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Project 49737.06
8 November 2021
R.001.Rev0
CB:kd

Attention: Matthew Bennett

Email: mbennett@ncc.nsw.gov.au

Proposed Rainwater Tank
Newcastle Art Gallery - Proposed Alterations and Additions
1 Laman Street, Newcastle

1. Introduction

This report presents the results of a qualitative assessment of vapour intrusion risks for the proposed rainwater tank associated with the redevelopment of the Newcastle Region Art Gallery at 1 Laman Street, Cooks Hill, NSW. The assessment was carried out at the request of Mr Matthew Bennett of Newcastle City Council (NCC) and was undertaken as an extension to the Douglas Partners Pty Ltd (DP) groundwater assessment conducted in February 2021 (Project 49737.04).

Recent design alterations have been made for the proposed development which now include a proposed rainwater tank within the north-east corner of the site. Additional localised excavation will be required for the installation of the tank to achieve a proposed invert level of RL 6.26 (refer to attached drawing by ARUP (ref 278551, SK-H-001, 29/10/21).

The results of previous site investigations (refer to Section 4 below) indicated that localised groundwater hydrocarbon and VOC impact was present on-site. The site was considered to be suitable for the proposed redevelopment in relation to site contamination for excavations of up to RL 7.4 AHD, subject to appropriate management of impacted soils, no basements or similar structures, and no extraction of groundwater for beneficial use.

This assessment was conducted to confirm the suitability of the revised rainwater tank design for a proposed invert level of RL 6.26 within the north-east corner of the site, with respect to vapour intrusion risks.

For the purpose of this assessment, NCC supplied Drawing 278551/SK-H-001 by ARUP which is attached.

2. Background

The following relevant previous investigations have been conducted within the site:

- Phase 1 Environmental Site Assessment (EIS, 2007);
- Targeted Contamination Investigation (DP, 2011a);
- Additional Contamination Assessment (DP, 2011);
- Preliminary Soil Vapour Intrusion Assessment (DP 2012a);
- Additional Groundwater and Preliminary Soil Vapour Intrusion Investigation (DP, 2012);
- Groundwater Sampling (DP,2021).

The proposed rainwater tank is located within the north-east corner of the site (refer to ARUP Drawing 27855/SK-H-001 attached). Previous DP Bore 203-U and Bore 203-D are located within the tank area. Groundwater from Bores 203-U and 203-D was sampled and tested in 2011. Unfortunately, these bores were not present during the recent 2021 groundwater testing. Groundwater sampling and testing, however, was conducted on groundwater collected from Bores 203B and C in 2021 which were located immediately south of the tank area (refer to Drawing 1 attached).

Relevant information from the previous reports is summarised below:

- Groundwater testing (DP, 2011):
  - Subsurface conditions at the site comprised filling over clays and sands. Fill materials were variable and comprised a range of materials including coal, bricks and cobbles, with some asbestos, heavy metals and PAH impacts;
  - A slight hydrocarbon odour was observed in the vicinity of the water table during drilling at two bore locations (i.e. Bores 201 and 107-D). There were no odours observed in Bores 203-U and 203-D within the proposed tank area;
  - Low chain hydrocarbons and Xylene were identified in groundwater from Bore 105; however, concentrations were within the adopted trigger values;
  - Trace volatile organic compounds (VOC's) were detected in groundwater in Bores 105 and 107-U. A trace single VOC detection was also identified in Bore 201, and Bores 203-U and 203-D located within the proposed tank area. VOC concentrations, however, were found to be within the adopted trigger values;
  - No free phase hydrocarbon impact was identified on site;
  - Groundwater was observed at RL 3.82 AHD to 4.96 AHD at the gauging event on 20 December 2011, with a groundwater flow direction towards the north-west;
  - A groundwater level of about RL 4.9 AHD was present at the proposed tank location (Bores 203-U and 203-D), which is about 1.35 m below the proposed invert of the tank (ie RL 6.26 AHD);
  - Subsurface gas monitoring indicated volatile hydrocarbon impact in Bore 105 and 107-U (located about 40 m and 80 m south-west of the proposed tank respectively);

- Soil gas monitoring suggested that biodegradation of organics due to natural attenuation was occurring on-site;
- Groundwater at the site was not considered to present an unacceptable vapour inhalation risk to the future occupants of the site based on the vapour intrusion model based on the proposed design for the art gallery at the time.

- Groundwater testing (DP, 2021):
  - Bores 203-U and 203-D located within the proposed tank area were not present. Bores 203B and C located immediately south of the proposed tank were, however, present;
  - Groundwater levels within the site ranged from about RL4 AHD to RL5 AHD;
  - The groundwater table was observed to be about 0.2 m lower than levels in 2011. The groundwater flow direction (i.e. north-west) was commensurate with 2011 groundwater monitoring;
  - There were no observations of gross contamination in the wells monitored (i.e. no floating product was detected in groundwater wells and no slicks / staining were observed in groundwater);
  - Slight hydrocarbon odours were observed in Bore 105 after purging and well recovery;
  - There was a reduction in volatile (low chain) petroleum hydrocarbon concentrations in Bore 105. Minor medium chain petroleum hydrocarbon concentrations were detected in Bore 1 and 107B;
  - Hydrocarbon concentrations detected in Bore 1 and 107B were within commercial / industrial guidelines for groundwater vapour intrusion (NEPC, 2013);
  - Trace VOC concentrations were identified in wells 105, 107-U and 107B which were commensurate with or slightly below 2011 concentrations;
  - There were no hydrocarbon odours, nor trace hydrocarbon or VOC concentrations in groundwater from Bores 203B and C located immediately south of the proposed tank;
  - Active remediation of groundwater was not considered to be necessary;
  - The site was considered to be suitable for the proposed landuse and revised redevelopment (with excavations up to RL 7.4 AHD), provided there was no extraction or beneficial reuse of groundwater;
  - The results of monitoring generally indicated that volatile impacts to groundwater are relatively low and appear to be reducing at the locations monitored. It was noted, however, that the source of volatile impacts within the site is unknown. If deeper basement construction is considered at levels of lower than RL7.4 AHD, additional assessment was recommended.

3. Discussion

The following is noted in relation to the proposed rainwater tank excavations within the north-east portion of the site:

- There were no observations of hydrocarbon or volatile impacts (ie staining, odours) during drilling or sampling of groundwater from Bores 203-U and 203-D located within the proposed tank area;
- There were no observations of hydrocarbon or volatile impacts (ie staining, odours) during sampling of groundwater from Bores 203-B and C located immediately south of the proposed tank area;
- Although trace VOC concentrations were identified within groundwater at Bores 203-U and 203-D in 2011, they were found to be within the adopted trigger values;
- There were no hydrocarbon or VOC concentrations within groundwater from Bores 203-B and C located immediately south of the proposed tank area;
- Groundwater was present about 1.35 m below the proposed invert level of the rainwater tank (ie RL 6.26 AHD). It should be noted that groundwater levels are affected by factors such as climatic conditions and soil permeability and will therefore vary with time;
- A groundwater flow direction toward the north-west was determined on-site. Bores identified to contain volatile impact (ie Bore 105 and 107-U) were located about 40 m and 80 m south-west of the proposed tank respectively (ie cross gradient, not upgradient);

On this basis, the presence of significant volatile impacts or vapour intrusion risks is considered to be low in relation to the proposed tank within the north-east corner of the site with an invert level of RL 6.26 m.

We note that the source of volatile impacts within the site is unknown. Excavations elsewhere on site should be maintained above RL 7.4 AHD. As a precautionary measure, we recommend that monitoring for volatile gases is conducted during the excavations for the rainwater tank. Additional investigation is recommended if volatile impacts are observed during construction.

4. References

DP. (2011). *Additional Contamination Assessment, Newcaslte Region Art Gallery Redevelopment, 1 Laman Street Cooks Hill.* Project 49737.01: Douglas Partners Pty Ltd.

DP. (2011a). *Targeted Contamination Investigation, Newcastle Region Art Gallery Redevelopment, 1 Laman Street Cooks Hill.* Project 49737: Douglas Partners Pty Ltd.

DP. (2012). *Additional Groundwater and Preliminary Soil Vapour Intrusion Investigation.* Project 49737.02: Douglas Partners Pty Ltd.

DP. (2012a). *Preliminary Soil Vapour Intrusion Assessment, Newcastle Region Art Gallery Redevelopment. 1 Laman Street, Cooks Hill.* Project 49737.02: Douglas Partners Pty Ltd.

DP. (2021). *Groundwater Sampling, Newcastle Art Gallery Proposed Alterations & Additions. 1 Laman Street, Cooks Hill. Project 49737.04: Douglas Partners Pty Ltd.*

EIS. (2007). *Report to the Council of the City of Newcastle, on Phase 1 Environmental Site Assessment, for Proposed Art Gallery Re-development at 1 Laman Street, Cooks Hill.* Ref E20829F-RPT: Environmental Investigation Services.

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM].* Australian Government Publishing Services Canberra: National Environment Protection Council.

NSW EPA. (2020). *Guidelines for Consultants Reporting on Contaminated Land.* Contaminated Land Guidelines: NSW Environment Protection Authority.

5. Limitations

Douglas Partners (DP) has prepared this report for this project at 1 Laman Street, Newcastle as requested by Matthew Bennett of Newcastle City Council. The work was carried out under DP's Conditions of Engagement and as an extension to Newcastle City Council Contract No 2021/154Q, (dated 29 October 2020).

This report is provided for the exclusive use of Newcastle City Council for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the (geotechnical / environmental / groundwater) components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Please contact the undersigned if you have any questions on this matter.

Yours faithfully
Douglas Partners Pty Ltd

Reviewed by

Katrina D'Alessandro

for **Chris Bozinovski**
Principal

Matthew Blackert
Senior Associate

Attachments: About this Report
Drawings:
Douglas Partners – Drawing 1: Test Location Plan (49737.04)
ARUP – Concept Rainwater Harvesting and OSD Tank (27855/SK-H-001 29/10/21).

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

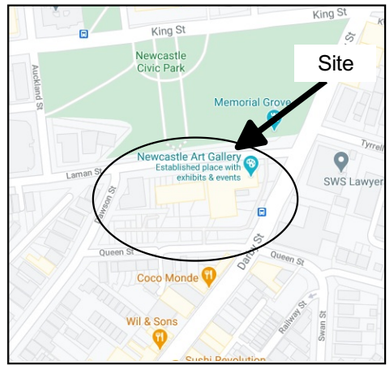
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.



Site Location

Legend

- Existing Groundwater Wells
- Missing Groundwater Wells
- Additional Wells (Not DP)
- Approximate Site Boundary

0 5 10 15 20 m

Drawing adapted from aerial imagery from Metromap dated 3 September 2020.
Test locations are approximate only and were located using Differential GPS.

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	Newcastle City Council	
OFFICE:	Newcastle	DRAWN BY: JRK
SCALE:	1:550 @ A3	DATE: 04 February 2021

TITLE: **Test Location Plan**
Newcastle Art Gallery - Groundwater Sampling
1 Laman Street, Newcastle

Project:	49737.04
DRAWING No:	1
REVISION:	0

DP.QGIS.A3LandScapeDrawingLayout.DftA

Direct connection to the council stormwater pit via access chamber with overflow into the landscaping. IL~6.6

PIT IL: RL 6.42

Civil stormwater pit

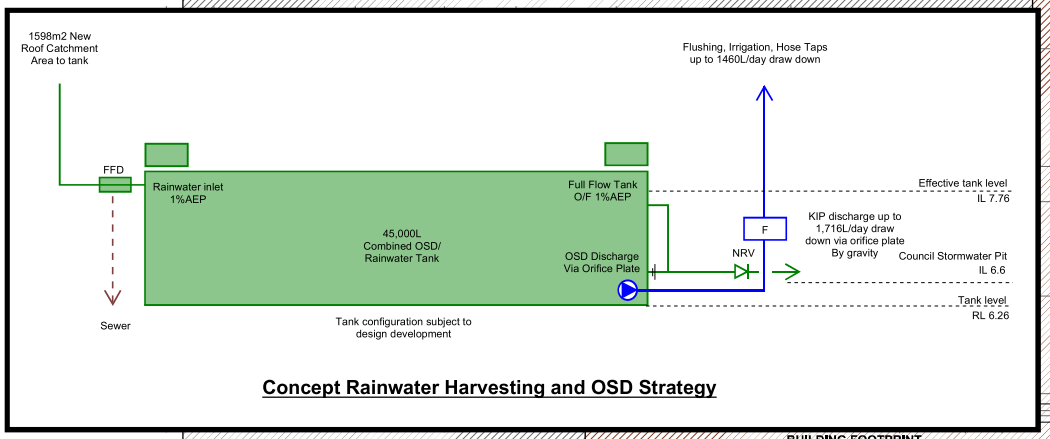
In-situ concrete 45kL combined rainwater harvesting and OSD tank below cafe deck.
The RL of Deck is 8.56
Ground level below cafe is approx 7.3 min. assuming the struct depth is 0.4m.

We would expect a min.1.5m depth tank + 1000mm clearance and concrete footing. So we would expect about 1.5m+ excavation.

IL 8.95

Design Constraint

Excavation required for buried pipework and tank



Concept Rainwater Harvesting and OSD Strategy

ARUP	Job No	278551
	Dwg No	SK-H-001
	Date	29/10/2021
Job Title	Newcastle Art Gallery Expansion	
Dwg Title	Concept Rainwater Harvesting and OSD Strategy	
	Rev: Concept	By: NX

General Notes

1. Tank location, flow rates, volumes, pipework routing and invert levels are indicative only and subject to design development.

Design Criteria

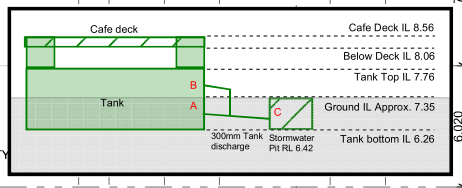
Catchment Area: 1598m2 (equivalent of new roof area)
Storage: OSD 39.95m3 (1598m2 x 25mm) + 5m3 based on water balance
*Draw down / restricted discharge: 3,176 L/day draw down (0.023*1.598) OR 0.8L/s to discharge to kerb and gutter (0.5*1.598)*

Option 1. Direct part of new and part of existing roof area to Rainwater tank to limit Rainwater pipe run above gallery space.

Option 2. Direct all new roof are to Rainwater tank where additional rainwater pipework is required to run within gallery space.

BUILDING FOOTPRINT PROPOSED GALLERY ABOVE

Dropper



Point A is the OSD discharge Via Orifice Plate level at approx. 6.6
Point B tank overflow with IL at approx 7.26
Point C Is the IL when stormwater connect into council stormwater pit which has to be above 6.42.

In addition to Matthew's comments we would add that the area below the currently proposed floor level seems unlikely to be sufficient for the Tank volumes required or for maintenance access.
- The proposed Café Floor level is at 8.575 to allow accessible entry from Laman street.
- Existing ground level along Laman Street is at RL7.4 m to RL8.1m.
- Ground level below the Café varies between RL7.3 and RL7.8

1 LEVEL -1
1:250

S4.55

REV I 11/10/2021 MODEL *12_002 Model-S455-1*

PROPOSED LOWER GROUND

S4.55

NEWCASTLE ART GALLERY EXPANSION

City of Newcastle

IN ASSOCIATION WITH

claredesign

Original sheet size: A3
12.5m - 1:250
10.0m - 1:200
5.0m - 1:100
2.5m - 1:50

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Nominated Architect: Peter Smith (Reg 7024)
SMITH & TZANNES

12_002 DA-A-100