CPB CONTRACTORS | Downer

WARRINGAH FREEWAY UPGRADE

Construction Water Reuse Strategy

Western Harbour Tunnel and Warringah Freeway Upgrade

SSI-8863

Stage 2 – Warringah Freeway Upgrade

July 2022

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Contents

Document control

Approval and authorisation

Title	Warringah Freeway Upgrade Construction Water Reuse Strategy
Signed	
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Distribution of controlled copies

This Construction Water Reuse Strategy (CWRS) is available to all personnel and subcontractors via the Project document control management system. An electronic copy can be found on the Project website.

The document is uncontrolled when printed. One controlled hard copy of the CWRS and supporting documentation will be maintained by the Quality Manager at the Project office and on the project website [https://caportal.com.au/rms/wht].

Copy number	Issued to	Version

Glossary/ Abbreviations

Abbreviations	Expanded text
CEMP	Construction Environmental Management Plan
CoA	NSW Minister's Conditions of Approval
CPBD JV	CPB Downer JV
CSSI	Critical State Significant Infrastructure
CWRS	Construction Water Reuse Strategy
DIA	Discharge Impact Assessment
DPE	Department of Environment (NSW)
EIS	Environmental Impact Statement
EPL	Environmental Protection Licence
GPT	Gross Pollutant Trap
ISC	Infrastructure Council of Sustainability
OWRS	Operational Water Reuse Strategy
Project, the	Warringah Freeway Upgrade
REMM	Revised Environmental Mitigation Measure
RtS	Response to Submissions
SWTC	Scope of Works and Technical Criteria
TfNSW	Transport for New South Wales
UV	Ultraviolet
WFU	Warringah Freeway Upgrade

1 Introduction

1.1 Context

This Construction Water Reuse Strategy (CWRS) has been prepared to address the requirements of the Minister's Conditions of Approval (MCoA) for the Western Harbour Tunnel and Warringah Freeway Upgrade project, the Western Harbour Tunnel and Warringah Freeway Upgrade Environmental Impact Statement dated January 2020 (the EIS), the Western Harbour Tunnel and Warringah Freeway Upgrade Response to Submissions Report dated September 2020 (the RtS) and applicable guidance and legislation.

This CWRS considers water reuse options applicable to the construction phase of Stage 2 of the Warringah Freeway Upgrade Project as detailed in the Staging Report – Western Harbour Tunnel and Warringah Freeway Upgrade (SSI 8863). Operational water consumption, re-use and elimination are not considered within the scope of the report.

1.2 Background and project description

The Western Harbour Tunnel and Warringah Freeway Upgrade Project comprises a new motorway tunnel connection across Sydney Harbour, and an upgrade of the Warringah Freeway to integrate the new motorway infrastructure with the existing road network and to enable the future connection of the Beaches Link and Gore Hill Freeway Connection project.

The Warringah Freeway Upgrade Project (the Project) extends from the northern end of the Sydney Harbour Bridge to Willoughby Road, and will optimise traffic flow, reducing the number of merge points along with introducing a southbound bus lane. The upgrade will also improve Ridge Street and Ernest Street bridges.

The Environmental Impact Statement (EIS) was prepared and finalised in January 2020 to assess the impacts of construction and operation of the Project and was placed on public exhibition between 29 January and 30 March 2020. A Response to Submissions Report (RtS) was prepared and finalised in September 2020.

The Western Harbour Tunnel and Warringah Freeway Upgrade Project is classified as State Significant Infrastructure under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) and Clause 94 of the State Environmental Planning Policy (Infrastructure) 2007. The Project was declared Critical State Significant Infrastructure (CSSI) under Section 5.13 under the EP&A Act and Clause 16 of the State Environmental Planning Policy (State and Regional Development) 2011.

The Western Harbour Tunnel and Warringah Freeway Upgrade Project was approved by the Minister for Planning and Public Spaces on 21 January 2021 (CSSI 8863).

The proponent, Transport for NSW (TfNSW), has contracted the CPB Contractors and Downer Joint Venture (CPB Downer JV) for the design and construction of the Project.

1.3 Scope of this Strategy

This strategy addresses the water use requirements and reuse options for the construction phase of Stage 2 of the Western Harbour Tunnel and Warringah Freeway Upgrade project (The Project). Water reuse is limited to rainwater collected within the Project boundaries.

This strategy addresses and details the following issues:

- Water use requirements for surface works,

- Stormwater management and discharge during surface works construction activities, and
- Rainwater harvesting and management.

This Strategy does not consider the:

- Treatment and reuse of tunnel excavation or other groundwater,
- Treatment and reuse of sewerage,
- Treatment and reuse of any contaminated water, and
- Operational water reuse.

This CWRS considers water reuse options applicable to the construction phase of Stage 2 of the Warringah Freeway Upgrade Project as detailed in the Staging Report – Western Harbour Tunnel and Warringah Freeway Upgrade (SSI 8863).

An Operational Water Reuse Strategy (OWRS) will be prepared separately prior to commencement of operations of the project in accordance with CoA E127.

The CWRS will be submitted to the Secretary prior to the commencement of construction works and will be implemented throughout construction as applicable.

2 Purpose and objectives

2.1 Purpose

The purpose of this CWRS is to set out options for the reuse of collected stormwater and groundwater during construction of the Project.

2.2 Objectives

- Demonstrate sustainability leadership and continuous improvement,
- Optimise resource efficiency (materials, energy, water, land, waste) throughout the Project life cycle,
- Increase resilience to future climate,
- Deliver lasting value for stakeholders, and
- Implement innovative solutions in sustainable design and construction.

2.3 Targets

The Project specific water reuse requirements are detailed in the Conditions of Approval (CoA), Scope of Works and Technical Criteria (SWTC), and the Infrastructure Sustainability Council (ISC) IS Technical Manual Version 1.2(2018). Section 3 describes these requirements and where they are addressed within this strategy.

3 Project requirements

3.1 Ministers Conditions of Approval and Revised Environmental Mitigation Measures

A Water Reuse Strategy is required by Minister's CoA E127. A description of compliance with the requirements of CoA E127 and REMM WM5 and where they are addressed are detailed in **Table 3-1**

Table 3-1 Minister's Conditions of Approval relevant to this Strategy

Ref #	Condition Requirements	Reference	How Addressed
E127	A Water Reuse Strategy must be prepared, which sets out options for the reuse of collected stormwater and groundwater during construction and operation. The Water Reuse Strategy must include, but not be limited to:	This document	This strategy addresses the construction phase of the project. A separate strategy will be prepared for the operational phase.
	a) evaluation of reuse options;	Section 6	This section identifies potential water reuse options and evaluates their applicability based on Project constraints
	b) details of the preferred reuse option(s), including volumes of water to be reused, proposed reuse locations and/or activities, proposed treatment (if required), and any additional licences or approvals that may be required;	Section 7	This section identifies water consumption requirements and options to reduce potable water demand including site access management, dust management and site amenities
	c) measures to avoid misuse of recycled water as potable water;	Section 7	This section identifies mitigation measures to avoid the misuse / unnecessary wastage of water to be re-used on the Project
	d) consideration of the public health risks from water recycling; and	Section 6.1.3	This section advises that given no recycled/treated water is proposed for use then public health risks are negligible.

Ref #	Condition Requirements	Reference	How Addressed
	e) a time frame for the implementation of the preferred reuse option(s).	Section 7	This section includes the circumstances where potable water reuse options will be used noting no recycled/treated water is proposed for use.
	The Water Reuse Strategy must be prepared based on best practice and advice sought from relevant agencies, as required. The Strategy must be applied during construction and operation.	Section 6.1.6 Section 10	These sections highlight the considerations employed to determine potential reuse options and concludes no advise was sought from relevant Agencies given no reuse options have been identified.
	Justification must be provided to the Planning Secretary if it is concluded that no reuse options prevail.	Section 10	Includes justification why no reuse options are available
	A copy of the Water Reuse Strategy must be made publicly available.	A copy will be provided on the project website once submitted to DPE	N/A
	Note: Nothing in this condition prevents the Proponent from preparing separate Water Reuse Strategies for the construction and operational phases of the CSSI.	Note	N/A
WM5	Opportunities for wastewater reuse and recycling will be pursued, including recirculating water during tunnel excavation to use for dust suppression and offsite reuse, will be investigated and implemented where feasible and reasonable.	Section 6	This section identifies potential water reuse options and evaluates their applicability based on Project constraints.

3.2 Scope of Works and Technical Criteria

In addition to CoA E127, this strategy has been prepared with consideration to the Project's Sustainability Requirements within the Scope of Works and Technical Criteria (SWTC) related to water reuse in Table 3-2 below. A cross reference is also included to indicate where the commitment is addressed in this Sub-plan or other Project management document.

Table 3-2 SWTC requirements relevant to this WRS

Metric/measure	Target	Timeframe	Reference
Percentage of non-potable water demand which is sourced from non-potable water sources during construction.	15%	Average over construction period.	Section 7
Percentage of water (rainwater, stormwater, wastewater, groundwater) generated/collected during construction which is reused, recycled or reclaimed.	15%	Average over construction period.	Section 7

3.3 ISC

The CoA and SWTC require CPB Downer JV to achieve an Excellent Design and As Built rating under the Infrastructure Sustainability Council Design and As-Built rating tool. As part of the Project's Sustainability Strategy, CPB Downer JV is targeting the following IS Rating benchmarks relating to the Water Category. Note that these targeted credits and levels may alter throughout the life of the Project as materiality adjusts as a result of dynamic and unforeseen Project changes.

Table 3-3 Indicative design phase IS targets

Credit	Name of credit	Target Level	Target Score	Comments	Reference
Wat-1	Water use monitoring and reduction.	2	3.70	Monitoring of water usage to take place as part of monthly reporting processes.	Section 9
Wat-2	Replace Potable Water.	0.5	0.51	Options to reduce potable water use may be achieved through reuse of treated water. Other potential initiatives include the use of rainwater tanks, smart metering of water usage, and the reuse of captured water from construction activities for dust suppression and misting, plant and equipment wash down, and compaction.	Section 7

4 Water requirements

Water will be required throughout the construction phase of the project for general construction activities. Water use will primarily be for the purposes of earthworks and dust suppression. Water will also be required to supply ancillary sites for ablutions and other ancillary activities. Both potable and non-potable will be required for the following activities:

- Dust suppression on exposed surfaces and roads;
- General wash down and wheel wash;
- Compaction and general earthworks;
- Concreting and concrete curing;
- Conditioning of fill material;
- Site amenities including toilets, showers, cleaning and drinking; and
- Establishment of landscaping.

Water demand from site offices and amenities will depend on the number of personnel based at a particular site and the hours of operation. Section 7.2 predicts possible quantities based on current Project personnel forecasts.

5 Initial water use assessment

Over the course of construction, several water sources will be utilised for the purposes described in Section 2. CPB Downer JV will adopt the Water Use and Sourcing Hierarchy illustrated in figure 5.1.

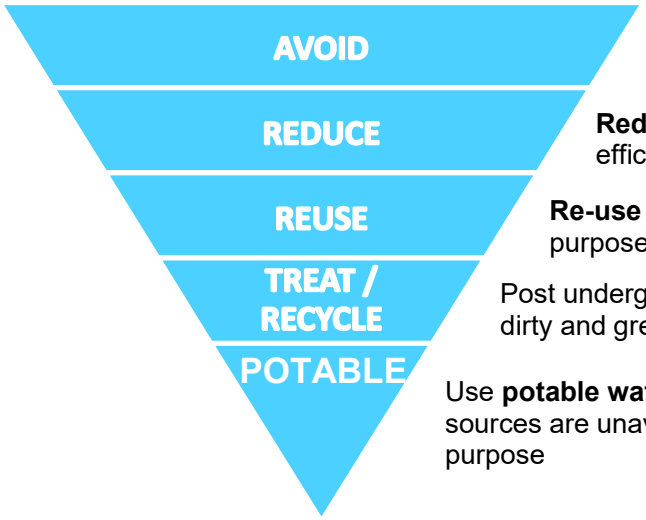


Figure 5.1 - Water Use and Sourcing Strategy

All construction sites will have access to potable water through metered connections to the Sydney Water network. During construction, potable water will supply the site offices and amenities. Water trucks will also access potable water supplies. If non-potable sources are identified and the water source is fit for purpose, water trucks will be filled from non-potable sources.

Opportunities for the use of non-potable water in place of potable water have been assessed in accordance with the CPB Downer JV Sustainability Strategy. Use of non-potable water will depend upon workplace health and safety considerations, economic feasibility, any relevant manufacturer's or design specifications and the availability and quality of non-potable water.

Given that minimal groundwater sources will be accessed for the project works, non-potable water if possible, will be sourced from either rainwater harvesting or stormwater capture.

Due to the spatial limitations of the project construction sites, there will be limited capacity for capture of stormwater on site. Earthworks trenches, sumps and sediment basins would capture relatively small volumes of water after rainfall events. This water will be beneficially used where feasible in accordance with the Project's Soil and Water Management Plan (WHTBLWFU-CPBD_NWW-WA-PLN-000006). Additionally, the Project Environmental Protection Licence (EPL 21619) defines that all sediments basin installed on the premises to detain surface waters must be reinstated within the basin design management period following the cessation of a rainfall event. The Project's planned basin design period is for a 5-Day rainfall event, providing only 5 days in which the Project may hold water prior to discharge. The time constraint enforced by the Project EPL prohibits the Project's from storing and utilising water captured within Project sediment basis for reuse opportunities.

6 Evaluation of reuse options

6.1 Considerations for water reuse

6.1.1 Climatic and seasonal conditions

Construction of the project will occur over a four year timeframe and therefore seasonal variation and climatic events will affect the volume and quality of water available for reuse at any time. A water reuse strategy reliant on rainwater and stormwater will therefore be opportunistic to enable beneficial reuse when conditions allow.

In addition, any water collected on site after a rainfall event may not be usable for irrigation or dust suppression if the site has become saturated. Storage of captured water would be required for reuse after the site has dried out sufficiently.

6.1.2 Water storage capacity

Rainwater runoff from site shed roof canopies may be captured in rainwater tanks for use in toilet flushing, cleaning, irrigation and dust suppression. The capacity of rainwater storage at each of the compound areas will depend on available space at each ancillary facility and the size of roof catchment available at each ancillary facility. Instillation of rainwater capture will be subject to a return on investment (ROI) assessment per site. Roughly a roof space of 850 m^2 is required to provide such a return over a four year Project period.

Stormwater runoff will generally be captured in trenches and excavations and would be managed in accordance with the project's Discharge Impact Assessment (DIA) and EPL conditions.

Captured stormwater would be used beneficially for irrigation and dust suppression where conditions allow, however as stated in section 5 requires captured water runoff must be discharged within a period of 5 days Storage of captured surface water would only be permissible under the Project EPL within holding tanks or basins with no water catchment, both options will be considered on a case-by-case basis due to Project spatial limitations preventing installation of additional tanks or basins.

6.1.3 Public health

CPB Downer JV has considered the potential health risks associated with reusing water on site. Reuse strategies identified in **Table 6-1** aim to mitigate these risks. Given that no recycled/treated water is proposed to be used, the public health risks are considered negligible, and advice in this regard is not considered necessary from relevant agencies.

6.1.4 Concrete and material batching

All concrete and asphalt will arrive on site pre-mixed and the use of non-potable water for batching plant production will be encouraged. Concrete and asphalt suppliers to the Project will be encouraged to use recycled water wherever possible and will report monthly on non-potable usage. Given these are offsite facilities, this is not addressed further by this Strategy.

6.1.5 Recycled water network

No network/pipeline exists within a feasible pumping distance for the Project to utilise. The use of any such network is prohibited by cost and distance.

6.1.6 Best practice and advice

This Strategy has considered water use practices and advice from similar major infrastructure projects in NSW. CPB Downer JV has consulted and advised with the following Projects in the development of the Strategy:

- Parramatta Light Rail Stage 1
- M6 Motorway Stage 1
- Sydney Metro - City and Southwest Package 5 Station Upgrades
- Sydney Metro - City and Southwest Package 6 Station Upgrades
- Western Sydney Airport
- Berry to Bomaderry – Princes Highway Upgrade
- M4-M5 Link Rozelle Interchange

CPB and Downer have a combined breadth of experience in sustainability and water reuse initiatives in civil infrastructure projects, this is further detailed within section 8 of this report.

Note: *Given the limited options for water reuse within the scope of this Strategy, no further advice has been sought from relevant agencies. As construction progresses, CPB Downer JV will continue to work collaboratively with TfNSW, suppliers and subcontractors to investigate any future potential water reuse options on the Project and will seek advice on those options from relevant agencies as needed.*

Table 6-1 Evaluation of potential reuse options

Non-potable Water Source	Evaluation of reuse option	Justification	
Surface water: captured runoff	Under Review	Stormwater affected by project works and which is captured by construction trenches, excavations or sediment basins/sumps etc will be reused where conditions permit and in accordance with the project's DIA and EPL. The Project is evaluating if storage tanks or additional basins can be installed. Currently space constraints prohibit this option for water retention after rainfall and reuse. Consideration of opportunities for water capture and reuse at additional (unapproved) project ancillary sites is currently ongoing. If additional opportunities are identified, these sites would be subject to additional DPE approvals and variation to the Project EPL. This strategy would also be updated. No further licences or approvals are anticipated. ***Timeframe for evaluation:*** Potential additional project ancillary sites have been identified. An update to the CWRS would be provided after the approval for use of any additional sites, which are likely to occur in quarter four, 2022 and quarter one, 2023. An update to this strategy is therefore anticipated for quarter two 2023.	

Non-potable Water Source	Evaluation of reuse option	Justification	
Surface water: rainwater	Unsuitable	Rainwater will be captured on site where spatial constraints permit. The installation of rainwater capture through roof canopy drainage/tanks and associated infrastructure are to be installed were return on investment (ROI) threshold is achieved. The contractor has calculated that an average roof area of greater than 850m^2 over a 4-year construction period is required to achieve Project ROI. All compound areas have been assessed based on the facilities lifespan for viability to achieve roof capture ROI. Due to the restricted space provided at the Project ancillary facilities, tiered Project offices with little to no roof space are required, providing minimal roof space and insufficient water capture for ROI. Project cost benefit analysis is provided in ***Appendix A***.	
Surface water: other stormwater	Unsuitable	Stormwater that is unaffected by project works will be diverted to existing stormwater drainage systems. The drainage systems are captured by North Sydney Council and managed through a series of treatment mechanisms, including Gross Pollutant Traps (GPTs), sand filters and ultraviolet (UV) light for reuse by North Sydney Council for local parkland irrigation. CPB Downer JV do not intend to intercept this existing water reuse system as North Sydney Council requires the water to maintain public works and are unable to install a similar treatment system due to spatial limitations. Additionally, due to limited site space treatment facilities for stormwater isn't feasible as an option as the nature of stormwater flows are variable and characteristically have pollution issues due to the reality of the urban environment.	

Non-potable Water Source	Evaluation of reuse option	Justification	
Groundwater	Under review	The project is unlikely to intercept significant volumes of groundwater during construction prior to excavation of the cut and cover structures for the tunnel portals. Any groundwater encountered prior to cut and cover works is unlikely to result in volumes that would justify a treatment and water reuse system. Groundwater may be encountered during construction of the cut and cover structures for tunnel portals during the latter stages of construction of the project. A water treatment plant would be necessary to process and treat the ground water to a level that is acceptable for non- potable use. ***Timeframe for evaluation:*** Groundwater reuse is subject to further design and construction investigation and will be addressed in an update to this plan as needed. A project update on the viability of the option will be provided in quarter 2, 2023.	
Recycled water network	Unsuitable	No network/pipeline exists within a feasible pumping distance for the Project to utilise. The use of any such network is prohibited by cost and distance.	

Non-potable Water Source	Evaluation of reuse option	Justification	
Recirculating water from construction activities	Under Review	Potential opportunities with specific trades to import recycled water or capture and reuse water from construction activities. This includes wastewater reuse and recycling, including recirculating water during tunnel excavation. The Project will assess tendering suppliers/sub-contractors for capability to provide water reuse opportunities in construction works. The Project will evaluate those sub-contractors using non-financial criteria, promoting through the sustainability component those parties that enable water reuse to facilitate meeting the targets in section 3.2. Note: Water quality from recycled network may affect the quality of the final product and will be assessed for reuse on a case-by-case basis. ***Timeframe for evaluation:*** The evaluation of the reuse option is tied to Project procurement and further detailed design and site investigations. The majority of procurement, investigation and design will be completed by the end of 2022. A project update on the viability of the option will be provided in quarter 2, 2023.	

Table 6-2 Water reuse assessment

Note. Ancillary Site Indicative Compound Detailed in Appendix B.

Ancillary facility / site	Area (m^2)	Roof Space (m2)	Roof Capture Viable	Water sources	Estimated volumes / month	Proposed reuse	Considerations/ constraints	Duration / timeframes
NH1	3168	475	No	Potable Mains	N/A	N/A	• Space constraints for roofed structures and rainwater tanks. • Space constraints prevent sediment basin establishment or water detention tank instillation. • DIA & EPL requirements.	3 Years
WFU2 – High Street south	2100	315	No	Potable Mains	N/A	N/A	• Space constraints for roofed structures and rainwater tanks. • Space constraints prevent sediment basin establishment or water detention tank instillation. • DIA & EPL requirements.	3 Years
WFU3 – High Street North	1800	270	No	Potable Mains	N/A	N/A	• Space constraints for roofed structures and rainwater tanks. • No proposed roofed structures. • Space constraints prevent sediment basin establishment or water detention tank instillation. • DIA & EPL requirements.	3 Years

Ancillary facility / site	Area (m^2)	Roof Space (m2)	Roof Capture Viable	Water sources	Estimated volumes / month	Proposed reuse	Considerations/ constraints	Duration / timeframes
WFU4 – Arthur Street	5100	765	No	Potable Mains	N/A	N/A	• Space constraints for roofed structures and rainwater tanks. • Space constraints prevent sediment basin establishment or water detention tank instillation. • DIA & EPL requirements.	4 Years
WFU5 – Berry Street east	3200	480	No	Potable Mains	N/A	N/A	• Space constraints for roofed structures and rainwater tanks. • Space constraints prevent sediment basin establishment or water detention tank instillation. • DIA & EPL requirements.	4 Years
WFU6 – Ridge Street east	300	45	No	Potable Mains	N/A	N/A	• Space constraints for roofed structures and rainwater tanks. • Space constraints prevent sediment basin establishment or water detention tank instillation. • DIA & EPL requirements.	4 Years
WFU7 – Merlin Street	1700	N/A	No	N/A	N/A	N/A	• Area to serve as temporary parking for the public. No opportunities for water capture or reuse as the area won't serve as a construction facility.	4 Years

Ancillary facility / site	Area (m^2)	Roof Space (m2)	Roof Capture Viable	Water sources	Estimated volumes / month	Proposed reuse	Considerations/ constraints	Duration / timeframes
WFU8 – Cammeray Golf Course	18000	70	No, threshold not met.	Rainwater capture through roof canopy and sediment basins. Captured runoff from road Potable Mains	N/A	Toilet flushing, cleaning, dust suppression, irrigation	• Space constraints for roofed structures and rainwater tanks. The majority of the compound planned for material storage. • DIA & EPL requirements. • Space constraints prevent sediment basin establishment or water detention tank instillation.	4 Years
WFU9 – Rosalind Street east	1300	195	No	Potable Mains	N/A	N/A	• Space constraints prevent sediment basin establishment or water detention tank instillation. • Limited access for water trucks. • Sediment basin not required.	4 Years
Project Wide	N/A	N/A	N/A	Recirculating water from construction activities	TBC	Construction Activities (Dust Suppression, street sweeper)	• Sub-contractor and supplier capability to supply recycled water or capture and reuse water during construction activities. • Sub-contractors and suppliers will alter throughout the construction period providing intermittent sources and no steady supply based on changing scope of works as the Project progresses. • Limited access for water trucks. • Health risks associated with reusing construction water or groundwater.	4 Years

7 Water Consumption Calculations And Mitigation Measures

7.1 Water Use for Environmental Mitigation Measures

Water consumption will be required throughout construction of the project for environmental management purposes.

Site Access Management

Water usage for road and gate management will necessitate use of potable water. Street sweeper pressurised nozzle systems are used intermittently when required for an estimated 5-15 minutes relevant to the square metres of road required to be cleaned.

Dust Suppression

Water usage for dust suppression will also necessitate us of potable water. Dust suppression systems are running for approximately 4 hours per day, utilised both intermittently and when required within standard construction hours.

7.1.1 Water Consumption - Site Access Management

Road sweepers have been selected by the Project to manage the environmental risk of sediment tracking onto Project haulage roads. Road sweepers utilise high pressure nozzles fitted to the body of the vehicle elevated within close proximity to the road surface (10-30mm). Road sweepers have been selected for efficiency over traditional methods of handheld hosing of road and paved surfaces. The high-pressure nozzles concentrate water pressure at a close proximity to sediment, reducing the volume and time required to remove clay and sandstone material that has strong binding properties to asphalt. The Project will typically have one to two street sweepers roving the Project site during periods of wet weather and heavy vehicle movements.

Heavy vehicle movements are forecasted thought the life of the Projects construction. Road sweepers will be utilised to mitigate minor sediment tracking expected as a result of vehicle movements within the Project footprint. Below is an indication of the water efficiency of road sweepers, the sweepers have been selected due to their more water efficient system for removing tough sediment tracked onto approved Project haulage routes.

Table 3. Estimated road sweeper consumption

Table 4-1. Estimated road sweeper consumption

Quantity of water used during Bulk Earthworks	Quantity of water used per month	Quantity of water used in project life
1 sweep per day at smaller satellite sites and 2 at the major ancillary compounds such as Cammeray Golf Course forecasted as a conservative figure.	= 70,000 L/ day x Average Month (30.4 Days) = 212,916.67 L /month	= 212,916.67 L /month x 4 Years = 851,666.67 over Project Life **Total Use – 851.67 Kilolitres (kL)**

7 L / m^2 (Water consumption[1]) × 1000 m^2 (average m^2 of road swept per site) x 10 (No. of sweeps per day) = (7 x 1000) x 10 = 70,000 Litre (L)/day		

Opportunities to reduce potable water demand for road sweepers

- Reducing or eliminating street sweeper movements through the installation of temporary erosion and sediment controls within the Project boundary:
    - Vehicle wheel wash bays;
    - Cattle/rumble grids; and
    - Extended areas of hardstand and ballast to provide stabilised access.

Barriers to reduce potable water demand for road sweepers

- The constrained nature of Project ancillary compounds prevents the instillation of a wheel wash and the associated grey water or recycling unit for the management of the water used;
- Cattle/ Rumble grids will be installed at all access points during the earthworks phase that have adequate space. Grids are proven to be most effective when they are approached at a reasonable pace and fronton to allow material to be sufficiently shaken from the tyres or track of the plant/vehicle; and
- Hardstand and ballast will be installed for safe access and egress at all sites where space allows.

7.1.2 Water Consumption - Dust Management

Portable dust cannons have been selected by the Project to manage the environment risk of dust generation associated with dust generating construction activities. The Dust cannon's selected by the Project capture small dust particles by nebulizing water particles and dispersing the water particles in a fine mist of water that evenly disperses over the Project area.

Dust cannons have been selected for efficiency over traditional nozzle hose systems for reduced water consumption, increased range, effectiveness of dust particulate capture and even spray of water.

Dust cannons are only utilised for a maximum of four hours periods to prevent excessive generation of water run-off, the cannons use is restricted to times of high dust generating activities to reduce total water consumption [2]. Optimisation of cannon use is a CPB Downer EDI JV delivery initiative to reduce total potable water consumption.

Below is an indication of the water efficiency of dust cannons, which have been chosen as an example unit based on the units efficient system for capturing fine airborne particles.

[1] Data obtained from VicRoads Integrated Water Management Guidelines
[2] Construction Methodology included within in sub-contractor work method statements

Table 5-2. Dust cannon water consumption

Quantity of water used per day	Quantity of water used per month	Quantity of water used in project life
The Genrac DF 2.2 Portable Dust Suppression System (Dust Cannon) utilises 8.5 litres per minute [3]. 8.5 (L/min) × 360(mins) = 2,040 L / day / per unit = 2,040 x 23 Units (9 Sites) = 46,920 L/ day	= 46,920 L/ day x Average Month (30.4 Days) = 1,427,150 L /month	= 1,427,150 L /month x 4 Years = 5,708,600 over Project Life **Total Use – 5708.60 Kilolitres (kL)**

Figure 1. Dust Cannon – Genrac DF 2.2

Opportunities to reduce potable water demand for dust cannons

- Re-use collected runoff water for dust cannons where water quality permits.
- Utilise other methods of dust suppression where practicable and safe to do so eg use of sprinklers to dewater sediment basins, sumps and excavations after rainfall.

Barriers to reduce potable water demand for dust cannons

- The larger size of dust cannons requires greater consumption of potable water;
- There is no water re-use system in place with the dust cannon, meaning any collected water will need to be processed in a water treatment facility before it can be used again;

[3] Data obtained from Genrac Mobile Products; supplier of the model utilised by the Downer construction team.

- Re-using water will need to ensure appropriate water quality to prevent possible human exposure to toxins that can lead to potential worker health issues as well as damage to the equipment;
- Restricted area of Project sites prevents the installation of additional water treatment infrastructure.

7.2 Project Personnel Site Amenities Water Consumption

Site amenities are required for project personnel constructing the Warringah Freeway Upgrade. There are a total of 9 Project facilities, forecasted operating conditions require on average of 300 construction personnel across the Project (*Figure 3*). The work force estimations are used for the following water usage calculations.

The Project site facilities consist of a number of amenity demountable buildings and are established with the following water reduction initiatives:

- Waterless urinals or systems;
- WELS 3-star rated toilets, taps and shower heads; and
- Sub metering of water where possible to identify high consuming sites for investigation.

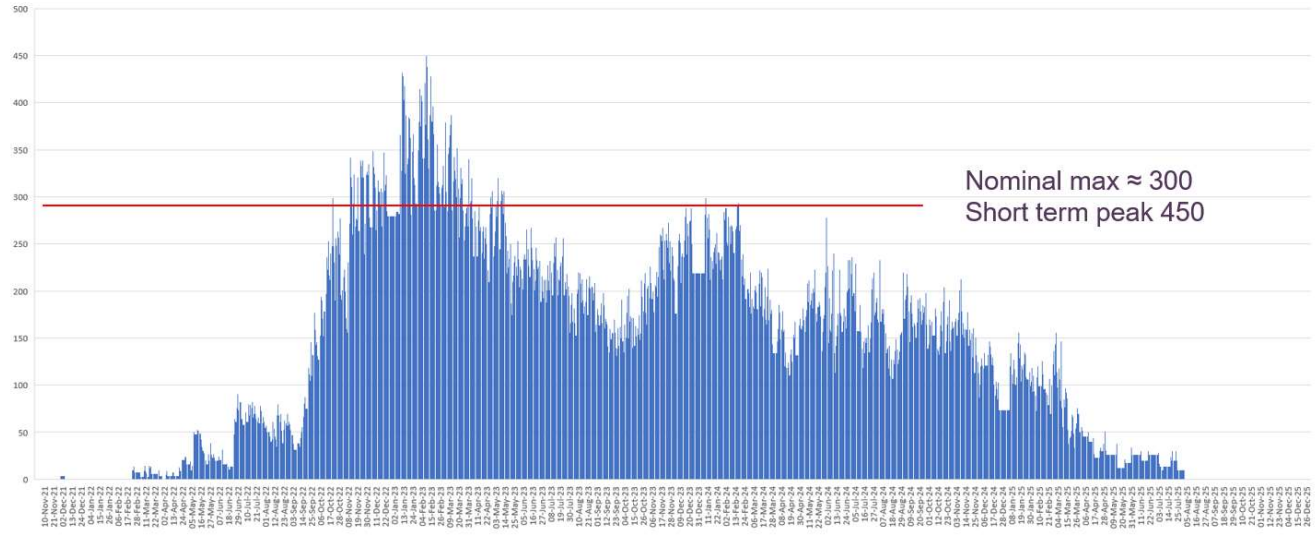


Figure 2. Total Labour - Day, Night & 56hr Campaigns

7.2.1 Water consumption from Project Amenities

All toilets in the site amenities will use potable water. There are an expected 72 toilets located across 9 Project ancillary sites, below is an estimated quantity of the amount of potable water required for Project operations over the lifecycle of construction.

An average of 4 litres per flush is used (based on a 3-star WELS rating)[4]. The assumption is made that the toilets are flushed twice a day per construction personnel, with an average of 300 people on-site during a standard 24 hour operational cycle (Figure 3).

[4] Consumption factors obtained from GBCA Potable Water Calculator – D&As Built Sydney Metro v1.1

Table 7-3. Estimated toilet water consumption during normal operating conditions

Quantity of water used per day	Quantity of water used in one month	Quantity of water over the project life
Average Normal operating headcount: 300 4 L / flush × average flush x personnel = 4 × 2 x 300 = 2,400 Litre (L)/day	= 2,400 L/ day x Average Month (30.4 Days) = 73,000 L / month	= 73,000 L/month x 4 Years = 292, 000 L over Project Life **Total Use – 292 Kilolitres (kL)**

Opportunities to reduce potable water demand for toilets

- Ensure toilets have a half flush option.
- Use toilets with a higher WELS rating.
- Reuse of rainwater captured through roof canopy collection infrastructure stored and plumbed into toilet blocks.

Barriers to reduce potable water demand for toilets

- Given the anticipated number of workers on site, toilet use will increase proportionately to workers.
- Use of facilities is dependent of individual personnel behaviour.

7.2.2 Water consumption from fixtures i.e. taps & showers

Shower water consumption

Showers are utilised by site personnel throughout the day, shower usage will increase and decrease depending on the different stages of the project. The Project forecasts the showers will be mostly utilised during the Project construction stages of site investigation, demolition and form, reo and pour (FRP) and asphalting. There are an expected 22 showers located in the site amenities across 9 Project ancillary sites, using 9 litres of water a minute (Based on a 3-star WELS rating)[5]. Showers will use potable water. An average shower time of 3-minutes per shower has been assumed with at least 10% of workers requiring showers daily based on personal behaviour and work scope. The tables below provide estimates of potable water consumption from showers once all sheds are operational throughout construction.

[5] Consumption factors obtained from GBCA Potable Water Calculator – D&As Built Sydney Metro v1.1

Table 7-4.6 Estimated shower consumption during normal operating conditions

Quantity of water used per day	Quantity of water used in one month	Quantity of water over the project life
Average Normal operating headcount: 300 Reduced Capacity Expected for Showers: 30 9 L / min x 10 min average time showering x 10% workforce showering a day = 9 × 10 × 30 = 2700 Litre (L)/day	= 2,700 L / day x Average Month (30.4 Days) = 81,125 L / month	= 81,125 L/month x 4 Years = 328,500 over Project Life **Total Use – 328.5 Kilolitres (kL)**

Indoor Taps consumption

There is a total expected number of 86 indoor taps within the site amenities, the amenities are split between the toilets and lunchrooms. All taps utilise potable water and use 9 litres of water a minute (Based on a 3-star WELS rating)[6]. The assumption is made that taps are switched on for 0.5 minute per use and that personnel use taps on average 8 times a day. This is based off the assumption that personnel wash their hands after each toilet visit and average 2 toilet visits per day. It is also assumed that personnel wash their hands before and after eating for 3 food breaks (morning tea, lunch and afternoon tea). A breakdown of estimated water usage is in the tables below.

Table 7-5. Estimated indoor taps consumption during normal operating conditions

Quantity of water used per day	Quantity of water used in one month	Quantity of water over the project life
Average Normal operating headcount: 300 9 L / min × 0.5 minute × personnel x personnel x how often personnel wash their hands 9 x 0.5 x 300 x 8 = 10,800 Litre (L)/day	= 10,800 L / day x Average Month (30.4 Days) = 328,500 L / month	= 328,500 L/month x 4 Years = 1,314,000 over Project Life **Total Use – 1314 Kilolitres (kL)**

[6] Consumption factors obtained from GBCA Potable Water Calculator – D&As Built Sydney Metro v1.1

Opportunities to reduce potable water demand for taps and showers

- Installing water saving taps and shower heads can reduce potable water usage. Using timed taps which must be re-engaged to release water can prevent the constant flow of water when not required.

Barriers to reduce potable water demand for taps and showers

- Re-using rainwater catchment or stormwater requires water treatment due to non-potable water sources having potentially negative health effects on site personnel.

8 Total Water Consumption

The project water balance assessment details that the majority of construction water is attributed to dust suppression, street sweeping and site amenities. Due the limitations and restrictions of the project listed within this report the only reliable available water source will be mains potable water. Water reduction will be achieved by implementing water reduction initiatives and assessing opportunities through planning for rainwater capture with construction teams.

Table 8. Summary of water consumption

Water Source	End-use	Volume (kL)
Mains Water (Potable)	Dust Suppression	5708.60
Mains Water (Potable)	Street Sweeping	851.67
Mains Water (Potable)	Site Amenities - Toilets	292.00
Mains Water (Potable)	Site Amenities - Showers	328.50
Mains Water (Potable)	Site Amenities – Indoor Taps	1314.00
Total Water		8494.77
Total Water Reduction		0
Maximum Total Water Demand from potable source		8494.77

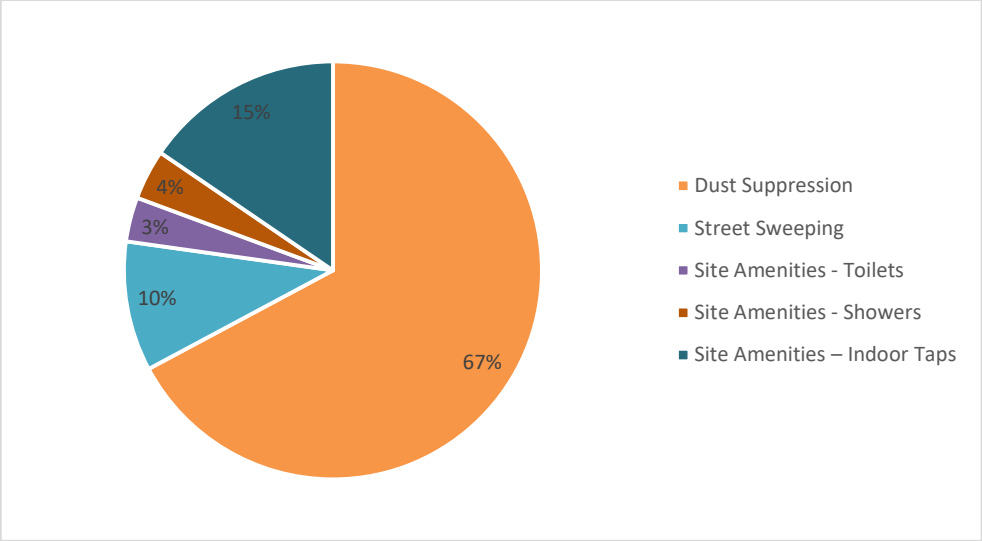


Figure 4. Percentage breakdown of water usage

9 Monitoring and management

The Project's consumption of water detailed within section 7 of this report will be regularly monitored and reported by CPB Downer JV through the establishment and implementation of a monthly monitoring program and ensure health and safety of project personnel and to monitor effectiveness of reuse strategies. CPB Downer JV will monitor all water consumption sources (Table 9-1) throughout the construction phase to evaluate Project performance towards Project SWTC requirements and targets defined section 3.2.

Measurement and tracking will be through following measures:

- A permit system for reuse of any rainwater captured on site will be implemented in accordance with the Soil and Water Management Sub-Plan (Appendix B4 of the CEMP);
- Standard Sydney Water meters at key potable water use points;
- Water cart load tracking and reuse estimates; and
- Smart metering at key locations to allow site water consumption to be monitored and recorded.

Table 9-1. Water data capture sources to be monitored during the Project.

Resource Type		Source/s	Responsible Party
Water	Potable water	Project invoices Subcontractor monthly reports Water meter reads	Sub-contractor, commercial Sub-contractor, commercial Site personnel & Environment & Sustainability team
	Non-potable water	Water meter reads Modelled consumption estimates (where water meter reads are unavailable) Subcontractor monthly reports Water Discharge & Reuse Permits	Site personnel & Environment & Sustainability team Sub-contractor, commercial Environment Tea,
	Water discharge	Water meter reads Modelled estimates (where water meter reads are unavailable) Water Discharge & Reuse Permits	Site personnel & Environment & Sustainability team

Reporting will be conducted as per the WFU Project reporting requirements (Table 9-2), reporting will be generated by the Environment and Sustainability team and provided to the Project client representative (TfNSW). The ISC targets set by the Project and detailed in Table 3-3 will be reported and Project achievement towards documented within the Monthly Sustainability Progress Report and ISC rating submissions.

Table 9-2. CPB Downer JV sustainability reporting requirements

Reporting Requirement	Description	Frequency
Client		
Monthly Sustainability Progress Reporting	Prepared by the Sustainability Manager for the Project Director's submission to the Client, this report will include requirements detailed in SWTC C.2 Section 1.2.6, including the following: ▪ Performance of the Contractor against the targets identified in the Sustainability Management Plan ▪ Progress towards achieving the "Design" and "As Built" ISC IS rating tool. ▪ Data to support reporting on targets, and a commentary / analysis of trends including actions to be undertaken to improve performance for the follow: ▸ GHG emissions throughout construction ▸ Current and accumulated energy use and GHG emissions and performance against energy and carbon targets ▸ Electricity consumption and performance against fuel consumption targets ▸ Volume and percentage of potable and non-potable water consumed against targets ▸ Quantities of waste generated, recycled, beneficially re-used or disposed for waste and spoil targets ▸ Volume weighted average of substitute cementitious content in concrete ▸ Details of sustainable training and inductions for major subcontractors ▸ Details of low carbon and greenhouse gas reduction initiatives ▸ Climate change risk assessments undertaken and details of where the assessments have influenced the design and construction ▸ Life cycle assessments undertaken, and details of environmental impact reduction initiatives Details of any innovative sustainable design initiatives The report will be submitted to the Principal's Representative and the Independent Certifier within five Business Days after the end of each calendar month. Note -sustainability data will be one month in arrears to capture all subcontractor data.	Monthly
Annual Sustainability Report	The report must demonstrate and detail performance in sustainability in relation to the Sustainability Management Plan and include progress against sustainability goals and targets over the last year including annual sustainability reporting metrics in line with the NSW Government Resource Efficiency Policy (2019), as per SWTC C.2 s1.7. The report will be submitted to the Principal's Representative and the Independent Certifier within five Business Days after the 31 August each year.	Annual (within 5 business days following 31 August each year)
Legislation		

Reporting Requirement	Description	Frequency
NGERS Reporting	CPB Downer JV is required to report sustainability data to CPB Contractors and CIMIC to fulfil reporting requirements under the National Greenhouse and Energy Reporting Scheme (NGERs)	Annual
Infrastructure Sustainability Council		
ISC rating submissions	CPB Downer JV is required to obtain an Excellent ISC rating for the WFU Project for the Design and As-Built phases. Sustainability data captured by CPB Downer JV will be used to support the preparation of the WFU Project ISC rating submissions	End of Design and Construction phases

10 Conclusion

CPB Downer JV is committed to using non-potable water sources where possible and when fit for purpose. As detailed within this Construction Water Reuse Strategy, currently the Project is unable to identify and quantify any viable water reuse opportunities for the Project. The following key restrictions prevent the Project from harvesting and reusing water at this current stage of the Project (further detailed in section 6):

- Spatial constraints of construction compounds and Project work areas prohibit additional water storage tanks or basins being established.
- The Project NSW Minister's Conditions of Approval, Environmental Protection Licence and Discharge Impact Assessment prohibit the retention of additional water due captured within Project sediment basis greater than 5 days due to the potential risk of runoff form the premises occurring.
- No network or recycled pipeline exists locally, as such the viability of pumping water from an existing network/pipeline is prohibited by substantial distance, cost, and logistical factors.
- Interception of existing stormwater drainage systems historically utilised by local council resulting in an impact upon North Sydney Council works and facilities management as a result of reduced availability of water.
- Rainwater capture through roof canopy drainage and tank instillation isn't feasible as a result of compound spatial restrictions preventing sprawling facilities and greater viable roof canopy, preventing a Project return on investment (ROI) and consistent water for use within the amenities blocks.

At this time the project concludes that due to the prohibiting factors detailed within this Strategy no reuse options will prevail at this stage of the Project. As a result of the above detailed restrictions no further advice has been sought from relevant agencies.

The Project is currently at 30% concept design and is yet to commence construction. As the Project design and construction progresses, CPB Downer JV will continue to work collaboratively to find a successful outcome with TfNSW and make all possible endeavours with Project suppliers and sub-contractors through the procurement process, to implement the options identified as under review within Table 6-1. CPB Downer JV will continue to investigate any further identified water reuse options on the Project and will seek advice on those options from relevant agencies as needed.

Appendix A – Viability Analysis for Rainwater Harvesting of Ancillary Compound Roof Canopy

Viability Analysis for Rainwater Harvesting of Ancillary Compound Roof Canopy

Ancillary Site (Refer to Table 6-2 within CWRS)	Unit	NH1 - Northern Hub	WFU2 – High Street South	WFU3 – High Street North	WFU4 – Arthur Street	WFU5 – Berry Street East	WFU6 – Ridge Street East	WFU7 – Merlin Street	WFU8 – Cammeray Golf Course	WFU9 – Rosalind Street East
Ancillary Site Total Area	m2	3168.00	2100	1800	5100	3200	300	1700	18000	1300
Roof Area (**Note* If 0, No facilities to be Installed**)	m2	0.00	54.00	18.00	90.00	54.00	54.00	0.00	144.00	18.00
Sydney Observatory Hill Mean Rainfall (***Note Extratced from Bureau of Meteorology**)	mm	1213.40	1213.40	1213.40	1213.40	1213.40	1213.40	1213.40	1213.40	1213.40
Max Potential Rainwater Capture	kL	0.00	65.52	21.84	109.21	65.52	65.52	0.00	174.73	21.84
Sydney Water Supply Cost	$ a kL	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Sydney Water Service Charge	$ a year	56.48	56.48	56.48	56.48	56.48	56.48	56.48	56.48	56.48
Savings p/y (Syd Water cost * Max Potential Rainwater Capture)	$	225.92	389.73	280.52	498.94	389.73	389.73	225.92	662.74	280.52
Years on hire	Years	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Total Savings over Project Life	$	903.68	1558.92	1122.09	1995.74	1558.92	1558.92	903.68	2650.98	1122.09
Net Profit (Savings - Total Cost of Install)	$	-9007.26	-8352.02	-8788.85	-7915.20	-8352.02	-8352.02	-9007.26	-7259.96	-8788.85
Plumber Quote for Instillation (5000Litre Tank and setup)	$	9910.94	9910.94	9910.94	9910.94	9910.94	9910.94	9910.94	9910.94	9910.94
Total Cost installation	$	9910.94	9910.94	9910.94	9910.94	9910.94	9910.94	9910.94	9910.94	9910.94
Return on Investment (ROI) (net profit/total cost of install)	$	-91%	-84%	-89%	-80%	-84%	-84%	-91%	-73%	-89%
Simple Payback in years	Years	43.9	25.4	35.3	19.9	25.4	25.4	43.9	15.0	35.3

**Note - Sydney Water kL price extracted from Website.*

**Note for Ancillary Sites where compound Setout is still under development, a 15% spatial requirement for Project site sheds is assumed.*

Appendix B – Indicative Site Layouts

LEGEND

- Construction Boundary
- Storage Sheds
- Toilets
- Parking
- Entry/Exit
- Laydown
- Sensitive Land User
- Noise Wall (existing)

Indicative Site Layout: NH1 – Northern Hub

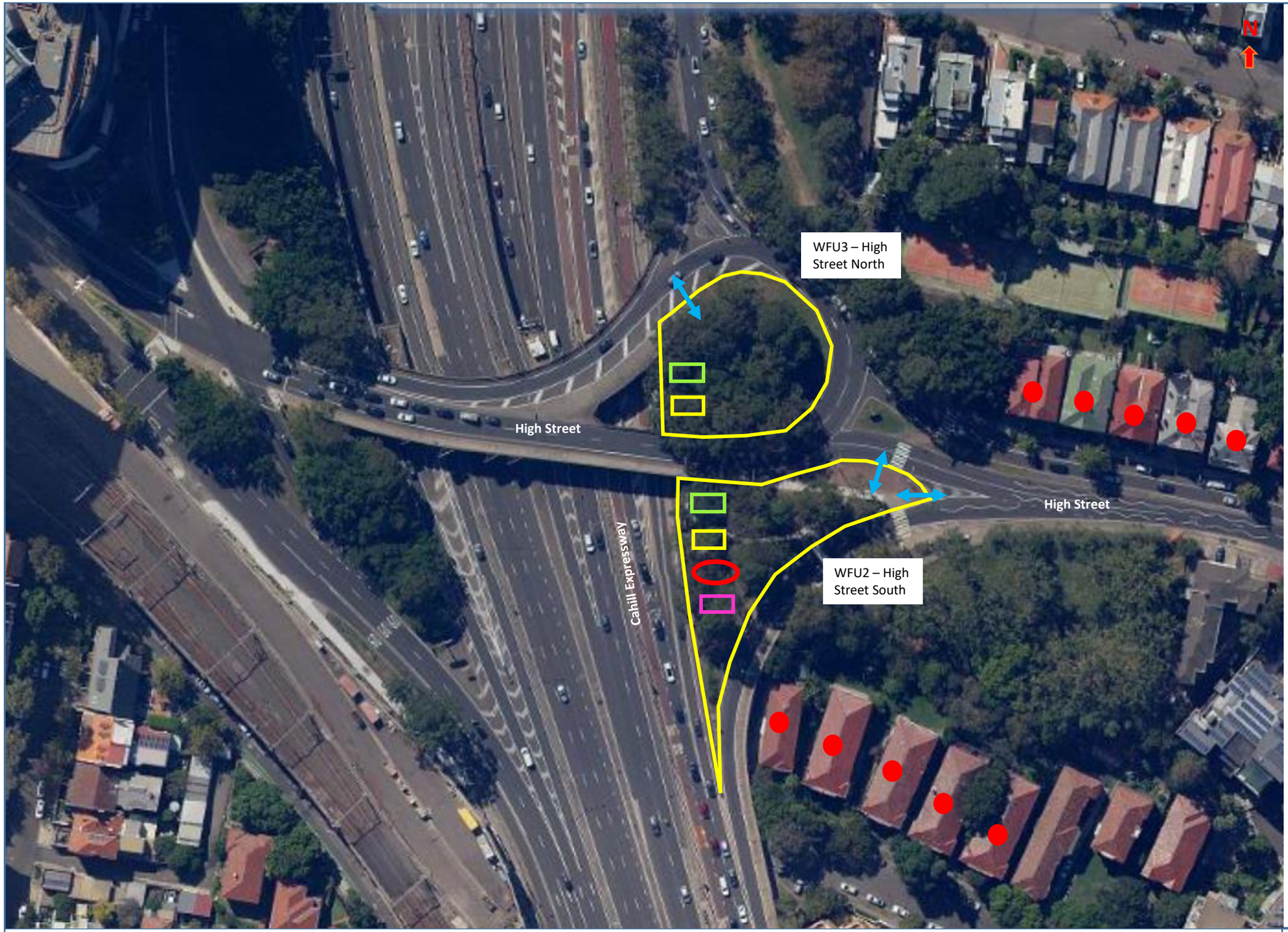
Western Harbour Tunnel and Warringah Freeway Upgrade SSI-8863

Stage 2 – Warringah Freeway Upgrade

1 July 2022

Revision E

0 30m 60m



LEGEND

- Construction Boundary
- Crib Facilities
- Toilets
- Parking
- Entry/Exit
- Laydown
- Sensitive Land User

Indicative Site Layout: WFU2 – High Street South and WFU3 – High Street North

Western Harbour Tunnel and Warringah Freeway Upgrade SSI-8863

Stage 2 – Warringah Freeway Upgrade

1 July 2022

Revision E

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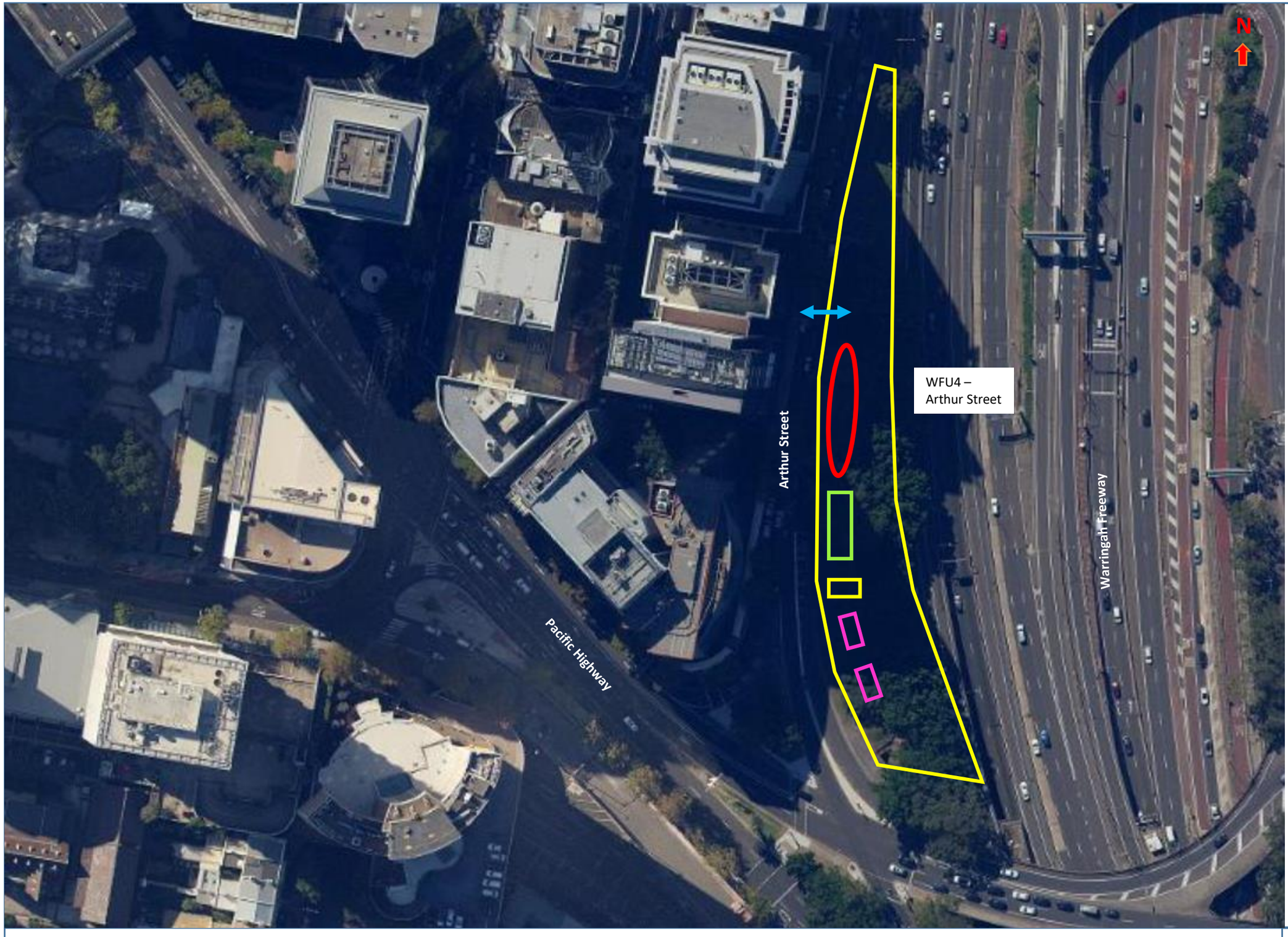

Indicative Site Layout: WFU4 – Arthur Street

Western Harbour Tunnel and Warringah Freeway Upgrade SSI-8863

Stage 2 – Warringah Freeway Upgrade

1 July 2022

Revision E

0 30m 60m

Indicative Site Layout: WFU5 – Berry Street East
Western Harbour Tunnel and Warringah Freeway Upgrade SSI-8863
Stage 2 – Warringah Freeway Upgrade

1 July 2022

Revision E

0 30m 60m

LEGEND

- Construction Boundary
- Crib Facilities
- Toilets
- Parking
- Entry/Exit
- Laydown
- Sensitive Land User

Indicative Site Layout: WFU6 – Ridge Street

Western Harbour Tunnel and Warringah Freeway Upgrade SSI-8863

Stage 2 – Warringah Freeway Upgrade

1 July 2022

Revision E

0 15m 30m

Indicative Site Layout: WFU7 – Merlin Street
Western Harbour Tunnel and Warringah Freeway Upgrade SSI-8863
Stage 2 – Warringah Freeway Upgrade

1 July 2022

Revision E

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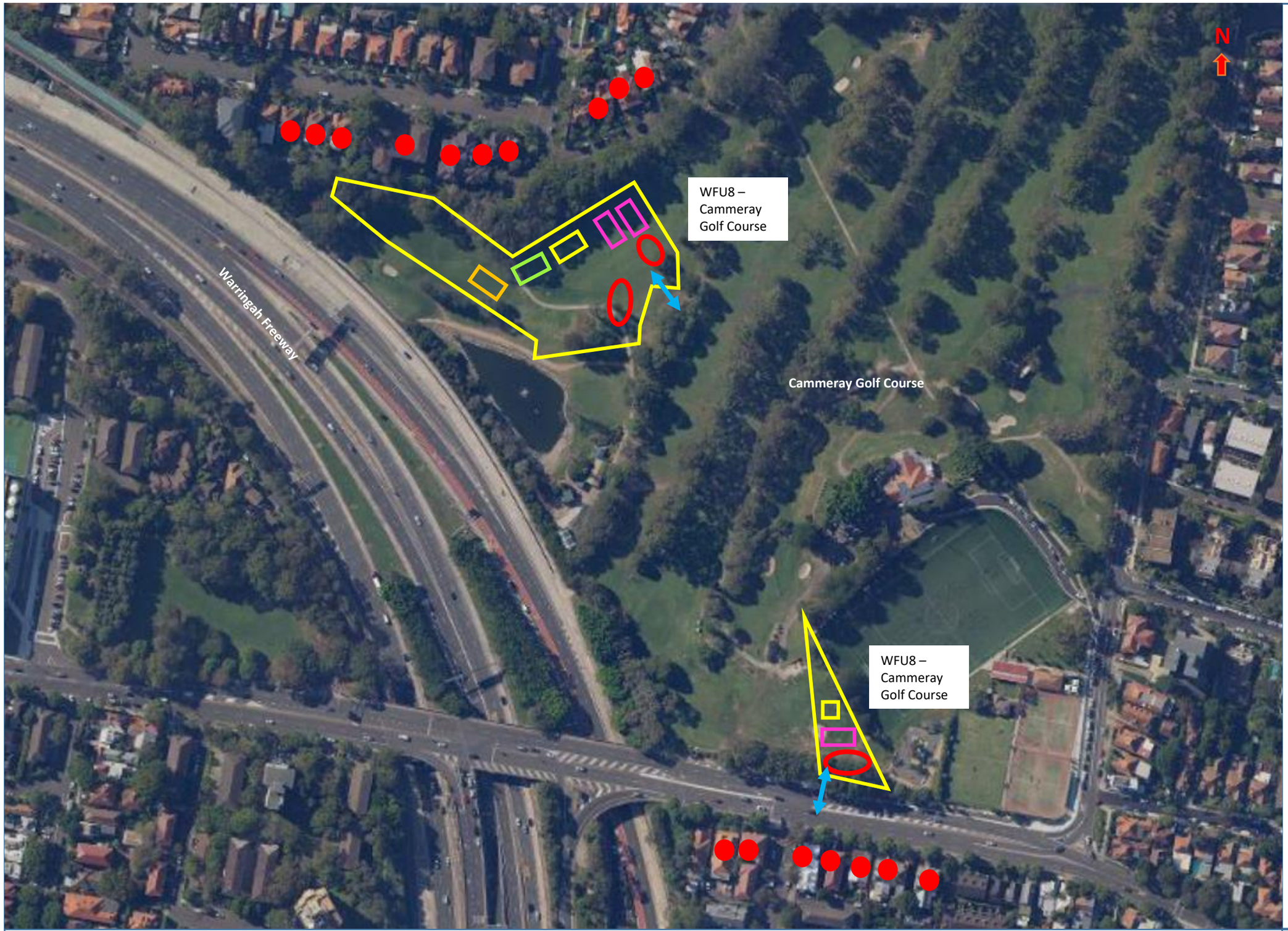


LEGEND

- Construction Boundary
- Crib Facilities
- Toilets
- Parking
- Entry/Exit
- Laydown
- Sensitive Land User
- Bus Laydown (exact location TBC)

Indicative Site Layout: WFU8 – Cammeray Golf Course

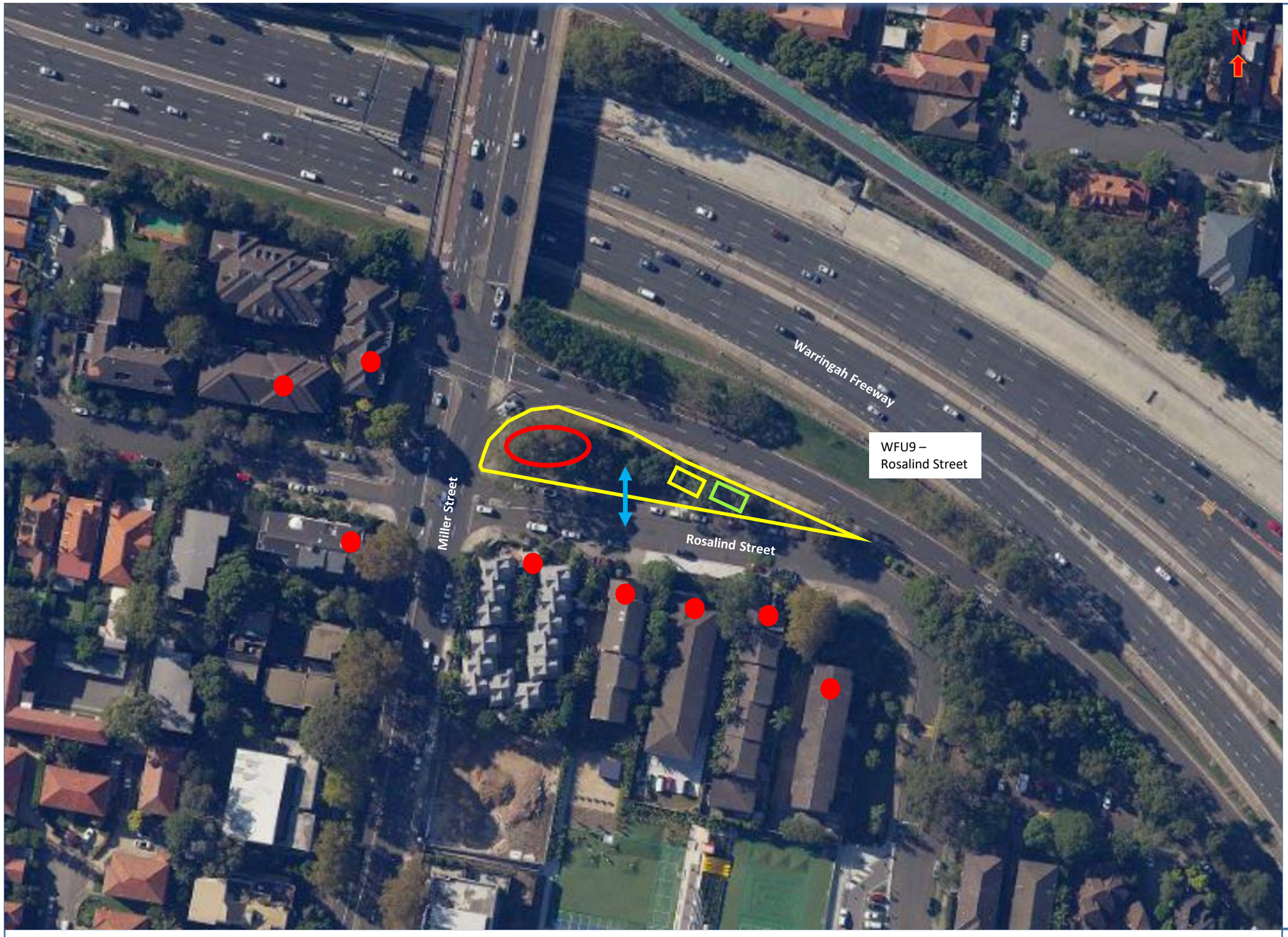
Western Harbour Tunnel and Warringah Freeway Upgrade SSI-8863

Stage 2 – Warringah Freeway Upgrade

1 July 2022

Revision E

0 50m 100m



LEGEND

- Construction Boundary
- Crib Facilities
- Toilets
- Parking
- Entry/Exit
- Laydown
- Sensitive Land User

Indicative Site Layout: WFU9 – Rosalind Street

Western Harbour Tunnel and Warringah Freeway Upgrade SSI-8863

Stage 2 – Warringah Freeway Upgrade

1 July 2022

Revision E

0 30m 60m