

FORMER PICRITE LAGOONS, GROUNDWATER ASSESSMENT

Introduction

The Picrite Lagoons are located along the southern section of the eastern boundary of the Site within Retained Land (Figure A). The Picrite Lagoons cover an area of approximately 10 hectares (ha) and are divided into northern and southern groups. The northern section comprises a total of four lagoons shown as 1A, 1B, 2 and 5. The northern lagoons are separated mainly by low vegetated banks. The southern group comprises a total of three lagoons shown as 3A/3B, 4A and 4B. The southern lagoons are separated by high-sided mounds.

The northern lagoons are bound to the north by process buildings, to the east by the perimeter road and the boundary fence, to the south and west by woodland. The Picrite Drain is located to the north of the northern lagoons. Lagoons 1B, 1A, 2 and 5 are located south to north respectively.

The southern lagoons are bound to the north and west by woodland, to the east by the perimeter road and boundary fence, and to the south by a roadway. Lagoons 4B, 4A, 3A/3B are located south to north respectively.

History

The lagoons were used until 1993 for the disposal of lime neutralised sulphuric acid effluent, a by-product of picrite manufacture. The slurry was pumped to the lagoons, the solids allowed to settle out and the liquid left to drain away from the unlined lagoons and/or evaporate to atmosphere.

Periodically, when the material had dried sufficiently, solids were excavated and mounded on adjacent land (particularly to the west of Lagoons 3A/B, 4A and 4B) and the lagoons reused for settling.

Previous Investigations

A number of investigations have previously been undertaken within the area of the Picrite Lagoons and their results are contained in the following reports:

- Investigation into the Location of Picrite Lagoons, Aspinwall & Co, June 1989.
- Picrite Lagoons, ROF Bishopton – Hydrogeological and Engineering Implications for Waste Disposal, Aspinwall & Co, July 1990.
- Analysis of Groundwater for Contamination, RO Environmental Services Group (RO ESG), May 1995.
- Preliminary Ground Investigation, Picrite Lagoons RO Bishopton. BAE Systems Property and Environmental Services, Report No. A182-0K-R3-1, November 2003.

The boreholes drilled during the investigations prior to 2003 (identified as ASP and ESG boreholes) had been monitored during 2002 and 2003. In addition, samples from Dargavel Burn and ditches entering Dargavel Burn from the area of the picrite lagoons were also analysed and the information provided in BAE SYSTEMS Environmental Services Report No. P501-0C-R2-A.

Figure B has been reproduced from the Water Sampling Location Plan included in the BAE Systems Environmental Ground Investigation Report No.A0182-0K-R3-1 and shows the location of the historical boreholes, surface drainage sampling points and concentrations of contaminants encountered.

Stage 2 Investigation

The following exploratory holes were undertaken adjacent to the Picrite Lagoons during the Stage 2 investigation:

- 4 No. cable percussive boreholes
- 2 No. rotary boreholes
- 13 No. window sample boreholes

The cable percussive, rotary and window sample boreholes undertaken during the Stage 2 investigation (19 No.) were installed with gas and groundwater monitoring standpipes. Prior to the Stage 2 investigation a total of 11 No. groundwater monitoring boreholes (shown as ASP and ESG boreholes) were drilled adjacent to the Picrite Lagoons as shown on Figure B.

With the exception of borehole ESGB, 10 No. previous boreholes were monitored during the March 2009 programme. All 19 No. of the Stage 2 boreholes were monitored during the March 2009 groundwater monitoring programme.

Ground Conditions

Made Ground

The Picrite Lagoon investigation confirmed that the lagoon solids generally comprise soft and very soft pink and grey silty material overlying either natural strata or sandy ash gravel and clay. Maximum thickness of the light coloured solids of 2.6m was encountered within Lagoon 3A/B.

Made Ground Type MGT1A comprising black sandy ashy gravel and gravelly clay were encountered beneath lagoons 3A/B, 4A, 4B and the small raised lagoon to the west of Lagoon 2 at depths between 0.4mbgl to 2.6mbgl. This material appeared to form the base of the lagoons and may have been placed to stabilise the soft clay and peat surface.

Made Ground Types MGT1A, MGT2A and MGT2B were encountered within the exploratory holes undertaken adjacent to the Picrite Lagoons.

Made Ground Type MGT1A was encountered to maximum proven depths ranging from 0.01mbgl to 3.9mbgl (ASPD), Made Ground Type MGT2A was encountered to maximum proven depths ranging from 0.2mbgl (ESGB) to 5.2mbgl (ASPA) and Made Ground Type MGT2B was encountered to maximum proven depths ranging from 0.3mbgl (TP1474) to 1.8mbgl (BH2652).

Superficial Deposits

Clippens Peat Formation

Peat was generally encountered within the area of the Picrite Lagoons and beneath Lagoons 1B and 2. The peat has been described as soft or very soft, dark brown and pseudo fibrous.

Peat was encountered to maximum proven depths ranging from 1.1mbgl (BH2643) to 5.5mbgl (BH2652).

Peat was encountered between 0.7mbgl and 1.2mbgl in Lagoon 1B, and between 0.5mbgl and 1.7mbgl in Lagoon 2.

Linwood/Paisely Formation

The Linwood/Paisely Formation generally comprises very soft to soft firm grey top brown sandy silty clay. The Linwood/Paisely Formation was encountered underlying the Clippens Peat Formation within the majority of the boreholes. The Linwood/Paisley Formation was encountered to maximum proven depths ranging from 2.4mbgl (ESGH) to 17.0mbgl (BH2652).

Linwood/Paisley Formation comprising soft grey and brown silty clay was found beneath lagoons 1A and 5.

Wilderness Till Formation

The Wilderness Till Formation generally comprises firm to stiff brown to grey silty clay and was generally encountered underlying the Linwood/Paisely Formation. However, The Wilderness Till was encountered underlying Made Ground to the north and east of the Lagoons. The Wilderness Till Formation was encountered at shallow depths along the eastern boundary of the Site and was encountered to maximum proven depths ranging from 2.3mbgl (BH2643) to 28.9mbgl (BH2652).

Solid Strata

Solid strata comprising the Lower Limestone Formation were only encountered within boreholes ESGB, BH2652 and BH2653. The Lower Limestone Formation generally comprises limestone, including interbedded mudstone and siltstone.

The Lower Limestone Formation was encountered at its shallowest depth in borehole ESGB at 9.0mbgl, this borehole was then terminated at 9.06mbgl due to increased strength of the Limestone.

The Lower Limestone Formation was encountered at depths ranging from 9.0mbgl (ESGB) to 28.9mbgl (BH2652) and was encountered to the full depth of the investigation at a maximum of 39.5mbgl in boreholes BH2652 and BH2653. The Lower Limestone Formation was recorded as grey mudstone (BH2652, 10.6m thick) and interbedded mudstone and siltstone (BH2653, 20.6m thick)

Summary

The area of the Picrite Lagoons is generally underlain by Made Ground, which is in turn underlain by soft peat deposits. The peat is underlain by relatively low permeability Linwood/Paisely Formation clay soils, which are in turn underlain by Wilderness Till Formation also comprising relatively low permeability clay soils.

The Solid strata are represented by sedimentary deposits of Carboniferous age and are encountered at depths ranging from 9.0mbgl to 28.9mbgl.

Groundwater Conditions

The water levels from the groundwater monitoring undertaken during the March 2009 programme are summarised in Table 1.

Borehole No.	Response Zone	Groundwater Levels (mAOD)
Superficial Boreholes		
ASPA	Linwood/Paisley Fm	10.18
ASPC	Linwood/Paisley Fm	9.62
ASPD	Made Ground / Peat / Linwood/Paisley Fm	12.08
BH2643	Wilderness Till Fm	11.97
BH2648	Wilderness Till Fm	13.81
BH2651	Wilderness Till Fm	11.08
BH2679	Linwood/Paisley Fm	9.92
BH3085	Linwood/Paisley Fm	9.75
ESGA	Made Ground/ Peat/Linwood/Paisley Fm	9.91
ESGC	Peat	10.19
ESGD	Peat	13.80
ESGF	Wilderness Till Fm	11.68
ESGI	Made Ground / Linwood/Paisley Fm / Wilderness Till Fm	9.23
ESGJ	Linwood/Paisley Fm	8.85
WS2646	Peat	12.52
WS2647	Peat	14.12
WS2649	Peat	15.23
WS2650	Linwood/Paisley Fm	9.87
WS3086	Linwood/Paisley Fm	11.52
WS3087	Linwood/Paisley Fm	12.07
WS3088	Peat & Linwood/Paisley Fm	13.15
WS3089	Linwood/Paisley Fm	9.25
WS3090	Linwood/Paisley Fm	10.79
WS3091	Peat & Linwood/Paisley Fm	12.07
WS3092	Peat	13.47
WS3093	Peat	13.58
WS3094	Peat	14.46
Bedrock Boreholes		
BH2652	Lower Limestone Fm	12.276
BH2653	Lower Limestone Fm	11.684

Table 1: Summary of Picrite Lagoon area groundwater levels from March 2009.

Superficial groundwater levels from the superficial strata have been plotted using a 3-D modelling package and are presented as Figure C. The 3-D model shows that a groundwater 'mound' is located within the area of the Picrite Lagoons. The mounding of the groundwater shows that recharge is occurring, with radial flow away from the Picrite Lagoons.

The Aspinwall report dated 1990 confirmed that as the lagoons were being recharged with effluent during 1989 and radial flow away from the lagoons was reported. Furthermore, the BAE SYSTEMS Environmental Services Report No. P501-0C-R2-A also confirmed flow towards the north, west and south of the Lagoons with highest groundwater levels located midway between the two sets of Lagoons.

Hydraulic gradients have been calculated for the superficial groundwater 'mound' feature, associated with the Picrite Lagoons and are presented in Table 2.

Direction	Distance (m)	Head Difference (m)	Hydraulic Gradient
North (WS2649 - BH2651)	186	4.16	0.022
West (WS3094 - ESGI)	274	5.23	0.019
South west (WS2647 - ESGJ)	474	5.27	0.011
South (WS2647 - BH2679)	367	4.21	0.011
East (WS3094 - BH2648)	152	0.65	0.004

Table 2: Shallow groundwater hydraulic gradients for the 'mound' associated with the Picrite Lagoons.

Table 2 shows that steep hydraulic gradients (0.019 to 0.022) have been calculated for shallow groundwater flowing towards the north and west from the Picrite Lagoon 'mound'. Shallow hydraulic gradients (0.004 to 0.011) have been calculated for groundwater flow towards the south and west of the 'mound'.

Surface Water Features

In addition to the lagoons a total of 3 No. surface water features shown as streams are located adjacent to the Picrite Lagoons.

A surface water feature trending north east to south west and shown as Picrite Drain is located to the north of Lagoon No. 5. The Picrite Drain is shown to flow in a south westerly direction and converges with Dargavel Burn west of the Environmental Test Facility (ETF). When the factory was producing picrite, the 'Picrite Drain' received process effluent from the manufacturing section which was discharged to Dargavel Burn as a consented discharge under the Control of Pollution Act 1974.

A surface water feature shown as a stream trending north east to south west is located west of Lagoon 1B and is shown flowing to the south west. A surface water feature shown as a forked stream is located to the west of the southern lagoons and is shown flowing to the south west. The two southern streams converge to the west of the southern lagoons and enter the Dargavel Burn within the southern section of the Site.

A number of ditches were noted parallel to the lagoons bunds and these are normally stagnant or dry but may constitute significant drainage routes to ditches and the 'Picrite Drain' during wet weather.

Summary of Analytical Results

In addition to analysing groundwater samples from the boreholes and surface water samples from the burns adjacent to the Picrite Lagoons, water samples were recovered from ditches adjacent to the lagoons during the BAE Systems 2003 Picrite Lagoon investigation (ref. A0182-0K-R3-1). A total of 9 No. water samples were recovered and analysed, the ditch water sampling locations are presented in Figure B.

Table 3 has been reproduced from the BAE Systems Environmental Report ref. A182-0K-R3-1 and summarises the ditch water sampling results.

Determinand	Units	No.	min	max
pH		9	5.9	7.8
Conductivity	uS/cm	9	353	2,520
Alkalinity as CaCO ₃	mg/l	9	48	283
Ammoniacal Nitrogen	mg/l	9	<0.3	59.7
Sulphate as SO ₄	mg/l	9	78	1,530
Suspended solids	mg/l	9	3	1,610
BOD (5 day)	mg/l	9	<1	2
TOC as C	mg/l	9	3.8	72.1
Picrite	mg/l	9	0.195	597

Table 3: Summary of adjacent ditch water sample results

Maximum electrical conductivity of 2,520uS/cm, maximum alkalinity of 283mg/l; concentrations of Ammoniacal Nitrogen and TOC of 59.7mg/l and 72.1mg/l respectively, were recorded in ditch water sample W6. Water sample W6 was recovered to the east of Lagoon 1A.

Maximum sulphate and BOD concentrations of 1,530mg/l and 2mg/l, respectively, were recorded in water sample W1, recovered from Lagoon 1B.

Concentrations in excess of the long term PNEC for picrite (recently derived by Peak Associates, 2009) were encountered in W5 and W6 at maximum recorded concentrations of 26,700µg/L and 597,000µg/L respectively. The picrite concentrations within the remaining samples ranged from 195µg/L to 3,660µg/L and are noted to be below the long term PNEC.

Recent Surface Water Conditions

Surface water samples from burns flowing through the Site have been recovered and analysed. The following surface water samples are considered to be most influenced by the Picrite Lagoons:

- SW07 - located on the Picrite Drain where it enters the Dargavel Burn, to the west of the Picrite Lagoons.
- SW08 - located on a tributary of the Picrite Drain prior to the tributary converging with the Dargavel Burn.
- SW09 - located on a tributary, draining from the west of the lagoons and converging with Dargavel Burns furthest south.

Surface water sampling points SW07, SW08 and SW09 are located from north to south and are shown in Figure 6.

The contaminant concentrations recorded in the Dargavel Burn samples SW01 and SW02 have been previously reported within Section 10 of the main interpretative report, 'Surface Water Risk Assessment'.

Summary of Surface Water Assessment

Picrite was recorded at monitoring points SW07 and SW09, at recorded concentrations below the long term PNEC value of 5,200µg/L. It is considered these sampling points represent points where surface waters drain from the Picrite Lagoons.

All reported concentrations from SW07 were less than the long term PNEC. Recorded concentrations from SW07 “Picrite Drain” have declined from 4,030µg/L (2007) to the most recent concentration of 1,210µg/L recorded during the visit undertaken in April 2009. However, these results indicate that the Picrite Lagoons are a potential source area.

No other explosives were detected during routine surface water monitoring rounds in 2006 and 2008 at a reporting limit of <50µg/L.

Recent surface water monitoring (2009) was undertaken for explosives at a lower reporting limit of <10µg/L. Recorded concentrations of picrite were encountered at SW02 (18µg/L), SW07 (1,210µg/L), SW08 (20µg/L) and SW09 (28µg/L) at below the long term PNEC.

Picrite concentrations have been consistently encountered at SW02 located at southern boundary of the site. However, the concentrations have never been encountered in excess of the long term PNEC.

Recorded concentrations from SW07, SW08 and SW09 show that picrite is entering surface water features and drains, most likely originating from the Picrite Lagoons. Recent monitoring showed that the highest concentrations were recorded at SW07 (Picrite Drain).

Historical concentrations of Total Petroleum Hydrocarbons (TPH) within the mineral oil range have been recorded between 2006 and 2009 at SW01, SW02, SW07 and SW09.

Recent recorded concentrations from monitoring undertaken in February 2009 show TPH concentrations in the mineral oil range have been encountered at SW07 (0.04mg/L) and SW08 (0.22mg/L).

TPH has been consistently been encountered within SW08 during the 2006 and 2009 monitoring periods at concentrations ranging from 0.01 to 0.22 mg/L, in the mineral oil band C20-C34.

Poly Aromatic Hydrocarbons (PAHs) comprising fluoranthene and benzo(a)pyrene have been recorded at concentrations in excess of the relevant EQS values at SW07, SW08 and SW09. Maximum concentrations of fluoranthene at 0.75µg/L in SW07 (03/05/06), 0.48µg/L (most recent visit, 18/02/09) and SW09 0.21µg/L (23/06/06) have been recorded.

A concentration in excess of the EQS for benzo(a)pyrene was recorded in SW07 at 0.081µg/L during a monitoring visit undertaken during 11 June 2007.

With the exception of SW08, all recorded concentrations from recent monitoring visits were below their relevant laboratory reporting limit.

Recorded concentrations of copper, zinc, iron, aluminium, manganese and vanadium have been detected above the relevant EQS values for SW07, SW08 and SW09. The most recent recorded concentrations from visits undertaken on 18 February 2009 show that elevated concentrations of aluminium and manganese are present at SW07 and SW08, and zinc, aluminium and manganese are present at SW09.

Concentrations of ammoniacal nitrogen have always been recorded in excess of the EQS value at SW02 on the Dargavel Burn.

A maximum concentration of 8.45mg/L for ammoniacal concentration was recorded during the January 2009 monitoring visit at SW09.

The most recent monitoring visit undertaken during 18 February 2009 encountered recorded concentrations of 0.55mg/L (SW07), 0.71mg/L (SW08) and 0.44mg/L (SW09), indicating that these surface waters are receiving loading of ammoniacal nitrogen from the east. The source of which may be the Picrite Lagoons.

Shallow Groundwater Assessment

Explosives

The majority of the explosive contaminant concentrations were encountered at below their laboratory reporting limit or the PNEC values, with the exception of picrite. Recorded concentrations of picrite in excess of the PNEC were encountered within the superficial groundwater from boreholes ASPA (6120µg/L), BH2679 (30,400µg/L) and WS3087 (6630µg/L).

Table 4 summarises the historical concentrations of picrite where detection has been recorded.

Borehole	Monitoring Date	Concentration (µg/L)	Exceedence of Long Term PNEC (5,200µg/l)
ASPA	04/07/2006	4530	No
	27/11/2006	6120	Yes
	18/04/2007	3440	No
	02/10/2007	2760	No
	07/02/2008	3690	No
	20/05/2008	2680	No
	08/12/2008	2090	No
BH2679	09/04/2009	4480	No
	08/12/2008	7450	Yes
WS3087	29/01/2009	30400	Yes
	12/01/09	4680	No
	04/02/09	6630	Yes

Table 4: Summary of adjacent ditch water sample results

In addition, to the above an elevated concentration of picrite of 32,900µg/L was encountered in borehole ASPA during the Picrite Lagoon investigation undertaken in 2003.

A picrite concentration in excess of the long term PNEC value was encountered within borehole ASPA during the 27 November 2006 monitoring programme. However, since then the picrite concentration has decreased steadily and is currently below the PNEC value. Borehole ASPA is located to the east of Lagoon 4B and is adjacent to the Site boundary.

Picrite concentrations in excess of the long term PNEC values encountered within the Stage 2 investigation boreholes BH2679 and WS3087 were recorded during 8 December 2008 and 29 January 2009; and 4 February 2009 respectively. A significantly elevated picrite

concentration of 30,400µg/L was encountered in borehole BH2679 during 29 January 2009. The picrite concentrations encountered within boreholes BH2679 and WS3087 have increased. Borehole BH2679 is located to the south of Lagoon 4B close to the perimeter road. Borehole WS3087 is located to the north east of Lagoon 1A.

Metals

Recorded concentrations of lead, copper, nickel, zinc, chromium, iron, aluminium and vanadium in excess of the relevant EQS values have been encountered in the shallow groundwater within the area of the Picrite Lagoons.

Lead

Recorded concentrations in excess of the EQS values were encountered within boreholes ASPC, BH2679, WS2646, WS2647, WS3091, WS3092 and WS3094. Recorded concentrations range from 0.014mg/L (WS3094) to 0.21mg/L (ASPC). Boreholes ASPC and BH2679 are located to the south of Lagoon 4B. Boreholes WS2646, WS2647, WS3091, WS3092 and WS3094 are located to the west of the lagoons within the wooded area.

An elevated concentration of 0.21mg/L was encountered in borehole ASPC during a monitoring visit undertaken 20 May 2005. Concentrations of lead prior to this visit (5 No.) and the most recent visit undertaken on 10 December 2008 were recorded at below the laboratory reporting limit.

An elevated concentration of 0.036mg/L was encountered in borehole BH2679 during the most recent monitoring visit undertaken 27 January 2009.

Elevated lead concentrations ranging from 0.014mg/L to 0.07mg/L were encountered in boreholes WS2646, WS2647, WS3091, WS3092 and WS3094 during monitoring visits undertaken between 20 and 21 January 2009. The contamination results from the most recent monitoring visit undertaken between 3 and 4 February 2009 recorded concentrations at below the laboratory reporting limit.

Copper

Recorded concentrations in excess of the EQS value for copper was encountered within boreholes ASPC, BH2679 and WS3091 at concentrations ranging from 0.011mg/L (WS3091) to 0.079mg/L (BH2679).

An elevated concentration of 0.05mg/L was encountered in borehole ASPC during a monitoring visit undertaken on 20 May 2005. Concentrations of copper prior to this visit (5 No.) and the most recent monitoring visit undertaken on 10 December 2008 were generally recorded at below the laboratory reporting limit.

An elevated concentration of 0.79mg/L was encountered in borehole BH2679 during the most recent monitoring visit undertaken on 27 January 2009.

An elevated concentration of 0.011mg/L was encountered in borehole WS3091 during the most recent monitoring visit undertaken on 20 January 2009.

Nickel

A recorded concentration in excess of the EQS value for nickel was encountered within borehole ASPC at 0.6mg/L. This nickel concentration is associated with a monitoring visit

undertaken on 20 May 2005. Concentrations of nickel prior to this visit (5 No.) and the most recent visit undertaken on 10 December 2008 were recorded below the EQS value.

Zinc

Recorded concentrations in excess of the EQS value for zinc were encountered within boreholes ASPC, BH2679, ESGD, ESGJ, WS2649 and WS3092 at concentrations ranging from 0.068mg/L to 1.316mg/L.

An elevated concentration of 0.098mg/L was encountered in borehole ASPC during a monitoring visit undertaken on 27 June 2006. Concentrations of zinc during the most recent monitoring visit undertaken on 10 December 2008 were recorded below the EQS value.

Elevated concentrations of 0.068mg/L and 1.316mg/L were recorded in borehole BH2679 during the two most recent monitoring visits undertaken on 19 December 2008 and 27 January 2009, respectively.

Elevated concentrations of 0.785mg/L and 0.085mg/L were recorded within boreholes ESGD and ESGJ, respectively, during the most recent monitoring visit undertaken on 10 December 2008.

Elevated concentrations of 0.077mg/L and 0.081mg/L were recorded within boreholes WS2649 and WS3092, respectively, during the January 2009 monitoring visit. However, concentrations below the EQS value were recorded during the most recent February 2009 monitoring visit.

Chromium

Recorded concentrations marginally in excess of the EQS value for chromium were encountered within borehole WS3089 at a concentration of 0.01mg/L during the monitoring visit undertaken on 8 January 2009.

Iron

Recorded concentrations in excess of the EQS value for iron were encountered within boreholes BH3085, WS2649, WS3087, WS3088, WS3089 and WS3091 at concentrations ranging from 3.6mg/L (BH3085) to 82.0mg/L (WS3087).

An elevated concentration of 3.6mg/L was encountered within borehole BH3085 during the most recent monitoring visit undertaken on 26 January 2009.

Elevated concentrations of 2.1mg/L and 82.0mg/L were recorded within boreholes WS2649 and WS3087, respectively during the most recent monitoring visits undertaken on 5 February 2009.

Elevated concentrations of 21.0mg/L, 9.3mg/L and 6.1mg/L were recorded within boreholes WS3088, WS3089 and WS3091, respectively during the recent monitoring visit undertaken on 3 February 2009.

Aluminium

Recorded concentrations in excess of the EQS value for aluminium were encountered within boreholes ASPC and ESGA at concentrations ranging from 0.106mg/L to 0.54mg/L.

Elevated concentrations ranging from 0.03mg/L to 0.54mg/L were recorded in borehole ASPC during monitoring visits undertaken on 27 June 2006 and 20 May 2008 respectively. A total of 6 No. water samples have been analysed for aluminium from borehole ASPC during monitoring visits undertaken between 27 June 2006 and 20 May 2008. Aluminium was detected on 4 No. separate occasions, and when detected was at concentrations in excess of the EQS value. Aluminium was recorded at a concentration in excess of the EQS during the most recent visit undertaken on 20 May 2008.

Elevated concentrations of 0.108mg/L and 0.30mg/L were recorded in borehole ESGA during the monitoring visits undertaken on 27 June 2006 and 16 May 2008 respectively. A total of 6 No. water samples have been analysed for aluminium from borehole ESGA during visits undertaken between 27 June 2006 and 16 May 2008. Aluminium was only detected during the above two visits. The recorded concentration is in excess of the EQS during the most recent visit undertaken on 16 May 2008.

Vanadium

Recorded concentrations in excess of the EQS value for vanadium were encountered in borehole ASPC at concentrations of 0.08mg/L and 0.033mg/L during monitoring undertaken on 17 April 2007 and 20 May 2008 respectively. A total of 6 No. water samples have been analysed for vanadium from borehole ASPC during visits undertaken between 27 June 2006 and 20 May 2008. Aluminium was only detected above the EQS during the above two visits. The recorded concentration is in excess of the EQS during the most recent monitoring visit undertaken on 20 May 2008.

Poly Aromatic Hydrocarbons (PAHs)

Recorded concentrations of fluoranthene and benzo-a-pyrene in excess of the relevant EQS values have been encountered in the superficial groundwater within the area of the Picrite Lagoons.

Fluoranthene

Recorded concentrations in excess of the EQS value for fluoranthene were encountered in boreholes BH3085, BH2643, ESGA, ESGC, ESGD, WS2649, WS2650, WS3091 and WS3093 at concentrations ranging from 0.02µg/L (ESGD) to 0.36µg/L (WS2650).

An elevated concentration of 0.07µg/L was encountered in borehole BH3085 during a monitoring visit undertaken on 14 January 2009. However, the most recent monitoring visit undertaken on 28 January 2009 recorded a concentration at below the laboratory reporting limit.

An elevated concentration of 0.03µg/L was encountered in borehole BH2643 during the most recent its latest monitoring visit undertaken on 12 February 2009.

An elevated concentration of 0.04µg/L was recorded in borehole ESGA during a monitoring visit undertaken on 26 September 2007. A total of 6 No. water samples have been analysed for fluoranthene from borehole ESGA during monitoring visits undertaken between 14 November 2006 and 10 December 2008. Fluoranthene was only detected on 1 No. occasion, and when detected was at a concentration in excess of the EQS value. Fluoranthene was recorded at concentrations below the laboratory reporting limit on the remaining 5 No. visits, including the most recent visit undertaken on 10 December 2008.

Elevated concentrations of 0.12µg/L and 0.2µg/L were recorded in boreholes ESGC and ESGD respectively, during the most recent monitoring visit undertaken on 10 December 2008.

Elevated concentrations of 0.06µg/L and 0.05µg/L were recorded in borehole WS2649 during the most recent monitoring visits undertaken on 21 January 2009 and 5 February 2009 respectively.

Elevated concentrations of 0.04µg/L and 0.36µg/L were recorded in borehole WS2650 during the most recent monitoring visits undertaken on 21 January 2009 and 5 February 2009 respectively.

Elevated concentrations of 0.31µg/L and 0.07µg/L were recorded in boreholes WS3091 and WS3093 respectively, during the 21 January 2009 monitoring visit. However, the most recent monitoring visits undertaken on 03 and 04 February 2009 recorded concentrations at below the laboratory reporting limit.

Benzo-a-Pyrene

Recorded concentrations in excess of the EQS for benzo-a-pyrene were encountered within boreholes WS2649, WS2650 and WS3091 at concentrations ranging from 0.04µg/L (WS2649) to 0.24µg/L (WS2650).

Elevated concentrations of 0.04µg/L and 0.24µg/L were recorded in boreholes WS2649 and WS2650 during the most recent monitoring visit undertaken on 5 February 2009.

Elevated concentration of 0.07µg/L was recorded in borehole WS3091 during the monitoring visit undertaken on 20 January 2009. However, the most recent monitoring visit undertaken on 3 February 2009 recorded a concentration at below the laboratory reporting limit.

Total Petroleum Hydrocarbons (TPH)

Recorded concentrations of hydrocarbons have generally been encountered at below their laboratory reporting limits. However, where concentrations have been recorded they marginally exceed the laboratory reporting limit.

Recorded concentrations of Diesel Range Organics and TPH have been encountered marginally exceeding the laboratory reporting limit within the area of the Picrite lagoons.

Diesel Range Organics/Total Petroleum Hydrocarbons

Recorded concentrations exceeding the detection limit for the test for Diesel Range Organics (DRO) and Total Petroleum Hydrocarbons (TPH) have been encountered in boreholes ASPA, ASPD, ESGA and ESGC at concentrations ranging from 0.01mg/L (ASPA, ASPD and ESGA) to 0.04mg/L (ESGC).

Concentrations in excess of the laboratory reporting limit for DRO and TPH at 0.01mg/L and 0.02mg/L were recorded in borehole ASPA during the monitoring visit undertaken on 22 June 2006 and 26 September 2007 respectively. A total of 6 No. water samples have been analysed for DRO from borehole ASPA during monitoring visits undertaken between 22 June 2006 and 16 May 2008. DRO was only detected on 2 No. occasions, and when detected was at concentrations marginally exceeding the reporting limit. DRO was recorded at concentrations at below the laboratory reporting on the remaining 4 No. visits including the most recent visit undertaken on 16 May 2008.

Concentrations in excess of the laboratory reporting limit for DRO and TPH at 0.01mg/L were recorded in borehole ASPD during the 17 April 2007 monitoring visit. A total of 6 No. water samples have been analysed for DRO from borehole ASPD during monitoring visits undertaken between 27 June 2006 and 20 May 2008. DRO was only detected on 1 No. occasion, and when detected was at concentrations marginally exceeding the reporting limit. DRO was recorded at concentrations at below the laboratory reporting limit during the remaining 5 No. visits including the most recent visit undertaken on 20 May 2008.

Concentrations marginally in excess of the reporting limit for DRO and TPH at 0.01mg/L and 0.02mg/L were recorded in boreholes ESGA and ESGC during the visit undertaken on 27 June 2006. In addition, concentrations in excess of the reporting limit at 0.03mg/L and 0.04mg/L were recorded in boreholes ESGA and ESGC during the visit undertaken on 19 February 2008. A total of 6 No. water samples have been analysed for DRO from boreholes ESGA and ESGC during monitoring visits undertaken between 27 June 2006 and 20 May 2008. DRO was only detected on 2 No. occasions, and when detected was at concentrations marginally exceeding the reporting limit. DRO was recorded at concentrations at below the laboratory reporting limit on the remaining 4 No. visits including the most recent visit undertaken on 16 (ESGA) and 20 (ESGC) May 2008.

Semi-Volatile Organic Compounds

Recorded concentrations exceeding the relevant EQS values for the Semi-Volatile Organic Compounds (SVOCs) were encountered within boreholes BH3085, ESGD, ESGC, WS2649, WS3091, WS3093 and WS3094.

A concentration in excess of the EQS for 2,4 Dichlorophenol at 158µg/L was recorded in borehole ESGD during the most recent monitoring visit undertaken on 20 May 2008. A total of 5 No. visits were undertaken prior to the visit in May 2008 and the majority of the concentrations were recorded at below the laboratory reporting limit, with the exception of the visit undertaken on 19 February 2008 where a concentration of 7.0µg/L was recorded.

A concentration in excess of the EQS for naphthalene at 30.35µg/L was recorded in borehole ESGD during a visit undertaken on 22 June 2006. A total of 5 No. visits have been undertaken since the visit in June 2006 and the majority of the concentrations were recorded at below the laboratory reporting limit, with the exception of the visit undertaken on 20 May 2008 where a concentration of 2.0µg/L was recorded.

A concentration marginally in excess of the EQS for fluoranthene at 0.01µg/L was recorded in borehole BH3085 during the most recent visit undertaken on 14 January 2009.

Concentrations in excess of the EQS values for fluoranthene and benzo(a)pyrene at 8.2µg/L and 11.4µg/L respectively, were recorded in borehole ESGC during the monitoring visit undertaken on 14 November 2006. A total of 6 No. water samples have been analysed for SVOC during monitoring visits undertaken between 27 June 2006 and 20 May 2008. fluoranthene and benzo(a)pyrene was only detected on 1 No. occasion, and when detected was at concentrations exceeding the relative EQS values. Fluoranthene and benzo(a)pyrene were recorded at concentrations below their relevant laboratory reporting limits on the remaining 4 No. visits, including the most recent visit undertaken on 20 May 2008.

Concentrations marginally in excess of the EQS values for fluoranthene and benzo(a)pyrene at 0.3µg/L and 0.1µg/L respectively, were recorded in borehole WS3091 during the most recent monitoring visit undertaken on 20 January 2009.

Concentrations marginally in excess of the EQS values for fluoranthene and benzo(a)pyrene at 0.1µg/L and 0.1µg/L respectively, were recorded in borehole WS3094 during the most recent monitoring visit undertaken on 20 January 2009.

A concentration marginally in excess of the EQS for fluoranthene at 0.01µg/L was recorded in borehole WS3093 during the most recent visit undertaken on 20 January 2009.

A concentration marginally in excess of the EQS for benzo(a)pyrene at 0.01µg/L was recorded

Other SVOCs, for which EQS values do not exist were generally detected in boreholes ESGC and ESGD, at concentrations marginally exceeding the reporting limits. These are highlighted in blue in Appendix xx.

Notable concentrations of 2,6-Dichlorophenol (7.8µg/L) and 2,4,5/2,4,6-Trichlorophenol (2.5µg/L) was recorded in borehole ESGD during the most recent monitoring visit undertaken on 20 May 2008.

SVOCs have been shown to persist over a number of years at ESGC and ESGD suggesting that sources are present at each of these locations. The nature of the sources are not known.

Volatile Organic Compounds

Concentrations of Volatile Organic Compound (VOC) comprising Trans-1,2-dichloroethylene was recorded in borehole ASPD marginally above the reporting limit at 0.008mg/L, during the monitoring visit undertaken on 26 September 2007. A total of 6 No. water samples have been analysed for VOCs from borehole ASPD during monitoring visits undertaken between 27 June 2006 and 20 May 2008. Trans-1,2-dichloroethylene marginally exceeding the detection limit was only recorded on 1 No. occasion. Trans-1,2-dichloroethylene was recorded at concentrations below the laboratory reporting limit on the remaining 5 No. visits including the most recent visit undertaken on 20 May 2008.

Others

pH

pH values lower than the EQS values were recorded within boreholes BH2679, WS2646, WS2647, WS3087, WS3091, WS3092 and WS3094. These boreholes are located within areas of peat surrounding the Picrite Lagoons. pH values ranged from 4.3 (WS2647) to 5.2 (WS2646).

Sulphate

Recorded concentrations in excess of the EQS for sulphate were encountered within boreholes BH2679, ESGD, WS2649, WS3087, WS3090, WS3093 and WS3094 at concentrations ranging from 473mg/L (WS2649) to 1328mg/L (WS3087).

Elevated concentrations of 552mg/L and 965mg/L were recorded in borehole BH2679 during the monitoring visits undertaken on 19 December 2008 and the most recent visit on 27 January 2009 respectively.

An elevated concentration of 676mg/L was recorded in borehole WS2649 during the most recent monitoring visit undertaken on 10 December 2008.

Elevated concentrations of 1328mg/L and 1132mg/L were recorded in borehole WS3087 during the only two monitoring visits undertaken on 13 January 2009 and 5 February 2009 respectively.

An elevated concentration of 643mg/L was recorded in borehole WS3090 during the monitoring visit undertaken on 13 January 2009. However, the most recent monitoring visit undertaken on 3 February 2009 recorded concentrations at below the laboratory reporting limit.

Elevated concentrations of 1005mg/L and 861mg/L were recorded in borehole WS3093 during the monitoring visits undertaken on 20 January 2009 and most recently 4 February 2009 respectively.

Elevated concentrations of 747mg/L and 740mg/L were recorded in borehole WS3094 during the monitoring visits undertaken on 20 January 2009 and most recently 5 February 2009 respectively.

The elevated sulphate concentrations encountered within the superficial groundwater is most likely associated with the Picrite Lagoons.

Cyanide

Recorded concentrations in excess of the EQS for total cyanide were encountered within borehole ASPA at 0.07mg/L during the visit undertaken on 27 January 2009 and borehole WS2646 at 0.08mg/L during the visit undertaken on 4 February 2009.

Free Cyanide concentrations at below their laboratory reporting limit were recorded during the same monitoring visits for boreholes ASPA and WS2646.

Ammoniacal Nitrogen

Ammoniacal nitrogen generally occurs at elevated concentrations across the Site from 0.01 to 49mg/L and is most likely due to background levels.

Table 5 summarises the historical concentrations of ammoniacal nitrogen within the area of the Picrite Lagoons.

Borehole	Monitoring Date	Concentration (mg/L)	Exceedence
ASPA	22/06/2006	29	Yes
	14/11/2006	28.1	Yes
	17/04/2007	67.3	Yes
	26/09/2007	31	Yes
	30/01/2008	27.52	Yes
	16/05/2008	25	Yes
	10/12/2008	2490	Yes
ASPC	10/12/2008	2.4	Yes
ASPD	10/12/2008	7.0	Yes
BH2643	13/01/2009	1.6	Yes
BH2643	17/02/2009	0.76	Yes
BH2648	03/02/2009	4.7	Yes
BH2648	12/02/2009	7.6	Yes

Borehole	Monitoring Date	Concentration (mg/L)	Exceedence
BH2651	13/01/2009	13	Yes
BH2651	12/02/2009	8.3	Yes
BH2679	19/12/2008	16	Yes
BH2679	27/01/2009	18	Yes
BH3085	14/01/2009	5.3	Yes
BH3085	28/01/2009	6.7	Yes
ESGA	10/12/2008	0.33	Yes
ESGC	10/12/2008	1.6	Yes
ESGD	10/12/2008	0.14	Yes
ESGF	10/12/2008	0.09	Yes
ESGJ	10/12/2008	0.09	Yes
WS2646	21/01/2009	13	Yes
WS2646	04/02/2009	6.2	Yes
WS2647	20/01/2009	2.5	Yes
WS2647	04/02/2009	4.9	Yes
WS2649	21/01/2009	16	Yes
WS2649	05/02/2009	11	Yes
WS2650	13/01/2009	12	Yes
WS2650	05/02/2009	12	Yes
WS3087	13/01/2009	11	Yes
WS3087	05/02/2009	49	Yes
WS3088	08/01/2009	1.2	Yes
WS3088	03/02/2009	19	Yes
WS3089	08/01/2009	1.4	Yes
WS3089	03/02/2009	14	Yes
WS3090	13/01/2009	11	Yes
WS3090	03/02/2009	12	Yes
WS3091	20/01/2009	3.2	Yes
WS3091	03/02/2009	4.1	Yes
WS3092	20/01/2009	8.8	Yes
WS3092	03/02/2009	8.2	Yes
WS3093	20/01/2009	4.9	Yes
WS3093	04/02/2009	4.4	Yes
WS3094	20/01/2009	20	Yes
WS3094	05/02/2009	9.7	Yes

Table 5: Summary of Ammoniacal Nitrogen concentrations

Elevated concentrations ranging from 0.09mg/L to 67.3mg/L have been recorded within the boreholes drilled at the Picrite Lagoons. A significantly elevated concentration of 2,490mg/L was recorded in borehole ASPA during the most recent monitoring visit undertaken on 10 December 2008.

The source of elevated ammoniacal nitrogen in the boreholes drilled is most likely associated with the Picrite Lagoons.

Risk Evaluation

Table 6 indicates all contamination exceedances recorded within the boreholes drilled at the Picrite Lagoons.

Possible Source	Borehole	Contaminants Exceeding Assessment Criteria
Picrite Lagoons	ASPA	Picrite, DRO, TPH, cyanide, ammoniacal nitrogen
	ASPC	Copper, lead, nickel, zinc, vanadium, aluminium, ammoniacal nitrogen
	ASPD	DRO, TPH, Trans-1,2-dichloroethylene, ammoniacal nitrogen
	BH2643	Fluoranthene, ammoniacal nitrogen
	BH2648	Ammoniacal nitrogen
	BH2651	Ammoniacal nitrogen
	BH2679	Picrite, lead, copper, zinc, low pH, sulphate, ammoniacal nitrogen
	BH3085	Iron, fluoranthene, ammoniacal nitrogen
	WS3087	Picrite, iron, low pH, sulphate, ammoniacal nitrogen
	WS3088	Iron, ammoniacal nitrogen
	WS3089	Chromium, iron, ammoniacal nitrogen
	WS3090	Sulphate, ammoniacal nitrogen
	WS2646	Lead, cyanide, low pH, ammoniacal nitrogen
	WS2647	Lead, low pH, ammoniacal nitrogen
	WS2649	Zinc, iron, sulphate, fluoranthene, benzo(a)pyrene, ammoniacal nitrogen
	WS2650	Benzo(a)pyrene, ammoniacal nitrogen
	WS3091	Lead, copper, iron, low pH, fluoranthene, benzo(a)pyrene, ammoniacal nitrogen
	WS3092	Lead, zinc, low pH, ammoniacal nitrogen
	WS3093	Fluoranthene, sulphate, ammoniacal nitrogen
	WS3094	Lead, Benzo(a)pyrene, Fluoranthene, low pH, sulphate, ammoniacal nitrogen
ESGA	Aluminium, DRO, TPH, ammoniacal nitrogen	
ESGC	DRO, TPH, fluoranthene, ammoniacal nitrogen	
ESGD	Zinc, 2,4-Dichlorophenol, sulphate, fluoranthene, naphthalene, ammoniacal nitrogen	
ESGF	Ammoniacal nitrogen	
ESGJ	Ammoniacal nitrogen	

Table 6: Historical contaminant exceedances for superficial groundwater at the Picrite Lagoons

The exceedances noted in Table 6, refer to the maximum contaminant concentrations recorded during the 2006 and 2009 monitoring programme. The most recent monitoring programme undertaken during December 2008, January and February 2009 indicates that some contaminants previously encountered at elevated concentrations have now been recorded at below the relevant EQS values or at below their laboratory reporting limit.

Table 7 summarises the elevated concentrations recorded during the most recent monitoring visits undertaken.

Possible Source	Borehole	Contaminants Exceeding Assessment Criteria
Picrite Lagoons	ASPA	Cyanide, ammoniacal nitrogen
	ASPC	Vanadium, aluminium, ammoniacal nitrogen
	ASPD	Trans-1,2-dichloroethylene, ammoniacal nitrogen
	BH2643	Fluoranthene, ammoniacal nitrogen
	BH2648	Ammoniacal nitrogen
	BH2651	Ammoniacal nitrogen
	BH2679	Picrite, lead, copper, zinc, low pH, sulphate, ammoniacal nitrogen
	BH3085	Iron, ammoniacal nitrogen
	WS3087	Picrite, iron, low pH, sulphate, ammoniacal nitrogen
	WS3088	Iron, ammoniacal nitrogen
	WS3089	Chromium, iron, ammoniacal nitrogen
	WS3090	Ammoniacal nitrogen
	WS2646	Cyanide, low pH, ammoniacal nitrogen
	WS2647	Low pH, ammoniacal nitrogen
	WS2649	Zinc, iron, sulphate, fluoranthene, benzo(a)pyrene, ammoniacal nitrogen
	WS2650	Benzo(a)pyrene, ammoniacal nitrogen
	WS3091	Copper, iron, low pH, fluoranthene, ammoniacal nitrogen
	WS3092	Zinc, low pH, ammoniacal nitrogen
	WS3093	Fluoranthene, sulphate, ammoniacal nitrogen
	WS3094	Benzo(a)pyrene, Fluoranthene, low pH, sulphate, ammoniacal nitrogen
ESGA	Aluminium, ammoniacal nitrogen	
ESGC	Fluoranthene, ammoniacal nitrogen	
ESGD	2,4-Dichlorophenol, sulphate, fluoranthene, naphthalene, ammoniacal nitrogen	
ESGF	Ammoniacal nitrogen	
ESGJ	Ammoniacal nitrogen	

Table 7: Contaminant exceedences recorded during most recent monitoring visits for superficial groundwater at the Picrite Lagoons

The superficial groundwater levels indicate that the Picrite Lagoons are underlain by an area of groundwater 'mounding' as shown on Figure C. The Conceptual Site Model for the superficial groundwater indicates that the superficial groundwater is a pathway leading to the receptors comprising the surface water features such as burns and streams flowing across the Site.

The Picrite Lagoons are considered to be a source of contamination within the area. The superficial groundwater is considered to be the pathway. The Picrite Drain, and 2 No. streams located to the west of the lagoons are considered to be the receptors.

Explosives

Picrite has been recorded at elevated concentrations during the most recent monitoring programme in boreholes BH2679 and WS3087 only, and picrite has not been recorded in excess of the long term PNEC within the surface water sampling points SW07, SW08 and SW09 to the west of the Site. Results of picrite concentrations from SW07 (Picrite Drain) recorded from 2006 until recent, show a general decline in recorded picrite concentrations,

indicating a potential reduction in the amount of picrite entering the shallow groundwater pathway from the lagoons. However, due to the elevated concentrations encountered within the superficial groundwater there is a potential for picrite to enter the Picrite Drain and the burns to the west of the Lagoon.

Additional surface water monitoring of SW07, SW08 and SW09 is recommended along with monitoring of points W2, W3, W7 and W8 from the Picrite Lagoon Investigation in 2003 (report No.A182-0K-R3).

TPH

DRO and TPH concentrations have been recorded at below their laboratory reporting limit during the most recent monitoring visits. However, DRO and TPH have been encountered within SW07, SW08 and SW09. Therefore, there is a potential source of DRO and TPH from the land draining from the Picrite Lagoons.

PAH

Elevated concentrations of benzo(a)pyrene, fluoranthene and naphthalene have been encountered within the shallow groundwater pathway. Elevated PAH concentrations have historically been recorded within SW07, SW08 and SW09. However, recent monitoring has shown that concentrations at below their laboratory reporting limit have been recorded for PAHs at SW07, SW08 and SW09. The Clippens Peat Formation is considered to be a potential source of PAHs along with the Picrite Lagoons.

Metals

Elevated concentrations of trace metals have been recorded in the superficial groundwater from the most recent monitoring visits. Trace metals have also been recorded in SW07, SW08 and SW09. The majority of the trace metals encountered are considered to be from natural concentrations encountered within strata at the Site. However, lead has consistently been encountered indicating a potential source associated with either the peat deposits or the Picrite Lagoons.

pH

Low pH values were recorded in a number of boreholes during the most recent monitoring visit. However, low pH values were not encountered within SW07, SW08 and SW09.

Sulphate

Elevated concentrations of sulphate have been encountered within the superficial groundwater during the most recent monitoring visits. Elevated sulphate concentrations have not been encountered within SW07, SW08 and SW09. However, as elevated concentrations are present within the groundwater it is considered that there is potential for migration into the nearby surface water features.

Ammoniacal Nitrogen

Elevated concentrations of ammoniacal nitrogen have been encountered within all of the superficial groundwater results including samples SW07, SW08 and SW09, and the Picrite Lagoons are considered to be contributing to the source for the elevated concentrations of ammoniacal nitrogen encountered within the shallow groundwater pathway.

Bedrock Groundwater Assessment

Rotary boreholes BH2652 and BH2653 were drilled as part of the Stage 2 investigation within the area of the Picrite Lagoons to determine whether the former lagoons were having an effect on the bedrock groundwater. Borehole BH2652 was drilled to the north east of Lagoon 3A/3B and borehole BH2653 was drilled to the east of Lagoon 1A. Monitoring of these two boreholes was undertaken during January and March 2009.

Explosives

All recorded concentrations for explosives were at below their relevant laboratory reporting limit.

Metals

All concentrations of metals, with the exception of iron were recorded at below their laboratory reporting limit. A marginally elevated concentration of iron at 0.23mg/L was recorded in borehole BH2652 during the most recent monitoring visit undertaken on 27 January 2009.

PAHs

Total PAH concentrations were recorded below the DWS value at below their relevant laboratory reporting limit.

TPH

Hydrocarbon concentrations were recorded below the relevant DWS values at below their relevant laboratory reporting limit.

VOC/SVOC

VOC/SVOC concentrations have been recorded below the relevant DWS values and at below their relevant laboratory reporting limit.

Others

The majority of the remaining contaminants analysed are below the relevant DWS values or below their relevant laboratory reporting limit, with the exception of chloride, phosphate and ammoniacal nitrogen.

An elevated concentration of chloride was encountered within borehole BH2653 at 268mg/L during the monitoring visit undertaken on 3 February 2009. However, the most recent visit undertaken on 17 February 2009 recorded a concentration at below the laboratory reporting limit.

An elevated concentration of phosphate was encountered within borehole BH2653 at 5.3mg/L during the only visit phosphate was analysed for on 3 February 2009.

Elevated concentrations of ammoniacal nitrogen were encountered within BH2652 at 12.5mg/L and 9.8mg/L during monitoring visits undertaken on 20 and 27 January 2009 respectively.

Elevated concentrations of ammoniacal nitrogen were encountered within BH2653 at 0.75mg/L and 0.81mg/L during monitoring visits undertaken on 3 and 17 February 2009 respectively.

Risk Evaluation

Marginally elevated concentrations of iron, chloride, phosphate and elevated concentrations of ammoniacal nitrogen have been encountered within the bedrock groundwater within the area of the Picrite Lagoons. These concentrations are considered to be associated with naturally occurring concentrations commonly encountered within the bedrock strata at the Site.

Summary

- As anticipated, given the local hydrogeological conditions, the groundwater within the underlying bedrock does not appear to be being impacted by the waste materials placed within the Picrite Lagoons
- The shallow groundwater around the Picrite Lagoons contains locally elevated concentrations of picrite, ammoniacal nitrogen, metals, sulphate, organic compounds and variable pH. Therefore, there is a high potential for continual entry of contaminants into the local groundwater pathway.
- Results of surface water monitoring have shown that intact pollutant linkages do exist, which may be significant (ammoniacal nitrogen).
- Based on the available groundwater and surface water data, it is considered that further monitoring of surface and groundwaters should be undertaken to determine the long term options for remediation of the lagoons.