SOILWATER CONSULTANTS

IRON VALLEY BELOW WATER TABLE PROJECT - GEOCHEMICAL INVESTIGATION

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Revision Code*

A - Report issued for internal review

B - Draft report issued for client review

C - Final report issued to client

LIMITATIONS

The sole purpose of this report and the associated services performed by Soil Water Consultants (SWC) was to undertake a Geochemical Characterisation of the Iron Valley Deposit, Below Water Table Project. This work was conducted in accordance with the Scope of Work presented to Mineral Resources ('the Client'). SWC performed the services in a manner consistent with the normal level of care and expertise exercised by members of the earth sciences profession. Subject to the Scope of Work, the Geochemical Characterisation was confined to the Iron Valley Deposit and waste rock material within the immediate surrounds of the proposed mine pit (Project Area). No extrapolation of the results and recommendations reported in this study should be made to areas external to this project area. In preparing this study, SWC has relied on relevant published reports and guidelines, and information provided by the Client. All information is presumed accurate and SWC has not attempted to verify the accuracy or completeness of such information. While normal assessments of data reliability have been made, SWC assumes no responsibility or liability for errors in this information. All conclusions and recommendations are the professional opinions of SWC personnel. SWC is not engaged in reporting for the purpose of advertising, sales, promoting or endorsement of any client interests. No warranties, expressed or implied, are made with respect to the data reported or to the findings, observations and conclusions expressed in this report. All data, findings, observations and conclusions are based solely upon site conditions at the time of the investigation and information provided by the Client. This report has been prepared on behalf of and for the exclusive use of the Client, its representatives and advisors. SWC accepts no liability or responsibility for the use of this report by any third party.

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LIST OF ACRONYMS AND ABBREVIATIONS

Below is a list of acronyms and abbreviations used throughout this document.

Acronym/Abbreviation	Description
ABA	Acid Base Accounting
ABCC	Acid Buffering Characteristic Curve test
ACA	Average Crustal Abundance
AHD	Australian Height Datum
ALS	Australian Laboratory Service
AMIRA	Australian Minerals Industry Research Association - International Ltd
ANC	Acid Neutralising Capacity
ANCOLD	Australian National Committee on Large Dams
ANZECC	Australian And New Zealand Environment Conservation Council
ANZMEC	Australian And New Zealand Mineral And Energy Council
ARD	Acid Rock Drainage
BIF	Banded Iron Formation
bcm	Bank Cubic Metres
CarbNP	Carbonate Neutralising Potential
cm	Centimetres
DEC	Department of Environment and Conservation (Western Australia)
DME	Department of Minerals and Energy (Western Australia)
DMP	Department of Mines And Petroleum (Western Australia)
DoH	Department of Health (Western Australia)
EC	Electrical Conductivity
EOM	End Of Mine
EP Act	Environmental Protection Act
EPA	Environmental Protection Authority (Western Australia)
Eqn	Equation
ESP	Exchangeable Sodium Percentage
FOS	Factor Of Safety
GAI	Global Abundance Index
GWL	Groundwater Level
GWSA	Geological Survey of Western Australia
ha	Hectare
ICMM	International Council on Mining and Metals
hr	Hour
kg	Kilogram
km	Kilometre
km2	Square Kilometres
L	Litres
LOM	Life Of Mine

Acronym/Abbreviation	Description
m	Metre
M	Million
m^2	Square Metre
m^3	Cubic Metre
max	Maximum
MD	Metalliferous Drainage
meq	Milliequivalent
mg	Milligram
min	Minimum
mm	Millimetre
mmol	Millimole
MP	Mining Proposal
mS	Millisiemen
Mtpa	Million Tonnes Per Annum
NAF	Non Acid-Forming
NAG	Net Acid Generation
NAPP	Net Acid Producing Potential
NATA	National Association of Testing Authorities
NHMRC	National Health and Medical Research Council
°C	Degrees celsius
PAF	Potentially Acid-Forming
RL	Reduced Level
ROM	Run Of Mine
s	Second
SOW	Scope of Work
SWC	Soilwater Consultants
t	Tonne
TDS	Total Dissolved Solids
TIC	Total Inorganic Carbon
µm	Micro metres
WA	Western Australia
WRL	Waste Rock Landform
yr	Year

1 INTRODUCTION

Soilwater Consultants (SWC) were engaged by Mineral Resources (MR) to carry out a geochemical characterisation for the proposed Below Water Table (BWT) expansion of the Iron Valley Project (IVP). This geochemical investigation was undertaken to identify the presence or absence of material which has the potential to form Acid Rock Drainage (ARD) or Metalliferous Drainage (MD), or other problematic materials which may impact on the surrounding environment and / or rehabilitation goals if managed inappropriately.

1.1 STUDY OBJECTIVES

The specific objectives of this work were to:

- Assess the current baseline conditions existing below the water table within the deposit.
- Identify the major lithological units present below the water table within the deposit.
- Undertake an Acid Base Account (ABA) to identify the environmental risks associated with disturbance of any potential ARD materials.
- Identify the risk of MD developing following disturbance of waste rock materials.
- Suggest management strategies for the handling and utilisation of waste rock materials during mining and rehabilitation.

1.2 SCOPE OF WORK

The scope of work (SOW) completed by SWC during this investigation included:

- Review of existing geological and assay drill data collected across the Project Area.
- Selection of samples for screen analysis to investigate conditions within the deposit.
- Undertake and coordinate laboratory screen analysis
- Selection of representative samples for additional detailed laboratory analysis to confirm their ARD and MD status.
- Review of all laboratory results and preparation of this report.
- Incorporate previous geochemical testing results into a consolidated geochemical assessment for the Iron Valley BWT Project.

2 PROJECT DESCRIPTION

The IVP is an open pit iron ore mining operation located in the East Pilbara Shire within the Eastern Pilbara Region of Western Australia, approximately 90 km north-west of Newman and 250 km south of Port Hedland. The IVP is within the vicinity of a number of operating iron ore mines including the Rio Tinto Iron Ore Yandicoogina (5 km to the west) and Hope Downs operations (45 km to the south west), BHP Billiton Iron Ore Yandi operation (35 km to the west), and Fortescue Metals Group Cloudbreak operation (55 km to the north).

2.1 SITE LAYOUT

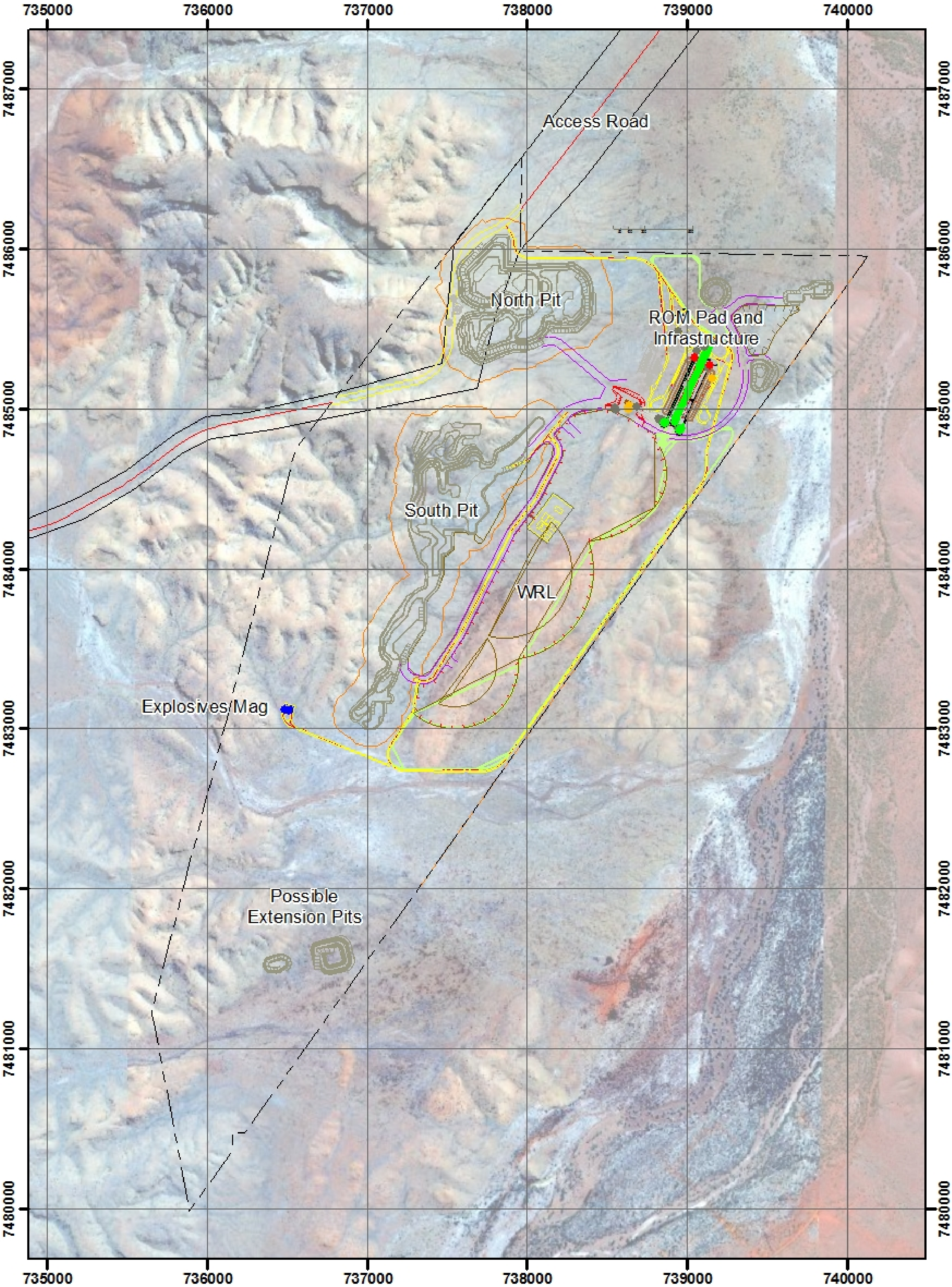
The IVP mining lease (47/1439) is owned by Iron Ore Holdings Ltd, and the mine is operated by Mineral Resources. The current layout of the IVP is shown in Figure 2.1. Within the approved 674 ha disturbance area, the ore will be mined from multiple pits through multiple stages, and sent to a Run of Mine (ROM) pad for blending. The ore will be dry-crushed and screened, before being transported via road for gate sale. Approximately 288 million dry tonnes of waste rock / uneconomic ore is expected to be generated and stored on the waste rock landform (WRL) adjacent to the main pit, with 133 million dry tonnes of ore generated.

2.2 REGIONAL GEOLOGY

The Iron Valley Project is contained within the Brockman Iron Formation which is part of the Precambrian iron formations present within the volcanic and sedimentary sequence of the Mount Bruce Supergroup, which spans a time interval of over 400 m.y. from > 2.77 to near 2.35 Ga. The deposit is hosted predominately within the eastern limb of a large anticlinal structure trending northeast/southwest, plunging to the south. The majority of mineralisation is contained within the upper Joffre Member (occurring in the limb of the anticline structure) with minor mineralisation occurring within the core of the anticline, confined to the Dales Gorge Member. A large dolerite dyke runs through the area, striking northeast/southwest and effectively dissects the deposit into northern and southern sections.

2.3 LOCAL GEOLOGY

The deposit is comprised of two categories of mineralisation; Tertiary Detrital and Bedded Mineralisation. The Tertiary Detrital mineralisation can be further sub-categorised based on the proportion of clay and chert fragments as compared to Hematite and Goethite mineralisation. The bedded mineralisation within the two geological members discussed above are composed of repeating formations of oxide Banded Iron Formation (BIF) 'facies' layers and intercalated chert-carbonate and silicate 'facies' layers (Ewers and Morris, 1981). These bands vary widely in thickness based on both seasonal conditions and the available supply of primary minerals (i.e. iron) at the time of deposition.



MINERAL RESOURCES	Figure 2.1: Current site layout	soilwater GROUP
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3 INVESTIGATION METHODOLOGY

3.1 GEOLOGICAL DATA REVIEW

A total of 664 drillholes are included in geological database which covers the Project Area (Figure 3.1 and 3.3). The drillholes were completed using Reverse Cycle (RC) drilling to depths of up to 358 m. Samples were logged at 2 m vertical intervals across the entire depth drilled resulting in over 36,000 separate samples logged and recorded as part of this database. Of these, 34,721 logged entries had values assigned for both lithology and total sulfur, across 658 unique drillhole collars. In order to classify samples, a cut-off grade of 50% Fe was used to delineate between ore and waste material. Using this criteria, 11,628 of the 34,721 samples classify as ore (33.5%) with the remaining 23,093 (66.5%) classified as waste material samples.

There are no unifying 'standard' criteria for classifying the acid production potential of mine waste materials, which reflects the diversity of possible sulfide mineral assemblages within lithologies of varying weathering and alteration status. Best practice guidelines recommend site specific approach to classification which allows the criteria to be tailored to deposit specific geochemistry and mineralogy. For the purposes of initial data review however, a cut-off value of 0.3% for Total S has been used to allow preliminary classification. This value for Total S % was chosen as there is general consensus (e.g. mining/environmental regulators in British Columbia, Canada) that materials with contents of Sulfide-Sulfur less than 0.3% are unlikely to oxidise at rates fast enough to result in acidification (Soregaroli and Lawrence, 1997). This position assumes that the groundmass hosting these sulfides is not simply quartz and/or clays, and for a carbonate deficient material the sulfides are not unusually reactive.

Of the more than 36,000 individual samples submitted for assay analysis of Total S contained within the database, only 153 samples (< 0.5 %) were identified as containing significant Sulfur content (samples with a Total Sulfur content of ≥0.3%). This indicates that the occurrence of minerals containing significant sulfur content is rare within the materials surrounding the deposit. Whilst not all sulfur present within these samples will be in a reduced (and therefore potentially reactive) state, taking a conservative approach and assuming that all sulfur recorded is capable of oxidising and subsequently producing acid, and then comparing the levels with the investigation criteria discussed above, the implied risk of ARD following disturbance is low.

A comparison of sulfur content across the waste sample lithologies was conducted to determine if particular lithologies may contain elevated sulfur content in comparison with the deposit as a whole. The results of this comparison are presented in Table 3.1, omitting lithology groups with statistically insignificant total number of samples (i.e. < 0.2% of logged waste samples). The four major lithological units identified from the waste samples logged (Table 3.2) are highlighted.

Table 3.1: Sulfur distribution across lithology types

Lithology group	No. Samples	Min S%*	Max S%	Mean S% †	Median S%
Mafic Intrusive - Dolerite	76	BDL	0.026	0.001	0.01
Sediment - BIF	1,130	BDL	0.058	0.008	0.004
Sediment - Goethitic BIF	345	BDL	0.059	0.009	0.004
Sediment - Chert	293	BDL	0.059	0.007	0.003
Regolith – Clay	318	BDL	0.112	0.006	0.004

Lithology group	No. Samples	Min S%*	Max S%	Mean S%†	Median S%
Regolith - Iron Rich Clay	96	BDL	1.323	0.036	0.006
Regolith - Colluvium	135	0.002	0.488	0.026	0.012
Regolith - Detrital	174	0.002	0.955	0.043	0.016
Goethite	269	BDL	0.091	0.016	0.007
Goethitic Hematite	101	BDL	0.074	0.010	0.003
Hematite	50	BDL	0.036	0.007	0.003
Limonite	114	BDL	0.334	0.013	0.008
Regolith - Alluvium	4,485	0.001	1.98	0.028	0.013
Sediment – BIF	6,345	BDL	7.80	0.016	0.004
Sediment – Mineralised BIF	323	0.001	0.195	0.016	0.011
Sediment – Shale (code 2)	526	BDL	0.077	0.009	0.005
Sediment – Mineralised Shale	116	0.004	0.093	0.026	0.020
Sediment – Shale	7,835	BDL	4.77	0.018	0.006

* 313 waste samples were below the detection limit of 0.001 % for sulfur assay.

† Values below detection limit have been treated as half the limit in all statistical analysis

In order to ensure adequate spatial coverage across the Project Area and representative sampling of the major lithological units within the deposit, the geological database was analysed to identify the major lithological units which will be excavated during mining. Table 3.2 shows the number of logged samples of each major lithology contained within the database as a whole, which together constitute 84.3 % of all samples logged. The remaining 15.7 % of samples logged consist predominately of minor mafic units along with isolated sedimentary samples of siltstone and alluvium and various miscellaneous logging entries (e.g. void, no sample retrieved etc.).

The four major lithological units identified during the database review together represent 75% of all drill samples within the deposit, and contain over 84% of all samples recorded with Total S content ≥0.3%.

Table 3.2: Drill sampling frequency of major lithological units within the Project Area.

Lithology group	No. of Samples Logged	% of all Samples Logged	No. of S Samples ≥0.3%	% of S Samples ≥0.3%
Sediment – Shale	8,346	24.0%	44	28.8%
Sediment – BIF	6,824	19.7%	26	17.0%
Sediment – Mineralised BIF	6,205	17.9%	3	2.0%
Regolith - Alluvium	4,624	13.3%	56	36.6%
Total	25,999	74.9%	129	84.3%

3.2 WASTE MATERIAL SAMPLE COLLECTION

Following the review of the geological drilling data, intervals from eight (8) drillholes held in storage as pulps were selected to undergo screen analysis testing (Figure 3.2 and 3.3). The drillholes were chosen to provide adequate spatial and geological coverage across the deposit, ensuring that all major lithological types and stratigraphic zones identified during the database review were sampled. Samples were identified across selected lengths of each drillhole omitting samples designated as ore. This selection method allows the entire profile of the waste material portion of the deposit to be analysed for the basic chemical conditions prevalent, permitting investigation of both ARD potential and identification of weathering fronts and potential areas of saline material (potentially representing previously oxidised material). The details of the 8 drillholes from which 203 samples were collected are provided in Table 3.3, with a breakdown of the lithologies sampled provided in Table 3.4.

During the review process, it was noted that a large proportion of those samples which reported elevated Total Sulfur values (Section 3.1) where located within a relatively small number of drillholes rather than evenly distributed. These drillhole are shown in Figure 3.4. As the distribution map shows they are mostly concentrated in the north and north-eastern portions of the northern pit, with two isolated drillholes occurring further to the south in the north and south deposit areas. Figures 3.5 and 3.6 show the drillholes located in the north and north-eastern areas, where the elevated Total S samples are shown to be contained within a relatively thin band of Shale. These drillholes were not selected for analysis in this investigation however, as the regions of elevated sulfur content shown occurred above the water table (Figure 3.5 and Figure 3.6), and therefore do not form part of the material proposed to be disturbed by the BWT expansion (i.e. they have already been mined).

Table 3.3: Details of drillholes selected for screen analysis.

Drillhole ID	GDA 94 (Zone 50)		Depth of sampling (m)	No. samples
	Easting	Northing		
IV140	738,347	7,485,502	0 – 174	27
IV147	737,416	7,483,595	0 – 152	25
IV153	737,602	7,483,997	0 – 152	26
IV197	737,749	7,484,401	0 – 248	41
IV260	737,948	7,484,604	0 – 207	35
IV387	737,650	7,484,502	0 – 48	12
IV410	737,354	7,483,795	0 – 70	12
IV413	736,400	7,481.400	0 – 152	25
Total			1,193 m	203

Table 3.4: Samples selected for screen analysis.

Lithology Code	Lithology group	No. Samples Selected
SSH	Sediment – Shale	65
SBI	Sediment – BIF	17
SBM	Sediment – Mineralised BIF	85
RAL	Sediment – Alluvium	23
DMD	Regolith - Detrital	4
Unknown	-	9
Totals		203

3.3 LABORATORY ANALYSIS

Samples collected in this investigation were assessed for pH, pH_{FOX}, dispersion characteristics and electrical conductivity (EC), according to the following methods:

- pH – 1:5 soil/water extraction. This parameter measures the existing acidity of the waste material sample and provides indication of previous oxidation of sulfides and the potential buffering capacity of the sample.
- EC – 1:5 soil/water extraction. This parameter measures the level of salinity of the waste materials, which may reflect previous oxidation of sulfides.
- pH_{FOX} – This parameter measures the pH of the waste materials following the addition of 30 % hydrogen peroxide to rapidly oxidise any sulfides present. The method followed is outlined in (Stone and Ahern *et al.*, 1998).
- Modified Emerson Dispersion (Aggregate Method) – This methods tests the dispersion potential of the fine (<2 mm) fraction of a material following AS 1289.3.8.1-2006

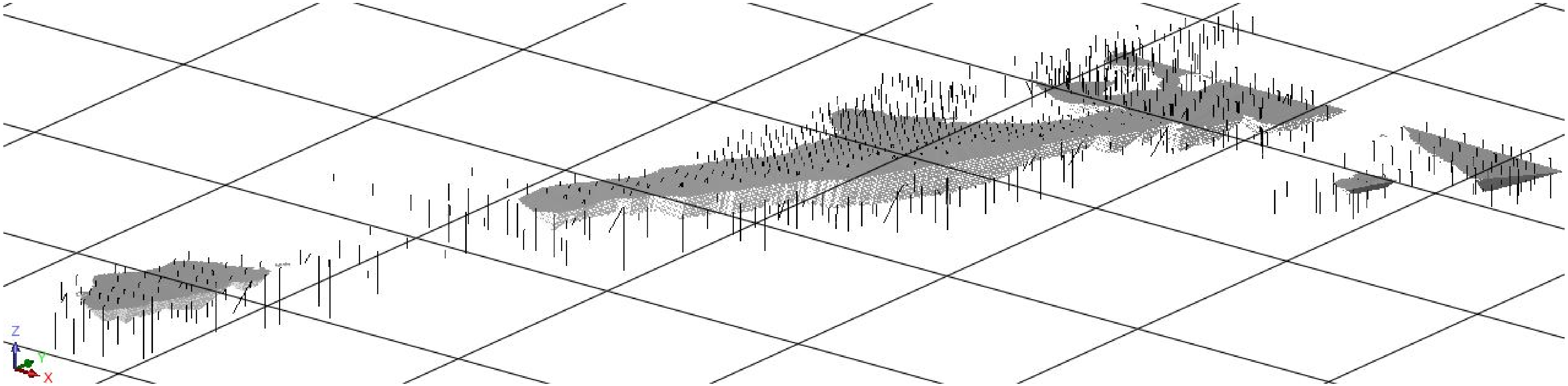
Following testing, analysis of the screen results and review of the geological drilling data, a total of twenty (20) samples which together adequately represented the geochemical variety within the deposit were selected for further detailed ARD and geochemical test work. This testing is designed to confirm their ARD and MD status, and allow broader geochemical classification of the materials for management purposes. Each sample was tested for the following parameters:

- Total Sulfur by combustion (S)
- Chromium Reducible Sulfur (S_{CR})
- Static Net Acid Generation (NAG)
- Acid Neutralising Capacity (ANC)
- Total Inorganic Carbon
- Multi-element (Ag, Al, As, B, Ba, Cd, Co, Cr, Cu, Fe, Hg, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Th, U, V, Zn)

The NAG, ANC and multi-element composition analysis was conducted at ChemCentre, whilst the Total S, S_{CR} and TIC analysis was conducted at Australian Laboratory Services (ALS), each NATA accredited for the laboratory work conducted. Details of the 20 samples selected for further ARD analysis are shown below in Table 3.5.

Table 3.5: Details of the 20 samples selected for further ARD testing.

Drillhole ID	Lithology	Depth (m)	Drillhole ID	Lithology	Depth (m)
IV140	Sediment – Alluvium	10-12	IV260	Sediment – Shale	62-64
IV140	Sediment – Shale	52-54	IV260	Sediment – Mineralised BIF	80-82
IV140	Sediment – Mineralised BIF	172-174	IV260	Sediment – Shale	132-134
IV147	Sediment – Shale	42-44	IV260	Sediment – Mineralised BIF	138-140
IV153	Sediment – Alluvium	6-8	IV260	Sediment – BIF	175-177
IV153	Sediment – Shale	30-32	IV387	Sediment – Mineralised BIF	34-36
IV153	Sediment – Mineralised BIF	102-104	IV387	Sediment – BIF	46-48
IV153	Sediment – BIF	150-152	IV410	Sediment – BIF	62-64
IV197	Sediment – Alluvium	18-20	IV413	Sediment – Shale	24-26
IV197	Sediment – Shale	222-224	IV413	Sediment – BIF	138-140



*1 km square grid

MINERAL RESOURCES	Figure 3.1: Drillholes completed to date across the Project Area (SURPAC)
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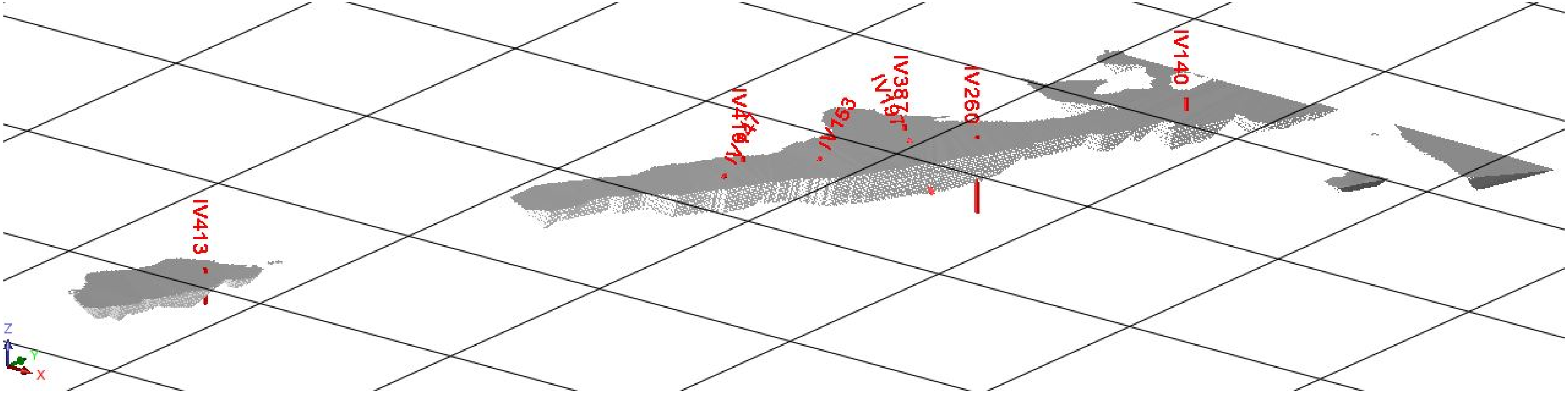

*1 km square grid

MINERAL RESOURCES

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Figure 3.2 : Drillholes selected for screen analysis (SURPAC)

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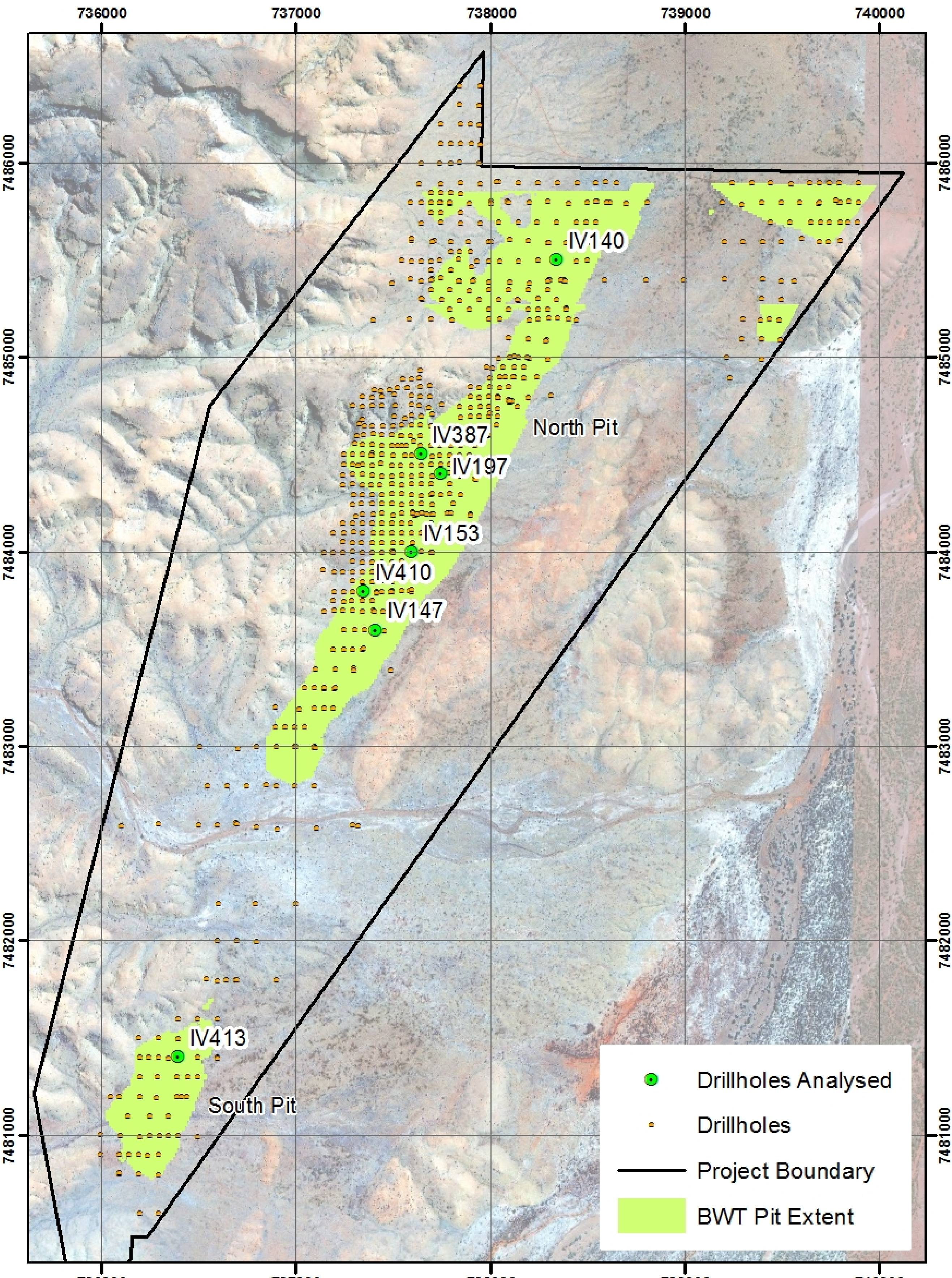

MINERAL RESOURCES	Figure 3.3: Location of drillholes (GIS)	soilwater GROUP
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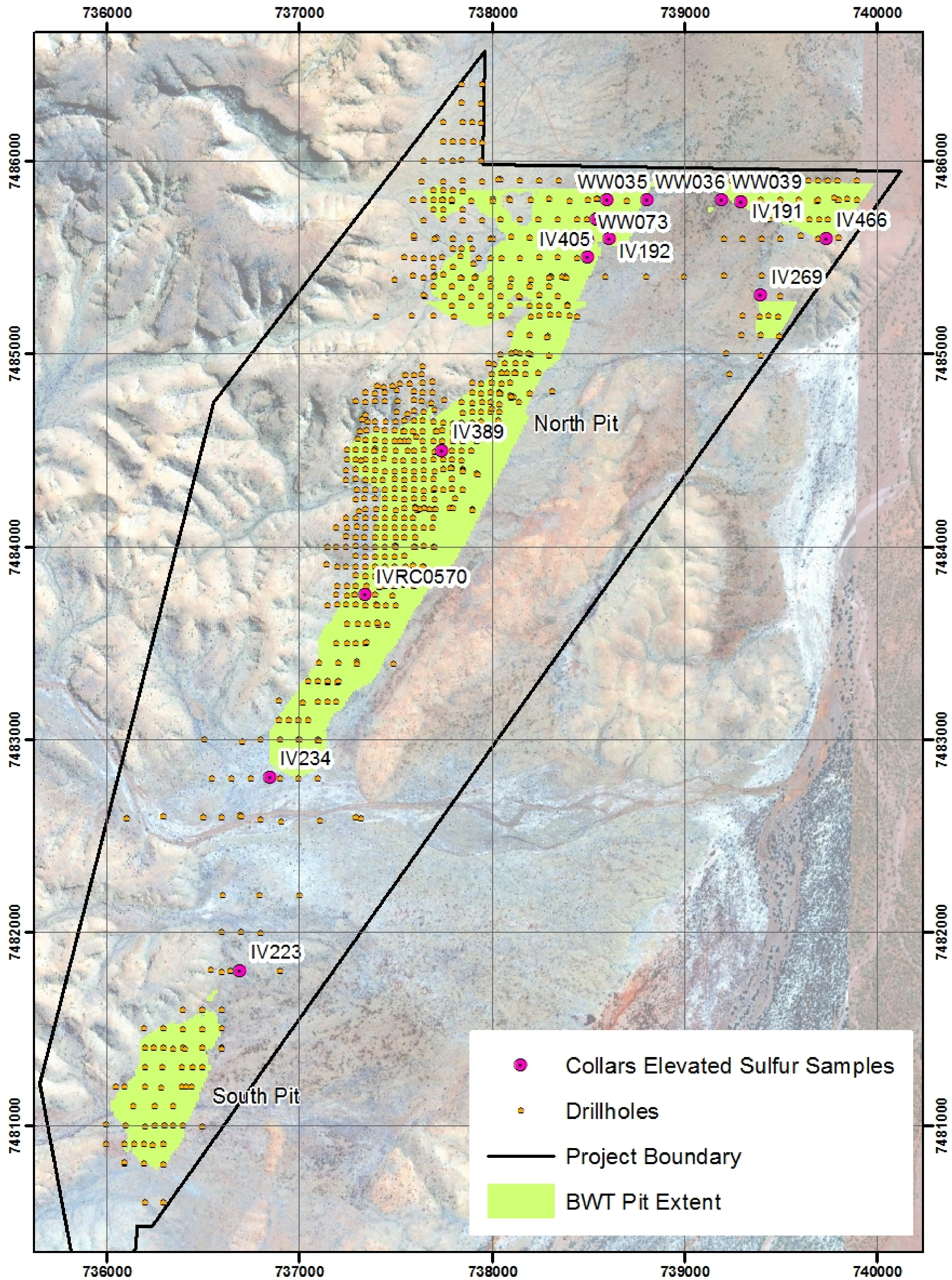

MINERAL RESOURCES	Figure 3.4: Drillholes containing 3 or more elevated sulfur samples	soilwater GROUP
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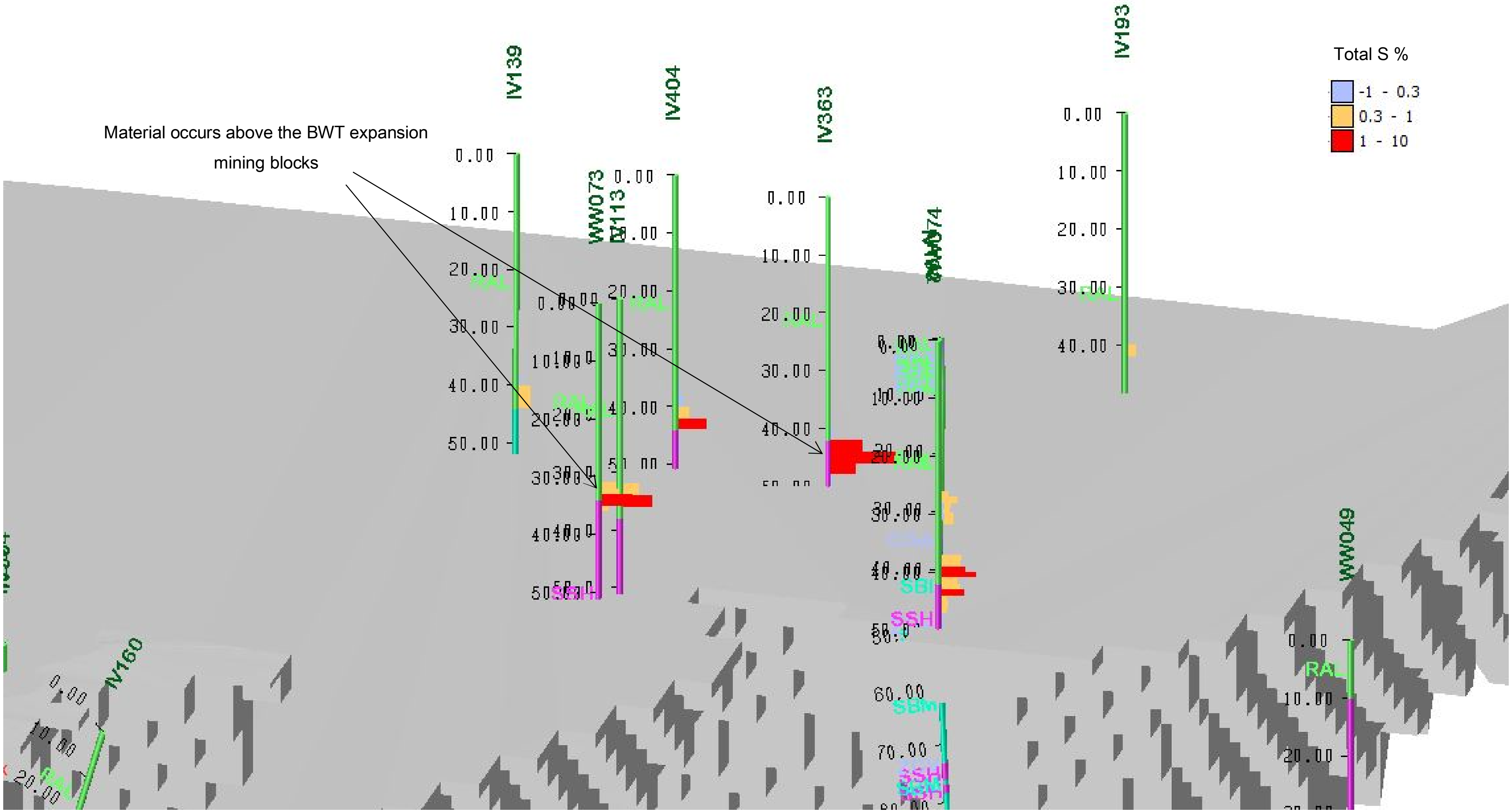

MINERAL RESOURCES	Figure 3.5: Drillholes in northern area
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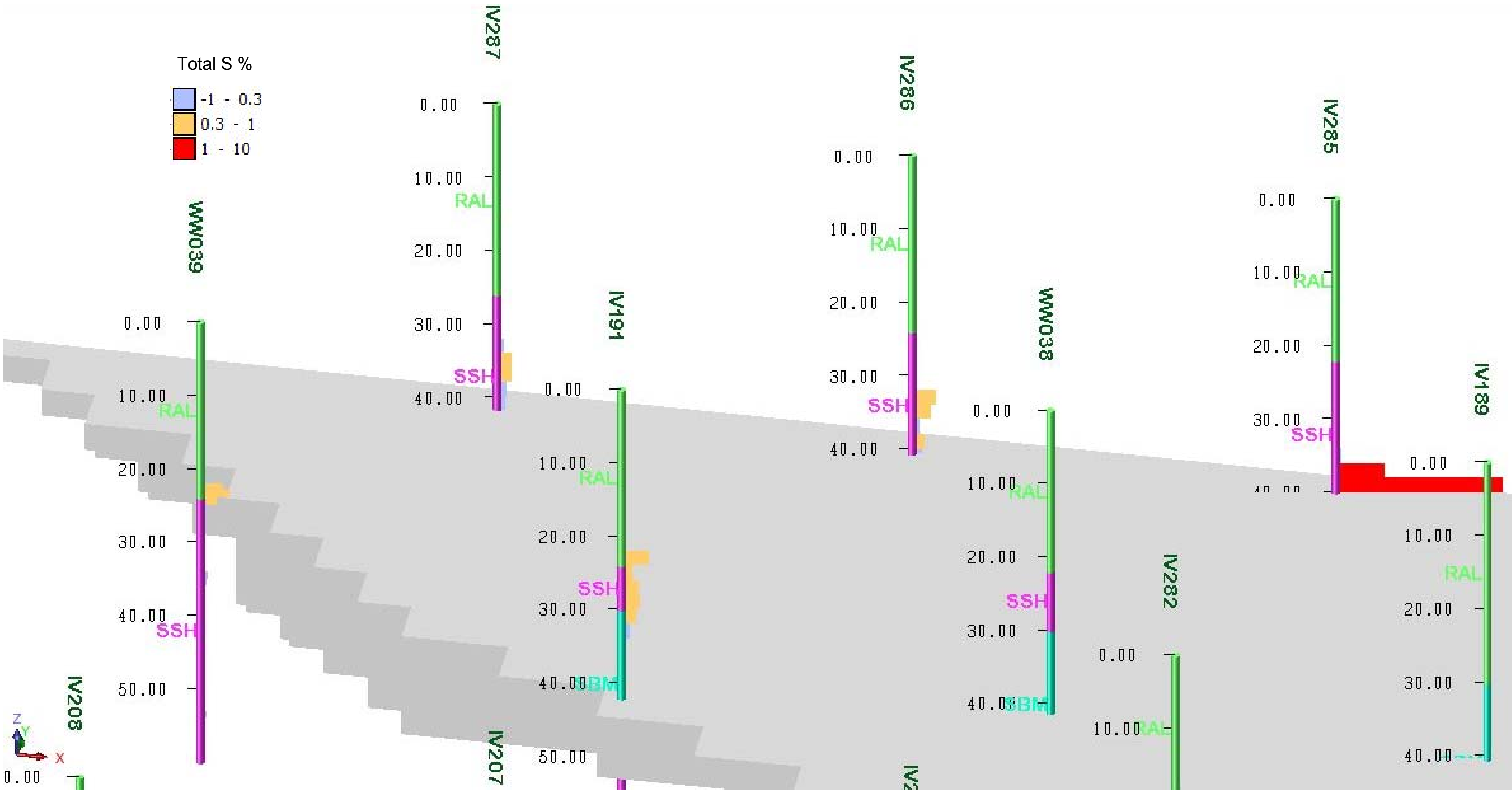

MINERAL RESOURCES	Figure 3.6: Drillholes in north eastern area	soilwater GROUP
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4 STUDY RESULTS

4.1 pH & pH_{FOX}

The pH and pH_{FOX} depth profiles for the 8 representative drill holes selected for screen testing (encompassing 203 samples) are shown in Figure 4.1, along with the electrical conductivity data. The pH measurements indicate that the majority of the *in situ* profile appears to be circum-neutral, with pH values typically within the range of pH = 6-8. Many of the drill holes indicated slightly more alkaline materials at surface, with pH decreasing with depth. Most of the slightly acidic materials existed at depths in excess of 40 m. Drillhole IV147 shows a pronounced change in pH at a depth of approximately 50 m. This depth does not match up with a change in logged lithology (the drillhole encountered Shale in the upper 80 m and Mineralised BIF for the remainder) and may possibly indicate a change in redox conditions caused by the presence of groundwater, although the other drillholes sampled do not repeat this occurrence.

The pH_{FOX} results varied from 8.98 (alkaline) to 4.16 (acidic) with an average of 6.47. The pH_{FOX} results are obtained from analysis modified from acid sulfate soils methods which is similar to the single addition NAG testing discussed in Section 4.7; the main difference being that a direct measurement of the acidity is not conducted. The method allows a quick and cost effective estimation of the potential un-oxidised sulfide concentration within a material for a large number of samples. Due to the similarity with the NAG test, the results are interpreted in a similar fashion. Both the magnitude of change in pH following oxidation (i.e.pH_{FOX}-pH) and the final pH (i.e. pH_{FOX}) are considered. The criteria applied which indicate the possible oxidation of sulfides within a material is a change in pH of > -1 pH unit, coupled with pH_{FOX} values < 4.5.

The pH_{FOX} test results indicate that sulphides are not likely to be present in the BWT materials based on the criteria discussed above, and that there is little potential for further oxidation and subsequent acidification of the tested materials. Measured values were typically pH_{FOX} > 5, and were rarely more than 1 pH units below the corresponding pH measurement.

Table 4.1: Summary statistics for the screen test results

Parameter	pH	pH_{FOX}	pH_{FOX}-pH	EC (mS/m)
Maximum	8.76	8.98	-2.02	155.1
Minimum	4.74	4.16	1.39	2.6
Average	6.77	6.47	-0.31	11.2
Median	6.71	6.45	-0.32	6.3
Standard Deviation	0.64	0.81	0.61	17.0

4.2 ELECTRICAL CONDUCTIVITY (EC)

The results of Electrical Conductivity (EC) testing are presented as depth profiles in Figure 4.1. The majority of measured EC values in the BWT portion of the profile were less than 20 mS/m (some larger values were encountered higher in the profile), indicating a deeper profile of relatively low salinity in which past oxidation is unlikely to have occurred. The upper 10 – 20 m of each drillhole display slightly higher EC values, corresponding to increased weathering / oxidation and regolith development in this portion of the profile. The generally low EC values provide an indication that previous oxidation of sulfides is unlikely to have occurred.

4.3 ASSAY TOTAL SULFUR

The results of Total Sulfur assay testing carried out for the samples within each of the 8 drillholes selected for screen testing are shown in comparison to the pH and pH_{FOX} values within Figure 4.2. The profiles highlight the low Total Sulfur values contained within these drillholes, with only one sample across the 8 drillholes exceeding a Total Sulfur content of 0.1%. These low values place an upper limit on sulfide concentration which is also low, a conclusion which is reinforced by the pH_{FOX} results which show little reaction in the majority of cases in response to forced oxidation via the addition of hydrogen peroxide.

Several samples at the base of Drillhole IV197 show a moderate drop in pH_{FOX} values matching a slight increase in the Total Sulfur values recorded from assay data. Whilst a correlation between these two data sets can be seen, the overall magnitude of the pH drops within these samples is small (max 2 pH units) and crucially the resultant pH after oxidation is still relatively high (above pH 4). This reflects the small Total Sulfur content reported within the material from the assay results; and the resultant limit this places on sulfide concentration.

4.4 DISPERSION TESTING

A total of 184 of the screen samples was observed for the degree of dispersion displayed using the modified Emerson test (aggregate method). 15 g of each pulverised sample was placed within approximately 100 ml of water and mixed via tumbling for approximately 45 minutes. Following this the samples were allowed to settle and observed for the degree of dispersion 15 mins and 24 hours after the mixing. Each sample received a qualitative score based on the degree of settling that had taken place during the time interval as below;

- Completely settled – 0
- Slight dispersion – 1
- Moderate dispersion – 2
- Complete dispersion - 3

The results of this testing are summarised below by logged lithology (Table 4.2) and depth (Table 4.3). The breakdown based on depth is provided as an approximation of the assumed degree of weathering. The results show that the finer fraction of the alluvium samples remains in suspension for significantly shorter periods than the other lithologies tested, with the average 24 hr observation of all alluvium samples being slight dispersion and the median completely settled. This may indicate a slightly lower sodium ion ratio at exchange sites on the clay particles which aids flocculation and therefore settling rates. The mineralised BIF and shale samples typically displayed slight to moderate dispersion at the 24 hour observations, whilst the BIF and regolith – detrital samples typically displayed only slight to moderate settling rates during this period. The overall high dispersion seen across all samples is likely to be a function of the low recorded salinity, which acts to limits flocculation in suspended particles, and therefore not necessarily indicative of sodic conditions.

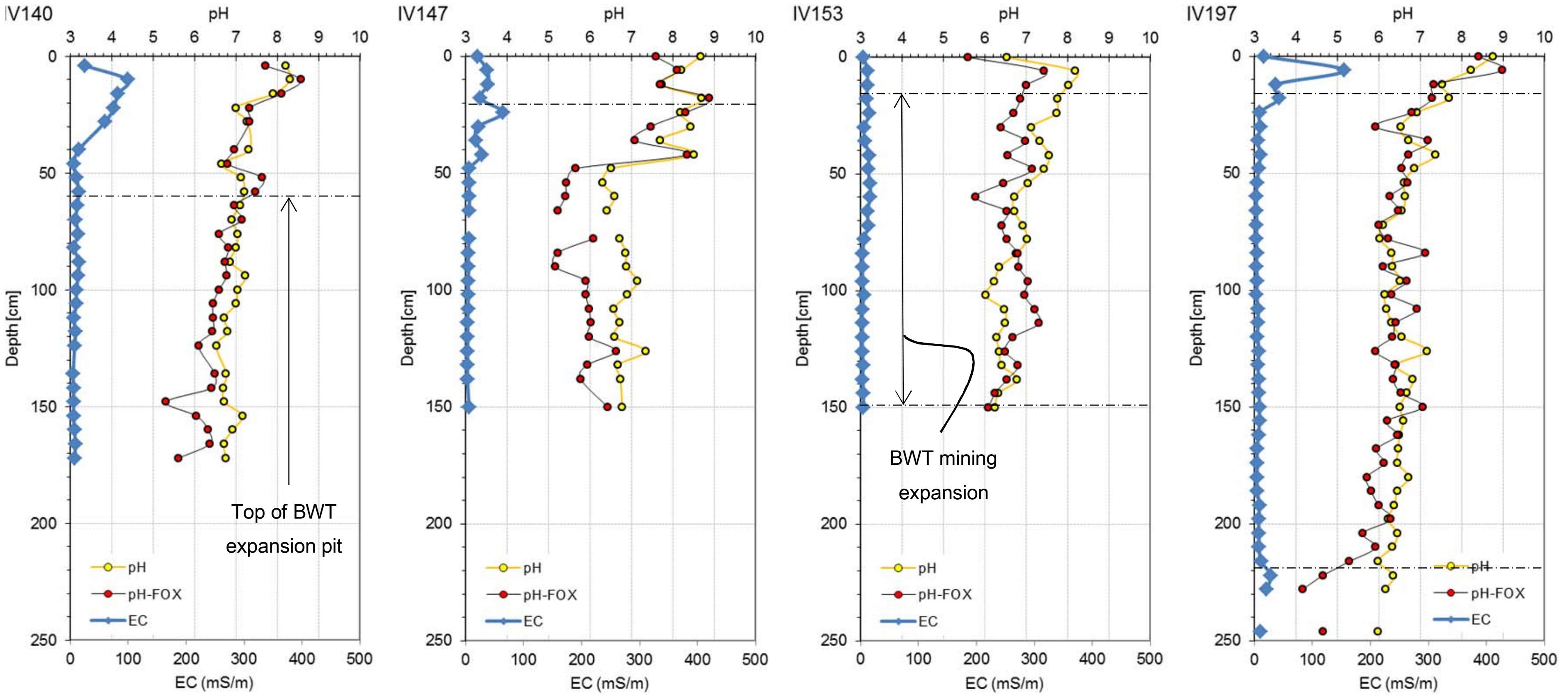
The breakdown of the observed settling rates into samples obtained from different depths is intended to illustrate the effect the degree of weathering may have on the sample. The results show there is little difference in the observed settling characteristics, possibly owing to the nature of the samples, which have been pulverised and stored for a period of time prior to the testing, which would act to negate possible differences caused by weathering.

Table 4.2: Emerson score of different lithology

Lithology	No. Samples	Average Emerson Score		Median Emerson Score	
		15 min	24 hr	15 min	24 hr
Regolith - Detrital	4	3	2.5	3	3
Alluvium	23	2.4	1	3	0
BIF	16	2.7	1.9	3	2
Mineralised BIF	85	2.7	1.3	3	1
Shale	54	2.7	1.2	3	1

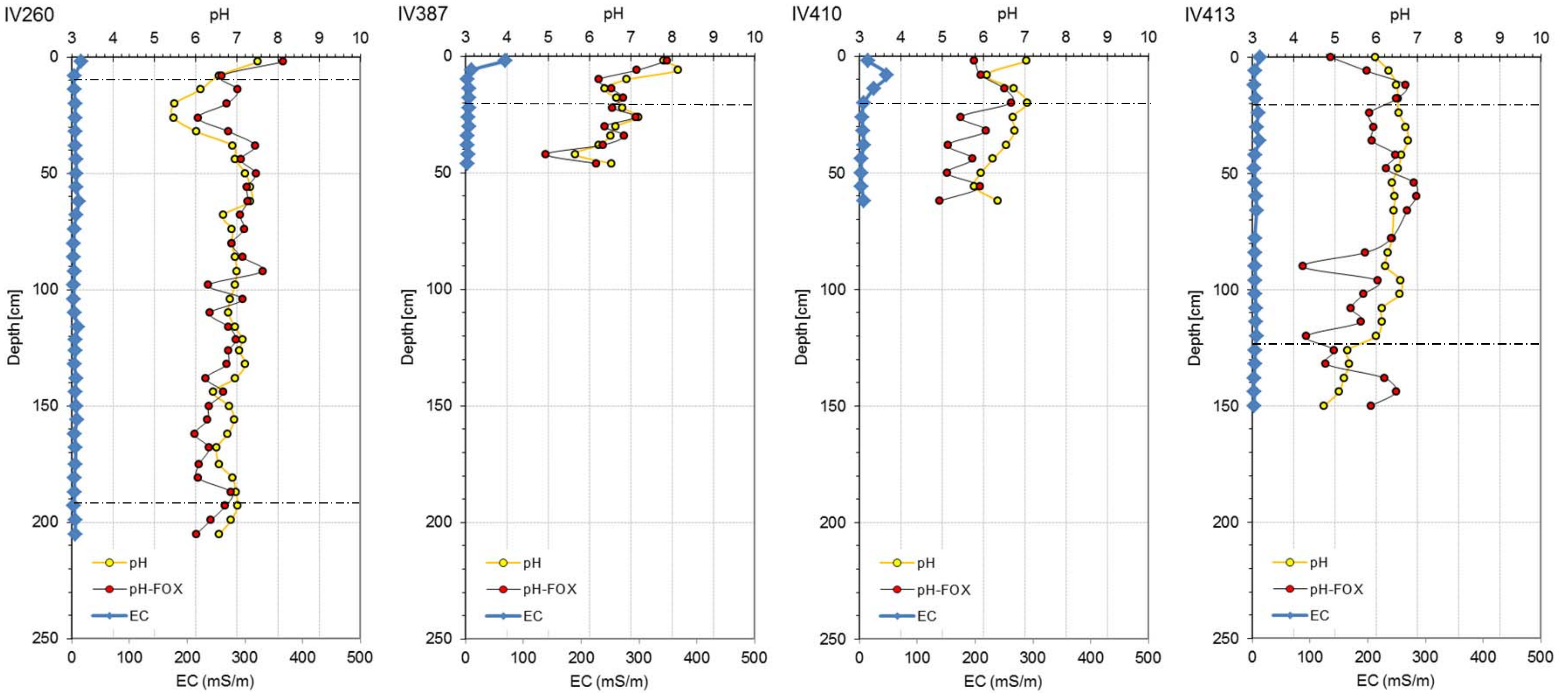
Table 4.3: Emerson score based on depth

Depth (m)	No. Samples	Average Emerson Score		Median Emerson Score	
		15 min	24 hr	15 min	24 hr
0 – 25	38	2.7	1.5	3	1
25 - 50	33	2.9	1.8	3	2
50 – 75	26	2.8	1	3	1
75 – 100	24	2.7	1.5	3	1.5
100 - 150	42	2.6	1.2	3	1
>150	21	2.3	0.7	2	1

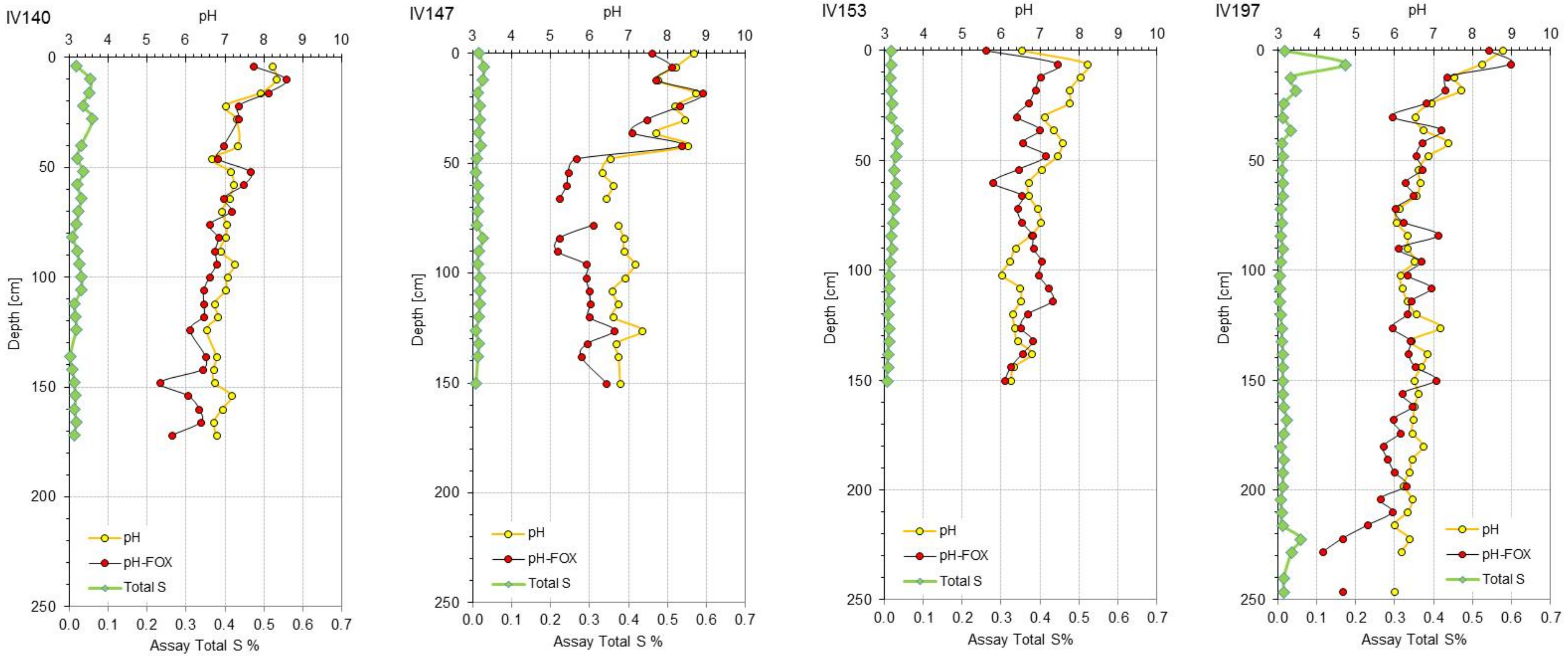


MINERAL RESOURCES	Figure 4.1: pH, pHfox and EC depth profiles for representative drillholes
IRON VALLEY BELOW WATER TABLE PROJECT - GEOCHEMICAL INVESTIGATION	

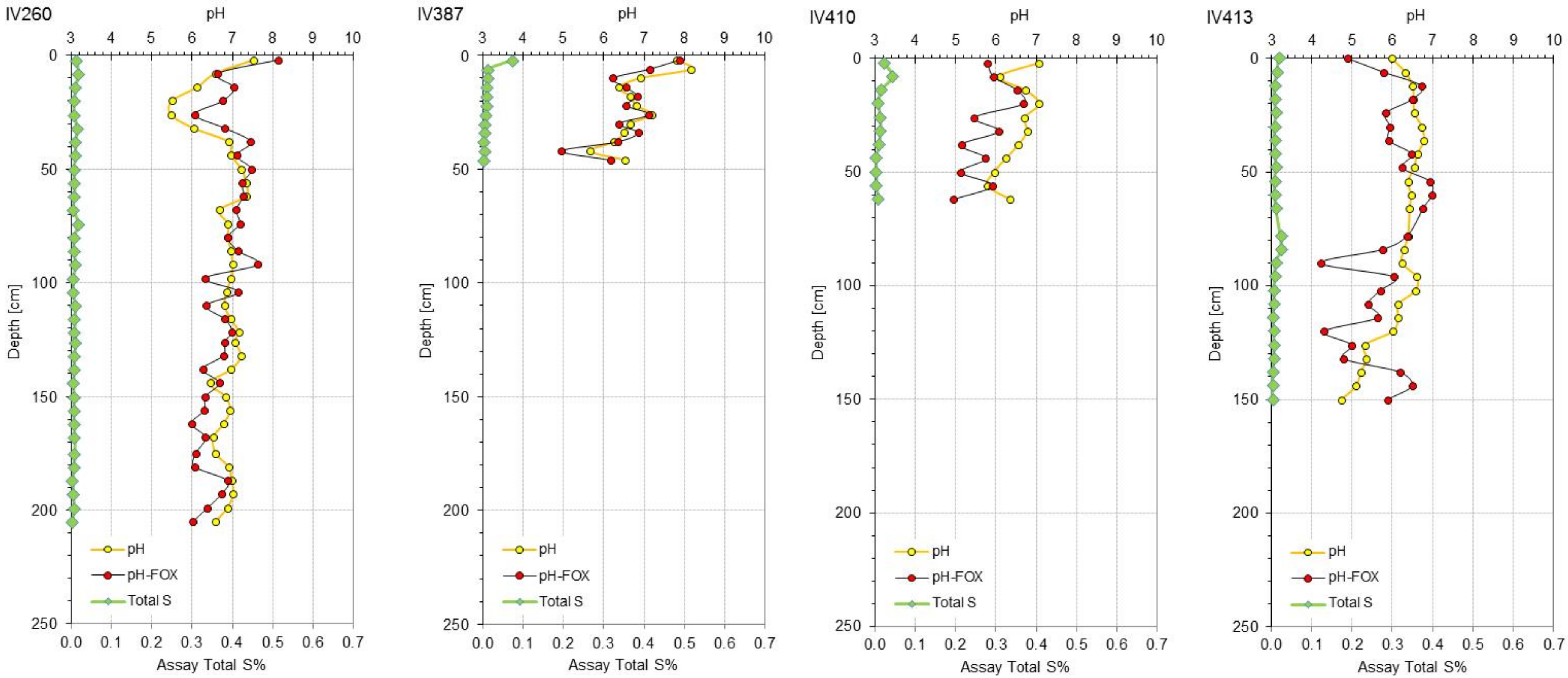
soilwater GROUP



MINERAL RESOURCES	Figure 4.1: pH, pHfox and EC depth profiles for representative drillholes
IRON VALLEY BELOW WATER TABLE PROJECT - GEOCHEMICAL INVESTIGATION	



MINERAL RESOURCES	Figure 4.2: pH, pHfox and Total S depth profiles for representative drillholes
IRON VALLEY BELOW WATER TABLE PROJECT - GEOCHEMICAL INVESTIGATION	



MINERAL RESOURCES	Figure 4.2: pH, pHfox and Total S depth profiles for representative drillholes	soilwater GROUP
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4.5 SULFUR SPECIATION

Twenty (20) representative samples were tested for Total Sulfur (S) content, along with their Chromium Reducible Sulfur (S_{CR}) content. These are tested to assess what portion of the Total S content within each sample is in the form of sulfide minerals such as pyrite, chalcopyrite etc., which can release acidity when oxidised and are the main drivers of ARD. The result of sulfur speciation testing on the 20 representative samples is presented below in Table 4.4.

The Total S % reported from testing varied from below the detection limit of 0.01% to 0.05%. Research led by industry groups and institutions into ARD reaction mechanics and environmental effects has led to a generally accepted guidance value of 0.3% Total S for screening purposes, with unexplained values higher than this warranting further investigation into the materials potential for acid generation. This guideline can be a useful screening tool but cannot replace criteria derived from site specific conditions and data. This is discussed in further detail in the following sections.

Results of S_{CR} analysis indicate the majority of the Total S reported within these samples is not in the form of reduced sulfur or sulfides. Therefore even the low Total S values reported with the assay data and testing conducted as part of this investigation are unlikely to be reactive and present little risk of forming ARD. The S_{CR} content is reported as a percentage of the Total S content of each sample within the last column of Table 4.2. As all S_{CR} values were below the detection limit, a value of 0.0025% (half) has been used here.

Table 4.4: Results of sulfur speciation testing on representative samples

Drillhole ID	Depth (m)	Lithology	Total S (%)	S_{CR} (%)	% S_{CR} within Total S
IV140	11	Alluvium	0.05	<0.005	5
IV153	7	Alluvium	0.02	<0.005	12
IV197	19	Alluvium	0.04	<0.005	6
IV140	53	Shale	0.03	<0.005	8
IV147	43	Shale	0.02	<0.005	12
IV153	31	Shale	<0.01	<0.005	50
IV197	223	Shale	ISS*	<0.005	
IV413	25	Shale	0.02	<0.005	120
IV260	63	Shale	<0.01	<0.005	50
IV260	133	Shale	<0.01	<0.005	50
IV140	173	Mineralised BIF	0.02	<0.005	12
IV153	103	Mineralised BIF	<0.01	<0.005	50
IV260	81	Mineralised BIF	<0.01	<0.005	50
IV260	139	Mineralised BIF	<0.01	<0.005	50
IV387	35	Mineralised BIF	<0.01	<0.005	50
IV153	151	BIF	<0.01	<0.005	50
IV413	139	BIF	<0.01	<0.005	50
IV260	176	BIF	<0.01	<0.005	50
IV387	47	BIF	<0.01	<0.005	50
IV410	63	BIF	<0.01	<0.005	50

*Insufficient sample remaining to carry out analysis

4.6 ACID NEUTRALISING CAPACITY

The contained buffering or Acid Neutralising Capacity (ANC) of the 20 selected representative samples was analysed using the modified Sobek method (Sobek and Schuller *et al.*, 1978) using HCl addition to the sample, followed by back titration utilising NaOH to determine the amount of un-buffered acid) and determination of Inorganic Carbon percentage within each sample. The addition of HCl determines the ANC of the material, but can overestimate the readily available buffering potential as it includes neutralising effects of primary silicate minerals, the breakdown of which can be slow kinetically under circum-neutral conditions (White and Brantley, 1995) and can therefore be ineffective at neutralising acid generation in some circumstances. For this reason the Total Inorganic Carbon (TIC) is used to calculate a Carbonate Neutralising Potential (CarbNP) which can be a more accurate measure of a materials ability to buffer acid generation from reduced sulfur oxidation under normal weathering conditions. The measured ANC and TIC, along with the calculated CarbNP, of each sample is shown in Table 4.5. A CarbNP of 2 has been assigned to those samples with TIC below limit of detection (i.e. equivalent to CarbNP < 4.1).

Table 4.5: Results of buffering capacity testing on representative samples

Drillhole ID	Depth (m)	Lithology	ANC*	TIC (%)	CarbNP*
IV140	11	Alluvium	13	0.05	4.1
IV153	7	Alluvium	6.1	<0.05	2
IV197	19	Alluvium	13	0.05	4.1
IV140	53	Shale	6.6	<0.05	2
IV147	43	Shale	28	0.15	12.3
IV153	31	Shale	5.4	<0.05	2
IV197	223	Shale	5.2	ISS†	2
IV413	25	Shale	10	0.05	4.1
IV260	63	Shale	6.3	<0.05	2
IV260	133	Shale	2	<0.05	2
IV140	173	Mineralised BIF	3	<0.05	2
IV153	103	Mineralised BIF	3.4	<0.05	2
IV260	81	Mineralised BIF	2.4	0.06	4.9
IV260	139	Mineralised BIF	3.1	<0.05	2
IV387	35	Mineralised BIF	3.3	<0.05	2
IV153	151	BIF	2.2	<0.05	2
IV413	139	BIF	1.8	<0.05	2
IV260	176	BIF	2.8	<0.05	2
IV387	47	BIF	1.6	<0.05	2
IV410	63	BIF	5.8	0.06	4.9

*Values given are in kg H_2SO_4/t (or equivalent).

† Insufficient sample remaining to carry out analysis

It can be seen that in the case of one sample (Mineralised BIF from IV260 @ 81 m) the calculated CarbNP is larger than the corresponding ANC. In these instances it is likely that some portion of the TIC measured is in the form of Fe (siderite) and/or Mn (rhodochrosite) carbonates that do not generally contribute to acid neutralisation under normal weathering conditions (Price, 2009) and therefore are not detected during the ANC determination.

All of the major material types tested displayed relatively low ANC contents < 30 kg H_2SO_4/t which indicates a low expected buffering capacity within these materials. The regolith Alluvium samples contained the highest ANC as a group when compared to other waste material types tested, averaging over 10 kg H_2SO_4/t equivalent of measured buffering capacity across the three samples tested. The sedimentary BIF and Shale samples tested displayed lower buffering capacities; with Shale reporting an average ANC of 8 kg H_2SO_4/t equivalent, and the two BIF lithologies ANC of < 5 kg H_2SO_4/t equivalent. The calculated CarbNP results in general mirrored the ANC results, but were also generally lower, which as discussed is likely due to the inclusion of buffering effects from primary silicates in the ANC determination.

4.7 ACID BASE ACCOUNT

An Acid Base Account (ABA) is the process of comparing the Maximum Potential Acidity (MPA) and ANC/CarbNP results for different samples and materials to establish their likely Net Acidity or Alkalinity. The results of this comparison are listed in Table 4.6 and shown graphically in Figure 4.3 A and B. The MPA value is typically calculated using the measured Total S content, assuming that all of the reported Sulfur within each sample occurs in the form of iron pyrite (FeS_2) and oxidises according to the equation shown below. To provide a more accurate measure of the Net Acidity or Alkalinity, the MPA is also determined using S_{CR} content, so that only the sulfide S portion is considered. This mineral and oxidation reaction produces the maximum amount of acidity per molar weight of S of any sulfide species and therefore provides a 'worst case' scenario for predicting acid production.

$$FeS_2 + \frac{15}{4}O_2 + \frac{7}{2}H_2O => Fe(OH)_2 + 2H_2SO_4$$

The MPA values calculated from the Total S contents vary from no acid production (i.e. Total S below detection) to 1.53 kg H_2SO_4/t, and between uniformly below detection limit when considering the S_{CR} MPA portion. When these MPA values are compared to the corresponding ANC for each sample (Table 4.6) the resulting Net Acid Producing Potential (NAPP-$_{ANC}$) varies between -27.4 and -0.2 kg H_2SO_4/t (Total S) and between -27.9 and -0.4 kg H_2SO_4/t (S_{CR}). These values equate to a moderate acid consumption (i.e. negative NAPP) through to samples which are barren with respect to both acid production and consumption.

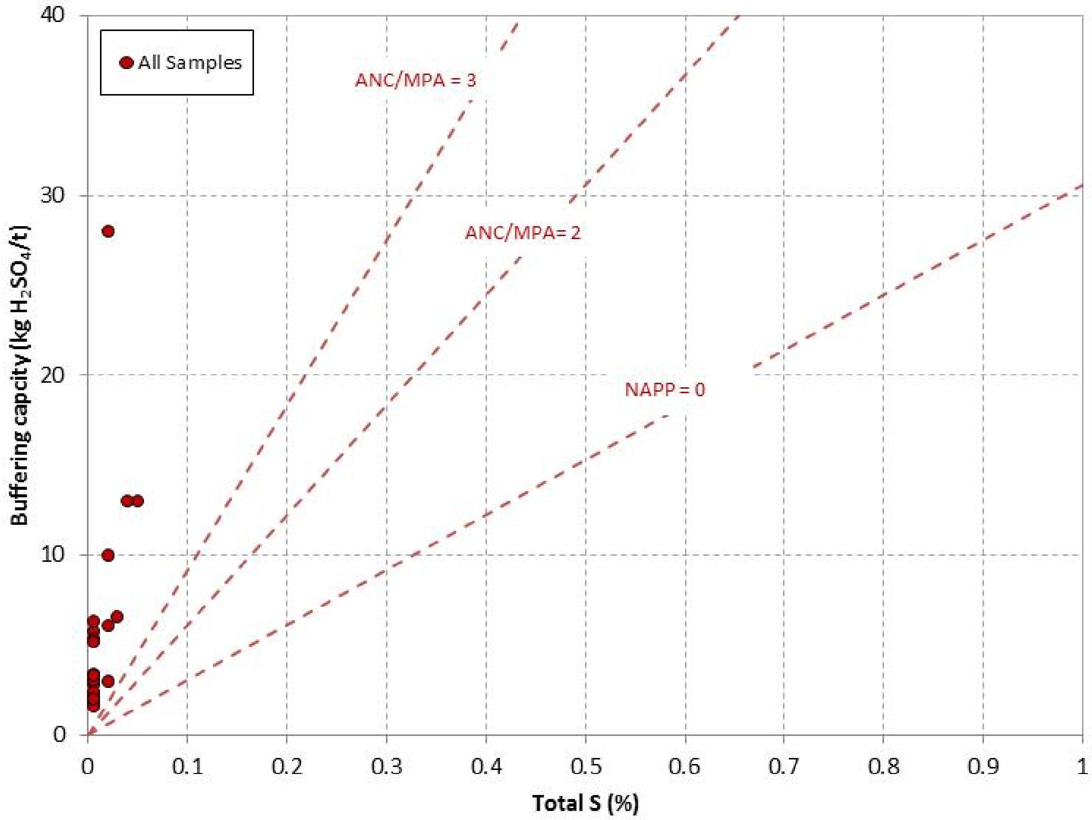
The two ABA plots shown in Figure 4.3 compare the measured ANC against the Total S % (MPA), highlighting the waste material types (A) and the depth in the profile or weathering environment (B). Experience from mining and research has shown that the ARD potential of a material can be considered low for materials which display an ANC/MPA ratio greater than 2 (Currey and Ritchie *et al.*, 1997). The two graphs reiterate the lack of sulfur (and sulfides) within all samples tested, with all samples from each major lithology type recording an ANC/MPA ratio above 3.

Table 4.6: Acid Base Account for representative samples

Drillhole ID	Depth (m)	Lithology	MPA* Total S	MPA* SCR	ANC*	CarbNP*	NAPP*Total S-ANC	NAPP*Total S-CarbNP	NAPP*SCR-ANC	NAPP*SCR-CarbNP
IV140	11	Alluvium	1.53	<0.15	13	4.1	-11.5	-2.6	-12.9	-4.0
IV153	7	Alluvium	0.61	<0.15	6.1	<4.1	-5.5	-1.4	-6.0	-2.0
IV197	19	Alluvium	1.22	<0.15	13	4.1	-11.8	-2.9	-12.9	-4.0
IV140	53	Shale	0.92	<0.15	6.6	<4.1	-5.7	-1.1	-6.5	-2.0
IV147	43	Shale	0.61	<0.15	28	12.3	-27.4	-11.6	-27.9	-12.2
IV153	31	Shale	<0.31	<0.15	5.4	<4.1	-5.2	-1.9	-5.3	-2.0
IV197	223	Shale	<0.31	<0.15	5.2	<4.1	-5.0	-1.9	-5.1	-2.0
IV413	25	Shale	0.61	<0.15	10	4.1	-9.4	-3.5	-9.9	-4.0
IV260	63	Shale	<0.31	<0.15	6.3	<4.1	-6.1	-1.9	-6.2	-2.0
IV260	133	Shale	<0.31	<0.15	2	<4.1	-1.8	-1.9	-1.9	-2.0
IV140	173	Mineralised BIF	0.61	<0.15	3	<4.1	-2.4	-1.4	-2.9	-2.0
IV153	103	Mineralised BIF	<0.31	<0.15	3.4	<4.1	-3.2	-1.9	-3.3	-2.0
IV260	81	Mineralised BIF	<0.31	<0.15	2.4	4.9	-2.2	-1.9	-2.3	-4.8
IV260	139	Mineralised BIF	<0.31	<0.15	3.1	<4.1	-2.9	-1.9	-3.0	-2.0
IV387	35	Mineralised BIF	<0.31	<0.15	3.3	<4.1	-3.1	-1.9	-3.2	-2.0
IV153	151	BIF	<0.31	<0.15	2.2	<4.1	-2.0	-1.9	-2.1	-2.0
IV413	139	BIF	<0.31	<0.15	1.8	<4.1	-1.6	-1.9	-1.7	-2.0
IV260	176	BIF	<0.31	<0.15	2.8	<4.1	-2.6	-1.9	-2.7	-2.0
IV387	47	BIF	<0.31	<0.15	1.6	<4.1	-1.4	-1.9	-1.5	-2.0
IV410	63	BIF	<0.31	<0.15	5.8	4.9	-5.6	-1.9	-5.7	-4.8

*Values given are in Kg H_2SO_4/t or equivalent.

A



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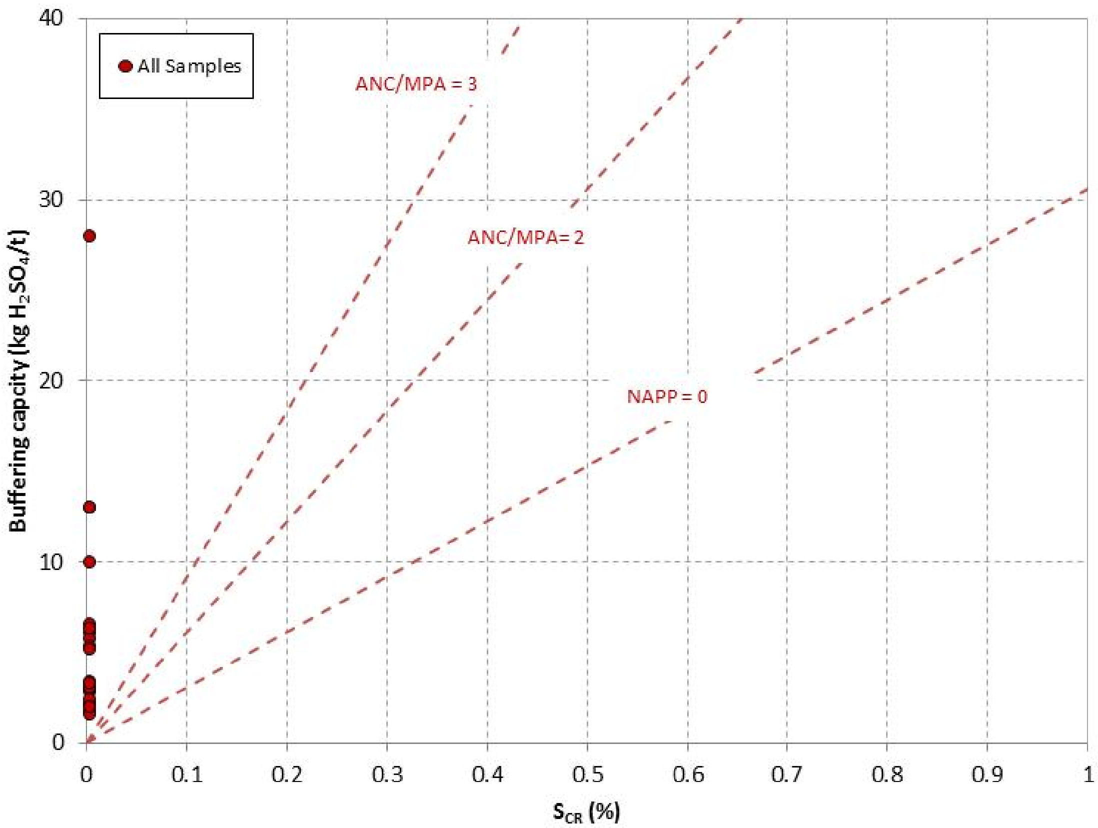

MINERAL RESOURCES	Figure 4.3: ABA plots of representative samples	soilwater GROUP
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4.8 NET ACID GENERATION

The static Net Acid Generation (NAG) testing results for the 20 representative samples tested are shown in Table 4.7. The NAGpH for all samples varied from 4.7 to 9.4, with an average pH of 6.6. All of the twenty samples tested reported a NAGpH above 4.5, indicating that all of the major waste material samples tested are unlikely to be capable of generating acidity that may have an adverse impact on the environment.

A number of the samples tested showed minor acid production between pH of 4.5 and 7 (i.e. $NAG_{7.0}$ value). As all of these samples reported low Total S contents, the low pH after oxidation is expected to not be caused by sulfidic materials but instead released acidity from Fe and Al oxyhydroxides (i.e. by ferrolysis) or some other relatively benign source present within the oxide materials contained within the sediments. There was no acid production below the NAG pH level of 4.5.

Table 4.7: Results of static NAG testing on representative samples

Drillhole ID	Depth (m)	Lithology	NAGpH	NAG 7.0*
IV140	11	Alluvium	8.6	<0.5
IV153	7	Alluvium	7.4	2.3
IV197	19	Alluvium	7.3	<0.5
IV140	53	Shale	7.6	<0.5
IV147	43	Shale	8.4	<0.5
IV153	31	Shale	6.4	2.8
IV197	223	Shale	4.7	5.3
IV413	25	Shale	5.8	2.2
IV260	63	Shale	7.3	1.6
IV260	133	Shale	6.8	5
IV140	173	Mineralised BIF	5.6	4.9
IV153	103	Mineralised BIF	7.0	1.7
IV260	81	Mineralised BIF	6.9	2.6
IV260	139	Mineralised BIF	6.3	5.5
IV387	35	Mineralised BIF	6.9	<0.5
IV153	151	BIF	6.1	3.1
IV413	139	BIF	6.2	0.7
IV260	176	BIF	6.1	<0.5
IV387	47	BIF	6.2	2.4
IV410	63	BIF	5.0	<0.5

*Values given are in kg H_2SO_4/t equivalent.

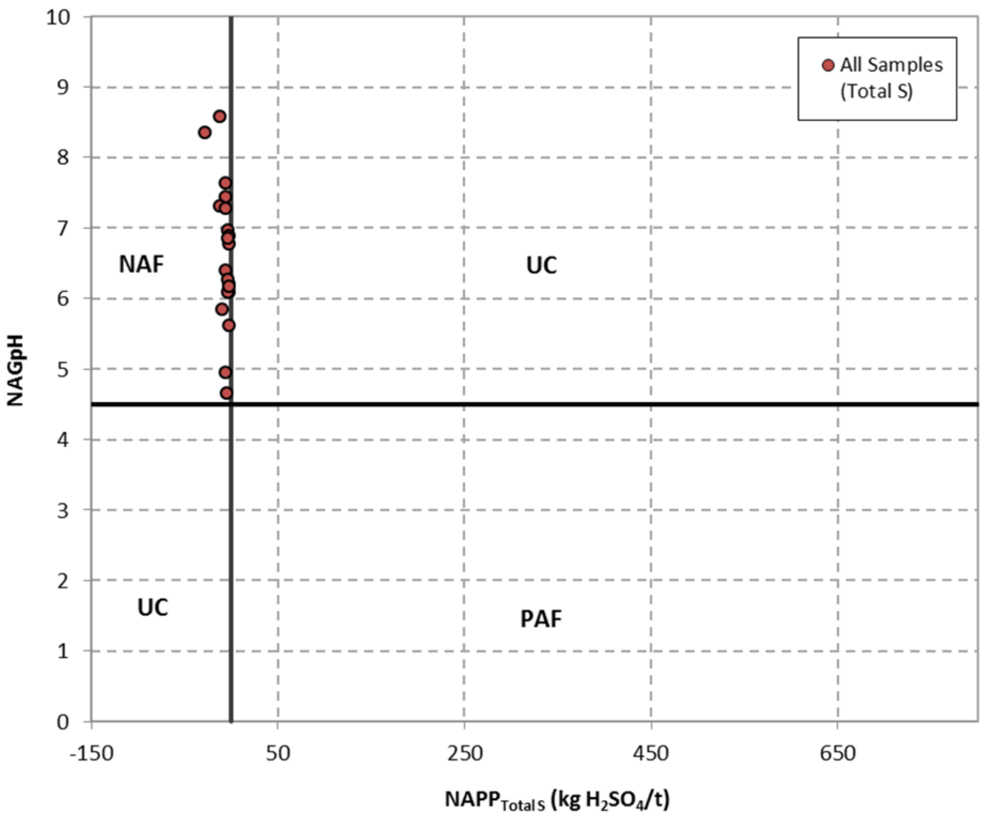
4.9 GEOCHEMICAL CLASSIFICATION

The results from the static NAG testing are used in conjunction with the NAPP results (ABA) to allow a geochemical classification of the acid generating potential of a material. Samples are placed into one of three categories based on the following criteria:

- Non-acid forming (NAF) – Samples classified as NAF may have significant acid generating potential but contain sufficient readily available ANC to adequately buffer any acidity formed. A sample is classified as NAF when it has a negative NAPP and a final NAGpH ≥ 4.5.
- Potentially-acid forming (PAF) – Samples with a PAF classification present the risk of generating acidic drainage if oxidation (i.e. exposure to atmospheric conditions) occurs. A sample is classified as PAF when it has a positive NAPP and a final NAGpH < 4.5.
- Uncertain (UC) – An uncertain classification is used where there is a conflict between the NAPP and NAG test results (i.e. where the NAPP is positive and the NAGpH ≥ 4.5 or vice versa). Uncertain sample classification may require further investigation to determine the likely acid generation potential.

Geochemical classification plots of the 20 representative samples tested are presented in Figure 4.4 A (Total S) and Figure 4.4 B (S_{CR}). The plots highlight the relatively low sulfur contents within all of the samples, and indicate all samples to be essentially barren of both acid producing and acid buffering capacity.

A



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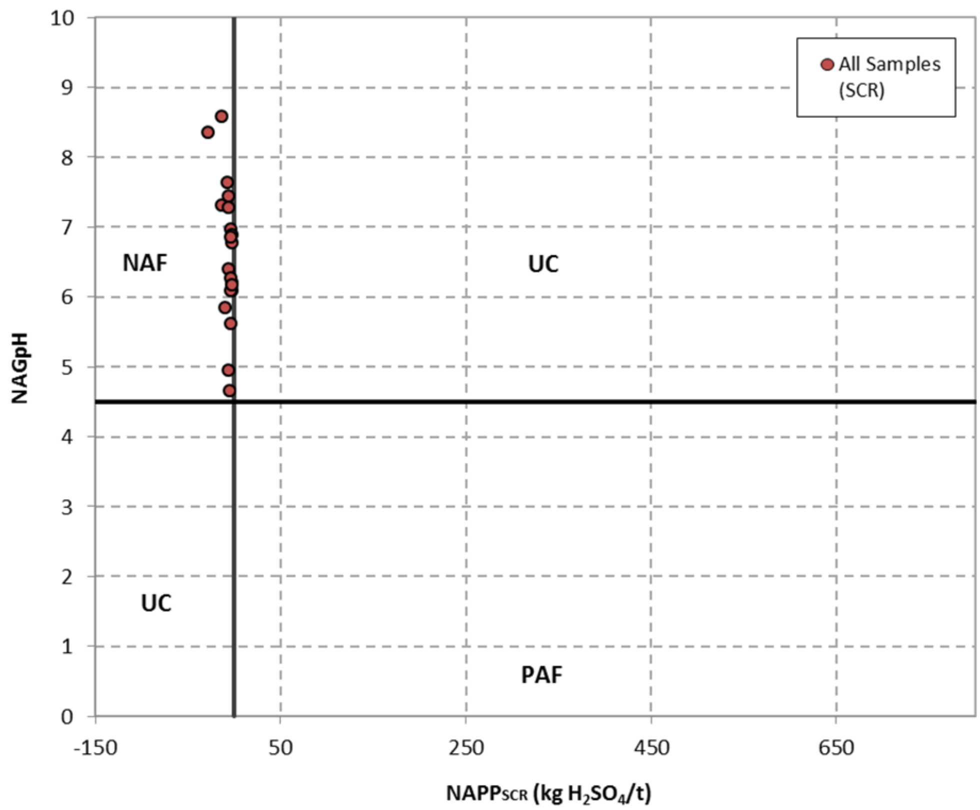

MINERAL RESOURCES	Figure 4.4: Geochemical classification plots
IRON VALLEY BELOW WATER TABLE PROJECT - GEOCHEMICAL INVESTIGATION	

4.10 MULTI-ELEMENT COMPOSITION

The relative enrichment of the 20 selected samples tested was determined using the Geochemical Abundance Index (GAI) through the equation shown below:

$$GAI = \log_2\left(\frac{C}{1.5 * ACA}\right)$$

Where C = element content within the material in mg/kg and ACA = the average crustal abundance of the element (Bowen, 1979). A GAI of 0 indicates that the content of the element is less than, or similar to, the ACA. A GAI of 3 corresponds to a 12-fold enrichment above the ACA whilst a GAI of 6 indicates a 96-fold or greater enrichment above the average crustal abundance. In general, a GAI > 3 indicates a significant level of enrichment. The elemental contents are also compared against the Department of Environmental Regulation (DER) Ecological Investigation Levels (DEC, 2010) to identify metals and metalloid levels that may pose a risk to the environment if they become mobile (i.e. soluble). The EIL used by the DER are primarily based on the Environmental Investigation Levels listed in the Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC & ARMCANZ, 2000). The EIL's represent screening levels with which to provide a first-pass or Tier 1 level assessment for a site. It is important to note that these levels do not take into account mineralised zones where elevated metal and metalloid contents can exceed the EIL criteria. Site specific information therefore needs to be used in conjunction with the EIL's to assess the appropriateness of each screening value. In the case of these materials the EIL's are shown in comparison with the ACA and calculated GAI in order to provide a context within which to interpret them.

The multi-element composition of the 20 selected samples is provided in Table 4.8 along with the calculated GAI and associated EIL. Element contents which exceed the EIL for a given sample are highlighted in bold. The results show that whilst some samples exceeded the EIL for elements AS, Mn and V, only one samples tested for As received a GAI of over 4, whilst the remaining samples were not considered to be significantly enriched with regards to any of the elements tested when compared with natural background levels (ACA).

The relatively higher levels of Arsenic reported were restricted to the Shale waste rock lithology. The Arsenic is likely to be associated with the high levels of Fe prevalent within the materials possibly as a result of surface complexation or adsorption onto iron (and manganese) oxy-hydroxides.

4.11 METAL MOBILITY

Two leaching trials were carried out using the Australian Standard Leaching Procedure (ASLP) on 9 of the samples selected for detailed ARD testing in this investigation. The first trial utilised a leaching agent of dilute glacial acetic acid (pH 5.0) simulating rainwater, whilst the second trial used a leaching agent of acetic acid (pH 2.9), following the leach agent preparations documented in AS 4439.3-1997.

The results of the leaching trials are provided in Table 4.9 (simulated near neutral conditions) and Table 4.10 (simulated acidic conditions).The tables show the amount of each element which was soluble (and therefore mobile) in mg/L. The amount which was reported within the solute of each trial is also given as a percentage of the total amount within the corresponding solid phase for the purpose of comparison. It should be noted that these values are not directly comparable, as different portions of each sample were used in each test (as the solid metal content testing destroys the sample during the analysis process), and are only included to provide an indication of relative proportions.

For the majority of the materials and elements tested under neutral conditions, the amount leached was low with values ≤ 10% (many elements were below detection limits within the collected leachate). The exception to this was a sample of Alluvium from Drillhole IV153 which reported leachate contents of Ba (17%) and Sr (33%) at a higher proportion when compared to the reported solid content. These results indicate that the majority of the elements are strongly bound within the mineral structure and are not readily soluble under neutral conditions. The samples which did display higher rates of leaching as a percentage of solid phase content (Ba and Sr) had uniformly low solid phase contents of these elements (i.e. GAI ≤ 0), making the total amount of these metals which became mobile within the leachate low. These results show that for the majority of elements mobility under normal leaching conditions within the waste materials will be limited, with significant metalliferous drainage unlikely to develop in the absence of ARD. However the potential elevated mobility of Ba and Sr should be addressed when managing runoff and/or seepage from WRL(s).

The results when simulating acidic leaching conditions show that in general the leaching rates as a percentage of solid phase content went up when compared to the neutral leachate, with almost all metals tested which were not below the detection limit showing a general increase in the amount of solute present in the acidic leachate. This increase in metal mobility with decrease in pH (from neutral range to acidic) is common for a range of metals. This has the effect of increasing the metal content within a number of samples for metals such as Al, Cu, Fe, Mn and Zn above the fresh water guidelines for slightly to moderately disturbed marine ecosystems set by ANZECC & ARMCANZ (2000). Whilst these guideline levels are intended for application to freshwater marine environments, the position of the Project within the catchment and adjacent to the lower reaches of the Weeli Wolli Creek makes their inclusion and discussion in this assessment relevant. However, as described in the preceding areas of this report the generation of acid following disturbance of the waste materials during proposed mining activities is considered unlikely due to the absence of sulfide minerals within the materials, therefore making the elevated rates of dissolution and mobility resulting from the simulation of acidic conditions during leaching unlikely to eventuate on site.

It should also be noted that the process involved in the use of standard bottle leach extraction (i.e. AS4439.3 – 1997) to study the mobility of metals and metalloids within the waste materials uses an aggressive soil/leaching agent ratio of 1:20. This large ratio is used to ensure that common ion effects which act to limit dissolution or desorption of elements into the liquid phase do not occur. In the case of field conditions under both saturated and unsaturated conditions a significantly lower solid/liquid ratio will occur (i.e. << 1:1), which will reduce the contact between mineral and liquid phases, thereby inhibiting the dissolution of the majority of soluble salts and restricting desorption of elements from the mineral surfaces. The overall effect of this decrease in solution to solid ratio is decreased metal and metalloid mobility occurring on site in comparison with those rates reported in this study.

Table 4.8: Multi element composition of representative waste material samples

Drill hole	Depth	Lithology	Al		As		B		Ba		Cd		Co		Cr		Cu		Fe		Hg		Mn	
			mg/kg	GAI	mg/kg	GAI	mg/kg	GAI	mg/kg	GAI	mg/kg	GAI	mg/kg	GAI	mg/kg	GAI	mg/kg	GAI	mg/kg	GAI	mg/kg	GAI	mg/kg	GAI
IV140	11	Alluvium	33,900	0	7.7	2	<50	0	120	0	0.1	0	10	0	68	0	17	0	210,000	2	<0.02	0	590	0
IV140	53	Shale	80,700	0	13	3	<50	0	280	0	<0.10	0	2.9	0	96	0	17	0	290,000	2	0.15	0	980	0
IV140	173	Mineralised BIF	6,630	0	5	1	<50	0	8.2	0	<0.10	0	2.3	0	6	0	6.6	0	410,000	3	0.05	0	390	0
IV147	43	Shale	64,100	0	17	3	<50	0	160	0	<0.10	0	4.5	0	49	0	14	0	170,000	1	0.2	0	300	0
IV153	7	Alluvium	27,200	0	8.2	2	<50	0	30	0	<0.10	0	2.2	0	53	0	7.4	0	260,000	2	<0.02	0	150	0
IV153	31	Shale	53,500	0	35	4	<50	0	16	0	<0.10	0	2.1	0	75	0	12	0	380,000	3	0.16	0	100	0
IV153	103	Mineralised BIF	12,400	0	2.9	0	<50	0	14	0	<0.10	0	<1.0	0	13	0	5.1	0	330,000	2	0.04	0	170	0
IV153	151	BIF	5,070	0	1.4	0	<50	0	24	0	<0.10	0	<1.0	0	20	0	4.3	0	250,000	2	0.02	0	130	0
IV197	19	Alluvium	40,100	0	8.4	2	<50	0	200	0	<0.10	0	3.2	0	26	0	24	0	320,000	2	<0.02	0	580	0
IV197	223	Shale	28,400	0	2	0	<50	0	5.8	0	<0.10	0	<1.0	0	9.1	0	14	0	91,000	1	0.07	0	88	0
IV413	25	Shale	37,800	0	12	2	<50	0	100	0	<0.10	0	5.8	0	120	0	3	0	350,000	3	0.02	0	190	0
IV413	139	BIF	1,320	0	1.3	0	<50	0	28	0	<0.10	0	<1.0	0	19	0	1.5	0	170,000	1	<0.02	0	170	0
IV260	63	Shale	15,700	0	2.3	0	<50	0	23	0	<0.10	0	1.7	0	130	0	20	0	360,000	3	0.03	0	110	0
IV260	81	Mineralised BIF	5,290	0	1.7	0	<50	0	15	0	<0.10	0	<1.0	0	8.5	0	5.1	0	390,000	3	0.12	0	290	0
IV260	133	Shale	5,930	0	1.9	0	<50	0	11	0	<0.10	0	1	0	14	0	6.5	0	330,000	2	<0.02	0	180	0
IV260	139	Mineralised BIF	8,680	0	3.4	1	<50	0	7.8	0	<0.10	0	1.3	0	14	0	12	0	390,000	3	0.03	0	530	0
IV260	176	BIF	5,940	0	2	0	<50	0	11	0	<0.10	0	<1.0	0	6.6	0	2.2	0	340,000	2	0.05	0	790	0
IV387	35	Mineralised BIF	12,500	0	3.5	1	<50	0	15	0	<0.10	0	<1.0	0	12	0	1.3	0	400,000	3	0.09	0	130	0
IV387	47	BIF	5,430	0	3	0	<50	0	15	0	<0.10	0	<1.0	0	4.6	0	2.3	0	180,000	2	<0.02	0	75	0
IV410	63	BIF	4,290	0	2.7	0	<50	0	42	0	<0.10	0	<1.0	0	6.4	0	2.2	0	220,000	2	0.08	0	290	0
Limit of Reporting			10		0.2		5		0.1		0.05		0.5		0.05		0.5		5		0.02		0.2	
Average Crustal Abundance			82,000		1.5		10		500		0.11		20		100		50		41,000		0.05		950	
Ecological Investigation Level			-		20		-		300		3		50		400		100		-		1		500	

Drill hole	Depth	Lithology	Mo		Ni		Pb		Sb		Se		Sn		Sr		Th		U		V		Zn	
			mg/kg	GAI	mg/kg	GAI	mg/kg	GAI	mg/kg	GAI	mg/kg	GAI	mg/kg	GAI	mg/kg	GAI	mg/kg	GAI	mg/kg	GAI	mg/kg	GAI	mg/kg	GAI
IV140	11	Alluvium	1.3	0	20	0	11	0	0.4	0	0.23	2	1.7	0	31	0	7.5	0	0.95	0	**96**	0	<50	0
IV140	53	Shale	0.19	0	<10	0	15	0	<0.10	0	0.52	3	2	0	33	0	8.1	0	1.5	0	**290**	0	<50	0
IV140	173	Mineralised BIF	0.51	0	<10	0	1.5	0	0.25	0	<0.10	0	<1.0	0	3.6	0	<1.0	0	0.57	0	12	0	<50	0
IV147	43	Shale	1.6	0	13	0	19	0	0.37	0	0.28	2	3.6	0	33	0	9.5	0	2.6	0	**77**	0	<50	0
IV153	7	Alluvium	1.1	0	<10	0	9	0	0.46	1	0.34	2	1.5	0	11	0	5.8	0	0.78	0	**72**	0	<50	0
IV153	31	Shale	2.4	0	<10	0	24	0	0.81	1	0.6	3	1.7	0	7.5	0	10	0	3.4	0	**84**	0	<50	0
IV153	103	Mineralised BIF	0.29	0	<10	0	4	0	0.84	1	<0.10	0	<1.0	0	3.8	0	2	0	0.76	0	12	0	<50	0
IV153	151	BIF	0.88	0	<10	0	1.4	0	0.44	1	<0.10	0	<1.0	0	3	0	<1.0	0	0.38	0	9.1	0	<50	0
IV197	19	Alluvium	4.6	1	12	0	14	0	0.18	0	0.27	2	2.9	0	18	0	5.3	0	1.5	0	45	0	<50	0
IV197	223	Shale	3	0	<10	0	3.6	0	0.16	0	<0.10	0	2.9	0	2.4	0	8.5	0	1.8	0	3.5	0	<50	0
IV413	25	Shale	1.7	0	15	0	19	0	0.6	1	<0.10	0	3.1	0	12	0	8.6	0	1.8	0	**93**	0	<50	0
IV413	139	BIF	2.2	0	<10	0	<1.0	0	0.34	0	<0.10	0	<1.0	0	2.4	0	<1.0	0	0.13	0	4.6	0	<50	0
IV260	63	Shale	0.28	0	<10	0	6.2	0	0.59	1	<0.10	0	2.5	0	13	0	12	0	4	0	31	0	<50	0
IV260	81	Mineralised BIF	0.3	0	<10	0	2.5	0	0.55	1	<0.10	0	<1.0	0	7.5	0	1.4	0	1.3	0	10	0	<50	0
IV260	133	Shale	0.25	0	<10	0	2.5	0	0.78	1	<0.10	0	<1.0	0	6.3	0	1.7	0	1.7	0	14	0	<50	0
IV260	139	Mineralised BIF	0.71	0	<10	0	1.7	0	1	2	0.12	1	<1.0	0	5.4	0	1.8	0	4	0	19	0	77	0
IV260	176	BIF	0.22	0	<10	0	1.3	0	0.59	1	0.12	1	<1.0	0	2.6	0	<1.0	0	1.3	0	6	0	<50	0
IV387	35	Mineralised BIF	0.22	0	<10	0	3.7	0	0.27	0	<0.10	0	<1.0	0	2.8	0	1.8	0	0.73	0	15	0	<50	0
IV387	47	BIF	0.33	0	<10	0	<1.0	0	0.37	0	<0.10	0	<1.0	0	3.4	0	<1.0	0	0.39	0	4.2	0	<50	0
IV410	63	BIF	0.45	0	<10	0	<1.0	0	0.22	0	<0.10	0	<1.0	0	4.4	0	1.3	0	0.3	0	6.1	0	<50	0
Limit of Reporting			0.05		1		0.5		0.05		0.05		0.5		0.2		0.5		0.01		0.2		5	
Average Crustal Abundance			1.5		80		14		0.2		0.05		2.2		370		12		2.4		160		75	
Ecological Investigation Level			40		60		600		-		-		50		-		-		-		50		200	

Table 4.9: Results of leaching tests conducted on representative waste material in neutral conditions

Drill hole	Depth	Lithology	Al		As		B		Ba		Cd		Co		Cr		Cu		Fe		Hg		Mn	
			mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%
IV140	11	Alluvium	0.54	0.0	<0.05	-*	0.15	-	0.21	0.9	<0.002	-	0.008	0.4	<0.001	-	<0.002	-	0.017	0.0	<0.0001	-	0.18	0.2
IV153	7	Alluvium	0.97	0.1	<0.05	-	0.08	-	0.28	17.1	<0.002	-	0.029	6.3	0.003	0.3	<0.002	-	6.2	0.0	<0.0001	-	0.56	0.7
IV140	53	Shale	0.45	0.0	<0.05	-	<0.02	-	0.11	0.2	<0.002	-	<0.005	-	<0.001	-	<0.002	-	<0.005	-	<0.0001	-	0.17	0.1
IV153	31	Shale	0.39	0.0	<0.05	-	<0.02	-	0.045	0.1	<0.002	-	<0.005	-	<0.001	-	<0.002	-	0.024	0.0	<0.0001	-	0.026	0.0
IV260	133	Shale	0.082	0.0	<0.05	-	<0.02	-	0.033	1.0	<0.002	-	<0.005	-	<0.001	-	<0.002	-	0.014	0.0	<0.0001	-	0.036	0.2
IV413	139	BIF	0.28	0.0	<0.05	-	<0.02	-	0.43	7.2	<0.002	-	0.019	4.3	0.003	0.0	<0.002	-	2.6	0.0	<0.0001	-	2	6.7
IV410	63	BIF	0.13	0.0	<0.05	-	<0.02	-	0.18	0.5	<0.002	-	<0.005	-	<0.001	-	<0.002	-	0.85	0.0	<0.0001	-	1.4	1.2
IV260	139	Mineralised BIF	0.027	0.0	<0.05	-	<0.02	-	0.016	0.6	<0.002	-	<0.005	-	<0.001	-	<0.002	-	<0.005	-	<0.0001	-	0.038	0.1
IV387	35	Mineralised BIF	0.33	0.0	<0.05	-	<0.02	-	0.073	1.5	<0.002	-	<0.005	-	<0.001	-	<0.002	-	0.027	0.0	<0.0001	-	0.099	0.4
Limit of Reporting			0.005		0.05		0.02		0.002		0.002		0.005		0.001		0.002		0.005		0.0001		0.001	

Drill hole	Depth	Lithology	Mo		Ni		Pb		Sb		Se		Sn		Sr		Th		U		V		Zn	
			mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%
IV140	11	Alluvium	<0.02	-	0.02	0.5	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.51	8.2	<0.02	-	0.0026	1.4	<0.005	-	<0.005	-
IV153	7	Alluvium	<0.02	-	<0.01	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.24	33.3	<0.02	-	0.0021	1.8	<0.005	-	0.009	-
IV140	53	Shale	<0.02	-	<0.01	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.12	1.8	<0.02	-	0.0007	0.2	<0.005	-	0.017	-
IV153	31	Shale	<0.02	-	<0.01	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.088	1.3	<0.02	-	0.0019	0.4	<0.005	-	0.016	-
IV260	133	Shale	<0.02	-	<0.01	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.032	2.1	<0.02	-	0.0006	0.1	<0.005	-	0.009	-
IV413	139	BIF	<0.02	-	<0.01	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.027	1.2	<0.02	-	0.0008	0.5	<0.005	-	0.029	-
IV410	63	BIF	<0.02	-	<0.01	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.074	2.1	<0.02	-	0.0008	0.3	<0.005	-	<0.005	-
IV260	139	Mineralised BIF	<0.02	-	<0.01	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.031	4.1	<0.02	-	0.0002	0.1	<0.005	-	<0.005	-
IV387	35	Mineralised BIF	<0.02	-	<0.01	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.026	4.3	<0.02	-	0.0008	1.1	<0.005	-	0.087	-
Limit of Reporting			0.02		0.01		0.02		0.05		0.05		0.02		0.002		0.02		0.0001		0.005		0.005	

*Where concentrations were below limits of reporting no percentage has been calculated.

Table 4.10: Results of leaching tests conducted on representative waste material in acidic conditions

Drill hole	Depth	Lithology	Al		As		B		Ba		Cd		Co		Cr		Cu		Fe		Hg		Mn	
			mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%
IV140	11	Alluvium	16	0.3	<0.05	-	0.2	-	0.25	21.6	<0.002	-	0.14	-	0.006	0.3	0.006	0.2	0.48	0.0	<0.0001	-	2.6	14.8
IV153	7	Alluvium	24	9.1	<0.05	-	0.1	-	0.53	9.5	<0.002	-	0.042	-	0.025	0.7	0.023	7.7	32	0.1	<0.0001	-	1.1	3.2
IV140	53	Shale	14	0.2	<0.05	-	<0.02	-	0.71	3.6	<0.002	-	0.014	1.2	0.003	0.0	<0.002	-	0.062	0.0	<0.0001	-	2.7	7.1
IV153	31	Shale	8.7	0.3	<0.05	-	<0.02	-	0.14	3.0	<0.002	-	0.006	1.8	0.007	0.0	0.004	0.1	0.27	0.0	<0.0001	-	0.3	1.4
IV260	133	Shale	2.2	0.2	<0.05	-	<0.02	-	0.037	1.7	<0.002	-	<0.005	-	<0.001	-	0.005	0.4	0.41	0.0	<0.0001	-	0.18	0.5
IV413	139	BIF	6.4	0.6	<0.05	-	<0.02	-	0.66	22.0	<0.002	-	0.018	-	0.013	0.8	0.011	1.1	17	0.0	<0.0001	-	2.6	4.5
IV410	63	BIF	0.47	0.0	<0.05	-	<0.02	-	0.47	15.7	<0.002	-	0.009	-	0.003	0.1	0.005	1.9	4.9	0.0	<0.0001	-	2.7	10.4
IV260	139	Mineralised BIF	1.2	0.1	<0.05	-	<0.02	-	0.021	1.3	<0.002	-	<0.005	-	<0.001	-	0.012	0.5	0.12	0.0	<0.0001	-	0.38	0.4
IV387	35	Mineralised BIF	9	0.8	<0.05	-	<0.02	-	0.2	9.1	<0.002	-	<0.005	-	0.002	0.2	<0.002	-	0.8	0.0	<0.0001	-	0.77	0.5
Limit of Reporting			0.005		0.05		0.02		0.002		0.002		0.005		0.001		0.002		0.005		0.0001		0.001	
Drill hole	Depth	Lithology	Mo		Ni		Pb		Sb		Se		Sn		Sr		Th		U		V		Zn	
			mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%
IV140	11	Alluvium	<0.02	-	0.04	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.65	135.4	<0.02	-	0.0041	1.1	<0.005	-	0.018	-
IV153	7	Alluvium	<0.02	-	0.02	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.32	66.7	<0.02	-	0.0031	11.9	<0.005	-	0.018	-
IV140	53	Shale	<0.02	-	<0.01	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.19	7.9	<0.02	-	0.001	0.3	<0.005	-	<0.005	-
IV153	31	Shale	<0.02	-	<0.01	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.14	5.4	<0.02	-	0.0029	0.4	<0.005	-	<0.005	-
IV260	133	Shale	<0.02	-	<0.01	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.032	2.5	<0.02	-	0.0016	0.5	<0.005	-	0.017	-
IV413	139	BIF	<0.02	-	<0.01	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.038	2.5	<0.02	-	0.0011	0.4	<0.005	-	0.015	-
IV410	63	BIF	<0.02	-	0.01	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.09	16.1	<0.02	-	0.0015	1.0	<0.005	-	0.01	-
IV260	139	Mineralised BIF	<0.02	-	<0.01	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.036	3.3	<0.02	-	0.0007	0.1	<0.005	-	<0.005	-
IV387	35	Mineralised BIF	<0.02	-	<0.01	-	<0.02	-	<0.05	-	<0.05	-	<0.02	-	0.032	6.2	<0.02	-	0.0019	0.7	<0.005	-	<0.005	-
Limit of Reporting			0.02		0.01		0.02		0.05		0.05		0.02		0.002		0.02		0.0001		0.005		0.005	

5 CONCLUSIONS

A geochemical investigation was undertaken for the proposed Below Water Table expansion of the Iron Valley Project. The purpose of the investigation was to assess the potential for acid mine drainage (AMD) or metaliferous drainage (MD) to develop following disturbance of the waste rock materials within the deposit. The major findings from this investigation are:

5.1 SCREEN ANALYSIS

- The pH of the majority of the waste rock materials tested was generally circum-neutral. The upper profile regolith materials displayed slightly alkaline conditions which gradually became more acidic in pH with increasing depth down profile. The pH_{FOX} results closely mirrored the *in situ* pH, and provided no indication of potentially ARD producing material
- The recorded EC of the materials tested showed that non-saline conditions prevail within the deposit; these results indicate that the pH and salinity levels within the waste rock materials are unlikely to negatively impact rehabilitation activities and revegetation efforts.

5.2 DETAILED ARD ASSESSMENT

- The Total S assay results have shown that all waste material samples tested contained negligible Total S contents.
- The assessment of the buffering capacity of the major waste rock materials showed that all materials contain moderate to negligible buffering capacity. This result indicates that there is unlikely to be a major rock unit or source of material which contains a large excess of buffering capacity.
- Due to the lack of buffering capacity and carbonates within the materials tested in this assessment, it is recommended that a screen value of >0.1 % Total S is adopted at this stage for ongoing ARD management on site to indicate materials which require further assessment of their ARD status.
- Geochemical classification of the major waste rock materials resulted in a NAF classification for all samples, reflecting the lack of sulfur within these samples. The testing also highlighted the lack of inherent buffering capacity.

5.3 MULTI-ELEMENT COMPOSITION

- The major waste rock materials generally contained low levels of metals and metalloids, with the exception of some of the Shale samples which contained moderate levels of the element Arsenic.
- Testing of total soluble metal contents under neutral conditions has shown that the majority of the metals and metalloids are either strongly bound to the mineral surface or held within the mineral structure and are therefore not readily soluble. Those elements which did show relatively increased leaching rates had insignificant contents within the solid phase. The elevated mobility of Ba and Sr will need to be considered by surface and groundwater management to ensure that adequate monitoring of runoff and/or seepage from the WRL(s) is conducted.
- Testing of total soluble metal contents under acidic conditions indicated that a number of metals displayed increased mobility, with a number of samples recording levels of Al, Cu, Fe, Mn and Zn above relevant fresh water marine environment guidelines. These results are only applicable to the development of management

strategies should acidic conditions develop within the waste material, which the results of this report show is considered unlikely.

5.4 MANAGEMENT RECOMMENDATIONS

- The screen testing has indicated that the pH and salinity levels recorded within the waste materials are unlikely to inhibit rehabilitation activities; however the low salinity may impact on the stability of waste rock materials. Where weathering of waste rock material located on the surface of constructed landforms results in considerable fines content, runoff from these areas is likely to contain elevated sediment loadings which will require management.
- The very low levels of Total S reported (in the geological database) and Sulfide-S (in this assessment) throughout the deposit and the classification of NAF for all waste material samples tested indicate that the development of ARD within the waste rock material tested is unlikely.
- Whilst the low Total S across the deposit as a whole indicates the development of ARD on a large scale is unlikely, the lack of significant buffering capacity and carbonates within all materials tested presents the possibility that minor volumes of material with relatively low Total S contents can still develop ARD on a small scale. With this in mind it is recommended that assay for Total S content continue to be conducted during operations on waste rock materials, with an initial screen level of >0.1 % Total S adopted for the identification of materials warranting further investigation into their ARD characteristics.

6 REFERENCES

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APPENDIX A
SCREEN RESULTS AND DRILL LOGS

Hole ID	From (m)	To (m)	Lithology	Fe%	SiO2%	Al2O3%	S%
IV140	0	2	RAL	30.09	46.76	3.1	0.021
IV140	2	4	RAL	32.99	40.69	5.48	0.025
IV140	4	6	RAL	32.69	42.88	5.15	0.019
IV140	6	8	RAL	31.43	43.5	5.87	0.021
IV140	8	10	RAL	28.53	43.25	8.94	0.032
IV140	10	12	RAL	28.22	42.14	10.19	0.054
IV140	12	14	RAL	22.59	44.49	13.52	0.042
IV140	14	16	RAL	24.54	41.49	13.58	0.103
IV140	16	18	RAL	26.63	39.64	13.91	0.051
IV140	18	20	RAL	19.73	43.94	17.48	0.039
IV140	20	22	RAL	18.07	44.99	18.75	0.028
IV140	22	24	RAL	18.64	40.03	21.35	0.035
IV140	24	26	RAL	42.36	14.69	11.83	0.034
IV140	26	28	RAL	20.41	31.61	24.12	0.034
IV140	28	30	RAL	45.67	10.93	10.29	0.06
IV140	30	32	RAL	43.94	9.13	14.72	0.033
IV140	32	34	RAL	44.82	8.99	11.54	0.036
IV140	34	36	SSH	53.79	3.87	5.32	0.014
IV140	36	38	SSH	47.58	7.07	7	0.024
IV140	38	40	SSH	44.95	10.11	9.09	0.02
IV140	40	42	SSH	19.52	26.86	22.75	0.03
IV140	42	44	SSH	13.33	31.39	26.87	0.02
IV140	44	46	SSH	38.37	14.8	13.82	0.022
IV140	46	48	SSH	33.25	18.7	16.11	0.02
IV140	48	50	SSH	38.17	15.07	13	0.035
IV140	50	52	SSH	33.23	17.44	16.6	0.02
IV140	52	54	SSH	34.51	15	18.22	0.037
IV140	54	56	SSH	27.02	19.8	17.9	0.027
IV140	56	58	SSH	22.11	18.65	17.19	0.027
IV140	58	60	SSH	45.56	7.78	8.33	0.021
IV140	60	62	SSH	48.51	6.72	7.18	0.025
IV140	62	64	SBM	45.9	9.92	9.34	0.022
IV140	64	66	SBM	54.54	4.16	6.03	0.03
IV140	66	68	SBM	54.78	4.72	5.72	0.021
IV140	68	70	SBM	53.16	5.96	6.56	0.019
IV140	70	72	SBM	52.52	5.6	6.66	0.024
IV140	72	74	SBM	52.74	5.84	6.37	0.029
IV140	74	76	SBM	53.74	5.58	5.84	0.02
IV140	76	78	SBM	55.48	5.38	4.73	0.019
IV140	78	80	SBM	59.82	2.9	3.34	0.013
IV140	80	82	SBM	60.18	2.97	3.49	0.011
IV140	82	84	SBM	62.11	2.72	2.57	0.009
IV140	84	86	SBM	60.52	2.88	3.03	0.013
IV140	86	88	SBM	60.36	3.15	3.35	0.011
IV140	88	90	SBM	57.84	4.84	4.64	0.021

Hole ID	From (m)	To (m)	Lithology	Fe%	SiO2%	Al2O3%	S%
IV140	90	92	SBM	56.87	5.53	4.88	0.013
IV140	92	94	SBM	53.93	7.56	6.6	0.001
IV140	94	96	SBM	59.25	2.71	2.98	0.025
IV140	96	98	SBM	56.46	4.48	4.36	0.017
IV140	98	100	SBM	52.49	6.84	6.66	0.015
IV140	100	102	SBM	53.67	6.53	6.26	0.032
IV140	102	104	SBM	51.39	7.79	7.17	0.017
IV140	104	106	SBM	52.97	7.39	6.93	0.016
IV140	106	108	SBM	59.4	3.31	3.56	0.03
IV140	108	110	SBM	57.67	3.99	4.41	0.016
IV140	110	112	SBM	61.25	2.67	3.02	0.011
IV140	112	114	SBM	59.77	3.61	3.88	0.014
IV140	114	116	SBM	59.56	3.43	3.98	0.012
IV140	116	118	SBM	53.23	6.83	7.44	0.015
IV140	118	120	SBM	54.68	5.81	5.95	0.016
IV140	120	122	SBM	60.72	2.78	3.25	0.011
IV140	122	124	SBM	60.29	3.61	3.64	0.012
IV140	124	126	SBM	58.61	4.5	4.7	0.017
IV140	126	128	SBM	60.97	2.41	2.97	0.013
IV140	128	130	SBM	63.86	1.33	1.64	0.011
IV140	130	132	SBM	63.16	1.75	1.94	0.002
IV140	132	134	SBM	64.33	1.12	1.32	0.012
IV140	134	136	SBM	63.2	1.09	1.72	0.011
IV140	136	138	SBM	64.58	1.15	1.42	0.009
IV140	138	140	SBM	64.13	1.25	1.69	0.009
IV140	140	142	SBM	63.9	1.57	1.93	0.01
IV140	142	144	SBM	63.03	1.75	1.97	0.012
IV140	144	146	SBM	63.62	1.21	1.5	0.011
IV140	146	148	SBM	64.78	0.96	1.21	0.01
IV140	148	150	SBM	63.69	1.07	1.37	0.016
IV140	150	152	SBM	63.95	1	1.47	0.012
IV140	152	154	SBM	63.03	1.26	1.72	0.016
IV140	154	156	SBM	64.16	1.13	1.39	0.014
IV140	156	158	SBM	63.16	1.2	1.78	0.011
IV140	158	160	SBM	61.81	2.1	2.37	0.011
IV140	160	162	SBM	60.29	2.77	2.41	0.017
IV140	162	164	SBM	63.28	1.96	1.57	0.013
IV140	164	166	SBM	63.46	2.15	1.35	0.013
IV140	166	168	SBM	62.45	2.74	1.92	0.013
IV140	168	170	SBM	63.55	2.06	1.22	0.014
IV140	170	172	SBM	62.84	2.02	1.37	0.016
IV140	172	174	SBM	62.04	1.71	1.45	0.015
IV140	174	176	SBM	61.23	1.73	1.46	0.016
IV140	176	178	SBM	62.46	1.32	1.39	0.012
IV140	178	180	SBM	63.65	1.19	1.11	0.002

Hole ID	From (m)	To (m)	Lithology	Fe%	SiO2%	Al2O3%	S%
IV140	180	182	SBM	62.6	1.29	1.09	0.013
IV140	182	184	SBM	61.87	1.86	1.72	0.014
IV147	0	2	RAL	25.77	48.49	6.96	0.016
IV147	2	4	RAL	15.72	45.06	19.11	0.025
IV147	4	6	RAL	20.3	41.79	17.18	0.023
IV147	6	8	RAL	23.86	38.28	17.39	0.028
IV147	8	10	SSH	20.1	42.88	17.58	0.026
IV147	10	12	SSH	16.69	44.11	18.21	0.037
IV147	12	14	SSH	17.52	41.47	21.67	0.026
IV147	14	16	SSH	13.35	44.72	23.51	0.023
IV147	16	18	SSH	10.64	27.33	14.11	0.023
IV147	18	20	SSH	10.96	31.92	14.67	0.013
IV147	20	22	SSH	16.17	43.57	20.01	0.014
IV147	22	24	SSH	14.29	43.16	22.84	0.014
IV147	24	26	SSH	15.61	44.66	19.39	0.017
IV147	26	28	SSH	14.34	45.52	18.61	0.021
IV147	28	30	SSH	14.49	45.81	17.88	0.018
IV147	30	32	SSH	16.37	43.99	16.93	0.018
IV147	32	34	SSH	10.48	59.12	12.46	0.016
IV147	34	36	SSH	15.9	47.24	16.14	0.016
IV147	36	38	SSH	7.29	48.63	24.84	0.016
IV147	38	40	SSH	17.6	40.23	19.14	0.016
IV147	40	42	SSH	14.97	37.36	25.36	0.017
IV147	42	44	SSH	21.24	37.83	17.65	0.02
IV147	44	46	SSH	14.47	35.34	28.61	0.012
IV147	46	48	SSH	5.02	41.94	35.17	0.011
IV147	48	50	SSH	2.36	44.05	36.81	0.011
IV147	50	52	SSH	2.22	44.21	36.94	0.01
IV147	52	54	SSH	2.72	43.85	36.68	0.01
IV147	54	56	SSH	1.77	44.3	37.45	0.009
IV147	56	58	SSH	2.53	43.7	37.1	0.01
IV147	58	60	SSH	3.1	43.36	36.73	0.01
IV147	60	62	SSH	3.98	43.97	35.31	0.012
IV147	62	64	SSH	6.16	40.95	34.57	0.013
IV147	64	66	SSH	5.9	41.09	35.05	0.013
IV147	66	68	SSH	3.56	42.69	36.09	0.014
IV147	68	70	SSH	6.1	40.7	34.99	0.011
IV147	70	72	SSH	10.35	35.48	31.45	0.015
IV147	72	74	SSH	10.37	35.54	31.5	0.013
IV147	74	76	SSH	12.64	34.22	30.39	0.013
IV147	76	78	SSH	31.89	20.48	18.87	0.014
IV147	78	80	SSH	53.06	6.5	6.23	0.011
IV147	80	82	SSH	48.77	9.91	8.93	0.01
IV147	82	84	SBM	52.68	8.48	7.19	0.009
IV147	84	86	SBM	60.59	4.01	3.01	0.026

Hole ID	From (m)	To (m)	Lithology	Fe%	SiO2%	Al2O3%	S%
IV147	86	88	SBM	57.97	4.83	3.98	0.016
IV147	88	90	SBM	56.53	5.24	4.68	0.013
IV147	90	92	SBM	59.4	3.32	3.44	0.016
IV147	92	94	SBM	60.78	2.66	2.72	0.014
IV147	94	96	SBM	59.43	2.76	3.07	0.013
IV147	96	98	SBM	59.93	2.77	2.98	0.012
IV147	98	100	SBM	55.77	5.29	5.13	0.012
IV147	100	102	SBM	54.96	5.83	5.73	0.018
IV147	102	104	SBM	50.22	10.37	8.95	0.019
IV147	104	106	SBM	53.74	6.99	6.62	0.016
IV147	106	108	SBM	55.64	6.59	6.23	0.021
IV147	108	110	SBM	58.87	4.49	4.55	0.017
IV147	110	112	SBM	59.39	4.62	4.33	0.017
IV147	112	114	SBM	59.42	4.51	4.37	0.018
IV147	114	116	SBM	59.13	4.65	4.45	0.017
IV147	116	118	SBM	61.65	2.63	2.79	0.017
IV147	118	120	SBM	60.3	3.73	3.71	0.015
IV147	120	122	SBM	59.74	4.09	4.02	0.016
IV147	122	124	SBM	60.88	3.19	3.51	0.013
IV147	124	126	SBM	59.74	4.14	4.18	0.012
IV147	126	128	SBM	60.65	3.6	3.9	0.009
IV147	128	130	SBM	61.21	2.4	2.61	0.016
IV147	130	132	SBM	62.19	2.34	2.51	0.015
IV147	132	134	SBM	59.63	4.17	4.1	0.015
IV147	134	136	SBM	61.06	2.8	2.77	0.015
IV147	136	138	SBM	62.45	2.33	1.74	0.013
IV147	138	140	SBM	63.1	2.22	1.87	0.013
IV147	140	142	SBM	62	2.88	1.64	0.014
IV147	142	143.8	SBM	62.86	2.54	1.52	0.009
IV147	143.8	146		63.29	1.19	1.21	0.009
IV147	146	148		63.14	1.5	1.33	0.008
IV147	148	150		64.14	1.7	1.67	0.01
IV147	150	152		62.78	1.97	2.04	0.008
IV147	152	154		63.46	2.23	2.12	0.007
IV147	154	156		63.52	1.22	1.43	0.007
IV147	156	158		63.54	1.4	1.47	0.008
IV147	158	160		63.14	2.51	1.83	0.008
IV147	160	162		64.01	1.72	1.57	0.007
IV147	162	164		63.58	2.2	1.16	0.006
IV147	164	166		63.75	2.38	1.54	0.008
IV147	166	168		62.47	3.5	2.12	0.007
IV147	168	170		62.1	4.83	2.08	0.01
IV147	170	172		61.37	4.32	2.35	0.007
IV147	172	174		61.75	3.98	1.68	0.01
IV147	174	176		62.52	3.73	2.04	0.008

Hole ID	From (m)	To (m)	Lithology	Fe%	SiO2%	Al2O3%	S%
IV147	176	178		62.31	3.62	1.57	0.007
IV147	178	180		61.36	6.3	1.45	0.006
IV147	180	182		59.4	9.59	1.78	0.006
IV147	182	184		56.99	12.87	1.07	0.006
IV147	184	186		55.16	14.75	1.49	0.006
IV147	186	188		48.05	24.89	1.64	0.005
IV147	188	190		52.56	18.66	1.67	0.006
IV147	190	192		54.19	16.92	1.67	0.006
IV147	192	194		38.9	38.19	1.47	0.005
IV147	194	196		40.23	36.36	1.05	0.004
IV147	196	198		37.04	40.36	2.33	0.004
IV147	198	200		33.03	48.86	1.19	0.004
IV147	200	202		35.96	44.7	0.97	0.005
IV147	202	204		40.17	36.44	1.24	0.005
IV147	204	206		36.05	44.58	0.59	0.004
IV147	206	208		33.69	47.97	0.88	0.004
IV147	208	210		32.75	49.48	0.82	0.003
IV147	210	211.7		35.42	43.83	1.06	0.004
IV153	0	2	RAL	34.93	39.88	5.21	0.015
IV153	2	4	RAL	34.73	40.34	4.94	0.015
IV153	4	6	RAL	33.12	42.93	4.66	0.015
IV153	6	8	RAL	33.88	40.01	6.28	0.015
IV153	8	10	RAL	15.65	47.18	19.53	0.013
IV153	10	12	RAL	12.37	52.51	19.08	0.013
IV153	12	14	RAL	16.41	48.68	17.13	0.013
IV153	14	16	RAL	17.19	41.9	21.29	0.015
IV153	16	18	RAL	14.76	40.71	24.89	0.017
IV153	18	20	RAL	17.08	45.86	16.71	0.015
IV153	20	22	RAL	8.24	72.25	6.81	0.011
IV153	22	24	RAL	4.01	83.48	4.34	0.01
IV153	24	26	RAL	4.84	53.93	23.22	0.018
IV153	26	28	SSH	13.08	47.75	18.65	0.018
IV153	28	30	SSH	42.8	18.25	7.57	0.016
IV153	30	32	SSH	40.24	17.27	12.35	0.016
IV153	32	34	SSH	28.85	26.21	18.64	0.016
IV153	34	36	SSH	50.33	7.57	8.7	0.025
IV153	36	38	SSH	51.23	7.69	8.35	0.031
IV153	38	40	SSH	50.26	7.63	9.01	0.036
IV153	40	42	SSH	42.05	15.41	11.71	0.026
IV153	42	44	SSH	34.62	19.79	15.63	0.03
IV153	44	46	SSH	31.76	22.66	16.87	0.025
IV153	46	48	SSH	43.43	12.75	11.06	0.024
IV153	48	50	SSH	43.2	12.29	11.42	0.027
IV153	50	52	SSH	47.64	10.99	9.14	0.023
IV153	52	54	SSH	40.14	15.18	13.36	0.024

Hole ID	From (m)	To (m)	Lithology	Fe%	SiO2%	Al2O3%	S%
IV153	54	56	SSH	37.38	17.95	14.4	0.024
IV153	56	58	SSH	38.85	19.49	11.82	0.026
IV153	58	60	SSH	44.94	11.08	11.72	0.022
IV153	60	62	SSH	43.5	12.56	12.04	0.027
IV153	62	64	SSH	47.56	9.19	10.5	0.027
IV153	64	66	SSH	48.93	8.87	9.7	0.025
IV153	66	68	SSH	49.51	8.93	9.59	0.022
IV153	68	70	SSH	49.33	9.05	9.55	0.021
IV153	70	72	SSH	46.68	10.63	10.5	0.024
IV153	72	74	SSH	45.99	10.84	11.18	0.023
IV153	74	76	SSH	43.83	12.84	11.84	0.021
IV153	76	78	SSH	50.75	7.24	8.3	0.024
IV153	78	80	SSH	50.97	7.71	7.77	0.02
IV153	80	82	SBM	51.82	5.26	7.07	0.022
IV153	82	84	SBM	51.88	8.86	7.93	0.019
IV153	84	86	SBM	47.34	12.82	10.85	0.016
IV153	86	88	SBM	53.39	8.8	7.57	0.016
IV153	88	90	SBM	57.26	6.7	5.46	0.02
IV153	90	92	SBM	60.14	4.38	3.47	0.018
IV153	92	94	SBM	60.72	4.11	3.21	0.016
IV153	94	96	SBM	60.99	3.87	2.97	0.013
IV153	96	98	SBM	60.73	3.59	2.78	0.013
IV153	98	100	SBM	59.73	4.54	3.47	0.013
IV153	100	102	SBM	62.58	2.97	2.39	0.011
IV153	102	104	SBM	61.98	3.33	2.7	0.011
IV153	104	106	SBM	62.17	3.36	2.72	0.013
IV153	106	108	SBM	64.8	2.01	1.64	0.01
IV153	108	110	SBM	63.7	2.43	1.93	0.01
IV153	110	112	SBM	64.21	2.17	1.77	0.01
IV153	112	114	SBM	63.69	2.32	1.78	0.011
IV153	114	116	SBM	63.83	2.53	1.93	0.01
IV153	116	118	SBM	62.19	3.13	2.47	0.009
IV153	118	120	SBM	63.51	2.36	1.87	0.009
IV153	120	122	SBM	63.19	2.2	1.86	0.009
IV153	122	124	SBM	62.72	2.85	1.98	0.01
IV153	124	126	SBM	62.23	2.54	1.56	0.009
IV153	126	128	SBM	63.53	1.96	1.21	0.01
IV153	128	130	SBM	61.87	3.39	1.49	0.011
IV153	130	132	SBM	61.93	4.39	1.23	0.01
IV153	132	134	SBM	60.7	6.83	1.51	0.01
IV153	134	136	SBI	39.21	39.4	1.55	0.009
IV153	136	138	SBI	37.79	42.16	1.16	0.008
IV153	138	140	SBI	39.78	39.27	0.81	0.009
IV153	140	142	SBI	36.17	44.71	1.17	0.007
IV153	142	144	SBI	33.61	49.14	0.89	0.007

Hole ID	From (m)	To (m)	Lithology	Fe%	SiO2%	Al2O3%	S%
IV153	144	146	SBI	35.1	46.65	0.86	0.007
IV153	146	148	SBI	36.76	44.38	0.69	0.006
IV153	148	150	SBI	37.02	42.41	0.93	0.009
IV153	150	152	SBI	35.67	45.12	1.06	0.006
IV153	152	154	SBI	30.45	53.24	0.74	0.006
IV153	154	156	SBI	30.48	53.74	0.86	0.005
IV197	0	2	RAL	31.61	42.54	3.81	0.017
IV197	2	4	RAL	35.7	40.51	2.55	0.015
IV197	4	6	RAL	27.53	53.54	2.64	0.015
IV197	6	8	RAL	37.88	35.97	3.3	0.175
IV197	8	10	RAL	24.01	39.84	14.38	0.207
IV197	10	12	RAL	14.22	47.5	19.7	0.076
IV197	12	14	RAL	12.85	51.62	15.13	0.033
IV197	14	16	RAL	26.63	38.66	11.05	0.029
IV197	16	18	RAL	48.09	13.65	5.94	0.03
IV197	18	20	RAL	36.3	27.59	8.71	0.046
IV197	20	22	RAL	44.88	17.62	5.26	0.018
IV197	22	24	RAL	43.33	19.6	5.35	0.019
IV197	24	26	RAL	43.66	17.33	6.53	0.015
IV197	26	28	SSH	29.36	35.67	9.89	0.009
IV197	28	30	SSH	36.18	20.66	13.14	0.01
IV197	30	32	SSH	8.96	38.26	28.73	0.012
IV197	32	34	SSH	19.94	33.08	22.3	0.011
IV197	34	36	SSH	15.01	35.74	26.31	0.013
IV197	36	38	SSH	54.08	7.68	5.7	0.033
IV197	38	40	SSH	51.78	8.04	6.72	0.018
IV197	40	42	SSH	32.71	21.05	18.24	0.016
IV197	42	44	SSH	19.66	30.35	25.97	0.01
IV197	44	46	SSH	38.67	16.21	14.98	0.009
IV197	46	48	SSH	33.23	20.15	18.27	0.011
IV197	48	50	SSH	34.55	20.27	16.96	0.013
IV197	50	52	SBM	53.43	6.3	5.79	0.02
IV197	52	54	SBM	57.6	5.19	4.41	0.013
IV197	54	56	SBM	46.07	11.77	9.85	0.011
IV197	56	58	SBM	48.13	10.42	8.46	0.014
IV197	58	60	SBM	48.37	9.66	8.54	0.01
IV197	60	62	SBM	59.52	3.58	3.02	0.013
IV197	62	64	SBM	58.19	4.11	3.73	0.016
IV197	64	66	SBM	60.29	3.83	3.47	0.018
IV197	66	68	SBM	60.2	2.37	2.09	0.012
IV197	68	70	SBM	61.71	2.29	2.04	0.011
IV197	70	72	SBM	61.72	3.15	2.54	0.009
IV197	72	74	SBM	61.61	2.61	1.91	0.008
IV197	74	76	SBM	61.2	3.12	3.14	0.007
IV197	76	78	SBM	62.22	2.75	2.45	0.008

Hole ID	From (m)	To (m)	Lithology	Fe%	SiO2%	Al2O3%	S%
IV197	78	80	SBM	62.04	2.97	2.7	0.011
IV197	80	82	SBM	60.56	3.7	3.49	0.011
IV197	82	84	SBM	62.2	2.9	2.72	0.007
IV197	84	86	SBM	59.8	4.43	4.23	0.007
IV197	86	88	SBM	58.43	5.4	4.9	0.009
IV197	88	90	SBM	59.76	3.73	3.6	0.009
IV197	90	92	SBM	63.1	2.35	2.25	0.013
IV197	92	94	SBM	63.14	2.6	2.26	0.011
IV197	94	96	SBM	63.37	2.09	1.97	0.01
IV197	96	98	SBM	63.45	1.68	1.64	0.008
IV197	98	100	SBM	64.67	1.31	1.42	0.007
IV197	100	102	SBM	64.52	1.75	1.6	0.006
IV197	102	104	SBM	65.18	1.74	1.57	0.006
IV197	104	106	SBM	64.26	1.94	1.82	0.007
IV197	106	108	SBM	64.5	2.02	1.83	0.005
IV197	108	110	SBM	64.94	1.8	1.62	0.006
IV197	110	112	SBM	65.68	1.25	1.35	0.006
IV197	112	114	SBM	65.66	1.18	1.22	0.006
IV197	114	116	SBM	64.99	1.51	1.31	0.005
IV197	116	118	SBM	62.65	2.74	2.36	0.006
IV197	118	120	SBM	63.83	1.64	1.75	0.008
IV197	120	122	SBM	50.41	9.7	9.05	0.007
IV197	122	124	SBM	57.65	4.21	3.67	0.006
IV197	124	126	SBM	58.83	4.67	4.21	0.006
IV197	126	128	SBM	53.24	5.11	5.5	0.01
IV197	128	130	SBM	61.36	2.46	2.61	0.012
IV197	130	132	SBM	58.12	4.71	4.42	0.011
IV197	132	134	SBM	58.32	4.54	4.36	0.011
IV197	134	136	SBM	58.76	3.62	3.49	0.013
IV197	136	138	SBM	59.45	2.92	3.02	0.013
IV197	138	140	SBM	56.59	4.85	4.8	0.013
IV197	140	142	SBM	55.56	5.65	5.34	0.015
IV197	142	144	SBM	54.79	5.86	5.5	0.012
IV197	144	146	SBM	58.6	3.78	3.72	0.012
IV197	146	148	SBM	57.15	4.68	4.49	0.016
IV197	148	150	SBM	56.01	5.16	5.1	0.012
IV197	150	152	SBM	55.85	5.17	5.11	0.013
IV197	152	154	SBM	53.08	6.79	7.06	0.012
IV197	154	156	SBM	53.26	5.71	6.2	0.012
IV197	156	158	SBM	54.07	5.9	6.51	0.014
IV197	158	160	SBM	55.32	5.17	5.66	0.013
IV197	160	162	SBM	56.98	4.58	5.04	0.014
IV197	162	164	SBM	59.21	3.63	3.85	0.015
IV197	164	166	SBM	60.64	3.29	3.39	0.017
IV197	166	168	SBM	61.36	2.71	2.92	0.017

Hole ID	From (m)	To (m)	Lithology	Fe%	SiO2%	Al2O3%	S%
IV197	168	170	SBM	61.85	2.61	2.51	0.023
IV197	170	172	SBM	61.4	2	1.95	0.017
IV197	172	174	SBM	61.07	2.53	2.3	0.018
IV197	174	176	SBM	61.63	2.72	2.48	0.016
IV197	176	178	SBM	62.16	2.46	2.31	0.015
IV197	178	180	SBM	61.6	2.73	2.52	0.012
IV197	180	182	SBM	63.19	1.67	1.49	0.009
IV197	182	184	SBM	63.55	1.9	1.62	0.008
IV197	184	186	SBM	61.27	2.45	1.87	0.012
IV197	186	188	SBM	61.45	2.45	2.05	0.015
IV197	188	190	SBM	55.89	5.86	5.31	0.017
IV197	190	192	SBM	59.02	3.89	3.81	0.011
IV197	192	194	SBM	52.38	7.46	6.83	0.013
IV197	194	196	SSH	41.87	14.43	12.36	0.009
IV197	196	198	SSH	45.59	11.41	10.44	0.01
IV197	198	200	SSH	52.49	7.79	6.93	0.013
IV197	200	202	SSH	43.92	12.36	11.36	0.009
IV197	202	204	SSH	41.87	13.99	12.48	0.009
IV197	204	206	SSH	35.2	19.15	17.58	0.008
IV197	206	208	SSH	33.25	20.14	18.67	0.009
IV197	208	210	SSH	33.26	20.4	18.45	0.011
IV197	210	212	SSH	33.69	30.24	12.26	0.01
IV197	212	214	SSH	26.61	35.72	16.19	0.007
IV197	214	216	SSH	21.77	39.61	19.45	0.007
IV197	216	218	SSH	35.23	27.98	12.35	0.012
IV197	218	220	SSH	14.99	53.82	16.38	0.007
IV197	220	222	SSH	14.03	58.45	14.53	0.006
IV197	222	224	SSH	10.11	66.48	11.91	0.059
IV197	224	226	SSH	5.36	75.61	10.93	0.038
IV197	226	228	SSH	6.21	75.2	10.38	0.038
IV197	228	230	SSH	11.61	65.32	11.53	0.036
IV197	230	232	SSH	7.9	70.61	11.53	0.011
IV197	232	234	SSH	3.95	77.97	11.07	0.011
IV197	234	236	SSH	7.19	70.86	11.45	0.021
IV197	236	238	SSH	6.81	69.79	11.97	0.015
IV197	238	240	SSH	6.89	69.29	11.94	0.013
IV197	240	242	SSH	7.1	69.62	11.07	0.015
IV197	242	244	SSH	8.25	68.09	11.35	0.01
IV197	244	246	SSH	4.37	78.12	10.67	0.006
IV197	246	248	SSH	6.67	74.16	10.59	0.016
IV197	248	250	SSH	6	74.84	10.84	0.015
IV197	250	252	SSH	5.19	74.21	12.45	0.011
IV260	0	2	RAL	35.93	36.97	3.62	0.015
IV260	2	4	RAL	28.46	46.7	4.93	0.013
IV260	4	6	RAL	30.02	43.14	6.09	0.016

Hole ID	From (m)	To (m)	Lithology	Fe%	SiO2%	Al2O3%	S%
IV260	6	8	SSH	37.84	26.72	10.89	0.014
IV260	8	10	SSH	38.73	19.97	13.26	0.018
IV260	10	12	SSH	40.44	17.69	12.5	0.017
IV260	12	14	SSH	42.72	18.98	9.18	0.018
IV260	14	16	SSH	45.99	11.66	8.79	0.011
IV260	16	18	SSH	30.59	27.8	14.39	0.011
IV260	18	20	SSH	5.93	50.22	26.29	0.009
IV260	20	22	SSH	11.55	49.57	19.51	0.008
IV260	22	24	SSH	2.3	47.67	33.07	0.007
IV260	24	26	SSH	1.46	48.8	32.89	0.008
IV260	26	28	SSH	1.36	50.75	30.93	0.007
IV260	28	30	SSH	2.33	46.87	32.19	0.008
IV260	30	32	SSH	54.02	5.8	4.87	0.012
IV260	32	34	SSH	58.29	2.8	3.07	0.015
IV260	34	36	SSH	57	2.43	3.22	0.016
IV260	36	38	SSH	58.97	2.58	2.82	0.012
IV260	38	40	SSH	57.77	2.93	3.56	0.011
IV260	40	42	SSH	55.23	4.73	4.68	0.011
IV260	42	44	SSH	51.07	8.1	6.32	0.013
IV260	44	46	SSH	54.17	5.69	5.28	0.011
IV260	46	48	SSH	55.75	5.02	4.77	0.011
IV260	48	50	SSH	51.81	7.58	6.67	0.01
IV260	50	52	SSH	50.21	9.54	7.83	0.007
IV260	52	54	SSH	51.43	8.32	7.02	0.009
IV260	54	56	SSH	53.81	6.98	5.8	0.009
IV260	56	58	SSH	52.45	7.63	6.67	0.009
IV260	58	60	SSH	44.73	12.48	10.95	0.01
IV260	60	62	SSH	46.02	11.06	9.62	0.009
IV260	62	64	SSH	45.84	11.81	10.07	0.008
IV260	64	66	SSH	48.76	10.35	8.47	0.008
IV260	66	68	SBM	57.24	5.62	4.22	0.007
IV260	68	70	SBM	58.16	4.83	3.66	0.006
IV260	70	72	SBM	58.67	3.91	3.18	0.007
IV260	72	74	SBM	59.98	2.77	1.97	0.016
IV260	74	76	SBM	60.88	2.15	1.6	0.018
IV260	76	78	SBM	60.85	2.12	1.38	0.012
IV260	78	80	SBM	59.73	2.49	1.86	0.013
IV260	80	82	SBM	61.46	1.88	1.29	0.007
IV260	82	84	SBM	60.35	2.36	1.8	0.006
IV260	84	86	SBM	59.19	3.31	2.81	0.008
IV260	86	88	SBM	60.47	2.43	2.05	0.007
IV260	88	90	SBM	59.18	3.2	2.91	0.011
IV260	90	92	SBM	61.13	2.22	2.11	0.009
IV260	92	94	SBM	62.44	2.14	1.99	0.01
IV260	94	96	SBM	61.56	2.05	1.97	0.008

Hole ID	From (m)	To (m)	Lithology	Fe%	SiO2%	Al2O3%	S%
IV260	96	98	SBM	62.57	1.83	1.7	0.006
IV260	98	100	SBM	61.78	2.13	2.05	0.006
IV260	100	102	SBM	62.21	1.72	1.78	0.005
IV260	102	104	SBM	62.14	2.47	2.05	0.005
IV260	104	106	SBM	61.38	3.23	2.91	0.005
IV260	106	108	SBM	63	1.98	1.57	0.004
IV260	108	110	SBM	60.66	3.62	3.04	0.006
IV260	110	112	SBM	62.11	3.64	2.91	0.01
IV260	112	114	SSH	52.42	8.29	7.13	0.008
IV260	114	116	SSH	51.71	8.33	7.59	0.01
IV260	116	118	SSH	42.83	14.45	12.53	0.009
IV260	118	120.8	SSH	36.22	18.61	16.47	0.007
IV260	120.8	121.5	SSH				
IV260	121.5	122		49.41	8.14	7.79	0.009
IV260	122	124		46.25	11.01	9.4	0.009
IV260	124	126		50.15	9.61	8.03	0.008
IV260	126	128		54.6	6.29	5.36	0.011
IV260	128	130		59.23	4.32	3.65	0.009
IV260	130	132		61.9	2.65	2.48	0.007
IV260	132	134		62.44	2.44	1.92	0.008
IV260	134	136		60.21	3.4	2.59	0.008
IV260	136	138		58.55	4.41	2.94	0.007
IV260	138	140		57.4	5.05	3.63	0.008
IV260	140	142		55.99	5.63	4.09	0.008
IV260	142	144		57.32	5.64	4.13	0.007
IV260	144	146		62.54	2.67	2.02	0.006
IV260	146	148		62.42	2.5	1.8	0.007
IV260	148	150		64.53	1.68	1.22	0.009
IV260	150	152		61.49	2.4	1.72	0.007
IV260	152	154		59.26	3.21	2.27	0.009
IV260	154	156		60.01	3.09	2.27	0.007
IV260	156	158		60.5	3.4	2.12	0.007
IV260	158	160		61.34	3.81	2.23	0.007
IV260	160	162		58.14	5.7	3.55	0.007
IV260	162	164		61.35	2.57	1.64	0.007
IV260	164	166		61.12	2.85	1.69	0.009
IV260	166	168		62.83	2.38	1.47	0.009
IV260	168	170		60.85	3.7	2.26	0.009
IV260	170	172.5		61.85	2.66	1.69	0.008
IV260	172.5	175		63.56	1.82	1.03	0.008
IV260	175	177		63.18	1.76	1.27	0.009
IV260	177	179		63.75	1.99	1.27	0.007
IV260	179	181		63.78	1.84	1.08	0.006
IV260	181	183		62.9	1.75	1.11	0.007
IV260	183	185		65.22	1.51	0.91	0.005

Hole ID	From (m)	To (m)	Lithology	Fe%	SiO2%	Al2O3%	S%
IV260	185	187		64.7	1.67	0.98	0.004
IV260	187	189		64.5	1.78	1.2	0.004
IV260	189	191		63.73	1.74	1.03	0.006
IV260	191	193		65.13	1.43	0.84	0.005
IV260	193	195		65.07	1.4	0.84	0.006
IV260	195	197		65.85	1.21	0.76	0.007
IV260	197	199		63.76	1.78	1.27	0.006
IV260	199	201		65.02	1.59	0.8	0.007
IV260	201	203		65.25	2.06	0.89	0.004
IV260	203	205		63.81	2.07	0.98	0.004
IV260	205	207		64.1	1.62	1.04	0.004
IV260	207	209		66.05	1.57	0.81	0.002
IV260	209	211		62.73	1.87	1.39	0.004
IV260	211	213		62.94	2.14	1.44	0.004
IV260	213	215		63.41	2.48	1.41	0.006
IV260	215	217		60.13	2.37	1.72	0.006
IV260	217	219		62.61	2.66	1.29	0.005
IV260	219	221		57.59	5.45	3.99	0.006
IV260	221	223		52.3	8.26	6.96	0.006
IV260	223	225		55.23	6.71	5.91	0.012
IV260	225	227		53.83	7.55	6.02	0.008
IV260	227	229		54.92	7.03	4.82	0.01
IV260	229	231		55.94	5.24	4.54	0.009
IV260	231	233		59.76	3.2	2.91	0.008
IV260	233	235		59.63	3.08	2.81	0.009
IV260	235	237		61.93	2.37	2.13	0.007
IV260	237	239		50.04	9.97	8.85	0.009
IV260	239	241		51.84	9.1	8.06	0.009
IV260	241	243		58.2	5.7	4.88	0.007
IV260	243	245		61.62	3.64	2.93	0.01
IV260	245	247		59.02	4.57	4.05	0.015
IV260	247	249		57.66	6.31	5.25	0.01
IV260	249	251		64.01	1.95	1.63	0.009
IV260	251	253		62.55	2.68	2.14	0.008
IV260	253	255		63.85	1.78	1.27	0.008
IV260	255	257		62.21	2.25	1.95	0.009
IV260	257	259		60.99	3	2.3	0.009
IV260	259	261		61.47	2.82	2.07	0.008
IV260	261	263		58.86	4.01	2.7	0.009
IV260	263	265		59.55	4.02	2.98	0.01
IV260	265	267		60.85	2.91	1.98	0.01
IV260	267	269		60.35	3.04	2.08	0.009
IV260	269	271		61.55	2.9	1.99	0.008
IV260	271	273		60.51	3.13	2.26	0.009
IV260	273	275		58.55	4.71	3.74	0.011

Hole ID	From (m)	To (m)	Lithology	Fe%	SiO2%	Al2O3%	S%
IV260	275	277		65	1.67	1.19	0.011
IV260	277	279		62.08	2.9	1.93	0.008
IV260	279	281		59.22	6.95	2.05	0.006
IV260	281	283		56.12	10.79	2.44	0.008
IV260	283	285		52.64	18.04	1.66	0.006
IV260	285	287		47.51	23.63	1.69	0.006
IV260	287	289		40.38	36.52	0.86	0.006
IV260	289	291		37.97	36.41	1.93	0.005
IV260	291	293		49.55	17.95	3.18	0.007
IV260	293	295		53.36	13.1	2.02	0.007
IV260	295	297		48.61	21.84	1.25	0.007
IV260	297	299		38.69	42.68	0.2	0.004
IV260	299	301		33.84	48.37	0.43	0.004
IV260	301	303		38.24	40.29	1.05	0.003
IV260	303	305		37.45	41.88	0.94	0.003
IV260	305	307		36.08	42.13	1.08	0.004
IV260	307	309		33.74	45.32	1.71	0.003
IV260	309	311		33.38	45.82	1.54	0.005
IV260	311	313		38.58	37.27	1.86	0.005
IV260	313	315		35.46	41.13	2.51	0.005
IV260	315	317		33.41	48.72	0.81	0.005
IV260	317	319		33.23	48.88	1.01	0.003
IV260	319	321		31.73	48.9	1.65	0.004
IV260	321	323		26.67	55.68	1.74	0.003
IV260	323	325		29.26	52.14	1.08	0.004
IV260	325	327		32.63	42.76	3.03	0.005
IV260	327	329		25.35	53.51	3.32	0.005
IV260	329	331		27.36	47.1	5.57	0.006
IV260	331	333		19.36	60.51	5.37	0.004
IV260	333	335		23.21	60.81	1.66	0.003
IV260	335	336.1		32.43	49.66	0.21	0.003
IV387	0	2	RAL	50.97	15.76	3.79	0.026
IV387	2	4	RAL	48.23	18.24	5.53	0.073
IV387	4	6	RAL	47.82	21.1	5.01	0.019
IV387	6	8	DMD	54.84	12.73	4.66	0.014
IV387	8	10	DMD				
IV387	10	12	DMD	60.74	6.46	3.58	0.013
IV387	12	14	DMD	56.21	11.18	4.65	0.012
IV387	14	16	DMD	62.83	4.31	3.57	0.011
IV387	16	18	DMD	63.03	4.29	3.18	0.011
IV387	18	20	DMD	63.41	4.06	2.9	0.01
IV387	20	22	SBM	62.05	3.21	2.37	0.018
IV387	22	24	SBM	61.3	5.34	2.68	0.01
IV387	24	26	SBM	62.13	4.48	2.37	0.01
IV387	26	28	SBM	58.48	8.64	2.04	0.009

Hole ID	From (m)	To (m)	Lithology	Fe%	SiO2%	Al2O3%	S%
IV387	28	30	SBM	54.7	10.81	2.25	0.007
IV387	30	32	SBM	56.65	4.41	3.1	0.006
IV387	32	34	SBM	55.97	4.96	3.14	0.003
IV387	34	36	SBM	56.68	5.01	3.35	0.005
IV387	36	38	SBM	57.97	5.1	3.03	0.006
IV387	38	40	SBI	44.42	23.57	4.7	0.003
IV387	40	42	SBI	41.87	34.01	1.25	0.003
IV387	42	44	SBI	42.26	34.01	1.51	0.005
IV387	44	46	SBI	39.33	38.38	1.36	0.003
IV387	46	48	SBI	33.71	47.09	1.56	0.002
IV410	0	2	RAL	40.99	31.01	4.24	0.015
IV410	2	4	RAL	32.85	40.67	6.06	0.023
IV410	4	6	SSH	34.39	38.5	6.27	0.032
IV410	6	8	SSH	31.74	36.38	11	0.029
IV410	8	10	SSH	33.92	33.45	11.21	0.043
IV410	10	12	SSH	35.96	30.54	11.32	0.02
IV410	12	14	SSH	29.68	34.92	14.28	0.015
IV410	14	16	SSH	29.04	33.53	15.99	0.015
IV410	16	18	SSH	25.83	36.27	17.12	0.012
IV410	18	20	SSH	30.4	31.19	15.97	0.009
IV410	20	22	SSH	39.71	23.65	11.96	0.009
IV410	22	24	PCY	55.22	10.61	6.05	0.013
IV410	24	26	SBM	60.6	6.02	3.82	0.013
IV410	26	28	SBM	63.22	3.32	2.67	0.013
IV410	28	30	SBM	64.74	2.07	1.58	0.011
IV410	30	32	SBM	62.81	2.72	2.25	0.015
IV410	32	34	SBM	57.76	3.94	2.71	0.014
IV410	34	36	SBM	58.43	3.7	2.39	0.011
IV410	36	38	SBM	58.42	5.33	1.85	0.013
IV410	38	40	SBI	52.02	12.73	2.56	0.01
IV410	40	42	SBI	40.54	34.67	1.36	0.007
IV410	42	44	SBI	32.53	42.83	2.92	0.006
IV410	44	46	SBI	10.94	75.53	4.65	0.003
IV410	46	48	SBI	10.36	77.58	4.46	0.002
IV410	48	50	SBI	31.95	51.21	0.74	0.006
IV410	50	52	SBI	32.21	51.08	0.83	0.004
IV410	52	54	SBI	35.76	46.55	0.53	0.004
IV410	54	56	SBI	32.33	49.24	1.87	0.006
IV410	56	58	SBI	33.22	49.06	0.81	0.004
IV410	58	60	SBI	36.15	45.02	0.73	0.005
IV410	60	62	SBI	36.26	45	0.47	0.007
IV410	62	64	SBI	36.77	42.42	0.88	0.009
IV410	64	66	SBI	35.75	45.4	0.58	0.007
IV410	66	68	SBI	34.78	45.34	0.73	0.009
IV410	68	70	SBI	32.98	49.53	0.45	0.008

Hole ID	From (m)	To (m)	Lithology	Fe%	SiO2%	Al2O3%	S%
IV410	70	72	SBI	38.62	40.82	0.64	0.007
IV413	0	2	RAL	24.47	56.94	3.43	0.017
IV413	2	4	RAL	25.53	56.74	2.77	0.011
IV413	4	6	RAL	26.9	53.14	3.86	0.011
IV413	6	8	RAL	35.1	39.96	4.16	0.014
IV413	8	10	RAL	32.35	37.03	9.82	0.025
IV413	10	12	RAL	38.2	30.51	8.57	0.04
IV413	12	14	RAL	48.74	15.82	9.4	0.007
IV413	14	16	RAL	37.64	29.72	10.1	0.008
IV413	16	18	RAL	30.86	36.31	11.73	0.01
IV413	18	20	SSH	28.6	34.46	15.22	0.007
IV413	20	22	SSH	23.14	40.77	15.5	0.006
IV413	22	24	SSH	33.56	29.57	12.75	0.007
IV413	24	26	SSH	45.18	16.26	10.54	0.011
IV413	26	28	SSH	39.92	18.62	14.24	0.008
IV413	28	30	SSH	30.98	26.11	17.77	0.006
IV413	30	32	SSH	35.77	20.65	15.22	0.007
IV413	32	34	SSH	30.37	25.47	16.8	0.006
IV413	34	36	SSH	38.79	19.75	12.46	0.008
IV413	36	38	SSH	17.96	35.95	23.11	0.007
IV413	38	40	SSH	13.4	39.7	25.74	0.004
IV413	40	42	SSH	48.67	11.71	8.28	0.006
IV413	42	44	SBM	59.3	4.06	2.96	0.009
IV413	44	46	SBM	40.52	16.17	13.51	0.007
IV413	46	48	SBM	52.13	6.42	6.97	0.006
IV413	48	50	SBM	53.89	5.52	5.65	0.011
IV413	50	52	SSH	45.68	12.36	10.27	0.007
IV413	52	54	SSH	30	23.28	20.23	0.006
IV413	54	56	SSH	39.02	16.04	15.05	0.007
IV413	56	58	SSH	33.36	20.48	18.51	0.006
IV413	58	60	SSH	35.53	18.86	16.98	0.006
IV413	60	62	SSH	44.02	12.36	11.93	0.008
IV413	62	64	SSH	55.83	3.72	4.71	0.009
IV413	64	66	SSH	53.22	5.2	6.14	0.009
IV413	66	68	SSH	55.39	3.92	4.72	0.011
IV413	68	70	SSH	55.77	3.83	4.44	0.01
IV413	70	72	SBM	51.52	6.93	7.19	0.012
IV413	72	74	SBM	58.16	4.51	4.03	0.014
IV413	74	76	SBM	57.99	4.91	4.36	0.014
IV413	76	78	SBM	62.81	2.31	1.89	0.028
IV413	78	80	SBM	60.31	3.5	3.19	0.022
IV413	80	82	SBM	59.36	3.87	3.63	0.019
IV413	82	84	SBM	61.02	2.56	2.74	0.022
IV413	84	86	SBM	59.88	2.53	2.78	0.024
IV413	86	88	SBM	60.05	2.5	2.76	0.022

Hole ID	From (m)	To (m)	Lithology	Fe%	SiO2%	Al2O3%	S%
IV413	88	90	SBM	60.74	2.42	2.57	0.016
IV413	90	92	SBM	60.71	2.47	1.94	0.01
IV413	92	94	SBM	61.94	1.89	1.32	0.009
IV413	94	96	SBM	61	2.21	1.68	0.008
IV413	96	98	SBM	61.39	2.54	1.76	0.008
IV413	98	100	SBM	62.48	2.26	1.95	0.008
IV413	100	102	SBM	62.84	2.29	1.85	0.007
IV413	102	104	SBM	62.33	2.58	1.64	0.006
IV413	104	106	SBM	64.18	1.82	1.43	0.006
IV413	106	108	SBM	64.21	1.96	1.36	0.005
IV413	108	110	SBM	63.27	1.68	1.45	0.006
IV413	110	112	SBM	62.21	2.83	1.67	0.005
IV413	112	114	SBM	62.4	2.81	1.74	0.005
IV413	114	116	SBM	63.31	2.09	1.42	0.004
IV413	116	118	SBM	61.79	2.54	1.65	0.005
IV413	118	120	SBM	62.27	3.76	1.54	0.004
IV413	120	122	SBM	62.51	3.68	1.16	0.006
IV413	122	124	SBM	60.68	6.29	1.13	0.005
IV413	124	126	SBI	57.84	10.03	1.1	0.005
IV413	126	128	SBI	53.97	17.17	1.07	0.006
IV413	128	130	SBI	46.5	28.79	0.95	0.005
IV413	130	132	SBI	40.73	37.93	0.88	0.004
IV413	132	134	SBI	40.86	38.02	0.73	0.006
IV413	134	136	SBI	35.56	46.97	0.74	0.004
IV413	136	138	SBI	34.39	48.4	0.56	0.004
IV413	138	140	SBI	30.25	55.39	0.45	0.003
IV413	140	142	SBI	32.93	50.95	0.71	0.004
IV413	142	144	SBI	31.81	52.67	0.47	0.003
IV413	144	146	SBI	30.59	54.45	0.42	0.003
IV413	146	148	SBI	32.24	52.13	0.4	0.002
IV413	148	150	SBI	37	44.16	0.63	0.003
IV413	150	152	SBI	31.46	52.79	0.43	0.003
IV413	152	154	SBI	29.99	55.43	0.52	0.003
IV413	154	156	SBI	38.96	40.06	0.59	0.002

Drill Hole	From	To	EC mS/m	pH	pHFOX	Difference	Sulfur %	15 mins	24 hr
IV140	4.00	6.00	25.49	8.22	7.73	-0.49	0.019	2	0
IV140	10.00	12.00	98.80	8.32	8.57	0.25	0.054	2	0
IV140	16.00	18.00	82.30	7.91	8.10	0.19	0.051	2	0
IV140	22.00	24.00	74.90	7.00	7.34	0.34	0.035	2	0
IV140	28.00	30.00	60.40	7.28	7.34	0.06	0.060	1	0
IV140	40.00	42.00	14.40	7.32	6.97	-0.35	0.030	3	2
IV140	46.00	48.00	6.37	6.66	6.81	0.15	0.020	2	0
IV140	52.00	54.00	10.41	7.13	7.64	0.51	0.037	3	3
IV140	58.00	60.00	14.62	7.21	7.48	0.27	0.021	3	1
IV140	64.00	66.00	11.85	7.10	6.97	-0.13	0.030	3	3
IV140	70.00	72.00	9.79	6.91	7.15	0.24	0.024	3	3
IV140	76.00	78.00	13.18	7.04	6.60	-0.44	0.019	3	2
IV140	82.00	84.00	6.64	7.01	6.82	-0.19	0.009	3	3
IV140	88.00	90.00	14.92	6.87	6.74	-0.13	0.021	3	2
IV140	94.00	96.00	13.66	7.24	6.78	-0.46	0.025	3	3
IV140	100.00	102.00	10.51	7.05	6.59	-0.46	0.032	3	3
IV140	106.00	108.00	10.36	7.01	6.45	-0.56	0.030	3	3
IV140	112.00	114.00	6.45	6.72	6.45	-0.27	0.014	3	2
IV140	118.00	120.00	9.16	6.81	6.44	-0.37	0.016	3	1
IV140	124.00	126.00	7.34	6.53	6.10	-0.43	0.017	3	1
IV140	136.00	138.00	5.03	6.77	6.49	-0.28	0.002	2	0
IV140	142.00	144.00	5.48	6.69	6.42	-0.27	0.009	2	0
IV140	148.00	150.00	5.89	6.73	5.32	-1.41	0.012	2	0
IV140	154.00	156.00	5.54	7.16	6.05	-1.11	0.016	2	0
IV140	160.00	162.00	7.09	6.92	6.33	-0.59	0.014	2	1
IV140	166.00	168.00	8.64	6.71	6.37	-0.34	0.017	2	1
IV140	172.00	174.00	7.77	6.77	5.62	-1.15	0.013	2	0
IV147	0.00	2.00	20.81	8.67	7.59	-1.08	0.016	2	0
IV147	6.00	8.00	37.40	8.21	8.10	-0.11	0.028	3	1
IV147	12.00	14.00	38.90	7.74	7.71	-0.03	0.026	3	1
IV147	18.00	20.00	25.71	8.71	8.89	0.18	0.013	3	1
IV147	24.00	26.00	64.60	8.18	8.31	0.13	0.017	3	0
IV147	30.00	32.00	21.98	8.43	7.47	-0.96	0.018	3	0
IV147	36.00	38.00	17.41	7.70	7.09	-0.61	0.016	3	1
IV147	42.00	44.00	28.00	8.52	8.35	-0.17	0.020	3	0
IV147	48.00	50.00	6.49	6.52	5.65	-0.87	0.011	3	0
IV147	54.00	56.00	6.10	6.31	5.44	-0.87	0.009	3	0
IV147	60.00	62.00	6.61	6.59	5.41	-1.18	0.012	3	0
IV147	66.00	68.00	6.20	6.41	5.22	-1.19	0.014	3	0
IV147	72.00	74.00					0.013	No	No
IV147	78.00	80.00	6.39	6.72	6.09	-0.63	0.011	2	0
IV147	84.00	86.00	4.31	6.87	5.22	-1.65	0.026	3	3
IV147	90.00	92.00	5.33	6.88	5.16	-1.72	0.016	3	1
IV147	96.00	98.00	4.65	7.15	5.90	-1.25	0.012	3	1

IV147	102.00	104.00	4.81	6.91	5.90	-1.01	0.019	2	0
IV147	108.00	110.00	4.07	6.58	5.98	-0.60	0.017	3	0
IV147	114.00	116.00	3.77	6.72	6.02	-0.70	0.017	3	1
IV147	120.00	122.00	3.60	6.60	5.98	-0.62	0.016	3	1
IV147	126.00	128.00	3.74	7.35	6.63	-0.72	0.009	3	1
IV147	132.00	134.00	3.59	6.68	5.94	-0.74	0.015	3	0
IV147	138.00	140.00	3.28	6.74	5.78	-0.96	0.013	3	0
IV147	150.00	152.00	5.91	6.78	6.43	-0.35	0.008	3	3
IV153	0.00	2.00	5.40	6.53	5.60	-0.93	0.015	3	2
IV153	6.00	8.00	11.55	8.20	7.44	-0.76	0.015	3	1
IV153	12.00	14.00	11.78	8.02	7.01	-1.01	0.013	3	3
IV153	18.00	20.00	10.69	7.76	6.87	-0.89	0.015	3	3
IV153	24.00	26.00	15.47	7.74	6.70	-1.04	0.018	3	3
IV153	30.00	32.00	6.04	7.12	6.40	-0.72	0.016	3	3
IV153	36.00	38.00	7.69	7.34	6.99	-0.35	0.031	3	3
IV153	42.00	44.00	14.57	7.56	6.56	-1.00	0.030	3	2
IV153	48.00	50.00	12.97	7.44	7.14	-0.30	0.027	3	0
IV153	54.00	56.00	16.14	7.04	6.45	-0.59	0.024	3	1
IV153	60.00	62.00	16.81	6.71	5.78	-0.93	0.027	2	0
IV153	66.00	68.00	11.37	6.71	6.53	-0.18	0.022	3	0
IV153	72.00	74.00	12.91	6.92	6.41	-0.51	0.023	3	0
IV153	78.00	80.00	6.16	7.02	6.53	-0.49	0.020	3	3
IV153	84.00	86.00	3.80	6.77	6.80	0.03	0.016	3	3
IV153	90.00	92.00	3.15	6.36	6.82	0.46	0.018	3	3
IV153	96.00	98.00	3.39	6.23	7.04	0.81	0.013	3	3
IV153	102.00	104.00	5.51	6.02	6.96	0.94	0.011	3	2
IV153	108.00	110.00	2.58	6.47	7.20	0.73	0.010	3	3
IV153	114.00	116.00	3.40	6.49	7.32	0.83	0.010	3	3
IV153	120.00	122.00	2.65	6.30	6.68	0.38	0.009	3	3
IV153	126.00	128.00	3.28	6.35	6.50	0.15	0.010	3	2
IV153	132.00	134.00	4.16	6.41	6.81	0.40	0.010	3	2
IV153	138.00	140.00	3.84	6.79	6.54	-0.25	0.009	3	2
IV153	144.00	146.00	4.95	6.33	6.25	-0.08	0.007	3	3
IV153	150.00	152.00	4.91	6.25	6.09	-0.16	0.006	3	3
IV197	0.00	2.00	16.97	8.76	8.42	-0.34	0.017	3	2
IV197	6.00	8.00	155.10	8.24	8.98	0.74	0.175	1	0
IV197	12.00	14.00	36.70	7.53	7.34	-0.19	0.033	3	0
IV197	18.00	20.00	43.20	7.71	7.30	-0.41	0.046	2	1
IV197	24.00	26.00	9.18	6.92	6.80	-0.12	0.015	3	0
IV197	30.00	32.00	10.79	6.53	5.93	-0.60	0.012	3	3
IV197	36.00	38.00	5.64	6.73	7.19	0.46	0.033	3	0
IV197	42.00	44.00	9.92	7.37	6.71	-0.66	0.010	3	3
IV197	48.00	50.00	7.45	6.86	6.55	-0.31	0.013	3	2
IV197	54.00	56.00	4.63	6.61	6.70	0.09	0.011	3	2
IV197	60.00	62.00	2.92	6.64	6.28	-0.36	0.013	3	0
IV197	66.00	68.00	3.94	6.56	6.48	-0.08	0.012	3	2

IV197	72.00	74.00	3.87	6.11	6.01	-0.10	0.008	3	0
IV197	78.00	80.00	3.39	6.03	6.22	0.19	0.011	3	1
IV197	84.00	86.00	4.00	6.32	7.12	0.80	0.007	3	2
IV197	90.00	92.00	3.66	6.33	6.10	-0.23	0.013	3	2
IV197	96.00	98.00	5.12	6.51	6.67	0.16	0.008	3	2
IV197	102.00	104.00	3.87	6.15	6.31	0.16	0.006	2	1
IV197	108.00	110.00	6.41	6.19	6.93	0.74	0.006	2	1
IV197	114.00	116.00	6.41	6.32	6.42	0.10	0.005	2	0
IV197	120.00	122.00	5.35	6.56	6.33	-0.23	0.007	3	1
IV197	126.00	128.00	8.12	7.17	5.93	-1.24	0.010	2	1
IV197	132.00	134.00	6.13	6.42	6.39	-0.03	0.011	3	0
IV197	138.00	140.00	7.21	6.82	6.35	-0.47	0.013	3	1
IV197	144.00	146.00	8.10	6.68	6.53	-0.15	0.012	2	0
IV197	150.00	152.00	8.84	6.51	7.06	0.55	0.013	3	0
IV197	156.00	158.00	8.58	6.6	6.2	-0.40	0.014	3	1
IV197	162.00	164.00	7.48	6.5	6.45	-0.05	0.015	3	1
IV197	168.00	170.00	4.54	6.48	5.95	-0.53	0.023	3	1
IV197	174.00	176.00	5.04	6.45	6.13	-0.32	0.016	3	1
IV197	180.00	182.00	4.24	6.73	5.71	-1.02	0.009	3	0
IV197	186.00	188.00	5.10	6.45	5.82	-0.63	0.015	2	1
IV197	192.00	194.00	8.40	6.38	6	-0.38	0.013	2	1
IV197	198.00	200.00	7.44	6.22	6.3	0.08	0.013	2	1
IV197	204.00	206.00	7.86	6.45	5.62	-0.83	0.008	2	0
IV197	210.00	212.00	8.09	6.33	5.93	-0.40	0.010	2	0
IV197	216.00	218.00	11.38	5.99	5.3	-0.69	0.012	2	0
IV197	222.00	224.00	28.40	6.36	4.66	-1.70	0.059	2	0
IV197	228.00	230.00	20.20	6.16	4.16	-2.00	0.036	2	0
IV197	240.00	242.00					0.015	No	No
IV197	246.00	248.00	10.45	5.98	4.65	-1.33	0.016	2	0
IV413	0.00	2.00	13.85	5.98	4.9	-1.08	0.017	2	1
IV413	6.00	8.00	4.63	6.32	5.78	-0.54	0.014	3	3
IV413	12.00	14.00	3.34	6.5	6.72	0.22	0.007	3	3
IV413	18.00	20.00	5.97	6.53	6.49	-0.04	0.007	3	3
IV413	24.00	26.00	10.21	6.55	5.84	-0.71	0.011	3	3
IV413	30.00	32.00	7.39	6.73	5.94	-0.79	0.007	3	3
IV413	36.00	38.00	11.53	6.78	5.91	-0.87	0.007	3	3
IV413	42.00	44.00	4.16	6.62	6.48	-0.14	0.009	3	3
IV413	48.00	50.00	3.57	6.54	6.25	-0.29	0.011	3	3
IV413	54.00	56.00	4.22	6.39	6.93	0.54	0.007	1	0
IV413	60.00	62.00	6.38	6.46	6.98	0.52	0.008	3	1
IV413	66.00	68.00	7.26	6.43	6.76	0.33	0.011	2	0
IV413	78.00	80.00	4.03	6.39	6.37	-0.02	0.022	2	0
IV413	84.00	86.00	4.49	6.29	5.75	-0.54	0.024	2	0
IV413	90.00	92.00	5.18	6.24	4.22	-2.02	0.010	2	0
IV413	96.00	98.00	4.81	6.6	6.04	-0.56	0.008	2	0
IV413	102.00	104.00	5.02	6.58	5.7	-0.88	0.006	2	0

IV413	108.00	110.00	6.28	6.15	5.4	-0.75	0.006	2	0
IV413	114.00	116.00	6.80	6.14	5.63	-0.51	0.004	2	0
IV413	120.00	122.00	7.06	6.01	4.31	-1.70	0.006	2	0
IV413	126.00	128.00	4.83	5.32	4.99	-0.33	0.006	1	0
IV413	132.00	134.00	4.74	5.36	4.79	-0.57	0.006	2	0
IV413	138.00	140.00	2.65	5.22	6.2	0.98	0.003	3	3
IV413	144.00	146.00	2.88	5.1	6.49	1.39	0.003	3	3
IV413	150.00	152.00	3.76	4.74	5.88	1.14	0.003	3	2
IV260	2.00	4.00	16.83	7.52	8.12	0.60	0.013	2	0
IV260	8.00	10.00	5.31	6.57	6.63	0.06	0.018	3	3
IV260	14.00	16.00	4.14	6.12	7.03	0.91	0.011	3	3
IV260	20.00	22.00	6.04	5.5	6.76	1.26	0.008	3	2
IV260	26.00	28.00	5.60	5.47	6.06	0.59	0.007	3	1
IV260	32.00	34.00	5.98	6.03	6.81	0.78	0.015	3	3
IV260	38.00	40.00	5.64	6.9	7.45	0.55	0.011	3	2
IV260	44.00	46.00	7.05	6.97	7.1	0.13	0.011	3	2
IV260	50.00	52.00	8.13	7.22	7.47	0.25	0.007	3	2
IV260	56.00	58.00	7.86	7.33	7.25	-0.08	0.009	3	1
IV260	62.00	64.00	12.02	7.33	7.27	-0.06	0.008	3	2
IV260	68.00	70.00	7.80	6.67	7.09	0.42	0.006	3	0
IV260	74.00	76.00	4.17	6.89	7.18	0.29	0.018	3	0
IV260	80.00	82.00	3.96	6.88	6.89	0.01	0.007	2	0
IV260	86.00	88.00	3.69	6.96	7.14	0.18	0.007	3	1
IV260	92.00	94.00	4.07	7	7.63	0.63	0.010	3	1
IV260	98.00	100.00	3.85	6.96	6.32	-0.64	0.006	3	1
IV260	104.00	106.00	3.40	6.85	7.14	0.29	0.005	3	3
IV260	110.00	112.00	4.08	6.8	6.35	-0.45	0.010	3	2
IV260	116.00	118.00	9.95	6.96	6.81	-0.15	0.009	1	0
IV260	121.50	122.00	6.04	7.15	6.99	-0.16	0.009	3	2
IV260	126.00	128.00	6.66	7.06	6.81	-0.25	0.011	3	2
IV260	132.00	134.00	4.58	7.21	6.77	-0.44	0.008	3	3
IV260	138.00	140.00	7.36	6.97	6.26	-0.71	0.008	3	3
IV260	144.00	146.00	5.65	6.44	6.67	0.23	0.006	3	3
IV260	150.00	152.00	7.05	6.82	6.33	-0.49	0.007	3	2
IV260	156.00	158.00	8.47	6.94	6.3	-0.64	0.007	3	3
IV260	162.00	164.00	5.38	6.78	5.98	-0.80	0.007	3	3
IV260	168.00	170.00	6.86	6.52	6.33	-0.19	0.009	3	3
IV260	175.00	177.00	6.20	6.58	6.09	-0.49	0.009	3	3
IV260	181.00	183.00	4.54	6.9	6.07	-0.83	0.007	3	3
IV260	187.00	189.00	4.98	6.98	6.87	-0.11	0.004	3	3
IV260	193.00	195.00	3.91	7.02	6.72	-0.30	0.006	3	3
IV260	199.00	201.00	6.21	6.87	6.38	-0.49	0.007	3	3
IV260	205.00	207.00	5.69	6.58	6.02	-0.56	0.004	3	3
IV387	2.00	4.00	68.70	7.81	7.88	0.07	0.073	2	0
IV387	6.00	8.00	10.61	8.15	7.14	-1.01	0.014	3	3
IV387	10.00	12.00	3.81	6.9	6.23	-0.67	0.013	3	3

IV387	14.00	16.00	5.70	6.38	6.54	0.16	0.011	3	1
IV387	18.00	20.00	6.66	6.66	6.83	0.17	0.010	3	3
IV387	22.00	24.00	6.23	6.8	6.56	-0.24	0.010	3	3
IV387	26.00	28.00	4.14	7.18	7.12	-0.06	0.009	3	3
IV387	30.00	32.00	6.60	6.64	6.37	-0.27	0.006	3	1
IV387	34.00	36.00	3.96	6.51	6.85	0.34	0.005	3	2
IV387	38.00	40.00	3.47	6.24	6.34	0.10	0.003	3	2
IV387	42.00	44.00	4.88	5.65	4.95	-0.70	0.005	2	0
IV387	46.00	48.00	3.33	6.53	6.16	-0.37	0.002	3	1
IV410	2.00	4.00	15.03	7.05	5.79	-1.26	0.023	3	0
IV410	8.00	10.00	47.60	6.08	5.94	-0.14	0.043	3	0
IV410	14.00	16.00	24.45	6.74	6.52	-0.22	0.015	3	3
IV410	20.00	22.00	7.86	7.06	6.67	-0.39	0.009	3	3
IV410	26.00	28.00	5.10	6.71	5.46	-1.25	0.013	3	3
IV410	32.00	34.00	6.55	6.77	6.07	-0.70	0.014	3	3
IV410	38.00	40.00	7.49	6.55	5.14	-1.41	0.010	3	3
IV410	44.00	46.00	3.19	6.24	5.74	-0.50	0.003	3	3
IV410	50.00	52.00	3.52	5.95	5.12	-0.83	0.004	3	1
IV410	56.00	58.00	3.58	5.78	5.92	0.14	0.004	3	2
IV410	62.00	64.00	8.32	6.35	4.95	-1.40	0.009	3	3

APPENDIX B
LABORATORY CERTIFICATES

ChemCentre
Inorganic Chemistry Section
Report of Examination

PO Box 1250, Bentley Delivery Centre
Bentley WA 6983
T +61 8 9422 9800
F +61 8 9422 9801
www.chemcentre.wa.gov.au
ABN 40 991 885 705

Purchase Order: None
Your Reference:
ChemCentre Reference: 14A0381 R2

Soil Water Resources Pty Ltd
45 Gladstone St
East Perth WA 6004

Attention: Sam Collins

Final Report on 20 samples of received on 26/05/2015

LAB ID	Client ID and Description
14A0381 / 001	15-0438-002
14A0381 / 002	15-0438-008
14A0381 / 003	15-0438-027
14A0381 / 004	15-0438-035
14A0381 / 005	15-0438-054
14A0381 / 006	15-0438-058
14A0381 / 007	15-0438-070
14A0381 / 008	15-0438-078
14A0381 / 009	15-0438-082
14A0381 / 010	15-0438-116
14A0381 / 011	15-0438-124
14A0381 / 012	15-0438-142
14A0381 / 013	15-0438-155
14A0381 / 014	15-0438-158
14A0381 / 015	15-0438-167
14A0381 / 016	15-0438-168
14A0381 / 017	15-0438-174
14A0381 / 018	15-0438-188
14A0381 / 019	15-0438-191
14A0381 / 020	15-0438-202

Analyte		S	TIC	ANC	CRS	NAG	Al
Method		(combs)	(combs)	ARD	eCRS	ARD	iMET2SAICP
Unit		%	%	kg H2SO4/t	%	kg H2SO4/t	mg/kg
Lab ID	Client ID						
14A0381/001	15-0438-002	0.05	0.05	13	<0.005	<0.5	33900
14A0381/002	15-0438-008	0.03	<0.05	6.6	<0.005	<0.5	80700
14A0381/003	15-0438-027	0.02	<0.05	3.0	<0.005	4.9	6630
14A0381/004	15-0438-035	0.02	0.15	28	<0.005	<0.5	64100
14A0381/005	15-0438-054	0.02	<0.05	6.1	<0.005	2.3	27200
14A0381/006	15-0438-058	<0.01	<0.05	5.4	<0.005	2.8	53500
14A0381/007	15-0438-070	<0.01	<0.05	3.4	<0.005	1.7	12400
14A0381/008	15-0438-078	<0.01	<0.05	2.2	<0.005	3.1	5070
14A0381/009	15-0438-082	0.04	0.05	13	<0.005	<0.5	40100
14A0381/010	15-0438-116	iss	iss	5.2	<0.005	5.3	28400
14A0381/011	15-0438-124	0.02	0.05	10	<0.005	2.2	37800
14A0381/012	15-0438-142	<0.01	<0.05	1.8	<0.005	0.7	1320
14A0381/013	15-0438-155	<0.01	<0.05	6.3	<0.005	1.6	15700
14A0381/014	15-0438-158	<0.01	0.06	2.4	<0.005	2.6	5290
14A0381/015	15-0438-167	<0.01	<0.05	2.0	<0.005	5.0	5930
14A0381/016	15-0438-168	<0.01	<0.05	3.1	<0.005	5.5	8680
14A0381/017	15-0438-174	<0.01	<0.05	2.8	<0.005	<0.5	5940
14A0381/018	15-0438-188	<0.01	<0.05	3.3	<0.005	<0.5	12500
14A0381/019	15-0438-191	<0.01	<0.05	1.6	<0.005	2.4	5430
14A0381/020	15-0438-202	<0.01	0.06	5.8	<0.005	<0.5	4290

Analyte		As	B	Ba	Cd	Co	Cr
Method		iMET2SAMS	iMET2SAICP	iMET2SAICP	iMET2SAMS	iMET2SAMS	iMET2SAICP
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Lab ID	Client ID						
14A0381/001	15-0438-002	7.7	<50	120	0.10	10	68
14A0381/002	15-0438-008	13	<50	280	<0.10	2.9	96
14A0381/003	15-0438-027	5.0	<50	8.2	<0.10	2.3	6.0
14A0381/004	15-0438-035	17	<50	160	<0.10	4.5	49
14A0381/005	15-0438-054	8.2	<50	30	<0.10	2.2	53
14A0381/006	15-0438-058	35	<50	16	<0.10	2.1	75
14A0381/007	15-0438-070	2.9	<50	14	<0.10	<1.0	13
14A0381/008	15-0438-078	1.4	<50	24	<0.10	<1.0	20
14A0381/009	15-0438-082	8.4	<50	200	<0.10	3.2	26
14A0381/010	15-0438-116	2.0	<50	5.8	<0.10	<1.0	9.1
14A0381/011	15-0438-124	12	<50	100	<0.10	5.8	120
14A0381/012	15-0438-142	1.3	<50	28	<0.10	<1.0	19
14A0381/013	15-0438-155	2.3	<50	23	<0.10	1.7	130
14A0381/014	15-0438-158	1.7	<50	15	<0.10	<1.0	8.5
14A0381/015	15-0438-167	1.9	<50	11	<0.10	1.0	14
14A0381/016	15-0438-168	3.4	<50	7.8	<0.10	1.3	14
14A0381/017	15-0438-174	2.0	<50	11	<0.10	<1.0	6.6
14A0381/018	15-0438-188	3.5	<50	15	<0.10	<1.0	12
14A0381/019	15-0438-191	3.0	<50	15	<0.10	<1.0	4.6
14A0381/020	15-0438-202	2.7	<50	42	<0.10	<1.0	6.4

Analyte		Cu	Fe	Hg_total	Mn	Mo	Ni
Method		iMET2SAMS	iMET2SAICP	iHG2STVG	iMET2SAICP	iMET2SAMS	iMET2SAICP
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Lab ID	Client ID						
14A0381/001	15-0438-002	17	210000	<0.02	590	1.3	20
14A0381/002	15-0438-008	17	290000	0.15	980	0.19	<10
14A0381/003	15-0438-027	6.6	410000	0.05	390	0.51	<10
14A0381/004	15-0438-035	14	170000	0.20	300	1.6	13
14A0381/005	15-0438-054	7.4	260000	<0.02	150	1.1	<10
14A0381/006	15-0438-058	12	380000	0.16	100	2.4	<10
14A0381/007	15-0438-070	5.1	330000	0.04	170	0.29	<10
14A0381/008	15-0438-078	4.3	250000	0.02	130	0.88	<10
14A0381/009	15-0438-082	24	320000	<0.02	580	4.6	12
14A0381/010	15-0438-116	14	91000	0.07	88	3.0	<10
14A0381/011	15-0438-124	3.0	350000	0.02	190	1.7	15
14A0381/012	15-0438-142	1.5	170000	<0.02	170	2.2	<10
14A0381/013	15-0438-155	20	360000	0.03	110	0.28	<10
14A0381/014	15-0438-158	5.1	390000	0.12	290	0.30	<10
14A0381/015	15-0438-167	6.5	330000	<0.02	180	0.25	<10
14A0381/016	15-0438-168	12	390000	0.03	530	0.71	<10
14A0381/017	15-0438-174	2.2	340000	0.05	790	0.22	<10
14A0381/018	15-0438-188	1.3	400000	0.09	130	0.22	<10
14A0381/019	15-0438-191	2.3	180000	<0.02	75	0.33	<10
14A0381/020	15-0438-202	2.2	220000	0.08	290	0.45	<10

Analyte		Pb	Sb	Se	Sn	Sr	Th
Method		iMET2SAMS	iMET2SAMS	iMET2SAMS	iMET2SAMS	iMET2SAICP	iMET2SAMS
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Lab ID	Client ID						
14A0381/001	15-0438-002	11	0.40	0.23	1.7	31	7.5
14A0381/002	15-0438-008	15	<0.10	0.52	2.0	33	8.1
14A0381/003	15-0438-027	1.5	0.25	<0.10	<1.0	3.6	<1.0
14A0381/004	15-0438-035	19	0.37	0.28	3.6	33	9.5
14A0381/005	15-0438-054	9.0	0.46	0.34	1.5	11	5.8
14A0381/006	15-0438-058	24	0.81	0.60	1.7	7.5	10
14A0381/007	15-0438-070	4.0	0.84	<0.10	<1.0	3.8	2.0
14A0381/008	15-0438-078	1.4	0.44	<0.10	<1.0	3.0	<1.0
14A0381/009	15-0438-082	14	0.18	0.27	2.9	18	5.3
14A0381/010	15-0438-116	3.6	0.16	<0.10	2.9	2.4	8.5
14A0381/011	15-0438-124	19	0.60	<0.10	3.1	12	8.6
14A0381/012	15-0438-142	<1.0	0.34	<0.10	<1.0	2.4	<1.0
14A0381/013	15-0438-155	6.2	0.59	<0.10	2.5	13	12
14A0381/014	15-0438-158	2.5	0.55	<0.10	<1.0	7.5	1.4
14A0381/015	15-0438-167	2.5	0.78	<0.10	<1.0	6.3	1.7
14A0381/016	15-0438-168	1.7	1.0	0.12	<1.0	5.4	1.8
14A0381/017	15-0438-174	1.3	0.59	0.12	<1.0	2.6	<1.0
14A0381/018	15-0438-188	3.7	0.27	<0.10	<1.0	2.8	1.8
14A0381/019	15-0438-191	<1.0	0.37	<0.10	<1.0	3.4	<1.0
14A0381/020	15-0438-202	<1.0	0.22	<0.10	<1.0	4.4	1.3

Analyte		U	V	Zn
Method		iMET2SAMS	iMET2SAICP	iMET2SAICP
Unit		mg/kg	mg/kg	mg/kg
Lab ID	Client ID			
14A0381/001	15-0438-002	0.95	96	<50
14A0381/002	15-0438-008	1.5	290	<50
14A0381/003	15-0438-027	0.57	12	<50
14A0381/004	15-0438-035	2.6	77	<50
14A0381/005	15-0438-054	0.78	72	<50
14A0381/006	15-0438-058	3.4	84	<50
14A0381/007	15-0438-070	0.76	12	<50
14A0381/008	15-0438-078	0.38	9.1	<50
14A0381/009	15-0438-082	1.5	45	<50
14A0381/010	15-0438-116	1.8	3.5	<50
14A0381/011	15-0438-124	1.8	93	<50
14A0381/012	15-0438-142	0.13	4.6	<50
14A0381/013	15-0438-155	4.0	31	<50
14A0381/014	15-0438-158	1.3	10	<50
14A0381/015	15-0438-167	1.7	14	<50
14A0381/016	15-0438-168	4.0	19	77
14A0381/017	15-0438-174	1.3	6.0	<50
14A0381/018	15-0438-188	0.73	15	<50
14A0381/019	15-0438-191	0.39	4.2	<50
14A0381/020	15-0438-202	0.30	6.1	<50

Analyte	Method	Description
S	(combs)	Sulfur total by combustion
TIC	(combs)	Total inorganic carbon determined by combustion after removal of organic carbon by ignition.
NAG	ARD	Net Acid Generation to pH 7
ANC	ARD	Acid Neutralisation Capacity
CRS	eCRS	Chromium Reducible Sulfur
Hg_total	iHG2STVG	Mercury, total, dry basis.
Mn	iMET2SAICP	Manganese, dry basis
Al	iMET2SAICP	Aluminium, dry basis
Cr	iMET2SAICP	Chromium, dry basis
B	iMET2SAICP	Boron, dry basis
Ba	iMET2SAICP	Barium, dry basis
Ni	iMET2SAICP	Nickel, dry basis
Sr	iMET2SAICP	Strontium, dry basis
V	iMET2SAICP	Vanadium, dry basis
Zn	iMET2SAICP	Zinc, dry basis
Fe	iMET2SAICP	Iron, dry basis
U	iMET2SAMS	Uranium, dry basis
Th	iMET2SAMS	Thorium, dry basis
Pb	iMET2SAMS	Lead, dry basis
Cd	iMET2SAMS	Cadmium, dry basis
Co	iMET2SAMS	Cobalt, dry basis
As	iMET2SAMS	Arsenic, dry basis
Mo	iMET2SAMS	Molybdenum, dry basis
Cu	iMET2SAMS	Copper, dry basis
Sb	iMET2SAMS	Antimony, dry basis
Se	iMET2SAMS	Selenium, dry basis
Sn	iMET2SAMS	Tin, dry basis

The results apply only to samples as received. This report may only be reproduced in full.

Unless otherwise advised, the samples in this job will be disposed of after a holding period of 30 days from the report date shown below.

The chromium reducible sulfur (CRS), total sulfur, and total inorganic carbon (TIC), were outsourced to ALS and their results incorporated into this report. Their reports are attached.

B. Price

Barry Price
Team Leader
Scientific Services Division
16-Jun-2015

CERTIFICATE OF ANALYSIS

Work Order	: **EP1510624**	Page	: 1 of 6
Client	: **CHEMISTRY CENTRE**	Laboratory	: Environmental Division Perth
Contact	: BARRY PRICE	Contact	: Customer Services EP
Address	: Building 500, Corner Manning Road and Townsing Drive BENTLEY WA, AUSTRALIA 6102	Address	: 10 Hod Way Malaga WA Australia 6090
E-mail	: bprice@chemcentre.wa.gov.au	E-mail	: ALSEnviro.Perth@alsglobal.com
Telephone	: +61 08 9422 9800	Telephone	: +61-8-9209 7655
Facsimile	: +61 08 9422 9998	Facsimile	: +61-8-9209 7600
Project	: 14A0381	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 27-May-2015 15:56
C-O-C number	: ----	Date Analysis Commenced	: 27-May-2015
Sampler	: ----	Issue Date	: 02-Jun-2015 15:13
Site	: ----		
		No. of samples received	: 19
Quote number	: ----	No. of samples analysed	: 19

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Leanne Carey	Acid Sulfate Soils Supervisor	Perth ASS

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	14A0381/001	14A0381/002	14A0381/003	14A0381/004	14A0381/005
			Client sampling date / time	[27-May-2015]	[27-May-2015]	[27-May-2015]	[27-May-2015]	[27-May-2015]
Compound	CAS Number	LOR	Unit	EP1510624-001	EP1510624-002	EP1510624-003	EP1510624-004	EP1510624-005
				Result	Result	Result	Result	Result
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	<0.005	<0.005	<0.005	<0.005	<0.005

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	14A0381/006	14A0381/007	14A0381/008	14A0381/009	14A0381/011
			Client sampling date / time	[27-May-2015]	[27-May-2015]	[27-May-2015]	[27-May-2015]	[27-May-2015]
Compound	CAS Number	LOR	Unit	EP1510624-006	EP1510624-007	EP1510624-008	EP1510624-009	EP1510624-010
				Result	Result	Result	Result	Result
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	<0.005	<0.005	<0.005	<0.005	<0.005

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	14A0381/012	14A0381/013	14A0381/014	14A0381/015	14A0381/016
			Client sampling date / time	[27-May-2015]	[27-May-2015]	[27-May-2015]	[27-May-2015]	[27-May-2015]
Compound	CAS Number	LOR	Unit	EP1510624-011	EP1510624-012	EP1510624-013	EP1510624-014	EP1510624-015
				Result	Result	Result	Result	Result
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	<0.005	<0.005	<0.005	<0.005	<0.005

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	14A0381/017	14A0381/018	14A0381/019	14A0381/020	----
			Client sampling date / time	[27-May-2015]	[27-May-2015]	[27-May-2015]	[27-May-2015]	----
Compound	*CAS Number*	*LOR*	*Unit*	EP1510624-016	EP1510624-017	EP1510624-018	EP1510624-019	--------
				Result	Result	Result	Result	Result
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	<0.005	<0.005	<0.005	<0.005	----

CERTIFICATE OF ANALYSIS

Work Order	: **EP1510886**	Page	: 1 of 6
Client	: **CHEMISTRY CENTRE**	Laboratory	: Environmental Division Perth
Contact	: BARRY PRICE	Contact	: Customer Services EP
Address	: Building 500, Corner Manning Road and Townsing Drive BENTLEY WA, AUSTRALIA 6102	Address	: 10 Hod Way Malaga WA Australia 6090
E-mail	: bprice@chemcentre.wa.gov.au	E-mail	: ALSEnviro.Perth@alsglobal.com
Telephone	: +61 08 9422 9800	Telephone	: +61-8-9209 7655
Facsimile	: +61 08 9422 9998	Facsimile	: +61-8-9209 7600
Project	: 14A0381	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 03-Jun-2015 14:33
C-O-C number	: ----	Date Analysis Commenced	: 10-Jun-2015
Sampler	: ----	Issue Date	: 12-Jun-2015 11:14
Site	: ----		
		No. of samples received	: 19
Quote number	: ----	No. of samples analysed	: 19

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.

- TIC conducted by ALS Brisbane, NATA Site No. 818.
- LECO & TIC conducted by ALS Brisbane, NATA Site No. 818.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	14A0381/001	14A0381/002	14A0381/003	14A0381/004	14A0381/005
			Client sampling date / time	[27-May-2015]	[27-May-2015]	[27-May-2015]	[27-May-2015]	[27-May-2015]
Compound	CAS Number	LOR	Unit	EP1510886-001	EP1510886-002	EP1510886-003	EP1510886-004	EP1510886-005
				Result	Result	Result	Result	Result
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.05**	**0.03**	**0.02**	**0.02**	**0.02**
EP003TIC: Total inorganic Carbon (TIC) in Soil								
^ **Total Inorganic Carbon**	----	0.02	%	**0.05**	<0.02	<0.02	**0.15**	**0.02**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	14A0381/006	14A0381/007	14A0381/008	14A0381/009	14A0381/011
			Client sampling date / time	[27-May-2015]	[27-May-2015]	[27-May-2015]	[27-May-2015]	[27-May-2015]
Compound	CAS Number	LOR	Unit	EP1510886-006	EP1510886-007	EP1510886-008	EP1510886-009	EP1510886-010
				Result	Result	Result	Result	Result
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	<0.01	**0.04**	**0.02**
EP003TIC: Total inorganic Carbon (TIC) in Soil								
^ **Total Inorganic Carbon**	----	0.02	%	<0.02	<0.02	<0.02	**0.05**	**0.03**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	14A0381/012	14A0381/013	14A0381/014	14A0381/015	14A0381/016
			Client sampling date / time	[27-May-2015]	[27-May-2015]	[27-May-2015]	[27-May-2015]	[27-May-2015]
Compound	CAS Number	LOR	Unit	EP1510886-011	EP1510886-012	EP1510886-013	EP1510886-014	EP1510886-015
				Result	Result	Result	Result	Result
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	<0.01	<0.01	<0.01
EP003TIC: Total inorganic Carbon (TIC) in Soil								
^ **Total Inorganic Carbon**	----	0.02	%	**0.02**	<0.02	**0.06**	<0.02	<0.02

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	14A0381/017	14A0381/018	14A0381/019	14A0381/020	----
			Client sampling date / time	[27-May-2015]	[27-May-2015]	[27-May-2015]	[27-May-2015]	----
Compound	CAS Number	LOR	Unit	EP1510886-016	EP1510886-017	EP1510886-018	EP1510886-019	--------
				Result	Result	Result	Result	Result
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	<0.01	<0.01	----
EP003TIC: Total inorganic Carbon (TIC) in Soil								
^ Total Inorganic Carbon	----	0.02	%	<0.02	<0.02	<0.02	**0.06**	----