

JUSTYN NG
SENIOR DEVELOPMENT MANAGER
TIME & PLACE
Level 34 – Suite 3402 Australia Square
264 George Street
SYDNEY NSW 2000

Arcadis Australia Pacific Pty Ltd
On the Lands of the Gadigal
580 George Street
Sydney NSW 2000
Australia
Phone: +61 2 8907 9000

www.arcadis.com

Date: 07 August 2025
Our Ref: 30250517-AAP-RPT-GH-0011
Subject: 45-53 Macleay St, Potts Point – Hydrogeological Appraisal

Dear Justyn,

In response to Request for Information (RFI) from the NSW Department of Climate Change, Energy, Environment and Water (DCCEEW), Water Group (Ref OUT25/4119), dated 23 April 2025, Arcadis has prepared a hydrogeological appraisal to understand whether the proposed development, which includes three levels of basement, could intercept groundwater and to provide an indication of potential groundwater inflow volumes during construction and ongoing operation (where groundwater interception is likely).

The hydrogeology appraisal has been prepared to consider the *Minimum requirements for building site groundwater investigations and reporting* (NSW Department of Planning and Environment, 2022) and *Water Management (General) Regulation 2018*. The table below summarises the responses to DCCEEW queries.

DCCEEW Query	Response
Water supply, take and licensing: <i>Pre-determination: That the proponent quantifies the maximum annual volume of water take due to aquifer interference activities and demonstrates the ability to acquire sufficient water entitlement unless an exemption applies.</i>	Proposed three-story basement (invert level of 10 m below existing ground level) is anticipated to be above the regional water table in the underlying Hawkesbury Sandstone aquifer by approximately 8 m. Therefore no persistent or significant groundwater inflow is predicted. Minor groundwater inflow may occur from potential perched groundwater in the upper sandstone layers, however this inflow would be significantly less than 3 ML per year taken through aquifer interference activities. Further details are provided in the groundwater inflow assessment section.

JUSTYN NG
TIME & PLACE
07/08/2025

DCCEEW Query	Response
Groundwater impacts and dewatering requirements: <i>If the take of groundwater is found to be greater than 3 ML per year, the proponent must assess the impacts due to aquifer interference activities in accordance with the NSW Aquifer Interference Policy and framework (2012).</i>	As stated above, minor inflows from perched groundwater would be significantly less than 3 ML year taken through aquifer interference activities; therefore the proposed development would be exempt from needing a water access licence in NSW. Sufficient water licence exemptions for the proposed basement will be achievable at detailed design stage.

The assessment recognises the potential presence of perched water that may be intercepted by the works, and whilst we haven't quantified the likely inflow volumes at this stage due to limited information we have stated they are likely to be minimal and within the exemption criteria.

Please let us know should you have any queries.

Kind Regards,
Arcadis Australia Pacific Pty Ltd



Paul Goff
Technical Director: Hydrogeology

Email: paul.goff@arcadis.com
Direct Line: 02 8907 2605
Mobile: 0403 638461

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Date: 01 August 2025
Our Ref: 30250517-AAP-RPT-GH-0010
Subject: 45-53 Macleay St, Potts Point – Hydrogeological Appraisal

Dear Justyn,

In response to Request for Information (RFI) from the NSW Department of Climate Change, Energy, Environment and Water (DCCEEW), Water Group (Ref OUT25/4119), dated 23 April 2025, Arcadis has prepared a hydrogeological appraisal to understand whether the proposed development, which includes three levels of basement, could intercept groundwater and to provide an indication of potential groundwater inflow volumes during construction and ongoing operation (where groundwater interception is likely).

The hydrogeology appraisal has been prepared to consider the *Minimum requirements for building site groundwater investigations and reporting* (NSW Department of Planning and Environment, 2022) and *Water Management (General) Regulation 2018*.

The assessment recognises the potential presence of perched water that may be intercepted by the works, and whilst we haven't quantified the likely inflow volumes at this stage due to limited information we have stated they are likely to be minimal and within the exemption criteria. Although DCCEEW may request further analysis, we recommend the letter is submitted to see if the department will accept the outcomes as they stand.

Please let us know should you have any queries on the attached assessment.

Kind Regards,
Arcadis Australia Pacific Pty Ltd



Paul Goff
Technical Director: Hydrogeology

Email: paul.goff@arcadis.com
Direct Line: 02 8907 2605
Mobile: 0403 638461

Introduction

Background

Arcadis Australia Pacific Pty Ltd (Arcadis) was engaged by Time & Place Management Pty Ltd ('the Client') to prepare a hydrogeological appraisal in response to the pre-determination submission from the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) Water Group (Ref OUT25/4119), dated 23 April 2025. DCCEEW Water Group is seeking additional information to confirm whether the proposed development, which includes three levels of basement, will intercept groundwater and to identify the potential groundwater inflow volumes during construction and ongoing operation (where groundwater is likely to be intercepted).

The proposed development which was submitted for concept approval is a 13-storey mixed use shop-top housing development comprising three levels of basement car parking, ground floor retail and residential above ('the Project') at 45-53 Macleay Street, Potts Point, New South Wales 2011 ('the Site'). The Site currently accommodates a 12- storey residential flat building comprising 80 studio apartments, and associated car parking.

The proposed three levels of basement car parking will go to a depth of approximately 10.15 m below existing ground level (layout plan provided in Appendix A). It is assumed that the basement will be constructed as a fully drained (non-tanked) structure.

Scope

The scope of the hydrogeological appraisal includes:

- Description of the groundwater conceptual model and relationship to proposed development (desk-based information).
- Provide a preliminary groundwater inflow assessment for the three-story basement for construction and ongoing operational phases.
- Provide recommendations for hydrogeological investigations to close out DCCEEW recommendations.

The appraisal is limited to a desk-based study approach using online local state mapping data sources, no site investigation information currently being available to fully appraise site specific conditions.

Legislation and Policy

The legislative and policy requirements relevant to the hydrogeological assessment include:

- *Water Management Act 2000*;
- NSW Aquifer Interference Policy (NSW Office of Water, 2012)
- Water Management (General) Regulation 2018; and
- Minimum requirements for building site groundwater investigations and reporting (NSW Department of Planning and Environment, 2022).

Assessment on the feasibility of a non-tanked basement structure is informed by the exemption in the Water Management (General) Regulation 2018 that allows 3 megalitres (ML) or less of groundwater per year to be taken through certain aquifer interference activities without the need for a water access licence.

Site Setting

The Site is within the City of Sydney (CoS) Local Government Area and located in the metropolitan suburb of Potts Point which is approximately 1.25 km from Sydney Central Business District (CBD).

The suburb of Potts Point occupies a narrow ridge that juts into the Sydney Harbour, with Woolloomooloo Bay located to west and Elizabeth Bay to the east, as shown by Figure 1. The Site, located on Potts Point ridge has an existing ground elevation of approximately 28 metres Australian Height Datum (AHD). The ridge steeply falls off towards the Sydney harbour shoreline on both sides, this is shown by the elevation profile extracted from Google Earth in Figure 1.

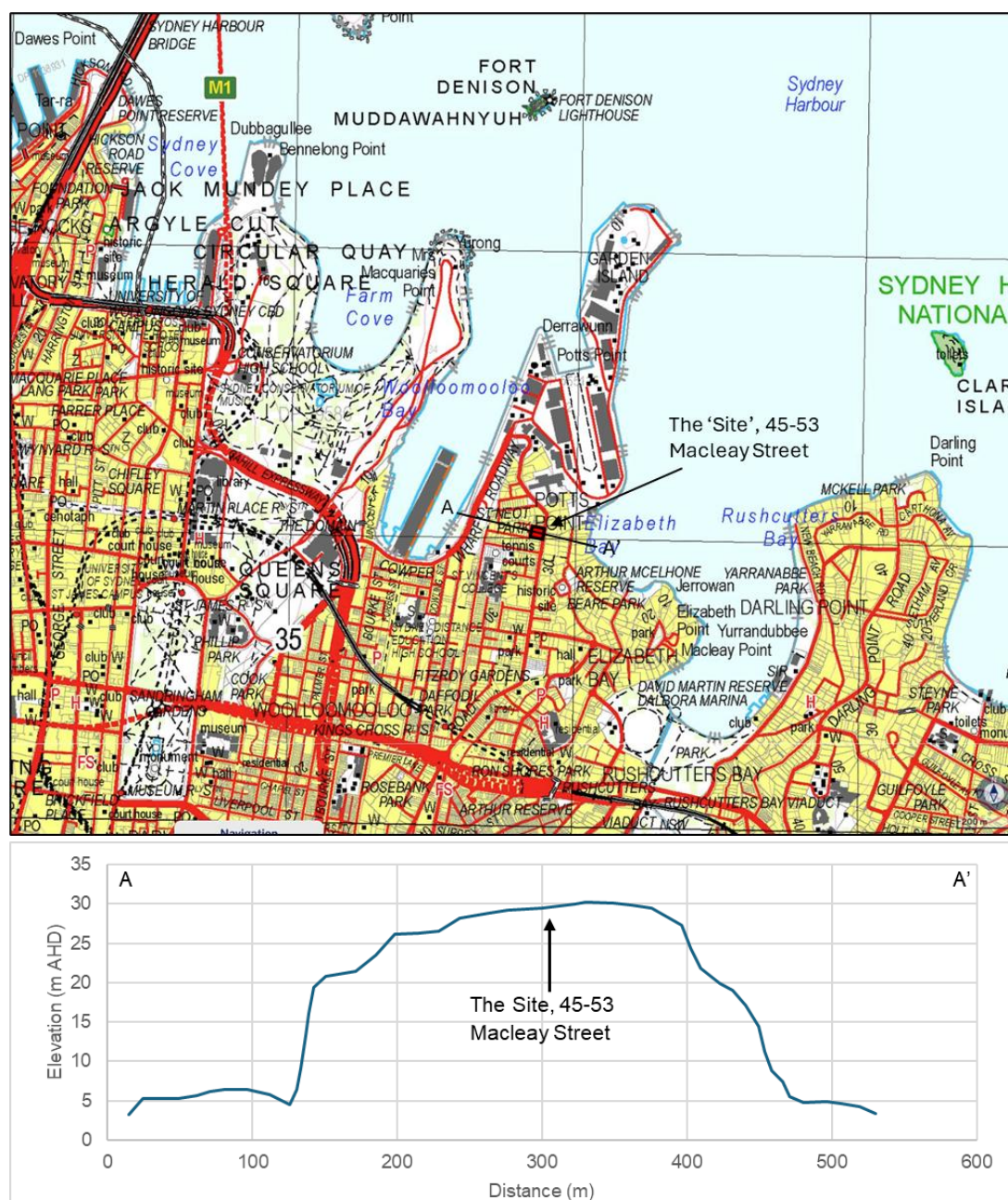


Figure 1: NSW Topography map for Potts Point and the surrounding suburbs (NSW, 2025), and elevation profile through the Site extracted from Google Earth

Long-term rainfall conditions at the Site have been characterised by the recorded climate data at Sydney Observatory Hill (BOM station 066062). Mean monthly rainfall data is summarised in Table 1 based on rainfall data from 1859 to 2020 (BOM, 2025). The annual mean pan evaporation is approximately 1,537 mm/yr, as estimated using the SILO database (Queensland Government, 2025).

Table 1: Sydney Observatory Hill mean climate data (mm/month and mm/year)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean rainfall	101.2	119.3	131.6	126.5	117.4	133.1	96.3	80.2	68.1	76.7	83.8	77.1	1211.1
Mean evaporation	191.9	153.8	135.9	101.3	74.7	60.5	69.4	96.6	126.2	156.8	172.0	198.0	1537.0

Geology

The 1:100,000 Series Geological Sheet for Sydney (excerpt presented in Figure 2) indicates that the Site is underlain by Hawkesbury Sandstone (HBSS), a medium to coarse grained quartz sandstone, with occasional fine-grained beds and minor shale and laminate lenses. It comprises of massive, thickly bedded and cross bedded strata in near horizontal layers, with some siltstone layers.

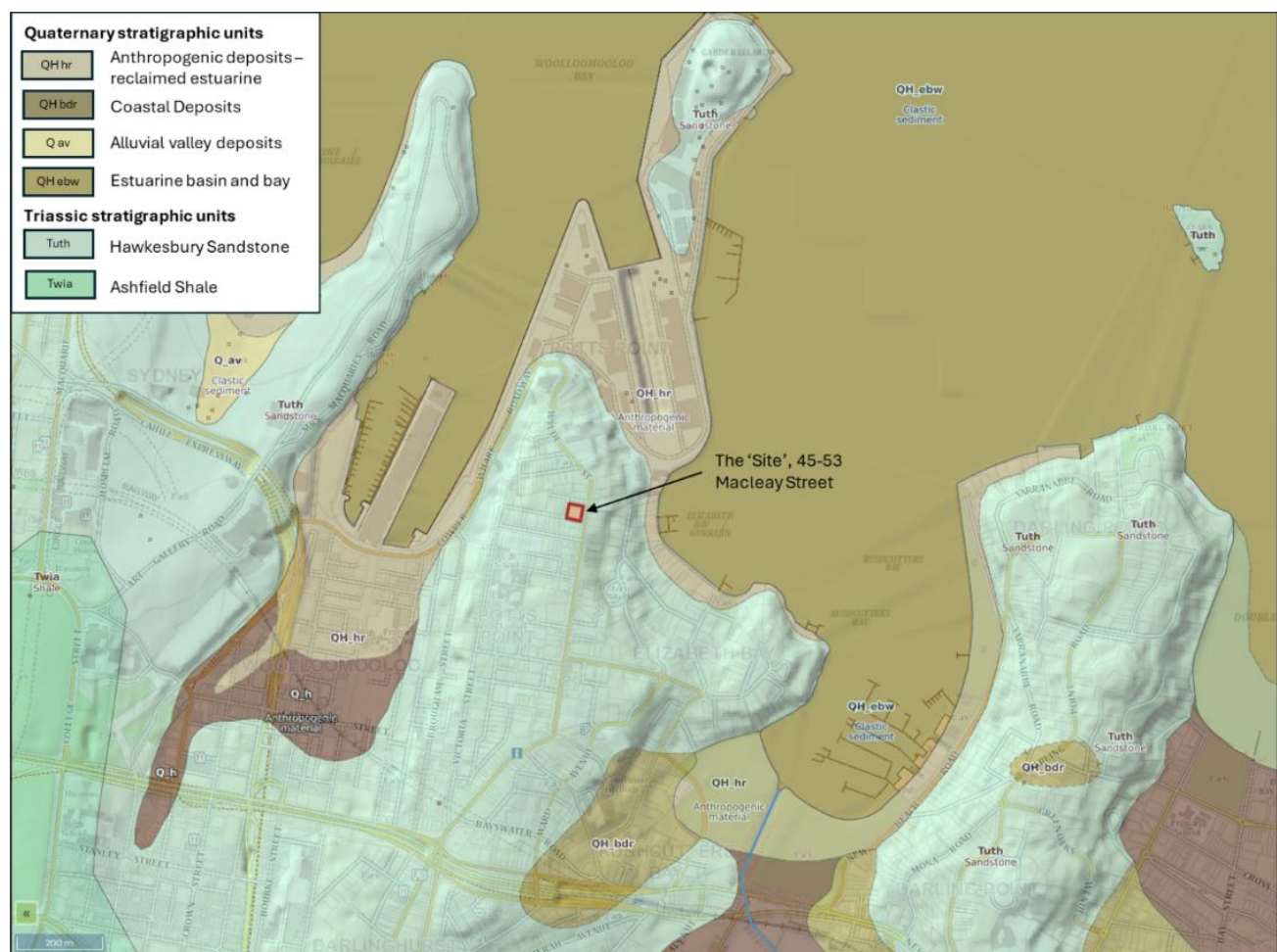


Figure 2: NSW Surface geology extracted from NSW MinView (2025)

Within the Sydney area the most common defects within the Hawkesbury Sandstone are widely spaced horizontal bedding planes, typically spaced at 1 m to 3 m, and two orthogonal sets of steeply dipping joints. The joints typically have dips of 75 to 90 degrees from horizontal (i.e. close to vertical) and are oriented with strikes just east of north (about 010 degrees) and just south of east (about 110 degrees). Apart from these main defect sets there are likely to be other less common joints or faults with moderate dips of 20 to 30 degrees and 40 to 60 degrees.

Shallow soils above the HBSS bedrock are expected to be relatively sandy, formed from the weathering and breakdown of the HBSS at the near surface. There is no existing local geological information available (e.g. existing geotechnical or groundwater bores) at or near the Site to provide site specific information on the in-situ soils and underlying Hawkesbury Sandstone.

Hydrogeology

The Site lies within the Sydney Basin Central Groundwater Source, part of the *Water Sharing plan for the Greater Metropolitan Region Groundwater Sources 2023*. On a local scale, the Hawkesbury Sandstone is the main water-bearing unit beneath the Site. It is characterised by permeability developed mainly with fractures and other secondary porosity features.

With the close proximity to Sydney Harbour shoreline, groundwater in the Hawkesbury Sandstone aquifer is expected to be tidal influenced and groundwater levels are likely to be closely linked to surface water levels in the harbour. The typical tidal range in Sydney Harbour is approximately 1.1 m. Groundwater discharge into Sydney Harbour, known as submarine groundwater discharge (SGD), is primarily from coastal sand aquifers (i.e. Hawkesbury Sandstone) and is relatively small compared to river discharge.

Groundwater level monitoring around Potts Point and the surrounding harbour suburbs is limited, however publicly available groundwater bore data from WaterNSW has been summarised in Table 2.

. Map of the groundwater bores is provided in Appendix A. The review found:

- There is one recorded groundwater bore in Potts Point along the shoreline; however this groundwater bore was only completed to a depth of 2 m and does not have any record of standing water level.
- Groundwater bores along the neighbouring Rushcutters Bay and Darling Point have been included as a proxy indicator for groundwater level at Potts Point. Darling Point is located 1 km to the east along the Harbour and has very similar hydrogeological conditions to Potts Point (both being Hawkesbury Sandstone ridges which protrude high above the harbour) and has a greater number of groundwater bores to review.
- Close to the harbour shoreline, the standing water level (SWL) ranges between 1.86 m to 3.5 m below ground level. Reduced standing water levels are consistently recorded between 3 to 4 m AHD (estimated using ground elevations from Google Earth).
- In the centre of Darling Point, a single groundwater bore recorded the recorded SWL at 38.3 m bgl in the sandstone (Reduced standing water level is approximately 9.4 m AHD). This is to be expected conceptually because the ground elevation is significantly higher at approximately 48 m AHD, elevated above the harbour on the sandstone ridge. The water level recording was taken following hole completion in the winter month of August 2005.
- Seasonal fluctuation in groundwater levels is expected to be small (<1 m) and primarily driven by rainfall recharge.

Table 2: Groundwater monitoring summary

Borehole ID	Location	Construction details	Standing water level (SWL) Reduced standing water level (RSWL)
GW106471	Potts Point, adjacent to Elizabeth Bay	Drilled 22/11/2004 Final depth 2.0 m (Hand auger hole) Approximate ground elevation: 5 m AHD	No data
GW113383	New Beach Road, Darling Point, adjacent to Rushcutters Bay	Drilled 19/08/2013 Final depth 8.0 m Approximate ground elevation: 5 m AHD Screened in sandstone from 5 to 6.5 m bgl	SWL = 1.86 m bgl RSWL = ~3.1 m AHD
GW107323	Eastbourne Road, Darling Point	Drilled 23/08/2005 Final depth 162.5 m Approximate ground elevation: 48 m AHD Screened in sandstone from 53.7 to 59.6 m bgl	SWL = 38.3 m bgl RSWL = ~9.4 m AHD
GW107412	Spring Street, Darling Point adjacent to Double Bay	Drilled 15/10/2005 Final depth 5.0 m Approximate ground elevation: 7 m AHD Screened in sand from 4 to 5 m bgl	SWL = 3.1 m bgl RSWL = ~3.9 m AHD
GW100462	Double Bay Park	Drilled 22/03/1995 Final depth 8.0 m Approximate ground elevation: 6 m AHD Screened in sand from 6 to 7.5 m bgl	SWL = 2.48 m bgl RSWL = ~3.52 m AHD
GW107418	Rushcutters Bay	21/01/2005 Final depth 11.5 m Approximate ground elevation: 7 m AHD Screened 8.5 to 11.5 m bgl	SLW = 3.5 m bgl RSWL = ~3.5 m AHD
GW100467	Rushcutters Bay Park	15/03/1996 Final depth 14.5 m Approximate ground elevation: 6 m AHD Screened 12.5 to 14.5 m bgl	SWL = 2.35 m bgl RSWL = ~3.65 m AHD

Figure 3 represent a cross-section through Darling Point which has been produced to illustrate the groundwater level change within the Hawkesbury Sandstone ridge, which is expected to represent the same (or similar) conditions that would be found beneath the Site at Potts Point. Based on available data, the groundwater beneath the Darling Point ridge is approximately 6 m higher than the groundwater levels next to the harbour shoreline.

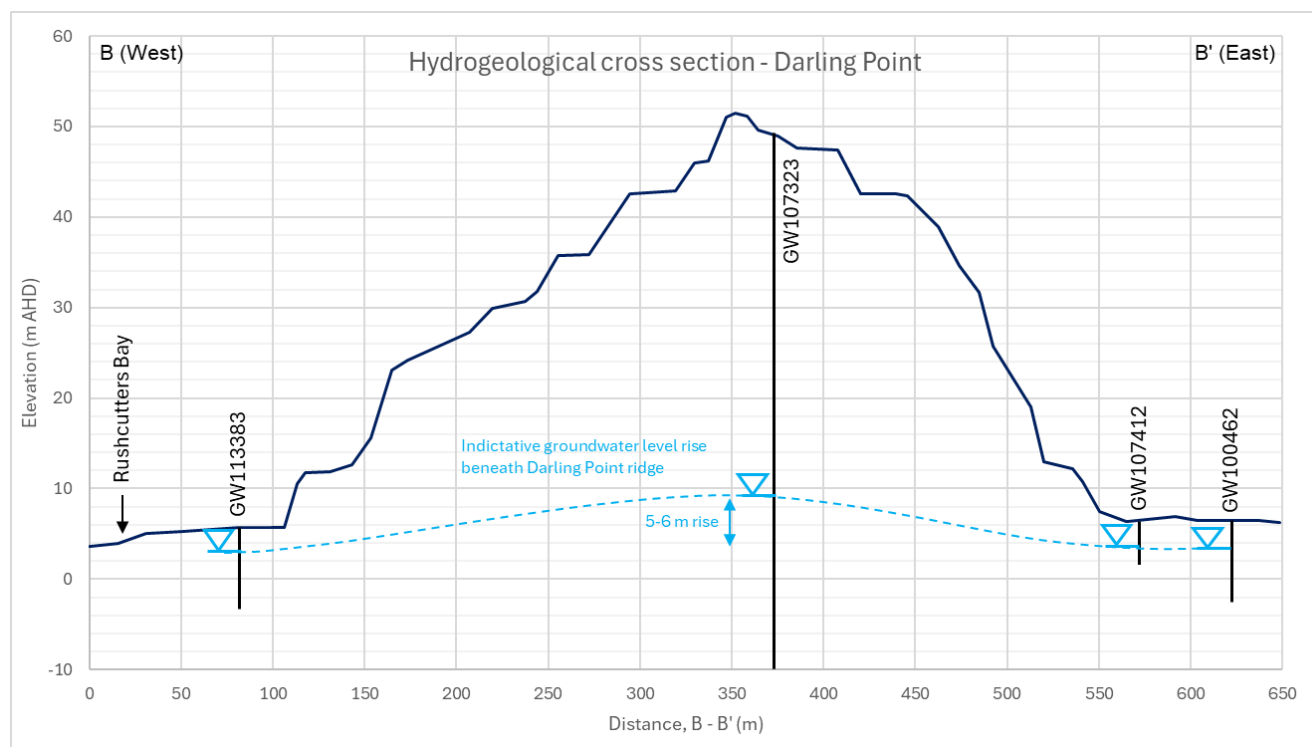


Figure 3: Hydrogeological cross section through Darling Point

Shallow perched groundwater may periodically present itself in the upper sections of the sandstone following periods of rainfall, as excess moisture infiltrates into the subsurface and leaking drains result in direct recharge to the shallow bedrock. This water can be perched high above the regional water table in the sandstone ridges, as vertical flow is restricted by low permeability layers (such as mudstone or siltstone bands) or preferential flow along horizontal bedding planes in the sandstone results in seepage out of slopes. This perched groundwater is likely to be very localised and only present for short periods of time (following rainfall).

Conceptual Hydrogeological Model

Based on the desk study review of baseline geology and hydrogeology, the hydrogeological conceptual model is summarised below:

- The Site is located in the suburb of Potts Point, which is located on a ridge that extends inland from the Sydney harbour shoreline. The ridge is made up by Hawkesbury Sandstone which is typical of the Sydney Basin. The site is elevated above Sydney harbour shoreline by approximately 25 m.
- The Hawkesbury Sandstone is the primary aquifer beneath the site. Groundwater flow mainly occurs through secondary permeability, such as fractures and other linear features, with only a minor contribution from primary permeability, which involves porous flow.
- Groundwater in the Hawkesbury Sandstone aquifer beneath the site is thought to be unconfined and influenced by tides in Sydney harbour (estuary). Groundwater levels at the shoreline will be close to ground level and connected to surface water.
- A review of available groundwater monitoring data for neighbouring Darling Point (no data available for Potts Point) indicates that near the shoreline, average depth to groundwater is 1.86 to 3.5 m bgl. On high ground in the centre of Darling Point ridge, depth to groundwater was recorded to be 38.3 m bgl. The

groundwater level profile beneath Darling Point is thought to be a good proxy indicator of groundwater levels beneath the Site and Potts Point.

- Seasonal fluctuation in groundwater levels is expected to be small (<1 m) and primarily driven by rainfall recharge.
- Perched groundwater is likely to develop in the upper layers of the sandstone ridges following periods of rainfall. This perched water is likely to be very localised and only be present for short periods before seeping horizontally out of the sandstone formation along the steep slopes or vertically down joints towards the regional water table.

A simplified conceptual hydrogeological model and the proposed development at 45-53 Macleay Street is presented in Figure 4. The proposed three levels of basement will extend to a depth of ~10 m below existing ground level. Depth to groundwater is anticipated to be greater than 20 m beneath the Site, based on groundwater monitoring at Darling Point. Therefore, the invert level of the basement is expected to be above the dominant water table in the Hawkesbury Sandstone by up to 8 m.

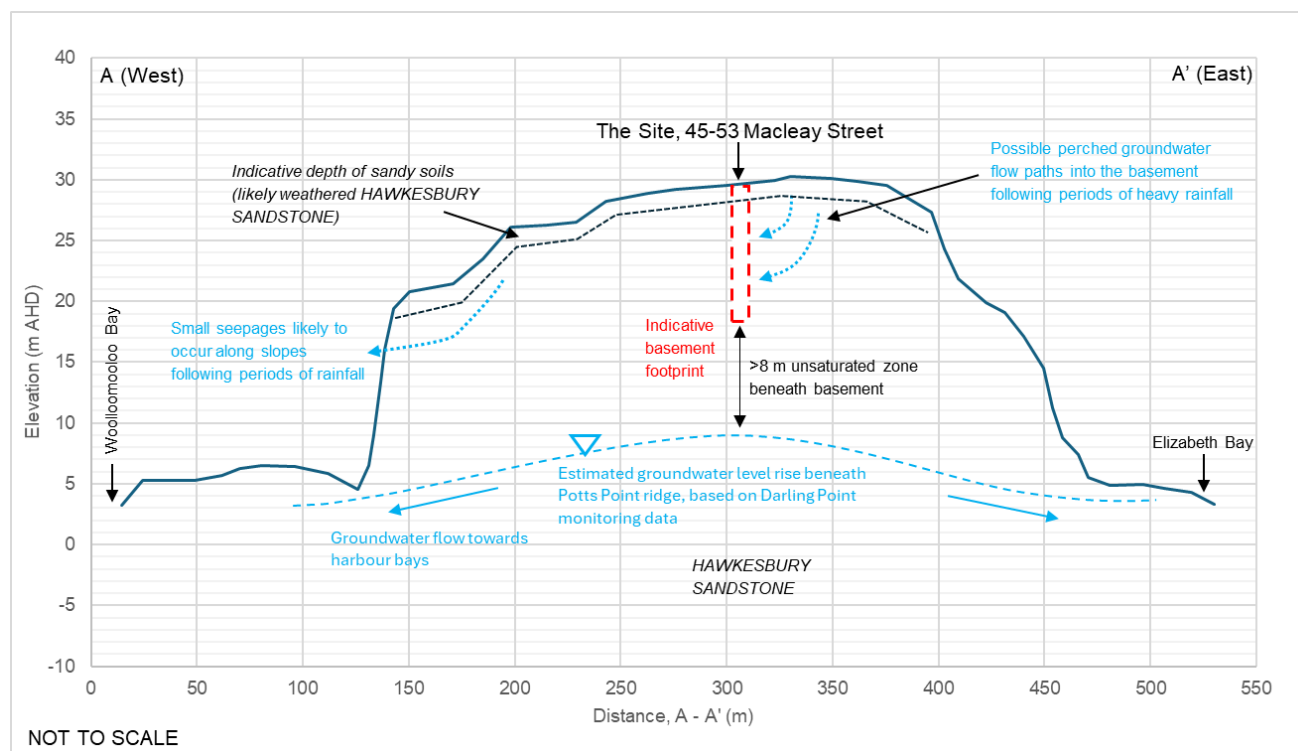


Figure 4: Site conceptual hydrogeological model

Groundwater Inflow Assessment

As presented above, the proposed three-story basement at the Site is anticipated to be above the regional water table in the Hawkesbury Sandstone aquifer by ~8 m, therefore no persistent or significant groundwater inflow is predicted.

Small groundwater inflows may occur following periods of rainfall and from the development of potential perched groundwater in the upper sandstone layers. The duration of these inflows would be dependent on the storm duration and the intensity of the rainfall. Higher intensity rainfall generally leads to higher run off and less infiltration to the ground. Leaking infrastructure (water mains and drainage) could also be a source of water leading to perched groundwater and small inflows to the basement. Groundwater inflow from perched

groundwater would be significantly less than 3 ML or less per year taken through aquifer interference activities, therefore the development would be exempt from needing a water access licence in NSW.

Site specific ground investigation is required to determine the depth to water table beneath the site and confirm the above assumptions regarding groundwater inflows to the basement during construction and ongoing operation.

Conclusions

Time & Place Management Pty Ltd are seeking concept approval for a proposed development consisting of 13-storey mixed use shop-top housing development and three levels of basement car parking. The basement has an approximate invert level of 10 m below existing ground level. This letter report presents the hydrogeological conceptual model based on available data, and subsequent appraisal undertaken to quantify groundwater inflows to the basement levels during construction and ongoing operation.

The Site is located in Potts Point, which occupies a narrow sandstone ridge that extends inland from the Sydney harbour Shoreline. The ridge is made up by the Hawkesbury Sandstone, which is the main water bearing aquifer in the Sydney Basin Central Groundwater Source, part of the *Water Sharing plan for the Greater Metropolitan Region Groundwater Sources 2023*.

Groundwater monitoring data around the Site in Potts Point is limited, therefore groundwater data for the neighbouring harbour suburb, Darling Point, was used as a proxy indicator for the groundwater level behaviour beneath the Site.

- It is expected conceptually that the water table in the Hawkesbury Sandstone aquifer is connected to Sydney harbour and at a similar elevation.
- Monitoring along the shoreline indicates the water table is at around 3 to 4 m AHD.
- Beneath the Potts Point ridge, groundwater is estimated to rise to 5 m higher than the groundwater level at the shoreline to around 9 m AHD.
- The proposed invert level of the basement is 17.8 m AHD, as such under these groundwater conditions the basement would be above the water table.

Perched groundwater may develop in the upper sandstone layers following periods of rainfall or from leaking infrastructure (water mains or drains). Minor inflows to the basement structure may occur from localised perched groundwater that is laterally and temporarily discontinuous. Inflows will be less than 3 ML per year taken through aquifer interference activities, therefore the development would be exempt from needing a water access licence in NSW.

Site specific ground investigation is recommended to confirm the conceptual hydrogeological model presented and the conclusions of the groundwater inflow assessment.

Recommendations

To adhere to the monitoring requirements set out in the *Minimum requirements for building site groundwater investigations and reporting (2022)* guidance and confirm the hydrogeological conceptual model presented based on desk-based information:

- At least one investigation hole drilled to 20 m below ground level would be required, with a screen installed from 6 m to 12 m below ground level (assuming uniform ground conditions).

- If groundwater is encountered, daily groundwater level measurements will be required for a minimum period of three months and weekly in-situ water quality measurements and determinations using a calibrated handheld water quality meter.
- In-situ permeability testing of the Hawkesbury Sandstone would be required if groundwater is encountered above the base of the basement to accurately predict groundwater inflow rates.

References

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Appendices

- Appendix A – Concept design drawing (45-53 Macleay Street))
- Appendix B – Groundwater monitoring bore locations (WaterNSW)

Appendix A – Concept design drawing (45-53 Macleay Street)



Appendix B – Groundwater monitoring bore locations (WaterNSW)

