Surface Water Discharge Permit Application: Surface Water Pollution Risk Assessment

Environmental Permit Application Details	
Project	PC0570
Site	Virginia Park
Document Reference:	PC0570_16042026_SWDP
Permit Number:	PPN-01510
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Revision Details		
Revision:	Date:	Nature of Changes:
1.0	16/04/2026	

Contents

Executive Summary

Prichard's undertook a Surface Water Pollution Risk Assessment in support of an Environmental Permit Variation Application for Virginia Park, Caerphilly.

Site operations have the potential to cause surface water impacts because of pollutants released within their effluent discharge during normal operation. A Surface Water Pollution Risk Assessment was therefore required to assess potential risks to the environment.

An assessment using a standard screening tool was undertaken in order to predict pollution levels as a result of operations. The findings indicated that substances were screened out by screening tests 1, 2, 3 and 4 and that the annual load of Priority Hazardous Substances are less than the significant load limit.

The Surface Water Pollution Risk Assessment indicates there are no significant risks to the environment.

1.0. Introduction

1.1. Background

Prichard's undertook a Surface Water Pollution Risk Assessment in support of an Surface Water Discharge Application for Phase 2 of the remediation works in Virginia Park, Caerphilly.

Site operations have the potential to cause surface water impacts because of pollutants released within their effluent discharge during normal operation. A Surface Water Pollution Risk Assessment was therefore required to assess potential risks to the environment.

1.2. Site Location and Context

Virginia Park, Caerphilly is located at approximate National Grid Reference (NGR): 316000,187750. The site is currently being prepared for development. The earthworks project includes the following activities:

1. Land Remediation
2. Water collection and storage
3. Controlled Discharge
4. Site Management and Monitoring.

Surface Water from site will be collected and stored in lagoons prior to discharge from site. The water discharged from the works have the potential to cause impacts at sensitive receptors. A Surface Water Risk Assessment was therefore required in order to assess potential risks to the environment (see Table 1 below).

Table 1: Relevant Impacts

Releases		**Test**	**Impact**
No	Air	No	No significant emissions to air from site activities. No dust, fumes, or volatile chemicals are produced.
No	Deposition from air to land	No	No airborne emissions are present, so no deposition to land occurs.
Yes	**Water**	**Yes**	**Surface Water Risk Assessment required**
No	Waste	No	Solids are collected/removed off site and don't enter the environment.
No	Visual	No	No significant visual impact beyond normal construction/remediation operations.
-	Ozone creation	No	No ozone depleting or ozone forming activities are carried out.
-	Global warming	No	Site operations produce no significant contribution to climate change.
-	BAT-AEL test	No	Not applicable as there are no regulated emissions other than water discharges.
-	Performance Indicators	No	No formal regulatory requirement to assess them.

2.0. Methodology

2.1. Introduction

During normal operation, the site has the potential to increase water pollution levels due to emissions present within its discharge. The potential impacts have therefore been assessed in accordance with Environment Agency (EA) guidance, *'Surface Water Pollution Risk Assessment for Your Environmental Permit'*, alongside the associated H1 Assessment Tool. The assessment methodology and input parameters are summarised in the following sections.

2.2. H1 Assessment Tool

The H1 Assessment Tool is a methodology used to calculate the contribution of defined emission sources to water pollution concentrations using a range of input parameters. These results can then be compared against the relevant Environmental Quality Standards (EQSs) to determine the acceptability of the site in relation to water pollution.

2.3. Emission Sources

A single potential emissions source was identified. This is summarised below in Table 2.

Table 2: Potential Emission Sources		
Source		**Description of Operation**
W1	Treatment Plant to Watercourse	Continuous operation

The water from the site will be treated at a dedicated water treatment plant on site.

The final discharge location will be at,

- Discharge Point 1 - monitoring with flow meter via surface water sewer NGR: ST 16106 87718, which is located on the site's southern boundary.

2.4. Assessment Inputs

Inputs for the assessment are summarised below in Table 3.

Table 3: Assessment Inputs		
Parameter	**Unit**	**Value**
Water Flow Rate	m3/s	0.001157 m^3/s (1.157 L/s) (Maximum discharge of 100m^3 per day) (100,000 litres ÷ 86,400 seconds = 1.157 L/s)
Discharge Location	NGR	ST 16106 87718
Discharge Depth	m	0 (surface water sewer)

Site surface water was sampled in July 2025 VP-SW-07-1 (Freshwater Test 1), and VP-SW-09-1 (Freshwater Test 2) September 2025. A total of 2 individual samples were undertaken. A summary of the results is provided in Table 4.

Table 4: Assessment Inputs			
Determinant	**Unit**	**VP-SW-07-1 (Freshwater Test 1)**	**VP-SW-09-1 (Freshwater Test 2)**
Ammoniacal Nitrogen	µg/l	53	72
Arsenic	µg/l	0.7	0.9
Beryllium	µg/l	0.16	<0.1
Biochemical Oxygen Demand (BOD)	mg/l	2.3	3
Boron	µg/l	66	60
Cadmium	µg/l	<0.02	0.04
Calcium	mg/l	63	106
Chromium	µg/l	1.5	<0.1
Chemical Oxygen Demand (COD)	mg/l	6.6	9.5
Copper	µg/l	0.6	1.2
Cyanide	µg/l	<10	<10
Lead	µg/l	0.5	0.3
Mercury	µg/l	<0.05	<0.05
Nickel	µg/l	3.1	1.5
pH	pH units	8.2	7.9
Phenol	µg/l	<10.0	<10.0
Selenium	µg/l	<0.6	<0.6
Sulphate as SO_4	µg/l	75000	19500
Sulphide	µg/l	<5.0	<5.0
Total Hardness as $CaCO_3$	mg$CaCO_3$	180	315
Vanadium	µg/l	1.1	0.3
Zinc	µg/l	8.9	1.5
Acenaphthene	µg/l	<0.01	<0.01
Acenaphthylene	µg/l	<0.01	<0.01
Anthracene	µg/l	<0.01	<0.01
Benzo (a) anthracene	µg/l	<0.01	<0.01
Benzo (g,h,i) perylene	µg/l	<0.01	<0.01
Benzo (a) pyrene	µg/l	<0.01	<0.01
Benzo (b) fluoranthene	µg/l	<0.01	<0.01
Benzo (k) fluoranthene	µg/l	<0.01	<0.01
Chrysene	µg/l	<0.01	<0.01
Dibenz (a,h) anthracene	µg/l	<0.01	<0.01
Fluoranthene	µg/l	<0.01	<0.01
Fluorene	µg/l	<0.01	<0.01
Indeno (1,2,3) cd pyrene	µg/l	<0.01	<0.01
Naphthalene	µg/l	<0.01	<0.01
Phenanthrene	µg/l	<0.01	<0.01
Pyrene	µg/l	<0.01	<0.01
PAH, Total	µg/l	<0.16	<0.16
Aliphatic VPH >C5 - C6	µg/l	<1.0	<1.0
Aliphatic VPH >C6 - C8	µg/l	<1.0	<1.0
Aliphatic VPH >C8 - 10	µg/l	<1.0	<1.0
Aliphatic EPH >C10 - C12	µg/l	<10	<10
Aliphatic EPH >C12 - C16	µg/l	<10	<10
Aliphatic EPH >C16 - C21	µg/l	<10	<10
Aliphatic EPH >C21 - C35	µg/l	<10	<10
Aliphatic EPH >C35 - C44	µg/l	<10	<10
Aromatic VPH >C5 - C7	µg/l	<1.0	<1.0
Aromatic VPH >C7 - C8	µg/l	<1.0	<1.0
Aromatic VPH >C8 - C10	µg/l	<1.0	<1.0
Aromatic EPH >C10 - C12	µg/l	<10	<10
Aromatic EPH >C12 - C16	µg/l	<10	<10
Aromatic EPH >C16 - C21	µg/l	<10	<10
Aromatic EPH >C21 - C35	µg/l	<10	<10
Aromatic EPH >C35 - C44	µg/l	<10	<10
MTBE (Methyl Tertiary Butyl Ether)	µg/l	<3.0	<3.0
Benzene	µg/l	<1.0	<1.0
Toluene	µg/l	<1.0	<1.0
Ethylbenzene	µg/l	<1.0	<1.0
p & m-xylene	µg/l	<1.0	<1.0
o-xylene	µg/l	<1.0	<1.0

2.5. Background Concentrations

Background pollutant concentrations at the surface water sewer were not available. As such, levels were assumed to be 50% of the EQS in accordance with EA guidance for all pollutants.

2.6. Environmental Quality Standards

Table 5 presents the EQSs for pollutants considered within this assessment. These were obtained from the link to current EQSs provided in EA guidance *'Surface water pollution risk assessment for your environmental permit' (EQSs_for_inland_freshwaters.ods)*

- *MAC-EQS Inland Surface Water C1<40mg/l CaC O3, and*
- *Freshwater AA-EQS 0-50mg/l CaCO3,*

In the absence of sufficient monitoring data to determine a representative average concentration, the maximum measured effluent concentration has been adopted as a conservative estimate of the average Release Concentration (RC) for the purposes of this assessment. This approach is precautionary and therefore protective of the receiving water environment.

Standards for pollutants present at more than 10% of the EQS are summarised below in Table 5.

Table 5 EQS and Drinking Water Standards Summary Table (units in µg/l unless stated)

Pollutant	EQS AA (Freshwater)	EQS MAC (Inland Surface Water)
Cadmium	0.08	0.45
Chromium	3.4	32
Copper	1 (bioavailable)	-
Lead	1.2	14
Nickel	4	34
Sulphate	400000	-
Zinc	10.9	-

3.0. Assessment

3.1. Introduction

The assessment was undertaken in accordance with the *'Screening tests for discharges to inland freshwaters'* section of the EA Surface Water guidance. (Surface water pollution risk assessment for your environmental permit - GOV.UK) This comprises four tests to assess whether potential impacts can be screened. The results are provided in the following sections.

3.2. Test 1

Test 1 assesses how the concentration of the substance in the discharge compares with the EQS (whether it is more than 10% of the EQS).

Comparison of concentrations against the EQSs indicates that all determinants can be screened out with the exception of the listed pollutants below in Table 6.

Table 6 Pollutants Recorded at 10% of EQS or greater

Pollutant	Recorded Range (µg/l)	EQS AA (µg/l)	% of EQS
Cadmium	<0.02 – 0.04	0.08	50%
Chromium	<0.1 – 1.5	3.4	44%
Copper	0.6 – 1.2	1	120%
Lead	0.3 – 0.5	1.2	42%
Nickel	1.5 – 3.1	4	78%
Sulphate	19,500 – 75,000	400,000	19%
Zinc	1.5 – 8.9	10.9	82%

Where a pollutant is greater than 10% of EQS, the assessment proceeds to Test 2. Cadmium, Chromium, Copper, Lead, Nickel, Sulphate, and Zinc were carried forward to Test 2 for further assessment.

3.3. Test 2

Test 2 assesses if discharge exceeds acceptable levels after accounting for dilution in the receiving watercourse.

The following data is known:

- The flow data of the surface water sewer is not known. (nrfa.ceh.ac.uk)
    - As a conservative estimate for a minor watercourse, a flow of 0.01 m^3/s (10 L/s) has been adopted. This value is considered suitably conservative for headwaters, field drains, and minor rural watercourses, and is commonly applied in permit screening and early-stage H1 assessments where no site-specific gauged flow data are available.
- The daily discharge volume. (Maximum of 100,000 L/d)

The Process Contribution (PC) is the concentration of a discharged substance in the receiving water after dilution. PC is calculated using these formulas:

1. [Effluent flow rate (EFR, m^3/s)] x [RC (µg/l) Release Concentration of the substance in the effluent]

   (Effluent flow rate, 1.157 L/s = 0.001157 m^3/s)

Table 7 Test 2, Step 1 Results			
Pollutant	**Effluent flow rate, EFR, m^3/s**	**Release Concentration, RC, µg/l**	**result of step 1**
Cadmium	0.001157	0.04	0.00004628
Chromium	0.001157	1.5	0.0017355
Copper	0.001157	1.2	0.0013884
Lead	0.001157	0.5	0.0005785
Nickel	0.001157	3.1	0.0035867
Sulphate	0.001157	75000	86.775
Zinc	0.001157	8.9	0.0102973

2. [EFR, m^3/s] + [the river flow rate (RFR, m^3/s)]

   0.001157 m^3/s + 0.01 m^3/s = 0.011157 m^3/s

3. [Result of step 1] ÷ [result of step 2] = Process Contribution (PC) (µg/l).

Table 8 Test 2, Process Contribution Results					
Pollutant	**Result of step 1**	**result of step 2**	**Process Contribution (PC) (µg/l).**	**EQS AA µg/l (Freshwater)**	**% of the EQS?**
Cadmium	0.00004628	0.011157	0.004148	0.08	5.18%
Chromium	0.0017355	0.011157	0.15556	3.4	4.57%
Copper	0.0013884	0.011157	0.12443	1 (bioavailable)	12.44%
Lead	0.0005785	0.011157	0.05186	1.2	4.32%
Nickel	0.0035867	0.011157	0.32148	4	8.04%
Sulphate	86.775	0.011157	7777.5	400000	1.94%
Zinc	0.0102973	0.011157	0.92293	10.9	8.47%

If the PC value is:

- equal to or less than 4% of the EQS no further tests are needed (unless the substance is a Priority Hazardous Substances (PHS))
- greater than 4% of the EQS then tests 3 and 4 are required

No further tests were needed for Sulphate as the Process Contribution (PC) was less than 4% of the EQS.

Remaining pollutants were carried forward to Test 3 for further assessment.

3.4. Test 3

Test 3 assesses how the difference between background water quality and the predicted environmental concentration (PEC) compares with the EQS. The test checks whether the proposed discharge increases the concentration of the substance downstream by more than 10% of the EQS.

An estimate flow of 0.0263 m^3/s (26.3l/s) has been adopted for Porset brook based on Qbar.

As Background Concentration (BC) data was not available, the Estimated Water Quality of Porset Brook was used.

Table 9 Test 3, Estimated Water Quality of Porset Brook

Pollutant	EQS AA µg/l (Freshwater)	50% of the EQS AA µg/l
Cadmium	0.08	0.04
Chromium	3.4	1.7
Copper	1 (bioavailable)	0.5
Lead	1.2	0.6
Nickel	4	2
Zinc	10.9	5.45

If the river flow rate (RFR)is equal to or less than ten times the Effluent flow rate (EFR), the Predicted Environmental Concentration (PEC)PEC is calculated by the following 5 steps.

1. [EFR (m^3/s)] x [RC (µg/l)]

Table 10 Test 3, PEC Calculation Step 1

Pollutant	Effluent flow rate, EFR, m^3/s	Release Concentration, RC, µg/l	result of step 1
Cadmium	0.001157	0.04	0.00004628
Chromium	0.001157	1.5	0.0017355
Copper	0.001157	1.2	0.0013884
Lead	0.001157	0.5	0.0005785
Nickel	0.001157	3.1	0.0035867
Zinc	0.001157	8.9	0.0102973

2. [RFR (m^3/s)] x [BC (µg/l)]

Table 11 Test 3, PEC Calculation Step 2

Pollutant	River Flow Rate (RFR), m^3/s (Porset Brook)	Background Concentration (BC), µg/l (50% of the EQS AA µg/l)	result of step 2
Cadmium	0.0263	0.04	0.001052
Chromium	0.0263	1.7	0.04471
Copper	0.0263	0.5	0.01315
Lead	0.0263	0.6	0.01578
Nickel	0.0263	2	0.0526
Zinc	0.0263	5.45	0.143335

3. [Result of step 1] + [Result of step 2]

Table 12 Test 3, PEC Calculation Step 3			
Pollutant	**result of step 1**	**result of step 2**	**result of step 3**
Cadmium	0.00004628	0.001052	0.00109828
Chromium	0.0017355	0.04471	0.0464455
Copper	0.0013884	0.01315	0.0145384
Lead	0.0005785	0.01578	0.0163585
Nickel	0.0035867	0.0526	0.0561867
Zinc	0.0102973	0.143335	0.1536323

4. [EFR (m^3/s)] + [RFR (m^3/s)]

0.001157 + 0.0263 = 0.027457

5. [Result from step 3] ÷ [Result from step 4] = PEC (µg/l)

Table 13 Test 3, PEC Calculation Step 5			
Pollutant	**result of step 3**	**result of step 4**	**PEC Calculation (µg/l)**
Cadmium	0.00109828	0.027457	0.04
Chromium	0.0464455	0.027457	1.6916
Copper	0.0145384	0.027457	0.5293
Lead	0.0163585	0.027457	0.5957
Nickel	0.0561867	0.027457	2.046
Zinc	0.1536323	0.027457	5.595

If the difference between background water quality and the PEC does not exceed 10% of the EQS - go to test 4

Table 14 Test 3, Predicted Environmental Concentration (PEC)						
Pollutant	**PEC (µg/l)**	**EQS AA µg/l**	**10% of EQS (µg/l)**	**BC (µg/l) 50% EQS**	**PEC – BC (µg/l)**	**Exceeds 10% of EQS?**
Cadmium	0.04	0.08	0.008	0.04	0.000	No - go to test 4
Chromium	1.6916	3.4	0.34	1.7	0.145	No - go to test 4
Copper	0.5293	1 (bioavailable)	0.1	0.5	0.0293	No - go to test 4
Lead	0.5957	1.2	0.12	0.6	-0.0043	No - go to test 4
Nickel	2.046	4	0.4	2	0.046	No - go to test 4
Zinc	5.595	10.9	1.9	5.45	-0.0084	No - go to test 4

All pollutants proceed to Test 4.

3.5. Test 4

Test 4 checks if the PEC exceeds the EQS in the receiving water downstream of the discharge. This test checks if the EQS is complied with in the receiving water by checking whether the PEC (calculated in test 3) is higher than the EQS.

Table 15 Test 3, PEC Calculation Step5

Pollutant	PEC Calculation (µg/l)	EQS AA µg/l	PEC exceeds AA EQS?	Outcome
Cadmium	0.04	0.08	No	No modelling needed
Chromium	1.6916	3.4	No	No modelling needed
Copper	0.5293	1.0 (bioavailable)	No	No modelling needed
Lead	0.5957	1.2	No	No modelling needed
Nickel	2.046	4.0	No	No modelling needed
Zinc	5.595	10.9	No	No modelling needed

An additional screening step is required for PHSs in discharges to inland freshwaters and to coastal waters and estuaries (including via the foul sewer or for discharges of cooling waters).

4.0. Additional screening tests for PHSs

4.1. Significant load test

Cadmium is an identified PHH. This test checks whether the annual load discharged for the PHS is greater than the significant load limit set for the PHS.

Calculating the annual load:

1. [Average discharge concentration (µg/l)] x [average flow (litres per day)]

   0.04 µg/l x 100,000 L/d = 4000 µg/day

2. [Result of step 1] ÷ by 1,000 = result in mg per day

   4000 ÷ by 1,000 = 4 mg per day

3. [Result of step 2] ÷ by 1,000 = result in g per day

   4 ÷ by 1,000 = 0.004 g per day

4. [Result of step 3] ÷ by 1,000 = result in kg per day

   0.004 ÷ by 1,000 = 0.000004 kg per day

5. [Result in kg per day] x [number of discharge days per year] = annual load (kg per year)

   0.000004 X 365 = 0.00146 kg per year

If the discharge is continuous throughout the year, the number of days will be 365 days.

The annual significant load limit (kg) for Cadmium is 5 kg.

As the annual load is less than the significant load limit, the outcome will depend on the previous screening results. As the initial screening for Cadmium reported no modelling is needed, no modelling is needed.

5.0. Conclusion

Prichard's undertook a Surface Water Pollution Risk Assessment in support of a Surface Water Discharge Permit for Phase 2 Remediation Works at Virginia Park, Caerphilly.

Site operations have the potential to cause surface water impacts because of pollutants released within their effluent discharge during normal operation. A Surface Water Pollution Risk Assessment was therefore required to assess potential risks to the environment.

An assessment using a standard screening tool was undertaken in order to predict pollution levels as a result of operations. The findings indicated that substances were screened out by screening tests 1, 2, 3 and 4 and that the annual load of Priority Hazardous Substances are less than the significant load limit.

The Surface Water Pollution Risk Assessment indicates there are no significant risks to the environment.