Sydney Office
Level 17
323 Castlereagh Street
HAYMARKET NSW
Australia 2000
+61 2 9319 4811
heritage@gml.com.au

Canberra Office
2A Mugga Way
RED HILL ACT
Australia 2603
+61 2 6273 7540
heritage@gml.com.au

GML Heritage Pty Ltd
ABN 60 001 179 362

Melbourne Office
17 Drummond Street
CARLTON VIC
Australia 3053
+61 3 9380 6933
heritage@gml.com.au

GML Heritage Victoria Pty Ltd
ABN 31 620 754 761

19 April 2024

George Economy
Project Manager
Savills Australia
Level 25, Governor Phillip Tower, 1 Farrer Place
Sydney NSW 2000

Our Reference: 23-0475 Soil analysis report

Re: Soil analysis results for Rouse Hill High School Upgrade

Dear George,

Savills and School Infrastructure NSW (SINSW) engaged GML Heritage Pty Ltd (GML) to undertake a program of soil analysis for the Rouse Hill High School Upgrade project. The project involves the construction of a new school building within the southern portion of the existing school. The upgrade development area is shown in Figure 1, and termed the study area. We understand that the Rouse Hill High School was constructed c2009, with buildings, playing fields and landscaping undertaken.

As part of the upgrade project, Douglas Partners prepared a Detailed Site Investigation (Contamination) for the project (Douglas Partners 2022, Report on Detailed Site Investigation (Contamination), Rouse Hill High School Upgrade 240 Withers Road, Rouse Hill). This investigation involved the completion of 15 boreholes, 12 of which were located within the project area (Figure 2). The accompanying bore logs (Douglas Partners 2022: Appendix J) generally describe a subsurface stratigraphy composed of introduced topsoils/fills overlying truncated subsoil clays. One of the bore logs (108) suggested that a horizon of residual Blacktown soil *could* be present. To determine and confirm the nature and extent of prior cut and fill associated with the study area and confirm whether any residual A1 or A2 topsoil horizons remained above basal B horizon clays, we hand augered a series of narrow diameter bore holes across the study area.

This letter report provides the results of the additional soil analysis program. It aims to provide further clarity regarding the nature and extent of the introduced fill/topsoil layers, particularly in relation to the high school's sports field.

Figure 1 Rouse Hill High School. The extent of the school's upgrade project, the study area, is outlined in red. The proposed new school building will be located within this area. (Source: Nearmap 2024, with GML additions)

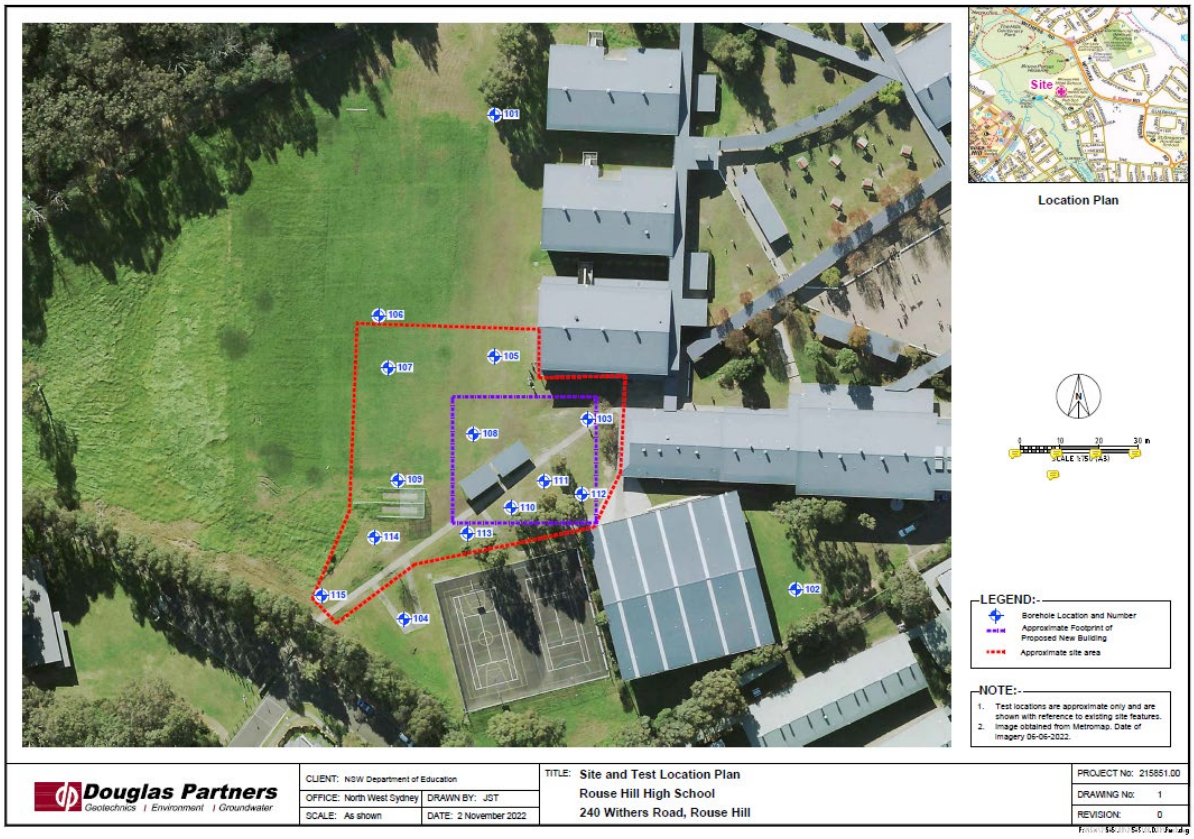

Figure 2 Douglas Partners' borehole locations. The current program of soil sampling aims to clarify the nature and extent of topsoil/fill layers. (Source: Douglas Partners 2022)

Environmental context

The study area is situated atop a gently sloping spur rising from Caddies Creek, approximately 100m south, to an east-west orientated ridgeline at Withers Road, Rouse Hill. Ephemeral first order tributaries of Caddies Creek once flowed either side of the spur—one was 25m north of the study area, the other 150m south. Both creeks were dammed by the mid-twentieth century and were infilled completely during the construction of Rouse Hill High School and nearby developments.

Ashfield shale geologies underlie the study area and provide the primary parent material for the clay-rich Blacktown soils mapped across the study area. The residual Blacktown soil landscape is characterised by red-brown podzolic soils on crests, upper slopes and well-drained areas, grading to yellow podzols on lower slopes and in drainage lines. Soils generally consist of friable brownish-black loamy A1 horizons overlying hard setting brown clay loam A2 horizons. Subsoils (B horizons) are strongly pedal, mottled brown light clays.

The natural landform and soils of the study area have been heavily disturbed by past land use activities including grazing (from the nineteenth century until 1978), a golf course (Mungerie Park Golf Course; 1978 until the 2000s), and construction of the school (Rouse Hill High School; 2000s until present).

Land clearing for grazing, and subsequent cattle trample, creek damming and vehicle usage, will have left natural topsoils vulnerable to erosion and compaction. The more intensive landscaping, excavation, and infilling activities associated with the construction of Mungerie Park Golf Course and Rouse Hill High School have almost certainly removed any natural topsoils across the study area. The current topsoils likely comprise introduced topsoil material allowing for the construction and maintenance of the sports field and other landscaped common areas.

Methodology

To clarify the nature and extent of fill/topsoil deposits, six hand augers (50mm diameter) were undertaken within the proposed development footprint; the locations are shown in Figure 3. The program of sampling focused on the western sports field as the area identified for further clarification. For each borehole a hand-held GPS location was taken. Augers ceased once the nature of the upper fill/topsoil layers was determined and/or upon auger refusal.

Soil was recovered and placed aside for in-field analysis. Soil analysis was undertaken in accordance with the *Australian Soil and Land Survey Handbook* (The National Committee for Soil and Terrain, 2009). The description of soils included the following attributes:

- a recording of depth and thickness;
- the boundary changes (as possible);
- the identification of colour using the Munsell soil colour chart, noting the moisture content of the deposit (moist being the preferred standard);
- field texture using sedimentary and/or soil profile terminology where applicable;
- inclusions such as gravels, contaminants, roots and any material culture eg ceramic, brick fragments etc; and
- where applicable, the soil (ped) structure or sedimentary (facies) features.

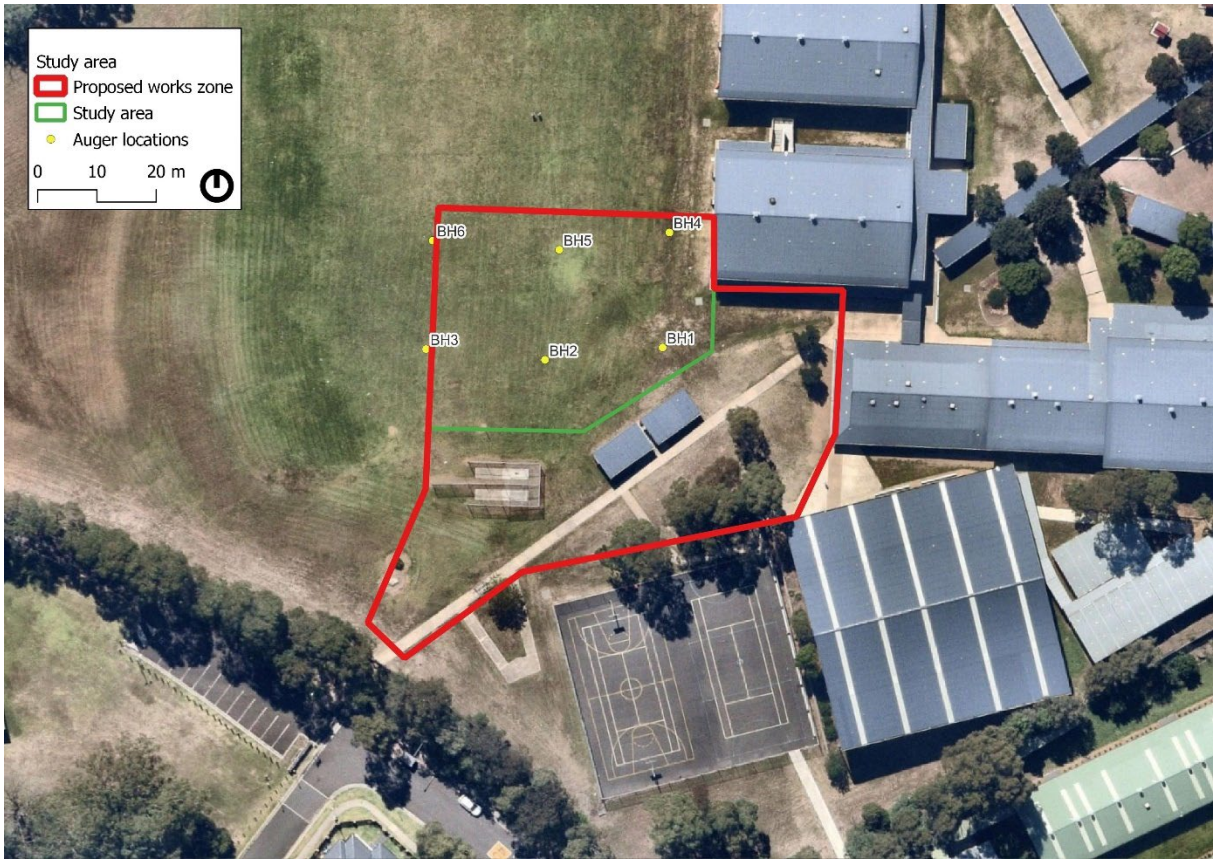

Figure 3 The locations of the six hand augers within the proposed works zone (red line) and study area (green line)—the western sports field. (Source: Nearmap 2024 with GML additions)

Results

The results of the hand auger program are provided in Table 1 and Figure 4 to Figure 9. The work confirmed that no stratigraphic units that could represent intact Blacktown soil landscape topsoils (A1 or A2 horizon, bt1 or bt2) were identified during the hand augering program.

Table 1 Results of the hand auger program.

AH	Description
BH1	**Unit 1**—0–15cm below ground level (bgl), very dark grey (10YR 3/1) sandy clay loam. Fine to medium granular pedal structure. Abundant rootlets, few ironstone gravels. Very few brick fragments. Moderately compacted. Sharp transition to Unit 2.
	Unit 2—15–25cm bgl, brown (10YR 4/3) clayey sand. Frequent yellow and red mottles. Few rootlets, although a possible root channel was identified at 24cm depth (characterised by a black silty loam material).
	Auger refused at 25cm depth.

AH	Description
BH2	**Unit 1**—0–25cm bgl, black (10YR 2/1) sandy loam. Abundant rootlets, few charcoal flecks and very few crushed sandstone inclusions (at 5cm depth). Loosely consolidated to approximately 5cm depth, below increased clay content is associated with increased compaction and friability. Clear boundary to Unit 2.
	Unit 2—25–28cm bgl, light yellowish brown (10YR 6/4) medium clay. Common mottling (white, dark brown, brown, red brown, red), few crushed sandstone inclusions.
BH2	Auger refused at 28cm bgl.
BH3	**Unit 1**—0–30cm bgl, loosely consolidated black (10YR 2/1) silty clay loam. Fine granular pedal structure. Abundant rootlets, common ironstone nodules and few yellowish-brown mottles. Clay content increased noticeably from around 5–10cm depth. Mixed boundary to Unit 2.
	Unit 2—30–45cm bgl, brown (10YR 4/3) heavy clay. Few large (>1cm) ironstone gravels, crushed sandstone inclusions and very few quartz gravels (<1cm). Common yellow, brown, red and black mottles. Clear transition to Unit 3.
BH3	**Unit 3**—45–54cm bgl, strong brown (7.5YR 4/6) heavy clay. Few large (>1cm) ironstone gravels, very few crushed sandstone inclusions. Few red and yellow mottles.
BH4	Auger terminated upon identification of likely subsoil clays.
	Unit 1—0–10cm, loosely consolidated dark grey (10YR 3/1) silty loam. Abundant rootlets, few charcoal flecks, ironstone gravels and very few brick fragments. Few brown and yellow mottles.
	Unit 2—10–23cm, dark grey (10YR 3/1) silty clay loam. Few ironstone gravels, brick fragments and rootlets.
BH4	**Unit 3**—23–30cm, light olive brown (2.5YR 5/4) light clay. Common grey-brown, white, brown and red-brown bands. Mixed boundary to Unit 4.
BH5	**Unit 4**—30–54cm, reddish brown (5YR 4/4) heavy clay with yellow (10YR 5/6) and brown (10YR 4/3) mottles. Few small (<5mm) ironstone gravels. Unclear boundary with Unit 5.
	Unit 5—54–65cm, reddish brown (5YR 4/4) light clay. Common sandstone, ironstone gravels, very few quartz gravels. Common brown and white mottles.
	Unit 6—65–69cm, brown (7.5YR 4/2) clayey sand. Common sandstone, ironstone gravels, very few quartz gravels.
	Auger refused at 69cm bgl. Unit 6 may represent a subsoils clay.
	Unit 1—0–15cm bgl, very dark brown (10YR 3/2) silty loam with very fine granular pedal structure. Abundant rootlets. Clear transition to Unit 2.
	Unit 2—15–25cm bgl, yellowish brown (10YR 5/6) clayey sand. Few small (<1cm) ironstone gravels and very few crushed sandstone inclusions. Red, yellow and white mottling. Clear transition to Unit 3.
BH5	**Unit 3**—25–45cm, reddish brown (2.5YR 4/4) heavy clay. Few large (>1cm) ironstone inclusions, very few charcoal flecks and gravels (unknown material). Common yellowish-brown and brown mottles.
BH6	

AH	Description
	Auger terminated following identification of B subsoil clays.
	Unit 1—0–15cm bgl, dark greyish brown (2.5YR 4/2) silty loam. Apedal structure. Abundant rootlets, few small (<5mm) ironstone gravels, very few crushed sandstone inclusions. Mixed boundary to Unit 2.
	Unit 2—15–25cm bgl, strong brown (7.5YR 4/6) heavy clay, common rootlets, small (<1cm) ironstone gravels, crushed sandstone. Few red, brown and grey-brown mottles. Clear transition to Unit 3.
BH6	**Unit 3**—25–45cm bgl, yellowish-brown (10YR 4/4) heavy clay. Common mottles (brown, red, yellow, white). Very few small (<1cm) ironstone gravels, rootlets. Mixed boundary to Unit 4.
	Unit 4—45–67cm bgl, brown (10YR 4/3) medium clay. Very few small ironstone gravels and charcoal flecks. Few white and yellow mottles.
	Unit 5—67–73cm bgl, reddish brown (2.5YR 4/4) heavy clay. Few ironstone gravels and very few sandstone inclusions.
	Auger terminated upon identification of subsoil clays.

Figure 4 BH1, Unit 1 on the left.

Figure 5 BH2, Unit 1 on the left.

Figure 6 BH3, Unit 1 on the left.

Figure 7 BH4, Unit 1 on the right.

Figure 8 BH5, Unit 1 on the left.

Figure 9 BH6, Unit 1 on the left.

Discussion

The stratigraphic sequence identified by the hand augers consists of introduced topsoils unconformably overlying either introduced or possible B horizon subsoil clays. Notably, far more variability was noted when compared to the descriptions in Douglas Partners 2022; however, we note the broad depositional context remains consistent between both analyses.

In all the auger holes, the uppermost units comprise introduced topsoils, likely imported to facilitate the construction and ongoing maintenance of the sports field. The general lack of pedal structure, significant ironstone inclusions or charcoal flecking are all indicative of relatively young soils. No units resembling a natural Blacktown A2 (bt2) soil horizon were observed. Further, the presence of brick fragments and/or crushed sandstone inclusions in some augers demonstrate some degree of anthropogenic disturbance. In any case the geomorphic position of the study area, which has clearly been deliberately excavated and levelled, further suggests that the uppermost units are not residual Blacktown horizons.

The activities that would have created this artificial landscape necessitate subsurface excavations, and these would have removed residual bt1 and bt2 (A1 and A2 horizon) topsoils.

The underlying layers are predominantly interpreted as introduced fills. This is based on both geomorphic position (artificially landscaped and levelled), high degree of mottling (indicative of mixed origin) and generally clear/sharp boundaries. While the exact depositional context of these layers could not be verified, they almost certainly comprise a combination of deliberately introduced levelling fills, by-products of the construction process and/or remnants of the landscaping/construction of Mungerie Park Golf Course. Subsoil clays were identified in BH3, 4, 5 and 6, indicating that while topsoils have been removed, subsoils (bt3, B horizon clays) may remain intact across portions of the study area.

Conclusion

The hand auger work has confirmed that the study area comprises a stratigraphy composed of introduced topsoils, overlying introduced fills and/or natural B horizon subsoils. While more variation in subsurface layers was observed compared to Douglas Partners' 2022 analysis, the broad depositional units/contexts are consistent. Therefore, our 2024 results support the findings of the 2022 prior assessment.

Yours sincerely,

Jacob Kiefel

Consultant

GML Heritage Pty Ltd