Technical Note

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Project title	Newcastle Art Gallery Redevelopment	Job number	284000
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Prepared by	Jordan Cashel (Arup) Edward Bond (Arup)	Date	12 October 2021
Subject	Development Application Request for Information Responses for Items 2, 5 and 7 - DRAFT		

1 Introduction

On 27 September 2021, Naomi Ryan of Urbis requested that responses to Requests for Information (RFI) are provided to support the Newcastle Art Gallery (NAG) Redevelopment project Development Application. This memorandum provides the draft responses to the following RFI Items:

- Item 2 – The provision of high-level advice regarding the feasibility of planting trees within the Darby Street footpath and nearest trafficked lane (the constraints and opportunities for accommodating trees in the design had not been considered at this level of detail previously).
- Item 5 – The provision of preliminary existing and proposed case flood depths and levels for the site, both to inform the flood planning level and flooding impacts assessments (flood planning levels and flooding impacts had not been considered at this level of detail previously).
- Item 7 – The provision of revised vehicle swept paths for access into the proposed loading dock (vehicle swept paths had last been assessed during 2013 and had not been updated to suit the revised Gallery extension design or the provision of updated topographical survey).

2 RFI Item 2 – High Level Tree Planting Feasibility

2.1 Soil Volumes

The minimum required soil depth and volume is dependent on the height of the tree. Table 1 and Figure 1 include the Development Control Plan (DCP) minimum soil volumes required by City of Newcastle (CoN) to support the establishment of ground cover, shrubs and tree growth.

Table 1: Minimum Standards for Plant Growth (Source: City of Newcastle Development Control Plan, 2017)

3. Provide sufficient soil depth and area to allow for plant establishment and growth. The following minimum standards are recommended:

Plant Type	Minimum Soil Depth (m)	Minimum Soil Volume (m^3)
Large trees (over 8m high)	1.3	150
Medium trees or shrubs(2m to 8m high)	1.0	35
Small trees or shrubs (up to 2m high)	0.8	9
Small shrubs and ground cover	0.5	Not applicable

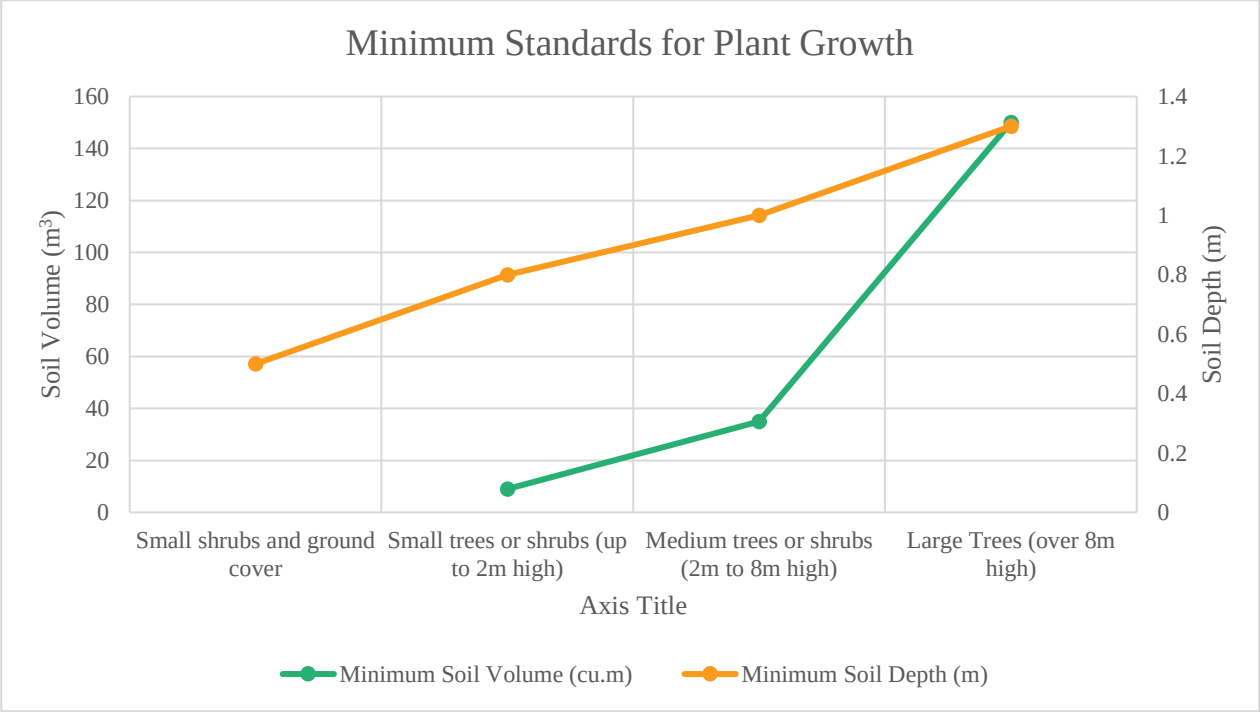

Figure 1: Minimum Standards for Plant Growth (Source: City of Newcastle Development Control Plan, 2017)

Considering the limited width available within the footpath, it is recommended that small or small-medium sized trees are considered for the project. Larger trees requiring larger soil volumes would necessitate significantly higher soil volumes, which are not ideal considering wind loads and more extensive root and canopy growths.

The arrangement of shared root balls is typically allowable to reduce the soil volume required for each tree, however the extent of overlap recommended depends on the tree species.

2.2 Tree Spacing

Street tree spacing is typically 8-10m depending on the tree species. The minimum recommended spacing is generally 6m, however, there would be nil to very minimal sharing of root balls in this situation.

From a lighting perspective, light poles are initially assessed with spaces of 2.5 times the height of the light poles (more detailed assessments consider the type, height and reach of the light poles). It is anticipated that small trees (up to 2m high) spaced approximately 6-10m apart will inflict minimal impact on the lighting through Darby Street. However, medium and large trees will need to be considered in more detail when assessing the proposed street lighting scheme for the site.

Given that the length of the footpath along Darby Street is approximately 75m, the recommended initial number of trees to be provided would be 7-12 trees. There are currently 6 established trees along Darby Street. This preliminary tree recommendation would need to assessed in more detail by an Arborist at subsequent design stages.

2.3 Tree Heights

Established tree canopy extents will need to be considered when assessing the dimensions of the proposed ground floor awning along Darby Street. The awning sits approximately 5.2m above the footpath along Darby Street and is proposed to extend outwards 3.4m from the building edge.

Along the southern portion of the Darby Street footpath, tree heights must also consider the overhead wiring above, which sits approximately 6.5m above the footpath.

As such, the recommendation for tree heights would be small-medium trees up to 5m in height whose canopies can be located within the footpath beneath the awning, unless the awning is cut back locally around individual tree locations. If opting for trees within the carriageway, trees up to 6m in height could be considered as they should be able to fit beneath the overhead wring.

However, please be aware that further considerations associated with utilities may prevent tree heights exceeding those of small trees – unless utilities are relocated. Please refer to Section 2.5 for details of the relevant utilities on site.

2.4 Landscaped trees within the adjacent trafficable lane

2.4.1 Overland Flow

The CoN standard drawings A3009 series outlines the arrangement of small to medium street tree planting between single, double and triple car spaces. Subsoil drainage in accordance with the CoN standard drawing A2003 will line the perimeter of the car park spaces and tree pits to facilitate the overland flow and direct the runoff to the main stormwater system. Please note this arrangement is recommended for roads with longitudinal grades less than 8%.

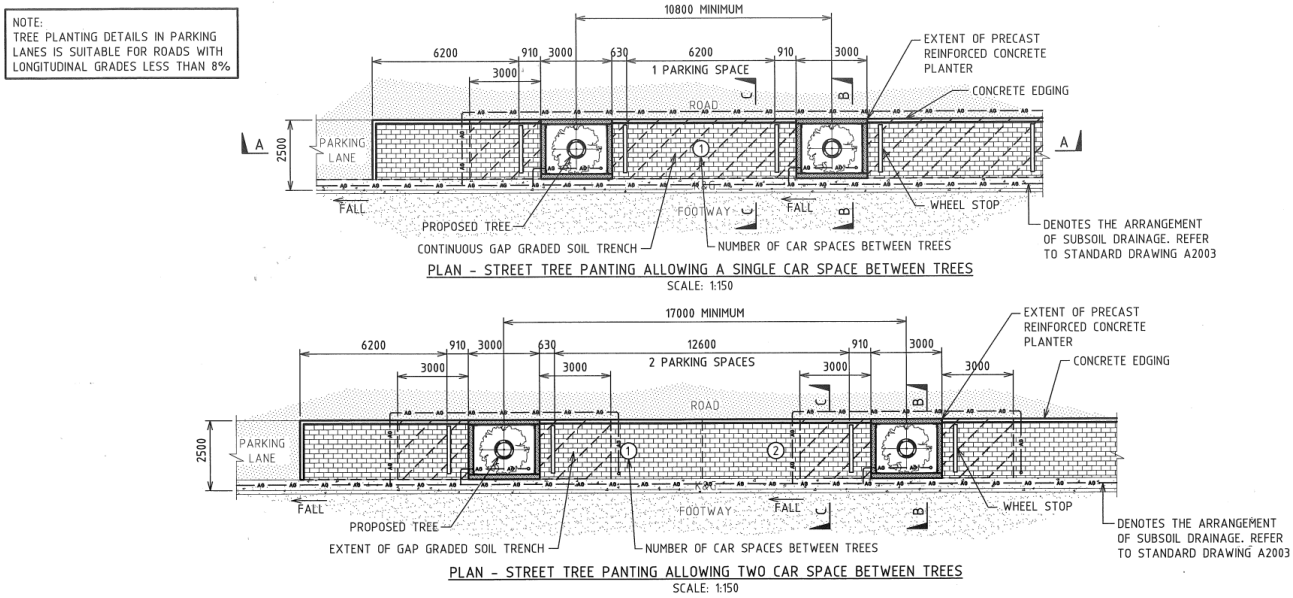

Figure 2: Excerpt of A3009-01 Tree planting small to medium road tree in parking lane residential area (Source: City of Newcastle Standard Drawings, 2018)

Again, please note that whilst tree planting details offset by car parking are available in CoN's guidance, the existence of utilities within the nearest trafficked lane of Darby Street will likely preclude the planting of large, medium and potentially even small trees within this area – unless these utilities are considered for relocation. Please refer to Section 2.5 for details of the relevant utilities on site.

2.4.2 Traffic Barriers around Mature Tree Trunks

Road safety barriers can be placed around significant tree trunks to prevent or reduce an unacceptable risk of injury or death from car crashes (due to the infrangible nature of mature tree trunks). However, this arrangement is generally only considered for roads with an unacceptable history of car crashes or for roads with allowable vehicle speeds in excess of 60km/hour (km/h).

As far as we understand, Darby Street includes a current maximum posted speed of 50km/h and has not been highlighted as having an unacceptable history of car crashes. It is therefore considered at this stage that medium to large mature trees would not require road safety barriers around them.

2.5 Potential Utilities Impacts

2.5.1 Utilities Interaction with Soil Volumes

There may be the potential for soil volumes to be established over existing communications and low voltage conduits with approval from the utilities owner, although this will need to be confirmed with each affected utilities owner. Whilst this is not a desirable outcome with regards to accessing utilities located beneath tree root zones and/or trunks, if the arrangement can be appropriately detailed and communicated to the utilities provider(s), apparently there is precedent for such an arrangement being reached within the CoN Local Government Area (as described by Matthew Swan from CoN during a NAG meeting held on 17 September 2021).

Establishing soil volumes over pressurised services is unlikely to be an acceptable option for tree establishment. Considering the existing gas and potable water mains located adjacent to the kerb beneath the road, planting trees within the roadway is not possible.

2.5.2 Potential Utility Impacts

The potential tree root ball impact to existing utilities within the Darby Street footpath have been identified and outlined in Table 2. The existing utilities and slit trench data used in this assessment were received from M&P surveyors on 20 September 2021. Please refer to Appendix A1 for existing utilities site plans and trench cross-sections with markups made by Arup indicating potential utilities impacts based on the type of ground cover, shrubs or tree planting, including small, medium and large trees.

Please note that the available trench cross-sections do not extend beyond the footpath. However, based on the existing utilities site plan, there are existing gas, potable water and sewer mains that run parallel to Darby Street within the nearest trafficked lane. Although levels have not yet been provided for these utilities by the surveyor, it is likely that at least the gas and water are located within the top 1m of the ground (perhaps even shallower), and would therefore preclude medium trees from being established unless these utilities were relocated.

Utilities providers could be consulted to determine whether they would permit small trees or ground cover to be planted over their assets within the nearest trafficked lane of Darby Street, although as this may be a viable option for the eastern side of the Darby Street footpath (where no utilities have been identified in the survey), it may make more sense to instead position small trees and groundcover within the footpath.

Table 2: Utilities Impacts for ground cover and shrubs and different sizes of trees within the nearest Darby Street trafficked lane

Potential Utility Impacts for each type of planting within the footpath				
Survey Slit Trench Location	**Small shrubs and ground cover**	**Small trees or shrubs (up to 2m high)**	**Medium Trees (2m to 8m)**	**Large Trees (over 8m high)**
Trench C*	• Electricity 100mm • Electricity NBN LV 40mm • Unknown Encasement.	All impacts from small shrubs and ground cover, plus: • Optus 50mm • Electricity Danger Tape (x3) • Unknown Encasement (x2) • Telstra 100mm.	All impacts from small trees or shrubs.	All impacts from small trees or shrubs.

Potential Utility Impacts for each type of planting within the footpath				
Survey Slit Trench Location	**Small shrubs and ground cover**	**Small trees or shrubs (up to 2m high)**	**Medium Trees (2m to 8m)**	**Large Trees (over 8m high)**
Trench D*	• Electricity LV 40mm.	All impacts from small shrubs and ground cover, plus: • Unknown Encasement (x3).	All impacts from small trees and shrubs, plus: • NBN 100mm.	All impacts from medium trees.
Trench E*	• Electricity LV 40mm.	All impacts from small shrubs and ground cover, plus: • Unknown Encasement (x3).	All impacts from small trees and shrubs, plus: • NBN 100mm.	All impacts from medium trees.
Trench F*	• Unknown Encasement (x2) • Danger Tape Electricity (x2) • NBN 100mm.	All impacts from small shrubs and ground cover, plus: • Telstra Optic Fibre Paver.	All impacts from small trees and shrubs.	All impacts from small trees and shrubs.

**All Trench cross-sections and utilities information is sourced from M&P dated 20 September 2021.*

2.6 Tree Assessment Conclusion

Given the constraints within the existing footpath, it is recommended that up to 12 small trees (up to 2m in height) are planted along the Darby Street footpath. While these trees will be smaller than the existing trees, this will be offset by the increased number of trees provided within the public domain. In the absence of an acceptable tree option on site, other vegetation options that may be worth considering include:

- A green wall
- A vegetated lattice structure with intermittent soil volumes for root establishment, either positioned along the Gallery extension wall or closer to the kerb (that potentially connect to the awning to create a shaded, green tunnel)
- Planter boxes (sizes and loads to be discussed with utilities providers, as needed)
- Planting trees at another site, as compensatory offset to the existing trees that will be removed on site (and which cannot be replaced on site).

3 RFI Item 2 – Preliminary Flood Model Results

The response to this item has been informed by running a series of Council-owned flood models which were provided to Arup on the 24th of September 2021. Details of the assessment are outlined in the following section in addition to an updated flood planning level assessment.

3.1 Available Data

There are several flood models throughout the Council area. The key studies of note include:

- Throsby, Cottage and CBD Flood Study completed by (BMT WBM, 2008)
- Newcastle Flood Planning – Stage 1: Concept Planning (BMT WBM, 2009)
- Nesca Park Detention Basins Dam Safety Assessment (Royal HaskoningDHV, 2020).

Overviews of these projects are discussed in the following sections.

3.1.1 Throsby, Cottage and CBD Flood Study (BMT WBM, 2008)

The Throsby, Cottage and CBD flood study was a detailed study undertaken by BMT WBM in 2008 to inform flood management approaches throughout Newcastle. The study was based upon Australian Rainfall and Runoff Guidelines 1987 (ARR87), with a hydrological model developed utilising WBNM software and a hydraulic model developed using TUFLOW software.

The hydrological and hydraulic models underwent calibration to recorded flood levels for two notable historic flood events: one in 1988 and one in 1990. Design events for the same models were then conducted utilising calibrated parameters.

Based on the modelling undertaken, the critical storm durations (‘critical’ storm durations produce the greatest flooding) were identified throughout the Throsby Creek, Cottage Creek and CBD areas as being either the 2-hour duration or the 9-hour storm duration. 2- and 9-hour critical storm durations are a common outcome of ARR87 studies in coastal NSW due to their dominant storm temporal pattern shapes.

The hydraulic model utilised a 10m grid, the extent of which is shown in Figure 3.

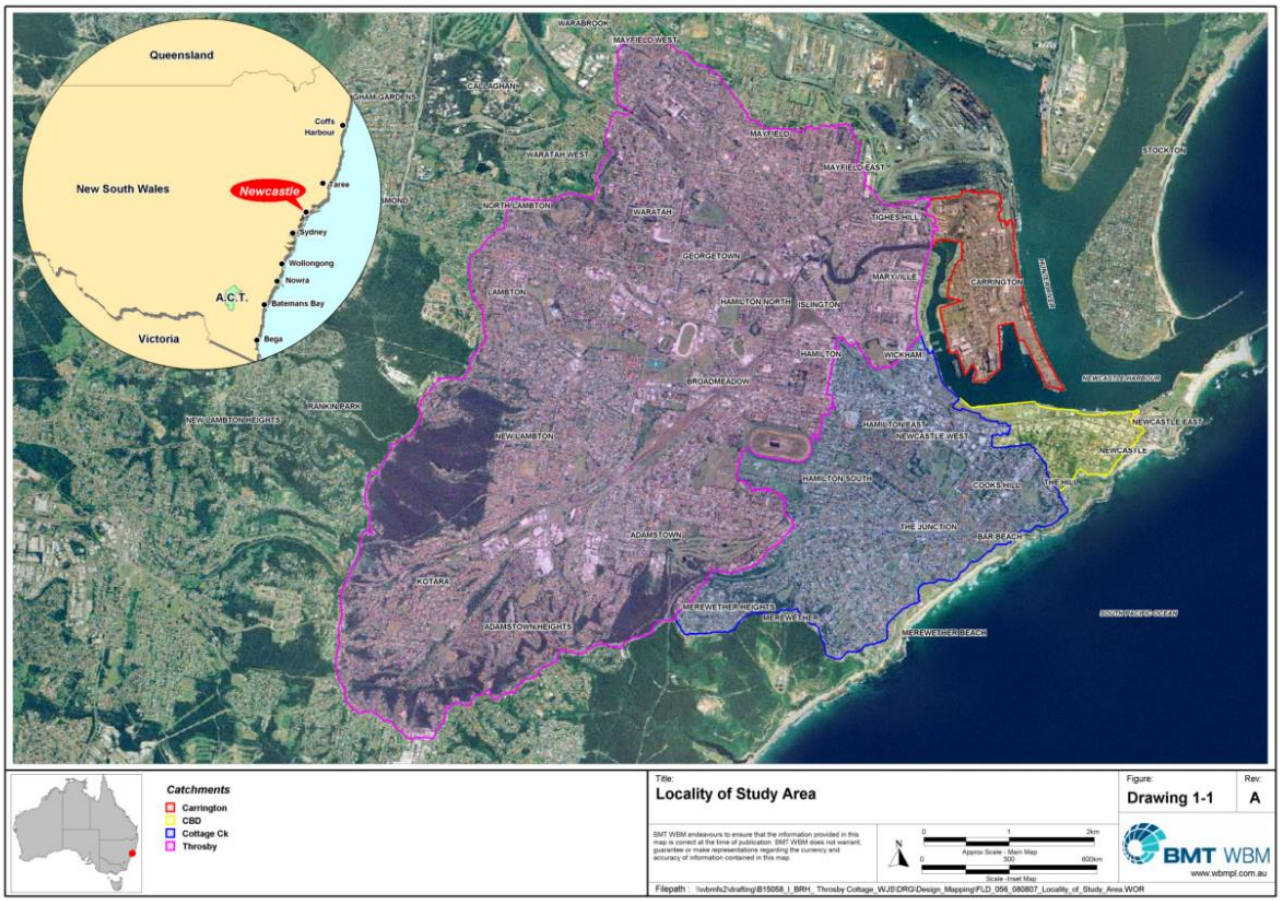

Figure 3: BMT WBM Study Area (BMT WBM, 2008)

Based on the flood contour results included in the study, flood levels at the southeast corner of the Newcastle Art Gallery are 8m AHD and 8.4m AHD for the 1% Annual Exceedance Probability (AEP) (1 in 100 year) and Probable Maximum Flood (PMF) events respectively.

3.1.2 Newcastle Flood Planning – Stage 1: Concept Planning (BMT WBM, 2009)

Following on from the works undertaken in 2009, BMT WBM undertook a flood planning study which expanded the works to consider additional creeks: Dark Creek & Wallsend, as well as considering Hunter River flooding and sea level flooding mechanisms. The outcome from these works indicate that the NAG site is impacted by local overland flooding, or flash flooding mechanisms, rather than flooding from the sea. The critical flooding mechanisms by area is shown in Figure 4.

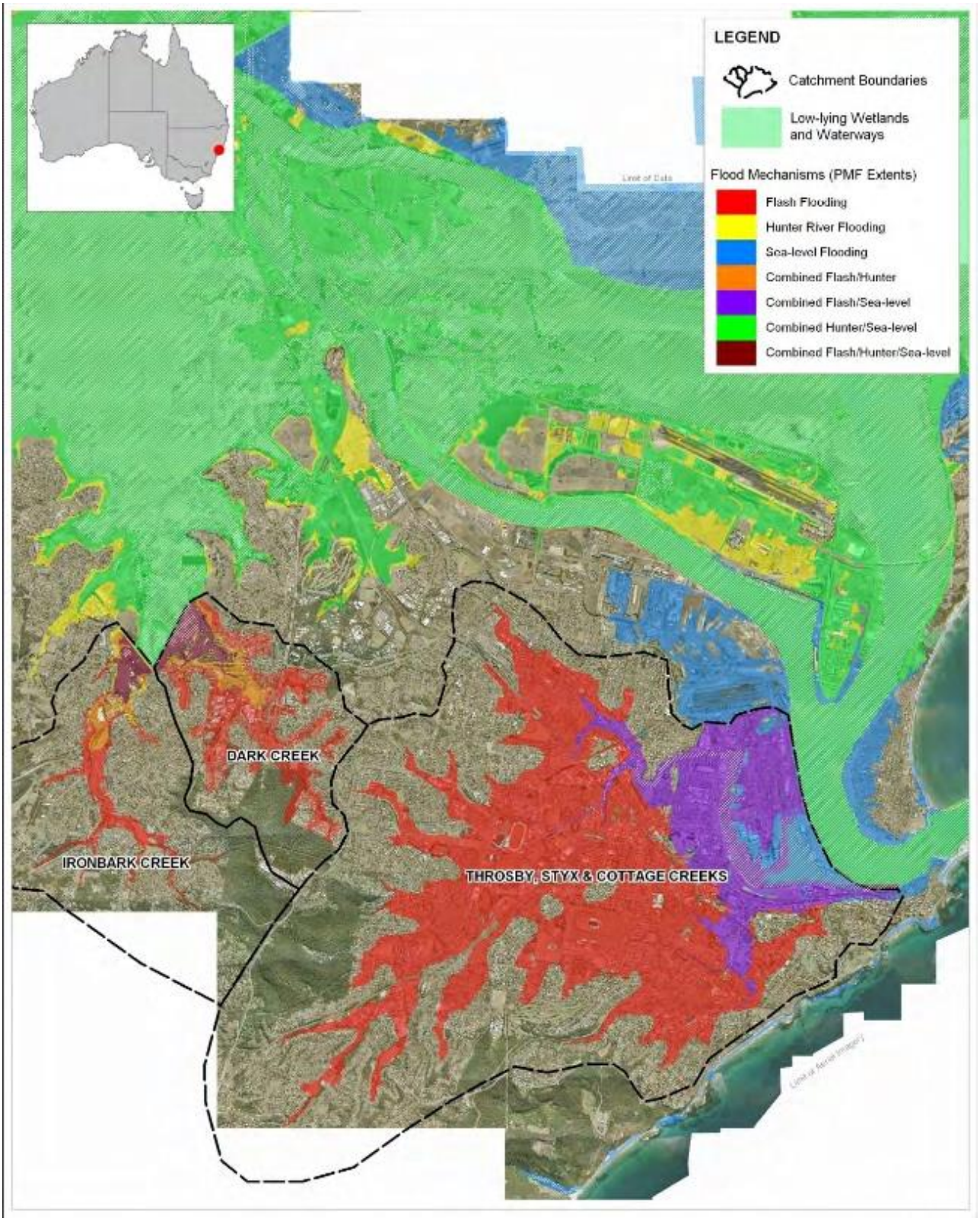

Figure 4: Local Catchments within the Newcastle Local Government Area (BMT WBM, 2009)

3.1.3 Nesca Park Detention Basins – Dam Safety Assessments (Royal HaskoningDHV, 2020)

The Dam Safety Assessment undertaken for the Nesca Park Detention Basins was completed in 2020 and involved the development and update of a detailed hydraulic model to align with Australian Rainfall and Runoff Guidelines 2019 (ARR2019). The study was undertaken with the intention of establishing the risk associated with a cascading dam failure of the detention basins in Nesca Park. The study area extent is shown in Figure 5.

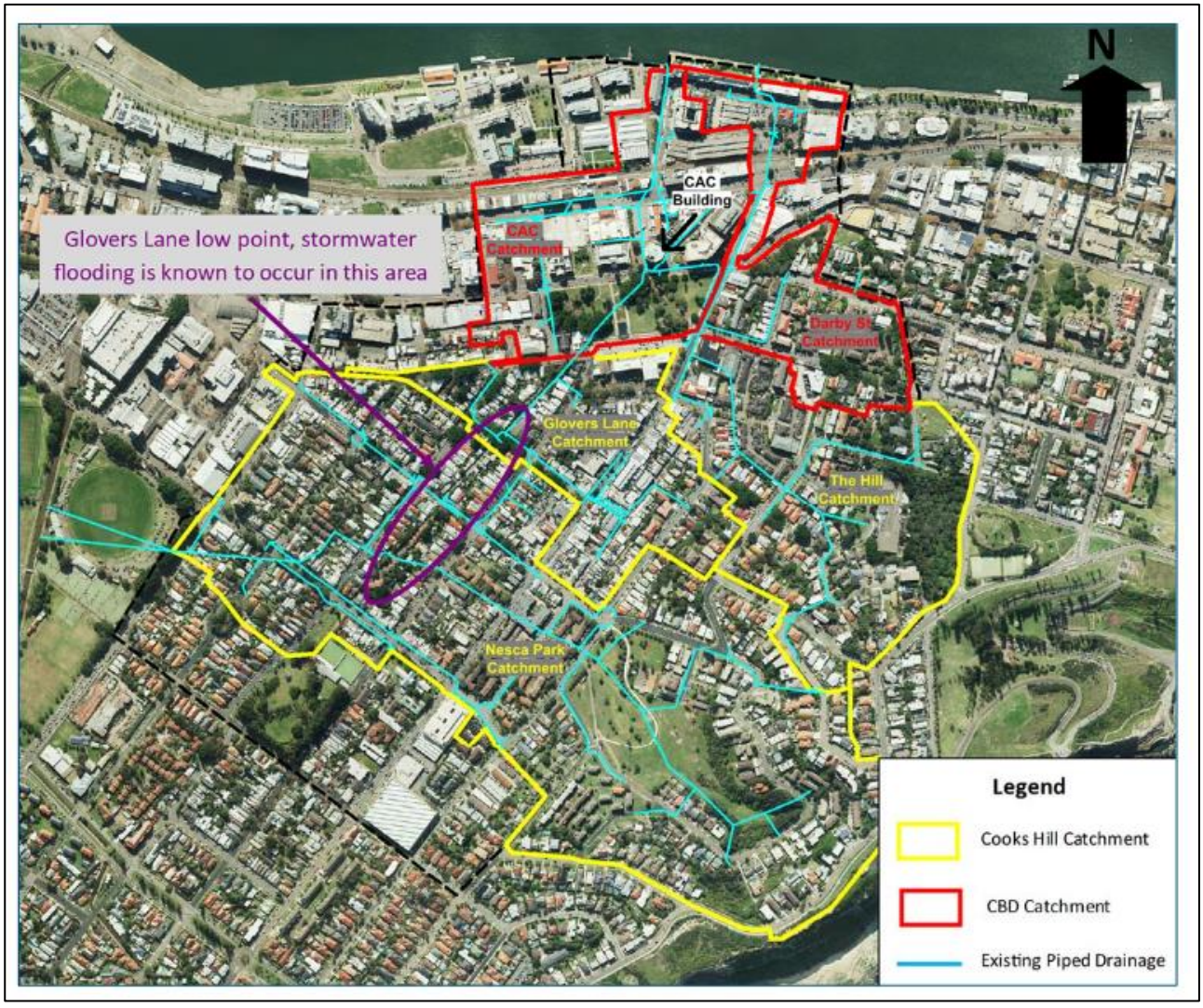

Figure 5: Study Area (RHDHV, 2020)

The models developed as part of this study utilised DRAINS software for hydrological modelling, and TUFLOW for the hydraulic modelling. The TUFLOW hydraulic model utilised 2018 terrain data, pit and pipe network details, survey information, and included a 1m computational grid spacing.

3.2 Adopted Model and Assumptions

Following review of the modelling files available, the decision was made to adopt the Royal HaskoningDHV (RHDHV) flood model to assess the impacts of the proposed Newcastle Art Gallery Extension. This approach was taken as the RHDHV model aligns with the latest industry accepted guidelines, utilises more recent data and includes a far finer computational grid, representing better conveyance through minor flow paths around the area of interest.

Note that the assumption has been made that the flood models developed by Royal HaskoningDHV are appropriate for the use of assessing the NAG site for flood planning levels and offsite flooding impacts, and that a detailed review of the provided hydrological model has not been undertaken.

3.3 Hydrology

The hydrological inputs for the hydraulic model were adopted from the RHDHV study under the assumption that they are appropriate for use on the NAG project. The hydrological assessment completed by RHDHV utilised DRAINS software and adhered to ARR2019 methodology. The inputs for the hydrological model are sourced from the ARR Data hub. The losses adopted within the DRAINSs model are shown below in Table 3.

Table 3: Adopted Design Storm Losses (RHDHV, 2020)

Area Type	**Loss**	**20% AEP (1 in 5 year)**	**10% AEP (1 in 10 year)**	**1% AEP (1 in 100 year)**
Impervious	Initial (mm)	2.5	2.5	2.5
	Continuing (mm/hr)	0	0	0
Pervious	Initial (mm)	8.1	8.4	5.4
	Continuing (mm/hr)	0.9	0.9	0.9

The ARR2019 ensemble approach was undertaken, with the critical durations throughout the area ranging between 30 minutes and 60 minutes for all storm events (refer to Table 4 for details). The adopted critical events for the AEPs assessed are shown in Table 4. Note a PMF event was also simulated using the Generalised Short Duration Method (GSDM), as is industry practice. Climate change modelling was also completed by RHDHV, with rainfall estimates forecast to the year 2100. Inputs for the 1% AEP, 1% AEP + CC (climate change) and the PMF event have also been utilised within the hydraulic model to assess the proposed NAG development.

Table 4: Critical Storms (RHDHV, 2020)

AEP Event	**Critical Duration (minutes)**	**Temporal Pattern**
20% (1 in 5 year)	45	TP8
10% (1 in 10 year)	30	TP8
1% (1 in 100 year)	60	TP8

As is industry standard practice, sensitivity testing was undertaken on the fraction impervious within the catchment, with a blanket 25% increase and decrease being trialled. Changes to flood levels resulting from changes were found to only be in the order of a few millimetres.

For details of the hydrological modelling process, refer to the Nesca Basins DSA Report (Royal HaskoningDHV, 2020).

3.4 Hydraulics

3.4.1 Model Build Summary

A 2D TUFLOW hydraulic model sourced from the works by Royal HaskoningDHV was utilised for the assessment of flood levels at the proposed NAG site.

A basic summary of the local catchment hydraulic model is shown in Table 5.

Table 5: Gilbert River Bridge Hydraulic Model Summary

Parameter	**Information**
Model Build Development Date	2020 by Royal HaskoningDHV
AEP Events assessed	1% AEP, 1% AEP + CC and PMF
Hydraulic Modelling Approach	Inflows determined through DRAINS hydrological modelling, applied through a combination of source area and direct rainfall polygons.
Hydraulic Modelling Platform	TUFLOW version 2020-01-AB-iSP
Model Extent	Refer to Figure 6
Grid Size	1m
Topographic Data	1m LiDAR and survey datasets
Roughness	Spatially various roughness values
Eddy Viscosity and Turbulence	Wu
Downstream Model Boundary	HQ (stage-discharge) boundary
Hydraulic Model Time Step	Adaptive time step (HPC GPU)
Modelled Scenarios	Existing Case (Opt4a) Proposed NAG site (Opt4a_NAG)

Figure 6: TUFLOW Model Extent (RHDHV, 2020)

For details of the hydraulic modelling process, refer to the Nesca Basins DSA Report (Royal HaskoningDHV, 2020).

3.4.2 Representation of Proposed NAG site in Hydraulic Model

The proposed expansion to the Newcastle Art Gallery has been represented within the hydraulic model through use of a raised Z-shape polygon (a polygon with ground level and roof elevations that can deflect overland flows like a building). This modelling approach is consistent with the way buildings are generally represented within the hydraulic model. The extent of the proposed structure is shown in Figure 7.

Figure 7: Extent of Proposed Building Extension

3.5 Flood Impacts of Proposed Works

As part of this assessment, the impacts of the proposed structure on flood behaviours have been quantified. Figure 8 below shows the afflux caused as a result of the building expansion for the 1% AEP event. The flooding impacts are shown to be negligible, with some minor localised affluxes (increased design case flood depths) of 10-14mm in between the kerbs of Queen Street. No 1% AEP flooding impacts are expected outside of the road corridor due to the proposed works.

Figure 8: 1% AEP Event Afflux

3.6 Flood Planning Levels

At the direction Council, proposed ground floor entrance threshold levels that lead to basement areas are required to be set at the greater of the:

a) 1% AEP event flood level plus a 300mm freeboard, or

b) PMF level.

Whichever is the greater flood level. Entrances that lead to basement areas are understood to include to all possible ingress points such as vehicle entrances and exits, ventilation ducts, windows, light wells, lift shaft openings, risers and stairwells.

Note that for the site, the 1% AEP event flood level + 300mm is very similar to the PMF level, with either event flood level standing higher than the other in some areas. As such, to assess the site an approach was adopted to use a maximum flood level results grid that combined the peak flood levels from the 1% AEP event + 300mm and PMF event.

A climate change scenario was also simulated and can be adopted if desired by Council. However, note that the difference between 1% AEP and 1% AEP + Climate Change is only approximately 60mm across the site. Refer to Section 3.3 for details of the climate chance scenario.

For the purposes of this assessment, the FPL (flood planning level) for each event has been tabulated in Table 6. Where the flood extent of a particular event did not reach a proposed entrance location, the FPL has not been included. Refer to Figure 9 for the entrance ID labels referenced in Table 6. Each of these entrances leads to a basement level.

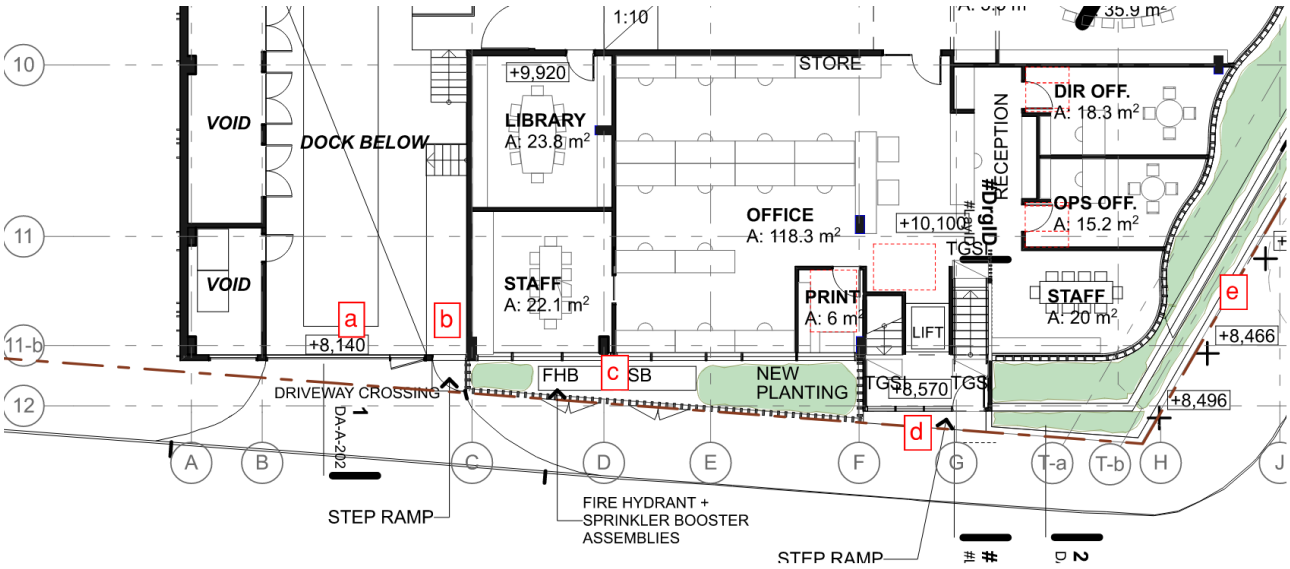

Figure 9: Ground Floor Plan Flood Planning Levels at Entrances Leading to Basement Areas

Table 6: Newcastle Art Gallery Flood Planning Level Assessment

Entrance No.	Entrance Type	Entrance Threshold Relative Level (RL)	1% AEP FPL	1% AEP + 300mm FPL	1% AEP + CC FPL	1% AEP + CC + 300mm FPL	PMF	Notes
a	Basement	Ground level = RL 8.14. Top of step up = RL 8.38).	-	-	RL 8.03	RL 8.33	RL 8.25	Loading Dock includes a step up prior to basement at RL 8.380 which has been considered as the entrance level.
b	Basement	RL 8.350	-	-	RL 8.03	RL 8.33	RL 8.25	
c	Basement	~ RL 8.20	-	-	RL 8.17	RL 8.47	RL 8.42	Louvres considered as potential ingress point.
d	Basement	RL 8.50	RL 8.33	RL 8.63	RL 8.37	RL 8.67	RL 8.60	
e	Basement	~ RL 8.77	RL 8.37	RL 8.67	RL 8.41	RL 8.71	RL 8.63	Window considered as potential ingress point.

Notes:
All levels are shown in mAHD to two decimal points of a metre.
A green highlighted value indicates where an entrance threshold level stands above a flood level; An orange highlighted value indicates where an entrance threshold level would be inundated by a flood level.

As is demonstrated by the assessment, the building levels are generally compliant with the flood planning level assessment. The points of concern at current are entrance points ‘c’ and ‘d’ which represent the louvres and the pedestrian access respectively. To mitigate the risks associated with these entrances, the following strategies are suggested for consideration:

- Louvres: Raise louvres to be above the FPL. The louvres could be widened as needed to meet the same ventilation requirements.
- Pedestrian access:
    a) Increase level to match the flood level of either the 1% AEP event + 300mm (8.63m AHD), 1% AEP event + CC + 300mm (8.67m AHD) or PMF event (8.6 mAHD) – whichever Council would prefer – and investigate a DDA complaint ramping solution that makes use of the land to the east without creating the need for existing footpath levels or grades to change. The existing footpath crossfall at this location is already non-compliant at greater than 3% (2.5% is the maximum compliant crossfall), so attempting to steepen the footpath so it climbs to meet a more elevated pedestrian access level is unlikely to be feasible. Other more involved options would include trying to raise kerb heights and even adjacent road levels to meet a more elevated pedestrian access level. However, these would be expensive and may consume floodwater conveyance area and exacerbate flooding issues further.
    b) Maintain level at 8.50m AHD and provide a demountable flood barrier for events rarer than a 1% AEP (1 in 100 year) flood. Maintaining the current access level would continue to achieve Disability Discrimination Act (DDA) compliance, provide better connectivity and activation to the existing footpath, and reduce the need for a local ramping solution.

Demountable flood barriers are removable and can be manually lifted and slotted into place when needed, which in the case of the current pedestrian access level would be during flood events less

frequent than a 1% AEP (1 in 100 year). An example of a demountable flood barrier is shown in Figure 10.

The benefits of demountable barriers are that they:

- Are cost-effective
- Are lightweight – they can be placed in position swiftly by a single individual when the time arises (such as a security guard)
- Can be stored flat against the ground or against a wall in a storage room
- Can be specifically designed to fit the width of an bespoke entrance.

However, demountable flood barriers that are purchased for rare, very rare or extreme events (events that occur less than once a century or even once every few million years) also include the risk that they are not erected when a large enough flood event occurs – perhaps because the security guard responsible for their erection is off sick, on holiday or retired by the time a large enough flood occurs, or perhaps no one can remember where the flood defence is stored when the time comes (or maybe it was even thrown away years ago because no one could remember what it was for). Demountable flood barriers are also not suitable for premises that do not have staff working at night who can erect them, or for catchments that display rapid flooding in response to rainfall (where flood warning would be too short or even not present at all).

For these important reasons, if a demountable flood barrier solution is adopted by Council, a flood management plan should be clearly documented and refreshed periodically to ensure that appropriate staff are aware of the need for the flood barrier and know where it is stored and how to erect it effectively.

Figure 10: Floodgate System (Flooding Solutions Advisory Group)

3.7 Flooding Assessment Conclusion

Offsite flooding impacts created by the new Gallery extension are very minor within one small localised area of Queen Street to negligible anywhere else for the 1% AEP (1 in 100 year) event. Offsite flooding impacts for the project are therefore considered to be compliant.

Flood planning levels for the entrances included in the proposal and their various levels of flooding immunity are included in Table 6. Two entrance threshold levels do not currently achieve flooding compliance: the louvres and the pedestrian access. It is recommended that:

- The level of the louvres are raised to achieve flood planning level compliance. It is assumed that is they are raised they can still be made to achieve compliant ventilation requirements.
- If practicable, the pedestrian access is raised to 8.63m AHD to achieve flooding compliance for the 1% AEP event + CC + 300mm freeboard, which is marginally higher than the PMF level at 8.60m AHD. A DDA compliant ramping solution that makes use of ground to the east may be a possibility to achieve this. If this level cannot reasonably be achieved, then the next highest feasible level should be included and the difference to the 1% AEP event flood level + CC + 300mm freeboard made up using a suitable flood defence.

4 RFI Item 7 – Loading Dock Vehicle Turning Paths

4.1 Medium Rigid Vehicle Turning Paths

Turning paths were assessed using a Medium Rigid Vehicle (MRV) with a length of 8.8m at a design speed of 5km/h. The assessment demonstrated that the vehicle is able to access Queen Street via a:

a) Right-hand turn from a Darby Street southbound approach, or

b) Left-hand turn from a Darby Street northbound approach.

This assessment is shown in Appendix A2. Upon entering Queen Street, the vehicle must then cross the centreline and reverse into the loading dock from the opposing lane. This can be achieved without restricting access to existing adjacent street parking.

Restricting the loading dock operation to a MRV only, rather than a Heavy Rigid Vehicle (HRV), requires minimal to no design changes or modifications to the public domain. However, this may have the effect of limiting the Gallery's versatility in providing unique exhibitions featuring large pieces of art.

4.2 Heavy Rigid Vehicle Turning Paths

Turning paths were also assessed using a HRV with a length of 12.5m at a design speed of 5km/h. The assessment demonstrated that the vehicle is able to access Queen Street via a right-hand turn from a Darby Street southbound approach only. This assessment is shown in Appendix A2. The issues with the existing configuration are listed below. The:

- HRV cannot enter Queen Street via a left-hand turn from a northbound approach

- HRV cannot enter Queen Street without crossing the centreline
- HRV cannot enter the loading dock without reversing in from the opposite lane
- HRV cannot exit the loading dock and adequately stop in the correct lane at the traffic lights.

Potential mitigation strategies and solutions for allowing HRV access to the art Gallery loading dock are listed below:

- Maintain the existing configuration but remove one on-street parking space along Queen Street. This will allow the vehicle space to exit the intersection and queue while waiting for vehicles to pass. Another alternative would be to include demountable bollards within the one on-street parking space to be removed, and to raise the bollards on the day (or the days before, just to be safe) that the HRV needs to access the loading dock.
- Replace the existing road vehicle barrier along the western section of Queen Street with demountable bollards to allow access to the loading dock by a HRV, when required. This would require CoN to approve the removal of the bollards each time HRV access to the Gallery is required (which may only be every few months or even years – to be confirmed with the Gallery), but would limit the requirement for traffic management solutions, the removal of existing car park spaces or public domain alterations.
- Public domain alterations to kerbs, footpaths and line marking to provide the lane width required for the HRV to utilise the loading dock. However, this would reduce existing footpath widths and represent a poor outcome for the public domain.

4.3 Loading Dock Assessment Conclusion

The recommended approach is to maintain the existing loading dock vehicle access arrangement whilst removing one on-street parking space or positioning bollards within this parking spot (and ensuring the parking spot is not occupied when a HRV needs to access the loading dock). The Gallery should ensure that a spotter assists the HRV to reverse into the loading dock to prevent collisions with parked vehicles and halt oncoming traffic.

If this approach is not accepted then the other strategies could be considered, however the result would likely be that the accepted vehicle size would need to be limited to a smaller MRV.

A1 Survey Slit Trench Section Markups

M&P

LINE TYPES

- DENOTES FENCING
- DENOTES CADSTRAL BOUNDARY
- DENOTES EDGE OF CONCRETE
- TOP — DENOTES TOP OF BANK
- TOE — DENOTES TOE OF BANK
- DENOTES CENTRELINE OF BITUMEN
- DENOTES EDGE OF BITUMEN
- DENOTES EDGE OF TREE LINE

SERVICES LINE TYPES

- DRAINAGE LINE CLASS A
- DRAINAGE LINE CLASS B
- DRAINAGE LINE CLASS C
- DRAINAGE LINE CLASS D
- UNDERGROUND ELECTRICAL CABLE CLASS A
- UNDERGROUND ELECTRICAL CABLE CLASS B
- UNDERGROUND ELECTRICAL CABLE CLASS C
- UNDERGROUND ELECTRICAL CABLE CLASS D
- UNDERGROUND RMS SIGNAL CABLE CLASS B
- UNDERGROUND TELECOMMUNICATIONS CABLE CLASS A
- UNDERGROUND TELECOMMUNICATIONS CABLE CLASS B
- UNDERGROUND TELECOMMUNICATIONS CABLE CLASS C
- UNDERGROUND TELECOMMUNICATIONS CABLE CLASS D
- GAS MAIN CLASS A
- GAS MAIN CLASS B
- GAS MAIN CLASS C
- GAS MAIN CLASS D
- SEWER MAIN CLASS A
- SEWER MAIN CLASS B
- SEWER MAIN CLASS C
- SEWER MAIN CLASS D
- WATER MAIN CLASS A
- WATER MAIN CLASS B
- WATER MAIN CLASS C
- WATER MAIN CLASS D

LEGEND

BUILDING
- AC AIRCON DUCT
- COL COLUMN
- FL FLOOR LEVEL

DRAINAGE
- DIP DRAINAGE INLET PIT
- INV INVERT LEVEL
- KIP KERB INLET PIT
- SIP SURFACE INLET PIT

ELECTRICITY
- EM ELECTRICITY MARKER
- EPT ELECTRICITY PIT
- LP LIGHT POLE
- PP POWER POLE

GAS
- GM GAS MARKER
- GPT GAS PIT
- GV GAS VALVE

MISCELLANEOUS
- MPIT MISCELLANEOUS PIT
- MW MONITORING WALL

ROAD
- LOOP RMS LOOP DETECTOR
- TLC TRAFFIC LIGHT CONTROL BOX

SEWER
- SMH SEWER MANHOLE
- IPS SEWER INSPECTION POINT

STRUCTURE
- BOL BOLLARD
- SGN SIGN POST

TELECOMMUNICATIONS
- TPI TELECOMMUNICATIONS PILLAR
- TPT TELECOMMUNICATIONS PIT

TREES
- TR TREE
- H HEIGHT OF TREE
- C SPREAD OF CANOPY
- D DIAMETER OF TRUNK

WATER
- HYD HYDRANT
- SV STOP VALVE
- WMT WATER METER

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0 5 10 15 20 25m

REDUCTION RATIO – 1:250 (A1)
REDUCTION RATIO – 1:500 (A3)

REVISIONS

No	REVISION	SVY	DFT	CHK	DATE
1	ISSUE TO CLIENT	JW	MAK	IRB	20/09/21

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P (02) 4926 1388
NEWCASTLE SYDNEY GUNNEDAH MUSWELLBROOK

Surveyed	Drafted	Checked
JW/GS	MAK	IRB

REGISTERED SURVEYOR

@A1 : 1:250
@A3 : 1:500

DO NOT SCALE

Original Size: A1

Client: CITY OF NEWCASTLE

Title: EXISTING SERVICES & SECTIONS
LAMAN, DARBY & QUEEN STREETS
COOKS HILL

CAD File: 210255C_01 | Ref No: 21/0255 | Date: 20/09/2021

Sheet No. 1/5

Revision 1

SURVEY INFORMATION

1. THE SURVEY IS ON MAP GRID OF AUSTRALIA (MGA) CO-ORDINATES (GDA 94) ZONE 56.

   -THE ORIGIN OF CO-ORDINATES IS PM 8465
   E 385343.533 N 6355901.402
   -SOURCE OF CO-ORDINATES: SCIMS
   -DATE 04/06/2021

2. ALL REDUCED LEVELS ARE ON AUSTRALIAN HEIGHT DATUM (A.H.D)

   -ORIGIN OF LEVELS PM 8465. RL7.091
   -SOURCE OF REDUCED LEVELS: SCIMS
   -DATE OF REDUCED LEVELS 04/06/2021

3. CONTOUR INTERVAL IS 0.2m.

4. MGA AND ISG CO-ORDINATE SYSTEMS ARE BASED ON A MATHEMATICAL EARTH MODEL AND SUBJECT TO VARIABLE SCALE FACTORS. DISTANCES CALCULATED FROM CO-ORDINATES MAY VARY SIGNIFICANTLY FROM GROUND MEASUREMENTS. IF FURTHER CLARIFICATION IS REQUIRED CONTACT MONTEATH AND POWYS.

IMPORTANT NOTES

1. NOT ALL SERVICE INFORMATION MAY BE SHOWN DUE TO UNAVAILABILITY OF SERVICE PLANS OR CURRENT INFORMATION.
2. THE POSITION OF SERVICES LOCATED BY ACCREDITED SERVICES CONTRACTOR USING CONDUCTIVE TRACING TECHNIQUES ARE RECORDED ON THIS PLAN. MONTEATH & POWYS ARE UNABLE TO VERIFY THE ACCURACY OF THESE LOCATIONS AND ADVISE THE REQUIREMENT FOR POSITIVE IDENTIFICATION PRIOR TO EXCAVATION OR CONSTRUCTION IN THEIR VICINITY. ANY DEPTHS OF SERVICES FROM INDUCTIVE TRACING WHICH ARE INDICATED ON THIS PLAN ARE INDICATIVE ONLY AND SHOULD BE VERIFIED BY POTHOLING IF CRITICAL TO DESIGN.
3. THE POSITION AND DEPTH OF SERVICES LOCATED BY POTHOLING/NON-DESTRUCTIVE DIGGING TECHNIQUES ARE RECORDED ON THIS PLAN. THE POSITION/DEPTH IS TRUE ONLY AT THE SPECIFIC SURVEYED POINT SHOWN, AND ANY INTERPOLATION BETWEEN SURVEYED SERVICES MAY NOT ACCURATELY REFLECT THEIR ACTUAL POSITION AT ANY POINT IN BETWEEN.
4. INDEPENDENT ENQUIRIES FOR UP-TO-DATE SERVICE LOCATIONS THROUGH THE RELEVANT AUTHORITIES MUST BE UNDERTAKEN PRIOR TO COMMENCEMENT OF ANY WORKS/EXCAVATION. EXACT SERVICE POSITIONS SHOULD BE ESTABLISHED BY APPROPRIATE MEANS. WE RECOMMEND PROFESSIONAL SERVICE LOCATORS.
5. THE BOUNDARIES SHOWN ON THIS PLAN ARE BASED ON OUR FIELD SURVEY. TO FORMALISE THESE DIMENSIONS, WE WOULD RECOMMEND THE PREPARATION OF A REDEFINITION PLAN, SUITABLE FOR LODGEMENT AND REGISTRATION WITH NSW LAND REGISTRY SERVICES.
6. DUE TO THE AGE OR COMPILED NATURE OF THE DEPOSITED PLANS USED, THESE DIMENSIONS COULD BE OUT OF DATE AND INCORRECT BY MODERN STANDARDS.
7. THIS PLAN SHOULD NOT BE USED FOR BUILDING WORKS CLOSE TO OR ON THE BOUNDARY, OR TO PROSCRIBED SET-BACKS WITHOUT FURTHER SURVEY INVESTIGATION.
8. NO EXCAVATIONS HAVE BEEN MADE TO DETERMINE THE EXTENT TO WHICH ANY SUBJECT WALLS, FOUNDATIONS OR FOOTINGS MAY ENCROACH UPON ADJOINING LAND.
9. NO EXCAVATIONS HAVE BEEN MADE TO DETERMINE THE EXTENT TO WHICH ANY ADJOINING WALLS, FOUNDATIONS OR FOOTINGS MAY ENCROACH UPON SUBJECT LAND.
10. ALL TREE DIMENSIONS, HEIGHT (H), CANOPY (C) AND TRUNK DIAMETER (D) HAVE BEEN ESTIMATED. IF ACCURATE DIMENSIONS ARE REQUIRED FOR DESIGN PURPOSES, FURTHER SURVEY SHOULD BE REQUESTED.
11. CONTOURS SHOWN DEPICT THE TOPOGRAPHY. CONTOURS DO NOT REPRESENT THE EXACT LEVEL AT ANY PARTICULAR POINT, EXCEPT AT SPOT LEVELS SHOWN.
12. THIS PLAN MUST REMAIN UNALTERED AS ISSUED BY MONTEATH & POWYS. ALTERING ANY PART OF THIS PLAN DESTROYS THE INTEGRITY OF THE PLAN. ANY REVISIONS REQUESTED MUST BE ISSUED BY MONTEATH & POWYS.
13. THESE NOTES ARE AN INTEGRAL PART OF THIS PLAN. REPRODUCTION OF THIS PLAN OR OF ANY PART OF THIS PLAN, WITHOUT THESE NOTES BEING INCLUDED IN FULL, WILL RENDER THE INFORMATION SHOWN ON SUCH REPRODUCTION INVALID AND NOT SUITABLE FOR USE.

LEGEND

BUILDING
- AC AIRCON DUCT
- COL COLUMN
- FL FLOOR LEVEL

DRAINAGE
- DIP DRAINAGE INLET PIT
- INV INVERT LEVEL
- KIP KERB INLET PIT
- SIP SURFACE INLET PIT

ELECTRICITY
- EM ELECTRICITY MARKER
- EPT ELECTRICITY PIT
- LP LIGHT POLE
- PP POWER POLE

GAS
- GM GAS MARKER
- GPT GAS PIT
- GV GAS VALVE

MISCELLANEOUS
- MPIT MISCELLANEOUS PIT
- MW MONITORING WELL

ROAD
- LOOP RMS LOOP DETECTOR
- TLC TRAFFIC LIGHT CONTROL BOX

SEWER
- SMH SEWER MANHOLE
- IPS SEWER INSPECTION POINT

STRUCTURE
- BOL BOLLARD
- SGN SIGN POST

TELECOMMUNICATIONS
- TPI TELECOMMUNICATIONS PILLAR
- TPT TELECOMMUNICATIONS PIT

TREES
- TR TREE
- H HEIGHT OF TREE
- C SPREAD OF CANOPY
- D DIAMETER OF TRUNK

WATER
- HYD HYDRANT
- SV STOP VALVE
- WMT WATER METER

SERVICES IMPORTANT NOTES

1. THIS PLAN SHOWS A REPRESENTATION OF THE DWG MODEL. THIS MODEL SHOULD BE VIEWED IN A CAD ENVIRONMENT TO INTERPRET THE INFORMATION.
2. THIS UTILITY PLAN IS VALID AND UPDATED AT THE TIME OF UTILITY INVESTIGATION. FURTHER CONFIRMATION WILL BE REQUIRED TO VALIDATE ANY FUTURE WORKS REGARDING UTILITY LOCATIONS.
3. THIS PLAN SHOULD NOT BE USED FOR EXCAVATION PURPOSES.
4. THIS PLAN HAS BEEN DRAWN TO SCALE, AND ANY REPRODUCTION OF THIS PLAN WILL NEED TO BE DRAWN IN COLOUR AND AT THIS SCALE TO ENSURE THAT ALL RELEVANT NOTES AND ENHANCEMENTS ARE SHOWN. FAILURE TO DO THIS WILL VOID ALL INFORMATION INDICATED FOR THIS JOB.
5. ALL SERVICES HAVE BEEN ELECTRONICALLY TRACED IN THE FIELD AND ARE SHOWN HERE FOR DIAGRAMMATIC PURPOSES ONLY. DEPTHS SHOWN ARE APPROXIMATE ONLY AND SHOULD BE VERIFIED PRIOR TO WORKS.
6. SERVICES LOCATED BY GPR ARE SHOWN AS QL-D.
7. POTHOLING IS NEEDED TO VERIFY UTILITY LOCATIONS AND DEPTHS ARE CORRECT, THAT IS QL-A, AND IS REQUIRED TO DETERMINE AND CONFIRM UNKNOWN ASSET CONFIGURATIONS.
8. ELECTRICITY IS HIGH VOLTAGE UNLESS OTHERWISE STATED. TO CONFIRM VOLTAGES ALONG THE LINE WOULD REQUIRE OBTAINING CONFIGURATION/ SCHEMATIC PLANS. NOT ALL ELECTRICITY CABLES ARE ENCLOSED IN CONDUITS OR MARKED WITH INDICATORS OF THEIR PRESENCE.
9. REFER TO THE UTILITY LOCATING DISCLAIMER INCLUDED WITH THE DELIVERABLES FOR A VISUAL REPRESENTATION OF SUB-SURFACE ACCURACY TOLERANCES AND IMPLIED CONFIDENCES.
10. REFER TO REPORT CARDS AND CCTV FOOTAGE FOR FURTHER INFORMATION.

SERVICES INFORMATION

SUBSURFACE UTILITY INFORMATION (SUI) AS5488. CLASS LABELLING OF UTILITY INFORMATION IS BASED ON A CLASSIFICATION CODE WHICH ALLOWS THE USER OF THIS INFORMATION TO UNDERSTAND CLEARLY HOW THE INFORMATION WAS COLLECTED AND THEN PLACE AN APPROPRIATE AMOUNT OF RELIANCE ON IT. PROJECT RISKS RELATED TO UNDERGROUND UTILITIES CAN THEN BE PROPERLY MANAGED.

QL-A: INFORMATION IS THE HIGHEST POSSIBLE LEVEL OF ACCURACY AND IS OBTAINED BY EXPOSING THE UNDERGROUND UTILITY USING A NON-DESTRUCTIVE EXCAVATION (POT HOLING) TECHNIQUE. THE VERTICAL INFORMATION FOR THIS LOCATING METHOD IS TO THE TOP OR SHALLOWEST PART OF THE LOCATED SERVICE. THE 3D LOCATION IS RECORDED BY SURVEY AS AN X, Y, Z COORDINATE.
QL-B: INFORMATION IS COLLECTED BY DESIGNATING THE HORIZONTAL AND VERTICAL LOCATION OF UNDERGROUND UTILITIES BY USING ELECTROMAGNETIC PIPE AND CABLE LOCATORS, SONDES OR FLEXI-TRACE, GROUND PENETRATING RADAR AND ACOUSTIC PULSE EQUIPMENT. THIS IS THE MOST COMMON FORM OF UTILITY LOCATING AND ALTHOUGH AN X, Y AND Z AXIS CAN BE ESTABLISHED IT IS NOT ALWAYS ENTIRELY ACCURATE DUE TO DIFFERING ELECTROMAGNETIC FIELDS, SOIL CONDITIONS AND MULTIPLE BANKS OF CABLES AFFECTING THE LOCATING SIGNAL.
QL-C: INFORMATION IS COLLECTED BY CORRELATING THE SURVEY OF VISIBLE UTILITY SURFACE FEATURES SUCH AS MARKER PLATES OR WATER HYDRANTS AND ACQUIRED DIAL-BEFORE-YOU-DIG PLANS TO 'DRAW' A STRING WHICH SHOWS THE APPROXIMATE POSITION OF SERVICES. THIS METHOD DOES NOT USUALLY SHOW MULTIPLE BANKS OF CABLES AND DOES NOT ALWAYS SHOW THREE DIMENSIONAL INFORMATION. ELECTRONICALLY TRACED LOCATE MARKS WITH POOR SCRATCHY SIGNALS ARE REPRESENTED AS QL-C.
QL-D: INFORMATION IS THE MOST BASIC LEVEL OF UTILITY LOCATIONS USING ONLY INFORMATION BASED ON EXISTING DIAL-BEFORE-YOU-DIG PLANS AND BY MEASURING BOUNDARY OFFSETS ETC. THIS METHOD OF UTILITY LOCATIONS SHOULD ALWAYS BE TREATED AS AN INDICATION OF THE PRESENCE OF A SERVICE ONLY AND SHOULD NOT BE USED FOR DESIGN. GPR SCANS ARE ALSO REPRESENTED AS QL-D AS THE GPR IMAGE CANNOT BE CONFIRMED TO IT'S ORIGIN POINT. DEPTHS ON GPR SCAN MUST BE TREATED AS INDICATIVE ONLY.

LINE TYPES

- DENOTES FENCING
- DENOTES CADSTRAL BOUNDARY
- DENOTES EDGE OF CONCRETE
- TOP DENOTES TOP OF BANK
- TOE DENOTES TOE OF BANK
- DENOTES CENTRELINE OF BITUMEN
- DENOTES EDGE OF BITUMEN
- DENOTES EDGE OF TREE LINE

SERVICES LINE TYPES

- D(A) D(A) D(A) DRAINAGE LINE CLASS A
- D(B) D(B) D(B) DRAINAGE LINE CLASS B
- D(C) D(C) D(C) DRAINAGE LINE CLASS C
- D(D) D(D) D(D) DRAINAGE LINE CLASS D
- E(A) E(A) E(A) UNDERGROUND ELECTRICAL CABLE CLASS A
- E(B) E(B) E(B) UNDERGROUND ELECTRICAL CABLE CLASS B
- E(C) E(C) E(C) UNDERGROUND ELECTRICAL CABLE CLASS C
- E(D) E(D) E(D) UNDERGROUND ELECTRICAL CABLE CLASS D
- UNDERGROUND RMS SIGNAL CABLE CLASS B
- T(A) T(A) T(A) UNDERGROUND TELECOMMUNICATIONS CABLE CLASS A
- T(B) T(B) T(B) UNDERGROUND TELECOMMUNICATIONS CABLE CLASS B
- T(C) T(C) T(C) UNDERGROUND TELECOMMUNICATIONS CABLE CLASS C
- T(D) T(D) T(D) UNDERGROUND TELECOMMUNICATIONS CABLE CLASS D
- G(A) G(A) G(A) GAS MAIN CLASS A
- G(B) G(B) G(B) GAS MAIN CLASS B
- G(C) G(C) G(C) GAS MAIN CLASS C
- G(D) G(D) G(D) GAS MAIN CLASS D
- S(A) S(A) S(A) SEWER MAIN CLASS A
- S(B) S(B) S(B) SEWER MAIN CLASS B
- S(C) S(C) S(C) SEWER MAIN CLASS C
- S(D) S(D) S(D) SEWER MAIN CLASS D
- W(A) W(A) W(A) WATER MAIN CLASS A
- W(B) W(B) W(B) WATER MAIN CLASS B
- W(C) W(C) W(C) WATER MAIN CLASS C
- W(D) W(D) W(D) WATER MAIN CLASS D

REVISIONS

No	REVISION	SVY	DFT	CHK	DATE
1	ISSUE TO CLIENT	JW	MAK	IRB	20/09/21

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NEWCASTLE FS 559134 EMS 709938 OHS 709944
NEWCASTLE SYDNEY GUNNEDAH MUSWELLBROOK

Surveyed	Drafted	Checked
JW/GS	MAK	IRB

REGISTERED SURVEYOR

@A1 : #####
@A3 : 1:500

DO NOT SCALE

Original Size: A1

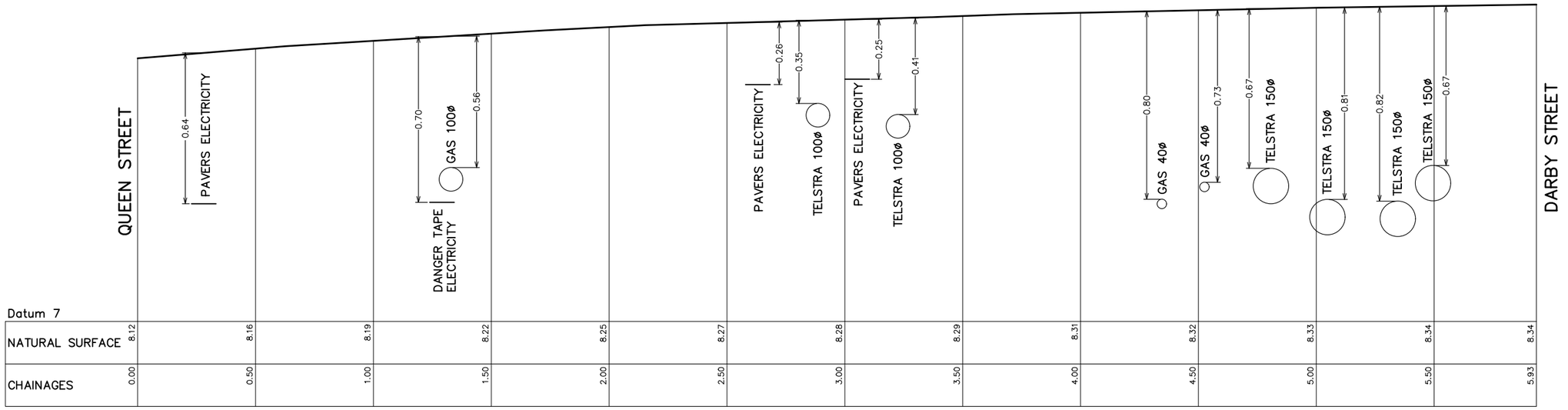
Client: CITY OF NEWCASTLE

Title: EXISTING SERVICES & SECTIONS
LAMAN, DARBY & QUEEN STREETS
COOKS HILL

CAD File: 210255C_01 | Ref No: 21/0255 | Date: 20/09/2021

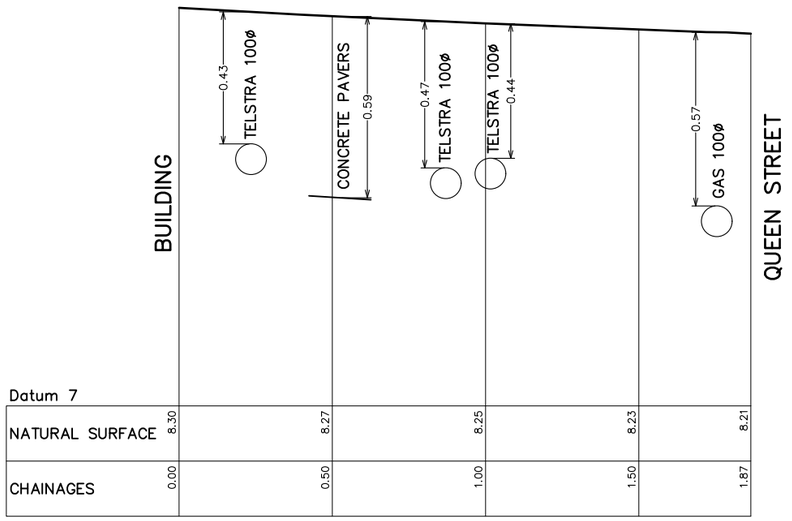
Sheet No. 2/5

Revision 1

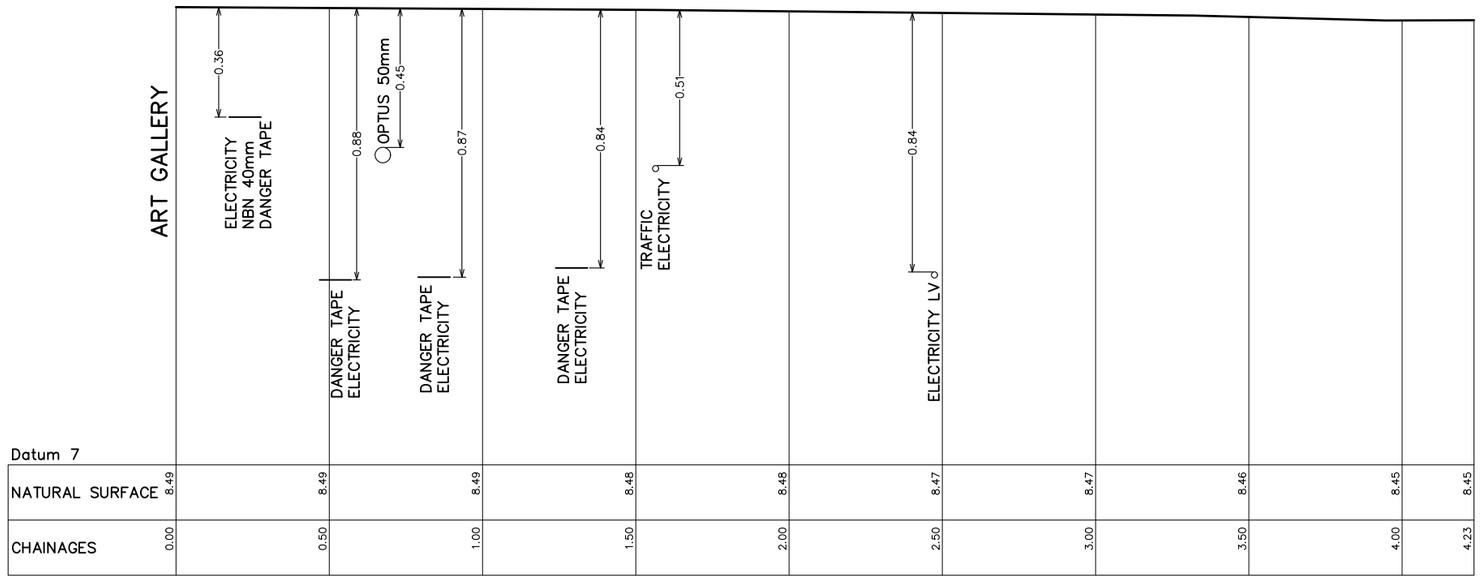


TRENCH A1

FOR SITE PHOTOS OF EXPOSED SERVICES
REFER SURESEARCH UNDERGROUND SERVICES
DOCUMENT SLIT A – 22–JUN–2021.PDF &
SLIT B F & G – 23–JUN–2021.PDF



TRENCH A2



TRENCH B

REVISIONS	No	REVISION	SVY	DFT	CHK	DATE
	1	ISSUE TO CLIENT	JW	MAK	IRB	20/09/21

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NEWCASTLE SYDNEY GUNNEDAH MUSWELLBROOK

Surveyed	Drafted	Checked
JW/GS	MAK	IRB

REGISTERED SURVEYOR
@A1 : #####
@A3 : 1:500
DO NOT SCALE

Original Size: A1

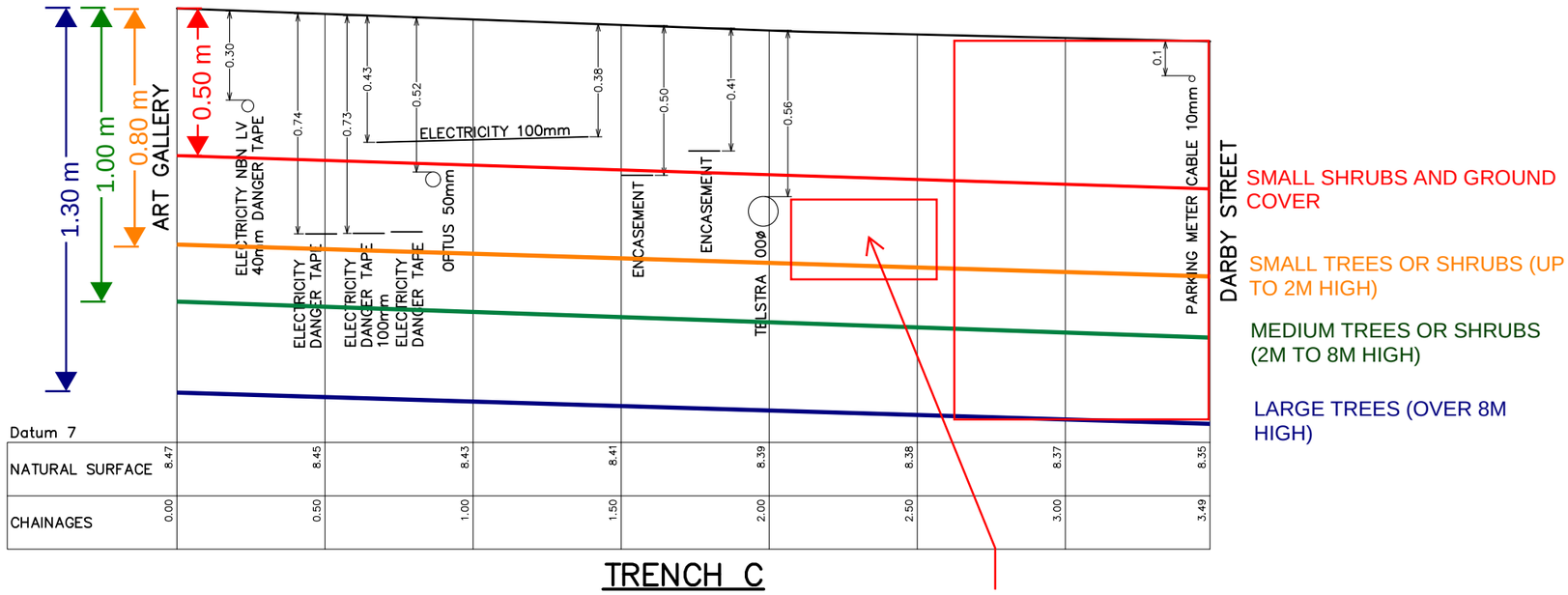
Client: CITY OF NEWCASTLE

Title: EXISTING SERVICES & SECTIONS
LAMAN, DARBY & QUEEN STREETS
COOKS HILL

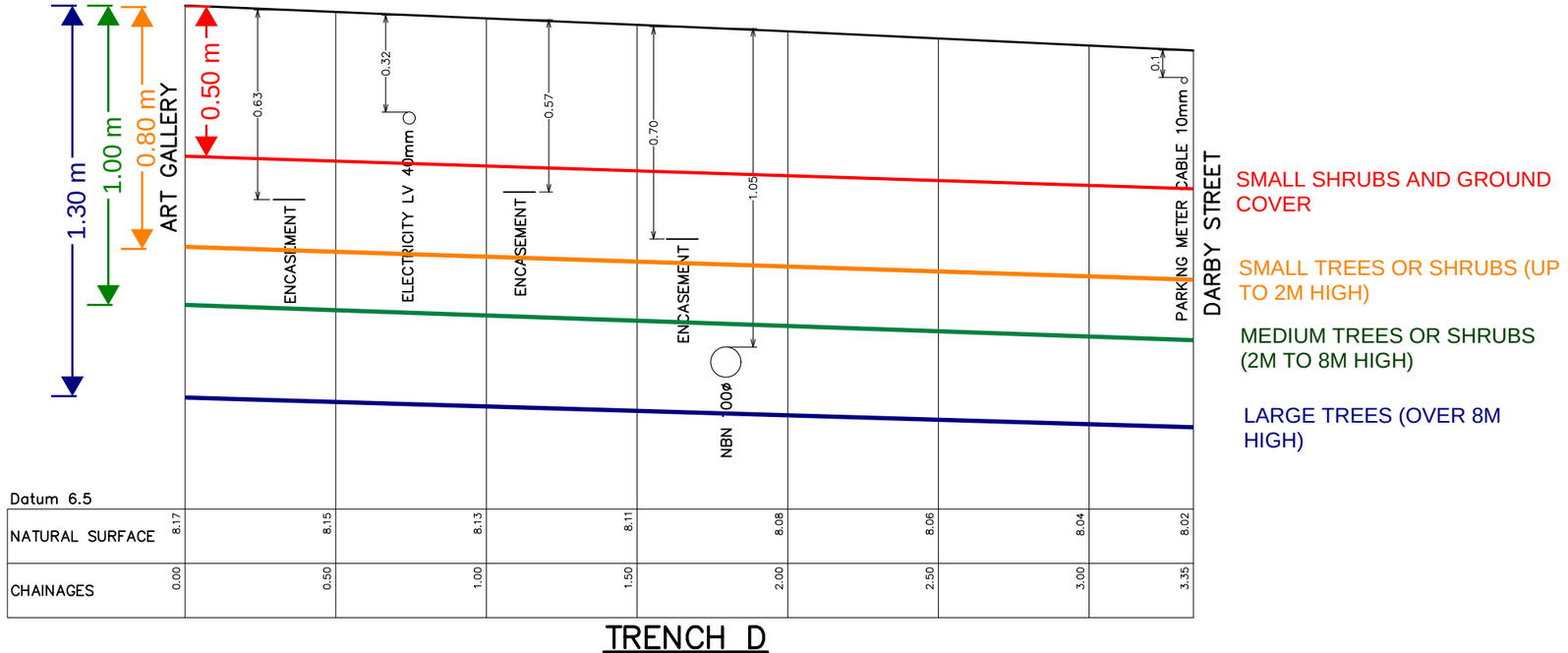
CAD File: 210255C_01 | Ref No: 21/0255 | Date: 20/09/2021

Sheet No. 3/5

Revision 1



FOR SITE PHOTOS OF EXPOSED SERVICES
REFER SURESEARCH UNDERGROUND SERVICES
DOCUMENT SLIT D & E – 21–JUN–2021.PDF



REVISIONS							
1	ISSUE TO CLIENT	JW	MAK	IRB	20/09/21		
No	REVISION	SVY	DFT	CHK	DATE		

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Surveyed	Drafted	Checked
JW/GS	MAK	IRB

REGISTERED SURVEYOR
@A1 : #####
@A3 : 1:500
DO NOT SCALE

Original Size: A1

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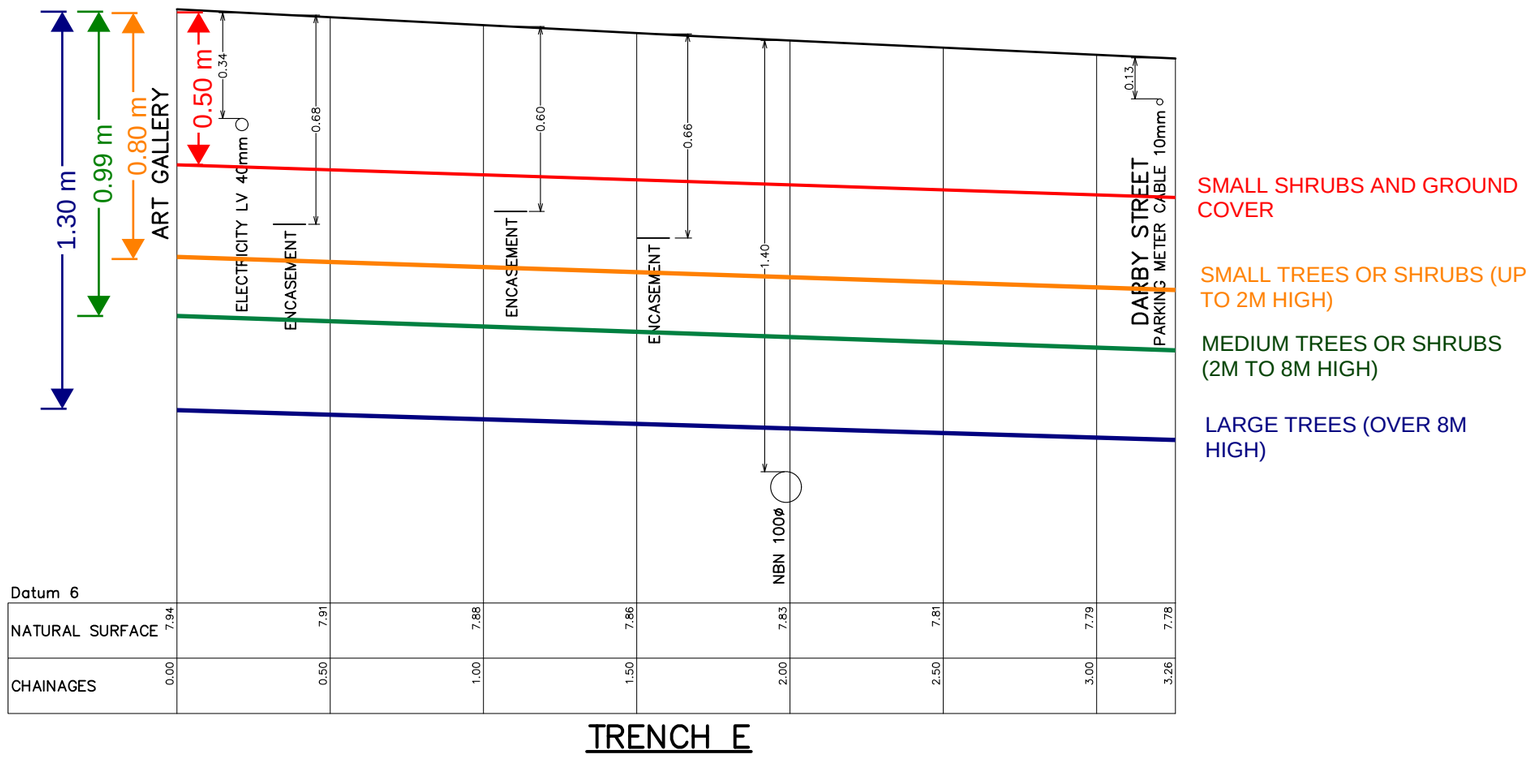
LAMAN, DARBY & QUEEN STREETS
COOKS HILL

CAD File: 210255C_01 | Ref No: 21/0255 | Date: 20/09/2021

Sheet No. 4/5

Revision 1



TRENCH E

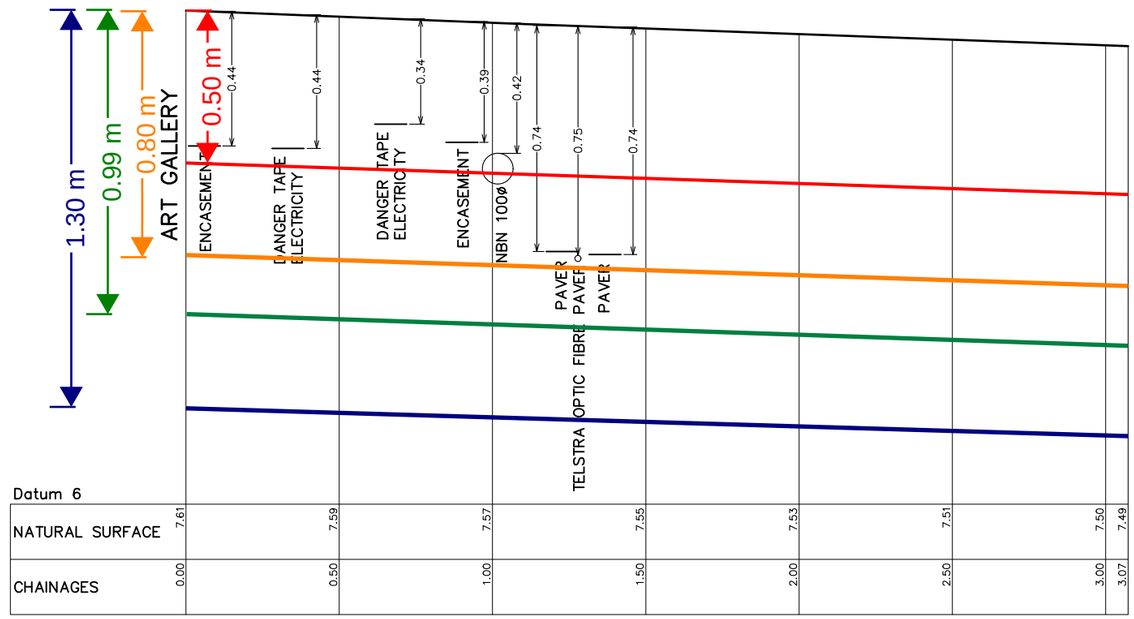
SMALL SHRUBS AND GROUND COVER

SMALL TREES OR SHRUBS (UP TO 2M HIGH)

MEDIUM TREES OR SHRUBS (2M TO 8M HIGH)

LARGE TREES (OVER 8M HIGH)

FOR SITE PHOTOS OF EXPOSED SERVICES REFER SURESEARCH UNDERGROUND SERVICES DOCUMENT SLIT D & E – 21–JUN–2021.PDF & SLIT B F& G – 23–JUN–2021.



TRENCH F

SMALL SHRUBS A COVER

SMALL TREES OR TO 2M HIGH)

MEDIUM TREES C (2M TO 8M HIGH)

LARGE TREES (O HIGH)

REVISIONS

No	REVISION				
1	ISSUE TO CLIENT	JW	MAK	IRB	20/09/21

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NEWCASTLE SYDNEY GUNNEDAH MUSWELLBROOK

Surveyed	Drafted	Checked
JW/GS	MAK	IRB

REGISTERED SURVEYOR
@A1 : #####
@A3 : 1:500
DO NOT SCALE

Original Size: A1

Client: CITY OF NEWCASTLE

Title: EXISTING SERVICES & SECTIONS
LAMAN, DARBY & QUEEN STREETS
COOKS HILL

CAD File: 210255C_01 | Ref No: 21/0255 | Date: 20/09/2021

Sheet No. 5/5

Revision 1

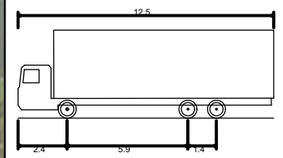
A2 Loading Dock Turning Path Assessment

A3

Legend

- Body Envelope
- 300mm Envelope
- 600mm Envelope
- Wheel Envelope

Design Vehicle(s)



HRV - Heavy Rigid Vehicle	
Overall Length	12.500m
Overall Width	2.500m
Overall Body Height	4.300m
Min Body Ground Clearance	0.417m
Track Width	2.500m
Lock-to-lock time	6.00s
Curb to Curb Turning Radius	12.500m

Issue	Date	By	Chkd	Appd
B	06/10/21	JJC	EB	KJS
	For Information			
A	01/10/21	JJC	EB	KJS
	For Information			

ARUP

Arup Sydney, Level 10, 201 Kent Street
Sydney, 2000
Tel +61(02)9320 9320 Fax +61(02)9320 9321
www.arup.com.au

Client
Smith & Tzannes Pty Ltd

Job Title
Newcastle Art Gallery
Redevelopment

Drawing Title
Turning Paths
12.5m Heavy Rigid Vehicle
Reversing into loading dock

Scale at A3 1:250

Discipline Transport

Drawing Status
Draft

Job No	Drawing No	Issue
284000-00	**SKT003**	**A**

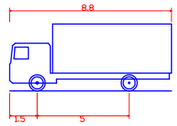
Do not scale

A3

Legend

- Body Envelope
- 300mm Envelope
- 600mm Envelope
- Wheel Envelope

Design Vehicle(s)



MRV - Medium Rigid Vehicle

Overall Length	8.800m
Overall Width	2.500m
Overall Body Height	3.633m
Min Body Ground Clearance	0.428m
Track Width	2.500m
Lock to Lock Time	4.00 sec
Curb to Curb Turning Radius	10.000m

Issue	Date	By	Chkd	Appd
B	23/07/13	JRT	AMH	AMH
	Updated plan			
A	02/07/13	JRT	AMH	AMH
	For Information			

ARUP

Arup Sydney, Level 10, 201 Kent Street
Sydney, 2000
Tel +61(02)9320 9320 Fax +61(02)9320 9321
www.arup.com.au

Client
Smith & Tzannes Pty Ltd

Job Title
Newcastle Art Gallery
Redevelopment

Drawing Title
Turning Paths
8.8m Medium Rigid Vehicle
Reversing into loading dock

Scale at A3 1:200

Discipline Transport

Drawing Status
Draft

Job No	Drawing No	Issue
224302-00	**SKT001**	**B**

Do not scale

DOCUMENT CHECKING (not mandatory for File Note)

	Prepared by	Checked by	Approved by
Name	Jordan Cashel (Arup)	Edward Bond (Arup)	Edward Bond (Arup)
Signature			