Surface Water Quality Flow and Baseline
Surface Water Discharge

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Approved by	**S.Fraei**	Role	

REVISION HISTORY

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Notice

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Document History

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1. Introduction

1.1. General

AtkinsRéalis (Atkins) have been commissioned by EDF (SZC) NNB GEN Co ('The client') to determine surface water baseline conditions and develop proposed limiting values for the discharge of surface water from development areas to watercourses at Sizewell C Belts (herein Sizewell Belts) and Leiston Drain, collectively referred to herein as the watercourses.

It is anticipated that the baselining activity and associated limiting values will be utilised to design Sustainable Urban Drainage treatment systems and demonstrate surface water run-off management aligns with the Sizewell C Early Works Drainage Strategy (Atkins Limited, 2020) in fulfilment of the requirements of the Development Consent Order (DCO). Additionally the baselining exercise is anticipated to be used in support of regulatory engagement and the acquisition of an environmental permit for the discharge of surface water to freshwater watercourses across the site area during the enabling works and construction phases.

1.2. Objective

The objective of these works is to use available surface water quality collected during previous phases of monitoring and to summarise baseline information on surface water quality and flow at Sizewell Belts and Leiston Drain.

The baseline water quality data has then been utilised to develop appropriate limiting values for surface water discharge in relation to key determinands.

1.3. Scope of Works

In order to achieve the objectives outlined in Section 1.2 the following scope has been completed:

- Summary and presentation of the surface water monitoring points where data has been collected and will be utilised within this assessment.
- Presentation of the 2019 Cycle 2 Water Framework Directive (WFD) classifications completed for Leiston Beck Water Body (Environment Agency, 2021) and derivation of WFD specific screening criteria for selected determinands. Atkins notes cycle 3 2022 is recorded as "does not require assessment" and, therefore, cycle 2 classification status has been applied.
- Collation, screening and summary of baseline surface water data recovered across the Sizewell Belts and Leiston Drain between November 2014 and June 2022.
- Presentation of mean and Q95 flow calculations using surface water flow data collected during the baseline monitoring programme.
- Utilisation of selected lines of baseline data to derive and justify appropriate water quality discharge limit values for key determinands.

1.4. Sizewell C Drainage Strategy

As part of Sizewell C enabling works, the majority of the site within the red line boundary will be stripped of topsoil and regraded, a Red Line Boundary of the site is provided as Figure 2-1. Prior to these activities all rainwater falling on the site is expected to infiltrate to ground, as per current baseline scenario. During construction surface water runoff will be to infiltration where possible, but it is expected that at some point as earthworks progress, discharge to watercourses will be required.

Prior to the construction of the overall surface water network described in the Sizewell Drainage Strategy, provision of early surface water management will be required to limit flow and ensure that surface water reaching the watercourses is of on appropriate quality.

This Technical Note pertains to the development of limiting values in support of a permit application that will allow for the discharge of surface water via outfalls into freshwater water courses from commencement of the Sizewell enabling works.

2. Baseline Quality and Flow Data

Surface water quality monitoring has been progressed at 7no. monitoring points at the site since November 2014, the monitoring dates and locations sampled are summarised in Table 2-1.

Table 2-1 - Monitoring Round Summary

Monitoring Dates	Locations Monitored
10 – 13 November 2014	G1, G3, G4, G5, G6a, G7a
9, 10 & 17 June 2015	G1, G3, G4, G5, G6A, G7A, G8, SW1, SW2, SW3, SW4, SW8
15, 17 & 22 July 2015	G3, G4, G6A, G7A, G8, SW1, SW10, SW2, SW3, SW4, SW8
17, 18 & 24 July 2018	G3, G3A, G4, G6A, G5, G5A, G1, G7A
11 & 13 June 2019	G8, G5, G6a, G1, G7a,G4
12 & 20 November 2020	G1, G3, G4, G5, G6A, G8
11 – 13, 18 & 19 May 2021	G1, G3, G4, G5, G6a, G7A
16 – 18 November 2021	G1, G3, G4, G5, G6a, G7a, G8, GW8
14, 16, 22 and 28 November 2022	G1, G3, G4, G5, G6a, G7A, G8

Surface water flow monitoring data (calculated from measured level and velocity) has been collected at 15-minute intervals between 2013 and 2021 at monitoring locations G1, G4, G5, G6A and G7A. Level only has been measured at G3.

Figure 2-1 presents the surface water monitoring points where data has been collected with the location and monitoring rationales **detailed in** Table 2-2**.**

Table 2-2 - Summary of Surface Water Monitoring Points and Monitoring Rationales

Location	Monitoring ID	National Grid Reference	Rationale
North of MCA	G1	647424, 264671	Downstream location to monitor total outflow from the Sizewell Marshes Site of Special Scientific Interest (SSSI) (downstream of the Leiston Beck/Sizewell Drain confluence) in the Leiston Drain.
MCA	G3	646127, 263717	Control structures (weirs) located to determine the partitioning of flow between Leiston Drain (G4) and Sizewell Drain (G3) at the upstream end of the Sizewell Marshes SSSI
MCA	G4	645827, 263799	
West of MCA	G5	645407, 263468	Upstream location to monitor surface water inflows to the Sizewell Marshes SSSI through the Leiston Drain, within the extent of the Aldhurst Farm Habitat Creation Scheme
MCA	G6a	646994, 264453	Downstream locations in the Leiston Drain (G6a) and Sizewell Drain (G7a)
MCA	G7a	647271, 264404	
MCA	G8	647603, 265627	Downstream location in Sizewell Marshes to the north.

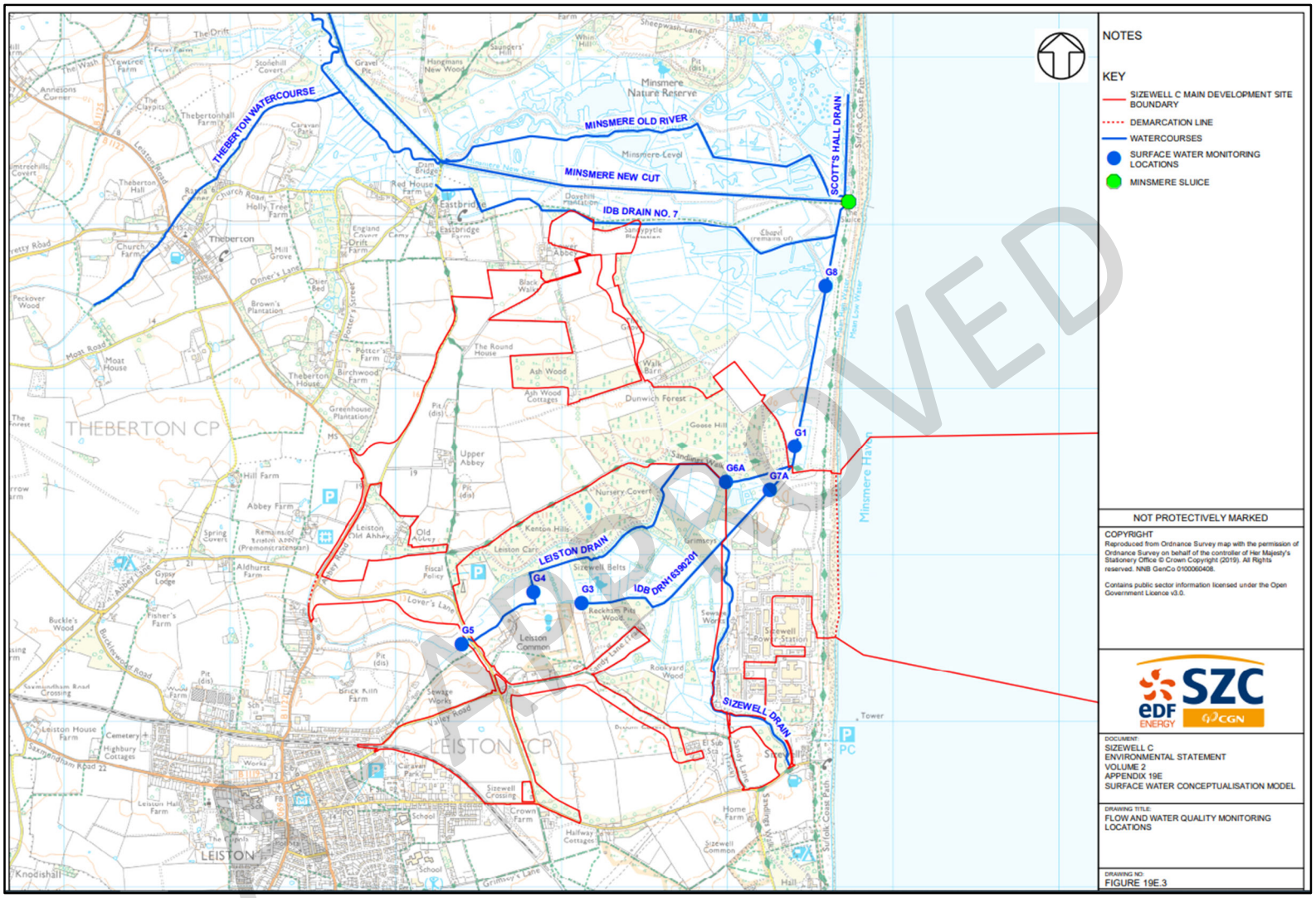

Figure 2-1 - Surface Water Sampling Locations

2.1. Surface Water Quality Data Summary

A total of 69no. samples were recovered from the 7no. sampling locations across the surface water monitoring regime between 2014 and 2022.

A further sample recovered from location G8 is noted to have been mislabelled 'GW8' in November 2021, this sample has been treated as one recovered from G8 herein.

Surface water samples were tested for a comprehensive suite of parameters to include baseline water quality indicators and contaminants, as detailed in the Sizewell C Groundwater, Surface Water and Ground Gas Monitoring Strategy (Atkins Ltd, March 2022) following determinands across the regime:

- Water quality indicators including pH, Electrical Conductivity, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), suspended solids at 105°c, alkalinity (total)
- Nutrients including chloride, ammonium, nitrite, nitrate, phosphate, phosphorus (total), sulphate, total oxidised nitrogen, sodium, dissolved organic carbon, total organic carbon
- Dissolved metals including chromium (hexavalent), chromium (trivalent), arsenic, boron, cadmium, chromium, copper, manganese, nickel, lead, zinc, iron, phosphorus, calcium, potassium, magnesium, and mercury (low level)
- Total metals including arsenic, boron, cadmium, chromium, copper, iron, manganese, nickel, lead, zinc
- A comprehensive suite of organic compounds and contaminants, the full list of individual compounds is presented in Appendix A.

Atkins note that testing samples for the 12no. congener PCB suite and a number of the SVOC / VOC determinands was only initiated in July 2018 and June 2019 respectively.

Atkins acknowledge that 10 no. samples were mislabelled SW1 – 4, SW8 and SW10 during monitoring completed in 2015, it cannot be confirmed which of the sampling locations these relate to, as such, they have been treated as standalone samples in any data presentation or discussion.

Surface water quality data for a selection of key determinands are summarised within Table 2-3. Based on the parameters shown the water quality is typical of lowland rivers, with high alkalinity reflective of the carbonate content of soils in the catchment. There are high maximum values for some nutrients including ammonium, chemical oxygen demand and phosphorus which may be indicative of inputs from wastewater treatment.

The associated data is presented in full within Appendix A and included those determinands that exhibited concentrations below LOD.

Table 2-3 – Data Summary of Key Determinands

Determinands	Minimum value	Maximum value	Average value*	Total Tests	Detections above LOD
pH	7.2	9.2	8.02	69	69
Electrical conductivity (µS/cm)	100	1600	957	69	69
Biochemical Oxygen Demand (mg O2/l)	1	16	4.33	14	28
Chemical Oxygen Demand (mg O2/l)	8.7	88	20.43	28	28
Suspended Solids At 105°C (mg/l)	5	2300	156	57	69
Alkalinity (Total) (mg/l)	110	740	351	69	69
Ammonium as N (mg/l)	<0.50	66.89	3.66	69	68
Phosphorus (Total) (mg/l)	<0.020	0.3	3.36	34	33
Total TPH >C6-C40 (µg/l)	<10	190	15.19	62	55

*Average concentrations do not include laboratory results recorded below respective Limits of detection (LOD).

2.2. Water Framework Directive Screening

A WFD Classification of Leiston Beck (Environment Agency ID GB105035046271), NGR TM 46927 64490 completed in 2019 is available on the Environment Agency's Catchment Explorer website. Classifications and ratings from this assessment has been summarised in Table 2-4.

Table 2-4 - Summary of Publicly Available WFD Classification Information - Leiston Beck Water Body

Classification Item	2019 Classification	Reason for not achieving good
Ecological	Moderate	-
Biological quality elements	Moderate	-
Invertebrates	Good	-
Macrophytes and Phytobenthos Combined	Moderate	-
Macrophytes Sub Element	Moderate	-
Physico-chemical quality elements	Moderate	-
Ammonia (Phys-Chem)	Moderate	-
Dissolved Oxygen	Bad	Sewage discharge (continuous)
Phosphate	Moderate	Sewage discharge (Continuous)
Temperature	High	-
pH	High	-
Hydromorphological Supporting Elements	Supports good	-
Hydrological Regime	Does not support good	-
Supporting elements (Surface Water)	Moderate	-
Mitigation Measures Assessment	Moderate or less	Physical modification
Specific Pollutants	High	-
Copper	High	-
Iron	High	-
Manganese	High	-
Permethrin	High	-
Triclosan	High	-
Zinc	High	-
Chemical	Fail	Not provided
Priority Hazardous Substances	Fail	Not provided
Benzo(a)pyrene	Good	
Cadmium and it's compounds	Good	-
Di(2-ethylhexyl)phthalate	Good	-
Dioxins and dioxin-like compounds	Good	-
Heptachlor and cis-Heptachlor epoxide	Good	-
Hexabromocyclododecane (HBCDD)	Good	-
Hexachlorobenzene	Good	-
Hexachlorobutadiene	Good	-
Mercury and Its Compounds	Fail	Not provided
Perfluorooctane sulphonate (PFOS)	Good	-

Classification Item	2019 Classification	Reason for not achieving good
Polybrominated diphenyl ethers (PBDE)	Fail	Not provided
Tributyltin Compounds	Good	-
Priority substances	Good	-
Cypermethrin (Priority)	Good	-
Fluoranthene	Good	-
Lead and Its Compounds	Good	-
Nickel and Its Compounds	Good	-

2.3. Derivation of Screening Criteria in Line with Water Framework Directive

Following the review of the 2019 WFD assessment, a number of parameters whose Environmental Quality Standards (EQS) are contingent upon the water body type and altitude have been derived using the *WFD Guidance presented in Schedule 2 – Categorisation of surface water body types* (European Council, 2015). These determinands include ammonia as nitrogen, phosphorous and biochemical oxygen demand (BOD). Atkins notes that no dissolved oxygen results were collected during baseline monitoring thus criteria for that determinant has not been derived.

Table 2-5 presents the values used to determine the water body type against the WFD criteria outlined in Table 2-5. The assessment indicates the Leiston Beck catchment to be a Type 7 water body, Table 2-6 to Table 2-8 present the appropriate criteria to be adopted for Total Ammonia as N, phosphorous and BOD.

Table 2-5 - Water Body Type Classification

Site Altitude	Baseline Criteria (Alkalinity)	Alkalinity (as CaCO3 mg/l) Classifications				
~ 0 m AOD	**331 mg/l**	<10	≥10 to <50	≥ 50 to <100	≥100 to <200	Over 200
Under 80 m AOD		Type 1	Type 2	Type 3	Type 5	Type 7
Over 80 m AOD				Type 4	Type 6	-

Blue highlighting indicates criteria aligns with that recorded in baseline data / review of WFD or site information.

Table 2-6 - Ammonia Screening Criteria WFD

Type	Total Ammonia as nitrogen (mg/l) *90th percentile*			
WFD Objective	High	Good	Moderate	Poor
1, 2, 4 and 6	0.2	0.3	0.75	1.1
3, 5 and 7	0.3	0.6	1.1	2.5

Blue highlighting indicates criteria aligns with that recorded in baseline data / review of WFD or site information.

Table 2-7 - WFD Phosphorus Criteria

WFD Objective	Annual mean total phosphorus concentration (µg/l)			
	High	Good	Moderate	Poor
Standard	5	8	16	32

Blue highlighting indicates criteria aligns with that recorded in baseline data / review of WFD or site information.

Table 2-8 - Biochemical oxygen demand (BOD) WFD Criteria

	Biochemical oxygen demand (BOD) standards for rivers (mg/l) *90th Percentile*			
Type	High	Good	Moderate	Poor
1, 2, 4, 6 and salmonid	3	4	6	7.5
3, 5 and 7	4	5	6.5	9

Blue highlighting indicates criteria aligns with that recorded in baseline data / review of WFD or site information.

2.4. Surface Water Data Screening

Surface water samples recovered from the monitoring points have been screened against Freshwater EQS (European Council, 2015) which are generally protective of receptors in freshwater surface water bodies. The screening criteria adopted for ammonia, BOD and phosphorus have been determined through review of the WFD classification with the values and rationales previously presented in Table 2-5 to Table 2-8.

The surface water monitoring points which have been included in the assessment are upstream of tidal effects and therefore it has not been deemed necessary to screen data against Coastal and Estuarine Environmental Quality Standards.

Surface water data has been processed through the Environment Agency WFD Metal Bioavailability Assessment tool (M-BAT) (Water Framework Directive - United Kingdom Technical Advisory Group (WFD-UKTAG), 2014) which has been used to derive predicted no effect levels (PNEC) for copper, lead, nickel, manganese and zinc. In line with the guidance, the 10th Percentile PNEC for calculated values were used as the Generic Assessment Criteria (GAC) in the screening exercise, the M-BAT assessment and PNECs are presented in Appendix B. The EQS value for cadmium has been adjusted based on average surface water hardness as per Environment Agency guidance (Environment Agency, April 2008).

On completion of the sample screening exercise, a number of inorganic determinands exhibited concentrations that exceeded the adopted EQS criteria, these have been summarised in Table 2-9 with the full screening results provided as Appendix C.

Table 2-9 - Summary of EQS Screening Exercise

Constituent	Unit	GAC (mg/l)	No. of Samples	Min. Value	Max. Value	No. of Exceeds	Locations of Exceedances (No.Exceeds)
Chloride	mg/l	250	69	50	350	6	SW8; G1; G8 (4)
Total ammonia as N*	mg/l	0.6	69	<0.05	86	13	G1 (3); G3 (2); G4 (1); G5 (1); G6A (2); G7A (1); GW8; ; SW1
Nitrite	mg/l	0.01	61	<0.02	1.1	56	G3 (7); G4 (7); G5 (7); G6A (8); G7A (6); G8 (4); SW1 (2); SW10; SW2; SW3; SW4; SW8 (2)
Cadmium (Dissolved)	mg/l	0.00008	69	<0.00008	0.00056	7	G5; G6a (2); SW2; SW8; G7A
Copper (Dissolved)	mg/l	0.0134	69	<0.0005	0.031	1	G1
Manganese (Dissolved)	mg/l	0.123	41	<0.001	17	15	G1 (4); G3; G4 (2); G5 (2); G6A; G7A; G8 (3); GW8
Nickel (Dissolved)	mg/l	0.00859	69	<0.0005	0.021	3	G7A; G3; G4
Zinc (Dissolved)	mg/l	0.0348	69	0.0014	0.046	2	G1
Iron (Dissolved)	mg/l	1	69	<0.005	10	2	G1; GW8

*Results reported as ammonium converted to total ammonia as N using molecular weight of compounds in order to progress screening process.

2.5. Summary of EQS Screening

On completion of the screening exercise a number of sampling locations exhibited inorganic and metal determinand concentrations that exceeded the freshwater EQS or WFD derived criteria. A total of 13 of 69no. samples exceeded the WFD derived criteria for total ammonia as N. As displayed within the box and whisker plots presented in Figure 2-2, the highest concentrations for total ammonia as N were consistently recorded in G8 (average of 11.07 mg/l) where 2 of 7no. samples exceeded the WFD derived criteria and a maximum concentration of 66.8 mg/l. Atkins note that the highest concentrations in G1, G3, G4 and G8 were all recorded on the same monitoring round which may be indicative of a pollution event, Figure 2-3 presented the distribution of Total Ammonia with the outlier values removed.

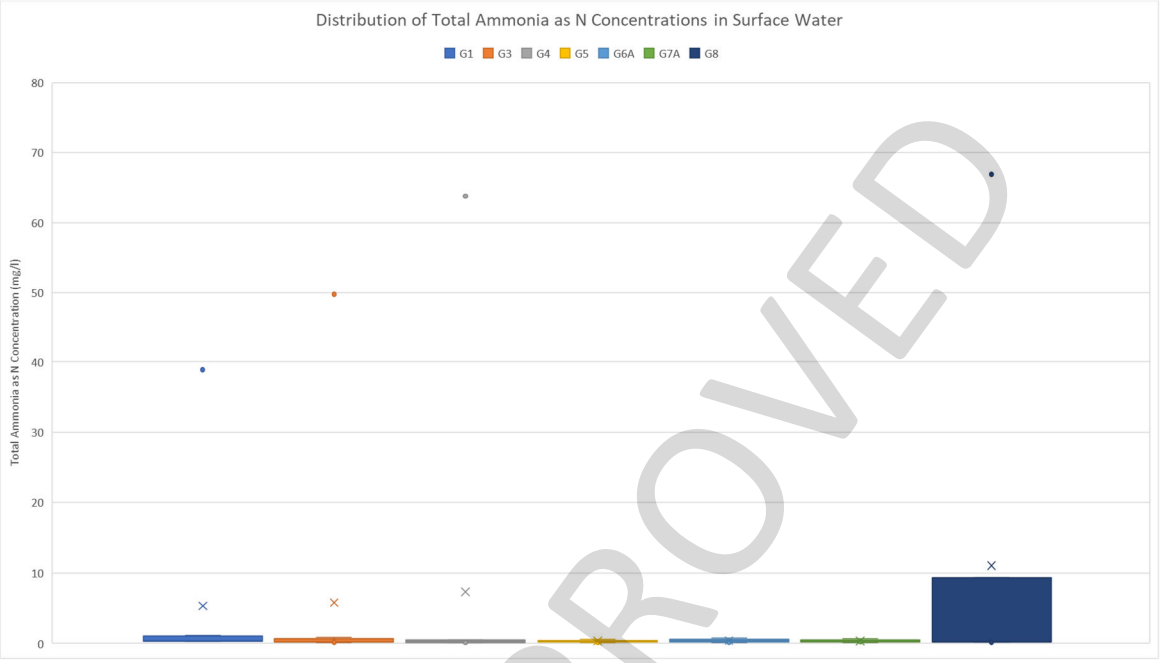

Figure 2-2 – Box and Whisker Plots - Distribution of Total Ammonia Concentrations in Surface Water

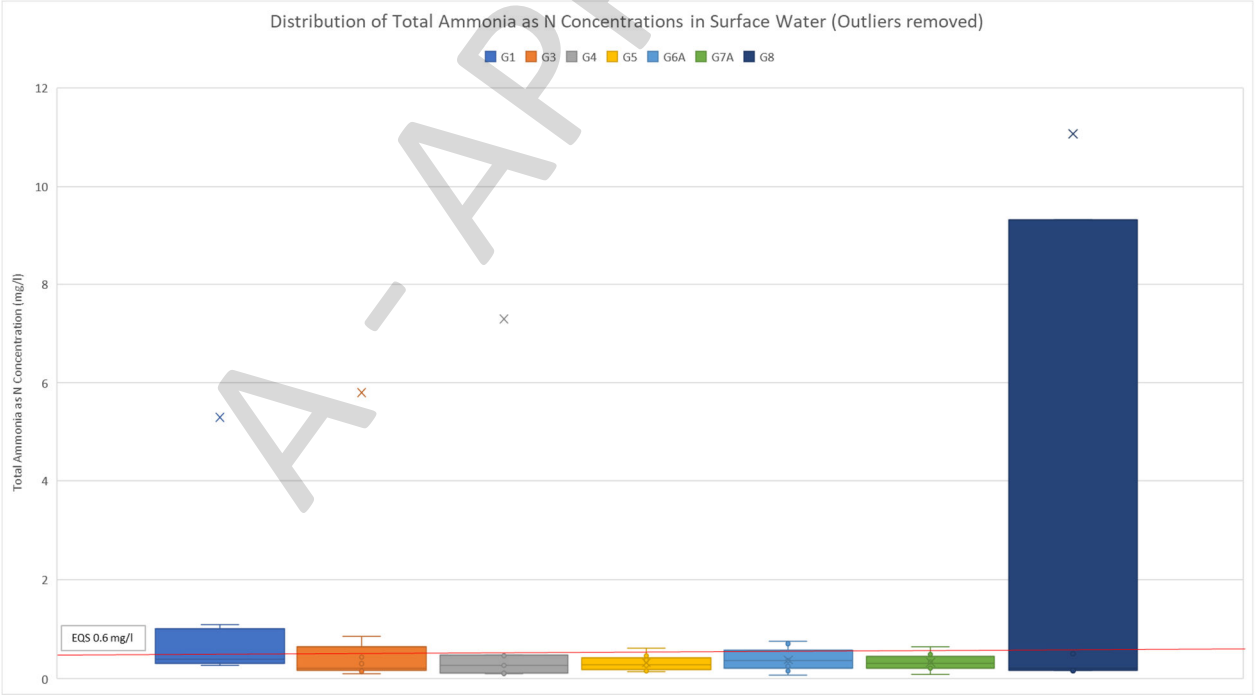

Figure 2-3 - Box and Whisker Plots - Distribution of Total Ammonia Concentrations in Surface Water (Outliers removed)

Nitrite concentrations exceeded EQS in 56 of 61no. samples, it is noted that the LOD of 0.2 mg/l exceeded the EQS of 0.01 mg/l and therefore any detectable concentrations of nitrite have been recorded as exceedances, it is also noted that concentrations of nitrite were recorded of up to 1.1 mg/l in SW1, June 2015.

Figure 2-4 presents box and whisker plots of nitrite concentrations recorded in at sampling locations and indicates the highest average and maximum concentrations were recorded in G5, other locations presented similar average concentrations on completion of the monitoring regime. G5 is noted to be the location situated in closest proximity to the sewage treatment works.

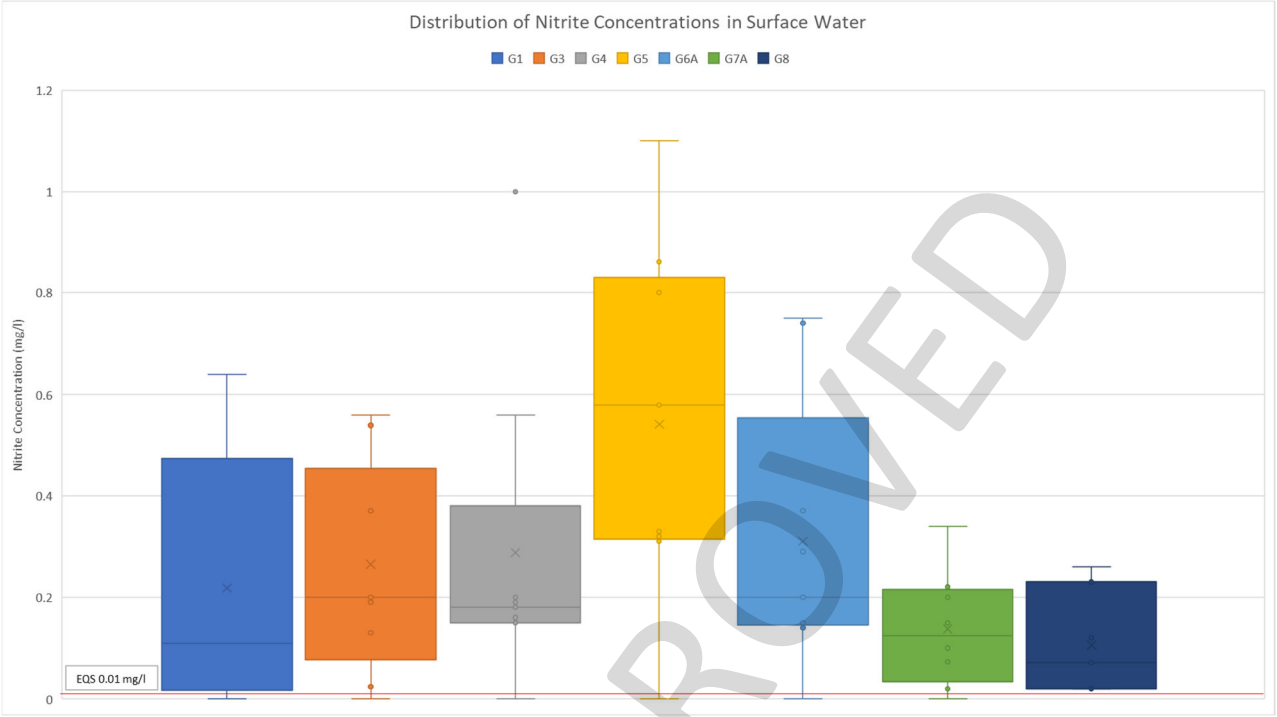

Figure 2-4 - Box and Whisker Plots - Distribution of Nitrite Concentrations in Surface Water

A number of samples presented metal concentrations that exceeded the adopted EQS (or M-BAT PNEC) criteria, the majority of these exceedances related to cadmium and manganese which presented 7 of 69no. and 15 of 41no. exceedances respectively, other metal exceedances such as copper, nickel, zinc and iron were limited to less than 3no. samples across the regime.

Given the frequency of exceedances, the distribution of manganese has been graphed on box and whisker plots and is presented as Figure 2-5. The box and whisker plots indicates though the highest concentrations of manganese were consistently recorded in G8, the maximum concentration of 17,000 µg/l is a significant outlier both within the context of G8 and the other locations monitored. Figure 2-6 presents the concentrations of manganese recorded with outlier values removed.

As discussed in Section 2.4, Atkins have utilised the EA M-BAT tool for screening purposes which is held in Appendix B, the results of the screening for manganese, copper, zinc and nickel broadly align with the M-BAT assessment progressed.

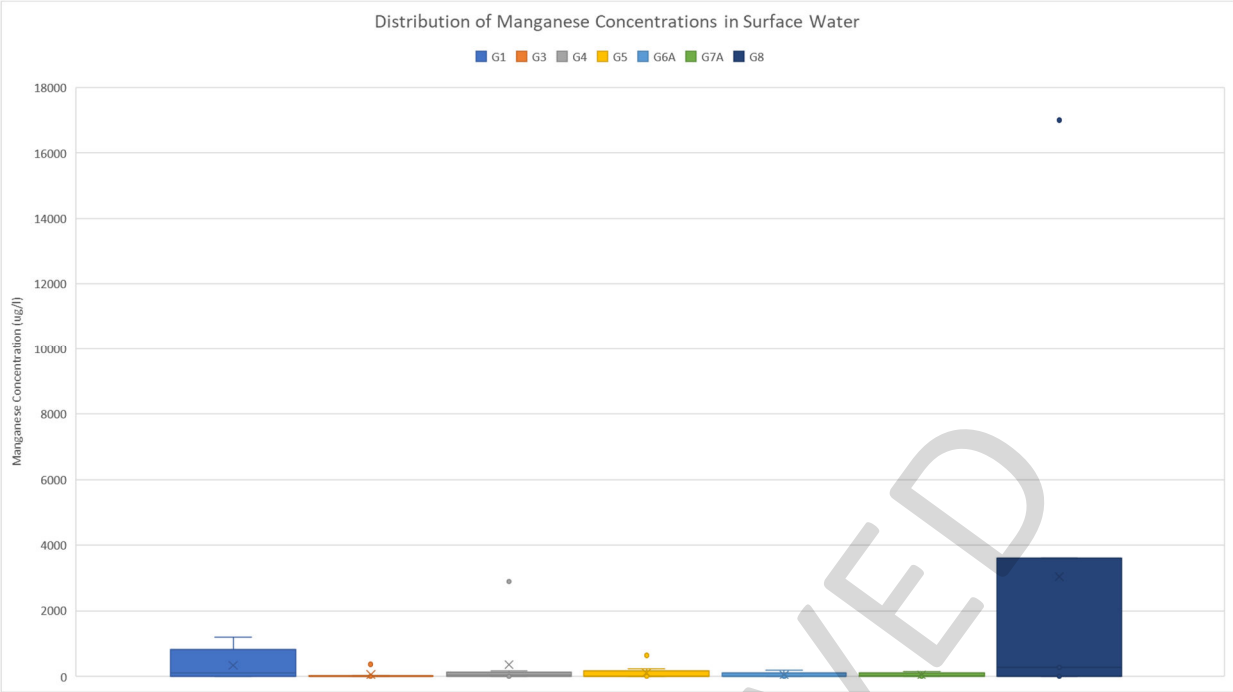

Figure 2-5 - Box and Whisker Plots - Distribution of Manganese in Surface Water

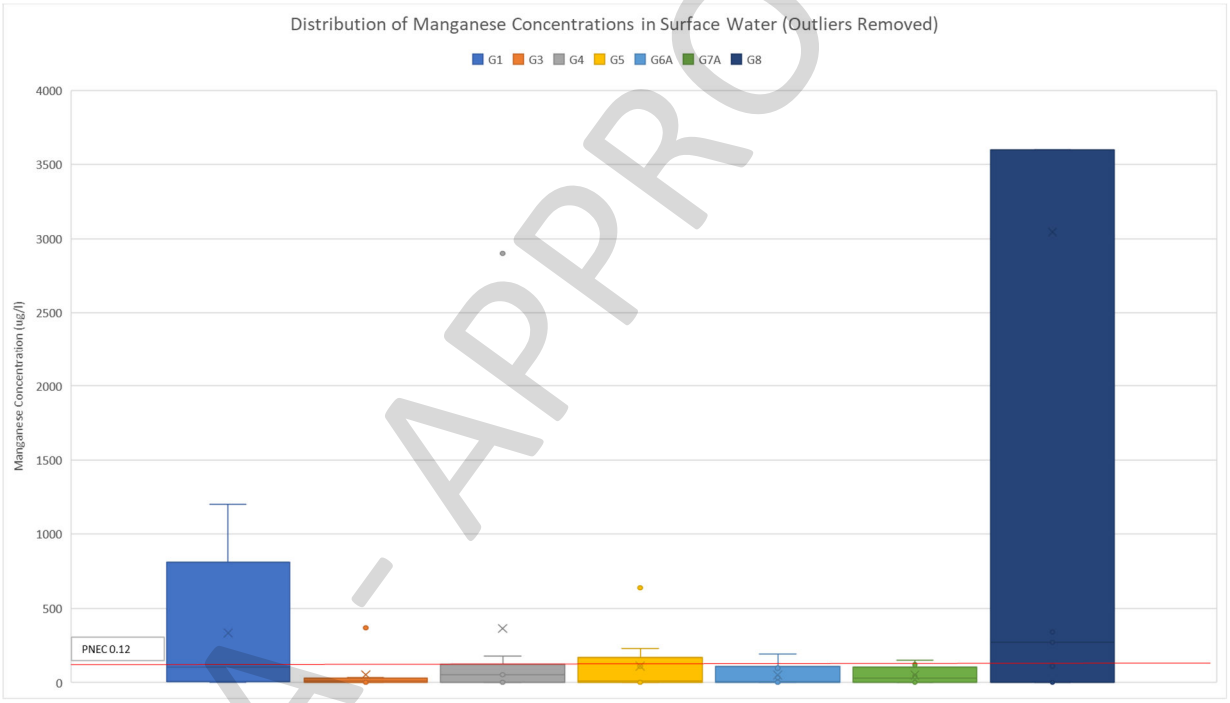

Figure 2-6 - Box and Whisker Plots - Distribution of Manganese in Surface Water (Outliers Removed)

Atkins note that no testing of organic determinands resulted in exceedances of the adopted EQS criteria, the majority of organic determinands returned results below the laboratory detection limits with the exception of Total TPH (7 of 62no.) and trichloroethene (2 of 69no.).

2.6. Surface Flow Monitoring Locations and Data

Surface water flow monitoring level has been collected at 15-minute intervals between 2013 and 2021 at monitoring locations G1, G4, G5, G6A and G7A. Monitoring locations are shown in Figure 2-1.

The level data from the monitoring locations summarised in this section have been utilised to calculate flows using measured velocity and stage using a calibrated rating equation which has been provided by Hydro-logic Services LLP.

G1 is located near to, and downstream of the SSSI crossing. G3 and G4 are control structures (weirs) located to determine the partitioning of flow between Leiston Drain (G4) and Sizewell Drain (G3) at the upstream end of the Sizewell Marshes SSSI. G6A and G7A are near to, and upstream of the crossing, on separate inflowing channels: the Leiston Drain and Sizewell Drain respectively. G4 is further upstream on the Leiston Drain, and G5 is located further to the west and monitors the Leiston Drain upstream of Sizewell Marshes. At G3 the weir separates a branch of the Leiston Drain (upstream) from the at the head of an Internal Drainage Board (IDB) drain above Sizewell Drain (downstream). The recorded stage data indicates that the water does not reach the weir crest, indicating no flow past this point, for much of the time.

The flow in the Leiston Drain is dominated by input from Leiston Sewage Treatment Works, which is augmented during rainfall events by surface runoff from Leiston (Atkins Limited, March 2015). G5 is downstream of the inputs from Leiston Sewage Treatment Works and Brick Kiln Farm, which are considered to provide a baseflow (Atkins Limited, March 2016).

2.6.1. Calculation of Mean Flow and Q95 Low Flow Value

A review of monthly gauging results has shown that the calculated flows based on the continuous monitoring data can be subject to significant errors. Errors are most likely due to vegetation in a relatively wide deep slow flowing channel. This is most noticeable at G6A and G1, where errors of up to 75% and 100%, respectively, have been recorded. Errors at G5 and G7 are generally less than 40%. Flows calculated at G4, which is a weir gauge, are subject to smaller errors (on average 15%).

Timeseries flow and stage data has been analysed at each flow monitoring location with any suspect data removed from the dataset. The suspect data included:

- Flow velocity readings where there was no corresponding stage data meaning that flow volume could not be calculated using the calibrated rating equation.
- It is also noted that there were extended periods of continuous unchanging negative flow velocity values which were deemed to be indicative of an instrument fault.

The mean flow and Q95 results at monitored locations are summarised in Table 2-10 with the calculations and flow duration curves and the flow and stage data summary as Appendix D.

Table 2-10 - Summary of Mean Flow and Q95 Results

Monitoring Location	Mean Flow (m^3/s)	Q95 Low Flow (m^3/s)	Data confidence
Leiston Drain upstream of crossing			
G5	0.0508	0.0168	Medium
G4	0.0848	0.0267	High
G6A	0.0783	0.0350	Medium / Low
Sizewell Drain upstream of crossing			
G3 (branch of Leiston Drain flowing into Sizewell Drain)	No data*	No data*	-
G7A	0.0527	0.0009	Low
Downstream of crossing			
G1	0.0690	-0.0419	Low

* stage data indicates that the water does not reach the weir crest, indicating no flow past this point, for much of the time

3. Derivation of Limiting Values for Surface Water Discharge

This section derives limiting values for surface water discharge to watercourses, where it may be required to support the management of the early surface water runoff on site.

3.1. Selection of Parameters Requiring Limiting Values

Limiting values have been proposed for pH, suspended solids and Visible Oil and Grease in line with the early works drainage strategy. These parameters for limiting values broadly align with CIRIA guidance (Woods Ballard, et al., 2015), but are refined from guidance based on the activities that will take place in the scheme and expected contaminants associated with those activities:

- It is understood the majority of the site within the red line boundary will be stripped of topsoil and regraded as part of Sizewell C enabling works.
- Limiting values for dissolved organics (such as petroleum hydrocarbons, BTEX, phenols or chlorinated solvents) are not required as such inputs (which are not expected to occur in normal activities on the site) are controlled via limiting value for visible oil and grease.
- Metal inputs will be managed through controlling and limiting the suspended solids discharged.
- Foul wastewater will not be discharged to the surface water network. It is understood that during early works (prior to commissioning of the discharge to sea via the CDO) foul waste is likely to be transported offsite to a permitted wastewater treatment facility. As such, it has not been deemed necessary to derive limiting values for nutrients such as ammonia, phosphorous and other nitrogen compounds.
- Chemical dosing to treat the water may be required to ensure suspended solids and pH are within the required limits prior to outfall. A risk assessment for the effect of these is included in Appendix E, which indicates the dosing will not result in any hazardous or polluting chemicals being present in the discharge.

3.2. Derivation of Limiting Values

3.2.1. pH Limiting Values

Figure 3-1 presents the range of pH results that have been recorded within the baseline surface water monitoring regime, results ranged between 7.2 and 9.2 pH with an average of 8.02 pH.

All but one of the baseline pH measurements are within the range of the freshwater operational EQS, which is between 6 and 9 pH. Atkins therefore propose limiting values of between 6 and 9 pH to align with the EQS.

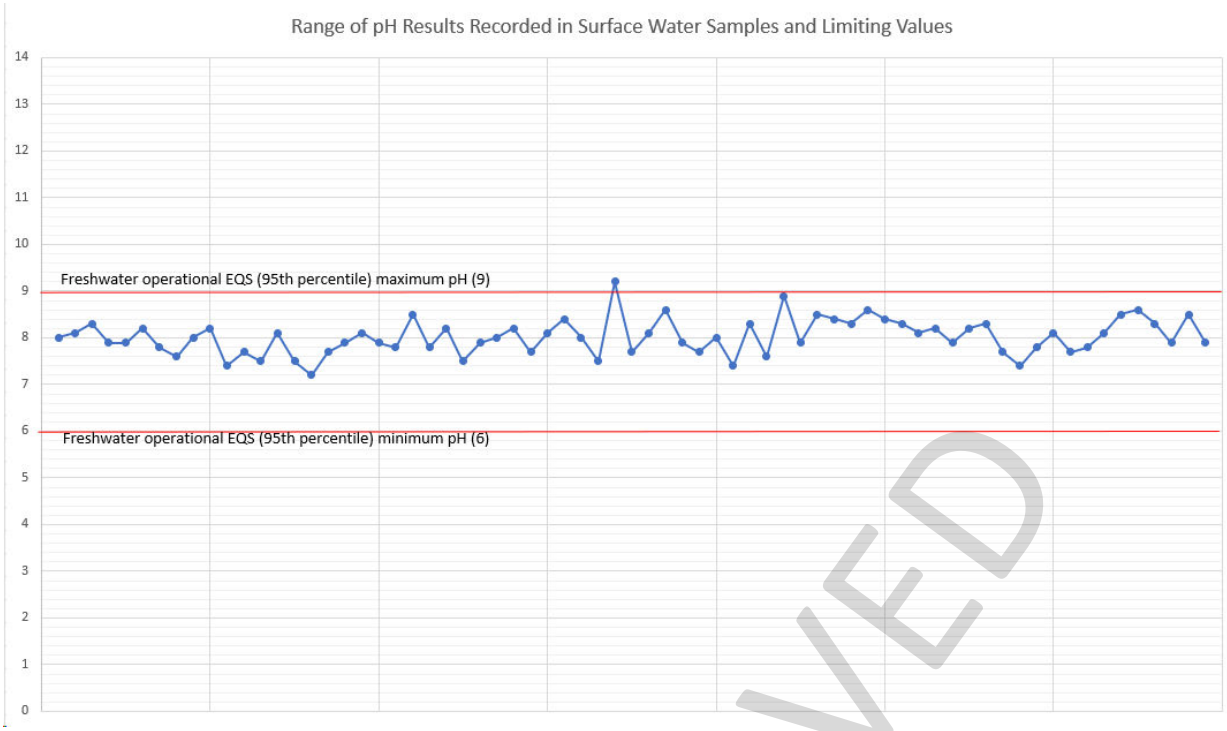

Figure 3-1 - Range of pH Results and Upper / Lower Limiting Values

3.2.2. Suspended Solids Limiting Values

The baseline data for suspended solids indicates a wide range of values (<5 mg/l to 2,300 mg/l). A histogram that graphically presents the distribution of the baseline data is provided as Figure 3-2, the chart indicates the vast majority of the data points are less than 60 mg/l with less frequent higher values.

The higher suspended solids (generally > 60 mg/l) are considered likely to be associated with episodes of higher rainfall and not representative of the general baseline within the surface water network.

As such, utilising the baseline as justification, Atkins recommend the adoption of a limiting value of 60 mg/l as the proposed limiting value for discharge which aligns with the provisional value presented in Early Works Drainage Strategy.

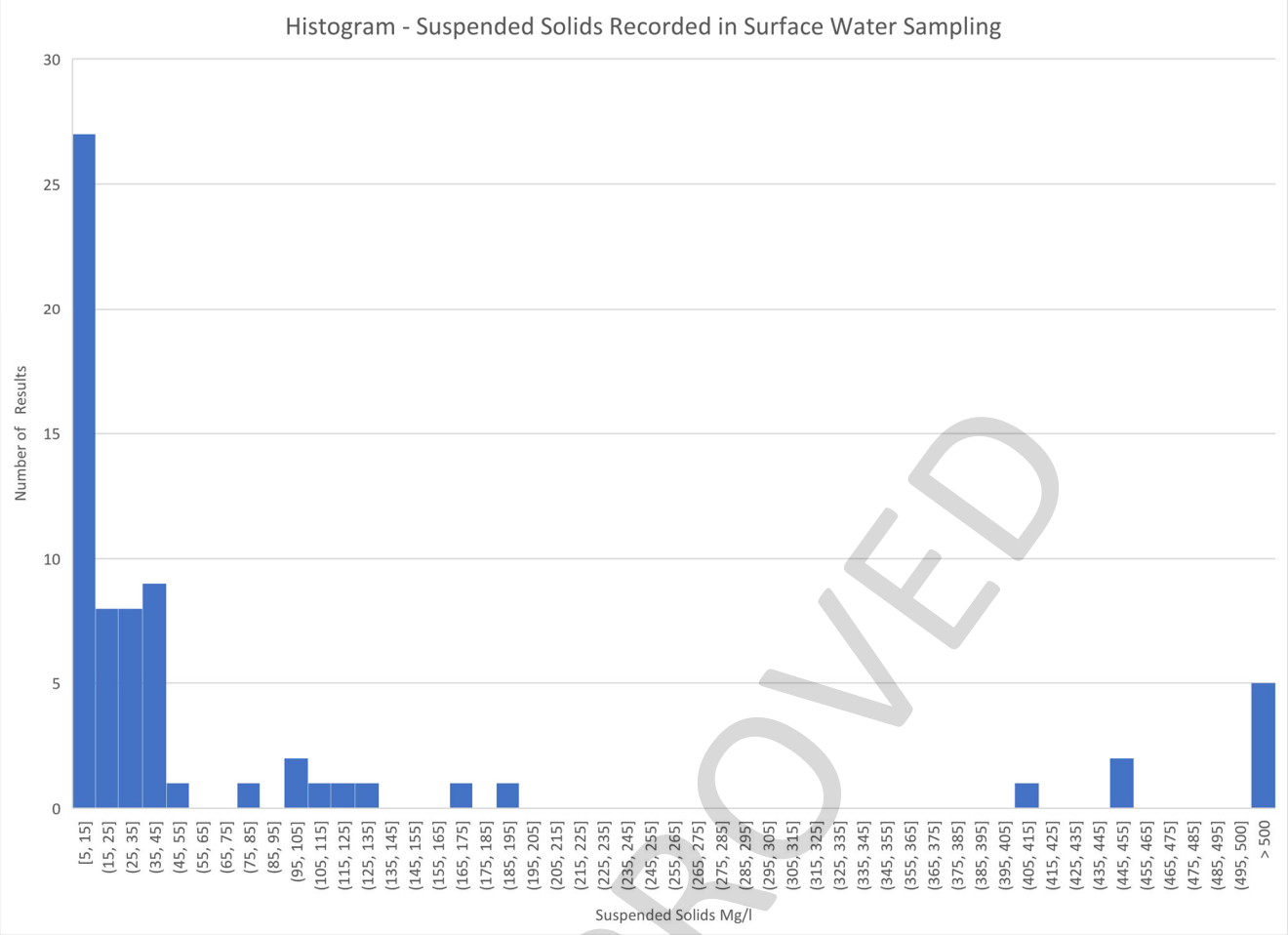

Figure 3-2 - Histogram presenting the suspended solids recorded in surface water

3.2.3. Visible Oil and Grease Baseline and Limiting Value

The vast majority of dissolved PAHs, phenolics, BTEX, PCBs and other volatile or semi volatile organic concentrations recorded across the regime were recorded below the laboratory of detection.

There were minor exceptions to this in the form of Total TPH where 7 of 62no. results presented detectable concentrations which ranged between 10 and 190 µg/l and 2no. trichloroethene detections recorded at G4 and G5 in November 2021 at 0.59 and 0.77 µg/l respectively.

Given the results of the baseline monitoring where the vast majority of organic tests recorded concentrations below laboratory LODs, Atkins propose to retain the provisional limiting value presented in the Early Works Drainage Strategy where “no visible oil/grease” defines the discharge criteria.

3.3. Summary and Closure

On completion of the quality and flow baselining activity, Atkins have derived proposed limiting values for key determinands using the baseline surface water quality monitoring data recovered from 2014 to 2022. The values derived as part of these works have been summarised and presented in Table 3-1.

It is noted that these limiting values are proposed and thus will need to be reviewed by and agreed with the Environment Agency prior to the discharge of surface water on site taking place.

Table 3-1 - Surface Water Quality Requirements

Criteria	Treatment Level Required at monitoring point	Sample Type	Notes
Visible Oils and Grease	No significant trace present	Visual inspection	
Suspended Solids (105C)	60 mg/l	Spot sample	Maximum Allowable Concentration (MAC)
pH	pH between 6.0 and 9.0	Spot sample	

4. References

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Appendices

Appendix A. Baseline Surface Water Quality Data

Appendix B. MBAT Assessment

Appendix C. EQS / WFD Screening

Appendix D. Surface Water Flow Stage and Q95 Data

Appendix E. Water treatment dosing chemicals risk assessment

E.1. Dosing required

In the event of periods of high flow and high suspended solids in the runoff the contractor has indicated that chemical dosing with coagulant (ferric chloride) and flocculant (Aquatreat 2084) may take place, in order to ensure suspended solids are reduced to the required limit prior to outfall.

Additionally high or low pH in the runoff may be treated by dosing with carbon dioxide gas (to treat high pH waters), or sodium hydroxide (to treat low pH waters).
All chemical would be dosed on a flow proportional basis via a calibrated mag-flow meter to ensure an accurate dose rate at all flow rates. The chemicals are stored on spill stands inside a dosing unit or dosing container.
Chemical Safety Data Sheets (SDS) for each of these are included in section E.3.

Coagulant (ferric chloride)

The SDS for ferric chloride indicates that it comprises 25 to 99% iron(III) trichloride. The contractor has indicated this would be dosed at a rate of 5 – 10 mg/l. Both ferrous and ferric ions released into (or generated in) water will rapidly precipitate as highly insoluble oxides and oxo-hydroxides. These stable compounds are exactly the forms in which iron is found naturally in the earth's crust (European Chemicals Agency, 2007-2023). Accordingly there is not considered to be any source term for iron associated with the application of this dosing chemical. On the contrary the dosing is likely to reduce dissolve iron by driving the formation of insoluble precipitates. Further evidence of the lack of dissolved iron in the effluent is shown in the table of example testing from a different site provided in the information from the contractor in section E.2.

At the dosing rate quoted, chloride in the Ferric Chloride coagulant is at concentrations which are not of relevance to the identified receptors: the baseline dataset for the watercourses indicates concentrations of chloride between 50 and 350 mg/l, average 132 mg/l. The freshwater EQS for chloride is 250 mg/l. The mass of chloride in the dosing chemical makes up approximately 65% of the mass of iron(III) trichloride. A dose rate of 5 – 10 mg/l ferric chloride, as indicated, where there is 25% to 99% iron(III) trichloride in the ferric chloride, would add between 0.81 and 6.4 mg/l of chloride to the discharge water. This is less than 10% of the freshwater EQS (below 25 mg/l) so passes screening test 1 of Surface water pollution risk assessment for your environmental permit guidance (Environment Agency, December 2019).

Flocculant (Aquatreat 2084)

The SDS for the flocculant Aquatreat 2084 indicates it comprises organic polymers, predominantly Hydrocarbons, C12-C15, n-alkanes, isoalkanes, cyclics, < 2% aromatics. This class of substance is considered by the European Chemicals Agency to be readily biodegradable based on data for analogue substances, and no ecotoxicity hazard has been identified from it (European Chemicals Agency, 2007-2023). The aim of flocculation is to promote the physical separation of solids from the aqueous phase by increasing particle sizes. Appropriately dosed, the flocculant will partition into the solid floc, and is therefore not expected to be in the effluent after treatment. The water treatment contractor has indicated a typical dose rate of 1-3 mg/l for the flocculant. The polymers do not have a freshwater EQS to assess against so screening in accordance with Surface water pollution risk assessment guidance is not possible. As the polymers are not expected to be present in the discharge,

are expected to readily biodegrade and are not hazardous or ecotoxic, no further assessment is considered necessary.

pH treatment (carbon dioxide gas or sodium hydroxide)

pH adjustment chemicals (CO_2 or NaOH) will readily react in the dosed water to form naturally occurring major ions (carbonate, dissolved sodium cations) and water. There are no hazards associated with these major ions and there is no freshwater EQS for any of them.

E.2. Information from contractor

RE CoagulationFloccula

E.3. Dosing chemical Safety Data Sheets