OLYMPIC DAM EXPANSION

DRAFT ENVIRONMENTAL IMPACT STATEMENT 2009

APPENDIX I
SOILS

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resourcing the future

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APPENDIX I

SOILS

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APPENDIX I1

Soil investigation

I1 SOIL INVESTIGATION

Chapter 10 of the Draft EIS presents the findings of the soil surveys undertaken for the proposed Olympic Dam expansion. The assessments were undertaken by Houghton Environmental Management Pty Ltd (gas pipeline corridors) and URS Australia Pty Ltd (southern infrastructure corridor). This appendix provides supplementary information in relation to the methodology undertaken and the detailed findings of the assessment.

I1.1 METHODOLOGY

I1.1.1 Desktop investigation

The desktop investigation included a review of:

- the topography, geology and soils sections from the 1982 Olympic Dam EIS and the 1997 Olympic Dam EIS (Kinhill Stearns Roger, 1982; Kinhill, 1997)
- BHP Billiton's annual environmental reports to obtain information relevant to the soil investigation
- published geology, soils and topographic reports and maps for the EIS Study Area (see references for full list)
- satellite imagery and aerial photography of the study area, including photographs taken during a helicopter survey over the proposed infrastructure corridors.

I1.1.2 Field investigation

Sampling sites

A total of 91 sites within the proposed southern infrastructure corridor were sampled in July 2006 to provide a representation of the in *situ* soil characteristics, to enable bulk samples to be collected for laboratory testing and to assess the ease of excavation, erosion potential, fertility and dustability. Additional sampling was undertaken in January 2008 for the proposed gas pipeline corridors between the Moomba gasfield and Olympic Dam. The location of the sample sites is shown in Figure I1.1 (gas pipeline corridors) and Figure I1.2 (southern infrastructure corridor).

The target depth of samples varied depending on the proposed infrastructure and the likely risk of erosion, as follows:

- sites located within the rail corridor were excavated to a target depth of 3.5 m
- sites located solely within the proposed transmission corridor were excavated to a minimum target depth of 1.5 m
- sites located in areas likely to have a high erosion potential based on the desktop investigation were excavated to a target depth of 3 m.

The target depth was reached for all of the test pits except where high resistance (effective refusal) was encountered. The final depth of each sample site is presented in Table I1.2.

For the gas pipeline corridors, investigations were undertaken by helicopter due to access constraints. Sampling was undertaken by hand auger with the maximum depth of augering being 1.5 m. In many cases along this route, the extreme looseness or stoniness of the soil matrix prevented excavation to depths below 0.5 m.

Each sample site was logged in accordance with the *Australian Soil and Land Survey Field Handbook* (McDonald et al. 1990) and the unified soil classification system. At each test pit location, site observations of erosion potential were made, field tests were undertaken and bulk samples collected for laboratory testing (as discussed in the following sections). Bulk samples were unable to be collected for the gas pipeline investigation.

Field testing

Field testing was undertaken to determine the electrical conductivity (EC) and pH of soil samples at each site using a 1:5 soil water extract and field chemical testing kit. Electrical conductivity and pH testing was conducted at multiple levels within the soil profile, generally once within each horizon but with two or more tests undertaken in thicker horizons.

Laboratory testing

The laboratory testing program consisted of tests to quantify the physical and chemical properties of the material that influences erosion potential, stormwater run-off quality and site stability. Chemical analysis was also undertaken to provide background concentrations for potential future comparison. Laboratory analysis was undertaken by Earth Testing Services and ALS Environmental. Both laboratories are accredited with the National Association of Testing Authorities (NATA). Laboratory analysis for the samples from the gas pipeline route was undertaken by Biotrack Pty Ltd.

Each different soil type was tested at least once, and multiple tests were undertaken on commonly recurring soil types. Multiple samples within the soil profile were selected for laboratory testing at some sites. At other sites, where a similar soil profile was encountered at an adjacent site, no samples were taken.

The concentrations of metals and nutrients from selected samples were compared with the National Environment Protection (Assessment of Site Contamination) Measure (NEPM) health and ecological based investigation levels. Concentrations of uranium were compared to the United States Environmental Protection Authority (US EPA) health-based investigation level (US EPA, 2004) because no such level exists for South Australia or Australia.

Table I1.1 shows the type and frequency of analysis, along with the testing laboratory, the method used or the Australian standard. Analytical results are presented in Section I1.2.

Table I1.1 Laboratory testing

Laboratory test	Laboratory	Laboratory method/ Australian standard	Number of samples analysed
Emerson class	Earth Testing Services / Biotrack	AS 1289.3.8.1	38/22
Attenberg limit[1]	Earth Testing Services	AS 1289	24
Particle size distribution[1]	Earth Testing Services	AS 1289	24
Metals	ALS Environmental / Biotrack	S-02, EG020X-T	16/22
Nutrients	ALS Environmental / Biotrack	EK055, EK062, EK067-EM, EN34	16/22
Organic content	ALS Environmental / Biotrack	EP004	16/22

[1] Test work for these parameters was not carried out for the gas pipeline route due to absence of bulk sample.

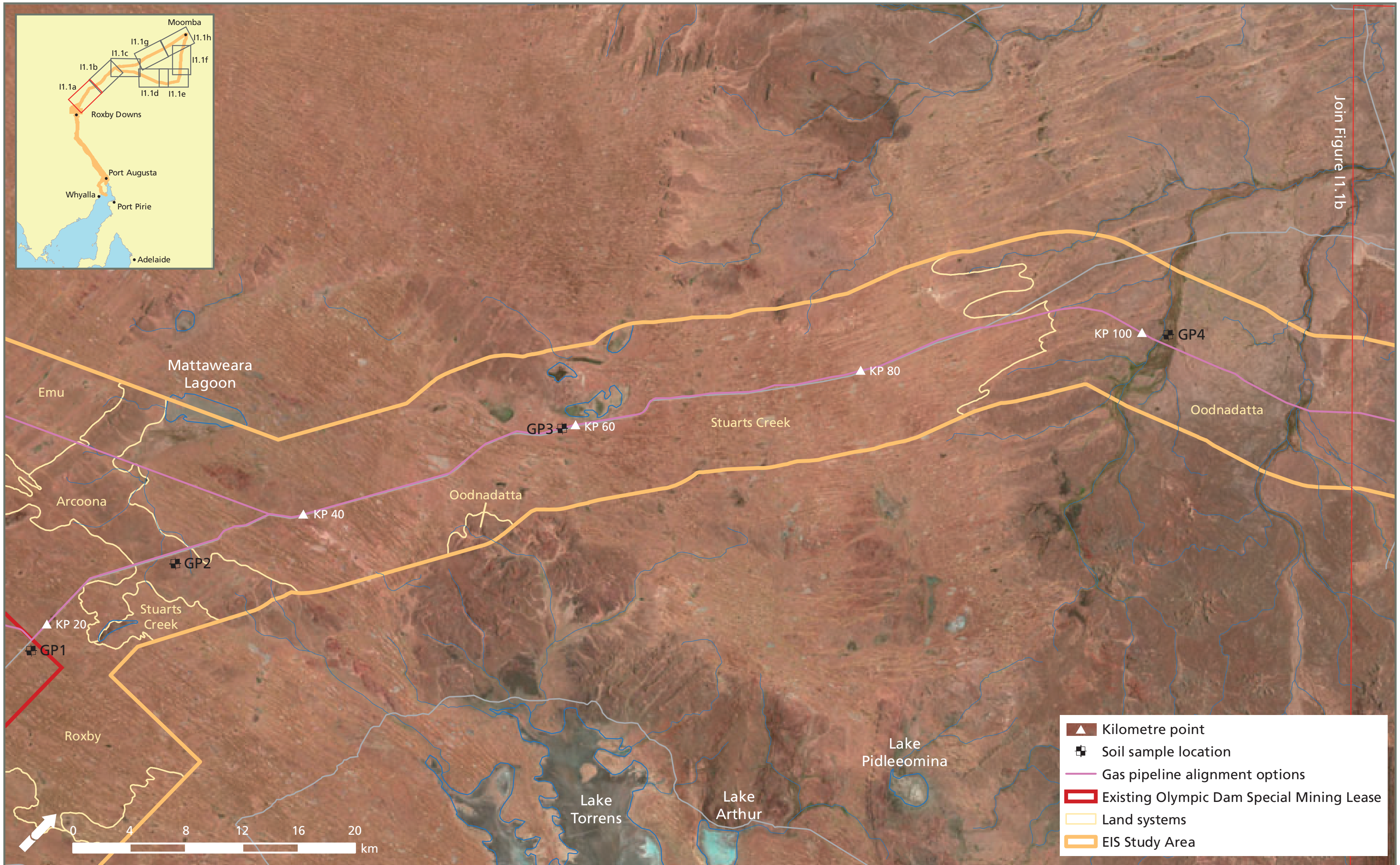

Figure I1.1a Soil sample locations and land systems along the gas pipeline corridors

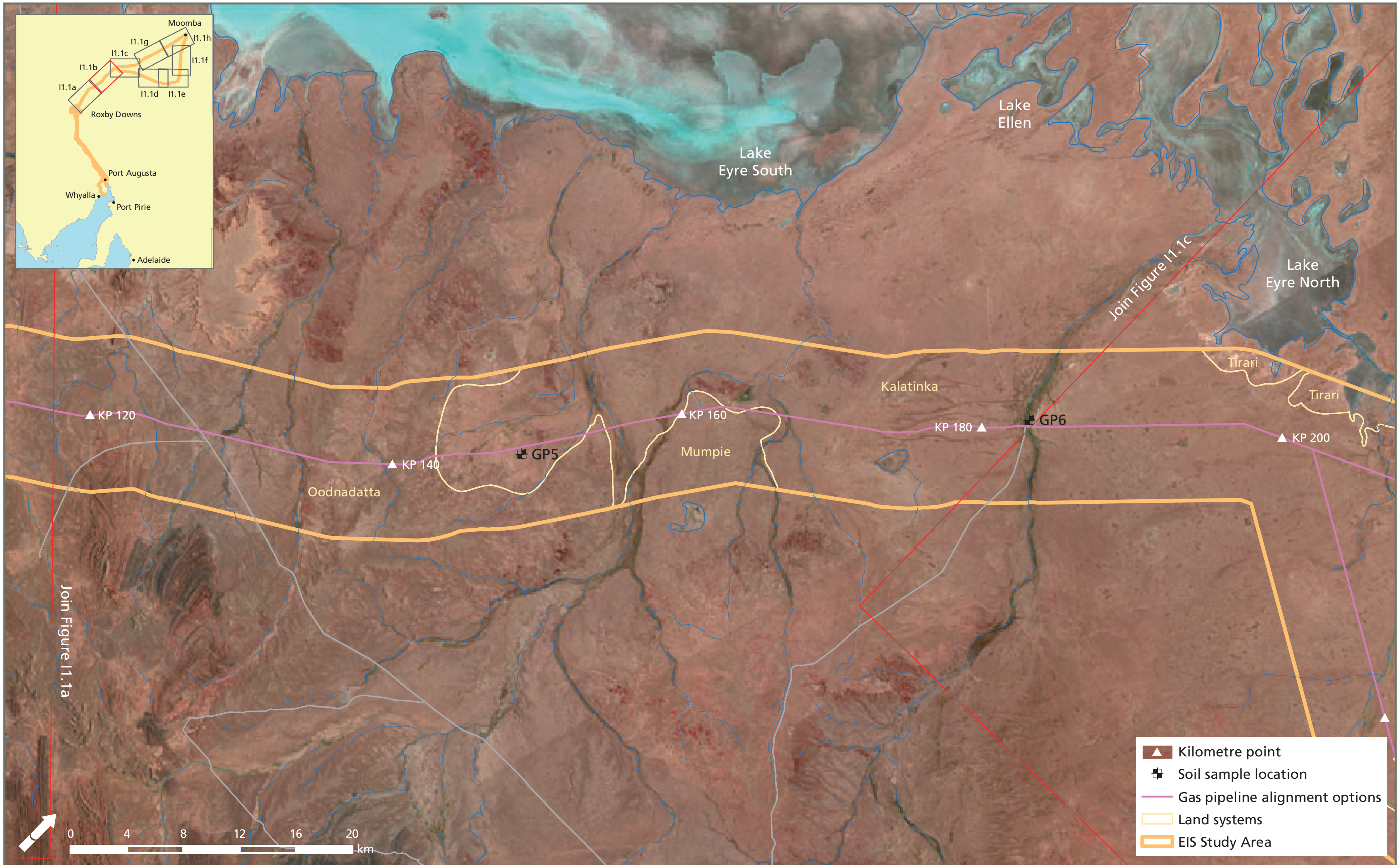

Figure I1.1b Soil sample locations and land systems along the gas pipeline corridors

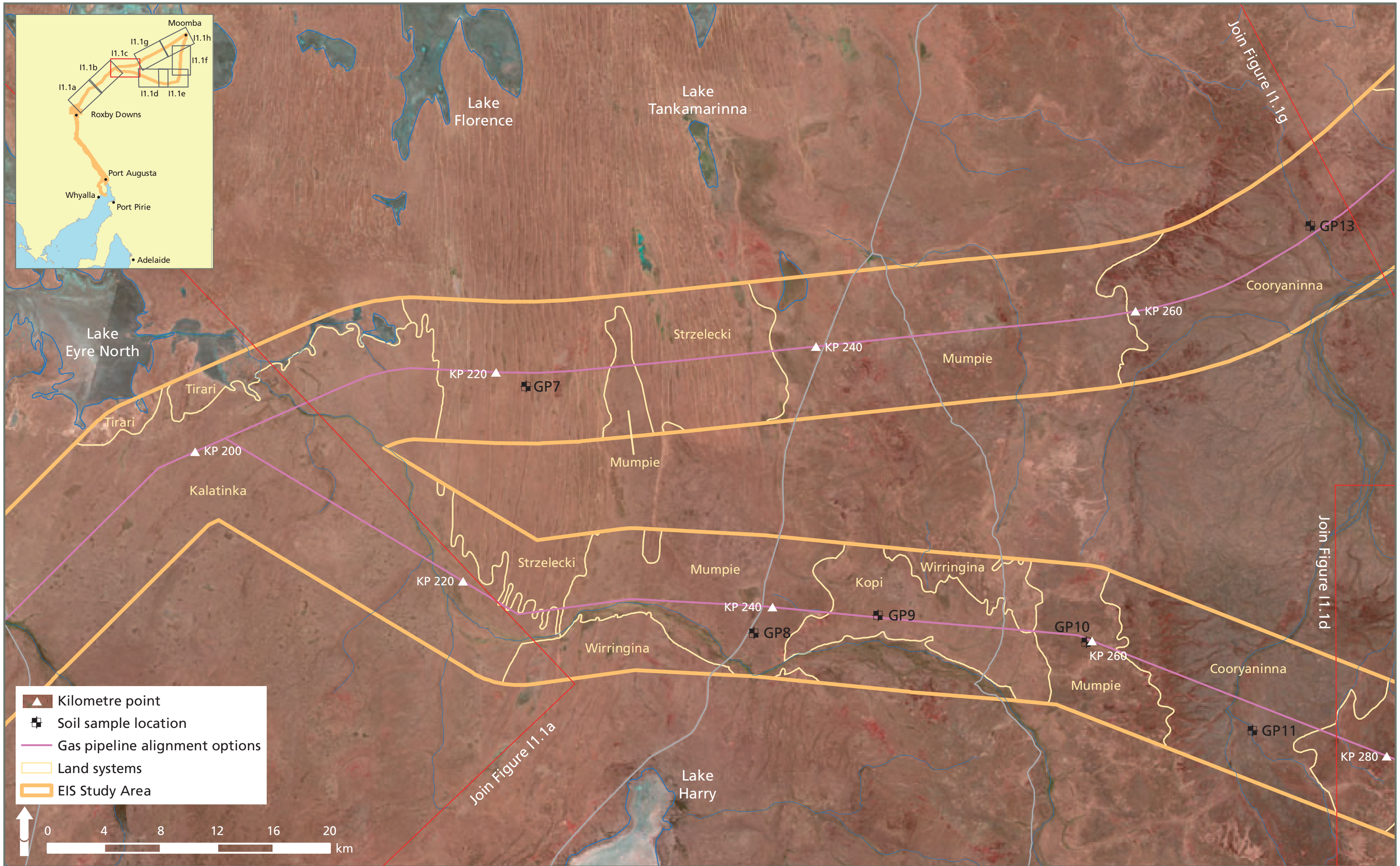

Figure I1.1c Soil sample locations and land systems along the gas pipeline corridors

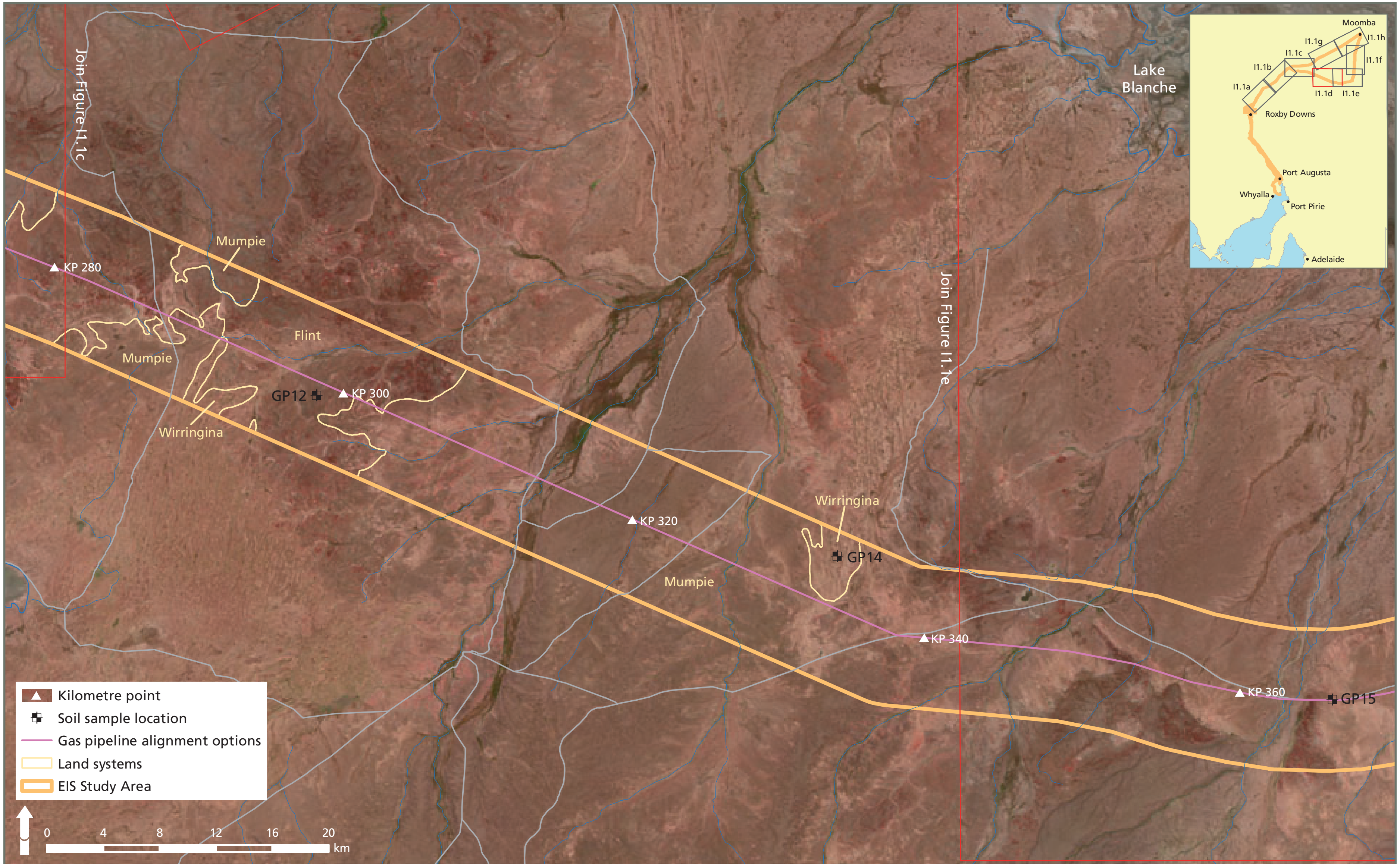

Figure I1.1d Soil sample locations and land systems along the gas pipeline corridors

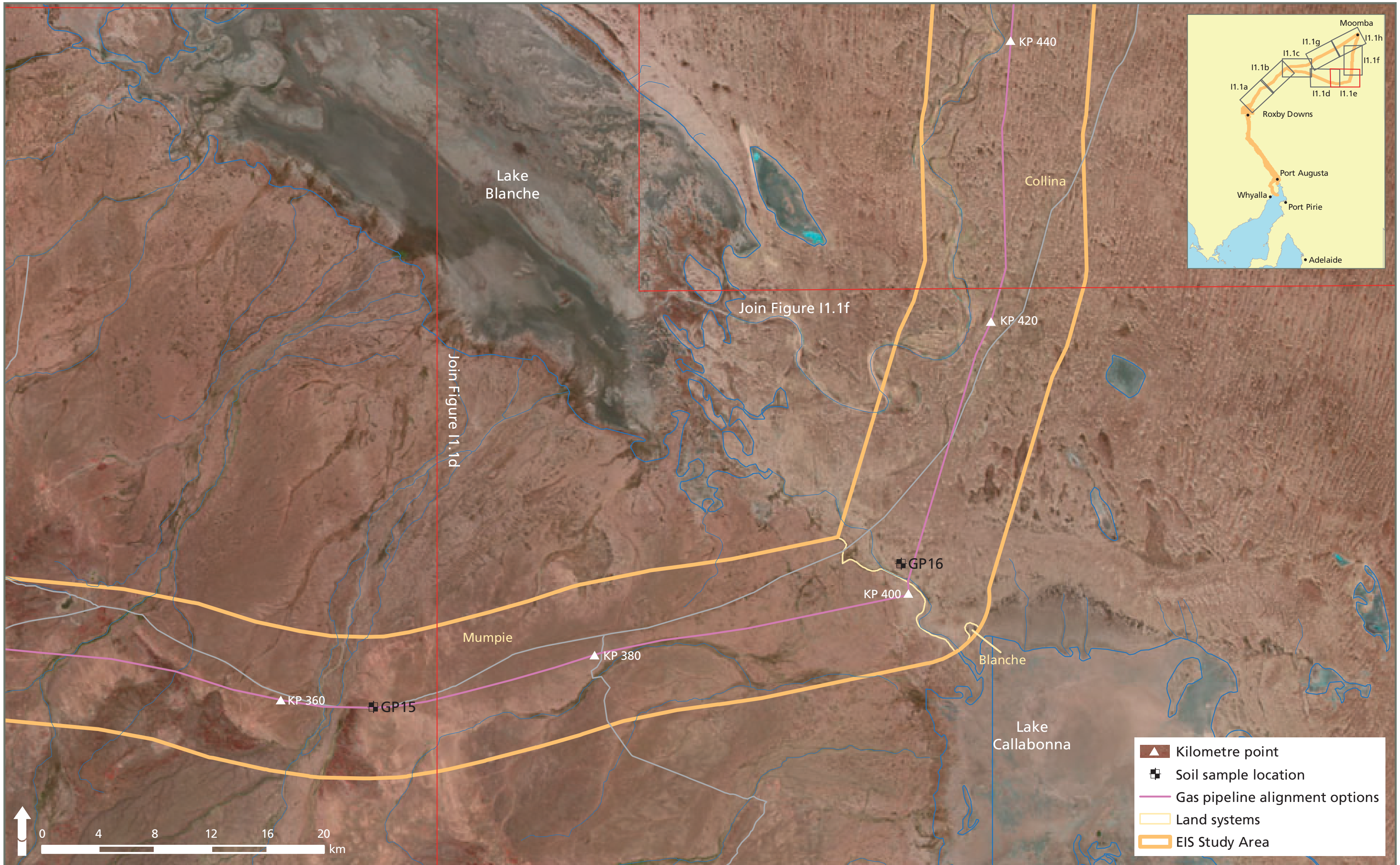

Figure I1.1e Soil sample locations and land systems along the gas pipeline corridors

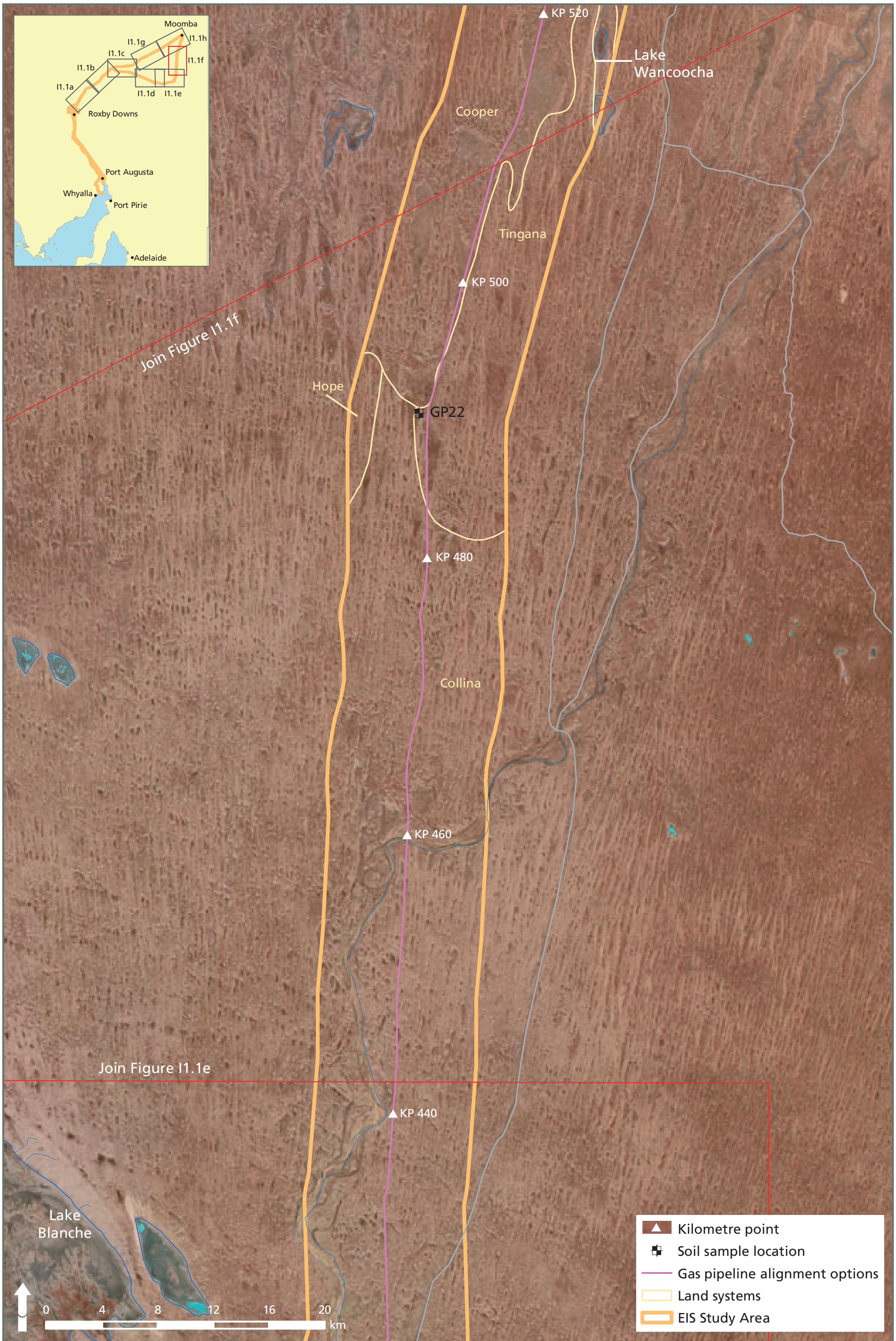

Figure I1.1f Soil sample locations and land systems along the gas pipeline corridors

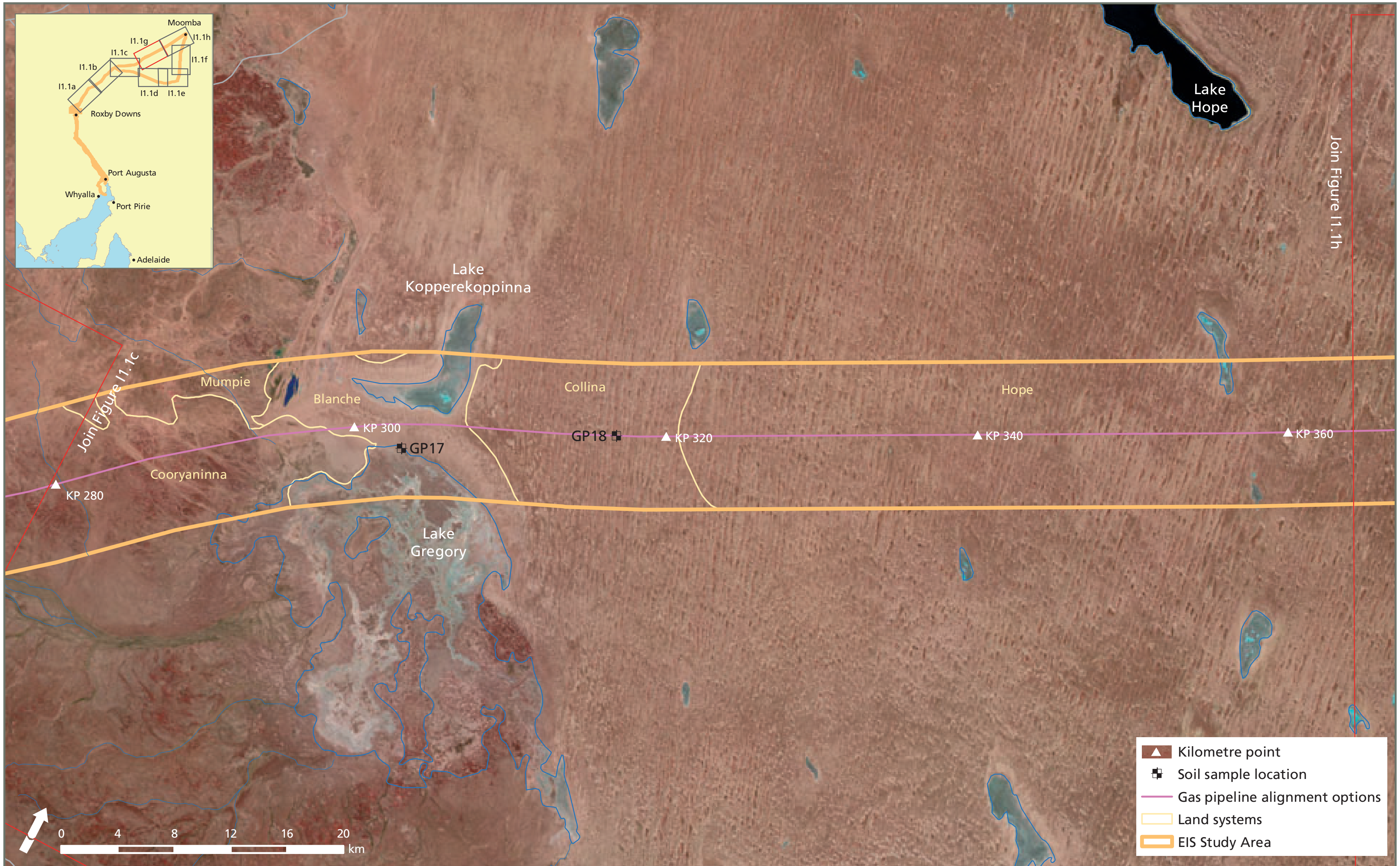

Figure I1.1g Soil sample locations and land systems along the gas pipeline corridors

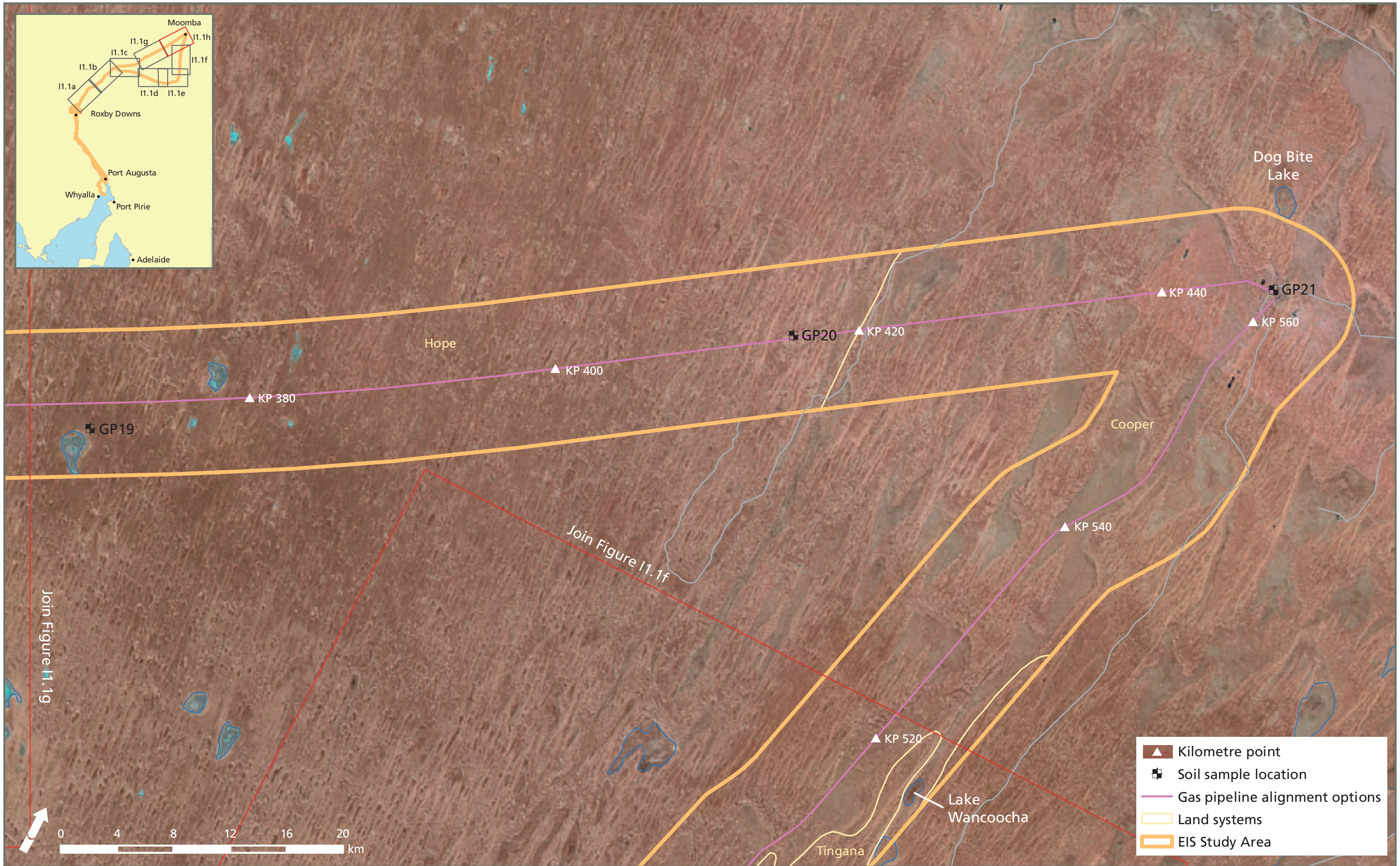

Figure I1.1h Soil sample locations and land systems along the gas pipeline corridors

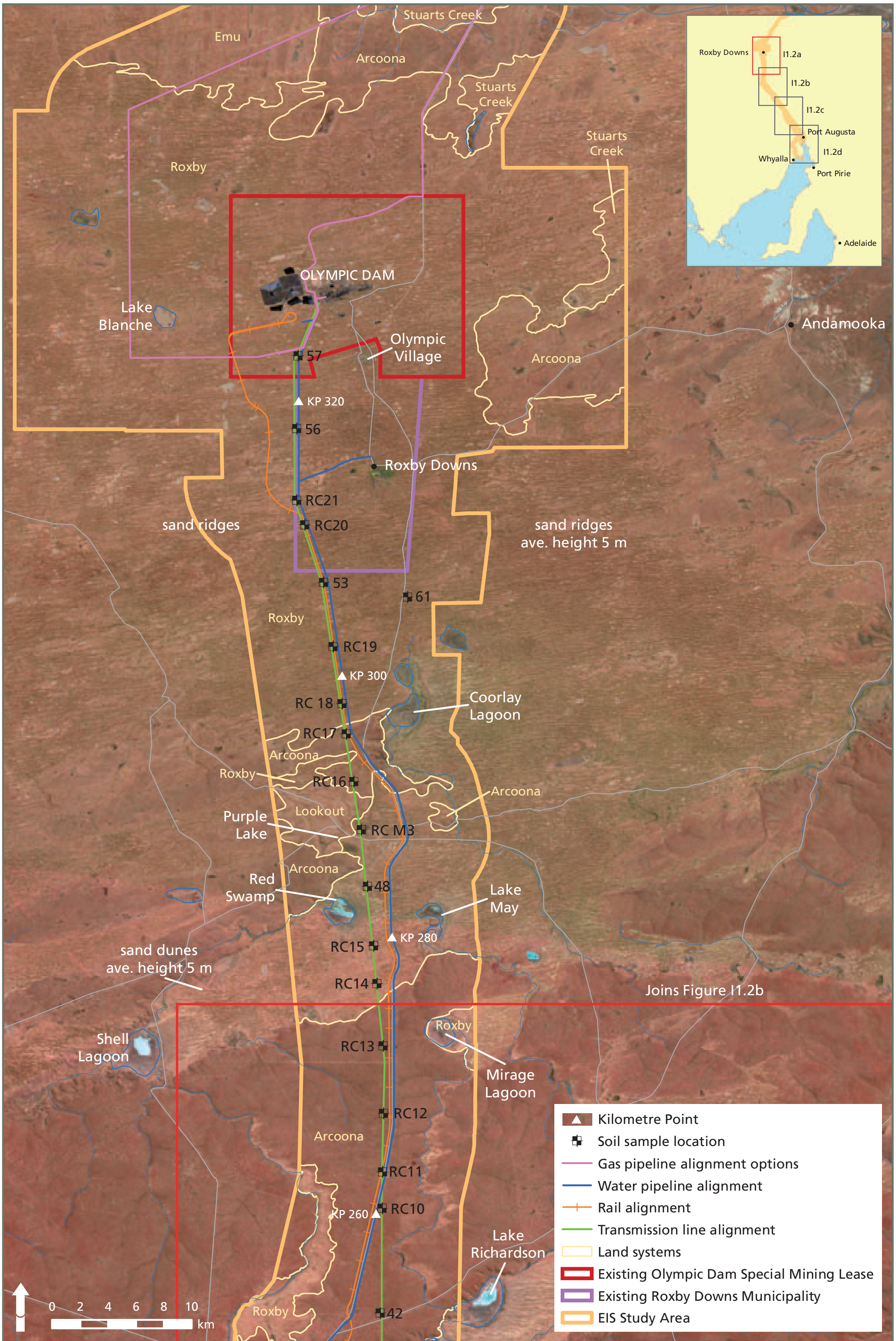

Figure I1.2a Soil sample locations and land systems along the southern infrastructure corridors

Figure I1.2b Soil sample locations and land systems along the southern infrastructure corridors

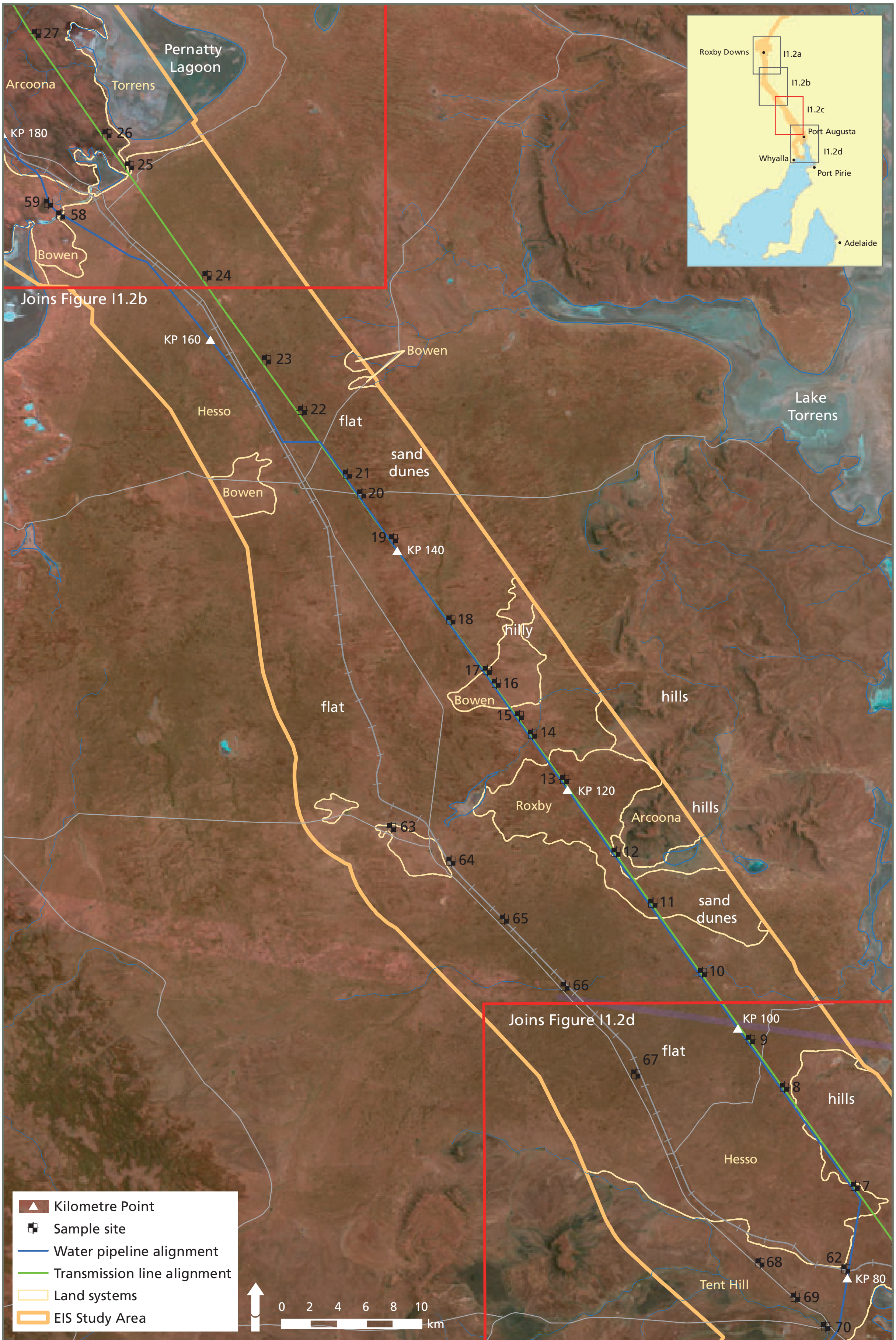

Figure I1.2c Soil sample locations and land systems along the southern infrastructure corridors

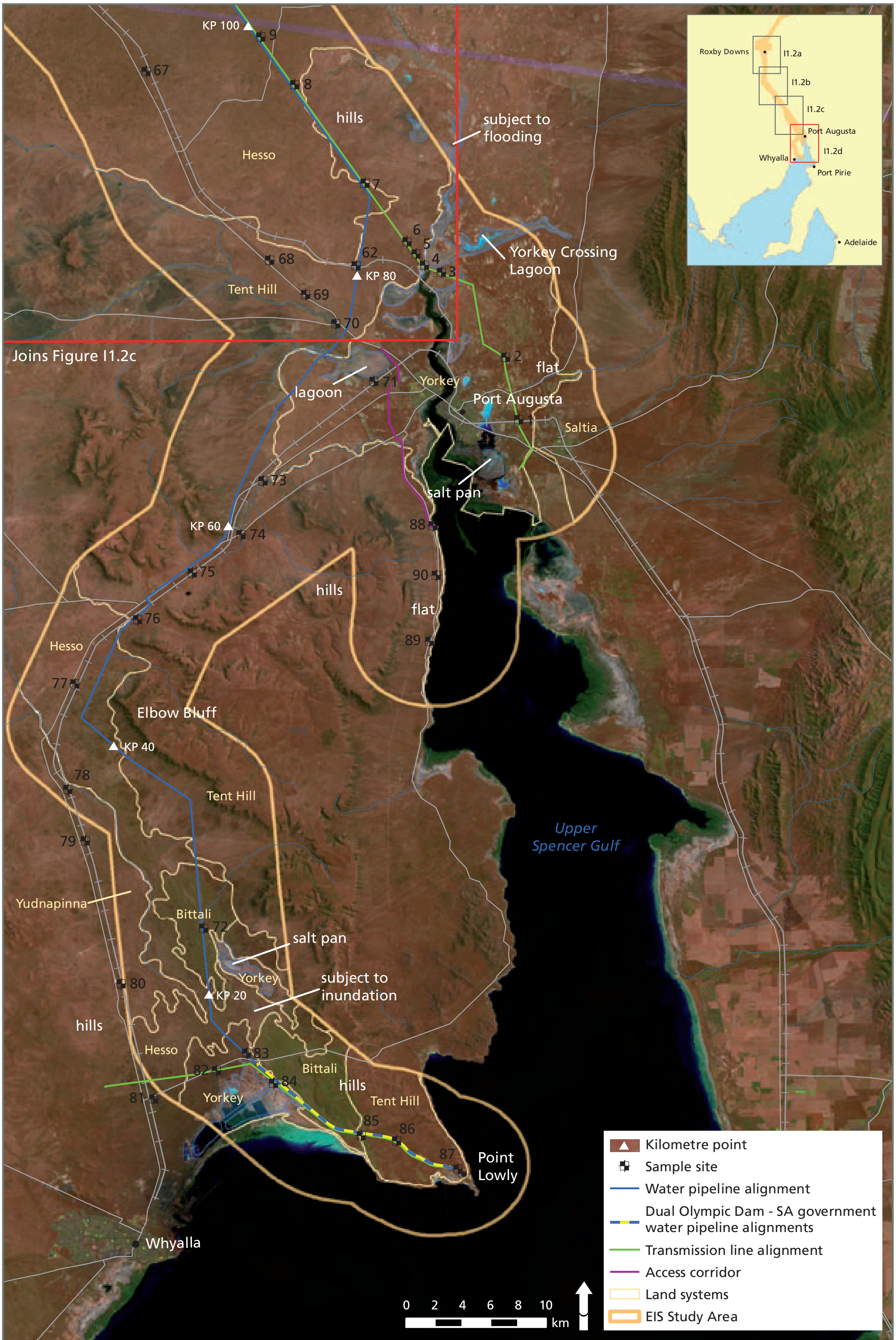

Figure I1.2d Soil sample locations and land systems along the southern infrastructure corridors

I1.2 RESULTS

The following tables provide data to supplement the information summarised within the topography, geology and soils chapter of the Draft EIS (Chapter 10).

- Table I1.2 – Field soil descriptions
- Table I1.3 – Erosion potential classification
- Table I1.4 – Soil erosion potential
- Table I1.5 – Metal concentrations
- Table I1.6 – Nutrient concentrations
- Table I1.7 – Soil physical properties.

Table I1.2 Field soil descriptions

Sample Site	Geology	General soil description	Topsoil	Subsoil
Gas pipeline corridors (refer to Figure I1.1 for locations)				
GP1	Quaternary sand plains: sand dunes with clay pans (Roxby Land System)	Red brown loamy sand overlying reddish brown sand. Test pit terminated at 0.4 m due to looseness of material.	100 mm: red (10R5/4) loamy sand with some gravel. pH 6.6	0.1–0.40 m: reddish brown (2.5YR5/4) silty sand with few salt crystals and gravel accretions. pH 7.8
GP2	Marree Subgroup (bulldog shale): gibber plain (Arcoona Land System)	Reddish brown earthy sand (high gravel content) overlying white-grey brown loamy clay. Auger refusal at 0.5 m due to gravel content.	400 mm: reddish brown earthy sand (2.5YR5/4) with high gravel content on surface and within profile, hardsetting. pH 7.3	0.4–0.5 m: pink/white (7.5YR8/2) loamy kaolinitic clay with high gravel content. pH 7.0
GP3	Marree Subgroup (bulldog shale) (Stuarts Creek Land System)	Reddish brown loamy sand overlying red brown clay. Auger terminated at 0.5 m.	300 m: hardsetting reddish brown loamy sand (7.5YR6/4). pH 7.3	0.3–0.5 m: red brown medium clay (2.5YR5/3) with minor sandstone fragments. pH 7.2
GP4	Quaternary alluvium (Oodnadatta Land System)	Grey brown sandy loam overlying grey brown loamy clay and brown sandy clay. Auger terminated at 1.0 m.	50 mm: grey brown sandy loam with minor ironstone gravel (10YR6/3). pH 7.0	0.05–0.3 m: grey brown loamy medium clay with few gravel fragments (7.5YR5/3). pH 7.1 0.3–1.0 m: brown sandy clay, minor gravel fragments (7.5YR5/3). pH 7.1
GP5	Quaternary alluvium (Kalatinka Land System)	Grey brown sand overlying grey brown sandy clay. Auger refusal at 0.4 m due to hardpan.	100 mm: grey brown fine sand, hardsetting, some organic fragments gibber gravel (5YR6/4). pH 7.6	0.1–0.4 m: grey brown sandy clay, minor gravel (7.5YR5/4). pH 7.5
GP6	Quaternary alluvium (Kalatinka Land System)	Grey sandy loam overlying light grey clayey sand. Auger refusal at 0.4 m due to hole collapse.	100 mm: light grey sandy loam with significant gravel (7.5YR8/2). pH 7.7	0.1–0.4 m: light grey clayey sand with significant gravel (7.5YR7/2). pH 8.0
GP7	Quaternary sand ridges and depressions (Strzelecki Land System)	Loamy red brown sand over grey white clayey sand. Auger refusal at 0.5 m due to hardpan.	400 mm: Loamy red brown sand, hardsetting (5YR7/4). pH 8.2	0.4–0.5 m: grey white clayey sand (7.5YR8/2). pH 7.5
GP8	Marree Formation: gibber plain (Mumpie Land System)	Gibber gravel surface overlying red brown gravely light clay. Auger refusal at 0.4 m due to stone.	Gibber surface with light brown soil exposures comprising light brown hardsetting clay (7.5YR6/4). pH 7.4	Surface scraping to 0.4 m: red brown light clay with high gravel component (5YR6/4). pH 7.4
GP9	Blanchewater Formation: gibber plain (Mumpie Land System)	Gravelly sandy loam with gibber. Auger refusal at 0.3 m due to stone.	Gibber surface with light brown soil exposures comprising light brown hardsetting clay (7.5YR6/3). pH 7.8	N/A
GP10	Blanchewater Formation: gibber rises (Mumpie Land System)	Gibber gravel surface with intermittent soil exposures. Augering not possible due to stone content.	Gibber surface with surface soil exposures comprising light brown hardsetting clay (5YR6/4). pH 7.7	N/A
GP11	Quaternary alluvium (Coryaninna Land System)	Grey brown, cracking silty clay overlying grey silty clay. Material from exposure in stream channel.	100 mm: light grey cracking silty clay with some organic material and minor gravel (75YR6/4). pH 7.4	0.1–0.8 m: grey brown cracking clay (5YR6/2). pH 6.6

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
GP12	Blanchewater Formation: gibber rises (Mumpie Land System)	Gibber gravel surface with intermittent soil exposures. Augering not possible due to stone content.	Gibber surface with soil exposures comprising light brown hardsetting clay (5YR6/4). pH 7.2	N/A
GP13	Quaternary alluvium (Cooryaninna Land System)	Brown loamy sand. Auger terminated at 0.4m due to hole collapse.	150 mm: light brown loamy sand, hardsetting (7.5YR6/4). pH 7.2	0.15–0.4 m: light grey loamy sand, minimal gravel (5YR6/4). pH 7.0
GP14	Quaternary outwash plains (Wirringina Land System)	Light brown loamy sand overlying red brown sandy clay. Auger to 0.8m.	200 mm: light brown loamy sand, hardsetting (2.5YR5/6). pH 7.1	0.2–0.8 m: red brown sandy clay (2.5YR4/4). pH 7.5
GP15	Pooraka Formation (Mumpie Land System)	Red brown loamy clay with significant gravel overlying gravely loamy clay. Auger refusal at 0.4 m due to stone.	100 mm: red brown loamy clay with significant gravel (5YR5/4). pH 7.8	0.1–0.4 m: loamy clay with significant gravel (2.5YR5/4). pH 8.1
GP16	Quaternary sand ridges: Simpson Sand (Blanche or Collina Land System)	Aeolian brown/white sand. Augering not possible due to hole collapse and sandstorm.	Light brown white sand surface, loose (10YR8/2). pH 8.6	N/A
GP17	Quaternary sand ridges: Simpson Sand (Blanche Land System)	Aeolian brown/white sand. Augering not possible due to hole collapse and sandstorm.	Light brown white sand surface, loose (10YR7/3). pH 7.5	N/A
GP18	Quaternary sand ridges and depressions: Simpson Sand (Collina Land System)	Loamy fine/medium sand overlying fine light brown clayey sand. Auger refusal at 0.3 m due to hardpan. Note: Special additional sampling due to presence of dark mineral on surface.	50 mm: Light brown fine loamy sand, hardsetting (10YR8/3). pH 8.0	0.05–0.3 m: light brown clayey sand (7.5YR7/3). pH 8.6
GP19	Quaternary sand ridges and depressions: Simpson Sand (Hope Land System)	Loamy fine red/yellow sand overlying brown medium sand. Auger terminated at 0.8 m due to hole collapse.	200 mm: loamy red/yellow sand; moderately hardsetting, some organics (7.5YR6/6). pH 8.2	0.2–0.8 m: brown medium sand (7.5YR6/6). pH 7.6
GP20	Quaternary sand ridges and depressions: Simpson Sand (Hope Land System)	Loamy fine red/yellow sand overlying brown medium sand. Material from exposure.	100 mm: Loamy fine sand, hardsetting (7.5YR6/4). pH 7.5	0.1–0.8 m: light brown clayey sand (7.5YR6/4). pH 7.6
GP21	Yandruwantha Sand: fluvial sands (Cooper Land System)	Light brown loamy clay overlying grey brown sandy clay. Auger refusal at 0.4 m due to hardpan.	150 mm: Light brown loamy clay, hardsetting; significant organic material (10YR6/2). pH 7.4	0.15–0.4 m: grey brown sandy clay, moderately stiff (10YR5/3). pH 8.6
GP22	Quaternary sand ridges and depressions: Simpson Sand (Hope Land System)	Light grey brown loamy sand overlying light brown clayey sand. Material from exposure.	50 mm: Light brown fine loamy sand, hardsetting (10YR7/3). pH 8.0	0.05–0.3 m: light brown clayey sand (10YR7/3). pH 8.5
Southern infrastructure corridor (refer Figure I1.2 for locations)				
1	Quaternary sand sheets and sief dunes*	Deep red sand overlying red clay loam, sandy with very few fine calcrete gravel fragments. Investigation depth terminated at 1.65 m.	300 mm: red (2.5YR4/6) sand with many fine roots. pH 9.4	0.3–1.05 m: red (10R4/6) sand. pH 9.0 1.05–1.65 m: red (2.5YR4/8) clay loam, sandy with very few fine calcrete gravel fragments. pH 9.8
2	Quaternary sand sheets and sief dunes	Brown sand over clay with some calcrete gravel. Investigation depth terminated at 1.55 m.	250 mm: dark reddish-brown (5YR3/4) clayey sand with abundant coarse roots. pH 9.1	0.25–0.7 m: dark red (2.5YR3/6) light clay with some calcrete gravel. pH 8.7 0.7–1.55 m: yellowish red (5YR4/6) medium clay with some calcrete gravel. pH 9.4

* A series of elongated narrow dunes oriented parallel to each other in the direction of the prevailing wind.

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
3	Quaternary sand sheets and sief dunes	Red fine to medium grained sand. Investigation depth terminated at 2.6 m.	2600 mm: red (2.5YR4/6) sand with some fine roots. pH 8.9	0.0–2.6 m: red (2.5YR4/6) sand. pH 9.0
4	Salt lakes and deposits	Shallow sand and clay overlying calcareous sandstone gravel. Investigation depth terminated at 0.75 m due to high resistance.	100 mm: yellowish red (5YR4/6) loamy sand with some fine calcareous sandstone fragments and many fine roots. pH 9.2	0.1–0.5 m: yellowish red (5YR4/6) sandy clay loam. pH 8.5 0.5–0.75 m: greyish-brown (10YR5/2) loamy sand with abundant calcareous sandstone fragments.
5	Quaternary fluvial† sands and gravels	Shallow sand and clay overlying calcareous sandstone gravel. Investigation depth terminated at 1.8 m.	350 mm: yellowish red (5YR4/6) sandy loam with few very fine roots. pH 10.5	0.35–1.4 m: red (2.5YR4/6) clay loam, sandy with few calcrete gravel fragments. pH 9.5 1.4–1.8 m: red (2.5YR4/6) sandy clay loam with many calcareous sandstone cobbles.
6	Quaternary fluvial sands and gravels	Shallow sand and clay overlying calcareous sandstone gravel. Investigation depth terminated at 1.8 m.	400 mm: dark red (2.5YR3/6) loamy sand with few medium roots. pH 9.5	0.4–0.8 m: red (2.5YR4/8) clayey sand with some sandstone gravel. pH 9.6 0.8–1.8 m: reddish brown (5YR4/4) clay loam, sandy with many sandstone fragments.
7	Quaternary fluvial sands and gravels	Sand and clay overlying calcrete gravel. Investigation depth terminated at 1.7 m.	450 mm: dark red (2.5YR3/6) fine sand with few medium roots. pH 9.3	0.45–1.2 m: red (2.5YR4/6) clayey sand with some calcrete gravel. pH 9.0 1.2–1.7 m: yellowish red (5YR4/6) clay loam, sandy with some calcrete gravel.
8	Quaternary fluvial sands and gravels	Sand and clay overlying calcrete gravel. Investigation depth terminated at 1.7 m.	100 mm: dark red (2.5YR3/6) fine loamy sand with few very fine roots. pH 8.4	0.1–0.6 m: red (2.5YR4/8) moderately plastic light medium clay with some calcrete gravel. pH 9.1 0.6–1.7: red (2.5YR4/6) light clay with some calcrete gravel. pH 7.9
9	Quaternary sand sheets and sief dunes	Sand and clayey sand with some calcrete gravel. Investigation depth terminated at 1.8 m.	500 mm: dark red (2.5YR3/6) fine sand with some coarse roots. pH 8.6	0.5–1.8 m: red (2.5YR4/6) clayey sand with some calcrete gravel. pH 8.9
10	Quaternary sand sheets and sief dunes	Sandy soils with some calcrete gravel. Investigation depth terminated at 1.9 m.	350 mm: dark red (2.5YR3/6) fine to coarse sand with very few fine to medium calcrete gravel fragments and coarse roots. pH 9.6	0.35–1.0 m: dusky red (10R3/4) sandy loam with few calcrete gravel fragments. pH 9.3 1.0–1.9 m: red (2.5YR3/6) loamy sand with very few fine to medium calcrete gravel fragments. pH 9.3
11	Quaternary sand sheets and sief dunes	Sand overlying clayey sand with some calcrete gravel. Investigation depth terminated at 1.75 m.	350 mm: dark red (2.5YR3/6) fine sand with very fine roots. pH 8.6	0.35–1.0 m: red (2.5YR4/6) clayey sand with very few medium calcrete gravel fragments. pH 8.4 1.0–1.75 m: dark red (2.5YR3/6) clayey sand with few medium calcrete gravel fragments. pH 9.3
12	Quaternary fluvial sands and gravels	Sand overlying clayey sand and sandy clay loam with calcrete gravel. Investigation depth terminated at 2.0 m.	500 mm: red (2.5YR4/6) sand with fine roots. pH 8.9	0.5–1.6 m: dusky red (10R3/4) clayey sand. pH 9.0 1.6–2.0 m: red (2.5YR4/6) sandy clay loam with coarse calcrete gravel. pH 8.7

† Sediments transported and deposited by running water.

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
13	Quaternary sand sheets and sief dunes	Sand overlying loamy sand. Investigation depth terminated at 2.0 m.	1600 mm: dark red (10R3/6) fine sand with fine roots. pH 8.5–8.7	1.6–2.0 m: dark reddish brown (2.5YR3/4) loamy sand with medium calcrete gravel fragments. pH 9.1
14	Quaternary sand sheets and sief dunes	Sand overlying loamy sand. Investigation depth terminated at 1.95 m.	1100 mm: dark red (10R3/6) sand with coarse roots. pH 8.4	1.1–1.95 m: red (2.5YR4/6) loamy sand with very few medium calcrete gravel fragments. pH 8.4–8.5
15	Quaternary sand sheets and sief dunes	Sand overlying loamy sand and sandy clay loam. Investigation depth terminated at 1.7 m.	800 mm: dark red (2.5YR3/6) sand with coarse roots. pH 8.3	0.8–1.2 m: red (2.5YR4/8) loamy sand with very few fine calcrete gravel fragments. pH 9.3 1.2–1.7 m: yellowish red (5YR5/6) sandy clay loam with few medium calcrete gravel fragments. pH 8.7
16	Pooraka Formation	Loamy sand overlying calcareous sandstone gravel. Investigation depth terminated at 1.4 m due to high resistance.	150 mm: red (2.5YR4/6) loamy sand with many coarse sandstone fragments and fine roots. pH 9.5–9.6	0.15–1.4 m: light grey (5YR7/1) limestone and calcareous sandstone gravel to 100 mm with fine to coarse sand.
17	Pooraka Formation	Sand overlying calcareous sandstone gravel. Investigation depth terminated at 1.2 m due to high resistance.	250 mm: dark red (2.5YR3/6) fine sand with medium roots. pH 8.8	0.25–1.2 m: pinkish grey (5YR6/2) limestone and calcareous sandstone gravel to 250 mm with fine to coarse sand.
18	Quaternary sand sheets and sief dunes	Loamy sand over clay loam, sandy with calcrete gravel. Investigation depth terminated at 1.8 m.	400 mm: dark red (2.5YR3/6) loamy sand with many coarse roots. pH 8.3	0.4–1.8 m: red (2.5YR4/8) clay loam, sandy with fine to medium calcrete gravel. pH 9.1
19	Pernatty Grit	Sand overlying clayey sand and loamy sand overlying limestone. Investigation depth terminated at 1.35 m due to high resistance.	600 mm: dark red (2.5YR3/6) fine sand with medium roots. pH 8.4–8.7	0.6–0.9 m: red (2.5YR4/8) clayey sand with very few fine limestone gravel fragments. pH 8.6 0.9–1.05 m: reddish brown (2.5YR5/4) loamy sand with medium limestone fragments. pH 8.9 1.05–1.35 m: light reddish brown (2.5YR6/3) medium strength limestone gravel fragments to 200 mm. pH 9.3
20	Quaternary sand sheets and sief dunes	Sand overlying loamy sand and clay loam, sandy with increasing limestone gravel content. Investigation depth terminated at 3.35 m.	600 mm: dark red (2.5YR3/6) fine sand with abundant medium roots. pH 9.4	0.6–1.5 m: red (2.5YR4/8) loamy sand with very few medium limestone gravel fragments. pH 9.4 1.5–3.35 m: red (2.5YR4/6) clay loam, sandy with many limestone gravel fragments to 60 mm. pH 9.7
21	Quaternary sand sheets and sief dunes	Dark red sand overlying red loamy sand, clayey sand and sandy loam. Investigation depth terminated at 2.3 m.	500 mm: dark red (2.5YR3/6) fine to coarse sand with abundant medium roots. pH 9.2	0.5–1.0 m: red (2.5YR4/6) loamy sand with very few fine calcrete gravel fragments. pH 9.3 1.0–1.4 m: red (2.5YR4/6) clayey sand with few fine calcrete gravel fragments. pH 9.7 1.4–2.3 m: red (2.5YR4/6) sandy loam with few fine calcrete gravel fragments. pH 8.7

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
22	Quaternary sand sheets and sief dunes	Red loamy sand over clayey sand over red sandy clay loam. Investigation depth terminated at 1.75 m.	550 mm: red (2.5YR4/6) loamy sand with abundant medium roots. pH 9.0	0.55–1.05 m: red (2.5YR5/6) clayey sand with very few fine calcrete gravel fragments. pH 9.1 1.05–1.75 m: red (2.5YR4/6) sandy clay loam with medium calcrete gravel fragments. pH 8.9
23	Quaternary sand sheets and sief dunes	Red sand over dark red loamy sand over reddish brown sandy clay loam. Investigation depth terminated at 2.9 m.	50 mm: red (2.5YR4/8) fine to coarse sand with abundant fine roots. pH 7.6	0.05–0.6 m: dark red (2.5YR3/6) loamy sand. pH 8.3 0.6–2.9 m: reddish brown (2.5YR4/4) sandy clay loam with medium calcrete gravel fragments. pH 8.8–9.0
24	Quaternary sand sheets and sief dunes	Red sand over red loamy sand and clayey sand and sandy clay loam. Test pit terminated at 1.7 m.	50 mm: red (2.5YR4/8) fine to coarse sand. pH 8.1	0.05–0.6 m: red (2.5YR4/6) loamy sand with very few fine calcrete gravel fragments and abundant medium roots. pH 9.6 0.6–1.0: red (2.5YR4/8) clayey sand with few calcrete gravel fragments. pH 8.1 1.0–1.7 m: red (2.5YR4/6) sandy clay loam with few calcrete gravel fragments. pH 8.8
25	Salt lakes and deposits	Red sand overlying red sandy loam overlying grey clay loam, sandy. Groundwater standing at 1.3 m. Investigation depth terminated at 1.5 m.	100 mm: red (2.5YR4/4) fine to coarse sand. pH 8.9	0.1–0.6 m: red (2.5YR4/6) sand with many medium roots. pH 8.3 0.6–1.2 m: red (2.5YR4/4) sandy loam. pH 7.5 1.2–1.5 m: grey (5YR6/1) clay loam, sandy. pH 7.1
26	Pernatty Grit	Dark red sandy clay loam overlying red heavy clay over reddish yellow sandy clay loam over red clay loam, sandy with increasing quartzitic sandstone. Investigation depth terminated at 1.65 m due to high resistance.	200 mm: dark red (2.5YR3/6) sandy clay loam with very few fine roots. pH 7.8	0.2–0.45 m: red (2.5YR4/6) very plastic heavy clay with few salt crystals. pH 8.3 0.45–1.4 m: reddish yellow (5YR6/6) sandy clay loam with salt crystals and very few fine quartzitic sandstone fragments. pH 7.9 1.4–1.65 m: red (2.5YR4/6) clay loam, sandy with salt crystals and many cobble sized quartzitic sandstone fragments.
27	Pernatty Grit	Red sandy loam overlying red medium heavy clay over light red clayey sand over red sandy clay loam with calcareous sandstone and quartzitic sandstone. Investigation depth terminated at 1.2 m due to high resistance.	100 mm: red (2.5YR4/8) sandy loam with very few fine roots. pH 6.9	0.1–0.5 m: red (2.5YR4/6) medium heavy clay with very few salt crystals. pH 6.7 0.5–0.8 m: light red (2.5YR6/8) clayey sand with salt crystals and very few fine calcareous sandstone fragments. pH 6.1 0.8–1.2 m: red (2.5YR5/6) sandy clay loam with salt crystals and abundant calcareous sandstone and quartzitic sandstone fragments. pH 6.6

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
28	Pernatty Grit	Reddish brown clayey sand over red medium heavy clay over yellowish red sandy clay loam overlying red clay loam, sandy with increasing quartzitic sandstone content. Investigation depth terminated at 1.3 m due to high resistance.	50 mm: reddish brown (2.5YR4/4) clayey sand with very few fine roots. pH 6.5	0.05–0.45 m: red (2.5YR4/6) medium heavy clay with few salt crystals. pH 6.3 0.45–0.9 m: yellowish red (5YR5/8) sandy clay loam with few salt crystals and very few quartzitic sandstone fragments. pH 7.4 0.9–1.3 m: red (2.5YR4/8) clay loam, sandy with salt crystals and many cobble sized quartzitic sandstone fragments. pH 7.4
29	Quaternary sand plains and sand dunes	Red sand and loamy sand overlying red and dark red sandy clay loam. Investigation depth terminated at 3.2 m.	250 mm: red (2.5YR4/6) sand with abundant medium roots. pH 7.8	0.25–0.5 m: red (10R4/6) loamy sand. pH 8.2 0.5–1.4 m: red (2.5YR4/6) loamy sand with medium calcrete gravel. pH 9.5 1.4–2.5 m: red (10R4/8) sandy clay loam with few calcrete gravel fragments. pH 9.6 2.5–3.2 m: dark red (2.5YR3/6) sandy clay loam with many quartzite and few calcrete gravel fragments. pH 8.7
30	Quaternary sand plains and sand dunes	Deep red sands. Investigation depth terminated at 2.35 m.	500 mm: red (10R4/6) sand with fine roots. pH 9.1	0.5–1.9 m: red (10R4/8) fine sand. pH 8.6 1.9–2.35 m: red (2.5YR5/8) sand with very few fine calcrete gravel fragments. pH 8.5
31	Quaternary sand plains and sand dunes	Deep red sands. Investigation depth terminated at 3.0 m.	650 mm: red (2.5YR5/8) sand with many medium roots. pH 7.5	0.65–2.5 m: red (2.5YR5/8) fine sand. pH 7.0–7.4 2.5–3.0 m: red (2.5YR5/6) fine sand with very slightly calcareous segregations. pH 7.7
32	Quaternary fluvial sands and gravels	Red clay loam, sandy over reddish brown light clay and sandy clay loam over light reddish brown sand. Investigation depth terminated at 2.8 m due to high resistance.	900 mm: red (2.5YR5/8) clay loam, sandy with few quartzitic sandstone fragments, salt crystals and fine roots. pH 7.2	0.9–1.2 m: reddish brown (2.5YR4/4) light clay with few salt crystals and quartzitic sandstone fragments to 60 mm. pH 6.6 1.2–1.6 m: reddish brown (2.5YR5/4) sandy clay loam with many salt crystals and few sandstone fragments. pH 6.3 1.6–2.8 m: light reddish brown (2.5YR6/3) sand with sandstone fragments to 100 mm. pH 5.3–6.4
33	Arcoona Quartzite/ white shaley sandstones	Reddish brown sandy clay loam overlying red clay loam, sandy with abundant high strength quartzitic sandstone to 300 mm. Investigation depth terminated at 1.3 m due to high resistance.	250 mm: reddish brown (2.5YR4/4) sandy clay loam with many medium roots and few quartzitic sandstone fragments. pH 8.8	0.25–1.3 m: red (2.5YR4/6) clay loam, sandy with abundant high strength quartzitic sandstone to 300 mm. pH 8.9

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
34	Arcoona Quartzite/ white shaley sandstones	Red light medium clay and heavy clay with few quartzitic sandstone fragments overlying red medium heavy and medium clay with quartzitic sandstone and sandstone fragments to 200 mm. Investigation depth terminated at 1.9 m due to high resistance.	200 mm red: (2.5YR4/6) moderately plastic light medium clay with few quartzitic sandstone fragments and very fine roots. pH 6.8	0.2–0.8 m: red (2.5YR4/6) very plastic heavy clay with few salt crystals and quartzitic sandstone fragments. pH 7.2 0.8–1.4 m: red (2.5YR5/6) very plastic medium heavy clay with few salt crystals and quartzitic sandstone fragments. pH 7.6 1.4–1.9 m: red (2.5YR5/6) moderately plastic medium clay with strong sandstone fragments to 200 mm and few medium gypsum fragments. pH 7.8
35	Arcoona Quartzite/ white shaley sandstones	Red light medium clay and medium heavy clay overlying light reddish grey clayey sand with very abundant calcareous sandstone fragments. Investigation depth terminated at 1.1 m due to high resistance.	50 mm red: (2.5YR4/6) moderately plastic light medium clay with few quartzitic sandstone fragments and very fine roots. pH 8.7	0.05–0.7 m: red (2.5YR4/6) very plastic medium heavy clay with very few salt crystals. pH 7.4 0.7–1.1 m: light reddish grey (2.5YR7/1) clayey sand with very abundant calcareous sandstone fragments to 200 mm. pH 8.3
36	Arcoona Quartzite/ white shaley sandstones	Reddish brown light medium clay overlying red heavy clay. Investigation depth terminated at 1.5 m due to high resistance.	100 mm: reddish brown (2.5YR4/4) light medium clay with many fine roots and few quartzitic sandstone fragments to 200 mm. pH 7.2	0.1–0.6 m: red (2.5YR4/6) very plastic heavy clay with very few salt crystals, calcareous segregations and quartzitic sandstone fragments to 60 mm. pH 7.7 0.6–1.5 m: red (2.5YR4/6) very plastic heavy clay with very few salt crystals, calcareous segregations. pH 8.0
RC 1	Arcoona Quartzite/ white shaley sandstones	Red light clay over and medium heavy clay, which overlies medium clay with increasing quartzitic sandstone content with depth. Investigation depth terminated at 1.7 m due to high resistance.	200 mm: red (2.5YR4/6) light clay with many fine roots. pH 8.2	0.2–1.45 m: red (2.5YR4/8) very plastic medium heavy clay with very few salt crystals and calcareous segregations. pH 7.7 1.45–1.7 m: red (2.5YR4/8) moderately plastic medium clay with abundant strong quartzitic sandstone fragments to 300 mm. pH 8.3
37	Arcoona Quartzite/ white shaley sandstones	Reddish brown clay loam, sandy over reddish brown heavy clay over red light medium clay and sandy clay loam with increasing limestone. Investigation depth terminated at 1.8 m due to high resistance.	150 mm: reddish brown (2.5YR4/4) clay loam, sandy with very fine roots. pH 8.4	0.15–0.75 m: reddish brown (2.5YR4/4) heavy clay with very few salt crystals and coarse quartzitic sandstone fragments. pH 7.9 0.75–1.3 m: red (2.5YR5/8) light medium clay with many limestone fragments to 200 mm. pH 7.9 1.3–1.8 m: red (2.5YR5/8) sandy clay loam with some limestone gravel. pH 8.0

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
38	Marree subgroup (Bulldog Shale)	Red clay loam sandy over reddish brown medium heavy clay over light red light clay and red clayey sand with kaolinitic mudstone. Investigation depth terminated at 1.75 m due to high resistance.	50 mm: red (2.5YR4/6) clay loam, sandy with few very fine roots and quartzitic sandstone fragments. pH 7.8	0.05–0.75 m: reddish brown (2.5YR4/4) very plastic medium heavy clay with very few salt crystals and quartzitic sandstone fragments. pH 7.9 0.75–1.25 m: light red (2.5YR6/8) light clay with kaolinitic mudstone fragments to 60 mm. pH 8.4 1.25–1.75 m: red (2.5YR5/6) clayey sand with weak kaolinitic mudstone fragments to 60 mm. pH 8.8
39	Arcoona Quartzite/ white shaley sandstones	Dark red silty clay loam over red heavy and medium heavy clay, which overlies light clay with abundant quartzitic sandstone fragments. Investigation depth terminated at 1.5 m due to high resistance.	50 mm: dark red (2.5YR3/6) silty clay loam with fine roots and very few quartzitic sandstone fragments. pH 7.6	0.05–0.75 m: red (2.5YR4/6) very plastic heavy clay with very few salt crystals and quartzitic sandstone fragments. pH 7.7 0.75–1.1 m: red (2.5YR5/6) very plastic medium heavy clay with salt crystals and few quartzitic sandstone fragments. pH 7.8 1.1–1.5 m: red (2.5YR5/6) slightly plastic light clay with abundant quartzitic sandstone fragments to 200 mm. pH 7.8
40	Quaternary sand plains and sand dunes	Red sand over reddish yellow sand with very few, fine calcareous segregations. Investigation depth terminated at 3.1 m due to repeated collapse of test pit.	1900 mm: red (2.5YR4/8) sand with very fine roots. pH 8.1–8.2	1.9–3.1 m: reddish yellow (5YR6/6) sand with very few, fine segregations. pH 9.2
41	Quaternary sand plains and sand dunes	Reddish brown sandy loam over dark reddish grey light medium clay with micaceous mudstone increasing with depth. Investigation depth terminated at 1.5 m due to high resistance.	400 mm: reddish brown (5YR4/3) sandy loam with fine roots and few quartzitic sandstone fragments to 60 mm. pH 9.4	0.4–0.85 m: dark reddish grey (5YR4/2) light medium clay with many micaceous mudstone fragments to 60 mm and very few quartzitic sandstone fragments, few salt crystals. pH 7.7 0.85–1.5 m: grey (5YR5/1) medium strength micaceous mudstone. pH 8.1
RC 9A	Arcoona Quartzite/ white shaley sandstones	Reddish brown medium clay overlying red heavy and light medium clay, overlying red light clay with quartzitic sandstone and sandstone gravel increasing with depth. Investigation depth terminated at 1.75 m due to high resistance.	100 mm: reddish brown (2.5YR4/4) moderately plastic medium clay. pH 8.3	0.1–0.75 m: red (2.5YR4/6) very plastic heavy clay. pH 7.7 0.75–1.65 m: red (2.5YR5/6) moderately plastic light medium clay with moderately calcareous silt segregations and coarse sandstone gravel fragments. pH 7.9 1.65–1.75 m: red (2.5YR5/6) slightly plastic light clay with moderately calcareous silt segregations and quartzitic sandstone and sandstone fragments to 150 mm. pH 7.7

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
42	Arcoona Quartzite	Red medium clay overlying red medium heavy clay with many quartzitic sandstone fragments. Investigation depth terminated at 2.25 m due to high resistance.	150 mm: red (2.5YR4/6) moderately plastic medium clay. pH 7.2	0.15–1.5 m: red (2.5YR4/6) moderately plastic medium clay. pH 7.4 1.5–2.25 m: red (2.5YR4/8) moderately plastic medium heavy clay with many quartzitic sandstone fragments to 200 mm. pH 7.8
RC 10	Arcoona Quartzite	Reddish brown silty clay loam over reddish brown medium heavy and heavy clay, overlying red light medium clay with abundant quartzitic sandstone fragments. Investigation depth terminated at 2.05 m due to high resistance.	100 mm: reddish brown (2.5YR4/4) slightly plastic silty clay loam with fine roots. pH 9.2	0.1–0.8 m: reddish brown (2.5YR4/4) very plastic medium heavy clay. pH 8.5 0.8–1.5 m: reddish brown (2.5YR4/4) very plastic heavy clay. pH 9.1 1.5–2.05 m: red (2.5YR4/6) moderately plastic light medium clay with abundant gypsum, quartzite and quartzitic sandstone fragments to 200 mm. pH 8.0
RC 11	Arcoona Quartzite	Red medium clay over heavy and medium clay, overlying light reddish grey quartzitic sandstone. Investigation depth terminated at 2.1 m due to high resistance.	100 mm: red (2.5YR4/6) moderately plastic medium clay with fine roots. pH 7.6	0.1–0.6 m: red (2.5YR5/6) very plastic heavy clay. pH 7.5 0.6–1.9 m: red (2.5YR4/6) moderately plastic medium clay. pH 8.0 1.9–2.1 m: light reddish grey (2.5YR7/1) quartzitic sandstone fragments to 100 mm. pH 7.9
RC 12	Arcoona Quartzite	Red medium clay over medium heavy clay, overlying light medium clay with increasing quartzitic sandstone gravel. Investigation depth terminated at 2.15 m due to high resistance.	50 mm: red (2.5YR4/6) moderately plastic medium clay with few very fine roots and quartzitic sandstone fragments. pH 6.8	0.05–0.75 m: red (2.5YR5/6) very plastic medium heavy clay. pH 7.4 0.75–1.9 m: red (2.5YR4/8) very plastic medium heavy clay with few quartzitic sandstone fragments to 150 mm. pH 7.7 1.9–2.15 m: red (2.5YR4/8) moderately plastic light medium clayey abundant quartzitic sandstone fragments to 200 mm. pH 7.5
RC 13	Arcoona Quartzite	Red light medium clay over heavy clay, overlying red light clay with quartzite gravel content increasing with depth. Investigation depth terminated at 2.0 m due to high resistance.	100 mm: red (2.5YR4/6) light medium clay with few very few fine roots and very few coarse quartzitic sandstone fragments. pH 6.9	0.1–0.85 m: red (2.5YR4/6) very plastic heavy clay. pH 8.0 0.85–2.0 m: red (2.5YR5/8) light clay with abundant quartzite fragments to 400 mm pH 7.6–7.8
RC 14	Quaternary sand plains: sand dunes with clay pans	Dark reddish brown sand over red fine-grained sand overlying red loamy sand. Investigation depth terminated at 3.1 m due to repeated collapse of test pit.	2500 mm: dark reddish brown (2.5YR3/4) sand over red (2.5YR4/6) fine-grained sand with fine roots. pH 7.9–8.7	2.5–3.1 m: red (2.5YR5/6) loamy sand. pH 8.3

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
RC 15	Arcoona Quartzite/ Eyre Formation	Red sandy clay loam overlying red medium and light medium clay, which overlies weak red sandy loam. Investigation depth terminated at 3.5 m.	50 mm: red (2.5YR4/6) sandy clay loam with few very fine roots. pH 8.5	0.05–0.5 m: red (2.5YR4/6) medium clay. pH 8.5 0.5–1.15 m: red (2.5YR5/6) light medium clay with some medium calcrete gravel fragments and very few quartzitic sandstone fragments. pH 8.6 1.15–3.5 m: weak red (10R5/4) sandy loam with many siltstone and quartzitic sandstone fragments to 100 mm. pH 8.8–9.1
48	Quaternary sand plains: sand dunes with clay pans	Red sand overlying reddish brown light clay overlying light reddish brown clayey sand. Investigation depth terminated at 3.5 m.	450 mm: red (2.5YR5/6) sand with medium roots. pH 9.0	0.45–1.5 m: reddish brown (2.5YR5/3) light clay with few moderately calcareous segregations and very few fine calcrete gravel fragments. pH 9.9 1.5–3.0 m: light reddish brown (2.5YR6/3) light clay with very few fine calcrete gravel fragments. pH 8.5 3.0–3.5 m: light reddish brown (2.5YR6/4) clayey sand. pH 8.6
RC M3	Arcoona Quartzite	Dark reddish grey clay loam, sandy overlying weak red medium clay overlying pale red clayey sand with very abundant strong quartzitic sandstone fragments to 400 mm. Investigation depth terminated at 0.5 m due to high resistance.	100 mm: dark reddish grey (5YR4/2) clay loam, sandy with fine roots. pH 8.9	0.1–0.45 m: weak red (2.5YR4/2) medium clay. pH 8.5 0.45–0.5 m: pale red (2.5YR6/2) clayey sand with very abundant high strength quartzitic sandstone to 400 mm. pH 9.2
RC 16	Marree subgroup (Bulldog Shale)	Dark reddish brown clayey sand overlying red medium heavy clay over red medium clay over light reddish brown sandy clay loam with increasing quartzitic sandstone and siltstone fragments. Investigation depth terminated at 2.35 m due to high resistance.	50 mm: dark reddish brown (2.5YR3/4) clayey sand with very fine roots and very few coarse quartzitic sandstone fragments. pH 8.2	0.05–0.7 m: red (2.5YR4/6) medium heavy clay with very few quartzitic sandstone fragments to 200 mm. pH 8.0 0.7–1.4 m: red (2.5YR5/6) medium clay with few quartzitic sandstone fragments to 300 mm. pH 7.8 1.4–2.35 m: light reddish brown (2.5YR6/3) sandy clay loam with coarse gypsum and quartzite and quartzitic sandstone fragments to 300 mm, few siltstone fragments to 100 mm. pH 7.5

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
RC 17	Marree subgroup (Bulldog Shale)	Reddish brown sandy loam over reddish brown medium heavy clay overlying red medium and light clays, overlying silty clay loam with kaolinitic mudstone and quartzitic sandstone increasing with depth. Investigation depth terminated at 3.25 m due to high resistance.	100 mm: reddish brown (2.5YR4/4) sandy loam with fine roots and very few quartzitic sandstone fragments. pH 7.8	0.1–0.6 m: reddish brown (2.5YR4/4) medium heavy clay with very few quartzitic sandstone fragments. pH 7.8 0.6–1.4 m: red (2.5YR5/6) medium clay with many moderately calcareous segregations and few quartzitic sandstone fragments. pH 7.9 1.4–2.5 m: red (2.5YR4/8) light clay with abundant kaolinitic mudstone fragments to 300 mm and few quartzitic sandstone fragments to 400 mm. pH 7.5 2.5–3.25 m: pale red (2.5YR7/2) silty clay loam with many kaolinitic mudstone fragments to 300 mm and few quartzitic sandstone fragments to 400 mm. pH 6.6
RC 18	Andamooka Limestone	Red sandy loam overlying red light clay and medium clay, over red light clay with increasing quartzite, limestone and siltstone gravel content. Investigation depth terminated at 2.7 m due to high resistance.	200 mm: red (2.5YR4/6) sandy loam with coarse roots. pH 8.3	0.2–0.65 m: red (2.5YR5/6) light clay with moderately calcareous segregations. pH 8.8 0.65–1.65 m: red (2.5YR4/6) medium clay with few moderately calcareous segregations and very few calcrete gravel fragments. pH 8.8–9.0 1.65–2.7 m: red (2.5YR4/6) light clay with quartzite, limestone and siltstone gravel to 300 mm. pH 8.4
RC 19	Quaternary sand plains: sand dunes with clay pans	Deep red uniform sands. Investigation depth terminated at 3.6 m.	2500 mm: red (10R4/8) sand with coarse roots. pH 7.8–8.4	2.5–3.6 m: red (10R5/8) sand. pH 7.4–7.8
53	Andamooka Limestone	Reddish brown sand overlying white limestone. Investigation depth terminated at 1.1 m due to high resistance.	450 mm: reddish brown (2.5YR4/4) sand with many medium roots. pH 8.9	0.45–0.8 m: white (2.5YR8/1) moderately strong limestone fragments to 300 mm. pH 9.4 0.8–1.1 m: white (2.5YR8/1) strong limestone fragments to 500 mm.
RC 20	Quaternary sand plains: sand dunes with clay pans	Red sand overlying red clayey sand and red loamy sand with increasing calcrete gravel content. Investigation depth terminated at 3.5 m.	350 mm: red (2.5YR4/6) sand with many fine roots. pH 8.6	0.35–1.1 m: red (2.5YR4/8) clayey sand. pH 9.0 1.1–3.0 m: red (2.5YR4/6) clayey sand with few fine calcrete gravel. pH 9.5–9.6 3.0–3.5 m: red (2.5YR5/6) loamy sand with few fine calcrete gravel. pH 8.9

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
RC 21	Andamooka Limestone	Red loamy sand overlying red light clay with increasing quartzitic limestone gravel content. Investigation depth terminated at 2.65 m due to high resistance.	200 mm: red (10R4/6) loamy sand with few fine roots. pH 9.4	0.2–1.0 m: red (2.5YR4/6) light clay. pH 8.8 1.0–2.4 m: red (2.5YR4/8) light clay with few medium calcrete gravel fragments. pH 9.4 2.4–2.65 m: red (2.5YR4/6) light clay with many cobble sized quartzitic limestone fragments and coarse calcrete gravel. pH 8.8
56	Andamooka Limestone	Red sand overlying red medium clay over dark red light clay with increasing gypsum gravel content. Investigation depth terminated at 1.6 m due to high resistance.	150 mm: red (10R4/8) sand. pH 9.3	0.15–1.1 m: red (2.5YR4/8) moderately plastic medium clay. pH 10.8 1.1–1.55 m: dark red (2.5YR3/6) light clay with coarse gypsum gravel. pH 9.1 1.55–1.6 m: abundant moderately strong gypsum gravel. pH 8.8
57	Quaternary sand plains: sand dunes with clay pans	Red clayey sand overlying reddish brown silty clay loam overlying red sandy clay loam over light grey limestone. Investigation depth terminated at 0.9 m due to high resistance.	100 mm: red (2.5YR4/6) clayey sand with fine roots. pH 7.8	0.1–0.45 m: reddish brown (2.5YR4/4) silty clay loam with few salt crystals. pH 7.9 0.45–0.85 m: red (2.5YR4/8) sandy clay loam with few salt crystals and coarse limestone gravel fragments. pH 8.6 0.85–0.9 m: light grey (10R7/1) limestone gravel to 300 mm.
58	Quaternary sand plains: sand dunes with clay pans	Red sand overlying reddish brown clayey sand and red sand and sandy loam. Investigation depth terminated at 3.0 m.	350 mm: red (2.5YR4/6) sand with medium roots. pH 8.8	0.35–1.35 m: reddish brown (2.5YR4/4) clayey sand with very few slightly calcareous segregations and salt crystals. pH 7.8 1.35–2.5 m: red (2.5YR4/8) sand with very few calcareous segregations. pH 8.6 2.5–3.0 m: red (2.5YR4/8) sandy loam with very few salt crystals. pH 7.3
59	Woocalla Dolomite	Reddish brown clay loam, sandy over red medium heavy and medium clay with dolomite gravel content increasing with depth. Investigation depth terminated at 0.8 m due to high resistance.	50 mm: reddish brown (5YR4/4) clay loam, sandy with fine roots and dolomite gravel. pH 7.8	0.05–0.3 m: red (2.5YR4/8) very plastic medium heavy clay with fine calcrete gravel and many dolomitic siltstone gravel fragments. pH 8.1 0.3–0.8 m: red (2.5YR4/8) moderately plastic medium clay with coarse calcrete gravel and abundant high strength grey dolomitic siltstone. pH 7.6

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
62	Pooraka Formation	Reddish brown light over medium heavy clay, overlying red medium clay with increasing quartzitic sandstone fragments with depth. Investigation depth terminated at 2.1 m due to high resistance.	50 mm: reddish brown (2.5YR4/4) slightly plastic light clay with very fine roots. pH 7.8	0.05–0.7 m: reddish brown (2.5YR4/4) very plastic medium heavy clay. pH 8.0 0.7–1.7 m: red (2.5YR4/6) moderately plastic medium clay with very few quartzitic sandstone fragments to 20 mm and few moderately calcareous segregations. pH 8.1 1.7–2.1 m: red (2.5YR4/6) moderately plastic medium clay with abundant quartzitic sandstone fragments to 300 mm.
63	Quaternary sand sheets and sief dunes	Red sand over red loamy sand, overlying red clayey sand with gypsum. Investigation depth terminated at 3.25 m due to high resistance.	100 mm: red (2.5YR5/8) fine to coarse sand with coarse roots. pH 7.8	0.1–1.3 m: red (2.5YR4/6) sand. pH 7.8 1.3–2.8 m: red (2.5YR4/6) loamy sand with few slightly calcareous segregations, salt crystals and gypsum fragments. pH 7.2–7.6 2.8–3.25 m: red (2.5YR4/8) clayey sand with gypsum fragments and salt crystals.
64	Pooraka Formation	Dark red loamy sand overlying yellowish red medium clay with moderately to highly calcareous segregations. Investigation depth terminated at 1.4 m due to high resistance.	450 mm: dark red (2.5YR3/6) loamy sand with many very fine roots. pH 8.6	0.45–0.9 m: yellowish red (5YR4/6) moderately plastic medium clay with pale moderately calcareous segregations. pH 9.4 0.9–1.4 m: yellowish red (5YR4/6) moderately plastic medium clay with pale highly calcareous segregations. pH 9.7
65	Quaternary sand sheets and sief dunes	Reddish brown clayey sand over red light medium clay over yellowish red medium clay. Investigation depth terminated at 1.7 m due to high resistance.	300 mm: reddish brown (2.5YR4/6) clayey sand with many fine roots. pH 8.2	0.3–0.9 m: red (2.5YR4/6) moderately plastic light medium clay with very few slightly calcareous segregations. pH 8.1 0.9–1.7 m: red (2.5YR4/6) moderately plastic medium clay with moderately calcareous segregations and very fine calcrete gravel fragments. pH 7.8
67	Quaternary sand sheets and sief dunes	Dusky red sand overlying reddish brown light and medium clay with few calcrete gravel fragments. Investigation depth terminated at 1.5 m due to high resistance.	350 mm: dusky red (10R3/4) sand with many fine roots. pH 7.4	0.35–1.0 m: reddish brown (2.5YR4/4) light clay with very few fine calcrete gravel fragments. pH 7.9 1.0–1.5 m: reddish brown (2.5YR4/4) medium clay with few fine to medium calcrete gravel fragments. pH 8.1
68	Pooraka Formation	Reddish brown clay loam, sandy overlying red medium heavy clay over red medium clay with increasing quartzitic sandstone fragments with depth. Investigation depth terminated at 1.4 m due to high resistance.	100 mm: reddish brown (2.5YR4/4) clay loam, sandy with many fine roots. pH 9.6	0.1–0.65 m: red (2.5YR4/6) very plastic medium heavy clay with very few coarse quartzitic sandstone fragments. pH 8.3 0.65–1.4 m: red (2.5YR4/6) moderately plastic medium clay with many strong quartzitic sandstone fragments to 200 mm. pH 8.3–8.4

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
69	Quaternary sand sheets and sief dunes	Dark reddish brown and red sand overlying red sandy clay loam and light medium clay, which overlies reddish brown medium heavy clay. Investigation depth terminated at 3.05 m.	900 mm: dark reddish brown (2.5YR3/4) sand with many very fine roots. pH 8.6–8.7	0.9–1.95 m: red (2.5YR4/6) sand with few slightly calcareous segregations. pH 9.7 1.95–2.5 m: red (2.5YR4/6) sandy clay loam with very few fine calcrete gravel fragments. pH 9.0 2.5–2.8 m: red (2.5YR4/8) moderately plastic light medium clay with very few fine calcrete gravel fragments. pH 8.5 2.8–3.05 m: reddish brown (2.5YR4/4) very plastic medium heavy clay with very few fine calcrete gravel fragments. pH 9.0
70	Quaternary fluvial sands and gravels	Reddish brown light and medium heavy clay over reddish brown medium clay and clayey sand with limestone, quartzite and calcareous sandstone fragments increasing with depth. Investigation depth terminated at 1.9 m due to high resistance.	100 mm: reddish brown (2.5YR4/3) moderately plastic light clay with many very fine roots. pH 8.7	0.1–0.6 m: reddish brown (2.5YR4/4) very plastic medium heavy clay. pH 8.9 0.6–1.4 m: reddish brown (2.5YR4/4) moderately plastic medium clay with quartzitic sandstone fragments to 20 mm, and few calcrete fragments to 6 mm and calcareous sandstone fragments to 60 mm. pH 8.9 1.4–1.9 m: reddish brown (2.5YR4/3) clayey sand with many quartzitic sandstone and quartzite fragments to 70 mm, abundant limestone fragments to 60 mm, and very few slate fragments to 40 mm.
71	Salt lakes and deposits	Reddish brown light and medium heavy clay overlying dark reddish brown medium clay and reddish brown light clay, which then overlies brown clay loam, sandy with increasing gypsum fragments. Investigation depth terminated at 3.0 m.	50 mm: reddish brown (5YR4/3) light clay with few very fine roots and calcareous segregations. pH 7.3	0.05–0.3 m: reddish brown (5YR4/3) moderately plastic medium heavy clay with few salt crystals. pH 7.0 0.3–1.8 m: dark reddish brown (2.5YR3/4 moderately plastic medium clay with few salt crystals. pH 8.0–8.1 1.8–2.6 m: reddish brown (2.5YR5/3) light clay with coarse gypsum fragments and salt crystals. pH 8.3 2.6–3.0 m: brown (7.5YR5/3) clay loam, sandy with medium gypsum fragments and salt crystals. pH 8.0
72	Pooraka Formation	Dark reddish brown loamy sand over light reddish brown light medium clay over red heavy clay, overlying dark red clayey sand with many sandstone fragments. Investigation depth terminated at 2.8 m.	400 mm: dark reddish brown (2.5YR3/4) loamy sand with many coarse roots. pH 10.1	0.4–1.1 m: light reddish brown (5YR6/4) moderately plastic light medium clay with medium calcrete gravel fragments. pH 9.5 1.1–1.7 m: red (10R4/8) very plastic heavy clay with few fine calcrete gravel fragments. pH 8.8 1.7–2.8 m: dark red (10R3/6) clayey sand with many weak sandstone fragments to 200 mm. pH 8.4

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
73	Quaternary fluvial sands and gravels	Dark red light and medium clay with few salt crystals overlying red light medium clay with few salt crystals and quartzite fragments to 200 mm. Investigation depth terminated at 3.0 m.	100 mm: dark red (2.5YR3/6) light clay. pH 9.3	0.1–1.2 m: dark red (2.5YR3/6) moderately plastic medium clay with few salt crystals. pH 7.5–8.3 1.2–2.6 m: red (2.5YR4/8) light medium clay with very few salt crystals. pH 8.3 2.6–3.0 m: red (2.5YR4/8) light medium clay with few salt crystals and quartzite fragments to 200 mm. pH 8.3
74	Pooraka Formation	Dark red light and medium clay overlying red light medium clay with increasing quartzite gravel content with depth. Investigation depth terminated at 2.4 m due to high resistance.	50 mm: dark red (2.5YR3/6) slightly plastic light clay with very few fine roots. pH 8.8	0.05–1.1 m: dark red (2.5YR3/6) moderately plastic medium clay with few salt crystals. pH 7.7–8.0 1.1–2.4 m: red (2.5YR4/6) moderately plastic light medium clay with abundant strong quartzite fragments to 200 mm. pH 8.2–8.4
75	Pooraka Formation	Red light and medium heavy clay with increasing quartzite and limestone gravel content with depth. Investigation depth terminated at 1.05 m due to high resistance.	300 mm: red (2.5YR4/6) light clay with many very fine roots. pH 8.8	0.3–0.75 m: red (2.5YR4/6) very plastic medium heavy clay with very few fine limestone gravel fragments. pH 8.0 0.75–1.05 m: red (2.5YR4/6) slightly plastic light medium clay with abundant quartzite gravel fragments to 200 mm and few fine limestone gravel fragments. pH 8.1
76	Quaternary fluvial sands and gravels	Dark red loamy sand over dark red and red light medium clay with increasing sandstone gravel content with depth. Investigation depth terminated at 2.0 m due to high resistance.	350 mm: dark red (2.5YR3/6) loamy sand with many very fine roots. pH 8.8	0.35–1.3 m: dark red (2.5YR3/6) moderately plastic light medium clay with few coarse sandstone gravel fragments. pH 8.7 1.3–2.0 m: red (2.5YR4/6) light medium clay with many strong sandstone fragments to 200 mm. pH 9.2
77	Quaternary Soil Mantles	Dark red sand over red sand with limestone gravel overlying red light clay with abundant quartzite gravel to 200 mm. Investigation depth terminated at 1.4 m due to high resistance.	500 mm: dark red (2.5YR3/6) sand with many coarse roots. pH 8.1	0.5–1.0 m: dark red (2.5YR3/6) sand with abundant weak to moderately strong limestone gravel fragments. pH 9.0 1.0–1.4 m: red (2.5YR5/6) light clay with abundant strong quartzite fragments to 200 mm and few medium limestone gravel fragments. pH 9.4
78	Quaternary Soil Mantles	Dark red clay loam, sandy overlying red light and medium clay with few calcrete and gypsum fragments. Investigation depth terminated at 1.6 m due to high resistance.	400 mm: dark red (2.5YR3/6) clay loam, sandy with many coarse roots. pH 8.6	0.4–0.9 m: red (2.5YR4/8) moderately plastic light medium clay. pH 8.9 0.9–1.3 m: red (2.5YR4/6) moderately plastic medium clay with few calcrete gravel fragments. pH 8.9 1.3–1.6 m: red (2.5YR4/6) moderately plastic medium clay with few gypsum fragments and salt crystals. pH 7.9

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
79	Quaternary Soil Mantles	Dark red clayey sand overlying dark red sand with abundant weak limestone gravel fragments, overlying reddish brown clay loam. Sandy and red light medium clay with gypsum and calcareous sandstone fragments over silty clay loam with abundant calcareous sandstone fragments. Investigation depth terminated at 2.75 m due to high resistance.	400 mm: dark red (2.5YR3/6) clayey sand with many coarse roots. pH 8.2	0.4–0.9 m: dark red (2.5YR3/6) fine to coarse sand with abundant weak limestone fragments. pH 8.8 0.9–1.3 m: reddish brown (5YR5/4) clay loam, sandy with few gypsum fragments, kaolinitic mudstone fragments and salt crystals. pH 7.7 1.3–2.2 m: red (2.5YR5/6) light medium clay with few calcareous sandstone and gypsum fragments. pH 4.6–6.2 2.2–2.75 m: reddish brown (5YR5/4) silty clay loam with abundant calcareous sandstone fragments.
80	Quaternary Soil Mantles/Pooraka Formation	Reddish brown clayey sand over red light medium clay with medium limestone and sandstone gravel fragments, overlying reddish brown medium heavy clay with gypsum fragments to 200 mm. Investigation depth terminated at 2.55 m due to high resistance.	250 mm: reddish brown (2.5YR4/4) clayey sand with abundant coarse roots. pH 8.3	0.25–1.0 m: red (2.5YR4/6) moderately plastic light medium clay with medium limestone and sandstone gravel fragments. pH 7.2 1.0–2.55 m: reddish brown (5YR5/4) very plastic medium heavy clay with many gypsum fragments to 200 mm. pH 6.0–6.2
81	Quaternary Soil Mantles	Reddish brown clay loam, sandy over dark red and red light and medium heavy clay with calcrete and gypsum gravel fragments, overlying red heavy clay. Investigation depth terminated at 2.5 m due to high resistance.	50 mm: reddish brown (2.5YR4/4) clay loam, sandy with medium roots. pH 9.0	0.05–0.3 m: dark red (2.5YR3/6) light clay with few fine calcrete gravel fragments. pH 8.6 0.3–0.95 m: red (2.5YR5/6) light clay with few slightly calcareous segregations and fine calcrete gravel fragments. pH 9.0 0.95–1.9 m: red (2.5YR4/6) very plastic medium heavy clay with coarse gypsum fragments and few salt crystals. pH 8.3 1.9–2.5 m: red (10R4/6) very plastic heavy clay. pH 6.4
82	Quaternary fluvial sands and gravels	Dark red loamy sand over red medium and light clay, overlying red clay loam, sandy and medium clay with few calcrete gravel fragments. Investigation depth terminated at 3.0 m.	200 mm: dark red (2.5YR3/6) loamy sand with many fine roots. pH 9.0	0.2–0.75 m: red (2.5YR4/6) moderately plastic medium clay with few salt crystals. pH 8.3 0.75–1.5 m: red (2.5YR5/6) light clay with few fine to medium calcrete gravel fragments. pH 9.0 1.5–2.2 m: red (2.5YR4/8) clay loam, sandy with few fine calcrete gravel fragments. pH 9.0 2.2–3.0 m: red (2.5YR4/8) moderately plastic medium clay with few medium calcrete gravel fragments. pH 9.1

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
83	Quaternary fluvial sands and gravels	Dark red loamy sand overlying red medium clay and clayey sand with few calcrete gravel fragments. Investigation depth terminated at 3.0 m.	200 mm: dark red (2.5YR3/6) loamy sand with many medium roots. pH 6.6	0.2–1.1 m: red (2.5YR4/6) moderately plastic medium clay. pH 7.3 1.1–2.0 m: red (2.5YR4/6) moderately plastic medium clay with few fine calcrete gravel and moderately calcareous segregations. pH 8.5 2.0–3.0 m: red (2.5YR4/6) clayey sand with few fine calcrete gravel fragments. pH 7.6
84	Quaternary fluvial sands and gravels/ St Kilda Formation	Reddish brown silty clay loam over dark red clay loam, sandy over light reddish brown sandy clay loam with many limestone fragments over red light clay and clayey sand. Groundwater standing at 2.75 m. Investigation depth terminated at 2.9 m, with sides of the investigation site collapsing below 2.4 m.	300 mm: reddish brown (2.5YR5/4) silty clay loam with many medium roots. pH 8.0	0.3–0.75 m: dark red (10R3/6) clay loam, sandy with few salt crystals. pH 8.2 0.75–1.25 m: light reddish brown (2.5YR6/3) sandy clay loam with many strong limestone fragments to 200 mm. pH 7.8 1.25–2.3 m: red (2.5YR5/6) light clay with very few slightly calcareous segregations. pH 7.9 2.3–2.9 m: red (2.5YR4/8) clayey sand. pH 8.3
85	Quaternary sand sheets and sief dunes	Dark reddish brown clayey sand over reddish brown sandy clay loam, over red light medium and light clay with increasing calcrete gravel content. Investigation depth terminated at 2.7 m due to high resistance.	250 mm: dark reddish brown (2.5YR3/3) clayey sand with many medium roots. pH 9.0	0.25–0.7 m: reddish brown (2.5YR4/4) sandy clay loam with few calcareous segregations. pH 9.3 0.7–1.4 m: red (2.5YR4/6) light medium clay with few medium calcrete gravel fragments. pH 8.9 1.4–2.7 m: red (2.5YR5/8) light clay with many coarse limestone gravel fragments. pH 9.9
86	Tent Hill Formation	Dark red loamy sand and medium clay over light reddish grey sand with abundant coarse limestone gravel and very abundant strong sandstone fragments. Investigation depth terminated at 0.8 m due to high resistance.	150 mm: dark red (2.5YR3/6) loamy sand with many coarse roots. pH 8.5	0.15–0.35 m: dark red (2.5YR3/6) moderately plastic medium clay. pH 8.3 0.35–0.8 m: light reddish grey (2.5YR7/1) sand with very abundant strong sandstone fragments to 300 mm and coarse moderately strong limestone fragments. pH 9.1
87	Tent Hill Formation	Red light clay and clay loam, sandy with few coarse sandstone fragments over red medium heavy clay with abundant high strength sandstone fragments. Investigation depth terminated at 1.55 m due to high resistance.	200 mm: red (2.5YR4/6) light clay with many coarse roots and few coarse sandstone gravel fragments. pH 9.0–9.1	0.2–1.15 m: red (2.5YR5/6) clay loam, sandy with few salt crystals and coarse sandstone fragments. pH 9.0 1.15–1.55 m: red (2.5YR5/6) very plastic medium heavy clay with abundant high strength sandstone fragments to 300 mm. pH 9.0

Table I1.2 Field soil descriptions (cont'd)

Sample Site	Geology	General soil description	Topsoil	Subsoil
88	Pooraka Formation	Red clay loam, sandy with few sandstone cobbles over red clay loam and light medium clay, overlying light clay to clay loam with abundant strong sandstone and quartzite fragments. Investigation depth terminated at 2.4 m due to high resistance.	150 mm: red (2.5YR4/6) clay loam, sandy with roots with very few sub angular strong sandstone cobbles. pH 7.7	0.15–0.5 m: red (2.5YR5/8) clay loam, slightly plastic. pH 8.4 0.5–0.9 m: dark red (10R4/6) light medium clay, moderately plastic with few calcareous veins. pH 8.4 0.9–1.8 m: dark red (10R4/6) light clay, moderately plastic with few calcareous veins and abundant high strength sandstone gravels. pH 7.6 1.8–2.2 m: red (2.5YR4/6) clay loam, sandy, slightly plastic with very few fine grey mottles, very few gypsum nodules and abundant high strength sandstone gravels. pH 8.4 2.2–2.4 m: light grey (GLEY1) very abundant sub angular sandstone boulders and common sub angular quartzite gravels. pH 8.1
89	Pooraka Formation	Red loamy sand overlying light clay and clayey sand with abundant strong quartzite cobbles. Investigation depth terminated at 1.5 m due to high resistance.	100 mm: red (2.5YR6/8) loamy sand, highly disturbed surface soil with sandstone fragments adjacent to nearby road. pH 8.3	0.1–0.3 m: red (2.5YR3/6) light clay, moderately plastic with fine pores and fine roots. pH 8.4 0.3–0.6 m: red (2.5YR5/8) light clay, moderately plastic with calcareous fine veins. pH 8.3 0.8–1.5 m: light grey (GLEY18/1) many sub angular strong quartzite cobbles. pH 8.7
90	Pooraka Formation	Red light clay overlying loamy sand and sand with abundant strong quartzite cobbles. Investigation depth terminated at 1.5 m due to high resistance.	200 mm : red (2.5YR5/8) light clay, slightly plastic with fine roots and few sub angular sandstone gravels, highly disturbed ground due to adjacent to road. pH 8.2	0.2–1.2 m: red (2.5YR3/6) loamy sand, slightly plastic with very few calcareous fine veins. pH 8.6 1.2–1.4 m: red (2.5YR7/6) sand non-plastic, common pale brown mottles with many sub angular strong quartzite gravels. pH 8.1 1.4–1.5 m: light grey (GLEY18/1) abundant sub angular strong quartzite gravels. pH 8.1

Table I1.3 Erosion potential classification

Field observations	No or minor erosion	Little erosion, surface slope wash features	Little erosion, surface slope wash features	Slope wash, rill, tunnelling and gully erosion	Slope wash, rill, tunnelling and gully erosion
Erosion potential	**Low** Little or no erosion potential	**Low or medium** Sheet/wind/some scalds may develop	**Medium** Sheet/wind/small scalds may develop	**High or very high** Gully or sheet and significant scalds may develop or major gullies may develop	**High or very high** Gully or sheet and significant scalds may develop or major gullies may develop
Emerson class	Classes 5 or 6 Soils are slightly or non-dispersible Class 5 – soil disperses after vigorous shaking Class 6 – soil flocculates after vigorous shaking Not highly susceptible to erosion	Class 4 Soil are slightly or non-dispersible Do not disperse after remoulding but contain minerals such as calcite or gypsum Not highly susceptible to erosion	Class 3 Soils are slightly dispersible After remoulding show dispersion Soils are generally stable Gypsum application can reduce crusting	Class 2 Soil are moderately dispersible Aggregates slake and partly disperse Indicate some degree of tunnelling susceptibility	Class 1 Soils are highly dispersible Aggregates slake and disperse completely Indicate high tunnelling susceptibility
Electrical conductivity	<70–150 μS/cm (sands) <150–300 μS/cm (clays) Very low to low salinity	150–340 μS/cm (sands) 300–700 μS/cm (clays) Medium salinity	340–630 μS/cm (sands) 700–1180 μS/cm (clays) High salinity	630–930 μS/cm (sands) 1180–1870 μS/cm (clays) Very high salinity	>930 μS/cm (sands) >1870 μS/cm (clays) Extremely high salinity

Table I1.4 Soil erosion potential

Sample Site	Observed erosion features	Emerson class	Field pH	Electrical conductivity (μS/cm)	Depth of pH and EC tests (m)	Erosion potential
Gas pipeline corridors						
GP1	Moderate scalding (within lake pan) and minor wind erosion due to absence of vegetation	3	6.6 7.8	170 220	0.10 0.40	**Minor** Minor scalding and wind erosion
GP2	Loss of surface soil due to wind erosion and moderate scalding; some protection offered by gibber surface material	4	7.3 7.0	800 < 10	0.10 0.50	**Medium** Moderate wind erosion and scalding
GP3	Significant gully erosion and scalding; some wind erosion	4	7.3 7.2	250 3410	0.10 0.50	**High** Sheet and gully erosion with moderate wind erosion
GP4	Moderate erosion/scalding from sheet flow within outflow channel	4	7.0 7.1 7.1	2800 2740 4340	0.10 0.50 1.10	**Moderate** Prone to scalding and sheet erosion
GP5	Moderate scalding and moderate wind erosion	5	7.6 7.5	260 140	0.10 0.40	**Moderate** Susceptible to significant scalding and minor wind erosion
GP6	Significant erosion/scalding from sheet flows; moderate wind erosion	4	7.7 8.0	150 240	0.10 0.30	**High** Susceptible to significant sheet flows and scalding
GP7	Moderate scalding and wind erosion (observation in pan area)	8	8.2 7.5	100 2540	0.10 0.50	**Moderate/High** Pans susceptible to moderate scalding with dunes prone to significant wind erosion

Table I1.4 Soil erosion potential (cont'd)

Sample Site	Observed erosion features	Emerson class	Field pH	Electrical conductivity (µS/cm)	Depth of pH and EC tests (m)	Erosion potential
GP8	Minor sheet erosion and scalding – protected by gibber surface	6	7.4 7.4	5630 6010	0.10 0.40	**Low** Low due to protection offered by gibber surface
GP9	Minor sheet and wind erosion – gibber surface provides protection	3	7.8	480	0.20	**Low** Low due to protection offered by gibber surface
GP10	Minor sheet erosion and scalding – protected by gibber surface	3	7.7	270	0.10	**Medium** Susceptible to sheet and gully erosion due to gradient with protection provided by gibber surface
GP11	Significant gully and stream bank erosion with some adjacent scalding	2	7.4 6.6	160 3550	0.10 1.10	**Very high** Susceptible to significant stream bank and channel erosion; significantly dispersive soils
GP12	Minor sheet erosion and scalding – protected by gibber surface	3	7.2	130	0.10	**Low** Low due to protection offered by gibber surface
GP13	Minor gully erosion and scalding	3	7.2 7.0	70 50	0.10 0.40	**Moderate** Susceptible to scalding
GP14	Minor scalding and wind erosion	4	7.1 7.5	130 2800	0.10 0.80	**Low** Minor susceptibility to sheet erosion/scalding due to gradient and stony matrix
GP15	Minor scalding and wind erosion	4	7.8 8.1	50 300	0.10 0.40	**Low** Minor susceptibility to sheet erosion/scalding due to gradient and gibber surface
GP16	Moderate wind erosion in hummocked dunal landform	6	8.6	60	0.10	**Moderate** Susceptible to moderate wind erosion
GP17	Significant wind erosion; within highly mobile dunefield; no vegetative cover	6	7.5	5690	surface	**Very high** Highly susceptible to wind erosion
GP18	Moderate scalding and wind erosion	6	8.0 8.6	110 100	0.10 0.30	**Moderate** Susceptible to moderate wind erosion and scalding
GP19	Moderate wind erosion and minor scalding (broad depression)	6	8.2 7.6	20 200	0.10 0.80	**Low** Susceptible to minor scalding and moderate wind erosion
GP20	Significant sheet and gully erosion and moderate wind erosion on hardsetting dunal system	6	7.5 7.6	100 40	0.10 0.80	**High** Susceptible to significant sheet, gully and wind erosion especially on elevated dune landform
GP21	Minor scalding and wind erosion within depression	–	7.4 8.6	150 220	0.10 0.40	**Low** Prone to minor scalding and wind erosion
GP22	Significant sheet and rill erosion and moderate wind erosion on hardsetting dunal system	–	8.0 8.5	30 70	0.10 0.70	**High** Susceptible to significant sheet, gully and wind erosion especially on elevated dune landform

Table I1.4 Soil erosion potential (cont'd)

Sample Site	Observed erosion features	Emerson class	Field pH	Electrical conductivity (µS/cm)	Depth of pH and EC tests (m)	Erosion potential
Southern infrastructure corridor						
1	Some loss of surface soils	4	9.4 9.0 9.8	85.6 85.1 436.0	0.05 0.55 1.4	**Medium** Moderate wind erosion
2	Some loss of surface soils	–	9.1 8.7 9.4	85.9 109.6 112.0	0.1 0.5 1.1	**Low** Minor wind erosion
3	Topsoil removed exposing loose sand	–	8.9 9.0	58.0 67.0	0.1 1.0	**Medium** Moderate wind erosion
4	Gullying associated with nearby Yorkey's Crossing. Minor scalding	4	9.2 8.5	132.0 3500	0.1 0.4	**Very high** Gullying and wind erosion and some scalds may develop
5	Minor scalding	4	10.5 9.5	63.4 2000	0.1 0.6	**Low** Sheet/wind erosion minor scalding
6	Minor scalding	–	9.5 9.6	215.0 620.0	0.3 0.7	**Low** Wind erosion/minor scalding
7	Minor scalding	–	9.3 9.0	36.1 99.1	0.05 0.65	**Low** Minor scalding
8	Minor scalding	–	8.4 9.1 7.9	83.4 300.0 3200	0.05 0.45 0.8	**Medium** Scalding/wind erosion
9	Some loss of surface due to wind	6	8.6 8.9	296.0 111.5	0.2 0.8	**Low** Wind erosion
10	Wind and sheet wash. Minor gullying associated with adjacent stream channel. Loose surface soils.	4	9.6 9.3 9.3	37.8 50.5 28.3	0.1 0.7 1.15	**High** Minor gullying at nearby stream channel Sheet/wind erosion
11	Some loss of surface soil due to wind erosion and minor scalding	4	8.6 8.4 9.3	23.5 33.1 334.0	0.05 0.55 1.2	**Low** Minor wind erosion/minor scalding may develop
12	Some surface soil removed due to wind erosion exposing loose soil. Minor gullies due to nearby stream channels.	–	8.9 9.0 8.7	70.2 34.5 94.5	0.05 0.75 1.7	**High** Moderate wind erosion, minor gullies and sheet erosion
13	Moderate wind erosion, some sheet wash adjacent to existing 275 kV tower.	–	8.7 8.5 9.1	24.2 19.5 54.0	0.1 0.95 1.8	**Medium** Moderate wind erosion, minor sheet erosion
14	Minor wind erosion and scalding	–	8.4 8.5 8.4	81.0 17.5 48.1	0.1 1.15 1.8	**Low** Minor wind erosion, some scalding may develop
15	Moderate wind erosion and minor scalding	5	8.3 9.3 8.7	25.9 74.0 430.0	0.1 0.3 1.5	Moderate wind erosion, some scalding
16	Minor scalding. Minor gullying at nearby stream channel	4	9.5 9.6	29.2 1160	0.05 0.45	**High** Minor scalding, some sheet wash and minor gullies at stream channel locations
17	Some loss of surface soil due to wind erosion	–	8.8 9.3 8.8	31.0 51.5 235.0	0.15 0.6 1.0	**Low** Minor wind erosion
18	Some loss of surface soil due to wind erosion, moderate scalding	4	8.3 9.1 9.1	34.5 555.0 710.0	0.05 0.75 1.6	**Medium** Minor wind erosion, moderate scalding may develop

Table I1.4 Soil erosion potential (cont'd)

Sample Site	Observed erosion features	Emerson class	Field pH	Electrical conductivity (µS/cm)	Depth of pH and EC tests (m)	Erosion potential
19	Some loss of surface soil due to wind erosion, minor scalding	–	8.7 8.4 8.6 8.9 9.3	46.0 25.5 31.4 54.5 80.5	0.1 0.5 0.7 0.95 1.2	**Low** Minor wind erosion, minor scalding may develop
20	Some loss of surface soil due to wind erosion, minor scalding.	–	9.4 9.4 9.7	24.0 107.7 835.0	0.1 0.9 2.2	**Low** Minor wind erosion, minor scalding may develop
21	Some loss of surface soil due to wind erosion, some scalding. Significant clearing for previous tower construction.	–	9.2 9.3 9.7 8.7	48.5 56.5 470.5 572.0	0.15 0.65 1.2 1.9	**Medium** Minor wind erosion, some scalding
22	Some loss of surface soil due to wind erosion.	–	9.0 9.1 8.9	51.5 63.5 195.5	0.1 0.9 1.25	**Low** Minor wind erosion
23	Surface soil removed due to wind erosion exposing loose soil.	–	7.6 8.3 8.9 8.8 9.0	40.1 16.3 419.0 634.0 925.0	0.02 0.15 1.1 1.7 2.8	**Medium** Moderate wind erosion
24	Surface soil removed due to wind erosion exposing loose soil.	4	8.1 9.6 8.1 8.8	80.1 252.0 600.0 531.0	0.02 0.3 0.8 1.35	**Medium** Moderate wind erosion
25	Surface soil removed due to wind erosion exposing loose soil, gully erosion and sheet wash of access track crossing nearby salt lake.	6	8.9 8.3 7.5 7.1	44.5 31.7 1785 1378	0.05 0.2 0.85 1.35	**Very high** Moderate wind erosion, some sheet wash and gullies at nearby salt lake (Ironstone Lagoon)
26	Minor wind erosion, gibber rock at surface	–	7.8 8.3 7.9 7.4	6350 3800 5250 2350	0.05 0.3 0.6 1.45	**Low** Minor wind/sheet erosion
27	Minor wind erosion, gibber rock at surface	6	6.9 6.7 6.1 6.6	9870 4650 3540 3980	0.05 0.35 0.65 0.95	**Low** Minor wind/sheet erosion
28	Minor wind erosion, gibber rock at surface	–	6.5 6.3 7.4 7.4	6660 4420 3610 4520	0.02 0.25 0.55 0.95	**Low** Minor wind/sheet erosion
29	Surface soil removed due to wind erosion exposing loose soil	–	7.8 8.2 9.5 9.6 8.7	290.0 73.5 126.0 226.5 615.0	0.05 0.35 0.95 1.6 3.0	**Medium** Moderate wind erosion
30	Surface soil removed due to wind erosion exposing loose soil	5	9.1 8.6 8.5	38.0 18.0 41.5	0.1 0.6 2.0	**Low** Minor/moderate wind erosion
31	Loss of loose sandy surface soil due to wind	5	7.5 7.4 7.0 7.7	55.2 36.2 45.4 60.3	0.05 0.7 1.3 2.6	**Medium** Moderate wind erosion
32	Some scalding and loss of surface soil due to wind and sheet flow. Gullying associated with nearby Lake Windabout	6	7.2 6.6 6.3 6.4 5.3	5920 5920 4850 3180 2690	0.05 0.95 1.35 1.7 2.5	**Very high** Gullying and sheet flow at Lake Windabout. Some scalds may develop

Table I1.4 Soil erosion potential (cont'd)

Sample Site	Observed erosion features	Emerson class	Field pH	Electrical conductivity (μS/cm)	Depth of pH and EC tests (m)	Erosion potential
33	Moderate gully erosion and some loss of surface due to sheet flow	–	8.8 8.9	135.5 34.9	0.05 0.8	**High** Moderate gully erosion and sheet flow
34	Some loss of surface soils, but limited by abundant gibber surface rock coating	6	6.8 7.2 7.6 7.8	4750 6060 5850 4680	0.05 0.5 0.95 1.5	**Low** Wind erosion
35	Some loss of surface soils, but limited by moderate gibber surface rock coating	–	8.7 7.4 8.3	57.5 5250 1420	0.02 0.45 0.9	**Low** Wind erosion
36	Minor scalding and some loss of surface soil due to wind	–	7.2 7.7 8.0	244.0 2660 5490	0.05 0.45 1.15	**Low** Minor scalding and wind erosion
RC 1	Some loss of surface soil	–	8.2 7.7 8.3	1120 3950 4070	0.1 0.5 1.5	**Low** Minor wind erosion
37	Minor scalding and some loss of surface soil due to wind and water erosion	6	8.4 7.9 7.9 8.0	62.1 1355 1570 1565	0.05 0.6 1.0 1.5	**Low** Minor scalding and wind / sheet erosion
38	Some loss of surface soil due to water and wind, but limited by abundant gibber surface rock coating	–	7.8 7.9 8.4 8.8	1141 4400 2650 2260	0.05 0.55 1.0 1.5	**Low** Minor wind erosion and minor scalding
39	Some loss of surface soil due to wind, but limited due to abundant gibber surface rock	6	7.6 7.7 7.8 7.8	5600 5250 6200 3450	0.05 0.45 0.9 1.2	**Low** Minor wind erosion
40	Surface soils removed by wind exposing loose sand	–	8.2 8.1 8.1 9.2	74.7 26.5 31.0 86.0	0.05 0.8 1.7 3.0	**Medium** Moderate wind erosion
41	Moderate scalding and significant movemen of surface soils due to water erosion	4	9.4 7.7 8.1	115.5 3650 1005	0.05 0.6 1.3	**Very high** Moderate scalding and severe sheet flow
RC 9A	Moderate scalding and wind erosion, but limited by moderate gibber surface rock coating	–	8.3 7.7 7.9 7.7	1340 2740 3600 4540	0.05 0.25 0.95 1.65	**Medium** Moderate scalding and wind erosion
42	Minor scalding, however moderate gibber surface rock coating	–	7.2 7.4 7.4 7.8	5350 6470 5250 4100	0.15 0.4 1.1 1.85	**Low** Minor scalding and wind erosion
RC 10	Minor scalding, however moderate gibber surface rock	–	9.2 8.5 9.1 8.0	128.5 355.0 1055 2870	0.05 0.55 1.2 1.9	**Low** Minor scalding and wind erosion
RC 11	Minor scalding and wind erosion, however abundant gibber surface rock	6	7.6 7.5 8.0 7.9	9020 6840 5530 6490	0.0 0.5 1.2 2.0	**Low** Minor scalding and wind erosion
RC 12	Minor scalding and wind erosion, however abundant gibber surface rock	–	6.8 7.4 7.7 7.5	3650 6530 5810 3980	0.05 0.35 1.2 1.95	**Low** Minor scalding and wind erosion
RC 13	Minor scalding and wind erosion, however abundant gibber surface rock	–	6.9 8.0 7.8 7.6	8560 3180 4350 3930	0.05 0.45 1.1 1.8	**Low** Minor scalding and wind erosion

Table I1.4 Soil erosion potential (cont'd)

Sample Site	Observed erosion features	Emerson class	Field pH	Electrical conductivity (µS/cm)	Depth of pH and EC tests (m)	Erosion potential
RC 14	Surface soils subject to wind erosion and minor scalding. Poor re-growth of vegetation where trees cleared for previous power line construction	–	8.7 7.9 8.0 8.3	85.5 22.0 23.5 27.5	0.05 0.8 1.7 2.8	**Medium** Wind erosion and minor scalding
48	Moderate scalding. Loss of surface soil leaving firm material due to wind erosion. Poor re-growth where trees were cleared for previous power line construction	4	9.0 9.9 8.5 8.6	29.8 125.1 1940 1595	0.15 0.8 1.7 3.2	**High** Moderate scalding and severe wind erosion
RC M3	Moderate scalding and some loss of surface soil due to wind erosion	–	8.9 8.5 9.2	151.5 235.0 124.7	0.05 0.3 0.5	**Medium** Moderate scalding and minor wind erosion
RC 15	Minor scalding and loss of surface soils due to wind, however moderate gibber surface rock present	–	8.5 8.6 8.8 9.1	3110 3720 3500 1790	0.05 0.35 0.8 2.4	**Medium** Wind erosion and minor scalding
RC 16	Some loss of surface soils, however abundant gibber surface rock present	6	8.2 8.0 7.8 7.5	122.5 3610 3490 3060	0.05 0.4 1.2 1.9	**Low** Wind erosion
RC 17	Minor scalding and loss of surface soils due to wind, however abundant gibber surface rock present	–	7.8 7.8 7.9 7.5 6.6	5270 3580 3990 2165 3700	0.05 0.4 1.1 2.1 3.0	**Medium** Wind erosion and minor scalding
RC 18	Moderate scalding and loss of surface soils due to wind	–	8.3 8.8 8.8 9.0 8.4	1223 1342 1230 966.0 1950	0.1 0.45 0.9 1.65 2.5	**Medium** Wind erosion and moderate scalding
RC 19	Loss of surface sandy soils due to wind erosion. Limited re-growth of vegetation after clearing for previous power line construction	–	8.4 7.8 7.4 7.8	30.0 20.0 23.5 21.3	0.1 1.1 2.5 3.5	**Medium** Wind erosion
53	Loss of surface sandy soils due to wind erosion where little or no vegetation present Nearby 275 kV tower has silt fencing adjacent to tower leg to prevent loss of soil adjacent to pile foundation	4	8.9 9.4	58.4 99.0	0.1 0.8	**Medium** Wind Erosion
RC 20	Loss of surface sandy soils due to wind erosion where little or no vegetation present	4	8.6 9.0 9.6 9.5 8.9	39.1 77.6 265.0 333.0 740.0	0.05 0.55 1.25 1.7 3.4	**Medium** Wind erosion
RC 21	Loss of surface sandy soils due to wind erosion where little or no vegetation present	–	9.4 8.8 9.4 8.8	65.5 1195 920.0 1345	0.05 0.6 1.4 2.5	**Medium** Wind erosion
56	Surface soils in clay pan generally bare of vegetation with severe scalding but with many gibber surface rocks	4	9.3 10.8 9.1 8.8	470.0 1207 1810 2380	0.05 0.4 1.25 1.55	**High** Severe scalding and erosion due to surface water and wind

Table I1.4 Soil erosion potential (cont'd)

Sample Site	Observed erosion features	Emerson class	Field pH	Electrical conductivity (µS/cm)	Depth of pH and EC tests (m)	Erosion potential
57	Some loss of surface soils and minor scalding in some areas where no gibber surface rock present	4	7.8 7.9 8.6 8.6	3660 4550 3310 3220	0.05 0.2 0.55 0.75	**Low** Wind erosion and minor scalding
58	Moderate loss of surface sandy soils due to wind erosion. Water pipeline crossing of nearby salt lake subjected to gullying and sheet erosion	5	8.8 7.8 8.6 7.3	74.3 1225 1680 2320	0.1 0.65 1.5 2.8	**Very High** Moderate wind erosion. Moderate gullying near salt lake (Lake Dutton)
59	Minor loss of surface soil due to scalding	–	7.8 8.1 7.6	73.9 148.3 136.5	0.05 0.15 0.6	**Low** Minor scalding
62	Minor loss of surface soil where no gibber surface rock present	4	7.8 8.0 8.1 8.1	4560 5020 6550 3250	0.03 0.3 0.95 1.35	**Low** Wind erosion
63	Moderate loss of surface soil due to wind and moderate water erosion nearby existing swamp	–	7.8 7.8 7.6 7.2	55.5 55.7 1475 1945	0.05 0.45 1.5 2.5	**Medium** Moderate wind/sheet erosion nearby to existing swamp
64	Some loss of surface soil due to wind	–	8.6 9.4 9.7	126.5 148.3 391.0	0.05 0.6 1.2	**Low** Minor wind erosion
65	Some loss of surface soil due to wind	–	8.2 8.1 7.8	39.1 231.5 797.0	0.1 0.45 1.3	**Low** Minor wind erosion
67	Some loss of surface soil due to water and wind erosion	5	7.4 7.9 8.1	28.2 43.9 91.2	0.1 0.6 1.1	**Medium** Moderate sheet erosion and minor wind erosion
68	Some loss of surface soil due to wind	–	9.6 8.3 8.4 8.3	140.3 2790 3760 3830	0.05 0.4 0.9 1.25	**Low** Minor wind erosion
69	Some loss of surface soil due to wind	–	8.6 8.7 9.7 9.0 8.5 9.0	325.0 115.8 655.0 603.0 785.0 1274	0.05 0.65 1.4 2.2 2.6 3.0	**Low** Minor wind erosion
70	Some loss of surface soil due to minor scalding and minor sheet flow	–	8.7 8.9 8.9 9.2	137.2 353.0 527.0 655.0	0.05 0.6 0.9 1.6	**Low** Minor scalding and sheet flow
71	Loss of surface soils adjacent to existing lagoon due to scalding, sheet flow and wind erosion	–	7.3 7.0 8.0 8.1 8.3 8.0	3200 8220 5890 4750 1860 3650	0.05 0.2 0.5 1.35 1.95 2.8	**High** Moderate scalding and minor wind/sheet erosion
72	Some loss of surface soil due to wind erosion	4	10.1 9.5 8.8 8.4	177.3 961.0 858.0 1200	0.1 0.65 1.3 2.3	**Low** Minor wind erosion
73	Loss of surface soils due to severe scalding, moderate wind erosion and minor sheet flow	4	9.3 7.5 8.3 8.3 8.3	854.0 8560 4400 1810 1810	0.02 0.25 0.8 1.25 2.65	**High** Significant scalds may develop. Moderate wind erosion and minor sheet flow

Table I1.4 Soil erosion potential (cont'd)

Sample Site	Observed erosion features	Emerson class	Field pH	Electrical conductivity (µS/cm)	Depth of pH and EC tests (m)	Erosion potential
74	Moderate loss of surface soils due to water and wind erosion	–	8.8 7.7 8.0 8.2 8.4	3390 10,150 7100 3770 3260	0.02 0.25 0.7 1.4 2.3	**High** Moderate scalding and wind/sheet erosion
75	Some loss of surface soil due to wind	–	8.8 8.0 8.1	144.5 1962 2520	0.1 0.4 0.9	**Low** Wind erosion
76	Some loss of surface soils due to wind erosion	–	8.8 8.7 9.2	86.4 101.4 107.4	0.05 0.55 1.5	**Low** Wind erosion
77	Some loss of surface soil due to wind and minor scalding	–	8.1 9.0 9.4	50.3 103.8 320.0	0.15 0.75 1.25	**Low** Wind erosion and minor scalding
78	Some loss of surface soil due to wind	4	8.6 8.9 8.9 7.9	61.0 146.2 454.0 2580	0.05 0.4 1.0 1.35	**Medium** Moderate wind erosion
79	Loss of surface soil due to wind and minor scalding	–	8.2 8.8 7.7 4.6 6.2	51.7 749.0 2390 2865 2890	0.1 0.6 1.0 1.35 1.8	**Low** Wind erosion and minor scalding
80	Loss of surface soil due to wind erosion and moderate scalding	–	8.3 7.2 6.2 6.0	271.0 3190 3160 2880	0.1 0.6 1.25 2.4	**Medium** Moderate wind erosion and scalding
81	Loss of surface soil due to wind erosion, but limited by existing vegetation	–	9.0 8.6 9.0 8.3 6.4	126.5 1350 1355 2950 1120	0.02 0.2 0.6 1.2 2.3	**Low** Moderate wind erosion
82	Loss of surface soil due to wind and minor scalding. Likely sheet erosion in floodplain	5	9.0 8.3 9.0 9.0 9.1	261.0 6110 2500 1440 1380	0.1 0.5 1.0 1.6 2.5	**Medium** Moderate wind/sheet erosion
83	Loss of surface soil due to wind. Likely sheet erosion in floodplain	4	6.6 7.3 8.5 7.6	1118 4050 1910 805.0	0.1 0.5 1.5 2.3	**Medium** Moderate wind/sheet erosion
84	Significant loss of surface soils due to water and wind erosion. Likely sheet erosion in floodplain	–	8.0 8.2 7.8 7.9	5380 4410 5010 4640	0.1 0.4 1.15 1.6	**High** Moderate wind and sheet erosion
85	Loss of surface sandy soils due to wind erosion, but limited by existing vegetation	–	9.0 9.3 8.9 9.9	88.5 261.0 666.0 745.0	0.1 0.45 0.95 1.5	**Low** Minor wind erosion
86	Some loss of surface soil due to wind erosion where no surface rock or vegetation present	4	8.5 8.3 9.1	59.7 87.4 127.5	0.1 0.3 0.55	**Low** Minor wind erosion
87	Loss of surface soil due to wind where no surface rock present	4	9.1 9.0 9.0 9.0	179.5 3970 2790 1520	0.05 0.15 0.65 1.25	**Medium** Moderate wind erosion

Table I1.4 Soil erosion potential (cont'd)

Sample Site	Observed erosion features	Emerson class	Field pH	Electrical conductivity (µS/cm)	Depth of pH and EC tests (m)	Erosion potential
88	Loss of surface soil due to wind where no groundcover or coarse rock surface rock present	4	7.7 8.4 8.4 7.6 8.4 8.1	5010 11070 12790 4370 4190 3140	0.15 0.5 0.9 1.8 2.2 2.4	**Medium** Moderate wind erosion
89	Loss of surface soil due to wind where no groundcover or coarse rock surface rock present	–	8.3 8.4 8.3 8.2 8.7	4650 2050 6900 3840 2490	0.1 0.2 0.5 0.7 1.4	**Medium** Moderate wind erosion
90	Loss of surface soil due to wind where no groundcover or coarse rock surface rock present	4	8.2 8.6 8.1 8.1	3650 2810 4360 4820	0.1 0.5 1.3 1.5	**Medium** Moderate wind erosion

Table I1.5 Soil metal concentrations (mg/kg)

Parameter	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	Mercury	Uranium
Limit of reporting (gas pipeline sample limits in brackets)	**5 (1)**	**1 (1)**	**2**	**5 (10)**	**5 (10)**	**2**	**5 (1)**	**0.1 (1)**	**0.1 (2)**
Health based guidelines	**500**	**100**	**600,000**	**5,000**	**1,500**	**3,000**	**35,000**	**75**	**204**
Ecological based guideline	**20**	**3**	**400**	**100**	**600**	**60**	**200**	**1**	**n/g**
Background ranges	**1–50**	**1**	**–**	**2–100**	**2–200**	**5–500**	**10–300**	**0.03**	**–**
Sample site location									
Gas pipeline corridors									
GP1	1	1	–	17	<10	–	<1	<1	<2
GP2	<1	1	–	89	<10	–	45	<1	<2
GP3	–	–	–	–	–	–	–	–	<2
GP4	1	1	–	128	10	–	98	<1	2
GP5	–	–	–	–	–	–	–	–	<2
GP6	–	–	–	–	–	–	–	–	2
GP7	<1	2	–	83	20	–	111	<1	<2
GP8	–	–	–	–	–	–	–	–	<2
GP9	–	–	–	–	–	–	–	–	<2
GP10	–	–	–	–	–	–	–	–	2
GP11	–	–	–	–	–	–	–	–	<2
GP12	–	–	–	–	–	–	–	–	<2
GP14	<0.1	0.1	–	33	<10	–	<1	<1	<2
GP15	–	–	–	–	–	–	–	–	<2
GP16	–	–	–	–	–	–	–	–	<2
GP13	–	–	–	–	–	–	–	–	5
GP18	<1	1	–	45	<10	–	<1	<1	<2
GP19	1	2	–	29	<10	–	<1	<1	<2
GP20	–	–	–	–	–	–	–	–	<2
GP21	<1	<1	–	18	10	–	<1	<1	<2
GP22									

Table I1.5 Soil metal concentrations (mg/kg) (cont'd)

Parameter	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	Mercury	Uranium
Southern infrastructure corridor									
3	–	–	–	–	–	–	–	–	<0.1
5	<5	<1	8	<5	<5	3	8	<0.1	–
9	–	–	–	–	–	–	–	–	<0.1
12	<5	<1	8	<5	<5	4	6	<0.1	–
16	–	–	–	–	–	–	–	–	<0.1
21	<5	<1	7	<5	<5	<2	6	<0.1	–
24	–	–	–	–	–	–	–	–	<0.1
26	<5	<1	18	14	8	10	24	<0.1	–
33	–	–	–	–	–	–	–	–	0.2
34	<5	<1	23	15	10	12	29	<0.1	–
37	<5	<1	9	6	<5	5	11	<0.1	–
40	<5	<1	5	<5	<5	2	6	<0.1	–
42	–	–	–	–	–	–	–	–	0.2
57	–	–	–	–	–	–	–	–	0.2
RC 14	<5	<1	4	<5	<5	<2	<5	<0.1	–
48	–	–	–	–	–	–	–	–	0.1
RC 18	–	–	–	–	–	–	–	–	0.2
RC 21	<5	<1	9	5	<5	4	11	<0.1	–
62	<5	<1	19	13	10	12	25	<0.1	–
67	–	–	–	–	–	–	–	–	0.1
72	<5	<1	9	5	5	4	12	<0.1	–
78	–	–	–	–	–	–	–	–	0.2
84	12	<1	15	7	9	6	19	<0.1	–
87	–	–	–	–	–	–	–	–	1.8
88_0.0–0.15	<5	<1	29	18	17	16	40	0.2	0.4
89_0.0–0.1	8	<1	16	17	<5	11	20	0.8	2.8
89_0.1–0.3	<5	<1	23	25	7	19	30	<0.1	0.2
MAX VALUE	**12**	**<1**	**23**	**128**	**20**	**12**	**98**	**<1**	**2.8**

Notes:
All results are presented in mg/kg.
n/g – no relevant published criteria/guideline.
Uranium Health based soil investigation level from USEPA Region IX PRG – Direct Contact Industrial Soil, 2004.
NEPM – National Environment Protection (Assessment of Site Contamination) Measure, 1999.
Assessment criteria/guidelines quoted for chromium are for chromium (III).
Background ranges taken from the 'Field Geologists Manual', compiled by DA Berkman, Third Revised Edition, 1995, The Australian Institute of Mining & Metallurgy.

Table I1.6 Soil nutrient concentrations

Parameter	Ammonia	Nitrite plus nitrate	Total Kjeldahl nitrogen	Total nitrogen	Total phosphorus	Organic matter
Units	**mg/kg of N**	**mg/kg of N**	**mg/kg of N**	**mg/kg of N**	**mg/kg of P**	**%**
Limit of reporting	**20**	**0.1**	**20**	**20**	**2**	**0.5**
Ecological based guideline	**n/g**	**n/g**	**n/g**	**n/g**	**2,000**	**n/g**
Sample site location						
Gas pipeline corridors						
GP1	–	–	280	–	55	0.4
GP2	–	–	420	–	160	0.8
GP3	–	–	290	–	80	0.2
GP4	–	–	100	–	60	0.2
GP5	–	–	190	–	45	0.3
GP6	–	–	200	–	70	0.4
GP7	–	–	130	–	25	0.2
GP8	–	–	250	–	110	0.3
GP9	–	–	160	–	50	0.3
GP10	–	–	410	–	80	0.7
GP11	–	–	410	–	170	0.6
GP12	–	–	220	–	100	0.4
GP14	–	–	130	–	40	0.4
GP15	–	–	190	–	40	0.5
GP16	–	–	50	–	50	<0.1
GP13	–	–	210	–	225	0.4
GP17	–	–	200	–	180	0.3
GP18	–	–	90	–	50	0.2
GP19	–	–	50	–	30	<0.1
GP20	–	–	70	–	25	0.2
GP21	–	–	160	–	60	0.3
GP22	–	–	90	–	–	0.2
Southern infrastructure corridor						
1	–	–	–	–	–	0.9
2	<20	2.7	740	750	241	–
6	–	–	–	–	–	<0.5
10	<20	1.1	40	40	44	–
12	–	–	–	–	–	<0.5
15	<20	1.5	190	190	107	–
19	<20	3.1	240	240	128	–
23	–	–	–	–	–	<0.5
25	–	–	–	–	–	<0.5
32	–	–	–	–	–	<0.5
39	<20	104	710	820	209	–
41	–	–	–	–	–	<0.5
RC 11	<20	73.9	470	550	145	–
RC 17	<20	24.1	370	400	102	–
53	–	–	–	–	–	<0.5
56	–	–	–	–	–	<0.5
58	<20	2.9	120	120	81	–
62	–	–	–	–	–	–

Table I1.6 Soil nutrient concentrations (cont'd)

Parameter	Ammonia	Nitrite plus nitrate	Total Kjeldahl nitrogen	Total nitrogen	Total phosphorus	Organic matter
64	<20	2.6	360	370	142	–
69	–	–	–	–	–	<0.5
73	–	–	–	–	–	<0.5
77	<20	1.0	340	340	111	–
81	–	–	–	–	–	1.8
82	<20	3.5	630	640	175	–
86	<20	3.5	920	920	152	–
88_0.0–0.15	<20	67.3	540	600	148	1.6
89_0.0–0.1	<20	56.6	250	300	130	0.8
89_0.1–0.3	<20	47.5	280	330	134	0.9
MAX VALUE	**<20**	**104**	**920**	**920**	**241**	**1.8**

Table I1.7 Soil physical properties

Sample site location	Depth of sample (m)	Proportion of fines (% passing 0.075 mm sieve size)	Liquid limit (%)	Plasticity index (%)
2	0.3–0.6	50	30	17
3	0.2–0.5	3	–	NP
7	0.8–1.0	30	52	31
8	0.25–0.5	53	41	26
13	0.5–0.8	10	–	NP
25	1.2–1.4	49	37	26
26	0.25–0.4	74	62	43
32	2.4–2.6	19	–	NP
34	0.2–0.6	75	55	37
39	0.0–0.5	80	58	41
RC 11	0.0–0.4	70	53	35
RC 14	0.4–0.7	5	–	NP
RC 19	0.0–0.3	6	–	NP
56	0.4–0.7	61	45	28
57	0.0–0.4	52	40	24
58	0.5–0.9	26	32	20
67	0.0–0.25	21	13	4
75	0.2–0.5	81	50	25
77	0.6–0.9	23	26	6
81	1.5–1.7	56	45	27
85	0.0–0.25	26	20	5
88	0.0–0.15	97	37	17
88	1.8–2.2	53	49	18
89	0.3–0.8	53	47	29
Minimum value		**3**	**–**	**NP**
Maximum value		**81**	**62**	**43**

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APPENDIX I2

Acid sulfate soil investigation

I2 ACID SULFATE SOIL INVESTIGATION

Chapter 10 of the Draft EIS presents the findings of the acid sulfate soil investigation undertaken for the proposed expansion. The assessment was undertaken by HLA Envirosciences Pty Ltd. This appendix provides supplementary information in relation to the methodology undertaken and the detailed findings of the assessment.

I2.1 METHODOLOGY

I2.1.1 Desktop investigation

The desktop investigation included a review of:

- published geology, soils and topographic reports and maps for the study area (see references)
- South Australian acid sulfate soil risk mapping (Merry et al. 2003)
- review of satellite imagery and aerial photography of the study area.

I2.1.2 Field investigation

Sampling locations

Sixteen investigation holes (BH01-BH10; BH12-BH17) were located at both high and low risk sites as described below:

- one location within a clay pan to confirm the absence of ASS in inland areas without sulfate accumulation
- six locations within inland salt lakes to establish the presence and extent of monosulphides
- nine locations of coastal sediments that correspond to high risk areas as per the desktop investigation. Seven of the ten samples were located within areas likely to be disturbed by linear infrastructure and three samples were taken adjacent to proposed landing facility sites. Of the seven samples collected, three samples were taken adjacent to Port Bonython access road (termed for this report Point Lowly investigation) and four samples at Yorkeys Crossing.

Sample locations were recorded using handheld GPS (+/– 20 m) and are shown in Figure 10.7 of the Draft EIS. Coordinates and brief location descriptions are provided in Table I2.1.

Table I2.1 Sampling locations

Bore hole	Sample date	Description	Coordinates (GDA94)
BH01	11 July 2006	Lake Torrens (near Andamooka)	53H 0689990 E 6621040 N
BH02	11 July 2006	Clay pan at Andamooka Rd	53H 0685142 E 6591254 N
BH03	12 July 2006	Lake Mary	53H 0683816 E 6586013 N
BH04	13 July 2006	Lake Windabout at transmission lines (clay area)	53H 0692457 E 6523402 N
BH05	13 July 2006	Lake Windabout at transmission lines (salt area)	53H 0692653 E 6523339 N
BH06	13 July 2006	Ironstone Lagoon (SW of road)	53H 0710448 E 6490340 N
BH07	13 July 2006	Pernatty Lagoon at transmission line (road through salt pan)	53H 0712699 E 6491856 N
BH08	14 July 2006	South of Port Bonython Road (western)	53H 0748957 E 6352881 N
BH09	14 July 2006	South of Port Bonython Road (central)	53H 0749697 E 6352061 N
BH10	14 July 2006	South of Port Bonython Road (eastern)	53H 0749847 E 6351740 N
BH12	14 Sept. 2006	Yorkeys Crossing, in upper reaches of tidal extent adjacent to road	53H 0759068 E 6411474 N
BH13	14 Sept. 2006	Yorkeys Crossing, in dry unvegetated upper reaches of estuary	53H 0760875 E 6410872 N
BH14	14 Sept. 2006	Yorkeys Crossing, under powerlines to north of estuary	53H 0758932 E 6411831 N
BH15	14 Sept. 2006	Yorkeys Crossing, under powerlines to south of estuary	53H 0759437 E 6411588 N
BH16	12 Sept. 2007	Landing facility sites, adjacent to Shacks Road, south of Port Augusta	53H 0759013 E 6393147 N
BH17	12 Sept. 2007	Landing facility sites, adjacent to Shacks Road, south of Port Augusta	53H 0758652 E 6385255 N

Sample collection
In the absence of detailed South Australian guidelines, sample collection and handling was carried out in accordance with the Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines (Dear et al. 2002) and Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils in Queensland 1998 (Ahern et al. 1998).

Bore holes were dug with a hand auger to a maximum depth of 2.5 m. This depth represents the soils most likely to be disturbed by construction. Samples from each borehole were collected at intervals of no less than 0.5 m or at changes in stratigraphy. A total of 42 samples were collected. Sample depth varied from between 1.5 and 2.0 m in coastal areas with the exception of BH16 and BH17 where refusal was encountered at approximately 0.5 m below ground level.

Soil profile morphology was recorded for each test hole, including observations of hydrogen sulphide odour, iron staining, and the presence of jarosite or shell material. The surrounding environment was also observed and recorded including indicators of acid tolerant plants, dieback, iron staining and topography. Field screening tests including rapid oxidation and monosulphide-indicator tests were undertaken on samples collected. Samples were stored in air-evacuated plastic bags on ice and sent to ALS Environmental, a NATA accredited laboratory, for analysis.

Sample screening
Samples were screened for actual acid sulfate soils (AASS) using the field pH in water (pH_f) method recommended by Ahern et al. (1998). This involves determining a paste pH based on a semi-quantitative 1:2 ratio (soil:distilled water).

Samples were also screened for potential acid sulfate soils (PASS) using the field peroxide pH test (pH_{fox}) method recommended by Dear et al. (2002) and based on van Beers method of analysis (Dear et al, 2002). The use of a strong oxidant (hydrogen peroxide) in the field pH test liberates protons associated with dissociation of other metal ions including iron and aluminium as well as organic compounds associated with non-sulphide minerals. Therefore, the test may over-estimate potential acidity, if organic acids are present, however, the test is recognised as a conservative guide to identifying PASS material particularly when supported by soil texture mapping and subsequent laboratory analysis for sulphur. The pH_{fox} method was also undertaken semi-quantitatively using a 1:2 ratio (soil:distilled water). Five millilitres of 30% hydrogen peroxide (H_2O_2) solution was used as the oxidising agent. The pH of the hydrogen peroxide was adjusted to the range 5.0–5.5 for the analysis using 0.1 molar (M) sodium hydroxide (NaOH).

An additional technique was also used to detect the presence or absence of monosulphides since they can react very quickly, and be missed in the rapid oxidation tests. The technique involved monitoring dissolved oxygen (DO) changes as sediment is added to distilled water. Monosulphides have a high chemical oxygen demand (COD) and therefore cause a significant reduction in DO over time.

Laboratory analysis
Based upon the geology encountered and the screening analysis, selected representative soil samples were analysed for total actual acidity (TAA) (QASSIT Methods 21 and 22), chromium reducible sulphur (S_{CR} Method 22B) and total sulphur (QASSIT Method 20A2 – Leco). Eighteen samples (representing 31% of the samples collected) were subject to laboratory analysis.

The presence of neutralising materials, such as calcium carbonate from shells, within soil does not necessarily indicate that neutralising capacity is available. The particle size of the material and possible shielding from reaction products can reduce or cancel the neutralising capacity. These processes are difficult to predict and can therefore not be relied upon. Self-neutralising capacity, if available, should be considered as an additional benefit that may further reduce environmental risk. As such, potential self-neutralising capacity of the samples was intentionally ignored for the purposes of this assessment.

A range of factors influence the magnitude and duration of effects that may arise from the oxidation and leaching of a PASS. The most important of these, when interpreting the results of soil analyses, are the permeability of the soil and the quantity of acid that it would produce on oxidation.

The permeability of a soil is strongly influenced by its texture and clay content. This information is obtained from field assessments of soil morphology.

The potential for a soil to produce acid on oxidation is best quantified by laboratory analysis to determine percentage of oxidisable sulphur. The Queensland Acid Sulfate Soils Investigation Team (QASSIT) and the Acid Sulfate Soils Management Committee (ASSMAC) published 'Action Criteria' to define levels above which the acid generating potential of a soil is considered to be significant (Ahern et al. 1998). The 'Action Criteria' for disturbance of greater than 1,000 tonnes of soil are shown in Table I2.2, and take into account both the acid generating potential and the texture of a soil. The acid soil material guideline published in 2007 by the South Australian EPA adopts the action criteria published by Ahern et al. (1998) with the exception of action criteria differing dependent on the volume of potentially disturbed material.

Table I2.2 Action criteria of oxidisable sulphur and total potential acidity for a range of soil textures for >1,000 tonnes disturbed[1]

Texture class[2]	Approximate clay content (%)	Action Criteria	
		Oxidisable sulphur (%S – oven dry basis)	Total potential acidity (molH^+/t – oven dry basis)
Sands to loamy sands	≤ 5	0.03	18
Sandy loams to light clays	5–40	0.03	18
Medium to heavy clays and silty clays	≥ 40	0.03	18

[1] Adapted from Ahern et al. (1998) and Dear et al. (2002).
[2] As per McDonald et al. (1990).

I2.2 RESULTS

Table I2.3 provides data obtained from the field and laboratory tests for the 16 boreholes.

The column headings for in Table I2.3 correspond to:

- pH_f – field pH in water
- pH_{fox} – field peroxide pH
- ΔpH – difference between field pH in water and field peroxide pH
- pH_{KCl} – laboratory measured pH
- TAA – total actual acidity
- CRS – chromium reducible sulphur
- S_{TOT} – total sulphur

Peak Reactions depicted as follows:

- – no reaction
- X – slight reaction
- XX – moderate reaction
- XXX – high reaction
- XXXX – very vigorous reaction, gas evolution and heat generation commonly >80 °C

Table I2.3 Field and laboratory test results (bold type denotes exceedence of 'Action Criteria')

Bore hole/sample depth	Location and description	Sample ID	pH_f	pH_{fox}	ΔpH	pH_{KCl}	TAA (molH^+/t)	CRS (%S)	S_{TOT} (%S)	Peak reaction
BH1	**Lake Torrens**									
0–0.15	Salt crusting									
0.15–0.5	Gravely SAND with trace of silt, black, water at 0.1 m	BH01 0.0–0.5	7.39	5.45	1.94	N/A	N/A	N/A	N/A	X
	Hole terminated at 0.5 m	BH01 0.0–0.5 (DUP)	7.66	4.88	2.78	7.9	<2	0.10	0.37	X
BH2	**Clay pan at Andamooka Rd**									
0–0.3	CLAY, orange, plastic, desiccated, surface cracking up to 0.5 cm *Hole collapsing – terminated at 0.3 m*	BH02 0.0–0.3	7.76	7.80	−0.04	8.5	<2	<0.02	0.21	XXXX
BH3	**Lake Mary**									
0–0.4	Sandy CLAY with gravel traces, light brown, highly desiccated, gravel typically 2 mm, pebbles up to 100 mm on surface, surface cracking up to 10 mm *Hole collapsing – terminated at 0.4 m*	BH03 0.0–0.4	7.9	7.81	0.09	N/A	N/A	N/A	N/A	XXXX
BH4	**Lake Windabout at transmission lines (clay area)**									
0–0.15	Clayey SAND, orange brown, medium grained, moist, mild salt crust, medium plasticity	BH04 0.0–0.15	7.46	6.81	0.65	N/A	N/A	N/A	N/A	X
0.15–0.8	SAND, fine to medium grained, gravel traces, occasional black mottles, yellowy-grey	BH04 0.15–0.3	8.04	6.56	1.48	N/A	N/A	N/A	N/A	X
		BH04 0.4–0.55	7.6	6.44	1.16	N/A	N/A	N/A	N/A	X
		BH04 0.55–0.75	7.76	6.03	1.73	N/A	N/A	N/A	N/A	–
0.8–1.2	As above, yellowy-orange band, becoming more coarse, moist, water table not intersected *Hole terminated at 1.2 m*	BH04 0.8–1.2	7.66	6.15	1.51	N/A	N/A	N/A	N/A	X
BH5	**Lake Windabout at transmission lines (salt area)**									
0–0.05	Sandy CLAY, black, highly plastic, medium grained sand, salt crust, pebbles on surface	BH05 0.0–0.05	7.2	5.96	1.24	7.9	<2	0.19	0.41	XXXX
0.05–0.3	CLAY, orange brown, highly plastic, moist, pebbles	BH05 0.05–0.3	7.21	7.05	0.16	7.3	<2	<0.02	0.15	XXXX
0.3–0.6	SAND with trace of clay, yellow, hard *Hole terminated at 0.6 m*	BH05 0.3–0.4	7.68	7.98	−0.3	N/A	N/A	N/A	N/A	XXXX
BH6	**Ironstone Lagoon (SW of road)**									
0–0.8	GRAVEL, medium grained, black, strong odour, wet, water at 0.05 m	BH06 0.0–0.4	7.36	6.51	0.85	N/A	N/A	N/A	N/A	XXX
		BH06 0.4–0.9	7.21	6.5	0.71	N/A	N/A	N/A	N/A	XXX

Table I2.3 Field and laboratory test results (bold type denotes exceedence of 'Action Criteria') (cont'd)

Bore hole/sample depth	Location and description	Sample ID	pH_f	pH_{fox}	ΔpH	pH_{KCl}	TAA (molH⁺/t)	CRS (%S)	S_{TOT} (%S)	Peak reaction
0.8–1.0	Clayey SAND with gravel traces, grey brown with orangey brown mottles, medium grained *Hole terminated at 1.0 m*	BH06 0.8–1.0	7.54	7.3	0.24	8.1	<2	<0.02	2.76	XXXX
BH7	**Pernatty Lagoon at transmission line (road through salt pan)**									
0.0–0.15	Sandy CLAY, medium grained, moderately plastic, moist, black	BH07 0.0–0.15	7.83	7.46	0.37	N/A	N/A	N/A	N/A	XXXX
0.15–0.5	SAND with trace of clay, coarse grained sand, medium brown and grey becoming black, moist, mild odour	BH07 0.15–0.25	7.83	4.77	3.06	N/A	N/A	N/A	N/A	–
0.5–0.9	Sandy CLAY, light grey to yellowy grey with some yellow and red mottles, fine grained sand with gravel traces *Hole terminated at 0.9 m*	BH07 0.5–0.9	7.38	6.98	0.4	N/A	N/A	N/A	N/A	X
BH8	**Coastal ASS (northern)**									
0.0–0.45	Clayey SAND, fine grained, light orangey-brown, few roots	BH08 0.0–0.3	7.92	6.65	1.27	N/A	N/A	N/A	N/A	XX
0.45–0.75	SAND with trace of clay, coarse grained, medium brown, many shell fragments	BH08 0.45–0.7	8.21	6.67	1.54	9.3	<2	<0.02	0.64	X
0.75–0.95	Sandy CLAY, fine grained, many shells, plastic, light browny grey	BH08 0.75–0.95	7.95	6.85	1.1	N/A	N/A	N/A	N/A	–
0.95–1.35	Sandy CLAY, dark brown, very soft, moist variable clay	BH08 1.0–1.3	4.64	4.49	0.15	6.2	<2	0.03	2	XX
1.35–1.7	SAND, coarse, shell, dark brown with yellow mottles *Hole terminated at 1.7 m*	BH08 1.4–1.7	6.84	5.49	1.35	N/A	N/A	N/A	N/A	–
BH9	**Coastal ASS (central)**									
0.0–0.15	SAND, coarse, light brown	BH09 0.0–0.15	8	6.85	1.15	N/A	N/A	N/A	N/A	X
0.15–0.65	SAND with trace of clay, moist, dark brown, medium grained	BH09 0.15–0.45	7.77	6.56	1.21	N/A	N/A	N/A	N/A	X
0.65–0.8	Clayey SAND, light pink, moist, plastic	BH09 0.65–0.8	8.21	6.66	1.55	N/A	N/A	N/A	N/A	–
0.8–1.0	As above, becoming gravely	BH09 1.0–1.2	8.41	6.66	1.75	N/A	N/A	N/A	N/A	–
1.0–1.35	Sandy CLAY, becoming soft, medium grained, plastic, light pink	BH09 1.1–1.35	8.09	6.71	1.38	9.4	<2	<0.02	0.15	X
1.35–1.5	As above, water table at 1.35 m, pebbles and gravel up to 3 mm *Hole terminated at 1.5 m*	BH09 1.35–1.5	7.54	6.62	0.92	N/A	N/A	N/A	N/A	_

Table I2.3 Field and laboratory test results (bold type denotes exceedence of 'Action Criteria') (cont'd)

Bore hole/sample depth	Location and description	Sample ID	pH_f	pH_{fox}	ΔpH	pH_{KCl}	TAA ($molH^+/t$)	CRS (%S)	S_{TOT} (%S)	Peak reaction
BH10	**Coastal ASS (southern)**									
0.0–0.5	SAND, fine-medium grained, light brown	BH10 0.2–0.4	8.15	6.97	1.18	N/A	N/A	N/A	N/A	X
0.5–0.9	SAND, dark brown, dry, medium-coarse grained	BH10 0.5–0.65	8.24	6.48	1.76	N/A	N/A	N/A	N/A	X
0.9–1.2	Sandy CLAY, light brown, medium grained, plastic	Not sampled	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Hole terminated at 1.2 m									
BH12	**Upper reaches of tidal extent adjacent to road**									
0.0–0.2	CLAY with trace of sand, medium orange-brown, crumbly	BH12 0.0–0.2	8.14	7.76	0.38	N/A	N/A	N/A	N/A	XXXX
0.2–1.1	CLAY, moist, light brown, highly plastic, soft, water table at approximately 0.5 m	BH12 0.2–0.4	8.00	7.74	0.26	N/A	N/A	N/A	N/A	XXX
		BH12 0.8–1.0	7.54	7.64	–0.1	N/A	N/A	N/A	N/A	XXXX
1.1–1.5	CLAY with trace of sand, coarse sand, soft, plastic, bluey grey, moist	BH12 1.3–1.5	7.72	7.58	0.14	N/A	N/A	N/A	NA	
1.5–1.9	Sandy CLAY, many shells, shells up to 10 mm diameter, saturated	BH12 1.7–2.0	8.06	6.53	1.53	9.4	<2	0.06	0.19	XXXX
1.9–2.3	SAND, grey, medium-coarse grained, some shell fragments	BH12 2.0–2.3	7.99	6.38	1.61	9.4	<2	0.11	0.20	XX
	Hole terminated at 2.3 m									
BH13	**Dry, unvegetated upper reaches of estuary**									
0.0–0.15	Clayey SAND, fine grained, orange, dry with minor salt crusting at surface	BH13 0.0–0.15	7.95	7.70	0.25	N/A	N/A	N/A	N/A	XXX
0.15–0.4	CLAY with trace of sand, orange-brown, moist, plastic, soft	BH13 0.2–0.4	7.70	7.79	–0.09	NA	N/A	N/A	N/A	XXXX
0.4–0.7	CLAY, moist, soft, light brown, plastic	BH13 0.5–0.7	7.44	7.82	–0.38	N/A	N/A	N/A	N/A	XXXX
0.7–0.8	SAND, bright orange, fine grained	BH13 0.7–0.8	7.68	7.75	–0.07	N/A	N/A	N/A	N/A	X
0.8–1.5	SAND with trace of clay, very fine grained, uniform, dark grey	BH13 1.0–1.3	7.71	7.22	0.49	N/A	N/A	N/A	N/A	XXX
1.5–1.7	SAND, orange brown, medium grained	BH13 1.5–1.7	7.67	6.68	0.99	9.6		0.02	0.07	XXX
1.7–2.0	CLAY, stiff, light brown with orange flecks	BH13 1.7–2.0	7.76	6.67	1.09	9.2	<2	0.03	0.18	X
	Hole terminated at 2.0 m									
BH14	**Location: under powerlines to north of estuary**									
0.0–0.2	Clayey SAND, dry at surface, shells on surface, red-brown, crumbly	BH14 0.0–0.2	7.90	7.72	0.18	N/A	N/A	N/A	N/A	XXXX
0.2–0.6	CLAY, light brown, moist, stiff	BH14 0.2–0.4	7.91	7.66	0.25	N/A	N/A	N/A	N/A	XXXX
0.6–1.0	CLAY, highly plastic, moist, light grey, stiff	BH14 0.7–0.9	8.19	7.29	0.90	N/A	N/A	N//A	N/A	XX

Table I2.3 Field and laboratory test results (bold type denotes exceedence of 'Action Criteria') (cont'd)

Bore hole/sample depth	Location and description	Sample ID	pH_f	pH_{fox}	ΔpH	pH_{KCl}	TAA (molH+/t)	CRS (%S)	S_{TOT} (%S)	Peak reaction
1.0–1.5	CLAY, plastic, light brown	BH14 1.0–1.3	7.91	6.81	1.10	N/A	N/A	N/A	N/A	X
1.5–2.0	Gravely SAND, dark grey, coarse grained, saturated *Hole terminated at 2.0 m*	BH14 1.5–1.7	8.12	6.37	1.75	9.4	<2	0.014	0.18	X
BH15	**Under powerlines to south of estuary**									
0.0–0.5	SAND, medium grained, orange	BH15 0.2–0.4	8.09	7.10	0.99	N/A	N/A	N/A	N/A	XXX
0.5–1.2	CLAY, light brown-grey, plastic, moist, soft	BH15 0.7–0.9	7.92	7.08	0.84	9.2	<2	<0.02	0.13	XXXX
1.2–1.8	Sandy CLAY, light grey, moist, fine grained	BH15 1.2–1.4	7.82	6.76	1.06	N/A	N//A	N/A	N/A	X
1.8–2.0	SAND with trace of clay, coarse grained, shell fragments up to 5 mm diameter, light orange, red and grey, moist *Hole terminated at 2.0 m*	BH15 1.8–2.0	7.94	6.81	1.13	9.5	<2	<0.02	0.10	X
BH16	**Landing facility sites, adjacent to Shacks Road, south of Port Augusta**									
0.0–0.15	SAND, light brown, fine to coarse grained, shelly, moist	BH16 0.0–0.1	8.32	7.63	0.69	N/A	N/A	N/A	N/A	X
0.15–0.25	SAND, brown, fine grained, shelly, moist Groundwater intersected at 2 m	BH16 0.2–0.25	8.19	7.80	0.39	9.7	<2	<0.02	N/A	X
0.25–0.3	SAND, light grey-brown, fine grained, rust staining, moist	BH16 0.25–0.3	7.89	7.34	0.55	N/A	N/A	N/A	N/A	X
0.3–0.5	Silty SAND with very minor clay, grey to dark grey, wet *Hole terminated at 1.5 m, refusal and hole collapsing*	BH16 0.35–0.4	7.82	2.06	5.76	9.1	<2	0.19	N/A	X X
BH17	**Landing facility sites, adjacent to Shacks Road, south of Port Augusta**									
0.0–0.1	SAND, brown, coarse grained, shelly, moist	BH17 0.0–0.1	8.45	7.71	0.74	N/A	N/A	N/A	N/A	X
0.2–0.25	SAND, brown, coarse grained, shelly, moist *Hole terminated at 1.5 m, refusal*	BH17 0.2–0.25	8.70	7.71	0.99	9.7	<2	<0.02	N/A	X

I2.3 REFERENCES

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