



Landscape—level to very gently undulating tidal flats (mudflats, mangrove and saltmarsh) on Quaternary marine sediments. Local relief and elevation <3 m, slope gradients <3%. Regularly inundated by tidal waters. Mangrove open-scrub, saltmarsh herbland and sedgeland, and low open-forest.

Soils—deep (>200 cm), waterlogged Calcareous Sands, Solonchaks (Uc1.11) and Siliceous Sands (Uc1.21, Uc5.11) on mangrove flats; deep (>200 cm) Calcareous Sands and Solonchaks (Uc1.11), some Siliceous Sands (Uc1.2, Uc5.1) and Humic Gley Soils (Dy4.53) on saltmarsh and forest flats.

Limitations—regular tidal flooding and waterlogging, high acid sulfate potential, saline soil, very low soil fertility, organic soil materials.

LOCATION

This soil landscape covers the tidal reaches of Broken Bay, Port Jackson and Botany Bay, extending into tidal sections of the Hawkesbury, Parramatta and Georges Rivers. Vegetated tidal flats are usually located in estuarine areas protected from intensive tidal scour and high energy wind and wave action. Most examples occur in Hawkesbury Valley and Cumberland Plains physiographic regions.

Examples may be found at Cockle Bay in Brisbane Water, Patonga Creek, Spectacle Island, Brooklyn and Big Bay in the Hawkesbury River; Middle Harbour and Bantry Bay in Port Jackson; and along the shores of the Georges River at Oatley, Lugarno and Picnic Point.

LANDSCAPE

Geology

Holocene sediments of silty to peaty quartz sand, silt, and clay. Common shell layers in sandy mud and muddy sand.

Topography

Local relief <3 m and slopes <3%. These tidal flats and creeks in coastal inlets and estuaries are regularly inundated by brackish tidal waters. There is a balance between the aggradation of sediment from erosion in upper catchments (some of which is accelerated erosion) and the process of scour by the ebb tide.

Four shore parallel zones are recognised, each zone with a different drainage pattern. At the lowest elevation is the mudflat zone. In order of increasing elevation are the mangrove zone, the salt marsh zone and littoral forest zone. Minor differences in topography result in a mosaic of zones.

The mudflat zone is inundated except at low tide. It is characterised by rapidly migrating, shallow (up to 70 cm deep), non-directional, meandering channels with reversible flows which widen rapidly in the downstream direction.

The mangrove zone is inundated only during high tide and the saltmarshes are inundated only during spring high tides. These zones have non-directional, often interrupted drainage. The forest zone is rarely flooded, and drainage is interrupted or absent.

Vegetation

Mangrove (open-scrub), saltmarsh (herbland and sedgeland), and low open-forest are the major vegetation types of Mangrove Creek soil landscape.

The open-scrub is dominated by grey mangroves *Avicennia marina*. Less commonly, river mangroves *Aegiceras corniculatum* are found toward the low lying riverine edges of the unit.

About one-third of the tidal flat mangroves of Sydney Harbour remain undisturbed. The remainder has been reclaimed by landfill operations.

Saltmarsh is found in areas less frequently inundated. Common species of the saltmarsh include seablite *Suaeda australis*, glasswort *Salicornia quinqueflora*, sand couch *Sporobolus virginicus*, and the rushes *Triglochin striatum* and *Juncus kraussii*. Some saltmarsh areas are devoid of all vegetation except algal growth.

The low open-forest zone is dominated by the swamp oak *Allocasuarina glauca* and less commonly, swamp mahogany *Eucalyptus robusta* and broad-leaved paperbark *Melaleuca quinquenervia*. This open-forest often has an understorey of sand couch *Sporobolus virginicus* and sea rush *Juncus kraussii*.

Pigeon (1940) recognised a series of seven vegetation zones proceeding from the land to the sea. Clarke and Hannon (1967, 1969, 1970 and 1971) described the plant ecology of tidal flat communities.

Land use

Mangroves and salt marshes are recognised as important breeding areas for commercial species of fish and crustaceans (West, 1985). They are also important breeding areas for some species of water birds. Oyster leases are located on the seaward edges of tidal flats near Brooklyn.

Many tidal flats of Sydney Harbour and the lower reaches of the Parramatta River have been disturbed by landfill. Some of this land is used extensively for port and heavy industry installations. Examples are Homebush Bay, Camellia industrial area, Silverwater, and Glebe Island.

Other areas that were once tidal flats have been reclaimed and used as recreation areas, golf courses and playing fields. Examples are Bardwell Park golf course, Massey Park, Hen and Chicken Bay, Davidson State Recreation Area at Roseville, and the State Sports Centre at Homebush Bay.

Existing Erosion

There is little appreciable erosion. Minor wave erosion is caused by powerboats (Scholar, 1974). Further erosion may occur as equilibrium adjustments after reshaping of adjacent foreshore areas. Sediments eroded from surrounding catchments are often deposited on this unit.

Mangroves appear to thrive in areas of sedimentation. Increased sedimentation associated with catchment development is predicted to enlarge mangrove communities (West, 1985).

SOILS

Dominant Soil Materials

mc1—Dark brown organic silty loam. This material consists of a spongy plastic very sticky greasy sludge of decomposing and saturated organic matter and matted algal growth. It occurs as a surface soil material (P horizon).

Texture is usually a silt loam or silty clay loam with apedal massive structure. Colour is commonly dark brown (10YR 3/3), but ranges between black (10YR 2/1) and yellowish grey (2.5Y 4/1). Dark red mottles are common at depth and are associated with abundant root and faunal channels. The pH ranges between neutral (pH 7.0) and moderately alkaline (pH 8.5). Shells and shell fragments can often be found.

mc2—Shelly dark brown organic sandy loam. This is a saturated shelly organic rich dark brown sandy loam to sandy clay loam with apedal massive structure and porous fabric. It generally occurs as topsoil (A1 horizon).

Colour is usually dark brown or black (10YR 2/1, 10YR 1.7/1, 5Y 2/1) with high amounts of organic matter present but can range to dull yellowish-brown (10YR 4/3). The pH ranges from neutral (pH 7.5) to moderately alkaline (pH 9.0). Roots, faunal channels, shells and shell fragments are common.

mc3—Shelly grey-brown sand. This is permanently saturated, shelly, greyish yellow brown, coarse sand with apedal single-grained structure and sandy fabric. It usually occurs as subsoil (B horizon).

Colour is greyish-yellow-brown (10YR 5/2), but ranges to dark greyish-yellow (2.5Y 5/2) often with grey mottles. The pH ranges from neutral (pH 7.0) to moderately alkaline (pH 9.0). Shell fragments and quartz pebbles are common, whilst root or faunal channels are rare.

mc4—Mottled, gleyed clay. This is a saturated mottled grey light sandy clay loam to heavy clay. Structure is apedal massive with dense and non-porous fabric. It commonly occurs as subsoil (B horizon).

Common colours include greyish-yellow-brown (10YR 4/2), brownish grey (10YR 6/1) and yellowish-brown (2.5Y 5/3). Orange-brown mottles are often present. It is often characterised by

concentrated lenses and bands of shell fragments. The pH ranges between neutral (pH 7.5) and moderately alkaline (pH 9.0). Roots are absent.

Associated Soil Materials

Charcoal bands. Up to 80% charcoal fragments within a sandy loam matrix. This material often occurs in bands within **mc2** and **mc3**, especially under mangrove scrub.

Middens. These contain large quantities of oyster and other mollusc shells, within a black (10YR 2/1) sandy loam to sandy clay loam matrix. Midden materials are located along the landward edges of the Mangrove Creek soil landscape. These are aboriginal shell dumps and should not be disturbed.

Occurrence and Relationships

A thick layer of decaying organic material and leaf litter is found in salt marshes, scrub and forests.

Mangrove flats. Up to 30 cm of dark brown organic silty loam (**mc1**) occurs as a surface material over most of the unit. It tends to be sporadically developed on the mud flats and within Casuarina forests. **mc1** generally overlies up to 50 cm of the shelly, dark brown, sandy loam (**mc2**) and shelly greyish-yellow-brown sand (**mc3**). Bands of charcoal fragments occasionally occur within **mc2** and **mc3**. The boundary between the soil materials is gradual to diffuse and total soil depth is >200 cm [Siliceous Sands (Uc1.21, Uc5.11) and Calcareous Sands (Uc1.1)].

Salt marsh. In these areas **mc1** overlies **mc2** and >200 cm of **mc3** [Calcareous Sands (Uc1.14, Uc1.12, Uc1.23), some Siliceous Sands (Uc1.2, Uc5.1)].

In some of the saltmarshes **mc1** and **mc2** overlie >100 cm of mottled, gleyed, clay (**mc4**) [Humic Gleys (Dy4.53)]. Towards the landward edge of this soil landscape **mc1** and **mc2** often increase in thickness and their boundaries with other soil materials become more abrupt.

LIMITATIONS TO DEVELOPMENT

Urban Capability

Not capable of urban development.

Rural Capability

Not capable of cultivation or grazing.

Landscape Limitations

Flood hazard

Wave erosion hazard

Waterlogging

Non-cohesive materials

Soil Limitations

mc1 Low wet strength
 Strongly saline
 Low permeability
 High organic matter
 Very low fertility
 Acid sulfate potential
 Strongly sodic

- mc2** High organic matter
Strongly sodic
Strongly saline
Low wet strength
Very low fertility
Very strongly acid
Acid sulfate potential
- mc3** High organic matter
Strongly saline
Strongly sodic
Very low fertility
Strongly acid
Acid sulfate potential
Low wet strength
- mc4** Low wet strength
Strongly saline
Strongly sodic
Low permeability
Low available water capacity
Low fertility
Acid sulfate potential
Moderate alkalinity

Fertility

The general fertility is very low. The soil materials are strongly saline and are frequently inundated by tidal waters. These soils should not be drained as this will result in organic sulphur compounds being oxidised. The sulphuric acid produced results in the soils becoming extremely acid.

Erodibility

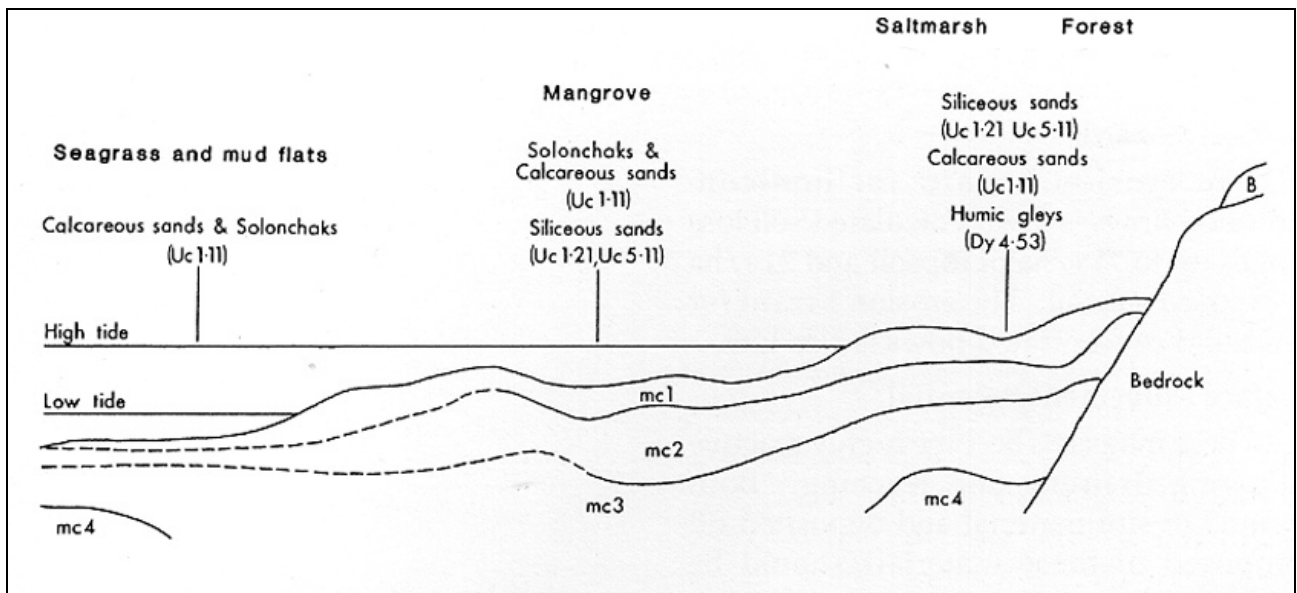
mc1 and **mc2** have very low erodibilities. They consist of sands strongly bound by abundant organic fibrous matter. **mc3** has very low erodibility consisting dominantly of well drained coarse sands. **mc4** has a moderate erodibility as it has a low organic matter content and consists of fine and coarse sand grains imbedded in a clay matrix. **mc4** clays are highly dispersible in freshwater, where it is highly erodible.

Erosion Hazard

The erosion hazard for non-concentrated flows is low. Calculated soil loss ranges up to 11 t/ha of topsoil and 21 t/ha of exposed subsoil. The erosion hazard for wave and concentrated flows is also low.

Surface Movement Potential

These materials become highly reactive following draining and leaching. Both drained *in situ* material and deposited fill composed of these materials should be tested to determine surface movement potential prior to construction.



Schematic cross-section of Mangrove Creek soil landscape illustrating the occurrence and relationship of the dominant soil materials.