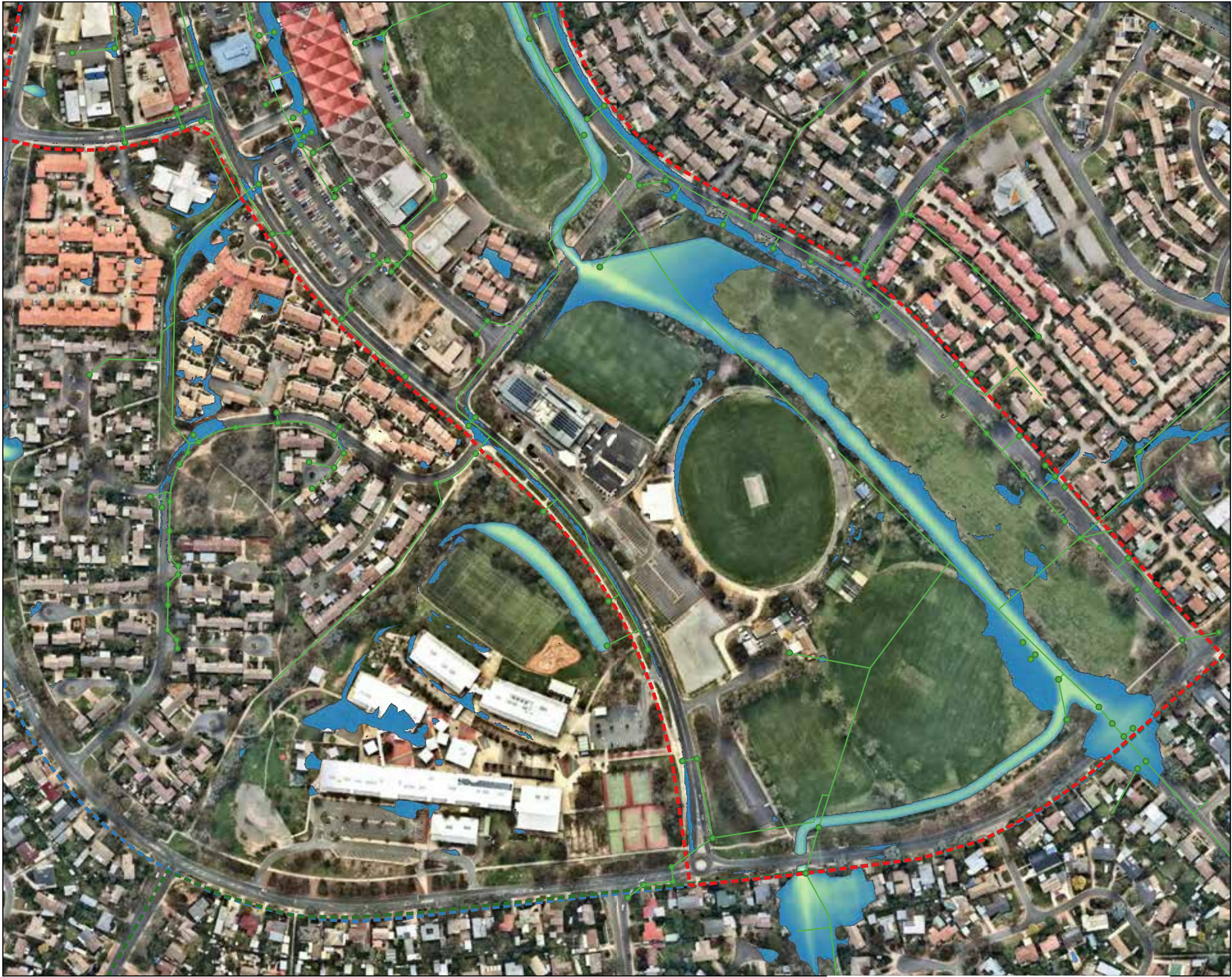
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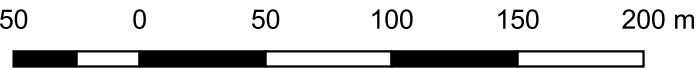
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An aerial photograph of a suburban neighborhood. A multi-lane road runs vertically on the left side of the image, intersecting with a horizontal road. To the right of the intersection is a large, open green field. The surrounding area is densely populated with houses, trees, and some commercial buildings. The text "Kippax Group Centre Traffic and Transport Study" is overlaid in the center of the image.

Kippax Group Centre

Traffic and Transport Study

April 2016

Kippax Centre Traffic and Transport Study

Client: Environment & Planning Directorate

ABN: 31432729493

Prepared by

AECOM Australia Pty Ltd

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ABN 20 093 846 925

24-Jun-2016

Job No.: 60491711

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Quality Information

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Reviewed by Neil Graham

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			Name/Position	Signature
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B	24-May-2016	Draft	Brendan Hogan Transport Team Leader	
1	17-Jun-2016	Final 1	Brendan Hogan Transport Team Leader	
2	24-Jun-2016	Final 2 – updates from comments	Brendan Hogan Transport Team Leader	

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Executive Summary

The Kippax Group Centre (the Centre) is a key retail and transportation hub for the West Belconnen region. The draft Kippax Group Centre Master Plan has been developed to outline the focus of the development of the Centre for the next 20 years in terms of planning, transport, land use, public domain and environmental sustainability.

This study provides a detailed analysis of the transportation and movement aspects of the draft Kippax Master Plan. It investigates the expected growth of the Centre, the roads and traffic within and around the Centre, the future public transport facilities, the future active travel arrangements, service and emergency vehicle access and the future parking requirements of the Centre. The investigation of these transport aspects has informed the determination of the preferred scheme for the future Kippax Group Centre Master Plan.

The preferred scheme involves the incorporation of the essential features of the transport and movement analysis which encompass the overall objectives and intent of the Kippax Master Plan.

The key infrastructure works recommended as part of the preferred scheme are:

- Development of a bus interchange to the north of the Kippax Library parallel to Hardwick Crescent and creation of a pedestrian zone along the northern frontage of Kippax Fair and ALDI.
- Construction of an underground public car park adjacent to the proposed bus interchange / beneath the proposed pedestrian zone to provide central parking without impacting on ground floor amenity or pedestrian accessibility.
- Construction of a structured car park to the north east of Kippax Fair, partially located in the location of the existing Health Facilities building.
- Construction of a link road from Moyes Crescent to the structured car park and the existing Kippax Place and Hardwick Crescent.
- Development of a pedestrian access link between the proposed bus interchange and a future light rail station.

The preferred scheme will achieve the following outcomes:

- Improve the public transport facilities within the Centre and relocate the bus facilities north of the existing Kippax Library.
- Relocate the business core of the Centre to the north of the Kippax Library.
- Develop a future structured public car park in a suitable location for servicing both the Kippax Group Centre local businesses and public transport facilities.
- Improve transport access/egress options for the Centre.
- Improve the pedestrian amenity within the Centre.
- Provide a location for a future light rail alignment and station and the future amenity of this facility.
- Activate the core of the Centre as a pedestrian friendly area.
- Provide improved connectivity between alternative travel modes (car, bike, bus, train, and walk).

The key features of the preferred scheme are summarised in Figure 9-1.

1.0 Introduction

1.1 Background

AECOM has been engaged by the Environment and Planning Directorate to undertake a Traffic and Transport Study for the Kippax Group Centre, henceforth referred to as the Centre. The study provides a qualitative and quantitative analysis of the Centre in terms of access, parking and public transport elements, service vehicles arrangements, pedestrian accessibility and active travel arrangements. It includes a detailed review of the Kippax Group Centre Draft Master Plan, to facilitate growth and guiding the future development of the Centre.

1.2 Kippax Group Centre – Draft Master Plan (EPD, November 2015)

The Kippax Group Centre Draft Master Plan was released by the ACT Government (Environment and Planning Directorate) in November 2015. It establishes what is important in the existing Centre and how these attributes can be enhanced through future development of the Centre. The draft master plan sets out the principals and policies for guiding the future growth and development of the Centre.

The development of the Draft Master Plan involved an integration of strategic planning directions and policy initiatives, community consultation and stakeholder engagement; and consideration of previous reports and analysis for the Centre.

The Draft Master Plan resulted in the following key actions and initiatives for the Centre:

- Provide for new mixed-use residential development through identification of sites suitable for buildings up to six storeys.
- Build and focus on Kippax as a public transport hub for West Belconnen.
- Upgrade Hardwick Crescent as a pedestrian friendly main street.
- Establish a community hub and pedestrian plaza in association with the Kippax library.
- Improve pedestrian connectivity and enhance the pedestrian environment.
- Allow for additional retail expansion.
- Improve and strengthen the connectivity between the Centre and the adjacent Kippax playing fields.

The Kippax Group Centre Draft Master Plan builds the future framework for the Centre. It is relevant to the development of this traffic and transport study as the Draft Master Plan outlines the proposed future direction of the Centre and the potential focus of traffic and transport for the Centre.

1.3 Purpose of Report

This report examines the existing parking, public transport, access arrangements, and traffic and transport facilities of the Centre in relation to the proposed Kippax Master Plan. In doing this, this report aims to:

- Review and analyse the current Kippax Group Centre Draft Master Plan.
- Determine the existing traffic and transport characteristics of the study area.
- Review background reports and previous relevant works.
- Identify existing parking areas and current utilisation rates throughout the study area, determine future parking demand and provide advice with regards to the future parking provisions for the study area.
- Determine future growth of the study area with consideration given to the future development of West Belconnen and a potential light rail connection.
- Determine the future public transport demands anticipated for the study area.
- Provide a review of the proposed future active travel plans and identify options to improve legibility and connectivity of the active travel mode network.
- Undertake a high level review of existing service and emergency vehicle access.
- Undertake a high level analysis of proposed new road links for Kippax road network and provide commentary on the future road network function.

1.4 Study Area

The Centre is located approximately 4.7km northwest of the Belconnen Town Centre. The study area for the Centre is shown in Figure 1-1. The study area is bounded by Southern Cross Drive to the north, Starke Street to the west, the Kippax playing fields to the east and Luke Street / Hardwick Crescent / playing fields to the south.

The study area has the following key characteristics:

- A Woolworth's supermarket and a range of smaller retail shops in Kippax Fair, which services the surrounding suburbs of Holt, Macgregor, Latham, Higgins and the future development of West Belconnen.
- The Centre is currently the focal public transport hub for the area and will be strengthened by the future development of West Belconnen.
- Two community clubs to the north of the study area, the Magpies Sports Club and to the south, the Raiders Belconnen Sports Club and a variety of restaurants to the west of the study area.



Figure 1-1 Study Area

2.0 Review of Background Documents

2.1 Kippax Site Analysis – Traffic and Transport (AECOM, January 2015)

AECOM was engaged by The Riverview Group Pty Ltd to undertake a comprehensive analysis of existing traffic conditions and an indication of expected traffic growth in the vicinity of the Group Centre based on microsimulation modelling undertaken for the West Belconnen development. The report investigated access to the Centre, pedestrian and bicycle movements and public transport arrangements for the Centre.

Traffic and parking surveys were undertaken in September 2013. These surveys included counts of vehicles, pedestrians and cyclists. Parking surveys were also undertaken to determine the utilisation of on-street and off-street parking in the area.

Key outcomes from the report were:

- Traffic volumes in the vicinity of the Centre are relatively moderate and only small delays observed at intersections in peak periods.
- Peak parking demand at the Centre was surveyed to be about 70 to 75% of the available supply, implying that it is relatively easy to find a parking space in the Centre.
- Pedestrian flows are generally higher than cyclist flows within the vicinity of the Centre.
- Public transport passenger flows are anticipated to increase on Southern Cross Drive and bus services are predicted to double on this arterial road over the next 30 to 40 years.
- Consideration should be given to an alternative access to the Centre via Moyes Crescent.
- An increase in traffic growth is forecast for the streets south of the Centre. Signalisation of the intersection of McNaughton Street with Drake Brockman Drive has been proposed to assist with this projected growth.

2.2 West Belconnen Technical Traffic Report (AECOM, February 2014)

The Riverview Group Pty Ltd engaged AECOM to provide technical traffic advisory services on the likely impacts of the proposed West Belconnen urban development.

The proposed West Belconnen developed will yield approximately 11,500 residential dwellings, 30,000 residents, 4,400 jobs and 4,000 school enrolments when fully developed, in about 40 years' time. The West Belconnen Technical Traffic Report investigates the likely impacts of this development on the existing road network and planning for potential road upgrades to cater for expected traffic growth in the region.

The key outcomes of the report are:

- The future requirement to duplicate Stockdill Drive and Drake Brockman Drive. Further, parts of William Hovell Drive, Southern Cross Drive and Ginninderra Drive will ultimately require duplication to accommodate the development of West Belconnen.
- The highest public transport movements to/from West Belconnen will occur in the Stockdill Drive, Drake Brockman Drive and William Hovell Drive corridors. The major bus flows will remain on Southern Cross Drive, east of Kippax, justifying additional bus treatments through the Centre.
- Parts of Drake Brockman Drive, Southern Cross Drive and William Hovell Drive are candidates for bus priority treatments. These treatments are unlikely to be justified until after 2031 when West Belconnen is nearing full development.

The micro-simulation modelling undertaken as part of the West Belconnen Technical Traffic Report incorporates the Centre as part of modelling. The Centre will be the nearest group centre to the future West Belconnen development and will act as the key public transport hub for the area. The impacts of West Belconnen need to be considered in the future planning and development of the Centre.

2.3 Southern Cross Drive and Starke Street (West) Signalisation Impacts (AECOM, September 2014)

AECOM was engaged by Roads ACT to undertake an investigation into the possible redistribution of traffic through Holt as a result of the proposed signalisation of Southern Cross Drive and Starke Street. Microsimulation modelling was undertaken for 2021 travel demands to analyse the effects of the proposed signalisation. The investigation revealed the following key impacts:

- There will be very little change in traffic distribution in the short term
- A 17% increase in eastbound traffic on Beaurepaire Crescent near Trickett Street by 2021
- A 11% increase in eastbound traffic on Starke Street near Macnaughton Street by 2021
- An 9% increase in southbound traffic on Fullagar Crescent by 2021

The modelling undertaken as part of this investigation is relevant to the Kippax Centre Traffic and Transport Study as it provides detailed analysis of the operation of the main access intersection from Southern Cross Drive to the Centre. Results of this analysis will be used to support the Kippax Centre Traffic and Transport Study.

2.4 Belconnen Town Centre and West Belconnen to City Improved Cycling Connections – Feasibility Study (SMEC, December 2015)

SMEC was commissioned by the Territory and Municipal Services Directorate (TAMS) to undertake the Belconnen Town Centre and West Belconnen to City Improved Cycling Connections – Feasibility Study. The study investigated the existing Active Travel network and potential improvements between the Centre and the Belconnen Town Centre.

Key issues identified in relation to the Centre include:

- The existing cycle network contains gaps in both on-road and off-road cycle facilities.
- Current network arrangements facilitate higher speed environments throughout the Belconnen road network.

The study identified a number of potential project options to address gaps in the Active Travel network. Key locations for works packages relevant to the Centre are:

- Hardwick Crescent and Flack Street works, and Starke Street / Moyes Crescent / Luke Street works.
- Southern Cross Drive cycleways.

2.5 Kippax Fair Bus Station Planning (MRCagney, October 2014)

In October 2014 MRCagney were engaged to investigate the bus station strategic planning for the Centre. Future redevelopment of the Kippax Fair Shopping Centre will result in changes to the layout of the car parks, access roads at the site and entrance points to the Centre itself.

The existing bus platform is a single platform, 43m in length. A 37m layover area is located adjacent to the existing bus station.

The future bus network has been adjusted to accommodate the new routes and services for the proposed West Belconnen development. The adjusted bus network suggests that the number of buses serving Kippax station during the AM and PM peak hours will be in the range of 48 to 58 per hour, which is an increase in bus activity of at least 130% above current levels.

The technical note provided a number of recommendations and options. The primary recommendation indicates that the bus station should be relocated to the north of the existing library, fronting both the Kippax Fair Shopping Centre and the Kippax library.

2.6 West Belconnen Transit Stops – Southern Cross Drive (AECOM, June 2014)

AECOM undertook a feasibility study to review the locations, catchments, frequency, accessibility and infrastructure at existing bus stops along Southern Cross Drive between Coulter Drive and Kippax. Various options and costs for the improvements to the Blue Rapid route were developed which includes:

- Bus Stops – minor works to the existing bus stops along the route.
- Transit Way – a continuous bus lane be provided within the existing road pavement.
- Bus Priority – upgrades to the intersections along the route to provide bus priority lanes on the Southern Cross Drive approaches to Kingsford Smith Drive.

The cost-benefit analysis associated with the study indicated that implementing the proposed bus priority works would be economically worthwhile and would provide value for money.

2.7 West Belconnen Community and Stakeholder Consultation – Phase 1 Summary Report (Elton, September 2014)

Elton Consulting was engaged by Riverview Projects (ACT) in 2013 to undertake community and stakeholder consultation, including a Vision Workshop and Planning Design Forum. This consultation phase was undertaken between June 2013 and April 2014. The report outlined the consultation approach and activities and feedback received from the community and stakeholders throughout the consultation period.

The community and stakeholder consultation resulted in a number of key outcomes for the proposed West Belconnen development. The key issues identified throughout the process are:

- The ability of Southern Cross Drive, Drake Brockman Drive and other existing roads to cope with the increased traffic associated with the West Belconnen development.
- Public access to Ginninderra River and Murrumbidgee River.
- Infrastructure for sustainable transport options.

3.0 Growth

The assumptions for growth used to inform this study were taken from a number of sources, as follows:

- Predicted growth in the region such as the future development of West Belconnen (~11,500 future dwellings). This future development has been incorporated into the existing EMME (Canberra Strategic Transport Model - CSTM) and Commuter models which have been utilised as part of this study.
- Future development yields for the Centre (core and peripheral areas) provided by the Environment and Planning Directorate. This information included existing site use and proposed additional use for each of the land use areas shown in Figure 4-4.
- Public transport modelling outputs. The future public transport analysis was based upon current bus routes / frequencies with the addition of the future bus routes / frequencies anticipated as part of the future West Belconnen development.
- Details of the alignment of the future light rail to Kippax were obtained from the study currently being undertaken by ARUP, this information is correct as at May 2016. AECOM has made assumptions as to the possible location of the future Kippax light rail station.

The impact of the potential changes in mode use and travel demand have been considered in the future modelling and growth predictions for the Centre in relation to mode share targets and the introduction of the future light rail network.

4.0 Parking

4.1 Introduction

Recent surveys of the existing parking facilities in the Centre area were undertaken in March 2014 by BVY Traffic Survey. These surveys were undertaken on Thursday 20th March 2014 between 7:00am and 7:00pm. They were based on observations in half hourly intervals and captured both on-street and off-street parking.

The locations of the parking facilities surveyed as shown in Figure 4-1.



Figure 4-1 Kippax Group Centre Survey Locations

4.2 Existing Parking Supply

General observations of the existing parking supply within the Centre are:

- The current configuration of the at-grade parking within the centre is an inefficient design. Realignment of kerbs, removal/relocation of trees and minor widening of the existing blocks would create sufficient space for an additional aisle within the at-grade car parks, increasing the capacity of these facilities by approximately 25%.
- Possible misuse of the existing park and ride parking facility and a low level of utilisation for park and ride parking on Moyes Crescent. Park and ride permits may be appropriate in this location.
- Parking generally more highly utilised within close proximity to retail facilities.
- Low level of utilisation on Kippax Place to the east of Kippax Fair.

The parking supply surveyed in March 2014 included 552 public parking spaces within the study area in the locations shown in Figure 4-1. The majority of these spaces are located adjacent to Hardwick Crescent. The public parking is time restricted in a number of locations; restrictions are generally imposed during the weekday peak periods. A breakdown of the parking supply restrictions is given in Table 4-1.

Table 4-1 Parking Supply Summary – Kippax Group Centre (March 2014)

Parking Restriction	Supply (spaces)
Disabled	23
1P or less (very short term)	95
2P (short term)	237
3P (short - medium term)	44
Unrestricted (long term)	113
Park and Ride	15
Other	25
TOTAL	552

Note: 1. Other includes parking for motorcycles, buses, taxis, service vehicles and loading zone spaces.

An additional 123 spaces is also available on nearby Moyes Crescent (P5 in Figure 4-1). This supply was not included in the March 2014 survey, however it was included in the survey undertaken in September 2013 as part of the Kippax Site Analysis – Traffic and Transport study (AECOM, 2015).

Figure 4-1 also shows some additional car parking on privately leased land, west of P1 and north-west of P2, which is used by staff and visitors of the adjoining commercial buildings. These have not been included in the surveys, but are generally underutilised.

The total number of on-street public car parking spaces available in the Centre (exclusive of Moyes Crescent) is 72 spaces. The total number of off-street public car parking spaces available is 480 spaces.

4.3 Parking Occupancy by Time of Day

The peak parking occupancy for the study occurred at 12:00pm with occupancy of approximately 83%. This can be seen in Figure 4-2, which shows the total number of spaces occupied (blue line) and the percentage of spaces occupied (red columns) between 7:00am and 7:00pm on Thursday 20th March 2014.

4.4 Existing Parking Demand

An analysis of the parking demand for public car parking spaces shows that the peak demand occurs at about 12:00pm (460 out of 552 spaces or 83%); the peak utilisation of 83% is maintained between 11:30am and 12:30pm. A secondary peak occurs at 4:00pm (70% utilisation), as shown in Figure 4-2.

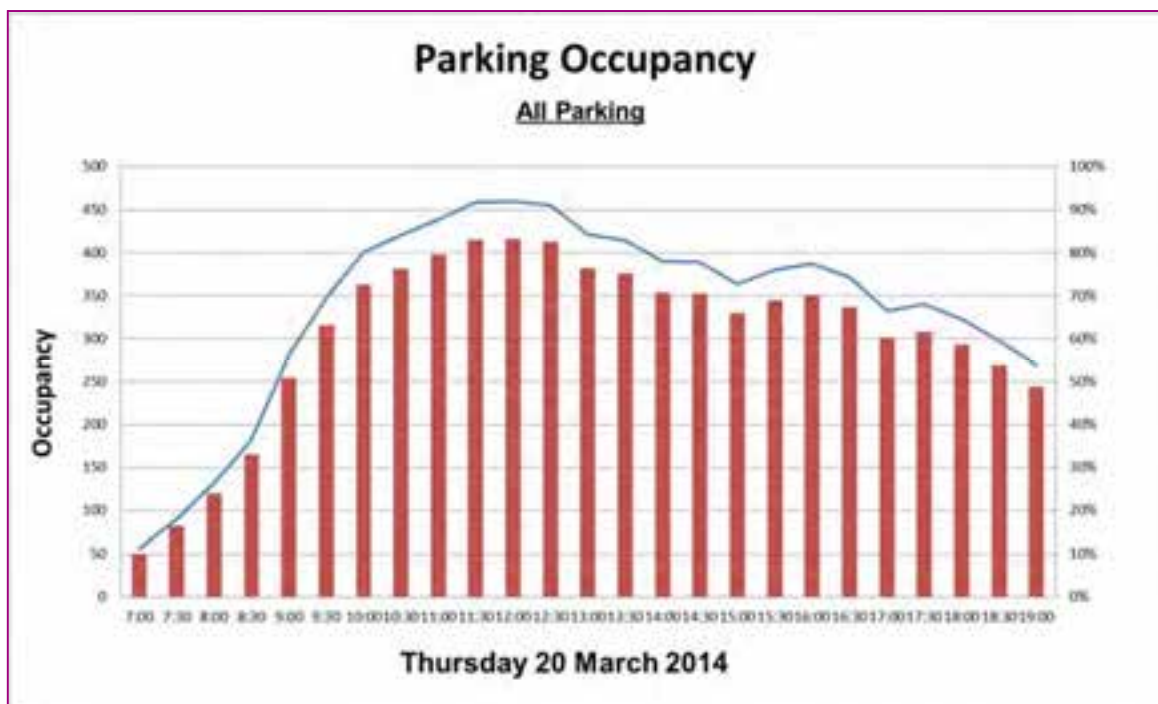


Figure 4-2 Total Parking Occupancy (BVY Survey - March 2014)

A summary of parking demand and utilisation in the Centre at 12:00pm on 20 March 2014 is given in Table 4-2 for the survey locations shown in Figure 4-1. It does not include Moyes Crescent.

The Kippax Site Analysis – Traffic and Transport study (AECOM, 2015) indicates that on-street parking on Moyes Crescent is significantly underutilised. Results from the September 2013 survey indicated that the peak parking utilisation for Moyes Crescent was around 14 out of 123 spaces (12%) in the Saturday peak period. However, this was at a time of little activity on the adjoining sport fields. It is busier at other times of the year; especially during the winter football season.

Table 4-2 Parking Demand Summary – Kippax Group Centre (March 2014)

Car Park		Weekday (12:00pm)							
		Disabled	1P or less	2P	3P	Unrestricted	Park and Ride	Other	
On Street	P1	0	11	0	0	0	0	0	11
	P2	4	5	3	0	0	0	0	12
	P3	6	8	0	0	0	0	1	15
	P4	0	8	0	0	0	0	5	13
	<i>Sub-total</i>	<i>10 (91%)</i>	<i>32 (92%)</i>	<i>3 (100%)</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>6 (27%)</i>	<i>51 (71%)</i>
Off Street	CP1	1	0	0	0	25	0	0	26
	CP2	0	0	90	0	0	0	0	90
	CP3	0	17	32	19	0	0	0	68
	CP4	3	16	9	0	0	0	1	29
	CP5	5	0	70	23	0	12	0	110
	CP6	0	0	0	0	37	0	0	37
	CP7	2	18	8	0	22	0	2	52
	<i>Sub-total</i>	<i>11 (92%)</i>	<i>51 (85%)</i>	<i>209 (90%)</i>	<i>42 (96%)</i>	<i>84 (75%)</i>	<i>12 (80%)</i>	<i>3 (100%)</i>	<i>412 (86%)</i>
TOTAL		21 (91%)	83 (88%)	212 (90%)	42 (96%)	84 (75%)	12 (80%)	9 (35%)	463 (84%)

Note: 1. Percentages shown in brackets represent percent total spaces that are occupied in each category

The off-street parking areas in the core area likely to be impacted by future development include car parks CP2-CP7. The total current demand for these car parks is 386 spaces (412 – 26 from CP1).

4.5 Land Use Parking Generation

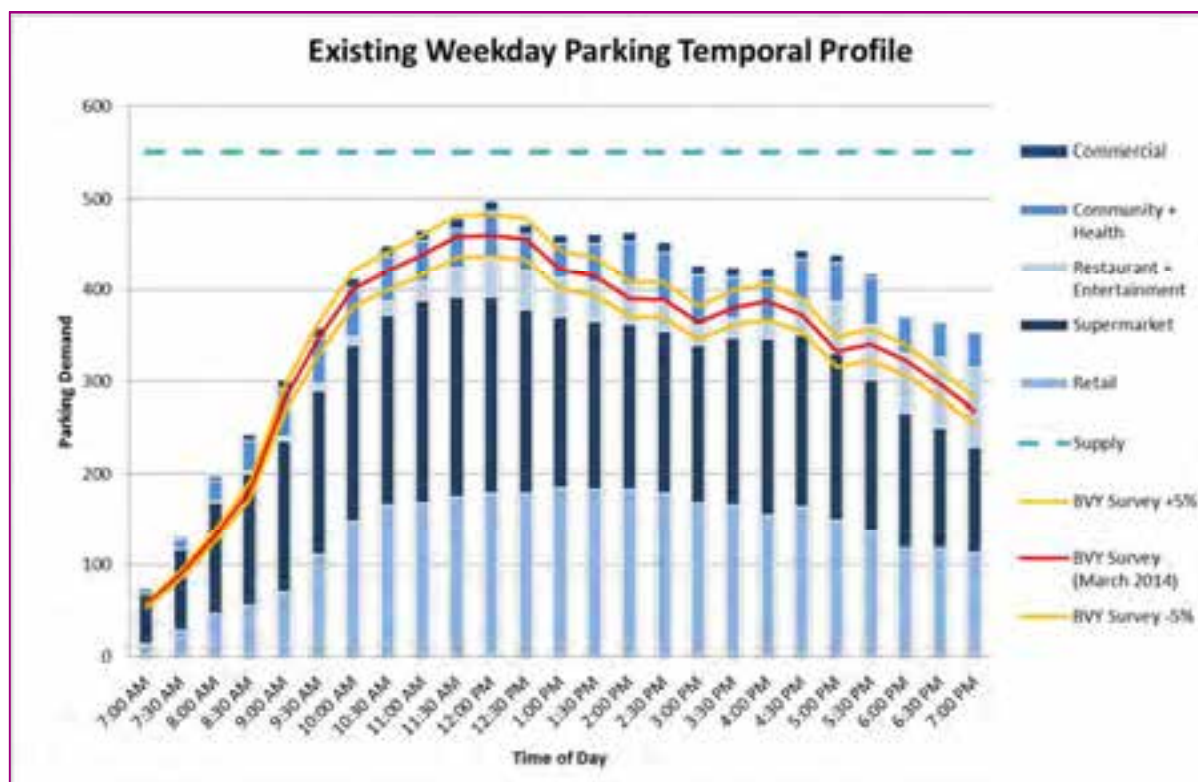
Consideration must be given to the required parking supply for the Centre based on the statutory requirements. Rates from the ACT Parking and Vehicular Access General Code and the RTA Guide to Traffic Generating Developments have been applied to the existing gross floor area values for the differing land uses.

The total car parking requirement as per the statutory parking requirements is summarised below in Table 4-3. This is 34% more than currently supplied and 61% more than current peak demand. This is due to temporal variations in demand for alternative uses and multi-purpose walk trips in the Centre.

Table 4-3 Existing Car Parking Demand Generated by Land Use

Land Use	Gross Floor Area (m ²)	Car Parking Code Rates	Car Parking Requirement (spaces)
Retail	4897	5 spaces / 100m ² GFA	245
Supermarket	5850	5 spaces / 100m ² GFA	293
Commercial	606	2.5 spaces / 100m ² GFA	15
Restaurant + Entertainment	1124	10 spaces / 100m ² GFA	112
Community + Health	2465	3 spaces / 100m ² GFA	74
Total Code Requirement			739
<i>Existing Supply</i>			<i>552</i>

AECOM has developed a range of demand profiles for various land uses which enables a better understanding of actual parking demand. These are based on surveys or other historical usage data such as admission numbers. These expected demand profiles were applied to the code rates and land uses within the Centre to develop an existing parking occupancy temporal profile for the study area. This enabled the development of a baseline for the determination of future parking demand. The code rates were adjusted downwards to align the temporal profile approximately with the surveyed profile shown above in Figure 4-2. A global adjustment factor of 75% was applied to the code parking rates to achieve a “best fit” of the temporal profile to the surveyed parking occupancy data. The global adjustment factor was developed from the existing parking supply divided by the total code requirement of the Centre. The adjusted existing weekday temporal profile is shown in Figure 4-3.

**Figure 4-3 Existing Weekday Parking Temporal Profile**

The graph shows a fairly close correlation between the temporal profiles when compared to the 2014 survey. The temporal profile shows a slightly higher demand between about 2-3PM and from about 4:30PM. This could be due the lower demand from retail, supermarket or restaurant/ entertainment land uses than other centres and presents a slightly conservative approach for future demand projections for the evening. The peak time (midday) shows a very close correlation and provides a good basis for future extrapolation.

4.6 Parking at Periphery Developments

The surveys were undertaken for the public parking within the Centre as shown in Figure 4-1. The periphery land uses and parking on privately leased land in the Centre have been reviewed to determine if the existing parking supply for these developments is satisfactory.

As in Section 0, a global adjustment factor was applied to the code rates in order to determine the parking requirement for each of the existing developments. A summary of the periphery parking locations supply and requirements is given in Table 4-4.

The review of the existing periphery developments indicates that parking requirements are generally met for each of the periphery developments in the Centre excluding the Magpies Sports Club and the Child and Family Centre on Starke Street. The additional parking requirement for the Child and Family Centre (5 spaces) and McDonalds (1 space) is considered in the future parking demand profile developed in Section 0. The 95 space parking supply deficiency from the Magpies Sports Club is catered for by the "Car Park Opp Magpies" parking area shown in Figure 4-4, part of the public car parking in the Centre. The peak demand for the Magpies Sports Club is offset from the retail peak demand period (as demonstrated in Figure 4-3); the Car Park Opp Magpies has sufficient parking supply for the existing Magpie Sports Club parking demand.

Table 4-4 Periphery Developments and Parking

Location	Land Use	Parking Requirement	Parking Supply	Difference	Comments
Magpies Sports Club	Restaurant + Entertainment	95	0	-95	Club utilises the adjacent northern car park area.
Veterinary Clinic	Veterinary Hospital	16	23	7	
McDonalds	Retail	23	22	-1	'Retail' land use, as per supplied data.
Child Care Centre	Child Care Centre	25	25	0	Assumed 90 child care places.
Child and Family Centre	Community + Health	32	27	-5	
Church	Place of Worship	30	30	0	Gravel car park, supply estimated.
Flack Street Petrol Station	Service Station	9	9	0	

4.7 Future Parking Demand

4.7.1 Future Land Use (excluding residential)

Future parking supply requirements for the Centre have been determined using the adjusted baseline temporal profile shown in Figure 4-3 in conjunction with future land use data for the Centre. The future land use data for the Centre is summarised in Table 4-5 and Figure 4-4. Table 4-6 indicates the additional gross floor area per location for the future Kippax Group Centre development.

Residential parking requirements have not been included in the following analysis of the Centre core area. Parking supply relating to residential development should be provided within the residential development site boundaries; this has been analysed separately.

Table 4-5 Future Site Areas Summary (Existing and Proposed Future Combined)

Location	Gross Floor Area (m ²)						
	Retail	Supermarket	Commercial	Restaurant & Entertainment	Community & Health	Other	Total
Kippax Fair	6945	4150	516	110	296	0	7867
Kippax Place Commercial	725	0	90	0	0	0	815
Hardwick Crescent West	1377	0	0	1014	146	0	2537
Library	0	0	0	0	2908	0	2908
Car Park Adj Petrol Station	500	0	0	0	0	0	500
Car Park Opp Woolworths	2000	0	500	500	0	0	3000
Central Plaza	0	0	0	0	0	0	0
Car Park Opp ALDI	1500	0	0	500	0	0	2000
Health Services	3000	0	0	500	0	0	3500
ALDI	1700	1700	0	0	0	0	1700
Kippax Place	250	0	0	250	0	0	500
Units Cnr Hardwick/Flack	0	0	0	0	0	0	0
Starke Street Community Cluster	260	0	0	0	1954	0	2214
Petrol Station Flack St	380	0	0	0	0	0	380
Car Park Opposite Magpies	0	0	0	0	0	0	0
Magpies and McDonalds	560	0	0	1140	500	450	2650
Church	0	0	0	0	800	0	800
Parkview Apartments	195	0	0	120	180	0	495
CORE TOTAL	12147	5850	1106	2874	3350	0	24627
PERIPHERY TOTAL	1395	0	0	1260	3434	450	6539
TOTAL	13542	5850	1106	4134	6784	450	

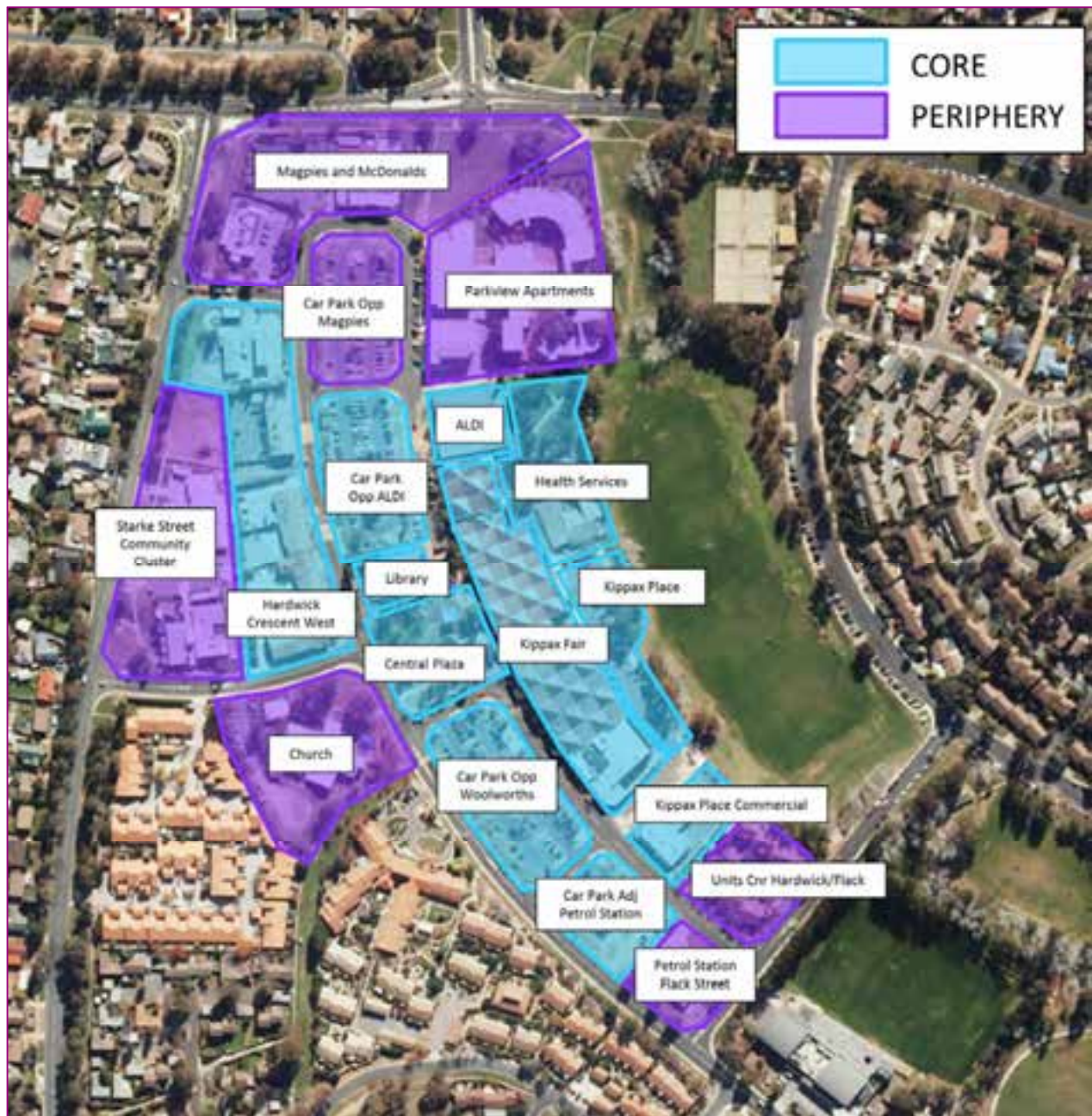


Figure 4-4 Future Site Areas

Table 4-6 Proposed Future Additional Gross Floor Area

Location	Gross Floor Area (m ²)						
	Retail	Supermarket	Commercial	Restaurant & Entertainment	Community & Health	Other	Total
Kippax Fair	0	0	0	0	0	0	0
Kippax Place Commercial	0	0	0	0	0	0	0
Hardwick Crescent West	0	0	0	0	0	0	0
Library	0	0	0	0	2000	0	2000
Car Park Adj Petrol Station	500	0	0	0	0	0	500
Car Park Opp Woolworths	2000	0	500	500	0	0	3000
Central Plaza	0	0	0	0	0	0	0
Car Park Opp ALDI	1500	0	0	500	0	0	2000
Health Services	3000	0	0	500	0	0	3500
ALDI	0	0	0	0	0	0	0
Kippax Place	250	0	0	250	0	0	500
Units Cnr Hardwick/Flack	0	0	0	0	0	0	0
Starke Street Community Cluster	0	0	0	0	0	0	0
Petrol Station Flack St	0	0	0	0	0	0	0
Car Park Opposite Magpies	0	0	0	0	0	0	0
Magpies and McDonalds	0	0	0	0	500	0	500
Church	0	0	0	0	0	0	0
Parkview Apartments	0	0	0	0	0	0	0
CORE TOTAL	7250	0	500	1750	2000	0	11500
PERIPHERY TOTAL	0	0	0	0	500	0	500
TOTAL	7250	0	500	1750	2500	0	

4.7.2 Future Parking Demand (excluding residential)

Table 4-7 indicates the car parking demand for the future land uses in the Centre, based on the adjusted code rates as determined below. The total parking demand as per the adjusted code rates is 1023 car spaces.

Table 4-7 Future Car Parking Demand Generated by Land Use (Core Area)

Land Use	Gross Floor Area (m ²)	Adjusted Car Parking Code Rate	Car Parking Demand (spaces)
Retail	12147	3.8 spaces / 100m ² GFA	462
Supermarket	5850	3.8 spaces / 100m ² GFA	222
Commercial	1106	1.9 spaces / 100m ² GFA	21
Restaurant + Entertainment	2874	7.5 spaces / 100m ² GFA	216
Community + Health	4465	2.3 spaces / 100m ² GFA	103
Total Adjusted Code Requirement			1023

The future parking demands determined in Table 4-7 were applied to the temporal profile shown in Figure 4-3 in order to determine a possible future weekday parking demand temporal profile. The future weekday parking demand profile is shown in Figure 4-5 which indicates a peak parking demand of 878 parking spaces at 12:00pm for the future development of the Centre. This assumes no reduction in demand due to changed mode use.



Figure 4-5 Future Weekday Parking Demand

The possible parking demand generated by key development sites is summarised in Table 4-8.

Table 4-8 Future Car Parking Demand Generated for Key Development Sites

Location	Car Parking Demand					
	Retail	Supermarket	Commercial	Restaurant & Entertainment	Community & Health	Total
Car Park Opp Woolworths	76	0	10	38	0	124
Car Park Opp ALDI	57	0	0	38	0	95
Health Services	114	0	0	38	0	152
TOTAL	247	0	10	114	0	371

4.7.3 Future Parking Supply Location

The existing Kippax Group Centre Draft Master Plan indicates a proposed location of a structured car park on the northern-most at-grade car park block of the Centre (Car Park Opp Magpies in Figure 4-4). A public parking facility in this location would ensure secure parking is maintained close to the Magpies Club, but it may not provide the best parking and access benefits to the Centre as a whole.

It should be noted that the existing Magpies Sports Club does not have any onsite parking facilities and relies solely on the existing public at-grade parking for its parking provisions which was not unusual at the time of development of the site. Development of this existing at-grade car park as a retail / residential sector would remove any public parking from this location; consideration should be given to providing adequate parking facilities for the Magpies Sport Club as part of development of this site.

The proposed location in the Kippax Group Centre Draft Master Plan is not desirable for providing car parking for the key retail centre of Kippax Fair and is not considered the preferred location for the following reasons:

- This location is a potentially desirable location for future retail or residential development. By developing this location as a retail/residential sector it would drive the core of the Kippax Group Centre north as per the ultimate Centre strategy.
- This location would continue to generate vehicular traffic to/from Hardwick Crescent via Starke Street, alternate locations would lower the traffic pressure on these roads.
- This location is approximately 250-300m from the key supermarket within the Kippax Fair development. Parking demand is currently lower in this location when compared to the remaining at-grade parking within the Centre.

Alternative locations are shown in Figure 4-6. The proposed locations for a structured car park have the following features and benefits:

- East of Kippax Fair (existing health services building location);
 - Central location to retail core and sports and recreation facilities.
 - Provides further justification for road connectivity to Moyes Crescent as shown in Figure 5-1, although this road connection is largely dependent on the structured car park being constructed in this location.
 - Close proximity to major retailers (ALDI, Woolworths).
 - Relatively close proximity to Magpies Sports Club.
 - Increases area of potentially developable land on Hardwick Crescent.
 - Reduces vehicular movements within the core of the Centre.
 - Redevelopment of the northern portion of Kippax Fair would be required to create a pedestrian friendly area between the future Kippax bus interchange and the proposed structured car park.

- Car Park opposite Woolworths;
 - Increases area of potentially developable land in the northern sector of the Centre.
 - Close proximity to Woolworths
 - Encourages passive pedestrian movement north-south through the Centre.
 - Reduces vehicular movements within the core of the Centre.

Of the proposed locations shown, the preferred option is to locate the structured car park to the east of Kippax Fair on the existing health services building block. This location best aligns with the overall objectives of the Centre Master Plan including moving the core of the centre north, reducing vehicle/ pedestrian conflicts, improving active travel, improving public transport, improving road connections to the Centre and improving accessibility. Ground floor activation, lighting and connectivity to the Centre are critical to the successful integration of this structure and to accommodate CPTED requirements.



Figure 4-6 Structured Car Park Location

4.7.4 Residential Parking Demand

Residential parking requirements have been considered separately in this study as parking supply relating to residential development should be provided within the residential development site boundaries. The following table outlines the parking requirement for the future residential developments considered within the study area. For the analysis, it has been assumed that each dwelling is an apartment with two or more bedrooms.

Table 4-9 Proposed Future Residential Dwellings

Location	Number of Dwellings	Car Parking Code Rate	Car Parking Requirement (spaces)
Kippax Place Commercial	34	1.5 spaces per 2 bedroom dwelling	51
Hardwick Crescent West	80	1.5 spaces per 2 bedroom dwelling	120
Car Park Adj Petrol Station	113	1.5 spaces per 2 bedroom dwelling	170
Car Park Opp Woolworths	137	1.5 spaces per 2 bedroom dwelling	206
Health Services	124	1.5 spaces per 2 bedroom dwelling	186
Starke Street Community Cluster	10	1.5 spaces per 2 bedroom dwelling	15
TOTAL			747

The proposed future residential dwellings represent an increase in parking demand for residential developments in the Centre by approximately 747 spaces (to 970 approx. including existing). This additional parking demand should be accommodated within the proposed future residential developments. Table 4-10 provides indicative areas and levels of basement parking required for the proposed residential developments listed in the above tables based on the available site area.

Table 4-10 Proposed Future Residential Parking Requirements

Location	Car Parking Requirement (spaces)	Available Site Area (m ²)	Required Area per Parking Space (m ²)	Required Area (m ²)	Approx. Number of Basement Parking Levels
Kippax Place Commercial	51	2,286	35	1785	0.8
Hardwick Crescent West	120	6,876	35	4200	0.6
Car Park Adj Petrol Station	170	2,826	35	5933	2.1
Car Park Opp Woolworths	206	5,475	35	7193	1.3
Health Services	186	4,952	35	6510	1.3
Starke Street Community Cluster	15	1,000	35	525	0.5
TOTAL	747	23,415		26,146	

Table 4-11 provides a summary of the proposed future parking requirements for the Centre. The table has been developed on the assumption of a requirement of 35m² per car space for basement parking. This rate includes area for the parking space, car park isle, columns and service requires. The replacement parking requirement is taken from the current demand for at grade parking in the Centre.

Table 4-11 Proposed Future Parking Requirements (Core Area)

Location	Car Parking Requirement (spaces)	Available Site Area (m ²)	Required Area per Parking Space (m ²)	Required Area (m ²)	Average Number of Basement Parking Levels
Non-residential use	1023*	26,442	35	35,805	1.4
Residential use	747**	23,415	35	26,146	1.1
Replacement Parking	386***	N/A	35	13,510	N/A
TOTAL	2156	49,857		75,461	

* From Table 4-7

** From Table 4-10

*** From Section 0

4.8 Future Parking Improvements

An analysis of the parking demand for public car parking spaces shows that the peak demand occurs at about 12:00pm (460 out of 552 spaces or 83%); the peak utilisation of 83% is maintained between 11:30am and 12:30pm. A secondary peak occurs at 4:00pm (70% utilisation).

The total car parking provision as per the statutory parking requirements is 739 spaces. This is 34% more than currently supplied (552 spaces) and 61% more than current peak demand (460 spaces). This is due to temporal variations in demand for alternative uses and multi-purpose walk trips in the Centre.

4.8.1 Short term

The current configuration of the at-grade parking within the centre is an inefficient design. In the short to medium term, it would be possible to realign kerbs, remove/relocation some trees and undertake some minor widening of the existing blocks which would create sufficient space for an additional aisle within the at-grade car parks, increasing the capacity of these facilities by approximately 25%.

There is possible misuse of the existing park and ride parking facility which cannot be readily enforced. The introduction of a Park and Ride permit area may be appropriate in this location. Better enforcement of time restricted parking including the possible implementation of smart parking could help better manage parking amenity in the short term and ensure short term high turnover spaces are available and not abused.

4.8.2 Longer term

In the longer term, the provision of structured parking area could increase the parking supply. However, this is likely to only occur in association with additional development which would bring its own additional demand.

4.8.3 Park and Ride

Park and Ride should be provided within close proximity to public transport facilities. Upon the redevelopment of the existing at-grade car parks, the current Park and Ride parking facilities will be required to be catered for, possibly through a permit system in the interim, before providing more permanent Park and Ride facilities in a location that is in close proximity to the future public transport facilities.

5.0 Roads and Traffic

5.1 Existing Road and Traffic Network

The key road links within the Kippax road network are shown in Figure 1-1. Some characteristics of the key roads providing access to and from the Centre are summarised in Table 5-1.

Table 5-1 Key Road Network Elements

Road	Classification	Number of Lanes (Total)	Access Arrangements	On-Street Parking Provision
Southern Cross Drive	Arterial Road	2-4	No Direct Access	No
Starke Street	Major Collector	2	Access to Hardwick Crescent	No
Hardwick Crescent	Minor Collector	2	Circulation Road	Part
Luke Street	Access Street	2	Access to Hardwick Crescent	No
Flack Street	Access Street	2	Access to Hardwick Crescent	No
Moyes Crescent	Minor Collector	2	No Direct Access	Yes

5.2 Future Road Link Options

In relation to the options developed, the schemes explored within this report align strongly with the current masterplan. This has also generated some constraints in relation to limiting planned redevelopment of existing buildings or public areas.

5.2.1 Options Considered

Future vehicular access options have been considered for the Centre as shown in Figure 5-1. A secondary road access from Moyes Crescent would provide additional connectivity between the Centre and Southern Cross Drive; this connection may warrant the future signalisation of Southern Cross Drive / Moyes Crescent in terms of safe amenity or for future light rail services. Development of a structured car park to the east of Kippax Fair would provide further warrant for this road link and signals. This road link could be constructed as a one-way road link or a car park access only road. These links would provide additional connectivity and amenity to the centre and could also be used for service access to the eastern side of Kippax Fair.

Other access options and road links were considered and dismissed. An access between the Centre and the intersection of Southern Cross Drive / Florey Drive was considered, but was dismissed due to the recent sale of this block of land. It is noted that Block 70, Section 51 still remains and could be considered for a public transport link.

A road access link between ALDI and the Parkview Apartments was also considered, but was dismissed due to the physical constraints in this location; the width between these existing developments is not sufficient for a road connection whilst still maintaining adequate accessibility for the ALDI delivery and service vehicles. A one-way access road or possible public transport link could be considered in this location. However, this link would be dependent on further studies and the physical constraints mentioned.

5.2.2 Future Road Link Cost

A high level approximate cost for the construction of the proposed road link including earthworks, service relocations, pavement works, kerbs, culverts, streetlighting, linemarking etc is briefly summarised below excluding GST.

This costing assumes a road length of approximately 300m with a width of 8m, which is assumed to be the extent of the additional pavement area. It is also assumed that a large culvert will be sufficient for the major flow path and an underpass/bridge will not be required in this location. Design, consultancy and procurement costs have not been included.

Table 5-2 Road Link Cost Estimate

Item	Cost
Preliminaries/Provision for Traffic	\$230,000
Earthworks	\$250,000
Services	\$130,000
Stormwater	\$350,000
Pavement	\$450,000
Kerbs	\$50,000
Streetlighting	\$80,000
Landscaping	\$30,000
Lines and Signs	\$30,000
Other	\$100,000
Contingency (20%)	\$340,000
TOTAL	\$2,040,000

Note: these costs are preliminary in nature and should not be relied upon for detailed business case development. The costing is based on estimates, assumptions and other information developed by AECOM from its independent research effort and general knowledge of the industry.



Figure 5-1 Future Road Links and Considerations

5.2.3 Commuter Microsimulation Modelling

A detailed Commuter microsimulation model has been developed by AECOM to investigate the future demands, traffic flows and service levels of the area as a result of the proposed future West Belconnen development. This model has been utilised in this study to gain an understanding of the potential impacts or improvements of the proposed road link shown in Figure 5-2. The model is relatively simple within the Centre area, it should be noted that the model does not precisely represent the layout of the Centre (Hardwick Crescent east is modelled as a continuous road although is actually a disconnected road segment) and the model has not been updated to include the additional future land use changes within the Centre as part of this masterplan. However the model provides an adequate representation to determine the impacts of the proposed road link.

The outputs of the 2041 AM peak Commuter model with and without the proposed road links is summarised in Table 5-3. The introduction of the proposed road link could result in an increase in peak hour volumes of 184vph in the AM peak on Moyes Crescent north of the proposed road link. The volume increase would primarily be due to the addition of the proposed road link being utilised to access the Centre. Peak volumes on this new road link indicate that it could carry approximately 2000vpd.

Further, the results of the microsimulation modelling show that there would be a reduction in peak hour traffic volumes on the other access roads to the Centre, including Starke Street, Luke Street and Flack Street, as a result of the proposed link road. It should be noted that the model does not consider the possible future generator of a structured car park as shown in Figure 5-1. It is considered that there would be additional increases in demand along the proposed road link if the structured car park was constructed in this location.

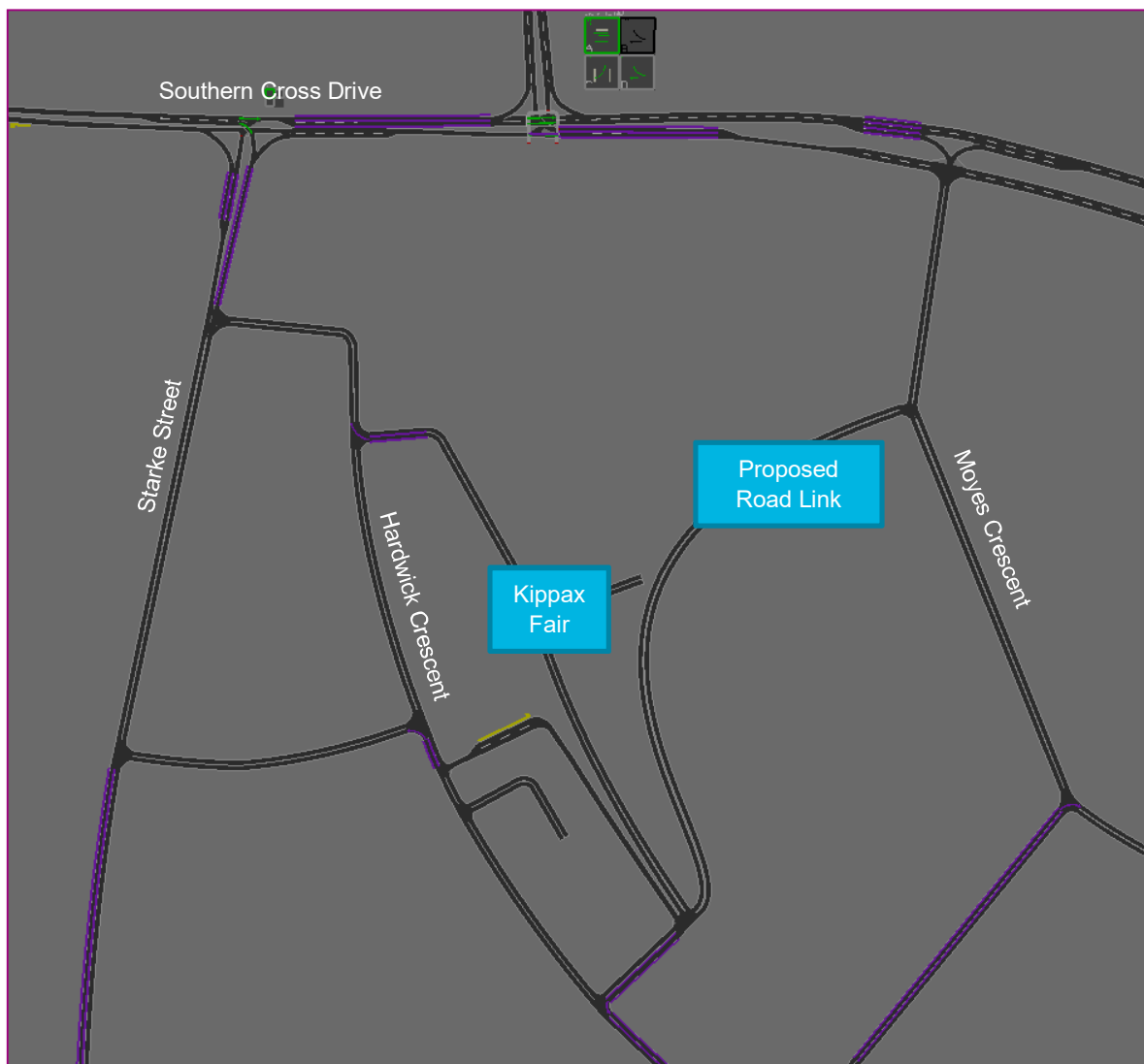


Figure 5-2 Kippax Group Centre Commuter Model

Table 5-3 Commuter Model Proposed Road Link Results (AM 2041 Model)

Road Link	Without Proposed Road Link (vph) (AM Peak)	With Proposed Road Link (vph) (AM Peak)	Change
Moyes Crescent Northbound (near SCD)	4	63	59
Moyes Crescent Southbound (near SCD)	98	223	125
Starke Street Northbound (near SCD)	196	178	-18
Starke Street Southbound (near SCD)	519	404	-115
Hardwick Crescent (between Starke Street and Hardwick Crescent) Eastbound	157	92	-65
Hardwick Crescent (between Starke Street and Hardwick Crescent) Westbound	40	28	-12
Luke Street Eastbound	206	151	-55
Luke Street Westbound	111	102	-9
Flack Street Eastbound	24	5	-19
Flack Street Westbound	7	3	-4
Hardwick Crescent (between Starke Street and Flack Street) Northbound	24	15	-9
Hardwick Crescent (between Starke Street and Flack Street) Southbound	57	35	-22
Hardwick Crescent (between Kippax Place and Flack Street) Northbound	31	21	-10
Hardwick Crescent (between Kippax Place and Flack Street) Southbound	77	37	-40
Proposed Road Link Northbound	-	62	62
Proposed Road Link Southbound	-	134	134

The model was observed during the peak period to determine the impact of the proposed road link on the intersection of Southern Cross Drive / Moyes Crescent. Figure 5-3 shows a screenshot from the model during the peak period. There was no significant queuing observed at the intersection and it was determined that improvements to this intersection are unlikely to be required as a result of the addition of this road link. However, it may need to be signalised to provide safer and more reliable access for public transport.

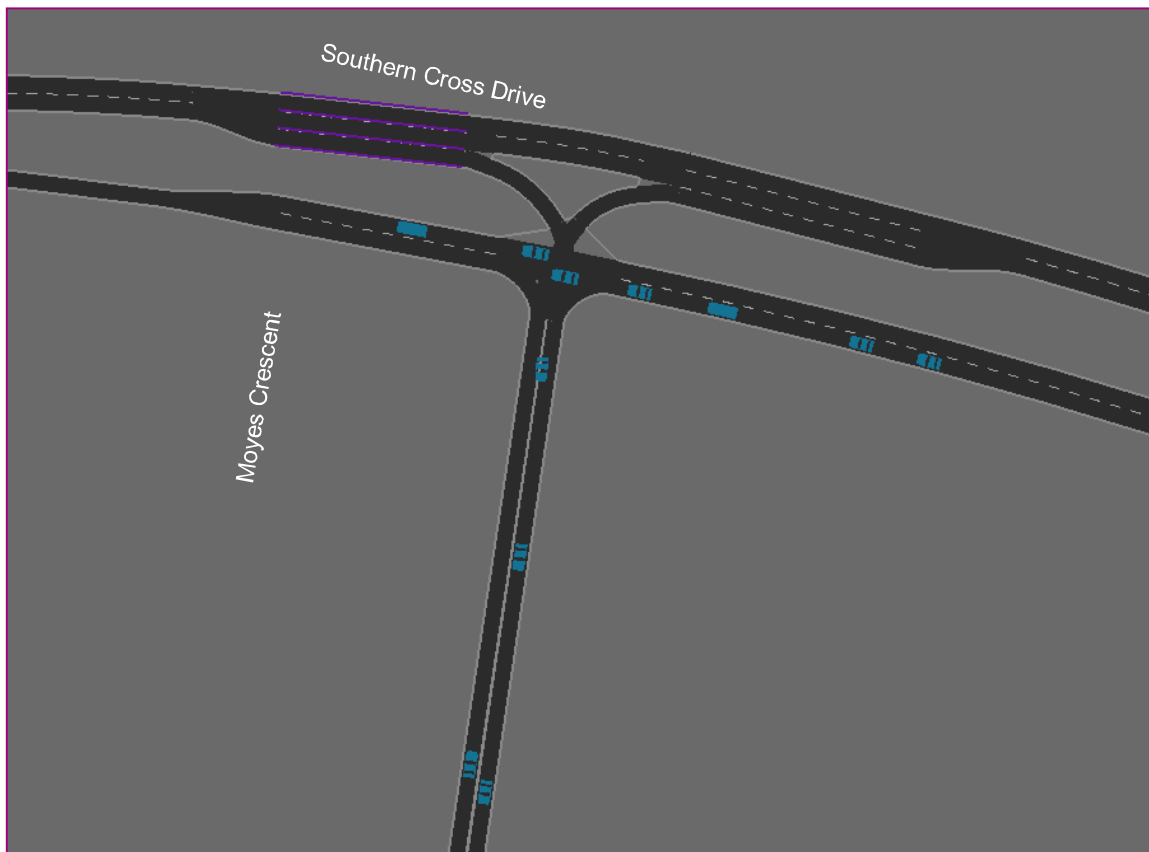


Figure 5-3 Southern Cross Drive / Moyes Crescent Microsimulation Model Observations

5.3 Road closure options

Two options for road closure have been promoted and are discussed at a high level in the text below.

- Option A - Hardwick Crescent East
- Option B - Kippax Place

It is assumed that these road closures would happen in conjunction with the relocation of the bus interchange and hence, this would not provide a point of conflict.



Figure 5-4 Closure Options

5.3.1 Option A - Hardwick Crescent East

One option discussed was the closure of Hardwick Crescent East south of the Bus Interchange. This section of road provides on short-term on-street parking for customers and goods vehicles. However, there are no businesses which actually address this section of road. This section of road currently provides layover parking for two buses although it is currently not a bus route.

This closure would allow safer travel paths for pedestrians from the off street parking to Kippax Centre. There is currently a zebra crossing at the northern end of this section of road.

The closure would be much more desirable and useful if there was an active shop frontage on Hardwick Crescent East. Currently it is a blank wall which faces Hardwick Crescent East. There is not expected to be any noticeable impact to the function of Hardwick Crescent west. If the future connection to Moyes Crescent was implemented, the closure of this link should have results in improved safety and capacity at this location. Taxi and loading zones would need to be considered.

5.3.2 Option B - Kippax Place

The section of Kippax Place is the link between Hardwick Crescent East and Hardwick crescent West. Closing this link would convert a current 4 leg cross intersection into a safer 3 leg Tee intersection. Closure of the link could allow an increase of up to 20 off street parking spaces, possibly more, depending on landscaping and pedestrian access provision.

The traffic volume redistribution would be dependent on the carpark access locations. This closure could shift more traffic to the Hardwick Crescent east / Flack Street intersection or past the Woolworths entry. The Closure would create further deviation for the proposed Moyes Street Connection and may reduce the attractiveness of this link.

Table 6-1 Existing Weekday Bus Services – Kippax Group Centre

Route No	Route Description	Frequency On / Off peak	AM Peak Hour Departure Frequency	PM Peak Hour Arrival Frequency
13	Fraser Terminus to Belconnen Community Bus Station via Kippax	60min / - (7:13am – 7:37pm)	1	-
16	Kippax Bus Station to Belconnen Community Bus Station	15-20min / 30min (6:25am – 10:31pm)	4	3
17	Kippax Bus Station to National Circuit via Belconnen Community Bus Station	20min / 30min (6:37am – 10:32pm)	3	3
44	Kippax Bus Station to National Circuit via Belconnen Community Bus Station	20-30min / 60min (6:06am – 10:23pm)	2	3
313	Fraser Terminus to Tuggeranong Bus Station via Belconnen Community Bus Station, City Bus Station and Woden Bus Station.	20min / 30min (5:59am – 11:18pm)	3	3
343	Fraser Terminus to Tuggeranong Bus Station via Belconnen Community Bus Station, City Bus Station and Woden Bus Station.	20min / 30min (6:21am – 11:33pm)	3	3
717	Kippax Bus Station to National Circuit via Belconnen Community Bus Station	30min / - (7:01am – 6:43pm) (Three services in each peak)	2	2
743	Fraser Terminus to Tuggeranong Bus Station via Belconnen Community Bus Station, City Bus Station and Woden Bus Station.	20-30min / - (6:32am – 6:15pm) (Four services in the AM peak, three services in the PM peak)	3	2
744	Kippax Bus Station to National Circuit via Belconnen Community Bus Station	30min / - (6:42am – 6:24pm) (Three services in each peak)	2	2
TOTAL			23	21

Figure 6-2 shows the existing location of the Centre bus stops and layovers. A bus station is located adjacent to the main entrance of the Kippax Fair Shopping Centre; this bus station is capable of accommodating two buses. Two bus layovers are located on Hardwick Crescent south-east of the main entrance. A secondary entrance to Kippax Fair is located to the north of the bus stops. The stops are all located within 200m of the Kippax Fair access points.

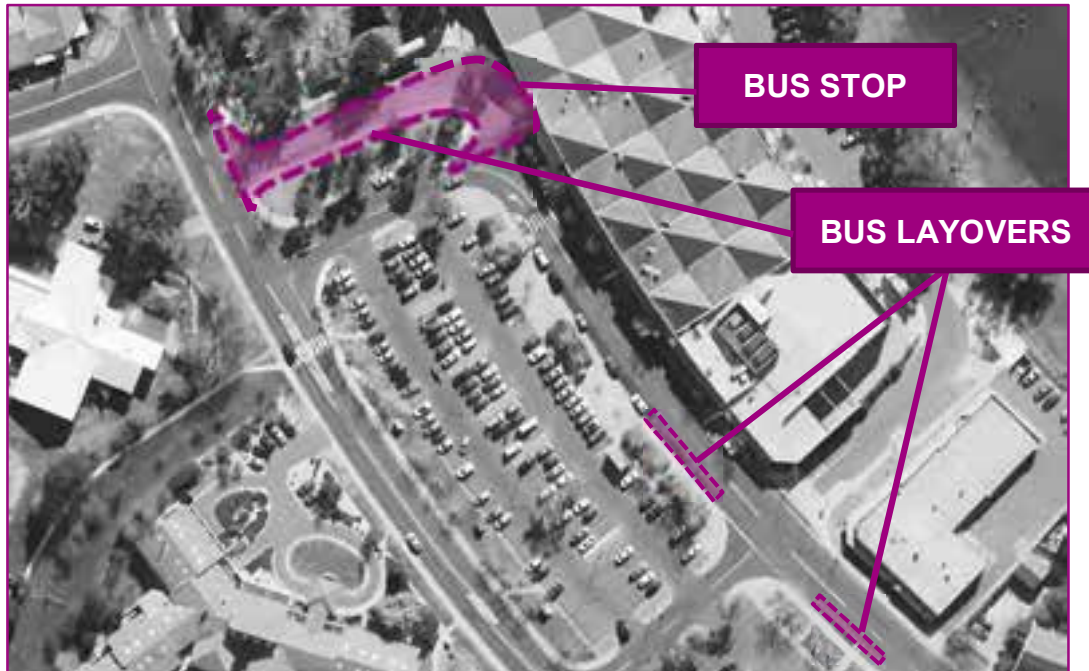


Figure 6-2 Existing Kippax Group Centre Bus Stops

6.2 Future Public Transport Services

Public transport should be at the heart of a Group Centre and provide safe, efficient and convenient access. Priority on public transport amenity should be placed higher than public parking. The current light rail masterplan shows the termination of light rail at Kippax. This is likely to result in Kippax being a major interchange hub and has been included in our considerations. A light rail terminus should be provided within close proximity to the Centre and future bus interchange. It should not be remote and should include passive surveillance. Where possible, cross platform interchanging between rail and bus should be accommodated as this is best practice for public transport interchanges.

The future public transport requirements for the Centre have been determined by analysing the existing public transport services and additional public transport services needed for the future West Belconnen Development (MRC, 2014). The additional bus services servicing the future West Belconnen area will provide public transport connectivity to the Centre. An additional three local bus services will be provided between West Belconnen and the Centre (MRC, 2014). To determine the likely interim bus and patronage numbers, a linear progression between the existing and ultimate projections was undertaken. Given Kippax is a 20year masterplan the ultimate buildout of West Belconnen and resulting bus services and patronage demand have been applied to the 2036 future year.

6.2.1 Interim Kippax Bus Interchange

The possibility of reformatting the existing bus interchange was considered. The available kerb length on the current bus stop is 45m. The available kerb length on the current layover opposite the library is also approximately 45m. A length of 45m would accommodate 2 buses allowing independent operation. This arrangement would require the existing bus layover opposite the library to be relocated.

There is some 10m of pavement between kerbs in the current bus station. Allowing 3m for a parked bus on either side, there is only 4m for through two-way movements for independent bus operation. The 4m shared overtaking lane could operate if buses always operate sequentially on a first on, first out basis. That is, where the bus bay is effectively also the through lane with no overtaking except under exception. However, this could create conflict and will need to be reviewed in further detail including swept path analysis if this idea is to be progressed. The island could be reduced to provide further road width and avoid this conflict.

The following tables detail the results of the analysis which indicates that a bus station with a capacity of two buses in each direction will be suitable up until 2031. The assumed suitability criteria is that there is less than a 10% chance of the third bus arriving while there are two buses parked at the bus stop. The 10% chance of third bus arrival is exceeded in 2036. The maximum probability of a 3rd bus arrival occurs in the AM peak. Details of the analysis are outlined in Section 6.2.3.

Woden and City bus interchanges work satisfactorily without zebra crossings and it is likely that this bus station could also work without zebra crossings. On-site monitoring and review is recommended.



Figure 6-3 Use of Existing Bus Station

Table 6-2 Maximum (AM) 2nd & 3rd Bus Arrival Probability

	2016	2021	2026	2031	2036
2nd bus arrival	21.06%	25.57%	30.33%	35.29%	40.39%
3rd bus arrival	4.08%	5.46%	7.05%	8.84%	10.83%

Table 6-3 3rd Bus Arrival Probability (AM & PM):

	2016	2021	2026	2031	2036
AM	4.08%	5.46%	7.05%	8.84%	10.83%
PM	1.89%	2.77%	3.83%	5.02%	6.34%

6.2.2 Future Kippax Bus Interchange

The new bus services that will connect to West Belconnen will result in an additional 12 peak hour bus movements through the Centre. The MRCagney Technical Note recommends the existing bus station is relocated to directly north of the Kippax Library. This location is supported in AECOM's assessment of the Kippax Master Plan. This location is central to the Centre, provides effective public transport circulation and is within 200m of potential future locations for a light rail terminus.

Three options have been considered for the proposed bus interchange layout. These options are illustrated in Figure 6-4 and Figure 6-5. The bus interchange layouts shown in Figure 6-4 and Figure 6-5 are indicative only. The length of the platforms has been assessed be in accordance with ACT Standard Drawing 3510 Pavement markings, bus stop details. For head of que operation we have assumed clear approach and departure for the first bus and clear approach with obstructed departure for the second bus. This yields 45m and has been taken as the minimum length for platforms. Design constraints may result in the length of platforms being less than the recommended length as per TAMS standards. Bus manoeuvrability and operation of the platforms will need to be confirmed through swept path analysis during the detailed design of the bus interchange. Details of the capacity analysis are provided in Section 6.2.3. All of the options presented have the capacity to accommodate the expected bus movements and patronage. However, each have other benefits and dis-benefits that need consideration with the wider master Plan, urban design objectives and safety considerations.

Good public transport planning separates inbound and outbound bus stops to aid passenger recognition of direction of travel. Most services used to terminate at Kippax whereas in the future most will be through services so the separated inbound and outbound stops will become increasingly important. The removal of the loading bay areas will need consideration with all options considered.

All of these layouts are indicative and would need further investigation in subsequent stages of design.



Figure 6-4 Future Kippax Bus Station / Interchange Location – Option 1

Option 1 utilises a similar layout to the interchange configuration outlined in the MRC report. It creates four separate platforms with a combined capacity of at least four buses in each direction with each platform could accommodate 2 buses. This assumes head of queue operation for each platform. Impacts to existing parking supply for Option 1 would be minimal (~10 spaces) and would not cause any significant impact to the Centre. There is a risk with the proposed station Option 1 that passengers will walk between stopped buses from the car park to the Aldi entry.



Figure 6-5 Future Kippax Bus Station / Interchange Location – Option 2

Option 2 utilises the existing roadway of Hardwick Crescent for southbound movements and a new one-way bus only link for northbound movements. It would create minimal impact on existing retail frontages, eliminate the need for a turn within the bus interchange and provide clear crossing points at each end resulting in less conflict. This option would enable three buses to operate with head of queue on each platform.

There is a strong pedestrian desire line in the location of the proposed bus interchange. Provision for pedestrians need be accommodated in the proposed bus interchange design.

Further, the design should ensure the existing retail frontages on Hardwick Crescent and Kippax Fair be impacted as little as practically possible. The location of the bus interchange shown in Option 2 allows for both of these locations to maintain activated frontages and provides additional area for potential retail development which could be utilised to activate the bus interchange via cafes, restaurants or other facilities in this location. Option 1 restricts pedestrian movement through the area and reduces the urban amenity within the Centre.

The reduced parking supply as a result of the development of Option 2 could be offset by a basement level car park beneath the proposed extension to the retail area in this location. Access to this car park would be provided from the north of the retail area as shown in Figure 6-5. Basement parking could allow additional development to occur on-site while not removing all parking from the core area and would minimise at grade conflict along Centre frontages.



Figure 6-6 Future Kippax Bus Station / Interchange Location – Option 3

A third bus interchange layout has been considered which involves three parallel bus bays oriented perpendicular to Hardwick Crescent (see Figure 6-6). This design incorporates two dedicated directional bays and one peak direction bay or terminating service bay. In the future model (2036) this arrangement would be adequate in terms of bus capacity were the bus bay lengths at least 45m (capacity of two buses in a head of queue arrangement). This layout will need to be confirmed in terms of geometric constraints and swept paths of Tag Steer buses. The location of this platform configuration could be inverted so the direction of travel can be changed. The location north-south along Hardwick Crescent can also be moved. It is desirable that the areas are bus only however, a shared provision with low frequency off peak service vehicles in the third bay might be possible pending detailed design and appropriate safety reviews. The location of the third platform along Hardwick Crescent West might also be possible.

6.2.3 Interchange Queuing and Capacity

An analysis of the bus distribution and likelihood of the queuing of buses at the future Kippax Bus interchange was undertaken to determine the required capacity of the station platforms. The bus distribution and queuing tool determines the passenger boarding time, alighting time and stop/start time to calculate the average services rate for each bus service. The bus service rate is applied to a basic probability function to determine the probability of a second or third bus arriving at the platform at any one time. The probability of the number of buses queued at any one time was determined and each of the options were analysed in terms of capacity in the 2036 scenario.

A head of queue operation has been assumed for each platform as this tends to be the most efficient method for a bus platform with a high % of through and continuing movements and minimises idling within the bus station. The distribution of the bus to each platform varies slightly between options but typically has inbound (to Belconnen or City) in one direction and outbound (from city / Belconnen to west Belconnen and other residential areas).

For the Option 1 layout (Figure 6-4) a capacity of two buses is required for platforms 2 and 3, and a capacity of at least one bus for platforms 1 and 4 in the 2036 scenario. The probability of an additional bus arriving at any platform during the peak period is less than 10%. The proposed layout can accommodate this.

For the Option 2 layout (Figure 6-5) it was determined that a peak capacity of three buses is required for platforms 1 and 2. The probability of an additional bus arriving at any platform during the peak period is less than 10%. The proposed layout can accommodate this.

The Option 3 arrangement (Figure 6-6) utilised a third platform which is effectively shared between services to provide additional capacity. The indicated layout would have sufficient capacity when the third platform operates as a secondary peak service platform (inbound services in the AM and outbound services in the PM). Appropriate way finding would need to be implemented to avoid any confusion or running between platforms to get to a bus.

The bus station and platform capacity calculations undertaken were reviewed against the Transit Capacity and Quality of Service Manual, Third Edition, Chapter 6, Bus Transit Capacity. This publication includes a bus capacity spreadsheet tool. This tool is similar in operation to the bus capacity tool developed and used by AECOM to determine the required platform capacity for the Kippax Master Plan. The review indicated that the analysis undertaken using the AECOM capacity tool aligned with the outputs of the Transit Capacity and Quality of Service Manual.

6.2.4 Bus Layover

A number of locations have been considered for potential future locations of bus layovers for the Kippax Bus Interchange, as follows:

- Hardwick Crescent northbound near the Gungahlin Raiders Club.
- Moyes Crescent northbound. Replace a portion of car parks with a bus layover which could also be used as parking bays during the weekend sports peak. The location is indistinctive and could be shifted north or south.
- Hardwick Crescent southbound near the Starke Street intersection (opposite the Kingsford Smith School). Consideration should be given to the pedestrian safety amenity of this location.

These locations are within 2 minutes travel time of the future bus interchange and provide adequate space in the existing verge / road reserve to accommodate a bus layover facility. These facilities would involve an indented bay and a modular services facility. These locations are shown in Figure 6-7. Currently most services terminate at Kippax where as in the future there will be a higher proportion of through bus movements. This is likely to reduce the bus layover demand.

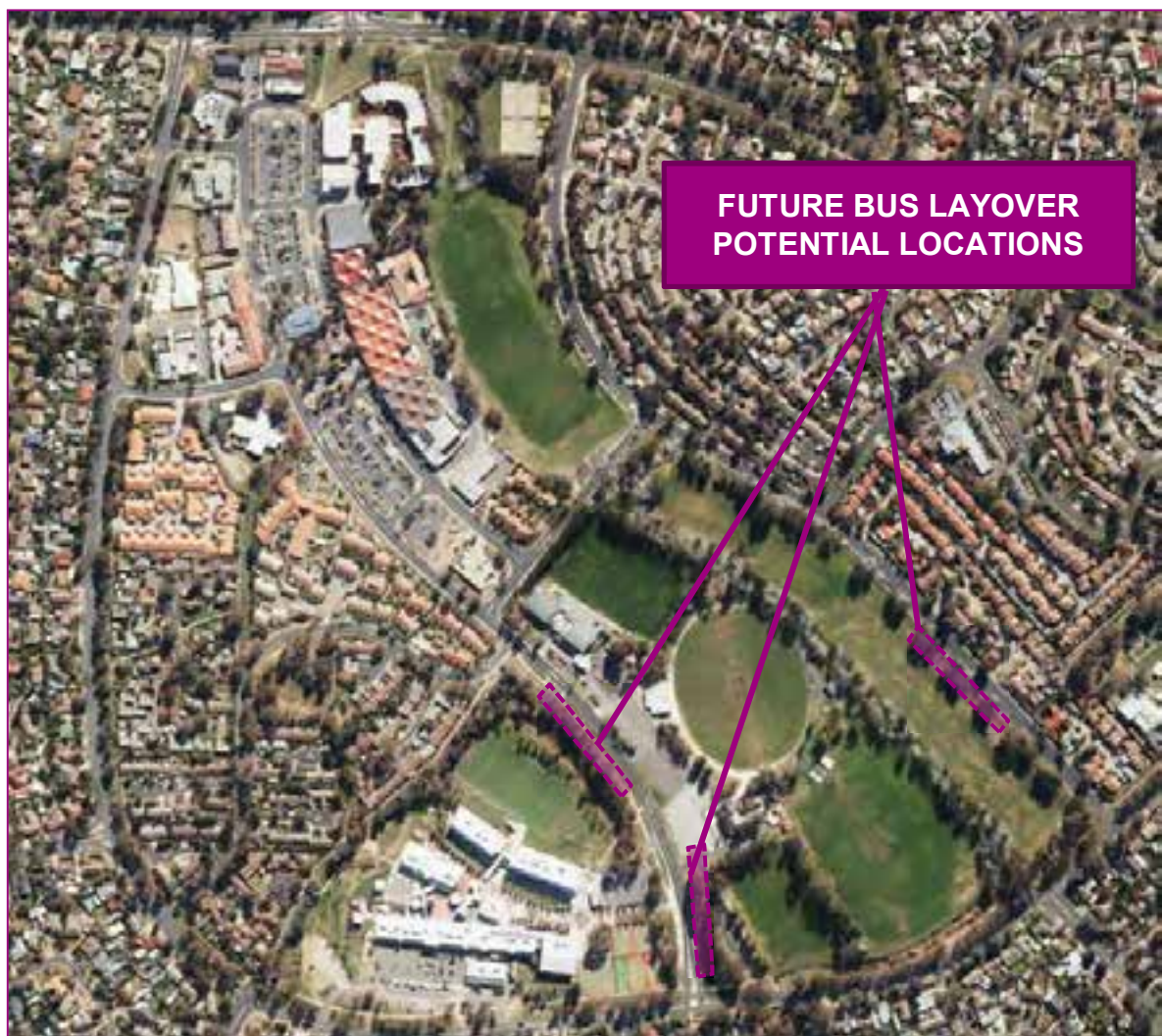


Figure 6-7 **Bus Layover Potential Locations**

6.2.5 Future Rapid Bus / Local Bus Routes

Future public transport bus routes for the study area would include an extension to the existing Blue Rapid (300 series) bus route to be inclusive of the Centre. The future development of West Belconnen will drive the expansion of the Centre as a public transport hub and warrant the extension of the rapid bus routes.

Figure 6-8 indicates the proposed future routes of the rapid bus services and local bus services including the location of existing and future infrastructure including the bus interchange, bus stops, park and ride and bike and ride facilities. Access options for the proposed bus interchange are also shown in Figure 6-8.

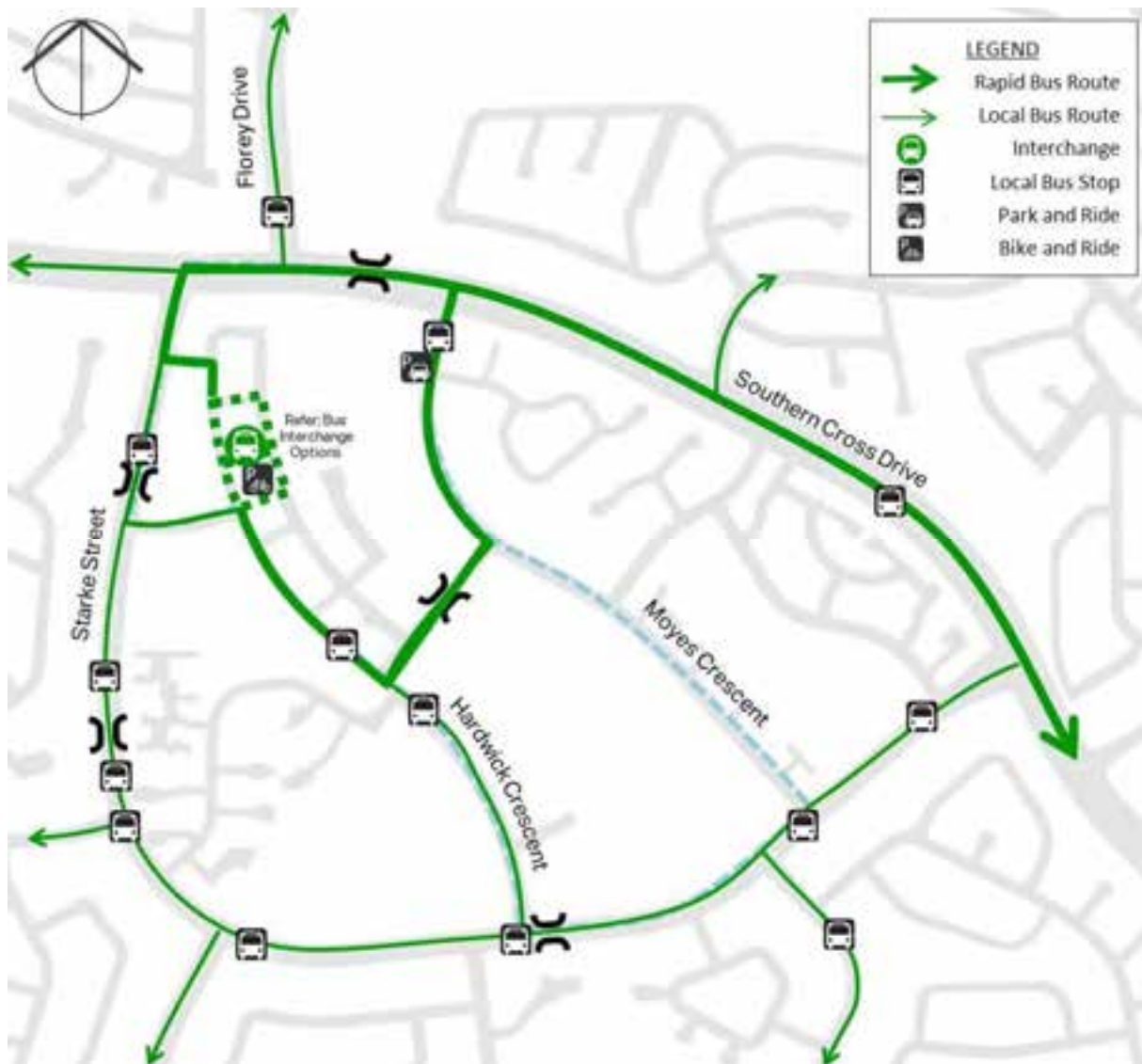


Figure 6-8 Future Kippax Public Transport – Rapid Buses

6.2.6 Future Light Rail / Local Bus Routes

The future Canberra light rail is proposed to be extended to Kippax along Southern Cross Drive before terminating at the Centre. Figure 6-9 indicates a possible future the proposed alignment for Canberra light rail (by AECOM) in relation to the Centre and local Kippax bus services. An indicative light rail route (as shown in Figure 6-9) will enable access to the Group Centre via Moyes Crescent before turning west directly north of the Kippax playing fields. The location of the future light rail terminal station shown in Figure 6-9 was preferred by AECOM to be in this location for the following reasons:

- The light rail masterplan shows that the service terminates at Kippax and good connectivity to the Centre and interchange with buses rather than travel time reduction should be prioritised (i.e. take it in from Southern Cross Drive SCD)
- The wide road reserve on Moyes Crescent make it the most practical location for the future Canberra light rail to access the Centre from Southern Cross Drive (SCD).
- Accessing the Centre via Moyes Street would avoid the potential delays associated with the intersections of SCD / Florey Drive and SCD / Starke Street.
- The proposed light rail station would be in close proximity to the proposed Kippax Group Centre bus interchange and Strong pedestrian connectivity could be achieved between modes
- It enables the light rail station to move into the Centre with good connectivity rather than be a periphery which has safety and amenity benefits.
- A line of sight between the two modes of transport could be achieved with the redevelopment of the centre.

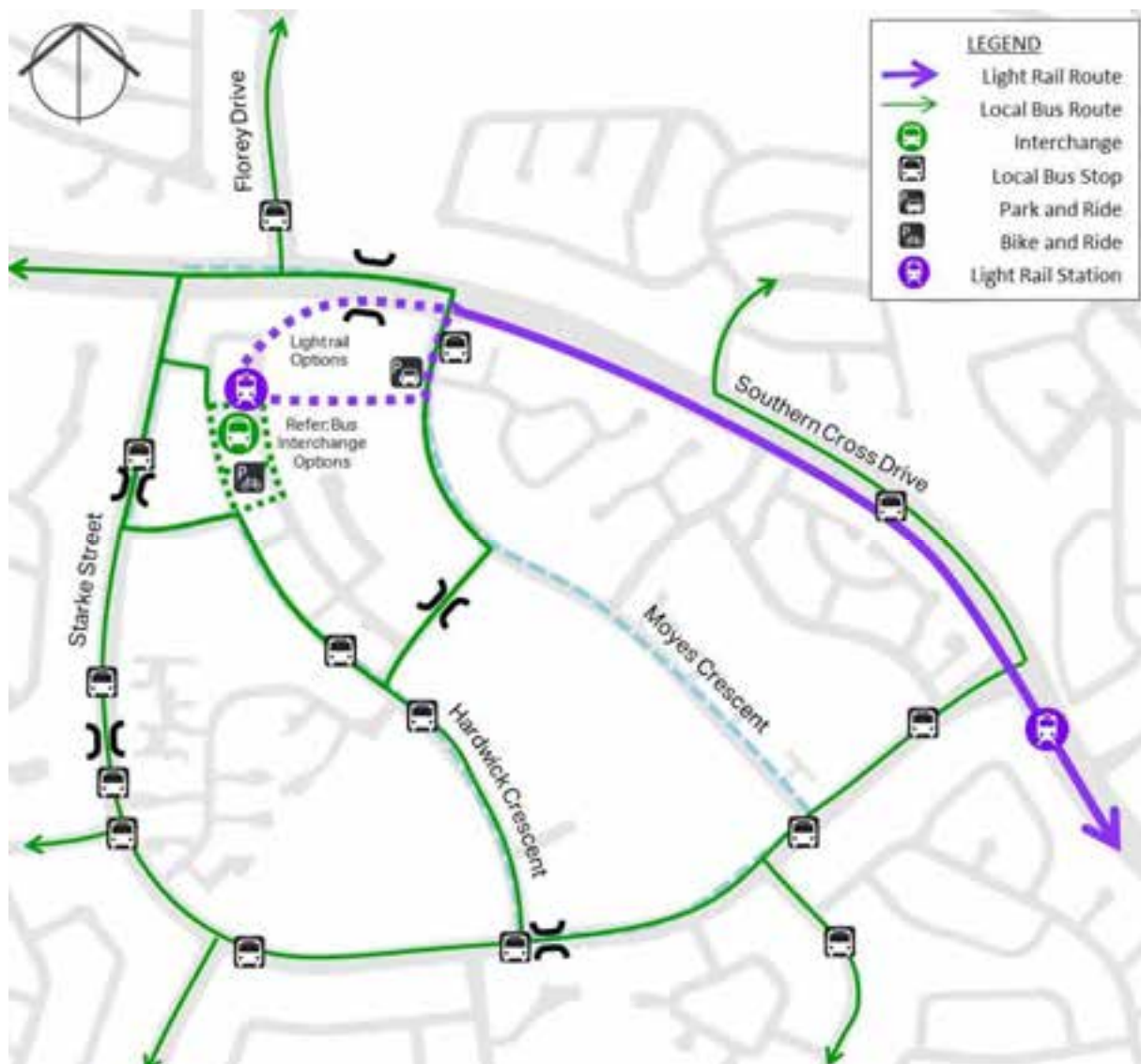


Figure 6-9 Future Kippax Public Transport – Light Rail

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Revision 2 – 24-Jun-2016

Prepared for – Environment & Planning Directorate – ABN: 31432729493

7.0 Active Travel

7.1 Existing Draft Master Plan

The existing Kippax Draft Master Plan indicates the current pedestrian and cyclist paths throughout the Centre area. It is apparent that there are key issues in terms of pedestrian connectivity within the centre. The key pedestrian connectivity concerns are in relation to the current pedestrian barrier of Kippax Fair and the poor connectivity between Kippax Fair and the businesses in the western portion of the core of the Centre. The poor connectivity in this area is due to the Hardwick Crescent central parking facilities reducing the pedestrian permeability of the area and increasing the walking distance between local businesses.

7.2 Existing Pedestrian Demands

Pedestrian movements throughout the Centre are generally focussed around Kippax Fair (including ALDI and Woolworths) as the focal pedestrian traffic generator. Other key pedestrian traffic generators include the Hardwick Crescent West retail sector, the Kippax Place retail sector, the Kippax Bus Stop and the Magpies Sports Club. The existing key pedestrian movements throughout the Centre are summarised in Figure 7-1.



Figure 7-1 Existing Pedestrian Demand Paths

7.3 Existing Bicycle and Pedestrian Networks

The existing bicycle and pedestrian networks adjacent to the Centre are shown in Figure 7-2. It identifies the nearby shared paths and on-road cycle lane provisions in the area. The shared use paths provide an adequate level of pedestrian connectivity within the local network. Pedestrian connectivity within the Centre is relatively poor. The existing Kippax Fair building does not provide pedestrian permeability acting as a barrier between the Centre core area and the Kippax playing fields.

On-road cycle lanes are provided on Southern Cross Drive west of the Florey Drive intersection. They provide indirect links to Kingsford Smith Dr and Belconnen, as beyond this point cyclists detour via Latham and Florey on the winding off-road path. A Bike and Ride cage is located on Hardwick Crescent within the Centre.

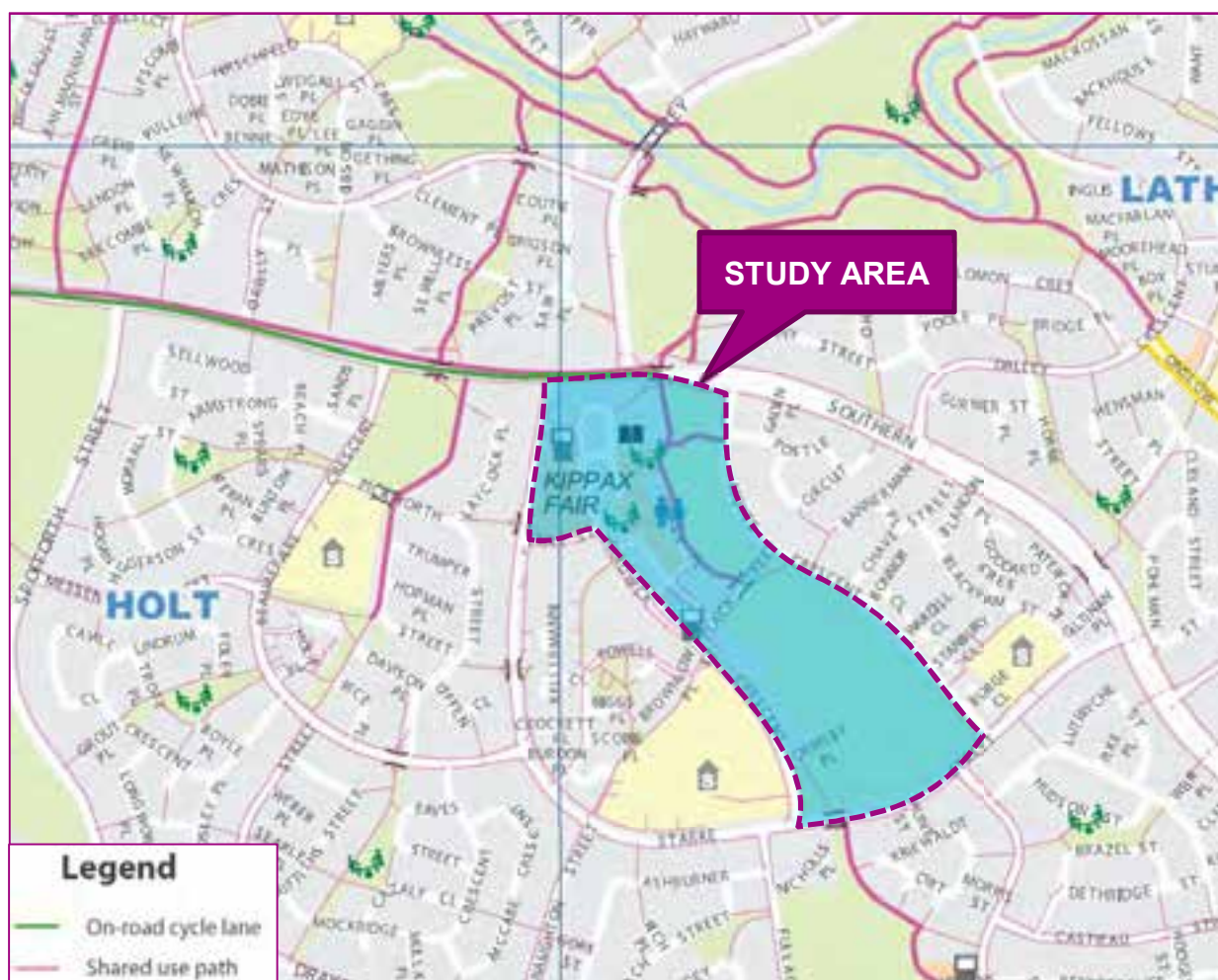


Figure 7-2 Canberra and Queanbeyan Walking and Cycling Map

7.4 Future Pedestrian and Cyclist Movement

The proposed future pedestrian and cyclist movements throughout the Centre and the surrounding areas are summarised in Figure 7-3. The key improvement in the future pedestrian/cyclist connectivity for the Centre is the extension of the shared-use paths to the east of Kippax Fair, providing a formalised connection for the north-south movements and the proposal of a shared path in the northern verge of Southern Cross Drive.

Further, a pedestrian public transport link is proposed between the future bus interchange location and the future light rail station location. A visual and physical connection between these two modes of transport is vital to the uptake of public transport within the Centre; the location of this link will be dependent on the final locations of the future bus interchange and the future light rail station. Redevelopment of Kippax Fair should ensure this link is improved and provides a high level of pedestrian amenity and pedestrian permeability.

Signalised pedestrian crossings are currently provided at the intersection of Southern Cross Drive and Florey Drive. Based on works undertaken by Roads ACT the intersection of Southern Cross Drive and Starke Street is due to be signalised within the next few years. This will include signalised pedestrian crossings across Starke Street and will also assist with bus movements turning right.

Extension to the existing on-road cycle provisions should occur in the future arrangement. This includes on-road cycling on Starke Street and extension to the on-road cycling on Southern Cross Drive. Pedestrian refuges should also be considered on Starke Street to assist with walkability and improve at grade crossings rather than reliance on underpass links.

A shared path has been proposed for the greenway between Hardwick Crescent and Moyes Crescent. This was seen as the most direct route, although this would need a more detailed study to be undertaken to determine the potential flood levels in this location. This link would formalise the existing goat track in this location. The existing infrastructure, available width, and driveway conflict were seen to present risks for a Hardwick Crescent shared path.



Figure 7-3 Future Kippax Pedestrian and Cyclist Movements

8.0 Service and Emergency Vehicle Access

8.1 Service Vehicles

Service vehicles can access the Centre from Southern Cross Drive via Starke Street to the west or via Moyes Crescent to the east. Heavy vehicles accessing Woolworths loading bay access Kippax Place via Hardwick Crescent in the south. ALDI's loading bay is accessed via Hardwick Crescent in the north of the Centre. Other businesses within the Centre are typically serviced via small rigid vehicles which utilise the loading zones provided within the at-grade car parks.

Access movements are summarised in Figure 8-1.

8.2 Emergency Vehicles

Emergency vehicles accessing the Centre via Southern Cross Drive can connect to the centre via Starke Street to the west and Moyes Crescent to the east. No notable barriers have been observed within the Centre which could restrict the ingress or egress of emergency vehicles from the centre. Emergency vehicles may access the Centre from the following locations:

- Lathlain Street, Belconnen (Ambulance/Fire)
- Lhotsky Street, Charnwood (Ambulance/Fire)
- Benjamin Way, Belconnen (Police)

Access movements are summarised in Figure 8-1.

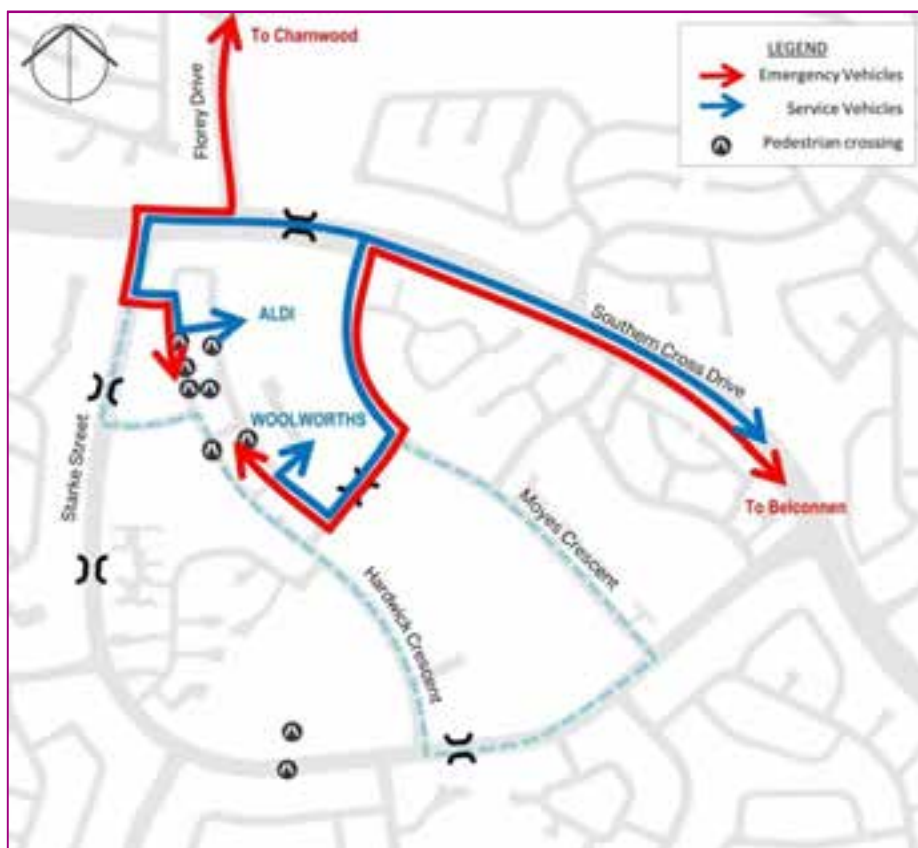


Figure 8-1 Emergency and Service Vehicle Access

9.0 Synthesis and Preferred Scheme

9.1 General

The above analysis of the draft Kippax Master Plan includes the development of a number of transport options consistent with the intent of the future development of the Centre. The determination of the preferred scheme was achieved through the presentation of a number of options to EPD. Public transport should be at the heart of a Group Centre and provide safe, efficient and convenient access. The current light rail masterplan shows the termination of light rail at Kippax. A light rail terminus should be provided within close proximity to the Centre and where possible, cross platform interchanging between rail and bus should be accommodated as this represents best practice for public transport.

9.2 Preferred Scheme

The preferred scheme involves the incorporation of the essential features of the analysis which encompass the overall objectives and intent of the Kippax Master Plan.

The key infrastructure works recommended as part of the preferred scheme are:

- Development of a bus interchange to the north of the Kippax Library parallel to Hardwick Crescent and creation of a pedestrian zone along the northern frontage of Kippax Fair and ALDI. There is flexibility to shift the bus interchange further north if it presents a superior connection dependant on adjacent land planning and location of the light rail terminus.
- Construction of an underground public car park adjacent to the proposed bus interchange / beneath the proposed pedestrian zone.
- Construction of structured car park located to the north east of Kippax Fair, partially located in the location of the existing Health Facilities building.
- Construction of a link road from Moyes Crescent to the structured car park and the existing Kippax Place and Hardwick Crescent. – access to the Aldi service dock and adjacent development could be accommodated though this new link as an alternative
- Development of a pedestrian access link between the proposed bus interchange and the assumed location of a possible future light rail station. This will require redevelopment of the northern portion of Kippax Fair to transform this area into and pedestrian friendly zone.
- Considers two options for a light rail link into the Centre for consideration in future planning assessment.

The preferred scheme will achieve the following outcomes:

- Improve the public transport facilities within the Centre and relocate the bus facilities north of the existing Kippax Library.
- Relocate the business core of the Centre to the north of the Kippax Library.
- Develop a future structured public car park in a suitable location for servicing the Centre's local businesses whilst shifting the core of the centre north.
- Improve transport access/egress options for the Centre.
- Improve the pedestrian amenity within the Centre.
- Provide a location for the future light rail alignment and station and the future amenity of this facility.
- Activate the core of the Centre as a pedestrian friendly area.
- Activate the rear of Kippax Fair with the addition of a road frontage. This will potentially allow for development to the rear of Kippax Fair.
- Allow for retail/residential development to the south of the Kippax Library in the location of the existing bus stop and at-grade car park.
- Provide improved connectivity between alternate travel modes (car, bike, bus, train, walk).

The key features of the preferred scheme are summarised in Figure 9-1.



Figure 9-1 Preferred Scheme Key Features

Appendix F

DFP Design Report

DEVELOPMENT SITE

Holt: Block 4 & Part B5 S88, Part Blocks 37, 47 & 66 Section 51, Blocks 6, 22, 36, 64 Section 51, and Part of Kippax Place Road Reserve.



DISCLAIMER

The Schemes (drawings documents information and materials) contained within this Report have been prepared solely for the purpose of providing information about potential schemes. The materials should not be considered to be error free or to include all relevant information. Further interrogation of the site including Site Investigation Reports and architectural schemes are to be tested prior to yield potential being confirmed. Nothing in this Report in any way constitutes advice nor does the transmission or sending of these materials create any contractual relationship. Neither DFP nor any employee's agents or contractors will be liable for any direct or indirect loss or damage you may suffer or incur arising directly or indirectly from the use of any materials from this Report.

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Subject to any law to the contrary and to the maximum extent permitted by law, DFP and its employee's agents or contractors disclaim all liability for any loss or damage suffered or incurred by a person acting or relying on the information provided in, or omitted from this Report. Given the limitations of our analysis, the Report should only be one input into, and not be relied upon solely, for any decision regarding the market process.

The following are selected excerpts from the TPV 361;



Figure 2 Ground floor uses and built form

R3

This rule applies to the ground floor residential area shown in Figure 2.

Residential uses are permitted at the ground floor level to a maximum depth of 20 metres measured from the frontage addressing urban open space towards Moyes Crescent.

C3

Ground floor residential uses comply with all of the following:

- are located generally in accordance with the area shown in Figure 2
- front and address the open space between the group centre and Moyes Crescent
- do not dominate ground floor commercial spaces.

1.1 Ground floor uses

R1

This rule applies to blocks with frontages to primary active frontages in C21 shown in figure 1.

Only the following uses are permitted at the ground floor level for the length of the primary active frontage:

- a) *business agency*
- b) *club*
- c) *community activity centre*
- d) *drink establishment*
- e) *financial establishment*
- f) *hotel*
- g) *indoor entertainment facility*
- h) *indoor recreation facility*
- i) *public agency*
- j) *restaurant*
- k) *SHOP.*

This is a mandatory requirement. There is no applicable criterion.



Figure 4 Building heights and set backs

2.4 Building heights

R11

The maximum *height of buildings* is two storeys, except for the following areas shown in Figure 4:

- a) area 'a'— six storeys and a maximum of 20 metres in height
- b) area 'b'— three storeys and a maximum of 11 metres in height
- c) area 'c' – five storeys and a maximum of 17 metres in height.

Plant room set back a minimum of 3 metres from the building facade of the floor immediately below is not included in the number of storeys.

C11

This is a mandatory requirement. There is no applicable criterion.

2.3 Setbacks

R8

This rule applies to buildings fronting Hardwick Crescent as identified on Figure 4 and buildings fronting primary active frontages as identified on Figure 1.

Buildings comply with all of the following:

- a) maintain a maximum podium height of 2 storeys and 9 metres
- b) development above the podium is setback a minimum of 3 metres excluding balconies.

C8

This is a mandatory rule. There is no applicable criterion.

R9

This rule applies to development fronting Hardwick Crescent as identified on Figure 4. Buildings have a zero front setback at ground floor and podium levels.

C9

Buildings achieve all of the following:

- a) a continuous building facade to the street
- b) building alignment is consistent with active uses at the ground level.



Figure 5 – future roads, pedestrian paths, public spaces and community buildings

2.6 Plot ratio

There is no applicable rule.

C14

Plot ratio achieves consistency with the desired character.

2.9 Heat island effect

There is no applicable rule.

C19

Development ensures no net gain of urban heat.

Compliance with this criterion is demonstrated in a microclimate assessment report by a qualified professional which details building and place design and use of mitigating measures including:

- a) low thermal mass, high albedo and or high emissivity building materials and/or finishes
- b) inclusion of canopy trees to achieve an overall minimum of 30% shade across the commercial zones of the Kippax Group Centre, measured at mature tree height or an equivalent area should be achieved through planting on structures
- c) a minimum of 30% permeable surfaces across the commercial zones of Kippax Group Centre
- d) use of water features
- e) appropriate location of open space and buildings
- f) other types of cooling measures such as green roofs, vertical gardens and shade structures.

4.2 Off-site works for the development of the group centre expansion area	
<p>R24 XXX</p> <p>There is no applicable rule.</p>	<p>C24</p> <p>This criterion applies to the group centre expansion area shown in Figure 5.</p> <p>Development of the group centre expansion area must include the following off-site works that are required to be designed and constructed to the satisfaction of the Transport Canberra and City Services Directorate:</p> <ul style="list-style-type: none"> a) upgrade the open space identified in area A in Figure 5 consistent with all of the following: <ul style="list-style-type: none"> i) a flood investigation report demonstrating that development in the expansion area does not increase flood risk in Area A ii) details of flood mitigation measures and water sensitive urban design works to be implemented as off-site works b) demolish the existing community building and construct a new community building as identified in Figure 5 c) construct a new road identified in Figure 5 consistent with all of the following: <ul style="list-style-type: none"> i) construct road A generally in accordance with Figure 5 ii) construct road A such that it can be connected road B to form a through road iii) provide basement access to development in the group centre expansion area from road A d) construct a new pedestrian path identified in Figure 5 consistent with all of the

Rules	Criteria
	<p>following:</p> <ul style="list-style-type: none"> i) construct path A generally in accordance with Figure 5 ii) construct path A such that it can be connected to path B to form a thoroughfare e) construct the new skate park in a central location within the urban open space area identified in Figure 5 consistent with all of the following: <ul style="list-style-type: none"> i) is outside the drainage line ii) has good passive surveillance from surrounding streets and residential areas. <p><i>Note: the pedestrian path within the shopping centre would only be publicly accessible during opening hours.</i></p>
<p>R25 XXX</p> <p>There is no applicable rule.</p>	<p>C25</p> <p>This criterion applies to road B identified on Figure 5</p> <p>Development of the blocks containing and/or fronting part B of the new road must be consistent with all of the following:</p> <ul style="list-style-type: none"> a) construct road B consistent with Figure 5 for the length of the block b) construct road B such that it can be connected to road A to form a through road c) design and construct the road to the satisfaction of the Transport Canberra and City Services Directorate.
<p>R26 XXX</p> <p>There is no applicable rule.</p>	<p>C26</p> <p>This applies to path B identified on Figure 5</p> <p>Development of blocks containing and/or fronting the pedestrian path B must be consistent with all of the following:</p> <ul style="list-style-type: none"> d) construct path B as identified on Figure 5 e) construct the path B such that it can be connected to path A to form a thoroughfare f) design and construct the off-site parts of the path to the satisfaction of the Transport Canberra and City Services Directorate.

Site Context

The following provides a summarised description of the site:

- Section 51 is currently largely undeveloped open grassland/playing fields;
- Section 88 contains the existing Holt Library and a children's (open space) play area.



Image 1. Aerial view of the subject sites showing their location either side of the Kippax Fair shopping centre.

INDICATIVE PLANNING SCENARIO

The objective of this study is to test the site for possibilities and constraints that would affect future development and to provide an indicative yield to aid the testing of existing infrastructures' capacity to accept development uplift (Site Investigation Reporting), not to establish saleable yield. The following development scenarios are indicative only and can only be confirmed with Planning Authority review and/or development consent (such as an approved DA).

OPTION A – CONSOLIDATED BLOCK – NEW DEVELOPMENT COMBINED WITH REDEVELOPMENT OF THE KIPPAX FAIR SHOPPING CENTRE



Image 2. Indicative layout showing expansion of the Kippax Fair consolidated with a new Block behind the shopping centre to the east.



OPTION A – CONSOLIDATED BLOCKS – MIXED USE

Option A considers the development of Section 51 by the owners of the Kippax Fair. This scenario appears to be aligned with the (perceived) intentions of the TPV 361.

In this scenario, retail ground floor could deliver a range of specialty retail, food and beverage outlets, as well as multiple, large floorplate supermarkets. The Hardwick Crescent frontage could have 5 floors of apartments on top of the retail offering as well as residential development up to 3 storeys (including ground floor) at the rear of the site overlooking green open space. A 'green spine' is envisioned to link the open space and broader Holt residential catchment areas to the east with the plaza space, Library and new Hub building to the west.

Yield Analysis

Commercial Ground Floor

This Option considers a 'strip mall' type arrangement fronting Hardwick Crescent with 2 x large floorplate supermarkets in the wings either side of a central Food and Beverage (**F&B**) area that would benefit from landscaped open space surrounds.

Indicative areas are as follows;

Street Retail = **2,300sqm** (1,500sqm + 1,800sqm)

Other Ground Floor Retail = **7,000sqm** (3,400 + 3,600sqm)

Supermarkets = **8,100sqm** (4,000sqm + 4,100sqm)

Total GBA = 17,400 x 80% efficiency = 13,920 GFA

F & B = **GBA 1,400sqm** (700sqm + 700sqm) x 80% efficiency = **1,120 GFA**

Community Hub Building

2 Storey New Hub = **GBA 1,500sqm** (1,000sqm GF + 500sqm 1st Floor) x 80% efficiency = **1,200 GFA**

Residential Development

This option shows 5 floors of apartments on top of the Hardwick Crescent 'strip mall'. The building typology considers an 18m wide double loaded corridor arrangement. Gross Building Area (**GBA**) per floor is approximately 3,950sqm. For the purpose of this study, 75% efficiency for building design and an average apartment size of 90m² is used to calculate dwelling numbers. Using this calculation, 33 apartments per floor are achieved.

Tower Residential

Total **GBA 19,750sqm** (5 floors of typical 3,950sqm) x 75% efficiency = **14,800 GFA**

Terrace Housing

Considering 5.5m wide, 3 storey terrace style housing with carports for the eastern boundary looking onto the open space and Moyes Crescent beyond, approximately **30 dwellings** are achieved.

PARKING

Parking generation rates used are;

- 1 space per single bedroom, 1.5 spaces per 2 bedroom, and 2 spaces per 3 or more bedroom apartments plus 1 visitor park per 4 apts. For this study, an average of 1.5 car spaces/apartment

is used plus 0.25 for visitor, **total 1.75/apt.**

- 2.25 x cars are allocated per terrace dwelling
- Commercial is 5 car spaces/100sqm GFA for SHOP and 10 spaces/100sqm for Food & Beverage.
- The Hub is considered to be a 'Community activity centre' and may require 4 spaces/100m²GFA

An average 35m² per parking space is used to calculate potential basement parking area.

Height	Use	GFA	Dwellings	Car parking	Car parking area (basement)
Ground Floor	Retail	13,920	-	696	24,360
Ground Floor	F&B	1,120	-	112	3,920
Ground + 1 (2 Floors)	Hub	1,200		48	Anticipate on-street
Floors 1 - 6 (5 Floors)	Residential Apts	14,800	164	287	10,045
Ground +2 (3 Floors)	Residential Terraces	4,500	30	68	Anticipate on site & on-street
		TOTAL 35,820m²	TOTAL 194	TOTAL 1,222	TOTAL 38,325

NOTE; It is not known at this time how much parking can be accommodated on-street and/or off-set by existing parking. The amount of basement parking indicated in the above table would require 2 subterranean levels. This is considered to be a major limiting factor for development due to cost. However, the large land parcel in this Option may see a 'mega' basement under the entire site which would offer efficiencies in layout. This combined with on-street parking may allow for 1 x level of basement only.

OPTION B - NEW DEVELOPER



Image 3. Indicative layout showing development for a newly created Block separate to the Kippax Fair.



OPTION B - INDICATIVE DEVELOPMENT – MIXED USE

Section 51 (NEW BLOCK CREATED) – RETAIL GROUND FLOOR + RESIDENTIAL DWELLINGS

Option B explores an indicative outcome if Section 51 was developed separately to the existing retail on Hardwick Crescent (existing Kippax Fair Shopping Centre).

This indicative development scenario studies Ground Floor (**GF**) commercial/retail use with possible residential apartments above facing Kippax Place. This development is considered to be a type of 'shop top housing' but only 2 storeys are allowed (the 6 storey allowance is on top of the Kippax Fair – see Option 1). At the rear of the site, 3 storey apartment buildings (including Ground Floor) may be delivered.

The retail offering could include specialty retail, food and beverage outlets and could also attract another full line supermarket.

A problem with this concept is the blank façade along Kippax Place (see *Image 4* below) which somewhat sterilizes activation of this street. However, if the Kippax Fair was also redeveloped, it could offer double frontage with activated street edges on Hardwick Crescent as well as Kippax Place.



Image 4. Back of the Kippax Fair presents a blank façade to Kippax Place (*Google Street view*).

Yield Analysis

Commercial Ground Floor

This Option considers two (2) large boxes which could house a supermarket and a mall type shopping.

Indicative areas are as follows;

Ground Floor Retail = **GBA 8,250sqm** (3750sqm + 4,500sqm) x 80% efficiency = **6,600 GFA**

Residential Development

This option shows 1 floor of apartments on top of the Kippax Place frontage in a 'shop top housing' typology.

One (1) storey apartments with a GBA of approximately 3,650sqm at 85% efficiency and an average apartment size of 90m² would yield 34 apartments.

Shop top housing

GBA 3,650sqm (1,900sqm + 1750sqm) x 85% efficiency = **3,100 GFA**

The three (3) storey apartment buildings on the eastern boundary use an 18m wide double loaded corridor arrangement. Gross Building Area (**GBA**) per floor is approximately 3,500sqm. For the purpose of this study, 75% efficiency for building design and an average apartment size of 90m² is used to calculate dwelling numbers. Using this calculation, 29 apartments per floor/building are achieved.

Tower Residential

3 Storey Apts = **GBA 10,500sqm** (3,900 + 6,600 ~ 3 x typical levels of 1,300sqm + 2,200sqm) x 75% efficiency = **7,875 GFA**

PARKING

Parking generation rates used are;

- 1 space per single bedroom, 1.5 spaces per 2 bedroom, and 2 spaces per 3 or more bedroom apartments plus 1 visitor park per 4 apts. For this study, an average of 1.5 car spaces/apartment is used plus 0.25 for visitor, **total 1.75/apt.**
- Commercial is 5 car spaces/100sqm GFA for SHOP and 10 spaces/100sqm for Food & Beverage.

An average 35m² per parking space is used to calculate potential basement parking area.

Height	Use	GFA	Dwellings	Car parking	Car parking area (basement)
Ground Floor	Retail	5,600	-	280	9,800
Ground Floor	F&B	1,000	-	100	3,500
1 st Floor (1 Floor)	Residential Shop-Top	3,100	34	60	2,100
Ground +2 (3 Floors)	Residential Apts	7,875	87	152	5,320
		TOTAL 17,575m²	TOTAL 121	TOTAL 592	TOTAL 20,720

NOTE; It is not known at this time if the extension and new parking configuration of Kippax Place would be allowed. Some 170 car spaces are shown on street in these Options which would contribute significantly to viability as an offset to basement parking. The amount of basement parking indicated in the above table would require 1 subterranean ('mega' basement) level.

Appendix G

*Eco Logical Australia, Ecological
Assessment*

18 May 2021

Our ref: CAN21-18407

JPS Engineering Consultants
0417 434 996
John.Samoty@gmail.com

Attention: John Samoty

Dear John,

Re: Ecological assessment of the Kippax Group Centre expansion, Holt

We are pleased to submit our results of the ecological assessment for the Kippax Group Centre expansion in Holt, ACT, under the Variation to the Territory Plan (V361). It was found that the development will not have a significant impact on ecological values and no development constraints exist within the site that would require mitigation. See below for more detail.

BACKGROUND

The location of the development is at Kippax Fair Shopping Centre, 26 Hardwick Cres, Holt ACT 2615. The study area used in the assessment is presented in **Appendix A**, covering the urban open space between Kippax Place and Moyes Crescent.

Eco Logical Australia (ELA) understands that under V361 rezoning of urban open space controlled by the Parks and Recreation Zone Development Code will take place. As part of the due diligence for this development, ELA was engaged to conduct an ecological assessment of the site to identify any ecological values that may be a constraint for the development and, if necessary, provide mitigation advice.

The results of this assessment are intended for review by the client, Environment, Planning and Sustainable Development Directorate, and the ACT Conservator of Flora and Fauna to support the Variation to the Territory Plan.

METHODS

A desktop review of available literature and data was conducted to gain contextual information about the site and determine the likelihood of the presence of threatened species or ecological communities. This involved using the following resources:

- Protected Matters Search for threatened species / populations that may have been recorded recently in the area that are listed under the ACT *Nature Conservation Act 2014* (NC Act) and

the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), including important aquatic habitat or aquatic flora and fauna,

- Aerial imagery and Google Street View,
- ACTMapi.

ELA ecologist Cassandra Holt conducted the site visit on 7 April 2021 with the intent to identify:

- Trees occurring on site,
- Whether any potential habitat occurs on site for species or ecological communities listed under either the ACT *Nature Conservation Act 2014* or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*,
- Whether the proposed development is likely to trigger the requirement to undertake impact assessment under the *Planning and Development Act 2007* (PD Act) as a result of schedule 4 triggers.
- Any other constraints for development.

RESULTS

The Protected Matters Search Tool and ACTMapi did not identify any ecological values within the study area or the surrounds.

During the site inspection a variety of native trees, some of which were likely planted, were identified (see **Appendix B**). This included but is not limited to: *Eucalyptus rossii* (Scribbly gum), *E. melliodora* (Yellow box) and *Casuarina cunninghamiana* (River sheoak). Exotic Birch trees were also common. The ground layer in both the treed areas and the playing fields was dominated by exotic grasses (especially *Paspalum dilatatum*) and herbs (for example, *Plantago lanceolata* and *Trifolium* spp.).

The vegetation identified on site is not considered to constitute a native vegetation area as defined in the NC Act. As such, clearing of vegetation in the development area would not trigger the requirement to undertake an impact assessment under Schedule 4 of the PD Act.

A number of bird species common to urban areas were observed and are listed in **Table 1**.

Table 1: Bird species observed within the study area

Common name	Scientific name
Australian magpie	<i>Cracticus tibicen</i>
Common starling*	<i>Sturnus vulgaris</i>
Crested pigeon	<i>Ocyphaps lophotes</i>
Galah	<i>Eolophus roseicapilla</i>
Magpie-lark	<i>Grallina cyanoleuca</i>
Noisy miner	<i>Manorina melanocephala</i>
Red wattlebird	<i>Anthochaera carunculata</i>
Red-rumped parrot	<i>Psephotus haematonotus</i>
Striated pardalote	<i>Pardalotus striatus</i>
Sulphur-crested cockatoo	<i>Cacatua galerita</i>
Welcome swallow	<i>Hirundo neoxena</i>

Common name	Scientific name
Willie wagtail	<i>Rhipidura leucophrys</i>


*Introduced species

While these species are likely using the trees for shelter and foraging, none of the trees were old enough to contain any hollows that could be used for breeding and therefore the vegetation is not considered important habitat. The presence of mature, native street trees surrounding the study area means that connectivity through the urban landscape would not be significantly affected by the clearing of vegetation within the development site.

In addition, no threatened species were observed or are likely to be present in the area.

As a mitigation measure we recommend engaging an ecologist or fauna spotter-catcher to check the trees for nests prior to felling them and, if found, take appropriate actions to minimise the impacts through 'soft-felling', and transfer of any birds to a wildlife carer.

Yours sincerely,



Cassandra Holt
Ecologist
Canberra Office

Appendix A – Study area



Appendix B – Site photos



Photo 1: *Eucalyptus rossii* and exotic Birch trees on western side of the playing fields (Kippax Place)



Photo 2: Planted shrubs and street trees along eastern side of the playing fields (Moyes Crescent)



Photo 1: Various Eucalypts at north eastern corner of the study area



Photo 2: Example of exotic dominated groundcover at the site

Appendix H

*Correspondence with ACT Parks &
Conservation Service, EPSDD*



John Samoty <john.samoty@gmail.com>

FW: Trees and the Superb Parrot Section 51

1 message

[REDACTED] <[REDACTED]>
To: John Samoty <john.samoty@gmail.com>

Mon, May 10, 2021 at 3:25 PM

OFFICIAL: Sensitive

FYI

From: [REDACTED] <[REDACTED]>
Sent: Friday, 7 May 2021 3:12 PM
To: [REDACTED] <[REDACTED]>
Cc: [REDACTED] <[REDACTED]>
Subject: Trees and the Superb Parrot Section 51

OFFICIAL: Sensitive

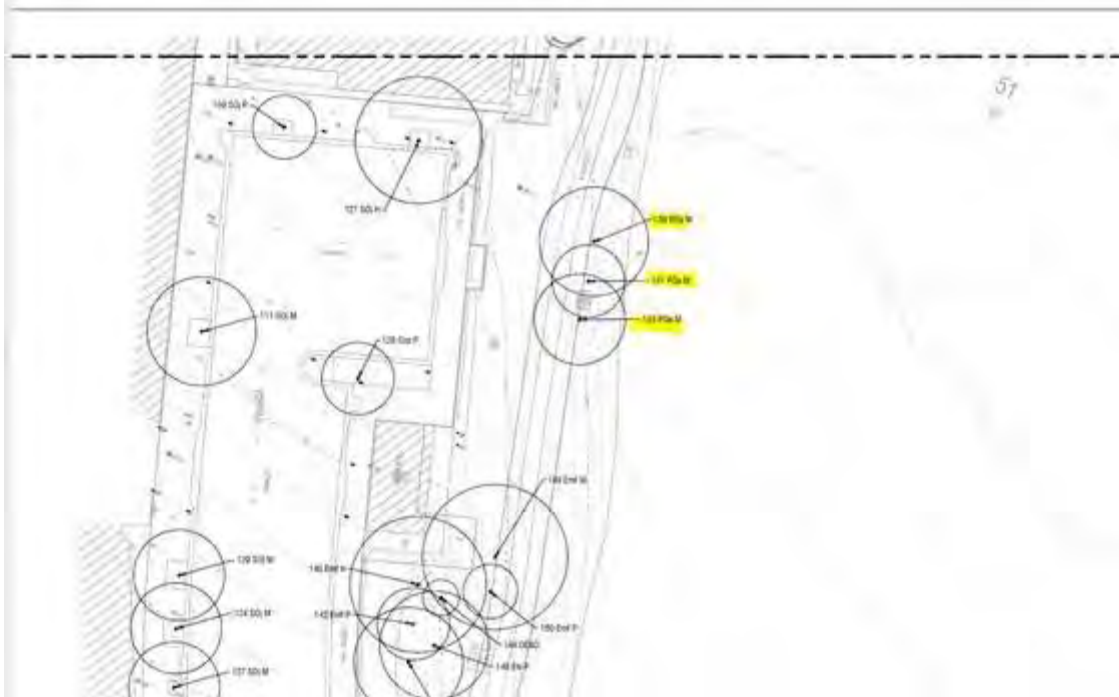
[REDACTED]

As discussed, thank you for providing the maps that show where there are important trees for the Superb Parrot in west Belconnen. If you agree with the wording below, this will be recorded in the Site Investigation Report and will be provided to appropriate government agencies and to a future developer.

- As discussed, the group of trees circled in blue (see Map 1), closest to the oval and the old health building have been shown to be important for the movement of the Superb Parrot in the area, but are not considered critical because no direct sightings of the bird have been recorded.
- Whilst this is the case in this circumstance, Parks and Conservation are keen to see trees protected where appropriate to enhance Superb Parrot habitat connectivity through these areas in the future.
- Our tree assessment (see Map 2) shows these trees as number 139, 141 and 143 as being Populus Alba – a weed species.
- The trees are also within the area under the 2019 Kippax Group Centre Master Plan and Territory Plan Variation number 361 for future expansion (part Section 51, Holt) (see Map 3).
- Given that the trees are not critical for the Superb Parrot at this site, it was agreed that rather than protecting the trees from future development, the best option would be to replace the trees with Yellow Box (*Eucalyptus melliodora*), as near as practicably possible within the Kippax Group Centre.
- Yellow Box is a species favoured by the Superb Parrot, for movement and shelter.
- As part of the future development within the centre, in line with the master plan and TPV 361, and in consultation with Parks and Conservation and the Tree Protection Unit TCCS, Yellow Box ~~can~~ plantings can be considered in Area A where there is not a high level of foot traffic. (see Map 3).
- Any tree removal/replacement would be undertaken in consultation with the community through a Development Application process.

Map 1: supplied by Parks and Conservation May 2021.
Assessment for Section 51 Holt, April 2021

Map 2: Tree



These documents reference Area A, as an area that should be considered to



Figure 5 Future roads, pedestrian paths, public spaces and community buildings

From: [REDACTED] <[REDACTED]@act.gov.au>

Sent: Wednesday, 5 May 2021 4:46 PM

To: C [REDACTED]

<[REDACTED]>

Cc: [REDACTED]

Subject: RE: Kippax ecological and tree assessments

OFFICIAL: Sensitive

Hi all

Please find attached a couple of reference maps for superb parrot habitat values at the site. Red points show superb parrot occurrences across the broader landscape (see *Landscape Context* map), and orange cells indicate sections of the Kippax site with high superb parrot movement or foraging values (see *Tree Protection* map). Apologies; these maps aren't amazing, lack legends, scales, etc. but I'm hoping they suffice for this initial discussion. I can provide better, if needed (let me know).

In summary, the broader landscape is a high movement area for the superb parrot, but the Kippax site specifically is not a hotspot of activity. If there is scope to protect the trees marked within the blue circles on the *Tree Protection* map (attached), this would be a great outcome for the species.

Hope this helps! Happy to take a call if you have any questions.

Cheers,

[REDACTED]

[REDACTED]

A/g Director Environmental Offsets / Senior Ecologist
ACT Parks & Conservation Service, EPSDD

[REDACTED]

From: [REDACTED] <[REDACTED]@act.gov.au>
Sent: Wednesday, 28 April 2021 3:11 PM
To: [REDACTED]; [REDACTED]
Cc: [REDACTED]
Subject: RE: Kippax ecological and tree assessments

OFFICIAL: Sensitive

[REDACTED],

Yes, as long as superb parrot considerations are included in the ecological assessment to [REDACTED]'s satisfaction we have no further comments.

Kind regards,

[REDACTED] Conservation Officer | Conservator Liaison

Phone: [REDACTED]

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