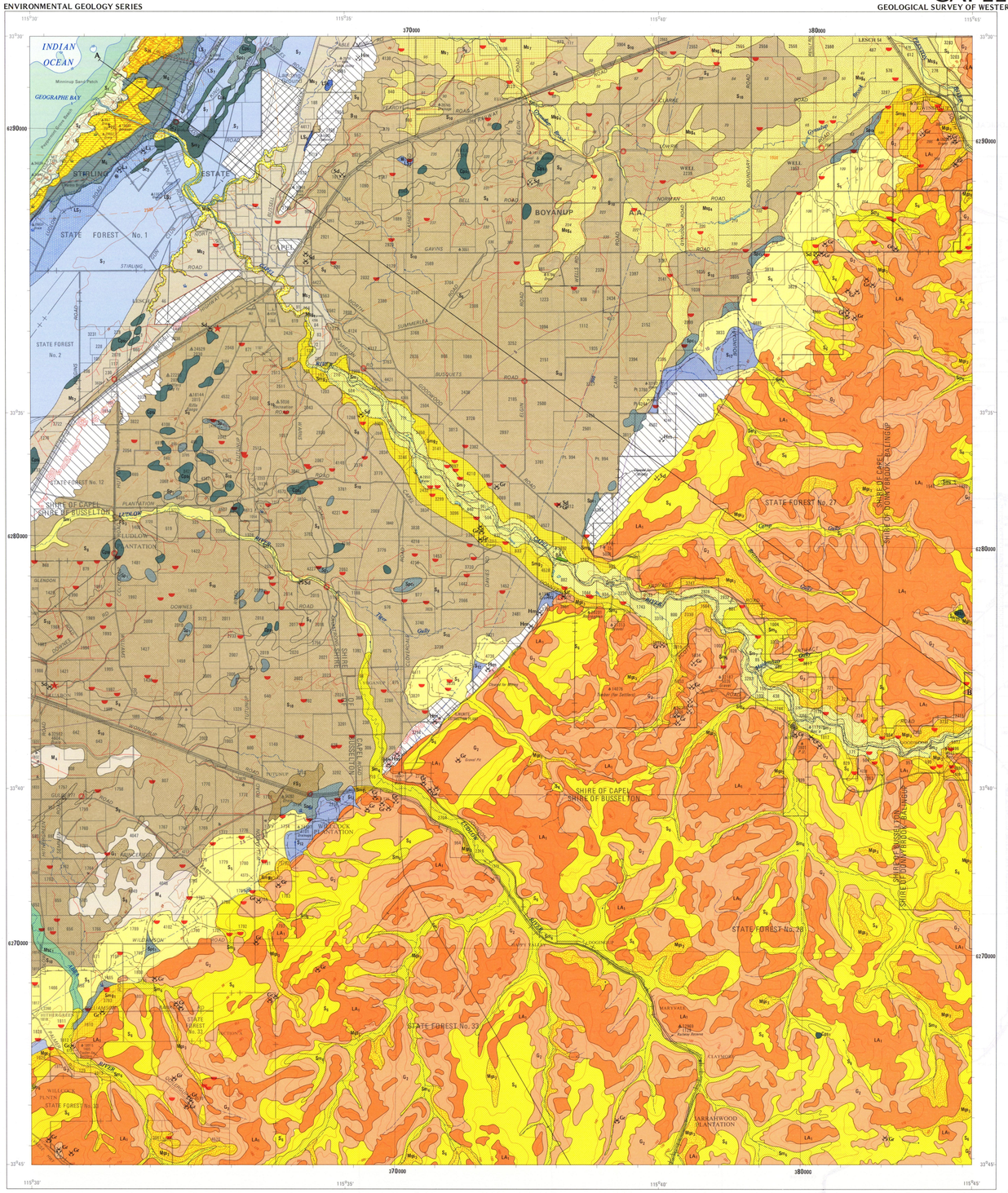
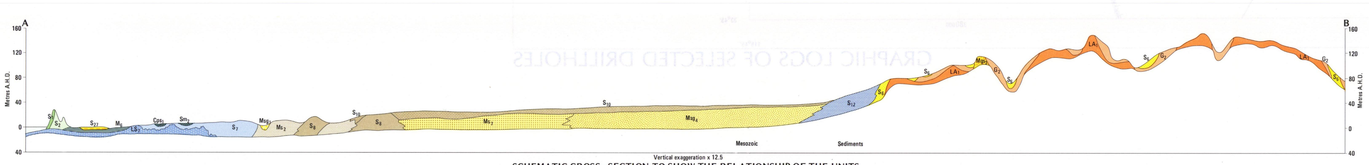
CAPEL

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA



SCALE 1 : 50 000

0 1 2 3 4 5 6 KILOMETRES



SCHEMATIC CROSS–SECTION TO SHOW THE RELATIONSHIP OF THE UNITS

Map Unit [1] Unconsolidated Material [2]	Rock [2]	Description	Equivalent unit on geological maps	Relief; slope [4]	Rock-mineral resources
Cm_2		PEATY CLAY – dark grey and soft, variable organic content, variable quartz sand content, of lacustrine origin	Swamp deposits (Qhw)	3–35m; F	Peat
Spc_2		CLAYEY PEATY SAND – grey to black quartz sand with variable organic content, minor clays, of lacustrine origin		3–50m; F	Peat
S_1		CALCAREOUS SAND – white, fine to medium-grained, sub-rounded quartz and shell debris, of eolian origin	Safety Bay Sand (mobile dunes Qhsm)	0–2m; F	Heavy minerals Limesands
S_2		CALCAREOUS SAND – as S_1	Safety Bay Sand (Qhs)	2–28m; G	Limesands
Sm_2		CALCAREOUS SAND – white, medium-grained, rounded quartz and shell debris, well sorted, of eolian origin, modified by estuarine and marine processes		1–4m; F	
Sz_2		CALCAREOUS SAND – overlying estuarine silts – as S_{2d} as a relatively thin layer over variably thick estuarine silts, grey clays of estuarine and eolian origin	Estuarine deposits (Qhg)	1–4m; F	
M_2		SILT – brownish grey, calcareous in part, soft, some fine sand and shell debris in places, minor clay content, of estuarine origin		0.5–1.5m; F	
Gm_2		SILTY SAND – greyish brown, medium to coarse-grained, quartz, variable silt content	Swamp deposits (Qhw)	2–2.5m; F	
Sc_2		CLAYEY SAND – grey quartz sand, fine to medium-grained, poorly sorted, sub-angular to rounded, variable clay content, of alluvial origin		2.5–3m; F	
Sp_2		PEATY SAND – grey to black, fine to medium-grained, moderately sorted quartz sand, slightly peaty, of lacustrine origin		18–35m; F	
	LS_2	LIMESTONE – white to cream, fine-grained, algal lamination common, some kankar development		10m; F	
Sm_3		SILTY SAND – strong brown, fine to medium-grained, quartz, variable silt content	Alluvium (Qha)	10–35m; G	
Mac_3		CLAYEY SANDY SILT – pale brown, angular to rounded sand, low cohesion, of alluvial origin		35–50m; G	
Sm_7		SILTY SAND – red-brown, medium-grained, firm, friable, quartz, variable silt content, occasional gravelly horizons		10–70m; F–M	
Mg_3		GRAVELLY SANDY SILT – strong brown, firm, friable, dispersive in part, occasional gravelly horizons with little matrix containing quartzite, quartz, laterite		2–10m; F–M	
G_3		GRAVEL – red-brown gravels set in a silty matrix overlying ironstones, cemented limonitic gravels and coarse sands of alluvial origin	Alluvium (Qha) and/or Colluvium (Qc)	22–38m; F	Gravel
	FS_2	IRONSTONE – red-brown limonitic gravel cemented in a limonite quartz sand matrix of alluvial origin		40–55m; F	
Sm_6		SILTY SAND – red-brown, fine to medium-grained, angular to rounded sand, quartz, variable silt content, occasional occurrence of pisolitic gravels	Colluvium (Qc)	38–130m; F–G	
Mg_{12}		GRAVELLY SILT – ferruginous gravel set in a clay sand mix, of colluvial and residual origin		50–150m; F–G	Gravel
Sm_{11}		GRAVELLY SANDY SILT – dark yellowish brown, tough silty, medium to coarse quartz sand, in places is abundant, medium to coarse-grained pisolitic laterite (G_3) pebbles		45–100m; F–G	
S_{13}		SAND – very pale brown, medium to coarse-grained, well sorted, little fines, sub-angular to rounded quartz and feldspar of colluvial origin		35–100m; G	Potential construction sand
S_9		SAND – light grey, fine to coarse, angular to sub-rounded quartz with some feldspar, moderately sorted, loose, of alluvial origin modified by colluvial processes	Colluvial sands (Qc)	55–160m; G–M	Potential construction sand
S_7		SAND – pale and olive-yellow, medium to coarse-grained, sub-angular quartz, moderately sorted, of residual origin modified by marine inundation	Sand derived from Tamala Limestone (Qts)	2–12m; F–M	Heavy minerals Specification sand
	LS_3	LIMESTONE – light yellowish brown, fine to coarse-grained, sub-angular to well-rounded quartz, shell and corals common, crinoids less common, of marine origin, often overlain by S_7	Tamala Limestone (Qts)	3–7m; F–G	Limestone
S_8		SAND – very light grey at surface, yellow at depth, fine to medium-grained sub-rounded quartz, local concentrations of heavy minerals, local development of coffee rock, moderately well sorted	Bassendean Sand (Qpa)	10–40m; F–G	Heavy minerals Construction sand Sand fill
S_{10}		SAND over SILT and SANDY SILT – sand as S_8 overlying silts and sandy silts		15–50m; F	
Mo_2		SANDY SILT – strong brown to mid-grey, mottled, blocky, disseminated fine sand, hard when dry, of alluvial origin	Guildford Formation (Qpa)	5–15m; F	Heavy minerals
M_4		SILT – very pale brown, soft when moist, firm when dry, low clay content, of alluvial origin		20–45m; F	
Mo_3		SANDY SILT – brown, mottled, blocky silt, disseminated, fine to medium-grained sand, some micas, hard when dry, of alluvial origin		10–20m; F	
Mg_4		SANDY SILT – strong brown, mottled, firm silt matrix with sand disseminated throughout, minor occurrences of pebbles, of alluvial origin		20-45m; F	
Smg_3		SILTY SAND – greyish to brown, medium to coarse-grained quartz sand,in places is abundant and overlying a gravelly (pisolitic G_3) silty sand		20–59m; F–M	Gravel
S_{12}		SAND – yellow, fine to medium-grained, sub-angular to rounded quartz with some feldspar, local concentrations of heavy minerals, well sorted overlying boulder and cobble conglomerates	Yoganup Formation (Qpr)	40–75m; G	Heavy minerals
G_2		GRAVEL – brown and reddish brown, ferruginous, pisolitic, occasionally cemented in a clay silt matrix, moderately sorted	Laterite (Czl, Czll)	50–180m; G	Gravel
LA_1		LATERITE – massive and cemented, occasionally vesicular, up to c. 4 m in thickness, overlies a zone of mottled and/or pallid clays, sometimes overlain by a ferruginous gravel set in a clay-sand matrix		55–182m; G	Gravel
BA		BASALT – dark green, tholeiitic, occasionally vesicular	Bunbury Basalt (Kbb)	30m;F	Armour stone Crushed rock aggregate

Map Unit [1] Unconsolidated Material [2]	Rock [2]	Permeability	Slope stability	Ease of excavation	Shrink-swell potential	Bearing capacity	USC [5]	CURRENT PROCESSES	SUITABILITY FOR SPECIFIED LAND USES [7] Sanitary (landfill)	Septic tanks	Urban (low rise)	Excavation (moving earth)	NOTES
Cm_2		L	L	H	M–H	L	OH–CH	Flooding	✕	✕	✕	●	High water table, prone to flooding
Spc_2		L	L	H	L–M	L	SC	Annual flooding	✕	✕	✕	●	High water table, seasonal flooding, variable bearing capacity depending on peat and clay content
S_1		H	L	H	N	L	SP–SW	Wind transportation, marine erosion	✕	◆	✕	✕	Active blowouts and sand sheets, unvegetated, high lime content gives it considerable potential for fixing certain types of waste and neutralising acids, settlement common
S_2		H	L	H	N	L	SP–SW	Wind transportation	◆	◆	⊛	●	Moderate to steep slopes, very susceptible to mobilisation when sparse vegetation is removed – as S_1
Sm_2		H	L	H	N	L	SP–SW		◆	◆	◆	●	
Sz_2		M–H	L	H	L	L	SP–SW	Flooding	✕	✕	✕	●	High water table, thin sands have physical properties modified by silts and clays underlying
M_2		L	L	H	L	V	ML	Flooding	✕	✕	✕	●	High water table, prone to flooding, differential settlement may occur
Gm_2		M–H	L–M	H	L	L–M	SM	Flooding	✕	✕	✕	●	High water table, prone to flooding, generally free draining
Sc_2		L–M	L–M	H	L	L–H	SC	Flooding	✕	✕	✕	●	High water table, suitability for foundations depends on clay content
Sp_2		M–H	M	H	L	M	SW	Annual flooding	✕	✕	✕	●	Swamps with seasonal flooding only, high water table
	LS_2	M–H	M	M–H	L	V	N/A		✕	●	✕	●	Restricted in area , usually thin, its properties depend on the lithologies of the underlying rocks
Sm_3		M	L–M	H	L	M	SM	Stream flow	○	✕	✕	◆	High water table, variable thickness, bearing capacity dependent on the amount of silt in the material
Mac_3		L	M	H	L	M	ML	Stream flow	○	✕	✕	◆	High water table, major streams on coastal plain, sand from eolian and alluvial sources
Sm_7		M	L–M	H	L	L–M	SM	Stream flow, sediment transport, flooding	✕	✕	✕	◆	Major rivers in this area, Capel and Preston, variable value as foundation, rich agricultural soils, lower terraces subject to rare flooding
Mg_3		L	M–H	H	L–M	M	ML	Stream flow, sediment transport	✕	●	✕	◆	Variable value as foundation, permanent cuts are unstable, slumping occurs along valley walls
G_3		L–M	M	M–H	L	L–M	GW		✕	●	✕	◆	Incipient formation of limonite deposits, poorly drained
	FS_2	V	H	V	L	H	N/A	Water table leaching /deposition	✕	●	✕	●	Bog iron or limonite deposited along palaeowater tables and along dune swales or rivers, deposition occuring today, very poor drainage
Sm_6		M	L–M	H	L	M	SM	Stream flow, sediment transport	◆	○	○	◆	
Mg_{12}		L	M–H	H	L	M–H	ML	Solifluction, some stream flow	◆	○	○	◆	
Sm_{11}		M–H	L	H	L	L–M	SM	Colluvial debris flow, sheet wash	◆	○	○	◆	Restricted occurrences along the Whicher Scarp
S_{13}		H	L–M	H	N	L–M	SP	Sheet wash	◆	◆	◆	◆	Often as thin fan overlying S_{12} , provides good foundations when compacted
S_9		H	M–H	H	N	M–H	SP–SW	Sheet wash	◆	◆	◆	◆	Good foundation properties, angularity produces good shear strength
S_7		M	L–M	H	N	L–M	SP–SW	Groundwater recharge	◆	◆	◆	◆	Few limitations, some settlement under foundations can be expected, some ability to attenuate pollutants due to small clay content
	LS_3	H	M–H	M–H	N	V	SP–SW	Groundwater recharge	✕	●	◆	◆	Variable bearing capacity depending on degree of cementation, solution cavaties and fisiures could lead to severe settlement under load and also offer an easy path for pollitants down to the water table
S_8		H	L	H	L	M–H	SP–SW	Groundwater recharge	◆	◆	◆	◆	Depth to water table variable, remobilised if dewatered, permanent cuts unstable, may have coffee rock zones at palaeowater table ranging from red discolouration to unripeable massive limonite
S_{10}		H	L	H	L	M–H	SP–SW	Groundwater recharge	●	◆	◆	◆	Of variable thickness, the sands physical properties are modified by the underlying silts, high water table
Mo_2		L	M–L	H	L	MH	ML	Annual flooding	✕	✕	○	◆	High water table, prone to flooding, dispersive in places
M_4		L	L–M	H	L–M	L–M	ML	Subject to flooding	✕	✕	○	◆	High water table, prone to flooding in part, potential in part for swelling and shrinkage
Mo_3		L–M	L–M	H	L	M	ML	Subject to flooding	✕	✕	○	◆	
Mg_4		L	M	H	L–M	M	ML	Subject to flooding	✕	✕	○	◆	
Smg_3		M	L–M	H	L	M	SM		✕	○	○	◆	
S_{12}		H	M–H	H	L	L–M	SW	Eolian and fluvial erosion	◆	✕	◆	◆	Marine beach deposit, good compaction characteristics provide good foundations, steep cuts moderately stable, may have zones of coffee-rock/laterite developed at palaeowater table
G_2		H	M	H	L	H	GP	Stream flow, sheet wash	✕	●	◆	◆	When compacted can stand heavy loads
LA_1		V	H	L(V)	L	H	N/A	Stream flow, sheet wash	●	●	◆	◆	Requires blasting to excavate, strong foundations but subsurface drainage is a problem
BA		L	H	L	L	H	N/A	Stream flow	✕	✕	✕	●	Very restricted occurrence in bed of Capel River, this unit underlies much of the area and is often encountered in wells and bores

REFERENCES

1 See Lithological Classification

2 These terms are used in the engineering sense of "soil" and "rock".
The term "soil" denotes an aggregate of mineral grains which can be separated by gentle mechanical means
The term "rock" denotes an aggregate of minerals connected by strong and permanent forces

3 Maximum and minimum elevation of the unit with respect to Australian Height Datum

4 Slopes expressed qualitatively
F–flat . . . . . 0°–3°
G–gentle . . . . . 3°–10°
M–moderate . . . . . 10°–20°
S–steep . . . . . >20°
The dominant slope of each unit is given

5 H . . . . . high
M . . . . . moderate
L . . . . . low
V . . . . . variable
N . . . . . none
N/A . . . . . not applicable
Properties vary with degree of weathering

6 Unified Soil Classification System which describes soils in terms of grain size, grading characteristics and compressibility. For rocks the symbols refer to the weathered products

7 ✕ land use undesirable for the environment
● possible problems for the environment
○ possible problems for the land use
◆ land use compatible with unit

The data contained on this sheet are provided for preliminary studies and are not intended as a substitute for detailed on-site investigation

LITHOLOGICAL CLASSIFICATION

UNCONSOLIDATED MATERIAL

A single capital letter denotes the main lithology of the soil unit followed, if required, by lower case letters denoting qualifying lithologies in decreasing order of importance – left to right

C . . . . . clay
M . . . . . silt
S . . . . . sand
G . . . . . gravel
P . . . . . organic material

ROCK

Double capital letters denote lithological symbols of rock

LA . . . . . Laterite
LS . . . . . Limestone
BA . . . . . Basalt
FS . . . . . Ironstone

Different mappable units of similar lithologies are shown by the lithological symbol followed by an Arabic number

SYMBOLS

GEOLOGY
. . . . . geological boundary
. . . . . fan
. . . . . river terrace
. . . . . macrofossil locality
. . . . . unrehabilitated mine site, may still be mining
. . . . . rehabilitated mine site

HYDROGRAPHY
. . . . . perennial stream with direction of flow
. . . . . seasonal stream with direction of flow
. . . . . marsh
. . . . . isohyet (mm) figure on high side of line
. . . . . depth to groundwater, metres
. . . . . isohaline (mg/L T.D.S.)
. . . . . limit of 1 in 100 year flood
. . . . . bathymetric contour in metres

BOREHOLES, WELLS AND OTHER WORKS
. . . . . observation borehole
. . . . . storage reservoir, dam or tank
. . . . . waterfilled excavation
. . . . . drain
. . . . . solid waste disposal site, active

MINERAL RESOURCES
. . . . . quarry or pit, active
. . . . . quarry or pit, inactive
. . . . . mineral occurrence
Gr . . . . . gravel
Ls . . . . . limestone
Hm . . . . . heavy minerals
Sd . . . . . sand

TOPOCADASTRAL INFORMATION
. . . . . road, classification as shown
. . . . . railway
. . . . . power line
. . . . . townsite boundary
. . . . . local authority boundary
. . . . . state forest boundary
. . . . . contour in metres

The Australian Map Grid covers Australia and the Territories administered by Australia. Zones are 6° wide plus ½° overlap. A.M.G. zones are numbered from zone 47 with central meridian 99° E to zone 58 with central meridian 165° E. The origin of each zone is the intersection of the central meridian with the equator. On this map ticks on the sheet edge represent 1000 metre intervals on the superimposed A.M.G. Zone 50.

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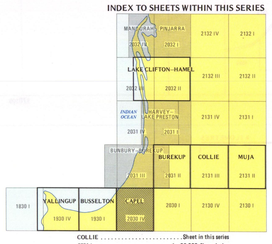

COLLIE . . . . . Sheet in this series
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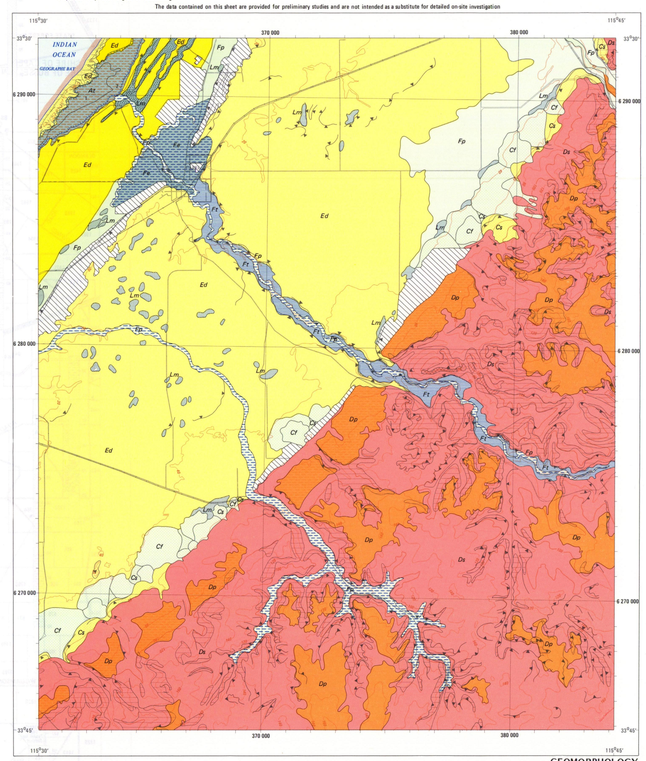

GEOMORPHOLOGY

SCALE 1 : 100 000

0 1 2 3 4 5 6 KILOMETRES

GEOMORPHOLOGICAL CLASSIFICATION

Ed Parabolic and nested parabolic dunes, Quindalup Dunes
Ed Degraded surface of eolian origin, Quindalup Dunes
Ed Degraded surface of eolian origin, Spearwood Dunes
Ed Degraded surface of eolian origin, Bassendean Dunes
Es Af Estuarine terraces, where identified
Lm Marsh in interbarrier depression
Lm Marsh on alluvial plain
Lm Marsh in interdunal swale
River delta
River floodplain
Fr River terrace
Fp Alluvial plain
Fp Alluvial plain
Cf Colluvial fan
Cs Colluvial slope
Cs Interfan depression
Dp Degraded surface of planation and denudational slopes
Dp Surface of planation – shelf
Dp Surface of planation – plateau
Made ground

The geomorphological classification comprises a single capital letter which denotes the origin of the material and a lower case letter which represents the landform

SLOPES
0°–3°
3°–10°
10°–20°
20°–30°

FEATURES
Prominent ridge
Sharp convex break of slope
Sharp concave break of slope
Limit of 1 in 100 year flood

ORIGIN
A . . . . . estuarine
C . . . . . colluvial
D . . . . . denudational
E . . . . . eolian
F . . . . . fluvial
L . . . . . lacustrine

LANDFORM
d . . . . . dune
e . . . . . delta
f . . . . . fan
m . . . . . marsh
p . . . . . plain
s . . . . . slope
t . . . . . terrace

e.g. Cs . . . colluvial slope Fp . . . . . floodplain

Sandy coast. Storm and erosion cycles have the greatest impact on these coasts. Without protection, large scale erosion during stormy years is likely to occur. Once erosion does start there is little to stop it. Preservation of the dunes and their vegetation is important in facilitating recovery following storm onset and beach erosion.

Cartography by the Surveys and Mapping Division, Department of Mines, Western Australia.
Topographic base from compilations by the Department of Land Administration, Cadastral base from the Department of Conservation and Land Management.
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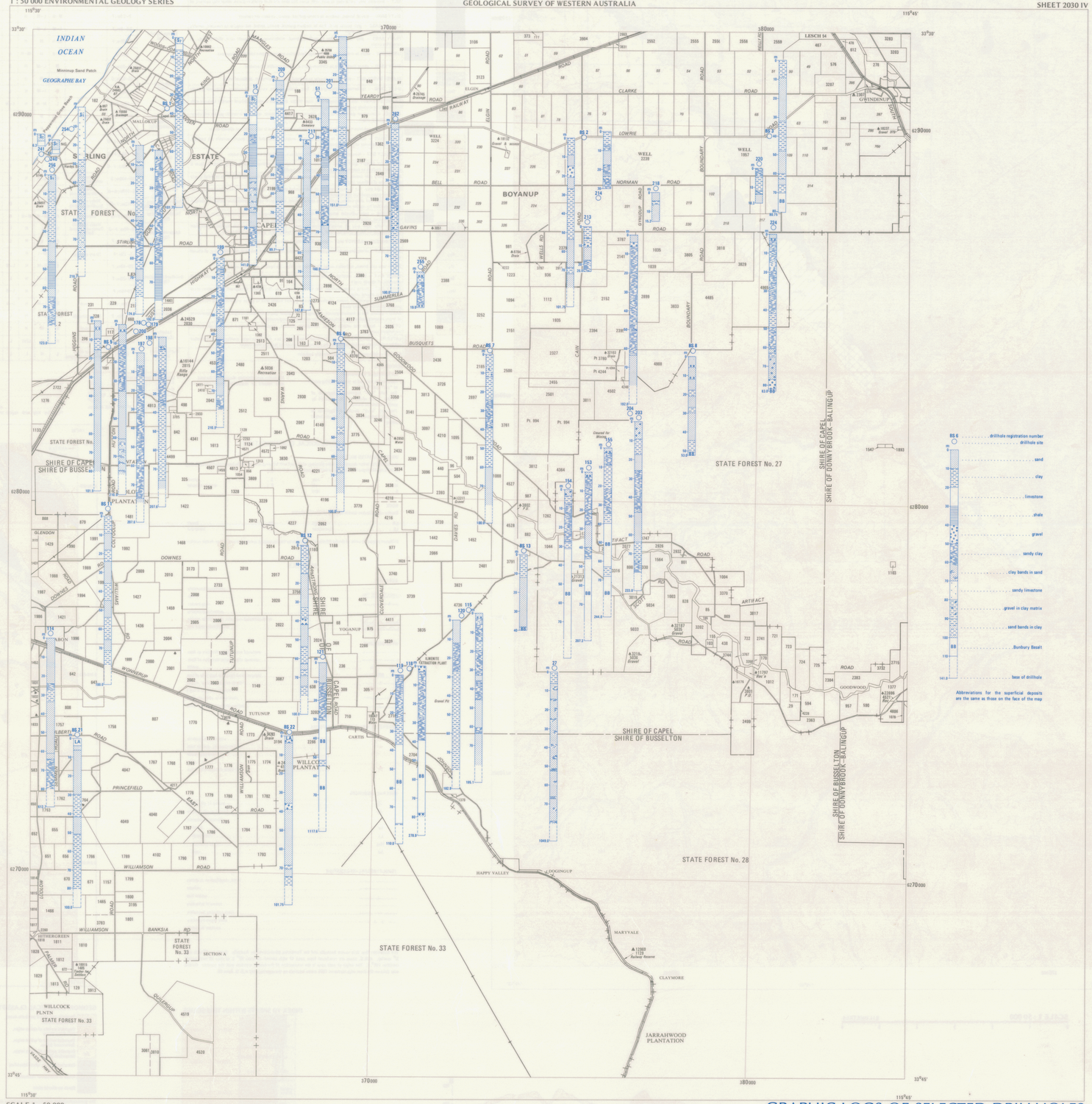

drillhole registration number
drillhole site
sand
clay
limestone
shale
gravel
sandy clay
clay bands in sand
sandy limestone
gravel in clay matrix
sand bands in clay
Bunbury Basalt
base of drillhole

Abbreviations for the superficial deposits are the same as those on the face of the map

GRAPHIC LOGS OF SELECTED DRILLHOLES