SINCLAIR KNIGHT MERZ PTY LTD

YAKABINDIE NICKEL PROJECT

REVIEW OF HISTORIC GEOCHEMICAL

TESTWORK ON MINE-WASTE SAMPLES

Implications for Mine-Waste and Low-Grade-Ore Management

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(ACN 061 827674)
OCTOBER 2005
Job No. 0516

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SUMMARY OF TECHNICAL TERMS EMPLOYED IN THIS REPORT

ACRONYM	PARAMETER	DEFINITION/DETERMINATION	UNIT
AFP	Acid-Formation Potential		
ARD	Acid-Rock Drainage		
Total-S	Total Sulphur	Analysis Result	% (w/w)
Sulphide-S	Sulphide Sulphur	Testwork Result [i.e. Sulphide-S = Total-S - Sulphate-S]	% (w/w)
ANC	Acid-Neutralisation Capacity	Testwork Result	kg H_2SO_4/tonne
MPA	Maximum-Potential Acidity	Calculation	kg H_2SO_4/tonne
NAPP	Net-Acid-Producing Potential	Calculation	kg H_2SO_4/tonne
NAG	Net-Acid Generation	Testwork Result	kg H_2SO_4/tonne
NAF	Non-Acid Forming	Calculation: • Sulphide-S < 0.3 % • Sulphide-S ≥ 0.3 %, and negative-NAPP value with ANC/MPA ≥ 2.0	kg H_2SO_4/tonne
PAF	Potentially-Acid Forming	Calculation: • Sulphide-S ≥ 0.3 %, and any positive-NAPP value • Sulphide-S ≥ 0.3 %, and a negative-NAPP value with ANC/MPA < 2.0	kg H_2SO_4/tonne
PAF-[SL]	PAF-[Short-Lag]	Estimation [e.g. inferred from 'kinetic' testing]	
PAF-[LL]	PAF-[Long-Lag]	Estimation [e.g. inferred from 'kinetic' testing]	
SOR	Sulphide-Oxidation Rate	Testwork Result [e.g. obtained from 'kinetic' testing]	mg SO_4/kg/week,

Notes:

The **PAF-[SL]** classification applies to (initially circum-neutral) PAF-materials that may acidify (viz. pH less than 5) within a matter of weeks-to-months when subjected to "aggressive-ambient-weathering", corresponding to periods of at least a few days during which unsaturated-conditions prevail (via drainage/evaporation processes) between successive inundations that, in turn, occur semi-regularly (e.g. weekly-to-fortnightly "on-average" during most of the annual hydrological-cycle).

The **PAF-[LL]** classification applies to PAF-materials where exposure to the atmosphere for years (even decades, or longer) may be needed before acidification develops. Circum-neutral-pH during the "lag-phase" for such lithotypes is chiefly due to buffering reactions involving carbonate-minerals.

Climate directly influences the duration of the "lag-phase", and a sulphide-gangue assemblage classified as PAF-[SL] in a "humid" environment where the SOR is controlled by **O_2-supply**, may instead be classified as PAF-[LL] in semi-arid/arid environments where the SOR is contolled by **water-supply** (viz. frequency of "flushing-episodes") [Campbell 2004]. The formation of "secondary-oxidation-products" (e.g. Fe-oxyhydroxides) as protective-coatings is generally enhanced during the "lag-phase-stage" of mine-waste weathering in semi-arid/arid environments, and so further curtails sulphide-oxidation rates.

1.0   INTRODUCTION

BHP Billiton Pty Ltd (Nickel West) is developing the Yakabindie Nickel Project located *c.* 30 kms to the south of Mt Keith, Western Australia.

Ore will be produced via open-pit mining of the Six-Mile Deposit and Goliath Deposit, and the excavated waste-rock materials (viz. regoliths and waste-bedrocks) placed on waste-dumps in the vicinity of the Pits. Low-grade-ores will also be stockpiled for possible subsequent treatment in the mill, subject to metallurgical evaluation, and Project economics.

Graeme Campbell & Associates Pty Ltd (GCA) was commissioned by Sinclair Knight Merz Pty Ltd to review reports by AGC Woodward-Clyde (1991) and ANSTO (1996) on geochemical testwork performed on mine-waste samples derived from the above Deposits.

The testwork results are presented and discussed in this report, and implications for mine-waste management highlighted.

2.0   STUDY APPROACH

2.1   Assumptions Made in Review of Historic Testwork

Since the AGC Woodward-Clyde (1991) and ANSTO (1996) studies, there have been numerous advances and improvements in the testwork procedures employed for the geochemical characterisation of mine-waste materials (e.g. AMIRA 2002). Nonetheless, the testing methods employed in these earlier studies allow valid assessment of the mine-waste materials to be produced during the Yakabindie Nickel Project.

2.1.1   AGC Woodward-Clyde (1991) Study

The samples tested in the AGC Woodward-Clyde (1991) study are derived from the Six-Mile Deposit, and correspond to down-hole intervals of *c.* 1 m.

It is assumed herein that the samples tested are representative of the major lithotypes to be produced during the open-pit mining of the Six-Mile Deposit.

Where Total-S values are listed as "0.0 %" in the AGC Woodward-Clyde (1991) report, they are presented as < 0.01 % herein.

Where appropriate, the parameter values listed in the AGC Woodward-Clyde (1991) report have been rounded to no more than two significant-figures herein.

In the AGC Woodward-Clyde (1991) study, the mine-waste samples were tested for acid-formation potential, and salinity. Selected samples were also assayed for a suite of minor-elements.

2.1.2   ANSTO (1996) Study

The samples tested in the ANSTO (1996) study are mostly derived from the Goliath Deposit with some samples from the Six-Mile Deposit. Drillhole details are not available for all samples, but where these are available, the down-hole intervals were *c.* 1 m.

It is assumed herein that the samples tested are representative of the major lithotypes to be produced during the open-pit mining of the Goliath Deposit.

Where CO_3 values are listed as "0 %" in the ANSTO (1996) report, they are presented as < 0.05 % herein.

Where Net-Acid-Generation (NAG) values are listed as "0 kg H_2SO_4/tonne" in the ANSTO (1996) report, they are presented as < 0.5 kg H_2SO_4/tonne herein.

Where appropriate, the parameter values listed in the ANSTO (1996) report have been rounded to no more than two significant-figures herein.

In the ANSTO (1996) study, the mine-waste samples were tested for acid-formation potential, and salinity.

2.2   Classification Criteria

The Maximum-Potential-Acidity (MPA) values (in kg H_2SO_4/tonne) of the mine-waste samples were calculated by multiplying the Sulphide-S values (in %) by 30.6. The multiplication-factor of 30.6 reflects both the reaction stoichiometry for the complete-oxidation of pyrite/pyrrhotite, by O_2 to "Fe(OH)$_3$" and H_2SO_4, and the different weight-based units of % and kg H_2SO_4/tonne.

The Net-Acid-Producing-Potential (NAPP) values (in kg H_2SO_4/tonne) were calculated from the corresponding MPA and Acid-Neutralisation-Capacity (ANC) values (i.e. NAPP = MPA - ANC).[1]

In terms of AFP, mine-waste materials may be classified into one of the following categories, viz.

- Non-Acid Forming (NAF).

- Potentially-Acid Forming (PAF).

There are **no** unifying, "standard" criteria for classifying the AFP of mine-waste materials (Campbell 2002a,b; Smith 1992), and reflects the diversity of sulphide and gangue-mineral assemblages within (un)mineralised-lithotypes of varying weathering- and alteration-status. Rather, criteria for classifying AFP may need to be tailored to deposit-specific geochemistry, and mineralogy.

The AFP-classification criteria often employed at mining-operations worldwide are:

- **NAF**: Sulphide-S < 0.3 %. For Sulphide-S ≥ 0.3 %, both a negative NAPP value, and an ANC/MPA ratio ≥ 2.0.

- **PAF**: For Sulphide-S ≥ 0.3 %, any positive-NAPP value; negative-NAPP value with an ANC/MPA ratio < 2.0.

In recent years, fundamental-research (especially estimation of reaction-rates for diverse sulphide/gangue-mineral assemblages), and field-experience at mining operations world-wide, have shown that the potential for Acid-Rock Drainage (ARD) production is

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[1] NAPP values were not performed for sample with Sulphide-S contents less than 0.1 %.

very low for mine-waste materials with ANC/MPA ratios greater than 2.0 (e.g. AMIRA 2002). This ANC/MPA ratio is employed in the present work.[2]

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[2] It should be noted that mining-regulators in Nevada (USA) classify a mine-waste sample as NAF, if it is characterised by an ANC/MPA ratio greater than 1.2 (US EPA 1994). This lower ANC/MPA ratio reflects the semi-arid conditions typically encountered at mine-sites in Nevada. Although utilised in the early-1990s, it is understood that an ANC/MPA ratio of 1.2 is still entertained by regulators in Nevada for "screening" PAF and NAF varieties of mine-wastes in semi-arid settings.

3.0 GEOCHEMISTRY OF REGOLITH AND WASTE-BEDROCK SAMPLES FROM SIX-MILE DEPOSIT

3.1 Salinity and Acid-Formation Potential

3.1.1 Regoliths

The fourteen (14) samples of regoliths were characterised by (Table 3.1):

- pH and EC values of 7.2-9.2, and 0.35-7.1 mS/cm, respectively;[3] and,

- Total-S values less than 0.1-0.2 %.[4]

The testwork results indicate that the samples are all classified as NAF.

The samples were neutral-to-alkaline with moderate-to-high contents of soluble-salts Although not tested, the soluble-salts are expected to be dominated by chlorides.

3.1.2 Waste-Bedrocks

The seventy (70) samples of waste-bedrocks were characterised by (Tables 3.2-3.4):

- pH and EC values of 5.9-10.1, and 0.17-2.7 mS/cm, respectively;

- Total-S values that ranged from less than 0.1-0.2 %, to 16.4 %; and,

- ANC values ranging up to 370 kg H_2SO_4/tonne.

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[3] EC = Electrical-Conductivity. The pH and EC Tests are described in the table footnote.
[4] One sample had a Total-S value of 3.7 %, but refer table footnote for qualifying remarks for this result.

Fifty-six (56) samples had Total-S values less than 0.5 %, and most of these had Total-S values less than 0.1 %. This distribution of Total-S indicates a paucity, at the "metre-scale", of sulphide-minerals in the majority of lithotypes, and accords with the style of mineralisation within the Six-Mile Deposit. Although ANC testing was not conducted on all samples, a groundmass with a moderate-to-high capacity to consume acid is the norm, and reflects at least "trace-carbonates", and/or ultramafic-silicates (e.g. antigorite and lizardite).[5]

The majority of samples are classified as NAF. Due to the nature of the groundmass, the PAF samples are generally classified as PAF-[Long-Lag]. Furthermore, where PAF-rock occur, the indications are that they would be co-dumped with NAF-rock.

As a group, and as expected, the samples of the *volcanic-sediment-(Footwall-Massive-Sulphides)* stood out with Total-S values of 2.1-16.4 %. Despite containing abundant sulphide-minerals, the high ANC values indicate a groundmass with appreciable pH-buffering capacity, so that this lithotype is classified as PAF-[Long-Lag].[6]

The samples were neutral-to-alkaline with low-to-moderate contents of soluble-salts Although not tested, the soluble-salts are expected to be dominated by chlorides.

3.2   Minor-Element Content

The assay results for selected minor-elements in thirty-four (34) samples of regoliths and waste-bedrocks are presented in Table 3.5.

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[5] Effervescence (i.e. "fizzing") was often observed when dilute HCl was added ('in-the-cold') to the samples in the ANC testwork (AGC Woodward-Clyde 1991).
[6] A programme of 'Kinetic-Testwork' (viz. Weathering-Columns) would be needed to fully assess the acid-forming character of this lithotype in terms of sulphide-mineral reactivity, and groundmass-buffering behaviour.

When compared with the respective minor-element contents typically recorded for <u>unmineralised</u> soils, regoliths and bedrocks (Bowen 1979), Ni and Cr stood out in a number of samples in terms of relative enrichments. The Ni and Cr contents ranged up to 0.6-0.7 %, and 0.1-0.2 %, respectively.

It is important to note that ultramafics are typically characterised by Ni and Cr contents of c. 0.20 %, and c. 0.23 %, respectively (Reimann and de Caritat, 1998). The Ni and Cr in these rock types occur as "fixed" forms within crystal-lattices of High-MgO-silicates (e.g. Ni in olivines and serpentines), and resistate-oxides (e.g. Cr in chromite). When this "bio-unavailable-Ni-baseline" is taken into account, the waste-bedrocks should typically contain less than 0.1-0.2 % of Ni forms which may potentially become available for leaching, and/or uptake by biota, through weathering.[7] Such Ni forms should be mainly associated with sulphide-minerals, and the lithotypes concerned should occur largely proximal to the Ore-Zone(s).

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[7] Nickel is one transition-metal which may be moderately soluble at circum-neutral-pH (Uren 1992).

4.0   GEOCHEMISTRY OF REGOLITH AND WASTE-BEDROCK SAMPLES FROM GOLIATH DEPOSIT

4.1   Salinity and Acid-Formation Potential

4.1.1   Regoliths

The twenty (20) samples of regoliths were characterised by (Table 4.1):

- pH and EC values of 6.7-10.0, and 0.096-6.5 mS/cm, respectively;[8]

- Sulphide-S values that ranges from less than 0.01 %, to 0.48 %; and,

- ANC values of 3.3-490 kg H_2SO_4/tonne.

If the results for the Silica-Carbonate-Oxide-[Mineralised] samples are excluded, then all samples had Sulphide-S values less than 0.1-0.2 %.

The testwork results indicate that the samples are all classified as <u>NAF</u>. The samples were neutral-to-alkaline with moderate-to-high contents of soluble-salts

4.1.2   Waste-Bedrocks

The fifty-eight (58) samples of waste-bedrocks were characterised by (Tables 4.2-4.4):

- pH and EC values of 7.9-10.3, and 0.095-1.9 mS/cm, respectively;

- Sulphide-S values that ranged from less than 0.01 %, to 4.0 %; and,

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[8] The pH and EC Tests are described in the table footnote.

- ANC values of 7.1-370 kg H_2SO_4/tonne.

Forty-nine (49) samples had Total-S values less than 0.5 %, and most of these had Total-S values less than 0.1 %. As for the Six-Mile Deposit, there is a paucity of sulphide-minerals, and accords with the style of mineralisation within the Goliath Deposit. The ANC-testing shows that the mine-wastes from the latter Deposit have a moderate-to-high capacity to consume acid, and reflects at least "trace-carbonates", and/or ultramafic-silicates.

The majority of samples are classified as NAF. Due to the nature of the groundmass, the PAF samples are generally classified as PAF-[Long-Lag]. Furthermore, where PAF-rock occur, the indications are that they would be co-dumped with NAF-rock.

As a group, the samples of the *volcanic-sediment-(Footwall-Massive-Sulphides)* stood out with Sulphide-S values of 0.71-4.0 %. Due to the high ANC values, this lithotype is classified as PAF-[Long-Lag].

The samples were neutral-to-alkaline with low-to-moderate contents of soluble-salts

4.2 Minor-Element Content

No assays for minor-elements were undertaken in the ANSTO (1996) study. However, given the common style of mineralisation of the Deposits, the pattern and degree of minor-element enrichments (chiefly in Ni and Cr) in mine-wastes derived from the Goliath Deposit should be similar to those for the Six-Mile Deposit (Section 3.2).

5.0   CONCLUSIONS AND MANAGEMENT IMPLICATIONS

Based on the review of the AGC Woodward-Clyde (1991) and ANSTO (1996) reports, conclusions and implications for mine-waste management during the Yakabindie Nickel Project are outlined in the following sections. Although generated *c.* 10-15 years ago, the data-base derived from the above reports provides a good picture of mine-waste geochemistry for the Project.

Since the geochemistry of the mine-waste samples tested from both the Six-Mile Deposit and Goliath Deposit is so similar, the key findings of the above studies are discussed as one.

5.1   Regoliths

Geochemically, the regoliths to be produced during open-pit mining should be benign, and hospitable as a rooting-medium for the native-vegetation endemic to the mine-site (e.g. mulgas, chenopods, forbs and arid-grasses/groundcovers). However, revegetation aspects for the final closure of waste-landforms need to be assessed by others.

Physically, it is inevitable that, due to their susceptibility to erosion (especially by episodic, intense storms) certain regoliths will pose constraints on waste-dump design, due to dispersive-clays, and/or enrichment in silts/fine-sands (ACMER 2004). However, the siliceous, duricrust-type stratum beneath the *in-situ* soil (e.g. *red earth*) should be a key resource for waste-dump sheeting to prevent (sub-)surface erosion (e.g. Campbell 2004).

In Section 6.0, it is recommended that the major types of regoliths are physically characterised to assist waste-dump design, especially to identify which regolith type(s) should be (a) segregated for later use in rehabilitation works site-wide, and (b) not placed in the surface-zone of the final waste-landforms.

5.2   Waste-Bedrocks

At the "metre-scale", the lithotypes/waste-bedrocks in the Waste-Zone of the Pits are characterised by meagre abundances of sulphide-minerals dispersed throughout a groundmass with a moderate-to-high capacity to consume acid, due to at least "trace-carbonates", and High-MgO-silicates. Accordingly, the waste-bedrocks are classified as <u>Non-Acid Forming (NAF)</u>.

Competent, durable varieties of the NAF-waste-bedrocks should be suitable for site-wide applications where they will be exposed over the longer-term (e.g. safety-bund around Pit-perimeter at site-closure, diversion-bunds for surface-hydrology control, rock-lined structures for drainage control on waste-dumps and tailings-storage facility, etc.). The durability of specific lithotypes would need to be assessed by others. However, geochemically, for applications where exposure will occur over the longer-term, consideration should be given to sourcing waste-bedrocks distal to the ore-zones, so that the release of soluble-metal (e.g. Ni) forms during circum-neutral weathering of "trace-sulphides" is negligible.

Two important exceptions to the above are:

(a)   The *volcanic-sediment-[Footwall-Massive-Sulphide]*. This lithotype occurs in the Wall-Waste-Zone of each Deposit, and is classified as <u>Potentially-Acid Forming (PAF)</u>, and due to its groundmass, may be further classified as <u>PAF-[Long-Lag]</u>.[9]   The volcanic-sediment-[Footwall-Massive-Sulphide] needs to be deeply buried to isolate sulphide-surfaces from meteoric-waters.[10] This lithotype is expected to

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[9] A programme of 'kinetic' testing (viz. Weathering-Column) would be needed to estimate the duration of the "lag-phase" (i.e. the period during which sulphide-oxidation occurs, but acidification does not develop, due to pH-buffering by groundmass-phases).

[10] Under the semi-arid conditions of the mine-sites, water-supply, and <u>not</u> O_2-supply, will control the rate of sulphide-oxidation (Campbell 2004).

be visually readily identified in the Pit(s) ahead of mining, and volumetrically, it constitutes a very-small proportion of the total-waste volume to be produced (Mr Ian Hart, *pers. commun.*); and,

(b)   The *Internal-Waste-Zone* (i.e. waste-bedrocks within ore-zones which are not segregated for stockpiling as low-grade ores). Although the weathering of such lithotypes should be characterised by circum-neutral (viz. pH 6-8) conditions, and the rates of weathering should be modest, soluble-Ni forms should result.[11] Accordingly, waste-bedrocks derived from the Internal-Waste-Zone should be deeply buried in the waste-dumps.

Additional sampling and testing should be undertaken, as appropriate, during the Project to confirm (or refine) the above "geochemical-typing", and ensuing implications for waste-bedrock management.

5.3   Low-Grade-Ores

It is understood that metallurgical evaluation has shown that talcose varieties of the various ores are currently difficult to treat, and that the Talcose-Oxide-Ores and Talcose-Supergene-Ores from both Deposits are to be placed within the waste-dumps (Mr Ian Hart, *pers. commun.*). These talcose-ores should be handled like the waste-bedrocks from Internal-Waste-Zone, as described above.

Talcose-Transition-Ores and Talcose-Primary-Ores are planned to be stockpiled (Mr Ian Hart, *pers. commun.*), and subsequently treated in the mill, subject to metallurgical evaluation, and Project economics. Such talcose-ores should be classified as NAF, so that during weathering on the stockpiles, circum-neutral (viz. pH 6-8) conditions should prevail, and sulphide-oxidation rates should be modest. Faster rates of sulphide-

oxidation may locally occur in the Talcose-Transition-Ores where violarite dominates the sulphide-mineral suite. Soluble-Ni forms should be produced during circum-neutral weathering, although under the semi-arid conditions of the mine-sites, this should be confined largely to the top 2-3 m of the stockpiles, as governed by seasonal moisture dynamics.[12] Further testing, including 'kinetic' testing, is required to better assess the nature of weathering processes on the stockpiles of the Talcose-Transition-Ores and Talcose-Primary-Ores derived from the Six-Mile Deposit and Goliath Deposit (Section 6.0).

Conservatively, provision should be made, at this stage, for the capture and retention of the drainage-waters produced by the stockpiles of the Talcose-Transition-Ores and Talcose-Primary-Ores. Opportunistic monitoring of the collected drainage-water should be carried out to assess water-quality, and other, issues pertinent to stockpile management in the longer-term.

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[11] Modest rates of sulphide-oxidation are contingent on violarite being absent.
[12] Direct, field-based evidence for this kind of weathering-profiles is clear from historic work undertaken by Dr. Graeme Campbell on low-grade-ore stockpiles at the Leinster Nickel Operations near Leinster, Western Australia.

Graeme Campbell & Associates Pty Ltd

6.0   RECOMMENDED ADDITIONAL TESTWORK

To assist pre-project planning, additional testwork is recommended, as outlined below.

- Characterisation of Topsoils and Regoliths for Erosion Prevention

   To identify the ease/difficulty with which the major topsoil/regolith types may erode on the side-slopes of waste-dumps, testing should be undertaken to determine mineralogy, clay-surface chemistry, soluble-salt composition, and dispersion tendency (e.g. Emerson-Dispersion Test). Testing of this kind may be readily undertaken on RC-cuttings, etc.

- Weathering/Solubility Behaviour of Talcose-Transition-Ore and Talcose-Primary-Ore

   A programme of 'kinetic' testing should be undertaken to allow assessment of sulphide-oxidation, pH-buffering properties, and metal-solubility behaviour (especially of Ni) for the above talcose-ores which are destined for stockpiling. Such testing may be readily undertaken on RC-cuttings, and should allow assessment of the "flushing-frequency-dependence" of sulphide-oxidation in semi-arid settings (Campbell 2004), since this dependence reduces both sulphide-oxidation, and metal-release rates.

7.0   REFERENCES

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TABLES

Table 3.1: **Acid-Base-Analysis, Salinity and Net-Acid-Generation Results for Regolith Samples (Six-Mile Deposit)**

SITE-SAMPLE NO.	DRILLHOLE & DOWNHOLE-INTERVAL (m)	pH	EC [mS/cm]	TOTAL-S (%)	ANC	NAPP	AFP CATEGORY
					kg H_2SO_4/tonne		
1: Ferruginous-Oxide-Waste							
623001	SMD64, 10-11	7.2	0.35	<0.01	nm	nc	NAF
623002	SMD55, 7-8	7.5	2.4	<0.01	nm	nc	NAF
623003	SMD43, 24-25	8.9	0.72	<0.01	nm	nc	NAF
622017	SMD85, 2-4	8.0	7.1	0.12	3.8	-0.1	NAF
1A: Ferruginous-Oxide-Waste-[Mineralised]							
623004	SMD85, 4-5	7.6	7.5	<0.01	nm	nc	NAF
622019	SMD73, 2-3	7.4	5.9	3.7	8.0	nc	NAF
2: Silica-Carbonate-Oxide-Waste							
623006	SMD14, 24-25	9.2	0.90	<0.01	nm	nc	NAF
623007	SMD50, 52-53	9.1	0.60	<0.01	nm	nc	NAF
622022	SMD14, 28	8.5	1.1	<0.01	nm	nc	NAF
623008	SMD27, 70-71	8.9	1.4	<0.01	29	nc	NAF
623009	SMD13, 35-36	8.7	0.64	<0.01	10	nc	NAF
622018	SMD13, 38-39	7.9	1.2	0.01	20	nc	NAF
2A: Silica-Carbonate-Oxide-Waste-[Mineralised]							
623010	SMD71, 50-51	9.2	0.49	<0.01	240	nc	NAF
622020	SMD73, 16-17	7.7	1.3	<0.01	nm	nc	NAF

Notes:

EC = Electrical Conductivity; ANC = Acid-Neutralisation Capacity; NAPP = Net-Acid-Producing Potential; AFP = Acid-Formation Potential; NAF = Non-Acid Forming;
PAF = Potentially-Acid Forming; nm = not measured; nc = not calculated.
The pH and EC values that are underscored correspond to measurements on sample-pastes, as employed in the AGC Woodward-Clyde (1991) study.

N.B. The Total-S value of 3.7 % reported for sample 622019 (from a down-hole depth of 2-3 m) is considered either an outlier, or that it corresponds to a SO_4-S value also of 3.7 %.

Table 3.2: Acid-Base-Analysis, Salinity and Net-Acid-Generation Results for Waste-Bedrock Samples (Hangingwall: Six-Mile Deposit)

SITE-SAMPLE NO.	LITHOTYPE	DRILLHOLE & DOWNHOLE-INTERVAL (m)	pH	EC [mS/cm]	TOTAL-S (%)	ANC kg H_2SO_4/tonne	NAPP	AFP CATEGORY
5A: Primary-Zone-Hangingwall-Sulphidic-Waste								
623031	Talc-Carbonate	SMD36, 210-211	9.8	0.22	0.3	nm	nc	NAF
623032	Antigorite	SMD82, 218-219	9.6	0.32	0.9	48	-20	**PAF**
623033	Antigorite-Liz.	SMD41, 158-159	9.5	1.1	0.4	nm	nc	NAF
623034	Antigorite-Liz.	SMD78, 398-399	9.6	1.6	1.2	110	-73	NAF
5B: Primary-Zone-Non-Sulphidic-Waste								
589179	Ultramafic-Adc.	SMD100, 542-543	9.8	0.87	1.5	370	-320	NAF
623035	Antigorite	SMD63, 242-243	9.3	1.5	0.1	42	-38	NAF
623036	Antigorite	SMD53, 187-188	9.3	0.79	<0.01	nm	nc	NAF
623037	Antigorite	SMD83, 230-231	9.6	0.85	<0.01	nm	nc	NAF
623038	Talc-Carbonate	SMD78, 271-272	9.5	0.25	0.3	23	-13	NAF
623039	Antigorite	SMG03, 207-208	9.6	0.28	<0.01	nm	nc	NAF
623040	Antigorite-Liz.	SMD45, 201-202	9.4	0.68	0.1	60	-56	NAF
622025	Antigorite	SMD57, 182	9.2	0.34	0.02	nm	nc	NAF
622026	Talc-Carbonate	SMD54, 162	8.3	0.43	0.01	21	nc	NAF
Other-Waste								
623054	Talc-Carbonate	SMG03, 94-95	9.7	0.29	0.2	52	-45	NAF
623055	Talc-Carbonate	SMD83, 298-299	10.0	0.41	<0.01	nm	nc	NAF
622023	Talc-Carbonate	SMD37, 70	9.1	0.69	<0.01	nm	nc	NAF
589185	Ultramafic-Carb.	SMG10, 230-231	9.8	0.22	0.05	nm	nc	NAF

Notes:

EC = Electrical Conductivity; ANC = Acid-Neutralisation Capacity; NAPP = Net-Acid-Producing Potential; AFP = Acid-Formation Potential; NAF = Non-Acid Forming; PAF = Potentially-Acid Forming; nm = not measured; nc = not calculated.

The pH and EC values that are underscored correspond to measurements on sample-pastes, as employed in the AGC Woodward-Clyde (1991) study.

The pH and EC values that are not underscored correspond to measurements on sample-slurries with a solid:solution ratio of *c.* 1:2.5 (w/w), as employed in the ANSTO (1996) study.

Table 3.3: **Acid-Base-Analysis, Salinity and Net-Acid-Generation Results for Waste-Bedrock Samples (Footwall: Six-Mile Deposit)**

SITE-SAMPLE NO.	LITHOTYPE	DRILLHOLE & DOWNHOLE-INTERVAL (m)	pH	EC [mS/cm]	TOTAL-S (%)	ANC kg H_2SO_4/tonne	NAPP kg H_2SO_4/tonne	AFP CATEGORY
6: Footwall-Massive-Sulphides								
623041	Volc.-Sediments	SMG01, 98-99	8.6	1.0	16.4	34	470	**PAF**
623042	Volc.-Sediments	SMG04, 82.5-83.5	8.0	0.92	2.1	110	-45	**PAF**
622032		SMG01, 139	8.3	0.52	10.6	200	130	**PAF**
7: Footwall-Sediment-Oxide-Waste								
623043	Volc.-Sediments	SMG01, 35-36	7.4	0.63	<0.01	nm	nc	NAF
623044	Volc.-Sediments	SMG02, 34-35	7.8	0.39	<0.01	5.3	nc	NAF
623045	Volc.-Sediments	SMG02, 64-65	9.2	0.20	<0.01	nm	nc	NAF
623046	Volc.-Sediments	SMG04, 48-49	7.7	0.58	<0.01	nm	nc	NAF
623047	Volc.-Sediments	SMG05, 50-51	8.4	0.30	<0.01	nm	nc	NAF
622028		SMG03, 29	8.6	2.0	<0.01	nm	nc	NAF
622030		SMG01, 17	7.3	2.0	<0.01	2.2	nc	NAF
622031		SMG01, 31.5	7.0	0.83	<0.01	nm	nc	NAF
589103	Volc.-Sediments	SMD101, 80-81	8.8	0.40	<0.01	nm	nc	NAF
7A: Footwall-Sediment-Fresh-Waste								
623048	Volc.-Sediments	SMG01, 150-151	8.3	0.32	5.0	21	140	**PAF**
623049	Volc.-Sediments	SMG01, 210-211	9.5	0.20	<0.01	nm	nc	NAF
623050	Volc.-Sediments	SMG02, 190-191	9.5	0.19	<0.01	nm	nc	NAF
623051	Volc.-Sediments	SMG04, 106-107	9.4	0.23	<0.01	nm	nc	NAF
623052	Volc.-Sediments	SMG05, 155-156	9.8	0.23	<0.01	nm	nc	NAF
623053	Volc.-Sediments	SMG05, 229-230	9.7	0.24	<0.01	nm	nc	NAF
622029		SMG04, 180	9.7	0.17	<0.01	100	nc	NAF
589186	Volc.-Sediments	SMG13, 239-240	10.1	0.17	0.01	nm	nc	NAF
589184	Volc.-Sediments	SMG09, 120-121	9.5	0.31	0.02	76	nc	NAF
589180	Volc.-Sediments	SMD101, 350-351	10.1	0.23	0.01	66	nc	NAF

Notes:

EC = Electrical Conductivity; ANC = Acid-Neutralisation Capacity; NAPP = Net-Acid-Producing Potential; AFP = Acid-Formation Potential; NAF = Non-Acid Forming; PAF = Potentially-Acid Forming; nm = not measured; nc = not calculated.
The pH and EC values that are underscored correspond to measurements on sample-pastes, as employed in the AGC Woodward-Clyde (1991) study.
The pH and EC values that are not underscored correspond to measurements on sample-slurries with a solid:solution ratio of *c.* 1:2.5 (w/w), as employed in the ANSTO (1996) study.

Table 3.4: **Acid-Base-Analysis, Salinity and Net-Acid-Generation Results for Waste-Bedrock Samples (Internal: Six-Mile Deposit)**

SITE-SAMPLE NO.	LITHOTYPE	DRILLHOLE & DOWNHOLE-INTERVAL (m)	pH	EC [mS/cm]	TOTAL-S (%)	ANC	NAPP	AFP CATEGORY
						kg H$_2$SO$_4$/tonne		
3: Supergene-Zone-Ore-Associated-Sulphidic-Waste								
623011		SMD17, 84-85	8.8	2.1	0.1	24	-20	NAF
632012		SMD27, 98.5-99.5	8.8	2.7	<0.01	nm	nc	NAF
622238		GPD11, 69	7.1	1.8	0.34	nm	nc	NAF
622239		GPD04, 104.8	5.9	2.5	1.5	15	31	NAF
589187	Ultramafic	SMG12, 99-100	9.8	0.86	1.0	380	-340	NAF
3A: Supergene-Zone-Hangingwall-Sulphidic-Waste								
623013		SMD46, 75-76	9.4	0.90	<0.01	nm	nc	NAF
623014	Talc-Carbonate	SMG03, 71-72	8.5	1.2	1.8	150	-94	NAF
623015	Antigorite	SMD42, 75-76	9.6	0.43	<0.01	58	nc	NAF
589101	Ultramafic	SMD100, 82-83	9.2	0.43	0.02	55	nc	NAF
3B: Supergene-Zone-Non-Sulphidic-Waste								
623016	Antigorite	SMD25, 80-81	9.6	0.29	<0.01	nm	nc	NAF
623017	Antigorite	SMD61, 62-63	9.6	0.25	<0.01	nm	nc	NAF
623018	Antigorite	SMD49, 61-62	9.5	0.41	<0.01	nm	nc	NAF
622021	Liz.-Oxide	SMD11, 80	8.7	1.7	0.18	22	-16	NAF
623019	Liz.-Antigorite	SMD58, 82-89	9.8	1.9	<0.01	nm	nc	NAF
623020	Talc-Carbonate	SMG03, 74-75	8.7	0.88	0.6	23	-4.6	NAF
4: Violarite-Transition-Zone-Ore-Associated-Sulphidic-Waste								
623021	Antigorite	SMD66, 133-134	9.5	0.24	0.2	nm	nc	NAF
623022	Lizardite	SMD61, 140-141	9.2	1.2	0.5	56	-40	NAF
589188	Ultramafic	SMG12, 110-111	9.6	0.71	1.1	nm	nc	**PAF (?)**
4A: Violarite-Transition-Zone-Hangingwall-Sulphidic-Waste								
623023	Antigorite	SMD21, 110-111	9.3	0.51	0.2	nm	nc	NAF
623024	Antigorite-Liz.	SMD49, 101-102	9.6	1.5	0.4	140	-120	NAF
589105	Ultramafic	SMD97, 120-121	9.9	0.27	0.05	nm	nc	NAF
4B: Violarite-Transition-Zone-Non-Sulphidic-Waste								
623025	Antigorite	SMD68, 104-105	9.4	0.72	0.1	60	56	NAF
623026	Antigorite	SMG06, 98-99	9.7	0.23	<0.01	nm	nc	NAF
623027	Antigorite-Liz.	SMD13, 135-136	9.6	2.0	<0.01	nm	nc	NAF
623028	Lizardite	SMD42, 124-125	9.6	1.2	<0.01	nm	nc	NAF
622024	Lizardite	SMD26, 130	9.8	0.74	0.03	84	nc	NAF
622027		SMG03, 143	9.6	0.17	<0.01	14	nc	NAF
5: Primary-Zone-Ore-Associated-Sulphidic-Waste								
623029	Antigorite	SMD81, 286-287	9.6	0.49	1.1	52	-18	**PAF**
623030	Antigorite-Liz.	SMD49, 340-341	9.4	1.2	0.8	24	0.5	**PAF**
589183	Ultramafic-Ortho.	SMD98, 400-401	10.1	0.30	0.04	nm	nc	NAF
5A: Primary-Zone-Ore-Hangingwall-Sulphidic-Waste								
589182	Ultramafic-Ortho.	SMD97, 245-246	10.1	0.30	0.08	nm	nc	NAF

Notes: EC = Electrical Conductivity; ANC = Acid-Neutralisation Capacity; NAPP = Net-Acid-Producing Potential; AFP = Acid-Formation Potential; NAF = Non-Acid Forming;
PAF = Potentially-Acid Forming; nm = not measured; nc = not calculated.
The pH and EC values that are underscored correspond to measurements on sample-pastes, as employed in the AGC Woodward-Clyde (1991) study.
The pH and EC values that are not underscored correspond to measurements on sample-slurries with a solid:solution ratio of *c.* 1:2.5 (w/w), as employed in the ANSTO (1996) study.

Table 3.5:   **Assay Results for Regolith and Waste-Bedrock Samples (Six-Mile Deposit)**

SITE-SAMPLE NO.	LITHOTYPE	DRILLHOLE & DOWNHOLE-INTERVAL (m)	TOTAL-S (%)	Ni (mg/kg)	Cr (mg/kg)	Co (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	As (mg/kg)	Mn (mg/kg)	Fe (%)
1: Ferruginous-Oxide-Waste												
622017		SMD85, 2-4	0.12	3,700	1,300	120	40	130	110	50	180	15.1
1A: Ferruginous-Oxide-Waste-[Mineralised]												
622019		SMD73, 2-3	3.7	1,200	3,900	45	160	5	90	80	100	5.8
2: Silica-Carbonate-Oxide-Waste												
623008		SMD27, 70-71	<0.01	260	280	80	10	10	30	20	230	2.1
623009		SMD13, 35-36	<0.01	2,100	820	120	10	15	35	22	830	4.6
2A: Silica-Carbonate-Oxide-Waste-[Mineralised]												
623010		SMD71, 50-51	<0.01	6,600	790	140	450	10	55	34	690	3.6
3: Supergene-Zone-Ore-Associated-Sulphidic-Waste												
623011		SMD17, 84-85	0.1	1,500	470	80	60	<5	30	12	290	3.0
622239		GPD04, 104.8	1.5	6,100	260	28	140	5	45	28	460	3.6
3A: Supergene-Zone-Hangingwall-Sulphidic-Waste												
623014	Talc-Carbonate	SMG03, 71-72	1.8	2,600	640	110	220	10	45	190	930	5.3
623015	Antigorite	SMD42, 75-76	<0.01	1,700	740	80	10	<5	30	17	400	3.6
3B: Supergene-Zone-Non-Sulphidic-Waste												
623018	Antigorite	SMD49, 61-62	<0.01	2,100	1,100	110	<5	<5	40	42	760	4.2
622021	Liz.-Oxide	SMD11, 80	0.18	2,800	430	100	160	10	60	7	290	3.1
623020	Talc-Carbonate	SMG03, 74-75	0.6	2,600	960	110	110	10	60	630	870	4.6
4: Violarite-Transition-Zone-Ore-Associated-Sulphidic-Waste												
623022	Lizardite	SMD61, 140-141	0.5	1,800	330	70	45	<5	25	20	250	1.9
4A: Violarite-Transition-Zone-Hangingwall-Sulphidic-Waste												
623024	Antigorite-Liz.	SMD49, 101-102	0.4	3,800	530	130	320	5	35	19	350	4.0
4B: Violarite-Transition-Zone-Non-Sulphidic-Waste												
623025	Antigorite	SMD68, 104-105	0.1	2,700	340	95	<5	<5	35	75	510	2.6
622024	Lizardite	SMD26, 130	0.03	2,200	420	55	20	10	35	11	250	2.7
622027		SMG03, 143	<0.01	480	1,800	65	35	10	50	6	850	4.2
5: Primary-Zone-Ore-Associated-Sulphidic-Waste												
623029	Antigorite	SMD81, 286-287	1.1	3,000	510	110	150	<5	<5	15	350	2.8
623030	Antigorite-Liz.	SMD49, 340-341	0.8	3,000	450	100	180	5	30	9	400	3.2
5A: Primary-Zone-Ore-Hangingwall-Sulphidic-Waste												
623032	Antigorite	SMD82, 218-219	0.9	2,000	400	85	120	10	35	13	390	3.2
623034	Antigorite-Liz.	SMD78, 398-399	1.2	1,400	350	60	85	10	70	11	580	3.9
5B: Primary-Zone-Non-Sulphidic-Waste												
623035	Antigorite	SMD63, 242-243	0.1	2,800	580	40	5	<5	40	5	440	3.8
623038	Talc-Carbonate	SMD78, 271-272	0.3	3,400	470	95	25	<5	35	26	310	2.2
623040	Antigorite-Liz.	SMD45, 201-202	0.1	2,700	380	95	<5	<5	35	14	530	2.8
622026	Talc-Carbonate	SMD54, 162	0.01	1,500	460	70	35	10	55	4	390	2.9
6: Footwall-Massive-Sulphides												
623041	Volc.-Sediments	SMG01, 98-99	16.4	1,400	890	120	310	20	250	3	7,400	42.9
623042	Volc.-Sediments	SMG04, 82.5-83.5	2.1	75	95	15	120	15	65	4	17,000	21.4
622032		SMG01, 139	10.6	80	310	30	40	5	130	15	13,000	22.4
7: Footwall-Sediment-Oxide-Waste												
622030		SMG01, 17	<0.01	190	85	20	25	15	80	6	1,700	13.0
7A: Footwall-Sediment-Fresh-Waste												
623048	Volc.-Sediments	SMG01, 150-151	5.0	40	260	10	25	15	25	10	2,800	7.1
623049	Volc.-Sediments	SMG01, 210-211	<0.01	50	200	10	40	25	50	50	880	15.1
623050	Volc.-Sediments	SMG02, 190-191	<0.01	35	120	15	35	30	55	11	710	2.9
622029		SMG04, 180	<0.01	55	140	15	20	<5	30	40	890	2.9
Other-Waste												
623054	Talc-Carbonate	SMG03, 94-95	0.2	1,700	790	85	75	<5	65	310	1,100	5.2

Table 4.1: Acid-Base-Analysis, Salinity and Net-Acid-Generation Results for Regolith Samples (Goliath Deposit)

SITE-SAMPLE NO.	LITHOTYPE	DRILLHOLE & DOWNHOLE-INTERVAL (m)	pH	EC [mS/cm]	TOTAL-S (%)	SO$_4$-S (%)	Sulphide-S (%)	CO$_3$ (%)	ANC	NAPP	NAG	NAG-pH	AFP CATEGORY
									kg H$_2$SO$_4$/tonne				
1: Ferruginous-Oxide-Waste													
589189		GPG18, 2-3	7.6	0.24	0.03	0.03	<0.01	nm	13	nc	<0.5	6.9	NAF
589121		GPD76, 1-2	7.3	0.28	<0.01	<0.01	<0.01	<0.05	10	nc	<0.5	6.5	NAF
589134		GPG04, 2-3	10.0	0.29	<0.01	<0.01	<0.01	nm	490	nc	<0.5	9.2	NAF
589126		GPD77, 2-3	8.2	6.5	0.64	0.58	0.06	nm	160	nc	<0.5	7.9	NAF
589138		GPG05, 3-4	6.7	4.3	0.06	0.07	<0.01	nm	3.3	nc	<0.5	4.9	NAF
589143	Ultramafic	GPG06, 3-4	8.3	4.6	0.76	0.63	0.13	nm	61	-57	<0.5	8.7	NAF
589152	Ultramafic	GPG11, 5-6	9.1	0.78	<0.01	<0.01	<0.01	0.15	30	nc	<0.5	7.4	NAF
1A: Ferruginous-Oxide-Waste-[Mineralised]													
589131	Ultramafic-Carb.	GPG03, 5-6	9.2	0.33	0.03	<0.01	0.03	0.18	44	nc	<0.5	8.6	NAF
589135	Ultramafic	GPG04, 5-6	7.9	0.39	<0.01	<0.01	<0.01	nm	21	nc	<0.5	7.7	NAF
589111	Ultramafic	GNM04, 65-66	9.4	0.41	0.10	0.02	0.08	11	200	nc	<0.5	10.8	NAF
2: Silica-Carbonate-Oxide-Waste													
589114	Ultramafic-Carb.	GPD73, 39-40	8.9	0.18	<0.01	<0.01	<0.01	nm	110	nc	<0.5	8.4	NAF
589116	Ultramafic-Carb.	GPD74, 25-26	9.7	0.096	<0.01	<0.01	<0.01	nm	190	nc	<0.5	8.7	NAF
589119	Ultramafic-Carb.	GPD75, 50-51	9.8	0.22	<0.01	<0.01	<0.01	1.1	36	nc	<0.5	9.2	NAF
589133	Ultramafic-Carb.	GPG03, 80-81	9.1	0.84	<0.01	<0.01	<0.01	nm	130	nc	<0.5	9.1	NAF
589124	Ultramafic	GPD76, 89-90	8.9	0.18	<0.01	<0.01	<0.01	nm	47	nc	<0.5	6.2	NAF
589130	Ultramafic	GPD78, 78-79	9.0	0.97	0.05	0.06	<0.01	<0.05	51	nc	<0.5	8.3	NAF
589132	Ultramafic	GPG03, 27-28	8.1	1.4	<0.01	<0.01	<0.01	nm	94	nc	<0.5	9.2	NAF
2A: Silica-Carbonate-Oxide-Waste-[Mineralised]													
589147	Ultramafic	GPG07, 19-20	9.2	0.97	0.03	0.02	0.01	nm	160	nc	<0.5	8.4	NAF
589153	Ultramafic	GPG11, 20-21	9.2	0.89	0.53	0.05	0.48	13	240	-220	<0.5	9.6	NAF
589154	Ultramafic	GPG11, 50-51	9.3	1.1	0.44	0.09	0.35	12	230	-210	<0.5	9.8	NAF

Notes:

EC = Electrical Conductivity; ANC = Acid-Neutralisation Capacity; NAPP = Net-Acid-Producing Potential; NAG = Net-Acid Generation; AFP = Acid-Formation Potential; NAF = Non-Acid Forming; nm = not measured; nc = not calculated.

The pH and EC values correspond to measurements on sample-slurries with a solid:solution ratio of *c.* 1:2.5 (w/w), as employed in the ANSTO (1996) study.

Table 4.2: Acid-Base-Analysis, Salinity and Net-Acid-Generation Results for Waste-Bedrock Samples (Hangingwall: Goliath Deposit)

SITE-SAMPLE NO.	pH	EC [mS/cm]	TOTAL-S (%)	SO$_4$-S (%)	Sulphide-S (%)	CO$_3$ (%)	ANC	NAPP	NAG	NAG-pH	AFP CATEGORY
							kg H$_2$SO$_4$/tonne				
7B: Hangingwall-Sediment-Oxide-Waste											
589120	8.9	0.25	0.07	0.01	0.06	nm	54	nc	<0.5	7.1	NAF
589122	7.9	0.13	<0.01	<0.01	<0.01	nm	7.1	nc	<0.5	4.8	NAF
589127	8.3	0.24	<0.01	<0.01	<0.01	0.05	24	nc	<0.5	6.4	NAF
589129	8.6	0.40	<0.01	<0.01	<0.01	nm	180	nc	<0.5	9.8	NAF
589178	9.5	0.20	0.25	0.06	0.19	nm	110	-100	<0.5	11.8	NAF
589145	9.6	0.26	0.03	0.01	0.02	nm	110	nc	<0.5	8.8	NAF
589156	9.3	0.095	<0.01	<0.01	<0.01	nm	58	nc	<0.5	7.1	NAF
589157	9.3	0.24	<0.01	<0.01	<0.01	nm	51	nc	<0.5	6.8	NAF
589158	9.9	0.27	<0.01	<0.01	<0.01	nm	61	nc	<0.5	7.1	NAF
7C: Hangingwall-Sediment-Fresh-Waste											
589168	9.7	0.16	0.02	<0.01	0.02	nm	44	nc	<0.5	8.2	NAF
589169	10.1	0.28	0.03	0.01	0.02	nm	78	nc	<0.5	7.7	NAF
589177	8.8	0.82	1.1	0.05	1.1	1.7	67	-33	11	2.9	**PAF**
589196	9.8	0.24	<0.01	<0.01	<0.01	1.4	76	nc	<0.5	10.4	NAF
589173	9.9	0.17	<0.01	<0.01	<0.01	nm	68	nc	<0.5	9.6	NAF
589197	9.7	0.16	0.01	0.01	<0.01	nm	38	nc	<0.5	7.6	NAF
589198	10.3	0.33	0.04	0.02	0.02	nm	14	nc	<0.5	7.8	NAF
589146	9.5	0.21	0.07	0.02	0.05	nm	63	nc	<0.5	7.9	NAF
7D: Hangingwall-Mafic-Oxide-Waste											
589123	9.7	0.28	0.01	<0.01	0.01	nm	79	nc	nm	nm	NAF
589136	8.4	0.19	<0.01	<0.01	<0.01	nm	65	nc	<0.5	6.9	NAF
589139	7.9	0.67	<0.01	<0.01	<0.01	nm	24	nc	nm	nm	NAF
589161	9.3	0.18	0.07	0.01	0.06	1.2	42	nc	<0.5	8.4	NAF
589159	8.0	0.14	<0.01	<0.01	<0.01	nm	44	nc	nm	nm	NAF
589110	9.7	0.34	<0.01	<0.01	<0.01	nm	53	nc	nm	nm	NAF
589118	8.1	0.11	<0.01	<0.01	<0.01	nm	22	nc	nm	nm	NAF
7E: Hangingwall-Mafic-Fresh-Waste											
589125	9.8	0.21	0.08	<0.01	0.08	0.09	68	nc	<0.5	6.8	NAF
589128	10.2	0.26	<0.01	<0.01	<0.01	nm	92	nc	<0.5	7.5	NAF
589174	9.9	0.15	0.10	0.03	0.07	0.81	67	nc	<0.5	11.3	NAF

<u>Notes</u>: EC = Electrical Conductivity; ANC = Acid-Neutralisation Capacity; NAPP = Net-Acid-Producing Potential; NAG = Net-Acid Generation; AFP = Acid-Formation Potential;
NAF = Non-Acid Forming; PAF = Potentially-Acid Forming; nm = not measured; nc = not calculated.
The pH and EC values correspond to measurements on sample-slurries with a solid:solution ratio of *c.* 1:2.5 (w/w), as employed in the ANSTO (1996) study.

Table 4.3: **Acid-Base-Analysis, Salinity and Net-Acid-Generation Results for Waste-Bedrock Samples (Footwall: Goliath Deposit)**

SITE-SAMPLE NO.	pH	EC [mS/cm]	TOTAL-S (%)	SO₄-S (%)	Sulphide-S (%)	CO₃ (%)	ANC	NAPP	NAG	NAG-pH	AFP CATEGORY
								kg H₂SO₄/tonne			
6: Footwall-Massive-Sulphides											
589190	9.6	0.31	0.73	<0.01	0.72	1.4	100	-77	<0.5	10.4	NAF
589191	8.0	0.72	4.0	0.05	4.0	0.63	38	85	70	2.3	**PAF**
589164	8.6	0.75	3.5	0.09	3.5	0.48	55	52	51	2.6	**PAF**
7: Footwall-Sediment-Oxide-Waste											
589140	9.3	0.39	<0.01	<0.01	<0.01	nm	65	nc	<0.5	10.0	NAF
589141	9.7	0.25	0.02	<0.01	0.01	nm	33	nc	<0.5	7.4	NAF
589142	9.2	0.57	0.35	0.06	0.29	nm	70	-61	<0.5	10.9	NAF
589163	10.2	0.34	<0.01	<0.01	<0.01	nm	32	nc	<0.5	7.3	NAF
589149	9.0	0.36	<0.01	<0.01	<0.01	1.5	48	nc	<0.5	8.7	NAF
589150	8.8	0.38	<0.01	<0.01	<0.01	nm	110	nc	<0.5	8.7	NAF
589151	8.8	0.31	<0.01	<0.01	<0.01	nm	43	nc	<0.5	8.3	NAF
589162	8.0	0.88	0.01	0.02	<0.01	nm	32	nc	<0.5	8.9	NAF
589160	9.6	0.14	<0.01	<0.01	<0.01	nm	52	nc	<0.5	7.5	NAF
7A: Footwall-Sediment-Fresh-Waste											
589165	9.7	0.28	0.02	0.01	0.01	nm	72	nc	<0.5	11.3	NAF
589166	9.6	0.19	0.17	0.04	0.13	2.4	90	-86	<0.5	11.4	NAF
589167	9.8	0.19	0.07	0.01	0.06	nm	38	nc	<0.5	8.3	NAF
589192	9.6	0.24	0.06	<0.01	0.06	0.86	77	nc	<0.5	10.5	NAF
589193	9.5	0.19	0.02	0.01	0.01	nm	96	nc	<0.5	11.3	NAF
589194	9.7	0.18	0.04	0.01	0.03	nm	140	nc	<0.5	11.8	NAF
589195	10.2	0.27	0.05	<0.01	0.05	nm	27	nc	<0.5	9.2	NAF

Notes:

EC = Electrical Conductivity; ANC = Acid-Neutralisation Capacity; NAPP = Net-Acid-Producing Potential; NAG = Net-Acid Generation; AFP = Acid-Formation Potential;
NAF = Non-Acid Forming; PAF = Potentially-Acid Forming; nm = not measured; nc = not calculated.
The pH and EC values correspond to measurements on sample-slurries with a solid:solution ratio of *c.* 1:2.5 (w/w), as employed in the ANSTO (1996) study.

Table 4.4: **Acid-Base-Analysis, Salinity and Net-Acid-Generation Results for Waste-Bedrock Samples (Internal: Goliath Deposit)**

SITE-SAMPLE NO.	LITHOTYPE	DRILLHOLE & DOWNHOLE-INTERVAL (m)	pH	EC [mS/cm]	TOTAL-S (%)	SO_4-S (%)	Sulphide-S (%)	CO_3 (%)	ANC	NAPP	NAG	NAG-pH	AFP CATEGORY
									kg H_2SO_4/tonne				
3: Supergene-Zone-Ore-Associated-Sulphidic-Waste													
589148	Ultramafic	GPG07, 39-40	9.6	0.22	<0.01	<0.01	<0.01	16	430	nc	<0.5	10.6	NAF
589144	Ultramafic	GPG06, 70-71	8.7	1.9	0.94	0.16	0.78	15	380	-350	<0.5	8.7	NAF
3A: Supergene-Zone-Hangingwall-Sulphidic-Waste													
589115	Ultramafic	GPD73, 58-59	9.5	0.25	0.26	0.01	0.25	0.98	39	-31	<0.5	7.6	NAF
589117	Ultramafic-Carb.	GPD74, 99-100	10.2	0.24	0.12	0.04	0.08	13	310	nc	<0.5	10.2	NAF
4: Transition-Zone-Ore-Associated-Sulphidic-Waste													
589113	Ultramafic	GNM04, 83-84	9.9	0.18	0.05	<0.01	0.05	8.0	180	nc	<0.5	10.7	NAF
4A: Transition-Zone-Ore-Hangingwall-Sulphidic-Waste													
589155	Ultramafic	GPG11, 60-61	9.2	0.39	0.59	0.03	0.56	1.3	100	-82	<0.5	7.8	NAF
4B: Transition-Zone-Non-Sulphidic-Waste													
589112	Ultramafic	GNM04, 83-84	10.0	0.20	0.07	0.02	0.05	nm	300	nc	<0.5	11.6	NAF
589137	Ultramafic	GPG04, 100-101	8.4	1.5	0.68	0.15	0.53	nm	95	-78	<0.5	7.0	NAF
5: Primary-Zone-Ore-Associated-Sulphidic-Waste													
589175	Ultramafic	GPD78, 290-291	9.7	0.21	0.61	0.07	0.54	13	250	-230	<0.5	9.9	NAF
5A: Primary-Zone-Ore-Hangingwall-Sulphidic-Waste													
589171	Ultramafic-Meso.	GPD77, 273-274	9.6	0.37	1.2	0.03	1.2	5.5	180	-140	<0.5	10.3	NAF
5B: Primary-Zone-Non-Sulphidic-Waste													
589172	Ultramafic-Adcum.	GPD77, 290-291	9.5	0.37	0.14	0.03	0.11	nm	280	-270	<0.5	10.6	NAF
589170	Ultramafic-Adcum.	GPD76, 292-293	9.8	0.92	0.27	0.03	0.24	8.7	290	-280	<0.5	11.2	NAF

Notes:

EC = Electrical Conductivity; ANC = Acid-Neutralisation Capacity; NAPP = Net-Acid-Producing Potential; Net-Acid Generation; AFP = Acid-Formation Potential; NAF = Non-Acid Forming; nm = not measured; nc = not calculated.

The pH and EC values correspond to measurements on sample-slurries with a solid:solution ratio of *c.* 1:2.5 (w/w), as employed in the ANSTO (1996) study.