The archaeological and palaeoenvironmental assessment of the sediments of Hyde Park, Sydney, New South Wales

Report to GML Heritage

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PROFESSOR STEPHEN GALE
Sedimentology and Geomorphology

ABN 14 824 251 557

Email: geoscience100@aol.co.uk

Summary

The City of Sydney has proposed a major upgrade of the lighting and power supply in Hyde Park in the central city. This work is likely to involve excavation for footings and conduits to depths of up to 700 mm. Although much of Hyde Park's landscape has been subjected to significant disturbance, it is believed that the northwest quadrant may retain and preserve an undisturbed pre-contact soil landscape beneath a thin cover of landfill.

A programme of coring was therefore proposed to assess whether the pre-contact soil landscape is preserved in this part of the park, and to determine whether excavation may be undertaken without causing further damage to a potentially archaeologically significant landscape remnant.

Nine cores were taken from the northwest quadrant of Hyde Park, Sydney, New South Wales to assess the Aboriginal archaeological potential of the upper 700 mm of the regolith materials of the park. The upper part of every core consists of fine-grained, dark-coloured, plant-organic-rich material. This forms a soil A1 horizon that appears to have been imported to the site in order to blanket the underlying fill and to provide a suitable medium for plant growth. Underlying this in most of the cores is a sequence of thin, disconformable beds possessing clear markers of human activity, including post-contact artefacts, reworked aeolian sands, exotic rock material whose origin lies beyond the catchment of the site, and angular intraclasts of weathered Ashfield Shale, the product of human reworking of the site's substrate. These deposits represent the deposition of anthropogenic fill at the site. The thin layers, the sharp contacts between each bed and the absence of a consistent stratigraphy in the fill hint at a complex pattern of infilling using material from several sources.

Two of the cores intersect weathered bedrock, either directly beneath the modern soil or below the layers of fill material. In the latter case, the bedrock is overlain by a thin truncated soil B-horizon. Although this occurs at a depth of <700 mm and may be of some palaeo-environmental interest, it has negligible Aboriginal archaeological potential. In none of the cores, therefore, is there evidence of Aboriginal archaeological potential at depths of up to 700 mm beneath the ground surface.

1 Scope of work

The City of Sydney has proposed a major upgrade of the lighting and power supply in Hyde Park in the central city. This work is likely to involve excavation for footings and conduits to depths of up to 700 mm. Although much of Hyde Park's landscape has been subjected to significant disturbance, mapping of the park by GML Heritage (2014, 43–44) indicated that the northwest quadrant may retain and preserve an undisturbed pre-contact soil landscape beneath a thin cover of landfill (Figure 1).

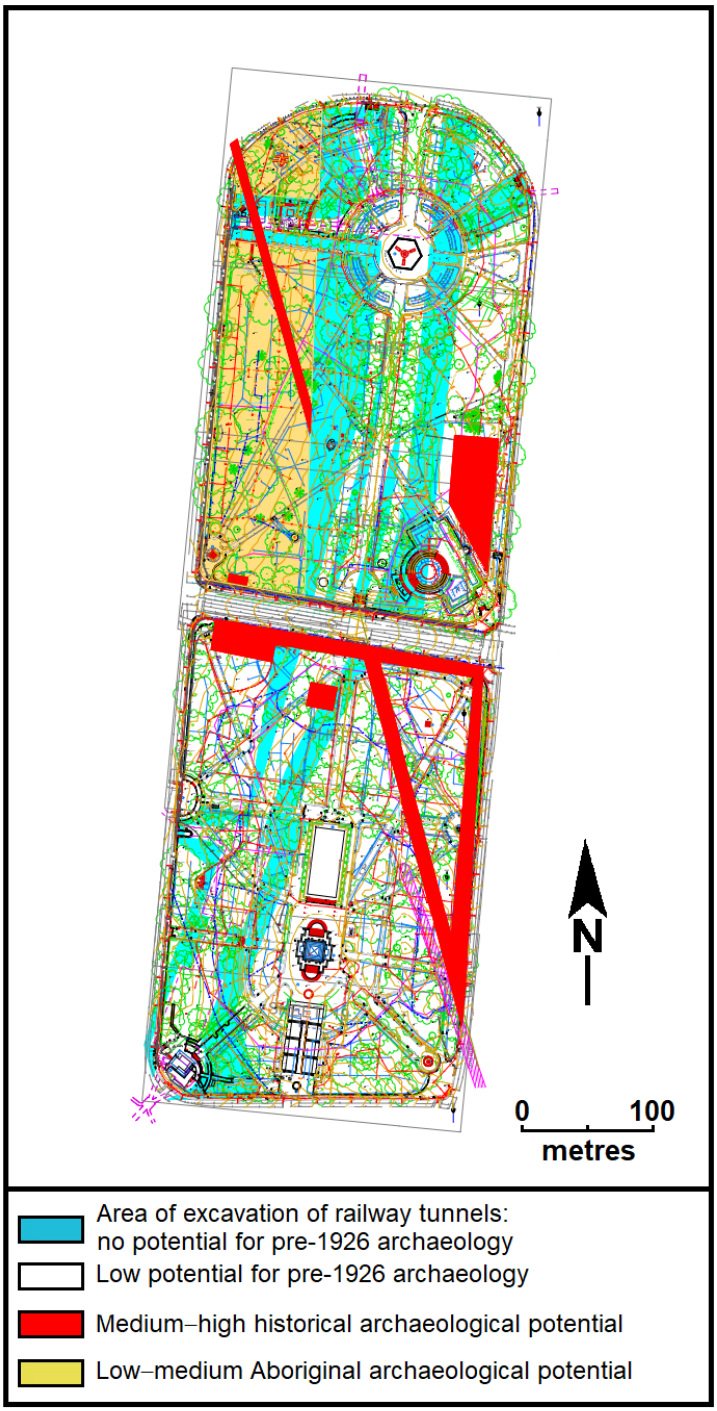

Figure 1. The archaeological potential of Hyde Park, Sydney, New South Wales. Modified from GML Heritage (2014, 43–44).

Professor Stephen Gale was therefore retained by GML Heritage to determine whether the pre-contact soil landscape had been preserved in this part of the park, to assess whether the associated buried soil and sediment sequence remains intact and to determine which parts of the northwest quadrant may be excavated without causing further damage to a potentially archaeologically significant landscape remnant.

The aim of the project was thus to obtain a network of undisturbed cores of the upper *c.* 1000mm of the surficial soils and sediments from the northwest part of the park to obtain information on the vertical and lateral pattern of soils and sediments across the area.

The field component of this project was undertaken on 16 December 2021 and 7–8 February 2022. The work involved the recovery of sediment cores from across the site, reporting on the stratigraphy of the cores and assessing the palaeo-environmental conditions under which deposition had occurred, with particular reference to their archaeological implications.

2 The physical context of the site

The modern city centre is bisected by a north–south ridge of Triassic Hawkesbury Sandstone that rises to over 30 m AHD (Herbert and West, 1983; Troedson, 2015) (Figure 2). The highest part of the ridge is capped by Triassic Ashfield Shale and it is on this material that Hyde Park is located. To the west of the ridge lies the valley formerly occupied by the Tank Stream. This flowed north into Sydney Cove and originated in a swamp that was located to the west of the present-day park. To the east, an even smaller creek drained north into Farm Cove.

3 The human context of the site

Hyde Park was formally reserved by Governor Macquarie as an open space on 11 February 1810, making it the oldest public park in Australia. Little is known of its pre-contact history, although in immediate post-contact times it appears to have been an important Aboriginal contest ground (Karskens, 2009, 545).

During the first century of its existence, trees were planted and various half-hearted attempts were made to 'improve' the park. Nevertheless, the area seems to have remained in a little disturbed state until 1916, when work began on the underground railway from Central to Museum and St James. This necessitated the excavation of a deep trench across the park and the dumping of a mountain of excavated material at its southern end. The railway was opened in December 1926. This was followed by several decades of planting, redesigning and reconstruction, all of which contributed to the modern formal and highly modified urban landscape. Despite this, there is little record of the depth to which the original landscape of the park may have been reworked. Overall, it is thought that the potential of the park to retain evidence of Aboriginal archaeology is low, although it is believed that the northwest quadrant may retain and preserve an undisturbed pre-contact soil landscape beneath a thin cover of landfill (Figure 1).

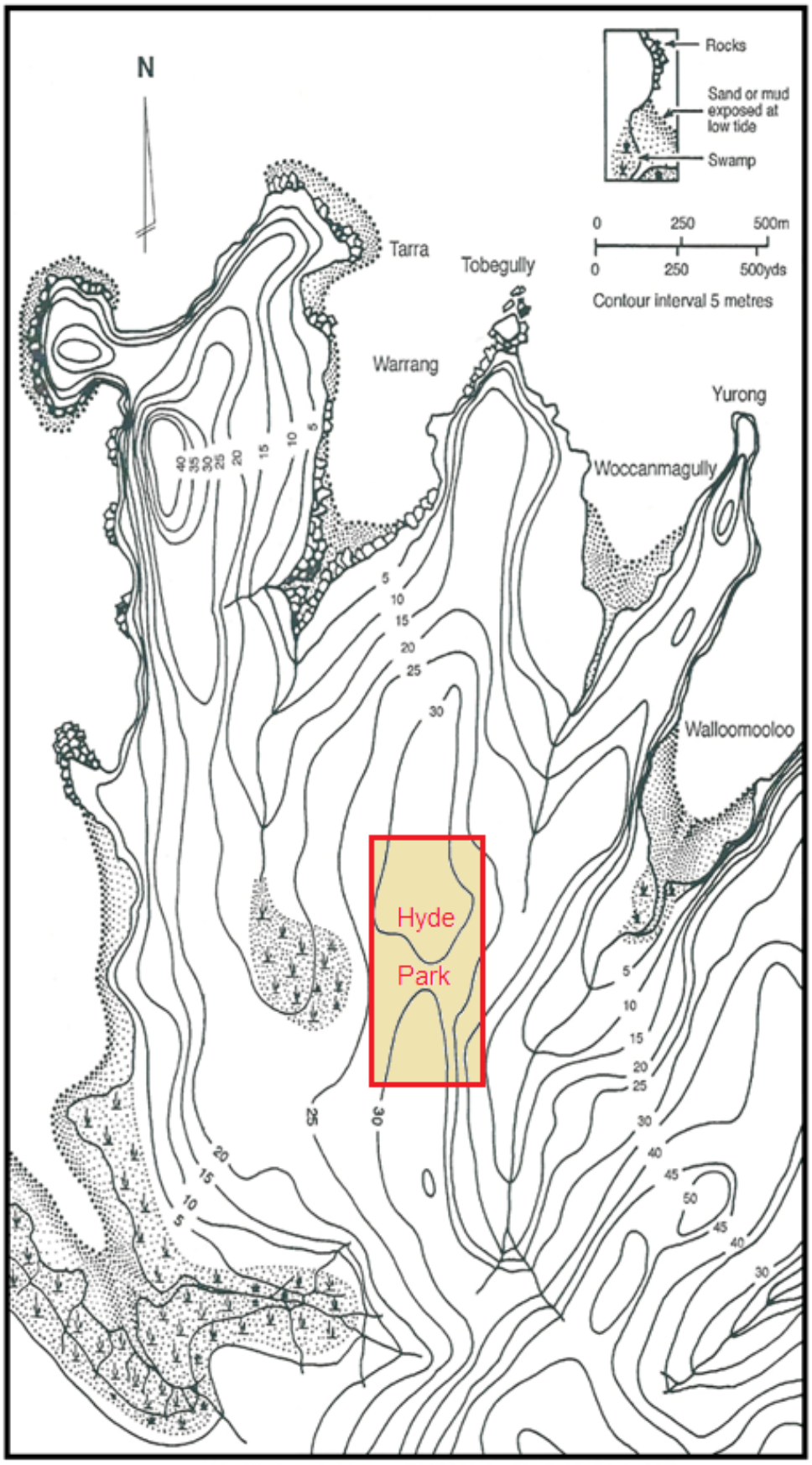

Figure 2. The topography of Sydney in January 1788, showing the location of the modern-day Hyde Park. Modified from Aplin (2013, 23).

4 Methods

4.1 Field sampling

Sampling in the northwest quadrant of the park was complicated by the tree coverage (with bioturbation associated with root systems likely to compromise the stratigraphy of the sediments) and by the existence of a dense and complex network of services (including drains, electrical conduits and telecommunication lines). The managing engineers, *AECOM*, therefore retained the services of *Geosurv* to run ground penetrating radar surveys to help locate services and to advise on the choice of sites for sampling. Using this information, nine sites were selected for coring (Figure 3). At each of these locations, percussion cores of 365–1125 mm in length were extracted using 55 mm external diameter polyvinyl chloride tubing (or, in the case of site HP001, 90 mm external diameter steel tubing).

4.2 Stratigraphy and lithology

Each core barrel was opened in the laboratory by making longitudinal cuts on opposite sides of the sleeving. One section of sleeve was removed to expose the deposits without disturbing them. The core and its retained sediments were photographed and detailed logs were made of the regolith sequence. The core descriptions employ the particle-size conventions of Wentworth (1922). Note that particles of diameters >2 mm are referred to as gravels. These are subdivided into granules (2–4 mm), pebbles (4–64 mm), cobbles (64–256 mm) and boulders (>256 mm). Our textural classification of regolith materials follows the definitions of Folk (1954). All colours were determined in field state following the procedures outlined by Gale and Hoare (2011, 158–161).

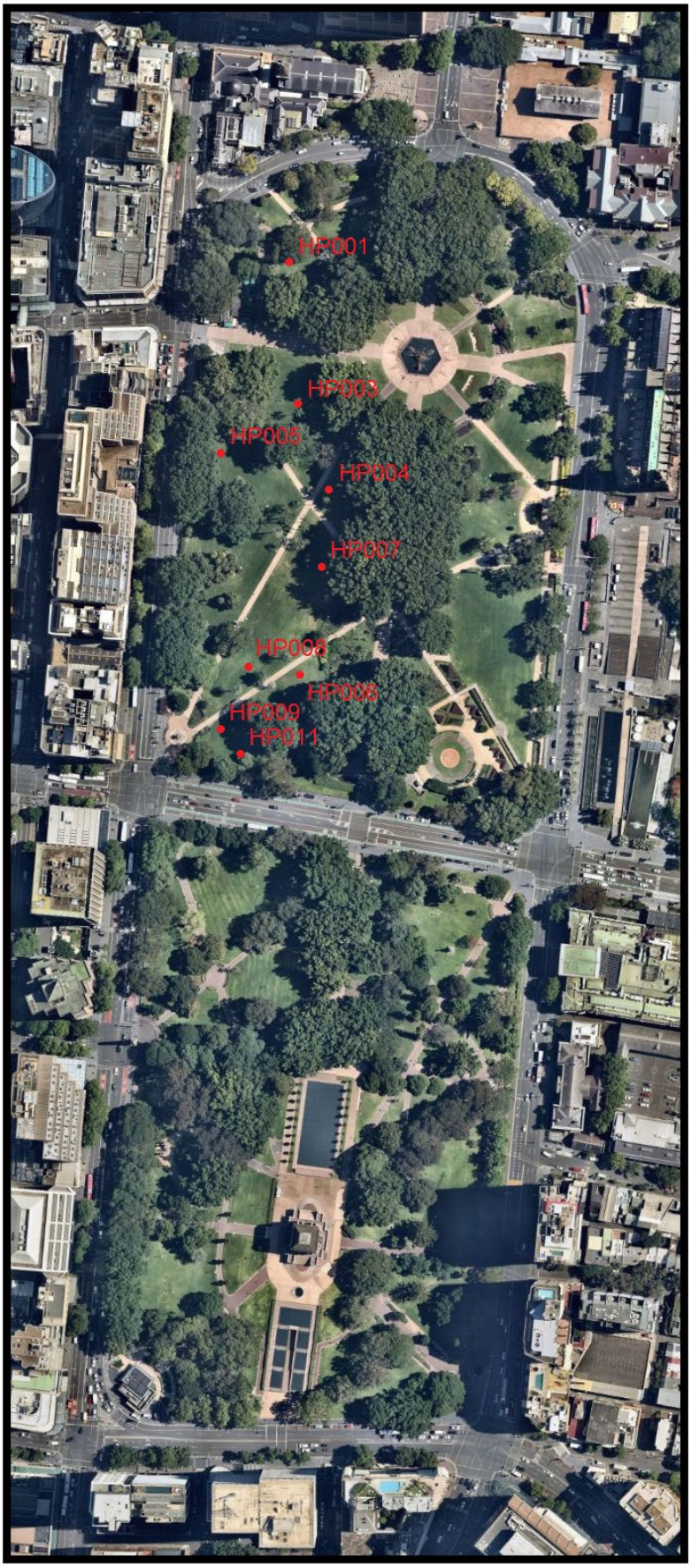

Figure 3. Location of coring sites, Hyde Park, Sydney, New South Wales. Aerial image: Nearmap.

5 Results

5.1 Core HP001

Table 1. The stratigraphy and lithology of Core HP001, Hyde Park, Sydney, New South Wales (56H 334525.217, 6250770.657). Surface elevation 26.402 m AHD.

Unit	Description	Thickness (m)	Depth (m)
Top	Black (10YR 2/1) sandy silt, upon which is developed a turf cover. The silt forms hexagonal peds and contains common roots and rootlets.		0.000 to
Base	Dark brown (10YR 3/3) sandy silt, containing common granules and pebbles, including a fine pebble of dark slate, a broken rounded pebble of pale quartzite and a pebble of industrial slag. Base of unit truncated by core.		to 0.805

5.2 Core HP003

Table 2. The stratigraphy and lithology of Core HP003, Hyde Park, Sydney, New South Wales (56H 334531.461, 6250685.621). Surface elevation 26.745 m AHD.

Unit	Description	Thickness (m)	Depth (m)
8	Black (10YR 2/1) sandy silt upon which is developed a turf cover. The silt forms hexagonal peds and contains occasional roots and rootlets. Transitional contact over ≈5 mm with underlying unit.	0.068	0.000 to 0.068
7	Black (10YR 2/1) structureless sandy silt, containing occasional roots and rootlets, and rare granules of exotic rock. Sharp, subhorizontal contact with underlying unit.	0.183	0.068 to 0.251
6	Clast-supported angular granules and pebbles of fine-grained clastic sedimentary rock with a matrix of brownish yellow (10YR 6/6) clayey silt, containing common granule-sized charcoal fragments. Sharp, subhorizontal contact with underlying unit.	0.048	0.251 to 0.299
5	Very dark gray (10YR 3/1) slightly silty sand, containing common angular granules and pebbles, including shale, common charcoal fragments. Sharp, subhorizontal contact with underlying unit.	0.054	0.299 to 0.353

4	Dark grayish brown (10YR 4/2) slightly silty sand, containing common charcoal fragments, occasional granules and a sherd of clear glass (*a* = 29 mm) at 0.37 m. Transitional contact over ≈10 mm with underlying unit.	0.082	0.353 to 0.435
3	Very pale brown (10YR 7/4) horizontally bedded sand, containing grayish brown (10YR 5/2) interbeds and rare granules and pebbles (including an angular granule of coal at 0.48 m). Sharp, subhorizontal contact with underlying unit.	0.122	0.435 to 0.557
2	Very dark grayish brown (10YR 3/2) silty sand, containing a single large (≈10 mm diameter) roots and a subrounded pebble of sandstone. Sharp, subhorizontal contact with underlying unit	0.068	0.557 to 0.625
1	Bleached white Hawkesbury Sandstone. Base of unit truncated by core.	0.095	0.625 to 0.720

Figure 4. Core HP003, Hyde Park, Sydney, New South Wales.

5.3 Core HP004

Table 3. The stratigraphy and lithology of Core HP004, Hyde Park, Sydney, New South Wales (56H 334548.436, 6250630.973). Surface elevation 27.105 m AHD.

Unit	Description	Thickness (m)	Depth (m)
9	Black (10YR 2/1) slightly sandy silt, containing rare granules, upon which is developed a turf cover. The silt forms hexagonal peds, becoming structureless with depth. Common roots are replaced by rare rootlets with depth. Base of unit truncated by core.	0.270	0.000 to 0.270
8	Black (10YR 2/1) structureless sandy silt, containing rare rootlets and rare granules. Sharp subhorizontal contact with underlying unit.	0.018	0.270 to 0.288

7	Subangular pebble (*a* = 65 mm) of iron-indurated sandstone. Sharp subhorizontal contact with underlying unit.	0.024	0.288 to 0.312
6	Very pale brown (10YR 7/4) clay with very dusky red to pale red (7.5R 2.5/4–7.5R 4/6) mottles. The darker mottles are commonly indurated. Sharp, dipping (at ≈30°) contact with underlying unit.	0.184	0.312 to 0.496
5	Dark brown (10YR 3/3) silty sand, containing rare angular and subangular sandstone pebbles. Sharp subhorizontal contact with underlying unit.	0.036	0.496 to 0.532
4	Subangular, pebble-sized intraclasts of very pale brown (10YR 7/4) clay with very dusky red to pale red (7.5R 2.5/4–7.5R 4/6) mottles in a matrix of sandy gravel. Sharp, erosional contact (with an amplitude of ≈10 mm) with underlying unit.	0.041	0.532 to 0.573
3	Brown (10YR 5/3) well-sorted, medium, quartzose sand with rare lithic fragments. Base of unit truncated by core.	0.042	0.573 to 0.615
2	Weak red (7.5R 4/4) semi-indurated sandy silt. Sharp subhorizontal contact with underlying unit.	0.033	0.615 to 0.648
1	Dark grayish brown (10YR 4/2) slightly sandy silt, containing common angular pebble-sized intraclasts of light yellowish brown to very pale brown (10YR 6/4–10YR 7/4) clay and rare charcoal fragments. Base of unit truncated by core.	0.267	0.648 to 0.915

Figure 5. Core HP004, Hyde Park, Sydney, New South Wales.

5.4 Core HP005

Table 4. The stratigraphy and lithology of Core HP005 (note that before being renumbered by *AECOM*, this logged as was Core HP002), Hyde Park, Sydney, New South Wales (56H 334485.263, 6250654.377). Surface elevation 24.933 m AHD.

Unit	Description	Thickness (m)	Depth (m)
7	Black (10YR 2/1) slightly sandy silt upon which is developed a turf cover. The silt forms hexagonal peds and contains common roots and rootlets. Transitional contact over ≈10 mm with underlying unit.	0.136	0.000 to 0.136
6	Very dark gray (10YR 3/1) structureless silty sand, containing rare rootlets, occasional subangular to subrounded granules of iron precipitates and fine-grained sedimentary rock, and very rare fragments of wood charcoal. Sharp, horizontal, planar contact with underlying unit.	0.204	0.136 to 0.340
5	Dark grayish brown (10YR 4/2), horizontally laminated (at a sub-millimetre scale) medium to fine-grained quartzose sand. The sand is dominated by medium rounded quartz grains with common lithic grains and a single subrounded granule of iron precipitate. Sharp, horizontal, planar contact with underlying unit.	0.019	0.340 to 0.359
4	Dark gray (10YR 4/1) silty sand, containing occasional roots, rare granules, common medium rounded quartz grains, rare granules and, at 0.525–0.563 m and 0.602 m, subrounded granules of sandstock brick. A 2 mm thick horizontal band of black (10YR 2/1) ?charcoal is found at 0.392 m. Sharp, complex (with an amplitude of ≈20 mm) contact with underlying unit.	0.321	0.359 to 0.680
3	Light gray (10YR 7/2) horizontally bedded, well-sorted, medium, rounded quartzose sand containing very dark gray (10YR 3/1) granule- and pebble-sized inclusions of silt and a fragment of burnt wood at 0.826 m. Sharp, subhorizontal, planar contact with underlying unit.	0.155	0.680 to 0.835
2	Dark gray (10YR 4/1) sandy silt containing occasional granules including one of very dark grey angular lithified sandstone. Transitional contact over ≈10 mm with underlying unit, the transition comprising interbedded laminae of the under- and overlying units.	0.049	0.835 to 0.884
1	Strong brown (7.5YR 5/6) clayey silt, containing occasional roots and occasional subrounded granules and pebbles of iron precipitate. Base of unit truncated by core.	0.136	0.884 to 1.020

Figure 6. Core HP005, Hyde Park, Sydney, New South Wales. Note that at the time of extraction, this core was labelled HP002. It was renamed by *AECOM* after it had been logged and photographed.

5.5 Core HP006

Table 5. The stratigraphy and lithology of Core HP006, Hyde Park, Sydney, New South Wales (56H 334530.312, 6250520.040). Surface elevation 27.847 m AHD.

Unit	Description	Thickness (m)	Depth (m)
12	Black (10YR 2/1) slightly sandy silt upon which is developed a turf cover. The silt forms hexagonal peds and contains common roots and rootlets. Transitional contact over ≈10 mm with underlying unit.	0.106	0.000 to 0.106
11	Black (10YR 2/1) structureless sandy silt, becoming very dark gray (10YR 3/1) with depth, containing rare roots and rootlets, and rare brick fragments. Sharp, horizontal, planar contact with underlying unit. Sharp, erosional contact (with an amplitude of ≈10 mm) with underlying unit.	0.198	0.106 to 0.304
10	Clast-supported, horizontally bedded, platy fragments of weathered shale with a matrix of gray (10YR 6/1) sandy silt. Sharp, erosional contact (with an amplitude of ≈10 mm) with underlying unit.	0.026	0.304 to 0.330
9	Dark brown (7.5YR 3/3) silty sand. Sharp, erosional contact (with an amplitude of 2–5 mm) with underlying unit.	0.092	0.330 to 0.422
8	Angular pebble-sized intraclasts of white (10YR 8/1) clay with dusky red to weak red (10R 3/4–10R 5/4) mottles supported in a matrix of dark brown (10YR 3/3) silty sand. Sharp, erosional contact (with an amplitude of ≈10 mm) with underlying unit.	0.027	0.422 to 0.449
7	Dark brown (10YR 3/3) silty sand, becoming dark yellowish brown (10YR 3/4) with depth, containing occasional millimetre-scale horizontal interbeds of silt and (at 0.49 m) a brick fragment. Sharp subhorizontal contact with underlying unit.	0.112	0.449 to 0.561

6	Very weathered subrounded granules and pebbles of ?sandstone and ?basalt supported in a matrix of dark yellowish brown (10YR 3/4) silty sand, containing occasional angular fragments of brick. Base of unit truncated by core.	0.033	0.561 to 0.594
5	Dark brown (10YR 3/3) silty sand, containing rare angular and subrounded granules of black ?basalt. Sharp, erosional contact (with an amplitude of ≈10 mm) with underlying unit.	0.046	0.594 to 0.640
4	Yellowish brown (10YR 5/4) quartzose sand with rare lithic fragments, containing common subrounded granule- to pebble-sized intraclasts of red (2.5YR 5/6) clay, occasional roots and (at 0.69 m) a pebble of sandstock brick. Sharp subhorizontal contact with underlying unit.	0.134	0.640 to 0.774
3	Dark grayish brown (10YR 4/2) sandy silt, containing occasional sandy horizontal interbeds. Sharp, erosional contact (with an amplitude of ≈30 mm) with underlying unit.	0.029	0.774 to 0.803
2	White (10YR 8/1) clay with dusky red to weak red (10R 3/4–10R 5/4) mottles. The clay forms subangular fragments of up to *a* = 100 mm supported in a matrix of dark grayish brown (10YR 4/2) sandy silt. Sharp subhorizontal contact with underlying unit.	0.116	0.803 to 0.919
1	Yellowish brown (10YR 5/4) clayey silt, containing pebble-sized inclusions of coarse sand, pebble-sized angular intraclasts of white and red mottled clay, rare granules of charcoal, two subangular pebbles of iron precipitate and a subrounded granule of black ?basalt. Base of unit truncated by core.	0.105	0.919 to 1.024

Figure 7. Core HP006, Hyde Park, Sydney, New South Wales.

5.6 Core HP007

Table 6. The stratigraphy and lithology of Core HP007, Hyde Park, Sydney, New South Wales (56H 334544.876, 6250587.572). Surface elevation 27.347 m AHD.

Unit	Description	Thickness (m)	Depth (m)
8	Black (10YR 2/1) slightly sandy silt upon which is developed a turf cover. The silt forms hexagonal peds and contains common roots. Transitional contact over ≈10 mm with underlying unit.	0.088	0.000 to 0.088
7	Very dark gray (10YR 3/1) structureless slightly sandy silt, containing occasional rootlets, rare granules and (at 0.33 m) a rounded pebble-sized intraclast of yellowish red (5YR 5/8) clay. Transitional contact over ≈20 mm with underlying unit.	0.287	0.088 to 0.375
6	Pebble-sized subrounded intraclasts of yellowish red (5YR 5/8) and yellow (10YR 7/6) clay supported in a matrix of dark brown (10YR 3/3) sandy sily, containing common rounded granules and occasional pebble-sized pockets of medium sand. Sharp, erosional contact (with an amplitude of ≈20 mm) with underlying unit.	0.221	0.375 to 0.596
5	Dark brown (10YR 3/3) silty sand, containing occasional granules of exotic rock, occasional clay intraclasts comparable with those in the overlying unit and (at 0.673 m) a shelly marine carbonate accretion. Sharp, undulating contact (with an amplitude of ≈5 mm) with underlying unit.	0.154	0.596 to 0.750
4	Light yellowish brown (10YR 6/4) well-sorted, medium, quartzose sand, containing rare fragments of charcoal. Sharp, undulating contact (with an amplitude of ≈5 mm) with underlying unit.	0.066	0.750 to 0.816
3	Dark brown (10YR 3/3) silt, containing occasional granules and occasional charcoal fragments. Sharp, subhorizontal contact with underlying unit.	0.110	0.816 to 0.926
2	Dark reddish brown (5YR 3/2) laminated silt, containing interbeds of yellowish brown (10YR 5/4) silt, occasional exotic granules and occasional subrounded granule-sized intraclasts of yellowish red (5YR 5/8) clay. Sharp, planar contact with underlying unit.	0.066	0.926 to 0.992
1	Brown (10YR 5/3) laminated silt containing rare granules. Base of unit truncated by core.	0.133	0.992 to 1.125

Figure 8. Core HP007, Hyde Park, Sydney, New South Wales.

5.7 Core HP008

Table 7. The stratigraphy and lithology of Core HP008, Hyde Park, Sydney, New South Wales (56H 334500.950, 6250524.813). Surface elevation 26.765 m AHD.

Unit	Description	Thickness (m)	Depth (m)
5	Black (10YR 2/1) slightly sandy silt upon which is developed a turf cover. The silt is compact and structureless and contains common roots and rootlets. Below 0.39 m, there are occasional weathered sandstone granules, an angular pebble of dusky red (10R 3/4) fine-grained metasedimentary rock, an angular pebble of black slate, and carbonate and marine-shell encrusted mud balls. Transitional contact over ≈10 mm with underlying unit.	0.627	0.000 to 0.627
4	Dark brown (10YR 3/3) millimetre-scale laminated silt, containing occasional roots, a granule of carbonate cemented mud, a granule-sized sherd of green glass and an angular pebble of industrial slag. Sharp, subhorizontal contact with underlying unit.	0.117	0.627 to 0.744
3	Light gray (10YR 7/2), finely horizontally laminated clay, containing common dark red (10R 3/6) interbeds and rare roots. Sharp, subhorizontal contact with underlying unit.	0.118	0.744 to 0.862
2	Dark brown (10YR 3/3) horizontally laminated, slightly sandy silt, containing rare fragments of wood charcoal. Sharp, subhorizontal contact with underlying unit.	0.029	0.862 to 0.891
1	Strong brown (7.5YR 5/6) clay, containing occasional red (2.5YR 4/8) granule-sized mottles. Base of unit truncated by core.	0.049	0.891 to 0.940

Figure 9. Core HP008, Hyde Park, Sydney, New South Wales.

5.8 Core HP009

Table 8. The stratigraphy and lithology of Core HP009, Hyde Park, Sydney, New South Wales (56H 334484.083, 6250488.553). Surface elevation 26.934 m AHD.

Unit	Description	Thickness (m)	Depth (m)
4	Black (10YR 2/1) slightly sandy silt, containing rare granules, upon which is developed a turf cover. The silt forms hexagonal peds, becoming structureless with depth and contains common roots becoming less frequent with depth. Sharp, subhorizontal contact with underlying unit.	0.285	0.000 to 0.285
3	An angular pebble (*a* = 32 mm) of ferruginised sandstone lies along the contact between Units 3 and 4. Light brownish gray (10YR 6/2) clay, containing rare pebble-sized pockets of sand and occasional granules of very weathered sandstone. Sharp, erosional contact (with an amplitude of ≈5 mm) with underlying unit.	0.047	0.285 to 0.332
2	Gray (10YR 6/1) clay, containing rare pebble-sized pockets of sand and rare pebbles of very weathered sandstone. Sharp, subhorizontal contact with underlying unit.	0.036	0.332 to 0.368
1	Variegated weak red (10R 4/4), yellow (10YR 7/8) and very pale brown (10YR 8/3) well-sorted, medium, openwork sand, containing occasional rounded pebbles of black ?basalt. Base of unit truncated by core.	0.047	0.368 to 0.415

Figure 10. Core HP009, Hyde Park, Sydney, New South Wales.

5.9 Core HP011

Table 9. The stratigraphy and lithology of Core HP011, Hyde Park, Sydney, New South Wales (56H 334494.650,6250474.459). Surface elevation 27.540 m AHD.

Unit	Description	Thickness (m)	Depth (m)
4	Black (10YR 2/1) slightly sandy silt upon which is developed a turf cover. The silt forms hexagonal peds and contains common roots and rootlets. Transitional contact over ≈10 mm with underlying unit.	0.080	0.000 to 0.080
3	Black (10YR 2/1) silty sand, becoming very dark grayish brown (10YR 3/2) with depth, containing rare pebble-sized intraclasts of white and red mottled clay, and exotic granules and pebbles. Sharp, steeply dipping (at ≈45°) contact with underlying unit.	0.228	0.080 to 0.308
2	White (10YR 8/1) clay with dusky red to weak red (10R 3/4–10R 5/4) mottles. Sharp, subhorizontal contact with underlying unit.	0.040	0.308 to 0.348
1	Horizontally-disposed weathered sandstone and finely laminated mudstone with a matrix of light yellowish brown (10YR 6/4) clay. Base of unit truncated by core.	0.017	0.348 to 0.365

Figure 11. Core HP011, Hyde Park, Sydney, New South Wales.

6 Discussion

6.1 The stratigraphy of the individual cores from the site

6.1.1 Core HP001

The upper unit in the core consists of black, sandy silt upon which a turf cover is developed. The presence of soil peds and the high plant-organic content (indicated by the dark colour of the material) is strongly indicative of a soil A1 horizon.

The base of the core consists of sandy silt containing industrial slag and exotic rock material whose origin lies beyond the catchment of the site. We interpret this material as anthropogenic fill.

6.1.2 Core HP003

The upper units in the core consist of black, sandy silt upon which a turf cover is developed. The presence of soil peds, becoming structureless with depth, and the high plant-organic content (indicated by the dark colour of the material) is strongly indicative of a soil A1 horizon. Curiously, the soil displays a sharp, disconformable contact with the underlying unit. This is unexpected at the base of a natural soil and suggests that the organic-rich material has been imported to the site in order to blanket the underlying fill and to provide a suitable medium for plant growth.

The underlying units consist of a series of thin, generally disconformable beds, containing a sherd of glass and exotic rock material whose origin lies beyond the catchment of the site. We interpret this material as a sequence of beds of anthropogenic fill.

The lowest two units in the sequence are enigmatic. At the base (Unit 1) is a deposit of bleached Hawkesbury Sandstone. We were unable to penetrate this

unit (indeed, our coring tube was fractured at this point). Although official geological maps suggest that the bedrock hereabouts consists of Ashfield Shale, the shale substrate must be thin, the site lies close to the sandstone boundary and mapping in urban areas is notoriously challenging. It is not inconceivable, therefore, that this unit represents the local sandstone basement, with the thin overlying bed of Unit 2 representing the buried and truncated soil that formerly overlay it.

Alternatively, Unit 1 may represent a sandstone clast overlying Ashfield Shale at depth. If this is the case, Unit 1 can only have reached the site by human means and Units 1 and 2 must therefore both be interpreted as anthropogenic fill.

In practical terms, neither interpretation would have an impact on the works proposed by the City of Sydney. In the first case, bedrock (Unit 1), overlain by a thin truncated soil B-horizon (Unit 2), would occur at a depth of <700 mm. However, although Unit 2 may be of some palaeoenvironmental interest, it has negligible Aboriginal archaeological potential. In the second case, anthropogenic fill of no Aboriginal archaeological potential may traced to depths of >700 mm.

6.1.3 Core HP004

The upper part of the core consists of black, slightly sandy silt upon which a turf cover is developed. The presence of soil peds and the high plant-organic content (indicated by the dark colour of the material) is strongly indicative of a soil A1 horizon. As with Core HP003, the soil displays a sharp, disconformable contact with the underlying unit. This is unexpected at the base of a natural soil and suggests that the organic-rich material has been imported to the site in order to blanket the underlying fill and to provide a suitable medium for plant growth.

The underlying units consist of a series of thin, generally disconformable beds. These include well-sorted sands and beds dominated by angular and subangular intraclasts of light yellowish brown to very pale brown clay with very dusky red to pale red mottles. The sands are very similar to the deposits of aeolian sand that are widespread in the nearby Botany Basin and which have been widely excavated for construction purposes in post-contact times (Gale and Wales, 2022). The clays are closely comparable with Loughnan *et al.*'s (1962) description of the upper component of the deeply weathered Ashfield Shale. The red to red-brown horizons identified by Loughnan *et al.* (1962) are typically around a metre deep and overlie mottled and gray, leached weathering profiles that reach depths of >10 m. The leached components are probably the equivalents of the light gray (10YR 7/1) clays identified by Chapman and Murphy (1989, 31–32) that occur as deep subsoil above the shale bedrock of the Blacktown Soil Landscape. The angular clay intraclasts found in the core are almost certainly the result of excavation of the weathered Ashfield Shale substrate and, like the accompanying sands, are the product of anthropogenic fill.

6.1.4 Core HP005

The upper units in the core consist of black and very dark gray, sandy silt and silty sand upon which a turf cover is developed. The presence of soil peds, becoming structureless with depth, and the high plant-organic content (indicated by the dark colour of the material) is strongly indicative of a soil A1 horizon. As with Cores HP003 and HP004, the soil displays a sharp, disconformable contact with the underlying unit. This is unexpected at the base of a natural soil and suggests that the organic-rich material has been imported to the site in order to blanket the underlying fill and to provide a suitable medium for plant growth.

The underlying units consist of a series of thin, generally disconformable beds. Unit 3 is composed of well-sorted sands that may be compared with the deposits of aeolian sand that are widespread in the nearby Botany Basin and which have been widely excavated for construction purposes in post-contact times (Gale and Wales, 2022). We therefore interpret Units 3–5 as the product of anthropogenic fill. Beneath that, Units 1 and 2 contain clasts almost certainly reworked from the Hawkesbury Sandstone and unlikely to have reached the site except by human agency. As with Core HP003, it is conceivable that sandstone rather than shale is found at depth at the site and that Units 1 and 2 are the product of sandstone weathering rather than human activity. From a practical point of view, however, this has no implications for the works proposed by the City of Sydney for these materials are found at depths well in excess of 700 mm in the sequence.

6.1.5 Core HP006

The upper units in the core consist of black and very dark gray, sandy silt upon which a turf cover is developed. The presence of soil peds, becoming structureless with depth, and the high plant-organic content (indicated by the dark colour of the material) is strongly indicative of a soil A1 horizon. As with Cores HP003–HP005, the soil displays a sharp, disconformable contact with the underlying unit. This is unexpected at the base of a natural soil and suggests that the organic-rich material has been imported to the site in order to blanket the underlying fill and to provide a suitable medium for plant growth.

The underlying units consist of a series of thin, disconformable beds, containing a pebble of sandstock brick and exotic rock material whose origin lies beyond the catchment of the site. Many of the units also contain the angular intraclasts of white and red mottled clay observed in Core HP004 that we identified as the products of the excavation of the weathered Ashfield Shale substrate. We interpret the entire sub-soil sequence as composed of anthropogenic fill deposits.

6.1.6 Core HP007

The upper units in the core consist of black and very dark gray, sandy silt upon which a turf cover is developed. The presence of soil peds, becoming structureless with depth, and the high plant-organic content (indicated by the dark colour of the material) is strongly indicative of a soil A1 horizon. As with

Cores HP003–HP006, the soil displays a sharp, disconformable contact with the underlying unit. This is unexpected at the base of a natural soil and suggests that the organic-rich material has been imported to the site in order to blanket the underlying fill and to provide a suitable medium for plant growth.

The underlying units consist of a series of thin, disconformable beds, containing pockets of well-sorted sands and exotic rock material whose origin lies beyond the catchment of the site (including a shelly accretion of marine carbonate). Unit 4 is composed of well-sorted sand that may be compared with the deposits of aeolian sand that are widespread in the nearby Botany Basin and which have been widely excavated for construction purposes in post-contact times (Gale and Wales, 2022). We interpret the entire sub-soil sequence as composed of anthropogenic fill deposits.

6.1.7 Core HP008

The upper unit in the core consists of black, slightly sandy silt upon which a turf cover is developed. The high plant-organic content (indicated by the dark colour of the material) is strongly indicative of a soil A1 horizon developed on a substrate of anthropogenic fill. The fill comprises a series of thin, disconformable beds, containing a sherd of glass, industrial slag and exotic rock material whose origin lies beyond the catchment of the site. Unit 3 is composed of gray and red clay closely comparable with the material observed in Cores HP004 and HP006 and identified as the products of the excavation of the weathered Ashfield Shale substrate. In the case of Unit 3, however, there is no evidence of the angular intraclasts that are indicative of reworking, and it would have been easy to interpret the bed as comprising *in situ* weathered Ashfield Shale had it not been underlain by the charcoal-bearing sediments of Unit 2. Presumably Unit 3 simply represents part of a larger clay intraclast intersected by our coring. In the light of this, we interpret the entire sub-soil sequence as composed of anthropogenic fill deposits.

6.1.8 Core HP009

The upper unit in the core consist of black, slightly sandy silt upon which a turf cover is developed. The presence of soil peds, becoming structureless with depth, and the high plant-organic content (indicated by the dark colour of the material) is strongly indicative of a soil A1 horizon. As with Cores HP003–HP007, the soil displays a sharp, disconformable contact with the underlying unit. This is unexpected at the base of a natural soil and suggests that the organic-rich material has been imported to the site in order to blanket the underlying fill and to provide a suitable medium for plant growth.

The underlying units consist of a series of thin, disconformable beds, containing pockets of well-sorted sand, reworked gray clay (comparable with the weathered Ashfield Shale substrate) and exotic rock material whose origin lies beyond the catchment of the site. We interpret the entire sub-soil sequence as composed of anthropogenic fill deposits.

6.1.9 Core HP011

The upper units in the core consist of black and very dark grayish brown, sandy silt and silty sand upon which a turf cover is developed. The presence of soil peds, becoming structureless with depth, and the high plant-organic content (indicated by the dark colour of the material) is strongly indicative of a soil A1 horizon. As with Cores HP003–HP006 and HP009, the soil displays a sharp, disconformable contact with the underlying unit. This is unexpected at the base of a natural soil and suggests that the organic-rich material has been imported to the site in order to blanket the underlying fill and to provide a suitable medium for plant growth. The steeply dipping nature of the contact suggests that the soil was dumped on an irregular surface and the presence of pebble-sized intraclasts of white and red mottled clay indicates that some of the underlying material had been reworked into the soil during its deposition.

The underlying units consist of white and red mottled clay closely comparable with the material observed in several of the other cores from the site and identified as weathered Ashfield Shale substrate (Unit 2). In this case, however, the weathered shale overlies a unit of finely laminated mudstone that we interpret as relatively unweathered Ashfield Shale. We regard Units 1 and 2 as comprising weathered *in situ* shale bedrock.

6.2 The interpreted stratigraphy of the northwest quadrant of Hyde Park

The interpretations reached in 6.1 are summarised in Figure 12. This shows that material interpreted as anthropogenic fill extends to depths in excess of 700 mm in almost every sequence. The exceptions are Core HP011, in which weathered Ashfield Shale bedrock is found at a depth of only 308 mm below the ground surface, and Core HP003, whose stratigraphy is ambiguous. The base of Core HP003 may be composed of weathered sandstone. Geological mapping of the area indicates that the site is underlain by Ashfield Shale, in which case the sandstone cannot be *in situ* and the base of the core must be composed of anthropogenic fill. We have noted the possible unreliability of the mapping hereabouts, however, and we suggest that the balance of probability is that the sandstone is *in situ*. In practical terms, neither interpretation has a bearing on the works proposed by the City of Sydney. In the first case, bedrock (Unit 1), overlain by a thin truncated soil B-horizon (Unit 2), would occur at a depth of <700 mm. However, whilst Unit 2 may be of some palaeo-environmental interest, it has negligible Aboriginal archaeological potential. In the second case, anthropogenic fill of no Aboriginal archaeological potential may traced to depths of >700 mm.

The basal units of Core HP005 may also be composed of weathered sandstone overlain by a buried and truncated soil, although we consider this unlikely. In any case, these materials are found at depths well in excess of 700 mm in the sequence and have no implications for the works proposed by the City of Sydney.

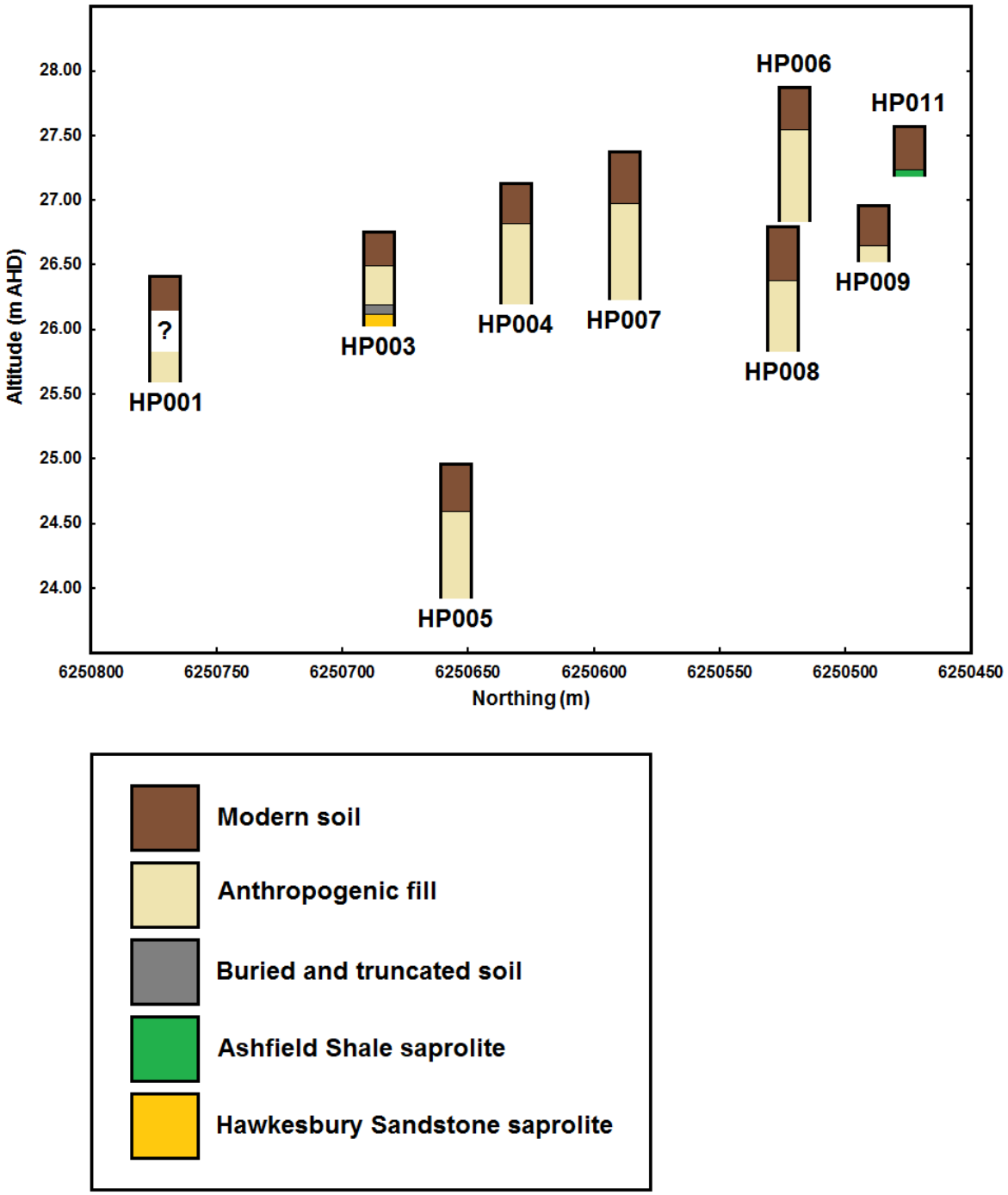

Figure 12. The interpreted stratigraphy of the northwest quadrant of Hyde Park, Sydney, New South Wales. The cores are displayed along a north–south transect.

7 Conclusions

Nine cores were taken from the northwest quadrant of Hyde Park, Sydney, New South Wales to assess the Aboriginal archaeological potential of the upper 700 mm of the regolith materials of the park. The upper part of every core consists of fine-grained, dark-coloured, plant-organic-rich material. This forms a soil A1 horizon that appears to have been imported to the site in order to blanket the underlying fill and to provide a suitable medium for plant growth.

Underlying this in most of the cores is a sequence of thin, disconformable beds possessing clear markers of human activity, including post-contact artefacts, reworked aeolian sands, exotic rock material whose origin lies beyond the catchment of the site, and angular intraclasts of weathered Ashfield Shale, the product of human reworking of the site's substrate. These deposits must represent the deposition of anthropogenic fill at the site. The thin layers, the sharp contacts between each bed and the absence of a consistent stratigraphy in the fill hint at a complex pattern of infilling using material from several sources.

Two of the cores intersect weathered bedrock, either directly beneath the modern soil or below the layers of fill material. In the latter case, the bedrock is overlain by a thin truncated soil B-horizon. Although this occurs at a depth of <700 mm and may be of some palaeoenvironmental interest, it has negligible Aboriginal archaeological potential. In none of the cores, therefore, is there evidence of Aboriginal archaeological potential at depths of up to 700 mm beneath the ground surface.

8 References

Aplin, G. 2013. A strange natural environment: colonists in eighteenth-century Sydney. *Sydney Journal* 4(1), 19–37.

Chapman, G.A. and Murphy, C.L. 1989. *Soil Landscapes of the Sydney 1:100 000 Sheet*. Soil Conservation Service of New South Wales, Sydney, 160 pp + map.

Folk, R.L. 1954. The distinction between grain size and mineral composition in sedimentary-rock nomenclature. *The Journal of Geology* 62, 344–359.

Gale, S.J. and Hoare, P.G. 2011. *Quaternary Sediments: Petrographic Methods for the Study of Unlithified Rocks*. Blackburn Press, New Jersey, 2nd ed., xlv + 325 pp.

Gale, S.J. and Wales, N.A. 2022. The Botany Sands of southeast Australia: a Quaternary inland dune and swamp system. *Geomorphology* in press.

Godden Mackay Logan Heritage Consultants (GML Heritage) 2014. *Hyde Park Archaeological Management Plan*. Report prepared for the City of Sydney, Sydney.

Herbert, C. and West, J.L. 1983. *Sydney*. 1;100 000 Geological Series Sheet 9130. Department of Mineral Resources, Sydney.

Karskens, G. 2009. *The Colony a History of Early Sydney*. Allen & Unwin, Sydney, 67 pp.

Loughnan, F.C., Grim, R.E. and Vernet, J. 1962. Weathering of some Triassic shales in the Sydney area. *Journal of the Geological Society of Australia* 8, 245–257.

Troedson, A.L. 2015. *Sydney Area Coastal Quaternary Geology 1:100 000 and 1:25 000*. Geological Survey of New South Wales, Maitland.

Wentworth, C.K. 1922. A scale of grade and class terms for clastic sediments. *The Journal of Geology* 30, 377–392.