Our ref: PS116542-GEO-LTR-19142 Rev B

27 August 2019

Tom Kennedy
Director
GTK Consulting
c/- Infrastructure NSW
Level 15, 167 Macquarie Street
Sydney NSW 2000

Dear Tom

Geotechnical Desktop assessment to meet SEARs requirement
Stadium Australia, NSW

1. INTRODUCTION

WSP Australia Pty Ltd (WSP) have reviewed the provided geotechnical information for the proposed work at Stadium Australia as per our proposal PP117825-CLM-LTR-Rev A dated 9 August 2019 and approved on 12 August, 2019. The work was performed to satisfy requirements in the Planning Secretary's Environmental Assessment Requirements (SEARS).

2. REVIEW

We have reviewed the following documents:

- Coffey report S10530/1-AF, April 1996, Geotechnical Investigation, Australia Stadium Project, Homebush Bay, for Multiplex Constructions (NSW) Pty Ltd
- Coffey report S10530/3-AB, September, 1996, Additional Geotechnical Investigations, Australia Stadium Project, Homebush Bay, for Multiplex Constructions (NSW) Pty Ltd
- Stadium Australia Redevelopment, Project Options Drawings, Cox Architecture, 8 October, 2019

Construction records and As-built drawings were not provided.

3. ASSESSMENT

The review of the above documents indicated that:

- The previous subsurface investigations included boreholes, geophysical testing consisting of a seismic refraction survey, and laboratory testing.
- The site was divided into an "elevated area" in the western portion of the site and a "depression area" in the eastern portion of the site. The conditions in each area were described as follows:

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- Elevated Area subsurface conditions included the following (Coffey, April, 1996)[1]

FILL 0 to 0.4m depth	Concrete pavement, rubble and road base fill
- above -	
RESIDUAL SOIL 0.4m to about 1.5m depth	CLAY, high plasticity, light grey, orange and red brown, moist and very stiff to hard consistency.
- above -	
EXTREMELY WEATHERED SHALE about 1.5m to about 6.5m depth	SHALE, light grey with red brown iron indurated laminations, extremely low rock strength. This unit grades into moderately to highly weathered shale in the lower 1m to 2m of the unit
- above -	
FRESH SHALE (minor slightly weathered) below about 6.5m depth	SHALE (SILTSTONE), dark grey with units of Interlaminated SILTSTONE and SANDSTONE, medium to high rock strength

[1] – Depths need to be tied to current RLs and materials / depths may vary due to previous earthwork.

- Depression Area subsurface conditions included the following (Coffey, April, 1996)[1]

FILL 0m to about 1.5m to 2.5m depth	Gravelly CLAY with pieces of brick, ash and concrete.
- above -	
BURIED TOPSOIL about 0.2m thick	Clayey SILT, dark brown with rootlets
- above -	
ALLUVIAL and RESIDUAL SOIL about 2.5m to 4m or 6m depth	CLAY, high plasticity, mottled red and light grey with layers of gravelly Clay containing iron stone gravel, very stiff consistency, moisture greater than Plastic Limit.
- above -	
WEATHERED SHALE below 6m depth with FRESH to SLIGHTLY WEATHERED SHALE below 7m or 9m depth	Descriptions of shale as per elevated site (discussed above).

[1] – Depths need to be tied to current RLs and materials / depths may vary due to previous earthwork.

- The rock underlying the site consisted of the Ashfield Shale. Its properties, such as strength and weathering, varied across the site laterally and with depth as indicated above. Indications of faulting were encountered in some locations. Contours of the top of "fresh" shale were provided in the reports, which should be useful for the proposed redevelopment.
- The rock was given geotechnical parameters based on the 1978 Australian Geomechanics Society (Pells et al, 1978) approach. We have updated the rock classification to that used in 1998 as referenced in Pells et al (2019) and included the information as an additional column in the table in Attachment A. In addition, the design values for loading on sandstone and shale have been revised in Pells et al (2019) and these are provided in Table 3.1 and Table 3.2.

Table 3.1 Design values for centric vertical loading on sandstone (Table 3 in Pells et al, 2019)

Class	Limit of approximately linear settlement versus bearing pressure (see text)	Guidelines for specific serviceability calculations		Revised guidelines	
		Design Young's Modulus (MPa)[1]	Design Poisson's Ratio	Bearing pressure to limit settlement to <1% of minimum footing dimension (MPa)[1]	Ultimate compressive socket side shear (kPa)[2]
I	>3 x UCS	2000 to 5000	0.2	12	3000
II	>2 x UCS	900 to 2000	0.2	6 to 12	1500 to 3000
III	>1.5 x UCS	350 to 1200	0.25	3.5 to 6	800 to 1500
IV	UCS	100 to 700	0.3	1 to 3.5	250 to 800
V	3MPa	50 to 200	0.35	0.8 to 1	150

Note 1: Lower values for lowest strength, closest defect spacing or maximum seam % in each Class.
Note 2: Clean sockets of roughness category R2 or better (Walker and Pells, 1998).

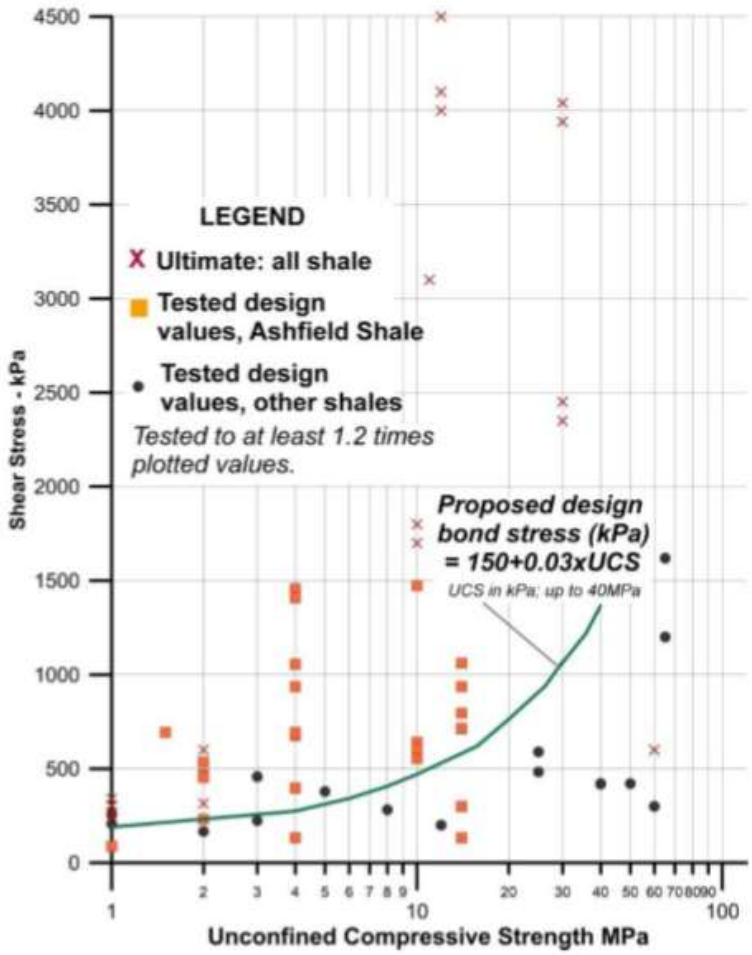
Table 3.2 Design values for centric vertical loading on shale (Table 4 in Pells e al, 2019)

Class	Limit of approximately linear settlement versus bearing pressure (see text)	Guidelines for specific serviceability calculations		Revised guidelines	
		Design Young's modulus (MPa)[1]	Design Poisson's ratio ν	Bearing pressure to limit settlement to < 1% of minimum footing dimension (MPa)[1]	Ultimate compressive socket side shear (kPa)[2]
I	>2 x UCS	2000 to 5000	0.15	8	1000
II	>2 x UCS	700 to 2000	0.15	3.5 to 6	600 to 1000
III	>1.5 x UCS	200 to 1200	0.2	1 to 3.5	350 to 600
IV	2MPa	100 to 500	0.2	1	150
V	1.5MPa	50 to 200	0.3	0.7	50 to 100

Note 1: Lower values for lowest strength, closest defect spacing or maximum seam % in each Class.
Note 2: Clean sockets of roughness category R2 or better (Walker and Pells, 1998); values must be reduced if smear is not removed.

Information regarding rock anchor bond stress was provided in the Coffey report S10530/1-AF, April 1996, but updated information was also provided in Pells et al, (2019), as reproduced in Figure 3.1.

Figure 3.1 Design bond values in Ashfield Shale (figure 7 in Pells et al,2019)



- Groundwater levels were assessed using piezometers. A perched groundwater level in the fill and an underlying groundwater system in rock were assessed. Artesian flows were reported in some locations.
- Soil classification testing was performed as follows:
  - Atterberg Limits, Linear shrinkage, and Oedometer shrink plus swell - The results indicated that "…the residual clays are of high plasticity, with moderate to high susceptivity to shrink/swell movements due to seasonal changes in moisture content." (Coffey, April, 1996).
  - Emerson Dispersion - "The Emerson Crumb dispersion testing indicates that all of the natural clay soils are susceptible to slaking while some are dispersive." (Coffey, April, 1996)
- Soil and groundwater aggressivity testing was not performed on onsite samples, but some limited chemical test data were used to assess these parameters. Their assessment indicated that "…the groundwater was considered to have minimal aggressivity towards concrete yet the high conductivity suggest that steel reinforcement should have at least 75 mm of concrete cover.

  They also noted," Given the variability of soil and groundwater salinity and sulphate levels in the general Olympic area, it is recommended that further work be carried out in the Stadium site to address aggressivity risks to buried structural elements." (Coffey, April, 1996)

4. COMMENTS / RECOMMENDATIONS

The following comments and recommendations are provided:

- Based on the previous geotechnical investigations the site would be suitable for the proposed development. It is recommended further investigations are undertaken prior to detailed design to confirm previous investigations.
- The current ground level with respect to that used for the previous studies by Coffey should be assessed since fill and / or excavation may have occurred, changing the surface RLs and subsurface conditions from those shown on the borehole logs. The data should be tied to the current site datum and "As-Built" drawings and construction records reviewed. In particular, this should also include a review of existing foundation installation depths, loads, and performance. It is also noted that the position of the existing foundations may impact the performance of new foundations and this needs to be assessed on an individual basis.
- The updated information for foundations bearing on rock and anchor bond stress should be used.
- Groundwater conditions may have changed over time due to development and should be reassessed since they could impact deep foundation (bored pier) construction.
- Soil and groundwater aggressivity data should be reviewed and assessed using current standards, and additional information obtained if needed.

5. CLOSURE

This letter report should be read in conjunction with the attached 'Limitations of geotechnical investigations' statement. The assessment was based on the provided information. We did not view the materials.

Should you have any questions, please do not hesitate to contact the undersigned at 02 4929 8345.

Yours sincerely

David L. Knott

David L Knott
Senior Geotechnical Engineer

Encl: Limitations of Geotechnical Investigations Statement
Attachment A - Updated rock classification

REFERENCES

Pells, P.J.N., Douglas, DJ., Rodway, B., Thorne, C. and McMahon, B.K., (1978). Design Loadings of Foundations on Shale and Sandstone in the Sydney Region. Aust. Geomechanics Journal, Vol. G8, pp31-39.

Pells, P.J.N., Mostyn, G., Bertuzzi, R., and Wong, P.K., (2019). Classification of Sandstones and Shales in the Sydney Region: A Forty Year Review. Aust. Geomechanics Journal and News, Vol 54:No 2, pp29 - 55

Legal

Limitations of Geotechnical Site Investigation

Scope of services

This geotechnical site assessment report (the report) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client and WSP (scope of services). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

Reliance on data

In preparing the report, WSP has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, WSP has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WSP will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

Geotechnical investigation

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared to meet the specific needs of individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor or even some other consulting civil engineer. This report was prepared expressly for the client and expressly for purposes indicated by the client or his representative. Use by any other persons for any purpose, or by the client for a different purpose, might result in problems. The client should not use this report for other than its intended purpose without seeking additional geotechnical advice.

This geotechnical report is based on project-specific factors

This geotechnical engineering report is based on a subsurface investigation which was designed for project-specification factors, including the nature of any development, its size and configuration, the location of any development on the site and its orientation, and the location of access roads and parking areas. Unless further geotechnical advice is obtained this geotechnical engineering report cannot be used:

- when the nature of any proposed development is changed
- when the size, configuration location or orientation of any proposed development is modified.

This geotechnical engineering report cannot be applied to an adjacent site.

Limitations of Geotechnical Site Investigation

The limitations of site investigation

In making an assessment of a site from a limited number of boreholes or test pits there is the possibility that variations may occur between test locations. Site exploration identifies specific subsurface conditions only at those points from which samples have been taken. The risk that variations will not be detected can be reduced by increasing the frequency of test locations; however this often does not result in any overall cost savings for the project. The investigation program undertaken is a professional estimate of the scope of investigation required to provide a general profile of the subsurface conditions. The data derived from the site investigation program and subsequent laboratory testing are extrapolated across the site to form an inferred geological model and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Despite investigation the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

The borehole logs are the subjective interpretation of subsurface conditions at a particular location, made by trained personnel. The interpretation may be limited by the method of investigation, and can not always be definitive. For example, inspection of an excavation or test pit allows a greater area of the subsurface profile to be inspected than borehole investigation, however, such methods are limited by depth and site disturbance restrictions. In borehole investigation, the actual interface between materials may be more gradual or abrupt than a report indicates.

Subsurface conditions are time dependent

Subsurface conditions may be modified by changing natural forces or man-made influences. A geotechnical engineering report is based on conditions which existed at the time of subsurface exploration.

Construction operations at or adjacent to the site, and natural events such as floods, or groundwater fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept appraised of any such events, and should be consulted to determine if additional tests are necessary.

Avoid misinterpretation

A geotechnical engineer should be retained to work with other appropriate design professionals explaining relevant geotechnical findings and in reviewing the adequacy of their plans and specifications relative to geotechnical issues.

Bore/profile logs should not be separated from the engineering report

Final bore/profile logs are developed by geotechnical engineers based upon their interpretation of field logs and laboratory evaluation of field samples. Customarily, only the final bore/profile logs are included in geotechnical engineering reports. These logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings. To minimise the likelihood of bore/profile log misinterpretation, contractors should be given access to the complete geotechnical engineering report prepared or authorised for their use. Providing the best available information to contractors helps prevent costly construction problems. For further information on this matter reference should be made to ‘Guidelines for the Provision of Geotechnical Information in Construction Contracts’ published by the Institution of Engineers Australia, National Headquarters, Canberra 1987.

Geotechnical involvement during construction

During construction, excavation is frequently undertaken which exposes the actual subsurface conditions. For this reason geotechnical consultants should be retained through the construction stage, to identify variations if they are exposed and to conduct additional tests which may be required and to deal quickly with geotechnical problems if they arise.

Limitations of Geotechnical Site Investigation

Report for benefit of client

The report has been prepared for the benefit of the client and no other party. WSP assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of WSP or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

Other limitations

WSP will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

Attachment A

APPENDIX C
ROCK MASS CLASSIFICATIONS
FOR RELEVANT STADIUM BOREHOLES

Borehole No. (Surface RL) (m)	Depth Interval (m)	Reduced Level Interval (m)	Assessed Shale Classification Ref. 1	1998 classification
OS1 (105.5)	6.0 to 6.4	99.5 to 99.1	V	V
	6.4 to 6.9	99.1 to 98.6	IV	IV
	6.9 to 8.4	98.6 to 97.1	III	III-IV
	8.4 to 14.5	97.1 to 91.0	II	III
	14.5 to 20.0	91.0 to 85.5	I	II-III
OS2 (109.7)	4.0 to 6.0	105.7 to 103.7	V	V
	6.0 to 6.8	103.7 to 102.9	IV	IV
	6.8 to 9.0	102.9 to 100.7	III	III-IV
	9.0 to 13.0	100.7 to 96.7	II	III
	13.0 to 20.5	96.7 to 89.2	I/II	II-III
	20.5 to 22.5	89.2 to 87.2	II	II
	22.5 to 25.0	87.2 to 84.7	I	II
OS3 (107.2)	3.4 to 4.0	103.2 to 103.0	V	V
	4.0 to 4.7	103.0 to 102.5	IV	IV
	4.7 to 5.1	102.5 to 101.3	III	IV
	5.1 to 10.0	101.3 to 97.2	II	II-III
OS4 (107.6)	3.4 to 4.0	104.2 to 103.6	V	V
	4.0 to 4.7	103.6 to 102.9	IV/V	IV-V
	4.7 to 5.1	102.9 to 102.5	III	III
	5.1 to 10.0	102.5 to 97.6	II/III	II-III
OS5 (112.08)	2.5 to 4.6	109.6 to 107.5	V	V
	4.6 to 5.9	107.5 to 106.2	III	III
	5.9 to 20.2	106.2 to 91.9	II	II-III
OS6 (113.8)	1.7 to 3.1	112.1 to 110.7	V/IV	V
	3.1 to 4.2	110.7 to 109.6	IV	IV-V
	4.2 to 5.3	109.6 to 108.5	III	III
	5.3 to 7.5	108.5 to 106.3	II	II-III
	7.5 to 14.5	106.3 to 99.3	I	I-III
	14.5 to 20.3	99.3 to 93.5	II	II-III
OS7 (112.9 approx.)	0.7 to 5.0	112.2 to 107.9	V	V
	5.0 to 6.0	107.9 to 106.9	III	III
	6.0 to 9.8	106.9 to 103.1	II	II-III

Borehole No. (Surface RL) (m)	Depth Interval (m)	Reduced Level Interval (m)	Assessed Shale Classification Ref. 1	1998 Classification
OS8	1.8 to 4.7	107.4 to 104.5	V	V
(109.2)	4.7 to 5.5	104.5 to 103.7	IV	IV-V
	5.5 to 6.0	103.7 to 103.2	V	V
	6.0 t o7.7	103.2 to 101.5	IV/III	III-IV
	7.7 to 10.1	101.5 to 99.1	II	II-III
OLY3	2.3 to 4.5	111.1 to 108.9	V	V
(113.4)	4.5 to 6.5	108.9 to 106.9	III	III
	6.5 to 9.8	106.9 to 103.6	I	II
OLY4 *	3.7 to 5.2	104.5 to 103.0	V	V
(108.2)	5.2 to 6.6	103.0 to 101.6	IV	IV
	6.6 to 8.9	101.6 to 100.7	II	II-III
OLY5 *	1.1 to 3.6	110.3 to 107.8	V	V
(111.4)	3.6 to 5.2	107.8 to 106.3	IV	IV-V
	5.2 to 7.4	106.3 to 104.1	II	II-III
OLY8 *	1.3 to 4.4	111.6 to 108.5	V	V
(112.9)	4.4 to 5.3	108.5 to 107.7	IV	IV
	5.3 to 6.6	107.7 to 106.3	III/IV	III-IV
	6.6 to 7.4	106.3 to 105.5	II	II
	7.4 to 9.1	105.5 to 103.8	I	I-II
JK1 *	4.8 to 5.2	103.4 to 103.0	V	V
(108.2)	5.2 to 6.6	103.0 to 101.6	IV	V
	6.6 to 7.2	101.6 to 101.0	III	IV
	7.2 to 10.0	101.0 to 98.2	II	II
JK2 *	5.0 to 6.4	101.3 to 99.9	V	V
(106.3)	6.4 to 8.0	99.9 to 98.3	IV	IV-V
	8.0 to 9.4	98.3 to 96.9	III	III
	9.4 to 10.6	96.9 to 85.7	II	II
JK3 *	5.4 to 5.9	107.6 to 107.1	IV	IV-V
(113.0)	5.9 to 7.1	107.1 to 105.9	III	IV
	7.1 to 10.1	105.9 to 102.9	I/II	II
JK4 *	2.1 to 4.7	113.0 to 110.4	V	V
(115.1)	4.7 to 6.1	110.4 to 109.0	IV	IV-V
	6.1 to 9.0	109.0 to 106.1	I/II	II

* Rock classes taken from Coffey Report S9547/1 and Jeffery and Katauskas Report 11234JH with minor modifications by Coffey based on point load strength and fracturing.

ROCK MASS CLASSIFICATIONS

Borehole No. and (Surface RL) (m)	Depth Interval (m)	Reduced Levels of Interval (m)	Assessed Shale Classification	1998 Classification
OS9	5.0 - 6.2	104.1 - 102.9	V	V
(109.1)	6.2 - 9.8	102.9 - 99.3	IV	V
	9.8 - 12.8	99.3 - 96.3	III (sheared)	III - IV
	12.8 - 14.5	96.3 - 94.6	II	II - III
OS10	3.3 - 6.9	106.1 - 102.5	V	V
(109.4)	6.9 - 7.7	102.5 - 101.7	IV	IV
	7.7 - 14.9	101.7 - 94.5	II	III
	14.9 - 20.9	94.5 - 88.5	I	II
OS11	4.3 - 5.9	103.2 - 101.6	V	V
(107.5)	5.9 - 6.8	101.6 - 100.7	IV	IV - V
	6.8 - 8.3	100.7 - 99.2	II	III
	8.3 - 9.0	99.2 - 98.5	III	IV - III
	9.0 - 14.1	98.5 - 93.4	II	II
	14.1 - 20.3	93.4 - 87.2	I	I - II
OS12	3.9 - 4.3	103.0 - 102.6	V	V
(106.9)	4.3 - 6.0	102.6 - 100.9	IV	IV - V
	6.0 - 6.9	100.9 - 100.0	III	III
	6.9 - 10.0	100.9 - 96.9	II	II
OS13	3.3 - 5.7	104.6 - 102.2	V	V
(107.9)	5.7 - 6.3	102.2 - 101.6	IV	IV
	6.3 - 7.8	101.6 - 100.1	III	III - IV
	7.8 - 9.4	100.1 - 98.5	II	II - III
	9.4 - 14.5	98.5 - 93.4	III	III - IV
	14.5 - 20.9	93.4 - 87.0	II	II - III
OS14	3.5 - 5.3	106.6 - 104.8	V	V
(110.1)	5.3 - 5.8	104.8 - 104.3	IV	V
	5.8 - 7.7	104.3 - 102.4	III	IV
	7.7 -15.5	102.4 - 94.6	II	III
	15.5 - 20.6	94.6 - 89.5	I	I - II
OS15	6.7 - 8.8	101.5 - 99.4	V	V
(108.2)	8.8 - 10.3	99.4 - 97.9	IV	V
	10.3 - 11.6	97.9 - 96.6	II	II - III

Zone 1 Core 4

Borehole No. and (Surface RL) (m)	Depth Interval (m)	Reduced Levels of Interval (m)	Assessed Shale Classification	1998 classification
OS16	6.7 - 7.7	101.7 - 100.7	V	V
(108.4)	7.7 - 9.0	100.7 - 99.4	IV	V
	9.0 - 9.7	99.4 - 98.7	V/IV	IV-V
	9.7 - 11.7	98.7 - 96.7	II	III
OS17	1.1 - 5.0	110.9 - 107.0	V	V
(112.0)	5.0 - 6.0	107.0 - 106.0	IV	V
	6.0 - 6.8	106.0 - 105.2	IV/III	V
	6.8 - 10.1	105.2 - 101.9	II	III
OS18	1.5 - 5.6	108.8 - 104.7	V	V
(110.3)	5.6 - 7.8	104.7 - 102.5	IV	IV
	7.8 - 8.2	102.5 - 102.1	III	IV
	8.2 - 17.2	102.1 - 93.1	II	II-III
	17.2 - 20.1	93.1 - 90.2	I/II	I-II
OS19	2.3 - 6.3	107.0 - 103.0	V	V
(109.3)	6.3 - 7.6	103.0 - 101.7	IV	IV
	7.6 - 8.5	101.7 - 100.8	III/II	II-III
	8.5 - 20.6	100.8 - 88.7	II	II-III
OS20	1.1 - 4.9	111.0 - 107.2	V	V
(112.1)	4.9 - 6.8	107.2 - 105.3	IV	IV
	6.8 - 7.1	105.3 - 105.0	III	IV
	7.1 - 20.1	105.0 - 92.0	II	II-IV
OS21	1.2 - 4.8	109.3 - 105.7	V	V
(110.5)	4.8 - 5.4	105.7 - 105.1	IV	IV
	5.4 - 7.1	105.1 - 103.4	III	III-IV
	7.1 - 10.0	103.4 - 100.5	II	II
OS22	1.8 - 5.7	111.9 - 108.0	V	V
(113.7)	5.7 - 7.1	108.0 - 106.6	III	III
	7.1 - 17.6	106.6 - 96.1	II	II
	17.6 - 19.7	96.1 - 94.0	IV (Shear)	IV
	19.7 - 20.4	94.0 - 93.3	II	II
OS23	1.0 - 3.85	113.5 - 110.65	V	V
(114.5)	3.85 - 6.5	110.65 - 108.0	IV	IV
	6.5 - 7.2	108.0 - 107.3	III	III
	7.2 - 20.1	107.3 - 94.4	II	II-III

Bore 3 cont 4

Borehole No. and (Surface RL) (m)	Depth Interval (m)	Reduced Levels of Interval (m)	Assessed Shale Classification	1998 classification
OS24	4.5 - 5.5	104.2 - 103.2	V	V
(108.7)	5.5 - 6.9	103.2 - 101.8	III	III-IV
	6.9 - 19.6	101.8 - 89.1	II	II-III
	19.6 - 20.6	89.1 - 88.1	I	II
OS25	1.3 - 4.7	105.7 - 102.3	V	V
(107.0)	4.7 - 5.3	102.3 - 101.7	IV	IV
	5.3 - 6.5	101.7 - 100.5	III	II-III
	6.5 - 14.3	100.5 - 92.7	II	II-III
	14.3 - 17.0	92.7 - 90.0	II (sandstone)	III
	17.0 - 20.2	90.0 - 86.8	II	II-III
OS26	3.2 - 5.0	104.9 - 103.1	V	V
(108.1)	5.0 - 5.9	103.1 - 102.2	IV	IV
	5.9 - 7.5	102.2 - 100.6	III	III
	7.5 - 17.5	100.6 - 83.1	II	II-III
	17.5 - 18.7	83.1 - 90.6	I	II
	18.7 - 19.0	90.6 - 90.3	II (shear)	III
	19.0 - 20.5	90.3 - 87.6	I	II-III
OS27	1.3 - 5.2	108.2 - 104.3	V	V
(109.5)	5.2 - 5.8	104.3 - 103.7	III	III
	5.8 - 8.0	103.7 - 101.5	II	II
	8.0 - 10.2	101.5 - 99.3	II/I	II
OS28	2.7 - 5.3	106.1 - 103.5	V	V
(108.8)	5.3 - 6.4	103.5 - 102.4	III	III
	6.4 - 10.1	102.4 - 98.7	II	II-III

Zone 2 Col 4

Zone 2+ Col 4