

## **Section 8.6: Soils Report – Roy Lawrie, NSW Agriculture**

# Report on Soil Properties at corner of George & O'Connell Streets, Parramatta

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## Introduction

The site lies on the main alluvial terrace of the Parramatta River, just upstream of the Marsden Street weir, close to the original tidal limit. There is a small drainage line running north-south into the river, behind Parramatta Hospital, north of the site. The drainage line has been filled in at various times. The thickness of fill increases closer to the drainage line, reaching a maximum of about 1.5m at the eastern boundary of the site.

Several profiles were inspected, two in the side walls of excavated pits, and one from an undisturbed soil core bored to 2.6m depth. The exposures show that the subsoil close to the drainage was a yellow clay, but this became more sandy with distance away from it, changing gradually to a red brown sandy clay to clayey sand.

## Profile Description

Site 1: profile located five metres north of the footpath along George Street, then metres west of rear entry to hospital; about one metre west of an old brick wall from a 19<sup>th</sup> century house.

Depth (cm)	Description	Layer
0	yellowish brown loamy sand, slightly porous, structureless; 10YR 4/3 dry; broken brick fragment below 10cm.	disturbed topsoil and fill
20	thin charcoal band overlying a light yellowish brown (10YR 5/3) sand, moderately moist, structureless; diffuse lower boundary.	?old topsoil (A <sub>1</sub> horizon)
80	very light grey (10YR 7/2) fine sand, moist, barely coherent, but loose when dry	old A <sub>2</sub> horizon
145	narrow band of light yellow brown sand overlying a very light grey (10YR 7/2) loose sand, moist, with fine vertical orange mottles	old B horizon
205	clear boundary to yellowish brown clayey sand, containing a few free roots (3-4mm diam.)	buried older soil
215	bright red brown and yellowish brown mottled sandy clay, with many roots (up to 8mm diameter), moist	buried older subsoil
260	maximum depth of inspection	

Site 2: profile located in a pit in the southwest corner of a former cellar.

Depth (cm)	Description	Layer
0	mottled light grey and light yellow brown dense sandy clay, compacted, contains fragments of gravel	fill, with some disturbed topsoil
10	light yellow brown sand	?old topsoil
35	yellowish brown sand, 5YR 6/4 when dry, 5YR 4/6 when moist; contains several banded, wavy silty layers (2-4mm thick)	?old B horizon of sandy soil
70	layer of rounded and flat, soft, weathered gravel over mottled red brown (2.5YR 4/6), yellow brown (10YR5/6) and grey sandy clay; contains roots	older buried subsoil, uses as cellar floor
85	maximum depth of inspection	

Site 3: Close to George Street (within 5m), 15m upslope (west) from site 1, away from the old drainage line.

Depth (cm)	Description	Layer
0	light brown (10YR 5/3) loamy sand, structureless, brittle and hard when dry; contains occasional plant root (2mm) and traces of charcoal and cinders; clear change to	old topsoil, slightly disturbed (A <sub>1</sub> horizon) sampled 0-10cm
15	very light grey loamy fine sand, structureless, brittle and hard when dry, slightly porous with an occasional plant root (1-2mm); gradually becomes harder and bleached at	original A <sub>2</sub> horizon (upper part); samples 20-30cm
70	very light grey (10YR 7/2) cemented fine sand, floury when crushed; becomes less cemented below 95cm; band of weak yellowish brown mottling 150-170cm; a few dead roots down to 200cm; changes gradually to	original A <sub>2</sub> horizon, (bleached lower part); sampled 120-130cm
195	very light grey fine sand, soft, loose, with weak yellow brown mottles; clear change to	zone of temporary perched water table; sampled 195-205cm
210	very light grey clayey sand, weakly cemented bleached cap (2cm thick) over a mottled yellow brown (10YR 6/6) sand; changes gradually to	B <sub>1</sub> horizon; sampled 210-220cm
220	red brown (2.5YR 3/6) cemented clayey sand, changes gradually to	B <sub>2</sub> horizon
230	grey (10YR 6/1) sandy clay with red brown and yellow brown sandy coatings along cracks and in pockets up to 10cm across dense, structureless, hard and brittle when dry, with plant roots 6-8mm in diameter	buried older soil; sampled 250-260cm
260	Maximum depth of inspection	

### **Interpretation**

The site has a thick cover of alluvial sediments, with 2 distinct periods of deposition. There is a clayey lower deposit buried under younger sandy sediments whose thickness varies across the site. The sandy layer at site 2 is quite thin and contains several distinctive thin silty bands. In contrast the sand at sites 1 and 3 is nearly 2m thick and bleached almost white.

The amount of bleaching and the absence of any visible layering or stratification in the sand (at sites 1 and 3) signifies that it is not a recent deposit. The surface lies well above the level of most current floods. At both sites (1 and 3) it is mottled in the lower part, indicating periods of temporary waterlogging. This is caused by the water table perching on the underlying, less permeable, clayey layer. Chemical analysis of samples from site 3 (see table 1) show that the salinity of thick bleached sand is extremely low (electrical conductivity of 1:5 soil/water suspension is 0.03 dS/m), indicating that any ground water present is likely to have been non-saline and probably quite suitable for human consumption.

On the other hand, the deeper red and yellow mottled clayey layer is much more saline and has a high concentration of exchangeable sodium. This high sodium content is often associated with low soil permeability. A few tree roots were found at site 1 (205-215cm and in the layer immediately below) indicating that water was available deep in the profile; at site 3 plant roots 6-8mm in diameter were seen down to depth of 2.5m. This deeper layer is also alkaline (pH>7.5), and acts as a sink for cations, leached downwards from the surface through the highly permeable sand above it. As with other soils from other archaeological sites in Sydney (Lawrie 1999), the topsoil is rich in exchangeable calcium (96% of total exchangeable cations). Calcium occupies nearly all the available exchange sites in the profile, down to a depth of 1.95m. This enrichment is almost certainly due to human activities on the surface. The other cations (i.e. sodium and magnesium) have leached downwards, and accumulated in the more clayey layers below. The potassium content is fairly low, suggesting that plant material such as hay (relatively high in potassium) were not fed to animals kept on the site for any significant period of time.

### **Conclusion**

The soils are formed on a sequence of alluvial deposits, with older clayey sediments underlying a thick sandy strongly leached layer closer to the surface. The age of these alluvial sediments is uncertain, but the strong degree of profile development suggests an advanced age, possibly pre-Glacial, for the underlying brightly mottled clayey layer. The overlying sand is not stratified, but at site 2 has several wavy silty bands. This probably represents incipient B horizon development, and is often seen in other very sandy alluvial soils (e.g. along the Nepean River), beneath younger more stratified layers (having many fine thin layers).

This is probably post-Glacial material, deposited when the river experienced much greater fluctuations in flow than at present.

**Table 1: Soil Chemical Properties – Site 3**

Soil features	Depth (cm)					
	0-10	20-30	120-130	195-205	210-220	250-260
	light brown loamy sand	pale grey loamy sand	bleached fine sand	mottled fine sand	mottled clayey sand	mottled sandy clay
pH	6.3	6.7	7.5	7.9	8.1	7.6
elec.cond. (1:5) dS/m	0.04	0.09	0.03	0.2	0.53	0.67
exchangeable cations – cmol(t)/kg	4.69	2.04	0.83	1.47	5.21	7.07
- calcium	4.5	1.8	0.75	0.53	2.3	2.0
- magnesium	0.13	0.10	0.078	0.22	1.1	1.1
- potassium	0.061	<0.05	<0.05	<0.05	0.21	0.17
- sodium	<0.1	0.14	0.72	0.72	2.6	3.8

**Reference**

Lawrie, R. ‘Soil chemical properties at historical archaeological sites in Sydney’, *Australasian Historical Archaeology* 17:70-78.