

2014 Annual Performance Report

Aberthaw Quarry Ash Disposal Site

Permit Number: BP3339BH

March 2015

Summary

This document gives details on the performance of Aberthaw Quarry Ash Disposal Site over 2014, as required by condition 4.2.1 of the site's Environmental Permit (EP).

Aberthaw Quarry Ash Disposal Site is being constructed and filled with Pulverised Fuel Ash (PFA) in four distinct phases (see Appendix A). Phase 1 was constructed in 2008, filled between Quarter 4 2008 to Quarter 4 2010 and then capped and hydroseeded in Spring 2011. Phase 2 was constructed in 2009/10 with filling commencing from Quarter 4 2010. Phase 2 East was filled until Quarter 3 2013 before being capped and hydroseeded whilst Phase 2 West was filled until Quarter 4 2014 before being capped and hydroseeded. Phase 3A (east) was constructed in 2012/13 with filling commencing in Quarter 3 2013 and remained the working phase throughout 2014. The construction of Phase 3B (west) was completed in 2014 and is currently awaiting regulatory approval.

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1. Review of Results for Emission Monitoring

1.1. Groundwater Quality Review

Monitoring Objective

To carry out routine monitoring of groundwater to monitor the performance of the ash disposal site by measurement of absolute levels and concentrations and trends relative to relevant criteria including background levels and concentrations, control levels and compliance limits.

Number and Location of Monitoring Points

A summary of the monitoring boreholes is provided in Table 1 below and the locations are shown in Appendix A. There are 11 boreholes in natural ground, all completed in the Porthkerry Member limestone.

Groundwater flow beneath the ash disposal site is directed towards the Lafarge Lagoons and the River Thaw to the west. Hence, monitoring boreholes, E09-01A, E09-01B, E09-02A and E09-02B on the north-eastern site boundary (approximately 200m apart) are upgradient.

Monitoring boreholes along the western site boundary (E05-03, E05-04 and E06-01) with an average spacing of 100m are downgradient of the current active Pulverised Fuel Ash (PFA) disposal area (Phase 1 and 2). Monitoring boreholes along the southern site boundary (E06-02 and E06-03) with an average spacing of 100m are downgradient of the current active PFA disposal area (Phase 3A) and future filling phases (Phase 3B and 4). Monitoring boreholes along the southern site boundary (E06-04 and E06-05) with an average spacing of 100m are not downgradient of current active PFA disposal area but may be downgradient of future filling phases (Phase 4).

Table 1: Summary of Monitoring Boreholes

Monitoring Borehole	Formation Sampled	Lithology Type – Natural (N)	Response Zone Depth (m b GL)	Designation
E09-01A	Limestone	N	16-25	Upgradient
E09-01B	Limestone	N	22-31	Upgradient
E09-02A	Limestone	N	19-28	Upgradient
E09-02B	Limestone	N	25-34	Upgradient
E05-03	Limestone	N	1.2 - 15	Downgradient Phase 1&2 Active Area
E05-04	Limestone	N	2 - 20	Downgradient Phase 1&2 Active Area
E06-01	Limestone	N	1 - 15	Downgradient Phase 1&2 Active Area
E06-02	Limestone	N	1 - 10	Downgradient Phase 3A Active Area
E06-03	Limestone	N	1 - 10	Downgradient Phase 3A Active Area
E06-04	Limestone	N	1 - 10	Downgradient Future Filling Phases
E06-05	Limestone	N	1 - 8	Downgradient Future Filling Phases

m b GL – metres below ground level

Monitoring Measurements

The groundwater monitoring analytical suite contains a range of parameters which are monitored on a quarterly basis along with the groundwater level and standard field measurements in accordance with the Environmental Permit. An independent external contractor is responsible for the sampling of the groundwater boreholes and an independent external laboratory is responsible for the analysis of the samples. There have been no changes to the contractor for the groundwater sampling and one change to the analytical laboratory in May 2010. Table 2 summarises the changes to the groundwater sampling method since monitoring began to improve the sample quality.

Table 2: Summary of Groundwater Sampling Methods

Monitoring Borehole	Purge Strategy	Purge Equipment	Date From	Date To
E09-01A, E09-01B, E09-02A, E09-02B, E05-04	1 x Well volume	Bailer	Quarter 1 2006	Quarter 2 2013
	Low flow steady state	Submersible pump	Quarter 3 2013	—
E05-03	1 x Well volume	Bailer	Quarter 1 2006	Quarter 3 2012
	1 x Well volume	Inertial pump	Quarter 4 2012	Quarter 2 2013
	Low flow steady state	Submersible pump	Quarter 3 2013	—
E06-01	1 x Well volume	Bailer	Quarter 1 2006	Quarter 2 2012
	1 x Well volume	Inertial pump	Quarter 3 2012	Quarter 2 2013
	3 x Well volume	Inertial pump	Quarter 3 2013	—
E06-02, E06-03	1 x Well volume	Bailer	Quarter 1 2006	Quarter 2 2012
	1 x Well volume	Inertial pump	Quarter 3 2012	Quarter 2 2013
	3 x Well volume	Inertial pump	Quarter 3 2013	Quarter 3 2014
	Low flow steady state	Submersible pump	Quarter 4 2014	—
E06-04, E06-05	1 x Well volume	Bailer	Quarter 1 2006	Quarter 2 2013
	3 x Well volume	Inertial pump	Quarter 3 2013	—

Figure 1 shows the recorded groundwater elevations for the previous 8 years which vary between +17 (E05-03) to +35m OD (E05-02B). Upgradient groundwater elevations are characterised by larger amplitude seasonal water level fluctuations with annual winter influxes of rainfall recharge. Downgradient groundwater elevations fluctuate only slightly due to effect of dewatering from the Quarry which maintains groundwater at near-constant elevations.

Figure 1: Groundwater Hydrograph

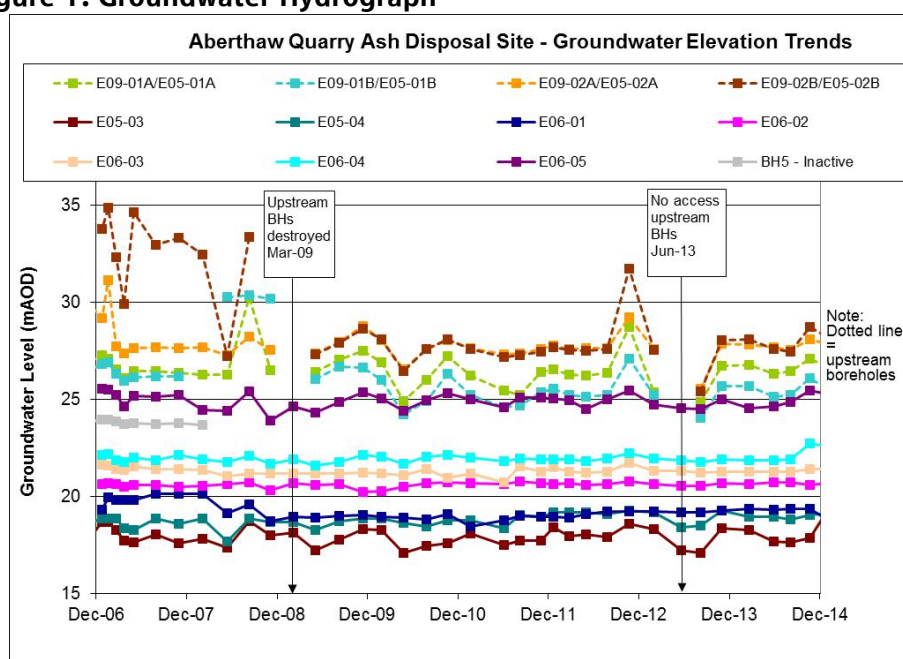


Figure 2 shows the general groundwater quality for the major ions in each of the groundwater boreholes. Natural groundwater quality varies between upgradient and downgradient groundwater. Calcium is depleted in downgradient boreholes, E05-03, E05-04, E06-01 and E06-02 and correlated with elevated sodium, suggesting ion exchange reactions are occurring along the groundwater flow path. Whilst in downgradient boreholes, E06-03, E06-04 and E06-05, major ion chemistry is distinctly different with elevation of calcium, magnesium and sulphate, suggesting a natural geological or quarry-related source in or upgradient of this area.

Figure 3 shows the groundwater control charts with concentrations of all downgradient boreholes plotted as well as the average upgradient concentration (representing concentrations in boreholes E09-01A, E09-01B, E09-02A and E09-02B i.e. background groundwater quality). It should be noted that the compliance limits and control levels (where defined) apply to boreholes E05-03, E05-04 and E06-01. An exceedance is defined as a result above the compliance limit or control level for 3 consecutive sampling events.

In 2014, there were no exceedances of the compliance limit or control level for any critical parameter except Molybdenum in E05-03, which has been on an upward trend since January 2012. The elevated mercury result in E05-03 in November 2013 appears to have been a spurious result as all subsequent results have been below the method detection limit of 0.01µg/l.

Figure 4 shows the control chart for molybdenum for E05-03 and the two other boreholes closest to it, E05-04 and E06-01 as well as the surface water monitoring points (note there are no surface water compliance limits or control levels for molybdenum). The boreholes are located to the west of and adjacent to Phase 1 and are downgradient of active filling operations. Natural background concentrations of molybdenum in the Porthkerry Formation are <3µg/l and the average pre-filling concentration for the Lafarge Lagoon (SW12) is 3µg/l.

Figure 4: Molybdenum concentrations

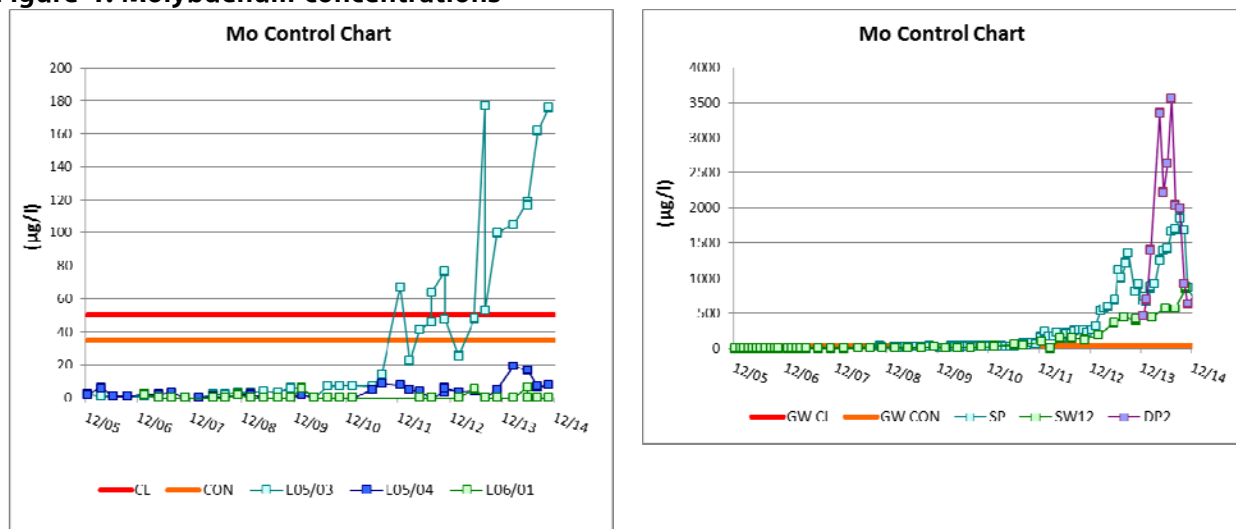


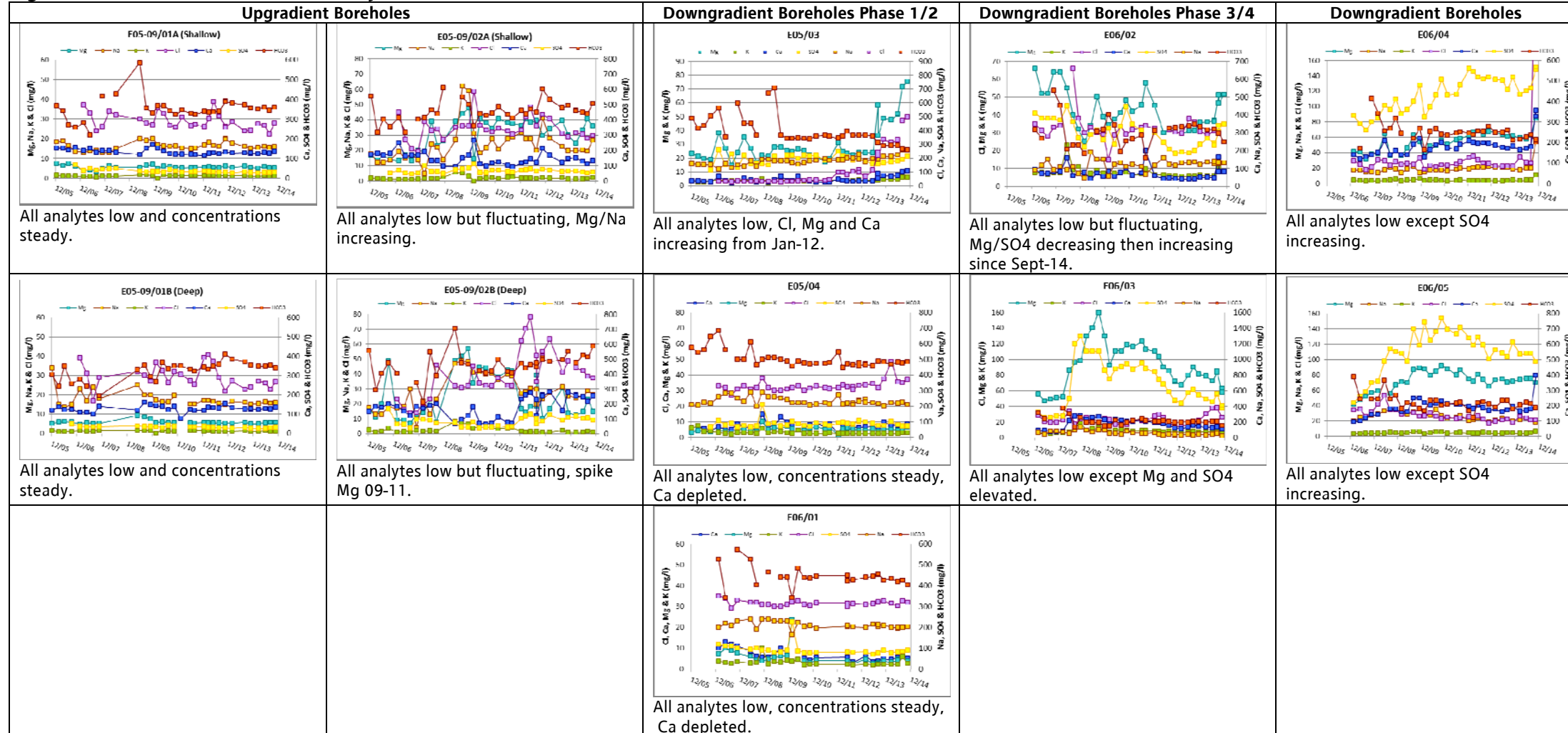
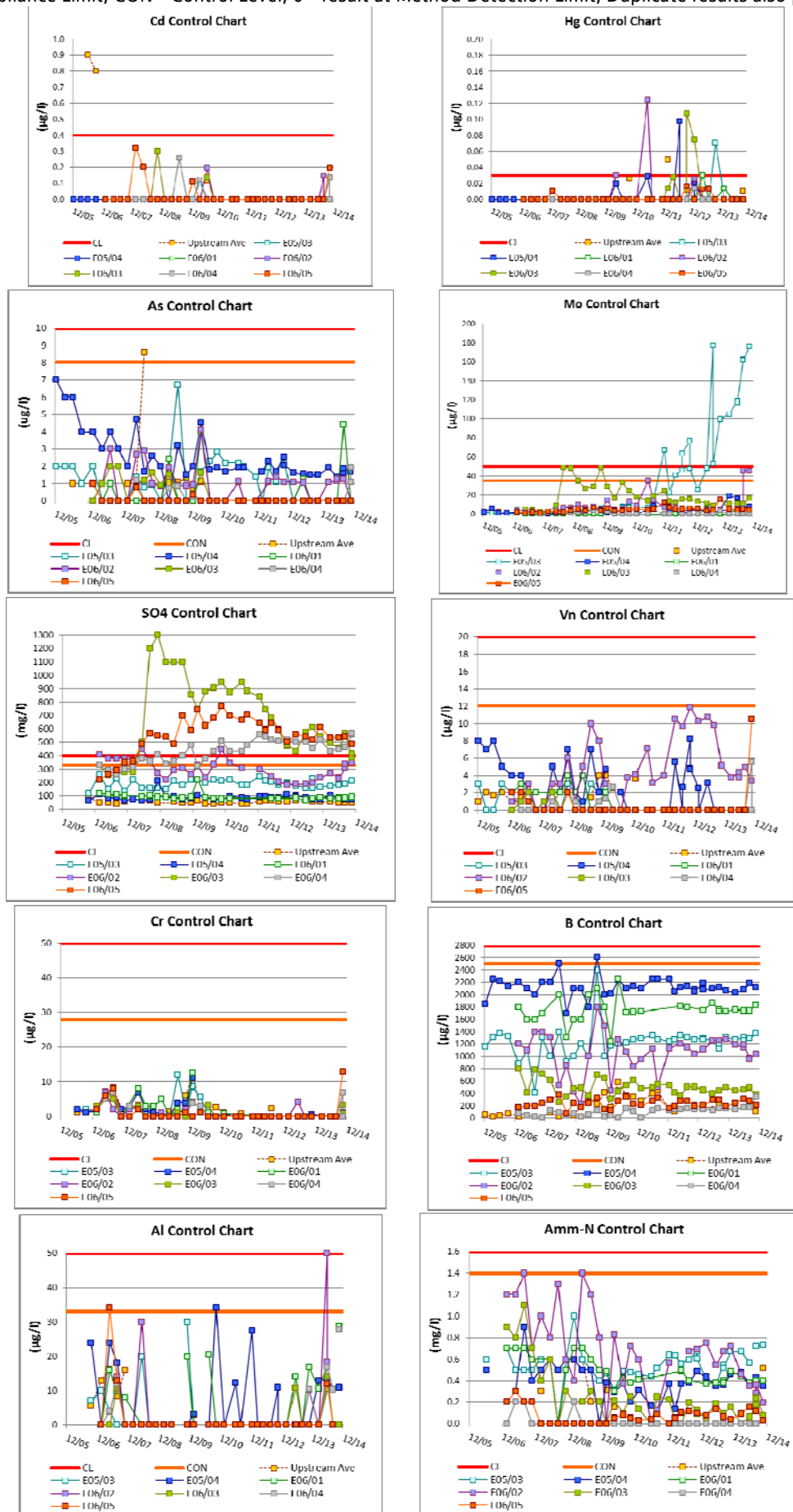
Figure 2: General Groundwater Quality Charts

Figure 3: Control charts for groundwater boreholes

(CL – Compliance Limit, CON – Control Level, 0 – result at Method Detection Limit, Duplicate results also plotted)



The molybdenum concentrations in E06-01 consistently reflect the natural background concentrations whilst in E05-04, concentrations are approximately double. There is no increasing trend in molybdenum in either of these boreholes, which suggests the source is localised to E05-03. Concentrations in E05-03 have been increasing since January 2012, around a year after Phase 1 was completed, which suggests the source is unlikely to be from the deposited PFA. There is also no co-association of increasing concentrations in other indicative PFA leachate parameters which also supports this theory. During site investigations in 2014, it was identified that the discharge from the wheel wash is currently piped across Phase 1 and discharged into the western boundary ditch adjacent to Phase 1 and close to E05-03. The wheel wash uses water from the settlement ponds which as shown in Figure 4 has high concentrations of molybdenum and therefore represents a possible source for the elevated levels in E05-03. Similarly the rise in molybdenum concentration in SW12 as a result of the discharge from the settlement ponds may be causing the rise in E05-03 if the groundwater is in hydraulic continuity with the Lafarge lagoon, as the borehole is located just to the north with a response zone between 1.2 and 15mbgl. There are plans to move the wheel wash discharge pipe in 2015 as part of drainage improvement works and to assess whether this improves molybdenum concentrations in E05-03.

In general the control charts in Figure 3 show that there are no increasing trends in critical parameter concentrations except for molybdenum as discussed above. Other key points to note are:

- a decrease in arsenic concentrations in E05-04 from 7µg/l to 2µg/l;
- naturally elevated sulphate concentrations in E06-03, E06-04 and E06-05 above 400mg/l; and;
- variable vanadium concentrations in E06-02 between 1µg/l and 12µg/l .

A summary of the average groundwater quality for all monitoring parameters between 2006 and 2014 is provided in Appendix B with a comparison of pre- and post-fill concentrations. The key trends in the data have been discussed above, however, it can be summarised that in general, groundwater at Aberthaw Quarry Ash Disposal Site has not been significantly impacted by PFA-derived substances.

The difference in pH between field and laboratory measurements in 2014 was generally less than 0.5 pH units which indicates stable sample conditions. For Electrical Conductivity the difference was between 6-36% with field measurements consistently higher. A change greater than 10% may indicate a change in sample conditions and therefore for some samples precipitation of solids between sampling and analysis may be occurring. Yet Major ion balances were all within +/- 5% suggesting precipitation of solids is minimal.

Duplicate samples collected during 2014 showed good repeatability except on occasion, for aluminium, with variances of around 35%. Laboratory results would generally be expected to be accurate to within +/- 20%, therefore there may be other potential sources of error. The control chart in Figure 3 shows that the aluminium results are fairly sporadic with results varying above the method detection limit of 10µg/l in all boreholes on occasion. There is however, no trend in concentrations over time and results are below the compliance limit.

During 2014 a borehole condition survey was undertaken which identified that E05-03 and E06-01 had a partial kink/blockage which prevented the appropriate installation of a submersible pump. Remedial action was undertaken in January 2015 to re-drill these boreholes. The condition survey also identified that the outer casing and cover required repair on E06-05 which was also completed in January 2015.

1.2. Surface Water Quality Review

Monitoring Objective

To carry out routine monitoring of surface water to;

- monitor the performance of the ash disposal site by measurement of absolute levels and concentrations and trends relative to relevant criteria including background concentrations and control levels; and;
- identify and quantify effects on surface water receptors.

Number and Location of Monitoring Points

A summary of the surface water monitoring points is provided in Table 3 below and the locations are shown in Appendix A. As detailed in a letter to NRW dated 13th June 2014 a new surface water monitoring point has been added, DP2, to monitor the composition of water from the under-drainage. Routine monitoring at DP2 began in May 2014.

Table 3: Summary of Surface water monitoring points

Monitoring Point	Description	Direction from site	Designation
SW12	East shore of Lafarge lagoon in NW area	West	Surface water Receptor
Settlement Ponds	Two concrete ponds collecting groundwater and surface water	South-west	
DP2	Surface water and groundwater drainage channel at base of Phase 1 and 2	West within site	

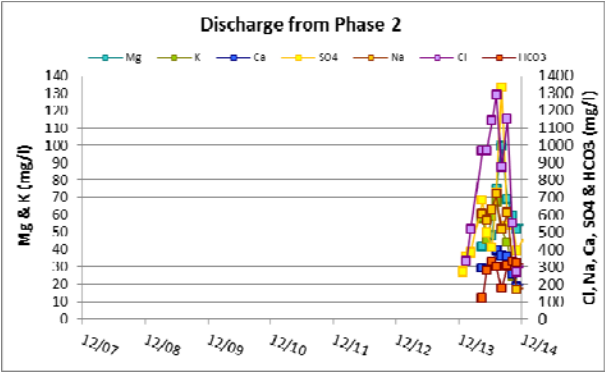
A proportion of the upstream and underlying groundwater will be collected in the groundwater drainage layer and directed towards the two settlement ponds along with any water that has infiltrated through the PFA and the barrier/attenuation layer. Surface water from runoff is also directed into the two settlement ponds via a series of perimeter ditches and toe drains. The settlement ponds are constructed on the quarry floor, contained by concrete and butyl lined 3m high bunds and are designed to allow suspended solids to settle out before the water is discharged through penstocks into the nearby Lafarge Lagoon (SW12).

Monitoring Measurements

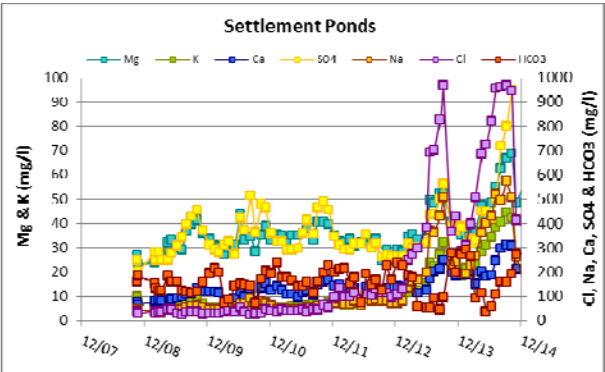
The surface water monitoring analytical suite contains a range of parameters which are monitored on a quarterly basis for SW12 and a monthly basis for the Settlement Ponds and DP2, in accordance with the Environmental Permit. Trained in-house operatives are responsible for the sampling of the Settlement Ponds and DP2 and an independent external contractor is responsible for the sampling of SW12. There have been no changes to the in-house operatives or the contractor for the surface water sampling. An independent external laboratory is responsible for the analysis of the samples. There was a change to the analytical laboratory in September 2009 for the Settlement Ponds surface water analysis and in May 2010 for the SW12 surface water analysis.

Figure 5 shows the general surface water quality for the major ions which is closely similar to the downgradient boreholes, E06-03, E06-04 and E06-05 with elevation of magnesium and sulphate, suggesting a natural geological or quarry-related source upgradient of this area. Concentrations appear to be seasonably variable in the settlement ponds with highs in July to December and lows in February to June. This seasonal pattern is much more marked in 2013 and 2014 and with much higher chloride concentrations than seen previously.

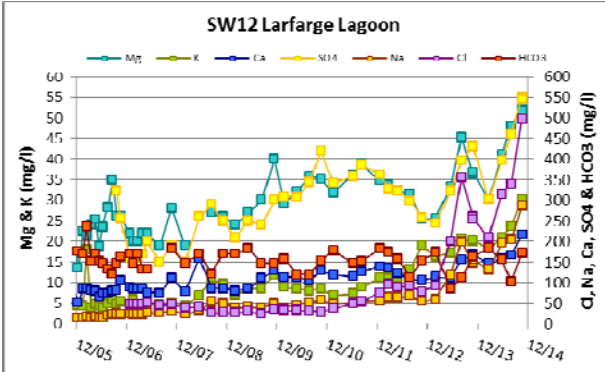
Figure 5: General Surface Water Quality Charts



SO4 & Cl increasing Jan-14



Fluctuations Mg, SO4 & HCO3, Cl increasing from Mar-13 til Oct-13 then Mar-14 til Dec-14



Concentrations steady, increase in Cl, SO4, Mg, K & Na from Feb-13

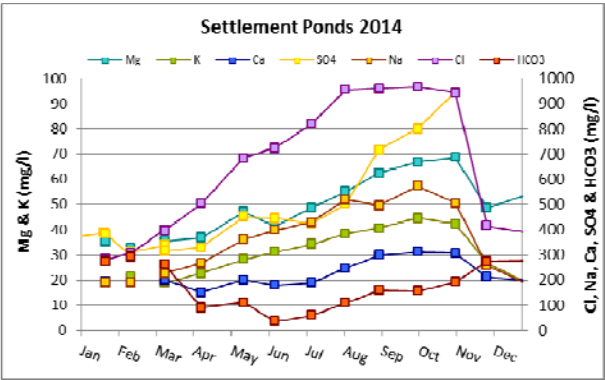
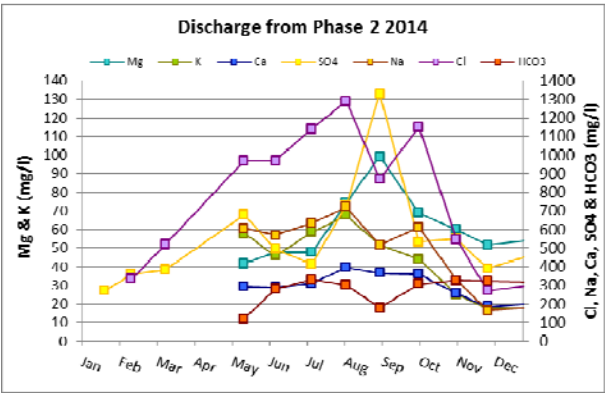


Figure 6 shows the surface water control charts. It should be noted that the compliance limits apply to the discharge from the settlement ponds whilst the control levels (where defined) apply to both the discharge from the settlement ponds and SW12. An exceedance is defined as a result above the compliance limit or control level for 3 consecutive sampling events.

In 2014, there were no exceedances of the compliance limit or control level for any critical parameter, except for sulphate. Concentrations exceeded the compliance limit of 400mg/l between May 2014 and January 2015. On the 5th June 2014, the Regulation department authorised the discharge from the settlement ponds on the basis that the onsite test result for sulphate was 366mg/l. There were no other discharges until the 19th September 2014 when it was noted that Lagoon 2 (Settlement Pond) was overflowing at a flow of approximately 1m³/hr. The discharge sulphate concentration was measured at 621mg/l against a permit limit of 400mg/l. Recent rainfall had increased the lagoon level height to capacity and had not diluted sulphate concentrations sufficiently to remain within the permit limit. The incident was reported to NRW and following an investigation a risk assessment was submitted requesting temporary approval of the elevated discharge on the basis of no environmental impact and the understanding that the elevated concentrations were being caused by drainage into the site from underlying groundwater/springs in the side wall of the unused Phase 3B area. NRW approved the request subject to flow restrictions and ongoing investigation.

In general, Figure 6 shows that there are no increasing trends in critical parameter concentrations except for sulphate as discussed above and that although concentrations of critical parameters have been variable over time there appears to be no impact on the water quality within SW12 – Lafarge lagoon into which the settlement ponds discharge. Other key points to note are:

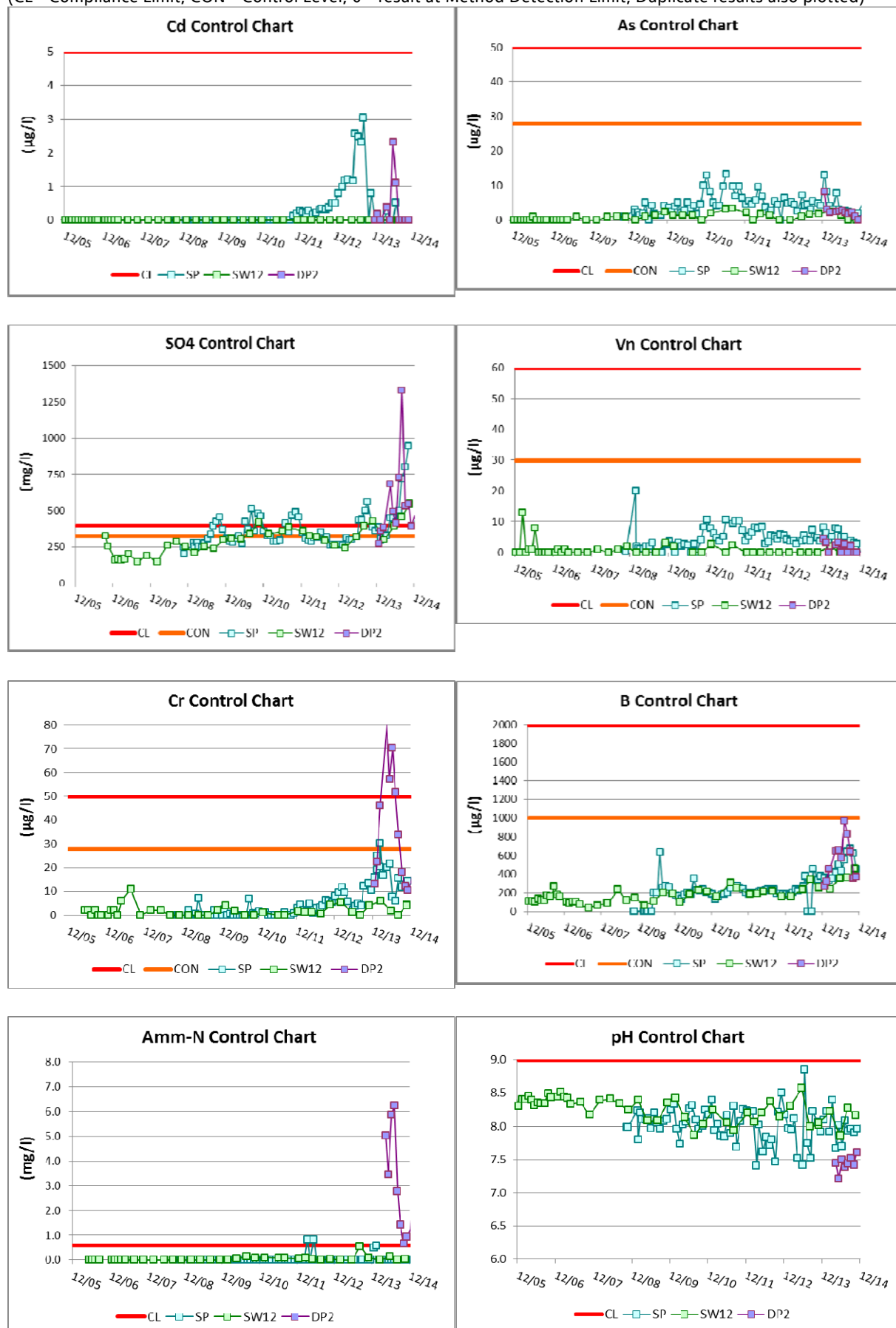
- variable chromium concentrations in SP (between 1µg/l and 30µg/l) and DP2 (between 10µg/l and 80µg/l).
- variable boron concentrations in SP (between 129µg/l and 673µg/l) and DP2 (between 241µg/l and 970µg/l).
- variable ammoniacal nitrogen concentrations in DP2, between 0.7mg/l and 6.2mg/l.

During 2014, works to improve surface water management include improved surfacing of the Haul Road to reduce sediment runoff into the drainage ditches, completion and capping of filled areas i.e. Phase 2 West, re-profiling of drainage ditches and removal of small PFA slippages.

A summary of the average surface water quality between 2006 and 2014 is provided in Appendix B with a comparison of pre- and post-fill concentrations. The key trends in the data have been discussed above, however, it can be summarised that there may be some low level contamination from fugitive emissions of PFA, which is considered to have not significantly impacted the surface water receptors.

Figure 6: Surface Water Control Charts

(CL – Compliance Limit, CON – Control Level, 0 – result at Method Detection Limit, Duplicate results also plotted)



2. Annual Improvement Targets Summary

Aberthaw Power Station continues to maintain its ISO 14001 Certification for the "Generation of electricity, by the combustion of fossil fuel and biomasses, together with the associated sale or disposal of ash". The station was recertified by Lloyds Register Quality Assurance during 2014 with two minor non-conformities. Table 4 provides details of the improvement targets for 2014 and the performance against those targets.

Table 4: Environmental Performance 2014

Objective	Target	Target Date	Responsible Person	Final Status
Maintain a High Level of Environmental Compliance	No more than 2 environmental incidents resulting in justified complaints.	End 2014	All employees	1 - Noise complaint from Quarry mobile plant incorrect reversing beepers.
	No more than zero exceedences of permit conditions which result or have potential to cause significant environmental harm. (Natural Resources Wales CCS Category 1 and 2).	End 2014	All employees	0
	Minimise exceedences of permit conditions which result or have potential to cause minor environmental harm. (Natural Resources Wales CCS Category 3). Fully investigate all exceedences of this type and implement improvements to minimise the likelihood of environmental harm.	End 2014	All employees	0
	No more than zero non-compliance with emissions limits or conditions as set out in EPR permits (Natural Resources Wales CCS Category 4). Submit all NRW reporting on time.	End 2014	Environmental Compliance Engineer	1 - Quarry SW Discharge above Sulphate ELV 400mg/l.
	Complete response to Improvement Condition 7 - Second Year Monitoring Report for acidification and eutrophication deposition and ecological effects at Usk Bat Sites SAC/Mynydd Llangatwyg SSSI.	Q4 2014	Environmental Compliance Engineer	Submitted 30/10/14.
	Complete response to Improvement Condition 26 - Commissioning of Carbon Capture Pilot Plant Report	Q3 2014	Environmental Compliance Engineer	Submitted 18/12/14.
	Review the reporting methodology for determining mercury mass water releases.	Q3 2014	Environmental Compliance Engineer	Agreed methodology based on emission factors.
Ensure Efficient Uses of Resources	Waste - < 15 segregation non-compliances. Non-compliance definition: - >10% wrong material in the skip. - Waste causing a safety or environmental hazard.	End 2014	All employees	0
	Monitor and regularly report waste disposal and recycling statistics to identify minimisation opportunities.	Ongoing	Environmental Compliance Engineer	2013 stats collated and discussed at Waste CIG.
	Water - 5% reduction on 2013 target < 110 m3/GWh process water (Ely Wells and St Lythans supplement).	End 2014	All employees	117m3/GWhr.
	Monitor and regularly report process and potable water use to identify minimisation opportunities.	Ongoing	Section Head Performance and Commercial Section Head Regulation	Process water leak identified from redundant fire main by meter readings.
	Complete implementation of the funded Energy Action Plan to include updating light fittings and installing energy control units.	End 2014	Section Head Maintenance	Lighting and Heaters modified across Station.

Objective	Target	Target Date	Responsible Person	Final Status
Be Responsive to Concerns and Complaints regarding our Operations	Provide response to public enquiries and complaints within 48hrs of normal office hours.	Ongoing	Section Head Regulation	Compliant.
			Environmental Compliance Engineer	
Be Accountable by Publicly Reporting our Environmental Performance	Hold a Local Liaison Committee.	July 2014	Station Manager	Held 25/09/14.
			Section Head Regulation	
Reduce the Carbon Intensity of Electricity Generated	Complete operation of a 3MW carbon capture pilot plant to test the feasibility of CO2 capture from power station flue gases and plan decommissioning.	Q2 2014	Section Head Production	Operation completed and decommissioning planned.
			Section Head Regulation	
	To meet the business plan targets for biomass burn and thermal efficiency.	End 2014	Section Head Performance & Commercial	Biomass -33%. TEMP -0.34%.
Drive Continuous Improvements in Standards of Environmental Management	Ensure the Environmental Management System is successfully re-certified to ISO 14001.	Ongoing	Section Head Regulation	2 Minor NCs - Energy efficiency survey on ACUs / Part E's HazWaste and SIC Codes
			Environmental Compliance Engineer	
	Ensure all staff and residential contractors (managers and first line supervisors) have completed the new environmental training program.	Q4 2014	Section Heads	Staff - 73% Contractors - 100%
			Technical Officers	
	Hold 2 Waste Continuous Improvement Groups.	End 2014	Environmental Compliance Engineer	Outage waste management meeting held 11/04. Meet held 23/09/14.
	Hold 1 Water Continuous Improvement Group.	End 2014	Station Chemist	No meeting held.
	Install oil in water monitor in the site drainage system at P2.	Q4 2014	Station Chemist	Carry forward.
	Install a weather station at Aberthaw Centre for Energy and the Environment.	Q2 2014	Section Head Electrical, Control & Instrumentation	Equipment ordered and awaiting installation.

3. Performance Parameters

The table below details the site performance parameters for 2014:

Performance Parameter	Quantity	Unit
Surface water disposed off site	0	m ³ /yr
Groundwater disposed off site	0	m ³ /yr
Energy used (including for leachate treatment)	Mains electricity supply for the amenities and wheel wash.	MWh of electricity

4. Contamination/Decontamination of Site

There have been no incidents or emissions which may have caused any site contamination during 2014, and, therefore, no requirement to decontaminate the site during 2014.

5. Topographical Surveys

The last topographical survey to ordnance datum was carried out in September 2014 which is shown in Appendix C.

6. Landfill Capacity

The table below details the amount of PFA (EWC 10.01.02) deposited at Aberthaw Quarry Ash Disposal Site during 2014.

Reporting Period	PFA Deposited (tonnes)
January 14 – December 14	296,504

The above data has been reported to Natural Resources Wales via the Waste Return Form. The total amount deposited is well below the permitted annual waste input limit which was increased to 650,000 tonnes in 2012 due to an increase in power station ash production. It is estimated that around 3,969,212 tonnes of void capacity remains.

7. Waste Acceptance Compliance Testing

Aberthaw Quarry Ash Disposal Site is a mono-landfill site which is under the direct operational control of Aberthaw Power Station. All the ash is transported directly from the Power Station using lorries.

The exact composition of PFA is dependent upon the composition of the fuel utilised by Aberthaw Power Station. RWE has well established procedures which control the quality of fuel supplied to its stations. The coal purchased by RWE for Aberthaw is only from an approved 'matrix' for the site (i.e. a list of named coals specifically approved for use at Aberthaw). Any new fuels undergo a rigorous fuel assessment process before trial/use on site to ensure they meet the mandatory fuel specifications and safety requirements of the station.

Table 5 summarises the analytical data obtained for leachate tests performed on composite samples of conditioned PFA from Aberthaw Power Station between 2012 and 2014. The CEN two-stage method for leachate analysis was used (BS EN 12457-3:2002 Characterisation of waste – Leaching – Compliance test for leaching of granular waste materials and sludges of which Part 3).

Table 7: Summary of 10:1 Leachate Calculated Results (mg/kg)

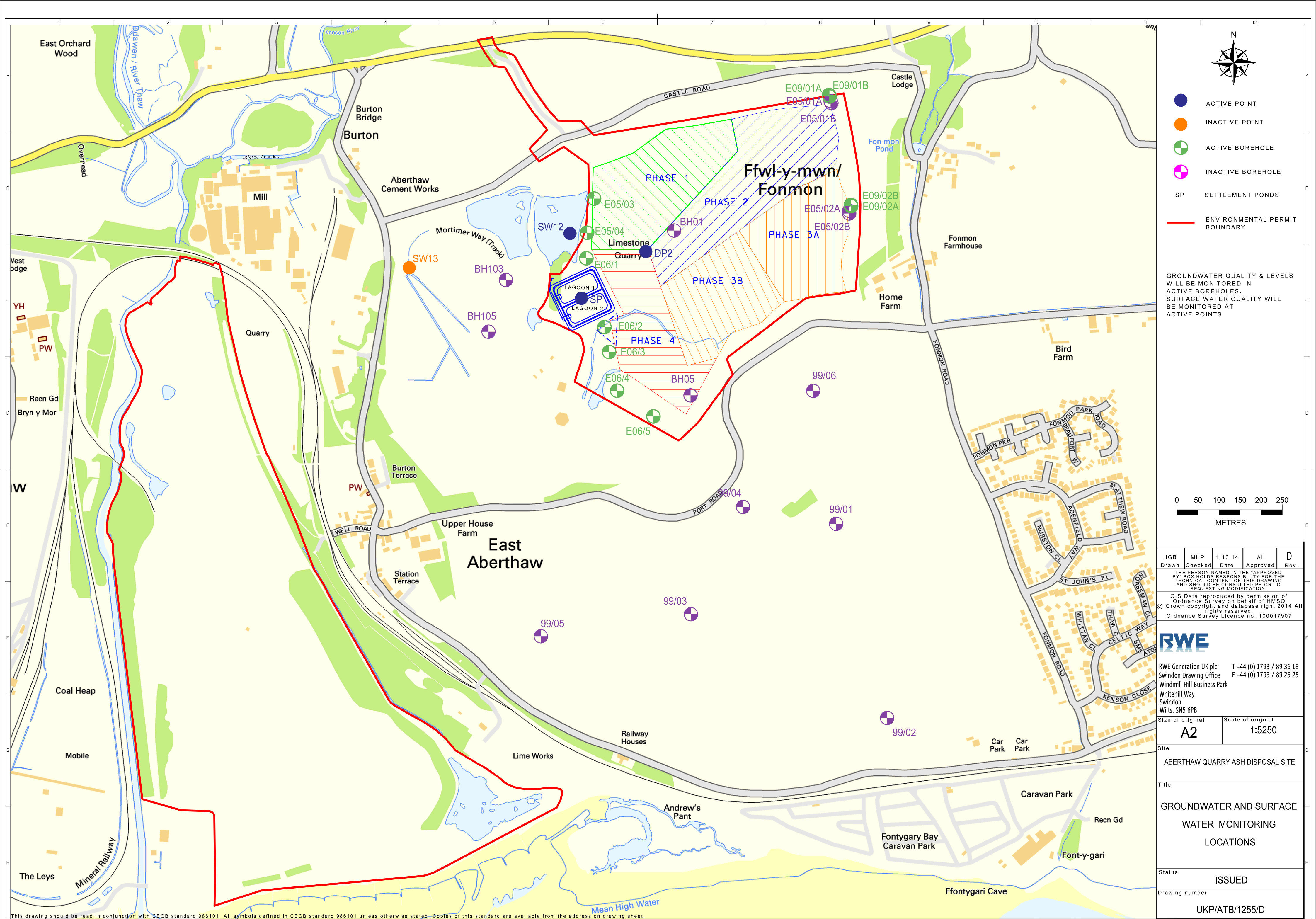
Analyte:	Oct-14 Latest Result	Apr-12 Minimum	to Mean	Oct-14 Maximum	Number of results
Aluminium as Al (Dissolved)	18.2	8.1	25.6	75.4	9
Ammoniacal Nitrogen as N	88.1	29.1	68.9	110.4	9
Antimony as Sb (Dissolved)	0.256	0.067	0.170	0.256	9
Arsenic as As (Dissolved)	3.274	0.077	1.937	3.274	9
Barium as Ba (Dissolved)	2.1	1.4	2.8	5.9	9
Boron as B (Dissolved)	11.2	10.9	13.9	17.7	9
Bromide as Br	22.1	22.1	53.0	293.5	9
Cadmium as Cd (Dissolved)	<0.001	0.0012	0.0007	0.0019	9
Chromium as Cr (Dissolved)	0.15	0.14	0.40	1.03	9
Copper as Cu (Dissolved)	<0.013	0.011	0.013	0.028	9
Cyanide (Total) as CN	<0.2	bld*	0.1	bld*	9
Dissolved Organic Carbon	12.3	5.4	20.3	34.4	9
Fluoride as F	24.9	15.9	23.0	40.7	9
Iron as Fe (Dissolved)	1.17	1.14	0.30	1.17	9
Lead as Pb (Dissolved)	<0.01	0.024	0.023	0.046	9
Manganese as Mn (Dissolved)	<0.024	0.060	0.049	0.174	9
Mercury as Hg (Dissolved)	0.0041	0.0041	0.0074	0.0132	9
Molybdenum as Mo (Dissolved)	12.5	6.8	9.7	16.2	9
Nickel as Ni (Dissolved)	<0.013	0.012	0.007	0.019	9
Nitrate as N	<2.9	2.6	1.4	2.7	9
Selenium as Se (Dissolved)	3.2	0.2	2.0	3.5	9
Sodium as Na (Dissolved)	2281	94	1084	2696	9
Total Dissolved Solids	11507	5571	8940	16169	9
Total Nitrogen as N	92.0	53.8	79.3	126.0	9
Total Sulphur as SO ₄ (Dissolved)	3410	3207	3670	4271	9
Vanadium as V (Dissolved)	2.92	1.24	2.44	3.43	9
Zinc as Zn (Dissolved)	0.09	0.05	0.17	0.57	9

*bld = below limit of detection

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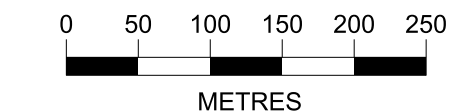
Appendix A. Groundwater and Surface Water Monitoring Locations

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- ACTIVE POINT
- INACTIVE POINT
- ACTIVE BOREHOLE
- INACTIVE BOREHOLE
- SP SETTLEMENT PONDS
- ENVIRONMENTAL PERMIT BOUNDARY

GROUNDWATER QUALITY & LEVELS WILL BE MONITORED IN ACTIVE BOREHOLES. SURFACE WATER QUALITY WILL BE MONITORED AT ACTIVE POINTS



JGB	MHP	1.10.14	AL	D
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RWE
RWE Generation UK plc
Swindon Drawing Office
Windmill Hill Business Park
Whitehill Way
Swindon
Wilts. SN5 6PB

Size of original	Scale of original
A2	1:5250

Site
ABERTHAW QUARRY ASH DISPOSAL SITE

Title
GROUNDWATER AND SURFACE WATER MONITORING LOCATIONS

Status
ISSUED

Drawing number
UKP/ATB/1255/D

Appendix B. Groundwater and Surface Water Quality

(Dark orange exceeds compliance limits, light orange exceeds EQS/DWS, blue exceeds background >25%)

	Aquifer	Response Zone Interval ¹	Al		Sb		As		B		Cd		Ca		Cr		Cu		Fe	
		m b GL	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l				
Background - Limestone			11		3		2		203		0.6		145		3		2		81	
Background - Seawater			256		<10		2		4166		0.1				1		12		<100	
GW EQS/DWL			200		5		10		2000		5.0		250		50		2000		200	
GW MRV							1				1.0									
GW CL			50				10		2800		0.4				50					
SW CL							50		2000		5.0				50					
Upstream Groundwater			Average		Average		Average		Average		Average		Average		Average		Average		Average	
E05-09_01A	Limestone	24-30	14		3		1		43		<0.1		134		3		3		106	
E05-09_01B		18-24	14		1		1		42		<0.1		127		3		2		75	
E05-09_02A		21-27	10		3		1		121		0.1		147		3		2		52	
E05-09_02B		27-33	9		2		2		339		0.9		180		4		2		86	
Downstream Active Filling Operations			Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill
E05_03	Limestone	2.5-15	15	11	4	1	1	2	1109	1278	<0.1	0.1	37	48	3	1	7	1	38	62
E05_04		2.5-20	21	12	6	2	4	2	2123	2128	<0.1	<0.1	6	8	4	1	5	1	39	31
E06_01		1-15	16	13	6	2	1	1	1667	1775	<0.1	<0.1	10	6	4	2	1	1	47	<30
E06_02		1-10	21	12	6	1	2	1	1113	1041	<0.1	0.1	89	69	3	1	5	2	86	<30
Downstream Future Filling Operations			Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill
E06_03	Limestone	1-10	19	10	5	2	1	1	561	477	<0.1	0.1	131	181	3	1	2	2	71	<30
E06_04		1-10	17	11	4	1	1	1	58	137	<0.1	0.1	147	191	3	1	5	3	55	42
E06_05		1-8	21	10	5	1	1	1	224	243	0.4	0.1	129	202	3	1	2	2	33	<30
Downstream Surface Water			Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill
DP2 Phase 2 West				15		1		2		504		0.4		275		33		4		<30
Settlement Ponds				103		1		5		260		0.3		140		6		2		60
SW12 Lafarge Lagoon				21	11	5	1	1	2	122	229	<0.1	<0.1	86	131	2	2	2	1	32

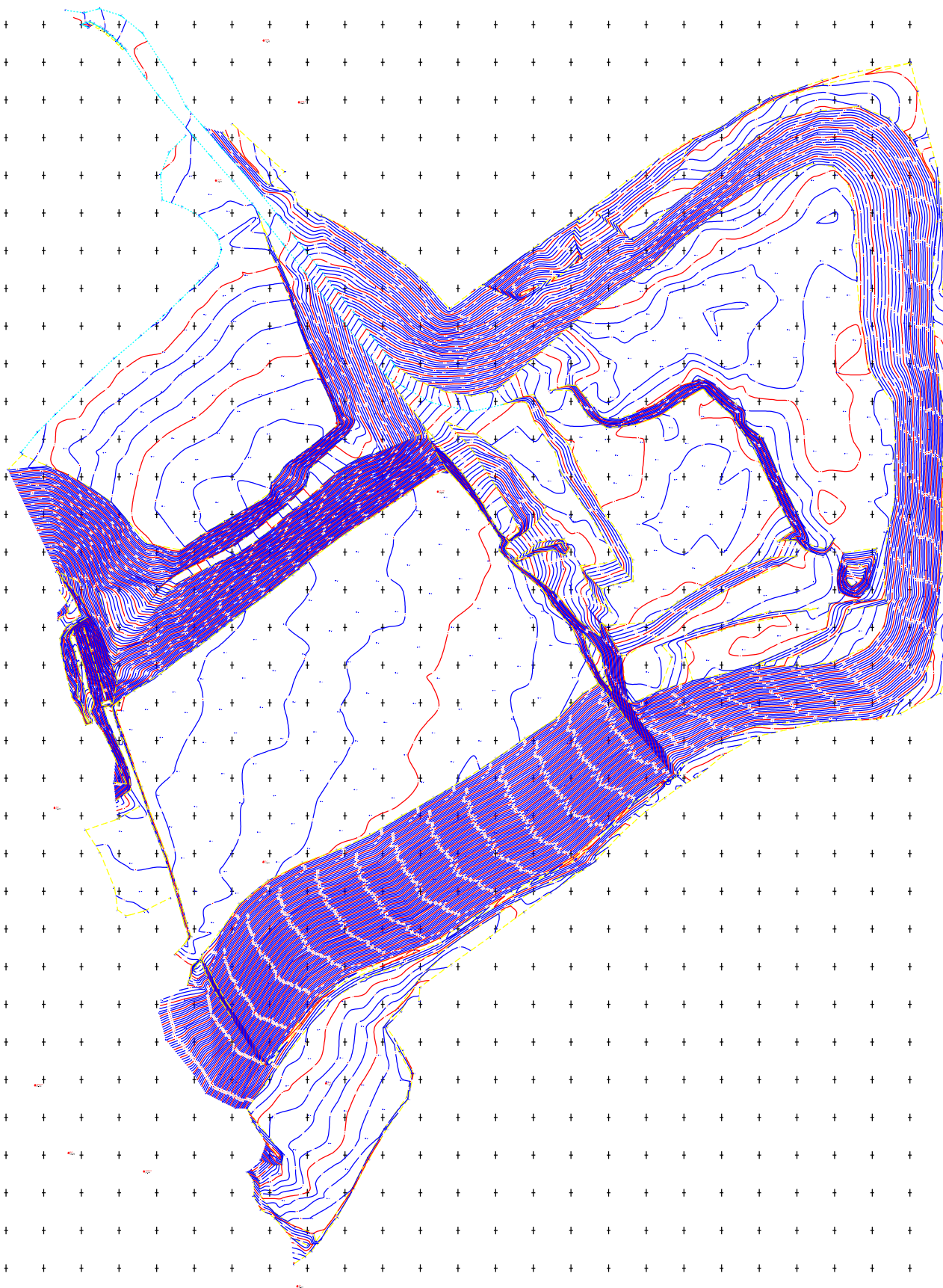
	Aquifer	Response Zone Interval ¹	Mg		Mn		Hg		Mo		Ni		K		Se		Na		Vn	
		m b GL	mg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	mg/l	µg/l								
Background - Limestone			18	48	0.02	3	4	2	3	21	2									
Background - Seawater				<20	0.02	<30	9	380	<1		<20									
GW EQS/DWL		50	50	1.00	70	20	12	10	200	60										
GW MRV				0.10																
GW CL				0.03	50					20										
SW CL											60									
Upstream Groundwater			Average		Average		Average		Average		Average		Average		Average		Average		Average	
E05-09_01A	Limestone	24-30	6	12	0.01	1	4	1	2	16	2									
E05-09_01B		18-24	6	8	0.02	3	3	1	3	18	2									
E05-09_02A		21-27	30	72	0.01	3	5	2	3	24	2									
E05-09_02B		27-33	24	53	0.01	2	6	2	2	28	2									
Downstream Active Filling Operations			Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill
E05_03	Limestone	2.5-15	24	32	11	19	<0.01	0.01	1	51	2	1	4	4	1	1	149	196	2	2
E05_04		2.5-20	4	5	6	9	<0.01	0.01	2	5	2	1	4	3	2	1	241	228	4	3
E06_01		1-15	7	5	<1	9	<0.01	0.01	1	3	1	1	3	3	1	1	215	210	2	2
E06_02		1-10	56	39	18	9	<0.01	0.02	3	11	4	2	10	7	2	1	109	122	2	6
Downstream Future Filling Operations			Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill
E06_03	Limestone	1-10	62	98	10	13	<0.01	0.02	11	20	5	3	7	9	5	2	70	55	1	2
E06_04		1-10	42	59	5	30	<0.01	0.01	3	3	4	3	4	5	2	1	17	21	1	2
E06_05		1-8	52	77	6	10	0.04	0.01	2	6	4	3	4	5	2	1	27	25	1	2
Downstream Surface Water			Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill
DP2 Phase 2 West				56		16		0.02		1583		19		39		1		430		2
Settlement Ponds				37		10		0.04		412		9		13		2		141		5
SW12 Lafarge Lagoon			23	35	2	15	0.05	#DIV/0!	3	217	2	4	6	14	2	2	23	99	2	2

	Aquifer	Response Zone Interval ¹	pH		EC		Bicarbonate		Sulphate		Ammoniacal Nitrogen as N		Total Oxidised Nitrogen as N		Nitrate		Chloride		Fluoride		Total Organic Carbon	
		m b GL			µS/cm		mg/l		mg/l		mg/l		mg/l		mg/l		mg/l		mg/l		mg/l	
Background - Limestone			7.48		801		403		56		0.3		9.19		20		33		0.3		9	
Background - Seawater			7.88				97		2396						16300		1.3					
GW EQS/DWL			8.50		2500		250		400		0.3			50		250		1.5				
GW MRV																						
GW CL									400		1.6											
SW CL			9.00						400		0.6											
Upstream Groundwater			Average		Average		Average		Average		Average		Average		Average		Average		Average		Average	
E05-09_01A	Limestone	24-30	7.48		685		351		35		<0.03		5.42		52		29		0.1		6	
E05-09_01B		18-24	7.49		672		327		33		<0.03		4.99		28		29		0.1		8	
E05-09_02A		21-27	7.45		846		454		66		0.46		6.72		3		34		0.3		7	
E05-09_02B		27-33	7.37		1006		462		84		0.24		20.48		15		39		0.3		9	
Downstream Active Filling Operations			Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
E05_03	Limestone	2.5-15	8.50	7.93	977	1195	462	364	178	193	0.53	0.56	0.14	0.06	0.42	0.41	33	130	1.4	1.7	16	10
E05_04		2.5-20	8.79	8.55	1010	923	564	479	79	90	0.53	0.37	0.30	0.09	0.84	<	31	34	6.4	5.2	19	20
E06_01		2-15	8.66	8.59	923	854	473	434	106	89	0.58	0.45	0.45	0.05	<	<	33	31	2.1	2.7	19	20
E06_02		2-10	8.39	7.86	1214	1014	336	293	390	273	1.09	0.56	0.72	0.63	0.60	0.37	38	38	0.6	0.5	11	20
Downstream Future Filling Operations			Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
E06_03	Limestone	2-10	8.20	7.67	1224	1463	276	199	443	732	0.67	0.15	2.28	1.26	1.60	<	23	23	0.5	0.4	4	26
E06_04		2-10	7.99	7.60	930	1181	290	242	320	465	0.20	0.04	0.10	0.09	0.50	<	26	52	<0.5	0.2	12	25
E06_05		2-8	8.08	7.61	1063	1278	289	206	363	603	0.21	0.07	0.30	0.13	3.30	<	37	25	<0.5	0.3	9	33
Downstream Surface Water			Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
DP2 Phase 2 West			7.49		3530		281		516		2.86		20.41		16.63		700		0.2		1	
Settlement Ponds			8.02		1451		161		367		0.06		4.95		9.84		227		0.3		2	
SW12 Lafarge Lagoon			8.38	8.16	713	1182	159	152	207	347	<0.03	0.08	1.16	1.73	5.09	2.17	44	130	<0.5	0.2	8	5

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Appendix C. Topographical Survey September 2014

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Key to Abbreviations

[illegible]

LINE TYPES

	Building
	Canopy
	Edge of Surfaces
	Embankments and ditches
	Fences
	Overhead cables
	Vegetation
	Walls, Kerbs etc.
	Hedges

Kerb levels are channel levels unless otherwise stated.

Kerb levels are channel levels unless otherwise stated

	Notes

Sheet Layout

North Point



All levels related to:
Ordnance Survey Datum derived by GPS.

Title
NORTH QUARRY,
ABERTHAW.

Client
RWE NPOWER

Scale: 1:1000 @ A0	Date: September 2014
Surveyed by: DM/JCB/PJB	Checked by: A H Davis

Surveyed by: DMJ/CB/PJB	Checked by: A H Davis
Drawing Number:	2019

DAVIES
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