Polyethylene Terephthalate Plastics Recycling Facility (PETPRF)
Surface Water Risk Assessment

Client: Enviroo Ltd

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Document control

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			Prepared By	Checked By	Approved By
00	October 2023	Final	Arabella Sharrock	Craig Fannin	Craig Fannin
01	November 2025	Final	Dan King / Jennie Walker	Craig Fannin	Craig Fannin
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[1] Introduction

[1.1] Report Objectives

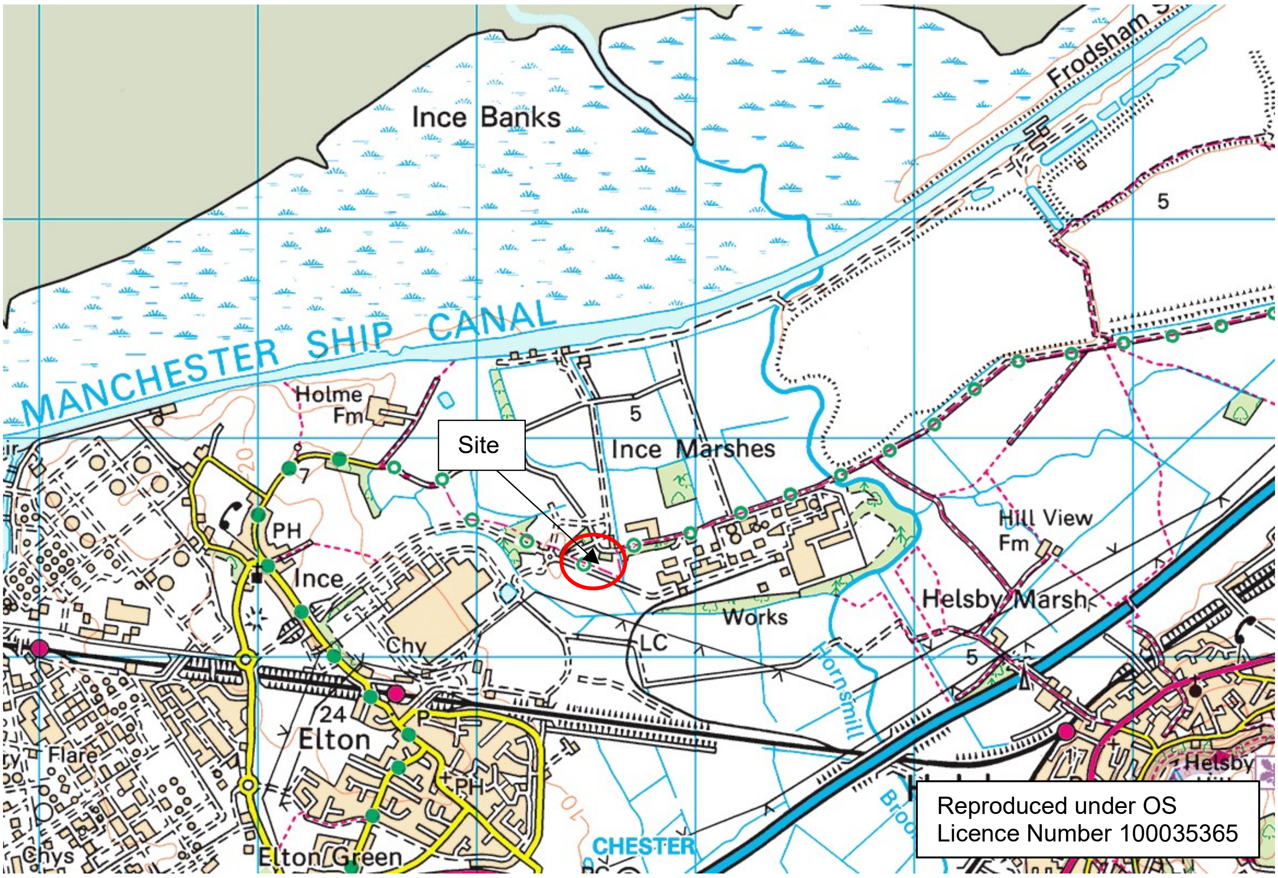
This surface water risk assessment has been prepared by ByrneLooby Partners (UK) Ltd on behalf of Enviroo Limited (Enviroo) to support an application to operate a Plastic Recycling Facility, which includes a wash plant for cleaning the plastics for recycling.

The effluent from the plastic recycling washing plant is to be treated to a quality suitable for discharge to surface water. In addition, two Package Treatment Plants (PTP) will treat sanitary effluent to allow discharge to surface water. This report sets out a risk assessment for the proposed discharges as well as identifying treatment objectives commensurate with the specific receiving water conditions. The report takes the form of an environmental risk assessment, formerly known as a "H1" risk assessment.

[1.2] Site Setting and Description

The facility is located at Plot 13 of Protos Resource Recovery Park at Enviroo Project Co., Marsh Lane, Ince, CH2 4FP at approximate National Grid Reference 346508 376458 (Figure 1). The site occupies an area of approximately 2.3 hectares and is located approximately 1.6km east of the town of Ince, and 1.1km northeast to the town of Elton, within a mixed industrial and semi-rural setting.

Figure 1 - Site Location

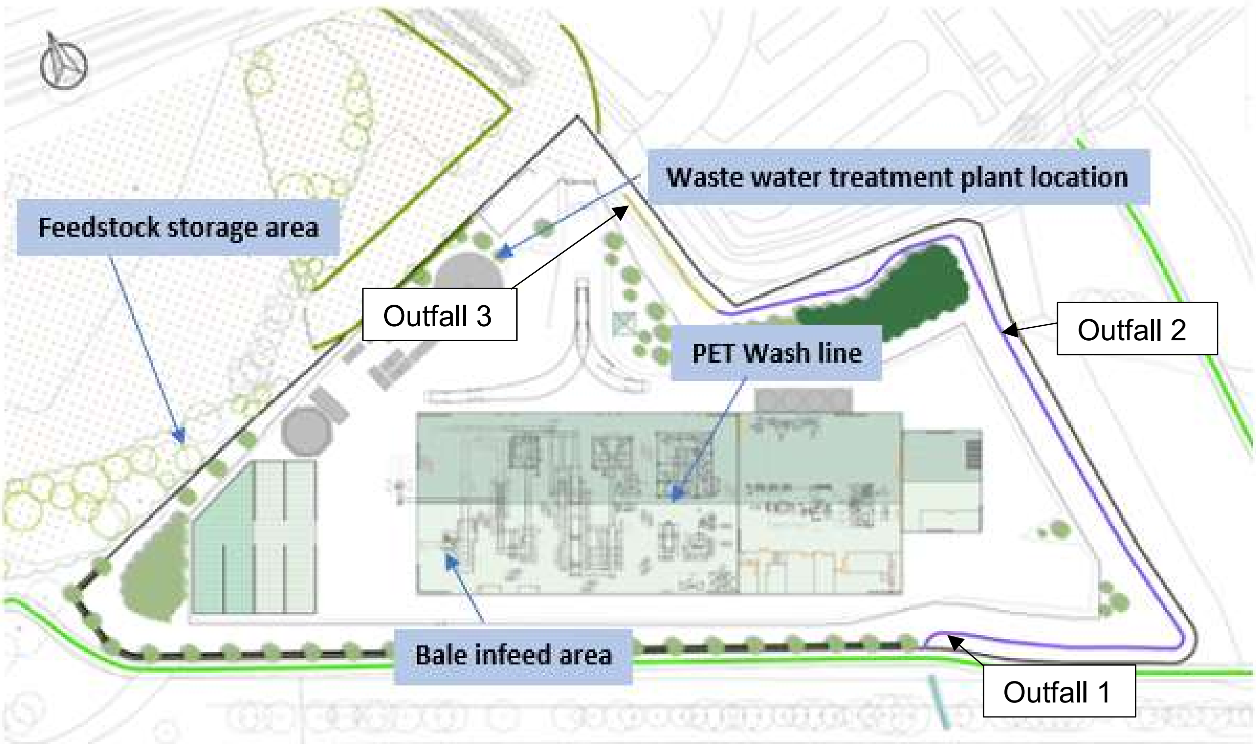


The site lies at circa 8m AOD. There is a fall from west to east with the western boundary at approximately 9m AOD and the eastern boundary at 4.5m AOD. The northern site boundary is formed by Marsh Lane, to the northwest is Protos Plot 10b and to the south a restricted byway (public right of way), which runs adjacent to Grinsome Road. The eastern boundary is approximately 20m from the restricted byway which links to Marsh Lane to the northeast of the site. The site layout is shown on Figure 2 below.

A small drainage channel runs along the northern and eastern boundary, exiting the site on the southern boundary close to the southeastern corner. There will be three outfalls from the site into this perimeter ditch:

- Outfall 1 – Discharge from PTP A including discharge of rainfall run-off from the southern roof areas.
- Outfall 2 – Rainfall run-off from hardstanding which has not come into contact with waste materials or process effluents and run-off from the northern roof areas.
- Outfall 3 – Discharge from the WwTP including discharge from PTP B.

Figure 2 - Site Layout Plan



A larger scale sanitary waste/sewage wastewater treatment plant (WwTP), which will serve the larger Protos Resource Recovery Park, is to be constructed on Plot 13, therefore the two BE EN 12566 compliant PTPs are an interim measure until the park's main WwTW has been commissioned. The discharges from the PTPs will only be temporarily discharged to surface water.

However, the main process effluent will be a continuous discharge throughout the operation of the plastics recycling plant.

The discharge from Outfall 2 is surface water run-off from the roofed area, and the hardstanding respectively only, with no substances of concern expected in either discharge. The roof water will discharge directly and the run-off from the hardstanding will discharge via an appropriately sized oil and silt interceptor. As such, the water in this discharge is considered clean and will not require assessment for the impact on the water quality in the wider environment.

Due consideration has been given to making a connection to foul sewer, even though there was no suitable foul sewer to connect to on Protos Resource Recovery Park. Preliminary discussions with the sewage undertaker, United Utilities, confirmed that even if a suitable connection could be made to foul sewer, Helsby WwTW would be the receiving works, and it did not have the process capacity to receive the trade effluent from the plastics recycling plant. Nevertheless, a Trade Effluent Consent application was made in October 2025 which United Utilities refused in December 2025, confirming that the proposed receiving sewer is currently at capacity according to the modelled data and sewer records. Consequently, on-site treatment and discharge to surface water is required.

[2] Effluent Type and Treatment

[2.1] Wastewater Treatment Plant Overview

The facility will accept the following types of pre-sorted baled plastics, over 3 separate lines;

- Clear polyethylene terephthalate (PET);
- Combined natural and coloured high-density polyethylene (HDPE); and
- Coloured polypropylene (PP) for treatment.

The eight EWC codes to be accepted at the site are listed below in Table 1.

Table 1 - List of EWC Codes to be accepted at the Site

EWC Code	Description
02	**WASTES FROM AGRICULTURE, HORTICULTURE, AQUACULTURE, FORESTRY, HUNTING, FISHING, FOOD PREPARATION AND PROCESSING**
02 01	**wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing**
02 01 04	Waste plastics (except packaging)
07	**WASTES FROM ORGANIC CHEMICAL PROCESSES**
07 02	**wastes from the MFSU of plastics, synthetic rubber and man-made fibres**
07 02 13	waste plastic from the manufacture, formulation, supply and use of basic organic chemicals
12	**WASTES FROM SHAPING AND PHYSICAL AND MECHANICAL SURFACE TREATMENT OF METALS AND PLASTICS**
12 01	**wastes from shaping and physical and mechanical surface treatment of metals and plastics**
12 01 05	Waste plastic shavings and turnings from shaping and physical and mechanical surface treatment of metals and plastics
15	**WASTE PACKAGING, ABSORBANTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED**
15 01	**packaging (including separately collected municipal packaging waste)**
15 01 02	separately collected municipal plastic packaging waste
16	**WASTES NOT OTHERWISE SPECIFIED IN THE LIST**
16 01	**End of life vehicles from different means of transport (including off-road machinery) and wastes from dismantling of end-of-life vehicles and vehicle maintenance**
16 01 19	Plastic

EWC Code	Description
19	**WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTEWATER TREATMENT PLANTS AND THE PREPARATION OF WATER FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE**
19 12	**wastes from the mechanical treatment of waste (e.g. sorting, crushing, compacting, pelletising) not otherwise specified**
19 12 04	plastic and rubber wastes from mechanical treatment of waste
19 12 12	Other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11
20	**MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) SEPARATELY COLLECTED FRACTIONS (EXCEPT 15 01)**
20 01	**separately collected fractions (Except 15 01)**
20 01 39	municipal plastics wastes

The washing process will remove contaminants from the plastic feedstock such as paper labels and residual liquids. The trade effluent (process water) produced by this washing process will be treated on site within a WwTP prior to discharge to surface water. The treatment plant has been designed to manage all the process water produced at the site and will discharge at a rate of no more than 240m^3/day.

[2.2] Wastewater Treatment Process Description

The wastewater treatment process will comprise of a series of steps as follows:

- Raw effluent screening via a sand and grit separator within the plastic recycling facility building to remove heavy particles prior to pumping to the buffer tank.
- Inlet screening via a filter flat screen or rotating screen prior to the buffer tank to remove plastic particles and fine sand sized or larger particles from wastewater.
- Flow and quality balancing within the buffer tank (including chemical dosing) prior to entry to the WwTP.
- Treatment within a WwTP comprising of
  - Dissolved Air Flotation (DAF) separation system; and
  - Membrane Biological Reactor (MBR).
- Sludge removed from the WwTP will be dewatered within a filter press prior to disposal.

Further details are provided in Table 2 below.

Table 2 - Wastewater Treatment Process Summary

Item	Process Unit	Process Objective
1	Sand and grit separator in plastics recycling facility building	To remove heavy particles from the wastewater prior to entry into buffer tank. Purpose of separator is to protect WwTP and eliminate mineral components from biomass.
2	Filter flat screen or rotating screen to remove plastic particles and fine sand sized or larger particles from wastewater	To ensure that plastic particles do not enter the buffer tank/ WwTP and reduce concentration of plastics within biomass.
3	Buffer (Intermediate) tank with integral mixer to allow dosing of water treatment chemicals, conditioning of flocs and to ensure that the flocs remain in suspension.	To enhance recovery of suspending particles within DAF unit and reduce COD loading onto biological treatment units.

Item	Process Unit	Process Objective
4	Containerized chemical dosing container (20ft). Forklift truck access to allow for exchange of chemical vessels (1000 l IBC) and for storage of chemicals (4 m by 2m) required.	To allow flow proportional addition of coagulant and flocculant into buffer tank
5	DAF unit	To recover suspended particles and floating oils from wastewater.
6	MBR (activated sludge aerobic bioreactor) unit, comprising of concrete tanks with submerged aeration diffusers. Permanent feature and cannot easily be removed from site.	Combination of membrane process with a biological wastewater treatment process to produce a high-quality effluent.
7	Sludge storage tank	To store sludge from DAF and MBR units prior to dewatering unit.
8	Sludge dewatering unit. (Daily lorry access to allow removal of filter cake produced).	To reduce moisture content of sludge and produce a dry filter cake.

[2.3] Wastewater Treatment Plant Process Water Quality

The effluent to be treated (Table 3) is an organic bearing liquor, which contains two fractions:

- a degradable component, consistent with the quantity of dissolved organic material (as identified by the consistency between the BOD and filtered COD components); and
- a non-degradable component of the COD which is also consistent with the suspended solids component of the influent liquor to the treatment plant.

The non-degradable/suspended solids component will be separated via the sand filtration/ screening and the DAF stages of the treatment process. The resultant separated component will be disposed of from site as a solid phase for treatment at an appropriate licensed facility.

The remaining degradable organic component is suitable for aerobic biological treatment (*i.e.* BOD ≈ Filtered COD). Treatment within a MBR system allows for a constant throughput of effluent into and out of the aerobic bioreactor as the ultrafiltration membrane retains the treatment biological solids, as well as any precipitates which form under the aerobic conditions. The ultrafiltration membrane will have a pore size of 0.02 – 0.05microns (up to $5x10^{-5}$mm) and will therefore also be capable of filtering and retaining inorganic microplastics with a size of between 1 – 5,000microns.

It is not considered likely that heavy metals, (such as aluminium, iron and manganese etc) will persist through the process and that dissolved metals will precipitate either within the DAF system or in the bioreactor. In both cases the metals precipitated under the aerobic conditions will be removed as part of the solids management process.

The salt content of the liquor (e.g. sodium, chloride etc) are unlikely to be treated within a DAF or a MBR process.

A summary of the expected influent water quality to the WwTP is provided in Table 3 and is taken from a similar operation at Ellesmere Port.

Table 3 - Influent Water Quality (to the Wastewater Treatment Plant)

Parameter	Units	Predicted Wash Water Quality	
		Average	Maximum
pH		7.2	7.6
Conductivity	µS/cm	1,973	2,710
COD Total	mg/l	2,575	6,430
COD Filtered	mg/l	1,042	2,790
BOD5 Total	mg/l	1,017	2,860
Suspended Solids	mg/l	1,113	2,860
TKN	mg/l	23	52
Total Nitrogen	mg/l	23	52
Ammonium (as N)	mg/l	16	40
Total Oxidisable Nitrogen	mg/l	<0.7	<0.7
Nitrate (as N)	mg/l	<0.7	<0.7
Nitrate (as NO_3)	mg/l	<3	<3
Total Phosphorous (as P)	mg/l	5	14
Orthophosphate (as P)	mg/l	1	9
Alkalinity (as $CaCO_3$)	mg/l	684	1,708
Alkalinity (as HCO_3)	mg/l	561	1,400
Chloride	mg/l	353	586
Sulphate	mg/l	20	64
Sodium	mg/l	315	458
Potassium	mg/l	30	44
Calcium	mg/l	113	164
Magnesium	mg/l	14	19
Silica	mg/l	10	27
Aluminium	mg/l	40	181
Iron	mg/l	6	14
Manganese	mg/l	0.2	0.4
Barium	mg/l	0.2	0.3
Boron	mg/l	0.2	0.2

[2.4] Wastewater Treatment Plant Effluent Quality

The environmental significance of the effluent is determined by Environmental Quality Standards (EQS) within surface waters and also the background quality of the receiving water. In this case, the relevant receptor is the Mersey estuary, and therefore saltwater type EQS are appropriate comparators. The proposed discharge is not in a Natural England designated nutrient neutrality area.

The two primary components that could present a potential risk to controlled waters are the organic content and the ammonium, and hence it is these two components which are being targeted by the treatment process. Process control and efficiency will be demonstrated by the reduction rate through the treatment process which is intended to convert the dissolved organic matter into carbon dioxide and nitrate. There is however a nitrogen and phosphorus biological demand from the treatment process and hence both total nitrogen and phosphorus contents of the final effluent are expected to be reduced.

The WwTP has been designed to meet the BAT (Best Available Techniques) associated emission levels (BAT-AELs) for direct discharges to a receiving water set out within the BAT Reference

(BREF) document for Waste Treatment[1] (set out in Table 4) as well as consideration of risk-based concentrations.

Table 4 - Comparison of Predicted Influent Quality, BAT-AELs and EQS

Parameter	Units	Predicted Wash Water Quality prior to treatment		Post treatment water quality from WwTP		
				BAT-AEL	EQS Terrestrial	EQS Estuarine
		Ave	Max	mg/l	mg/l	mg/l
Total Organic Carbon [2]	mg/l			10 - 100		
COD Total [2]	mg/l	2,575	6,430	30 - 300		
COD Filtered [2]	mg/l	1,042	2,790			
Suspended Solids	mg/l	1,113	2,860	5 - 60		
Total Nitrogen	mg/l	23	52	1 - 60		
Total Phosphorous	mg/l	5	14	1 - 3		
Other Metals & Metalloids [3]						
Arsenic	mg/l			0.01 - 0.1	0.05	0.025
Cadmium	mg/l			0.01 - 0.1	$2.5x10^{-4}$ ($1.5x10^{-3}$)	$2x10^{-4}$
Chromium	mg/l			0.01 - 0.3	0.0047 (0.032)	None
Chromium (VI)	mg/l			0.01 – 0.1	0.0034	0.0006
Copper	mg/l			0.05 – 0.5	0.001 (bio)	0.00376
Lead	mg/l			0.05 - 0.3	0.0012 (0.014)	0.0013 (0.014)
Nickel	mg/l			0.05 – 1	0.004 (0.034)	0.0086 (0.034)
Zinc	mg/l			0.1 – 2	0.0109	0.0068
Mercury	µg/l			0.001 - 0.010	$7x10^{-5}$	$7x10^{-5}$
Other Minor Components						
Hydrocarbon oil index (HOI)	mg/l			0.5 – 10		
Phenol Index	mg/l			0.05 – 0.3		
Free Cyanide [3]	mg/l			0.02 – 0.1		
Adsorbable organically bound halogens (AOX) [3]				0.2 - 1		

[1] Blank cells = no data available.
[2] Either the BAT-AEL for COD or the BAT-AEL for TOC applies. TOC monitoring is the preferred option because it does not rely on the use of very toxic compounds.
[3] The BAT-AELs only apply when the substance concerned is identified as relevant in the wastewater inventory mentioned in BAT 3 (maintain an inventory of wastewater streams, as part of the environmental management system).
() Maximum allowable concentration (MAC) EQS is in brackets

BAT 3 requires the influent to be regularly monitored to characterise the wastewater and for this data to be recorded in accordance with an environmental management system. The influent and effluent will be monitored for the substances identified in Table 5 during the commissioning stage which are recommended within the BREF document[1] to fully characterise the treated effluent and treatment rates.

In the longer term a more targeted monitoring programme can be undertaken routinely based on key parameters, risk based and BAT required treatment objectives and monitoring frequencies.

Continued monitoring for metals, metalloids, AOX, BTEX, PFOA and PFOS will only be required where they are identified at a significant concentration (*i.e.* above their relevant EQS). In accordance with the BREF document for Water Treatment, monitoring frequencies may be reduced if the emission levels are proven to be sufficiently stable.

[1] Pinasseau A. et a. (2018) Best Available Techniques (BAT) Reference Document for Waste Treatment accessed at https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/JRC113018_WT_Bref.pdf

Table 5 - BAT Recommended Influent and Effluent Monitoring

Parameter	Analysis Standard(s) [1]
	mg/l
COD	UKAS lab
Suspended Solids	EN 872
Total Nitrogen	EN 12260, EN ISO 11905-1
Total Phosphorous	Various *e.g.* EN ISO 15681-1
Arsenic	Various EN standards available (e.g. EN ISO 11885, EN ISO 17294-2, EN ISO 15586)
Cadmium	
Chromium	
Copper	
Lead	
Nickel	
Zinc	
Manganese	
Chromium (VI)	EN ISO 10304-3 or 23913
Mercury	EN ISO 17852 or 12846
Hydrocarbon oil index (HOI)	EN ISO 9377-2
Phenol Index	EN ISO 14402
Free Cyanide	EN ISO 14403-1 and -2
Adsorbable organically bound halogens (AOX)	EN ISO 9562
Benzene, toluene, ethylbenzene & xylene	EN ISO 15680
PFOA (perfluorooctanoic acid)	None
PFOS (perfluorooctanesulphonic acid)	None

[1] Equivalent standard may be used

Compliance limits will be applied to control the final discharge quality for key parameters, and these are discussed in more detail in Section 5 (quantitative risk assessment) of this report along with monitoring requirements for the commission stage.

[2.5] Package Treatment Plant Overview

There will be two package treatment plants (PTPs) on site; one serving effluent from the security office positioned beside the northern perimeter, and one serving effluent from the primary building for site operations and which will be positioned in the south-eastern corner of the site.

The proposed PTP for the security office will be a Klargester BioTec+2, and the PTP for the primary building will be a Klargester BioTec+8 or similar. Both will handle only sanitary effluent from the toilet and kitchen areas of the security office and primary operations buildings. The BioTec+2 PTP is designed to process up to 1.92m^3 per day, whilst the BioTec+8 is designed to process up to 7.872m^3 per day resulting in a total of up to 9.792m^3 per day of effluent treated between the two PTPs. Both PTPs will discharge to the same channel that runs along the northern, eastern and southern perimeters.

The Klargester Biodisc declaration of performance[2] provides details on the treatment performance and expected effluent quality summarised as per Table 6. The Klargester Biodiscs are manufactured

[2] Kingspan 2021, Klargester Biodisc BA to BF – Declaration of Performance. Reference 1587 v1

to British Standard BS EN 12566-3[3], and will be operated in accordance with the manufacturers specifications such that all operations are in accordance with the British Standard.

Table 6 Package Treatment Plant Effluent Quality

Substance	Treatment Efficiency*	Predicted Effluent*	EQS
	%	mg/l	mg/l
COD	89.4	59	No EQS
BOD	95.7	10	5 – (EQS)
Ammoniacal Nitrogen	88.6	3.8	0.6 - (‘Good’ river quality)
Suspended Solids	94.8	15	No EQS

* Data provided in the Klargester Biodisc declaration of performance[2]

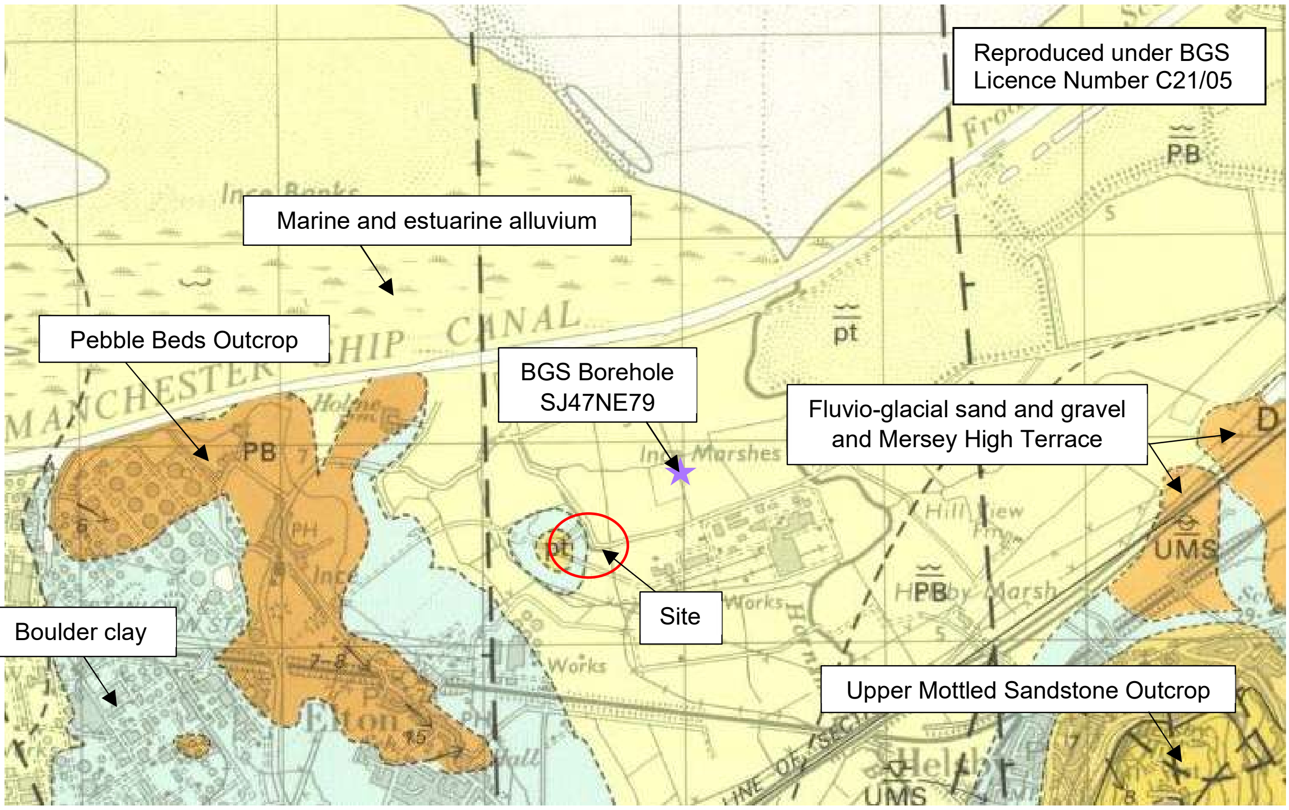
[3] Pathways/Receptors

[3.1] Geology

British Geological Survey (BGS) mapping (sheet 97) indicates the site is predominantly underlain by marine and estuarine tidal flat deposits and boulder clay (Figure 3). The mud flat and sand flat deposits were formed as extensive nearly horizontal marshy land in the intertidal zone that is alternately covered and uncovered by the rise and fall of the tide. These conditions still continue outside of the coastal flood defences. The tidal flat deposits consist of unconsolidated clayey silts and/or sand.

[3] British Standards Institute 2016, Small wastewater treatment systems for up to 50 PT. Part 3: Packaged and/or site assembled domestic wastewater treatment plants. BS EN 12566-3:2016

Figure 3 - Drift Geology (Extract from BGS Drift Sheet 97[4])



Note: Bedrock geology also noted on Figure 3 as PB (Pebble Beds), pt (Permo-Triassic Sandstone) and UMS (Upper Mottled Sandstone).

The superficial geology is confirmed by borehole logs for nearby boreholes (*e.g.* BGS ref: SJ47NE79, Figure 3) which demonstrate that there is circa. 8 - 10m of silty material in the local area with pockets of peat and clay layers.

Superficial sediments are absent in some places within the local area where bedrock is exposed at the surface as illustrated on Figure 3, including the Kinnerton Sandstone (formerly Permo-Triassic Sandstone) outcropping in the south-western corner of the site. The Chester Formation (formerly the Pebble Beds) outcrops some 900m to the south-west of the site, and the Wilmslow Sandstone (formerly Upper Mottled Sandstone) outcrops some 2.7km to the south-east (Figure 3).

Locally, the bedrock geology at the site comprises of:

- Helsby Sandstone (formerly the Keuper Sandstone)
- Wilmslow Sandstone (formerly the Upper Mottled Sandstone)
- Chester Formation (formerly the Pebble Beds)
- Kinnerton Sandstone (formerly the Lower Mottled Sandstone and Permo-Triassic Sandstone, undifferentiated)

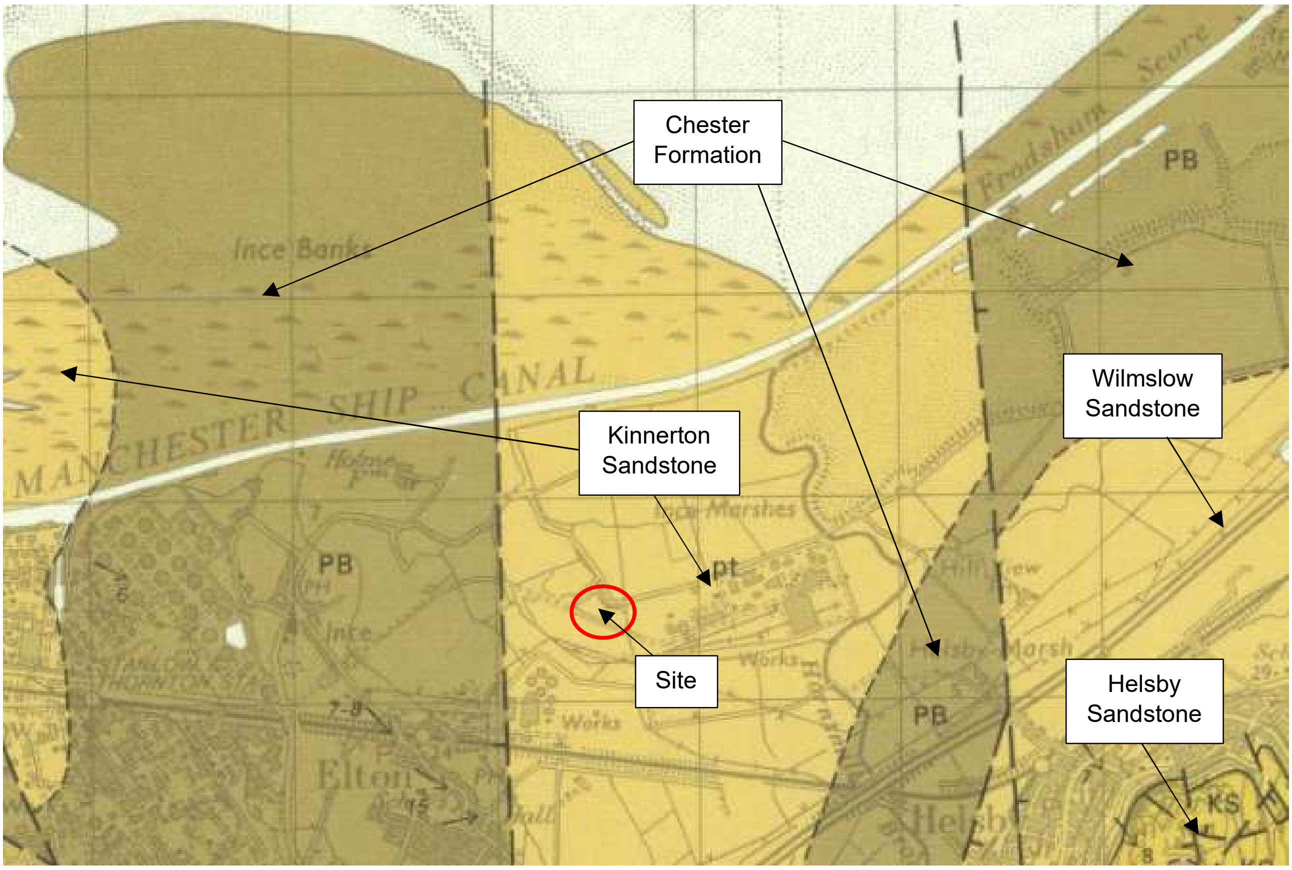
The bedrock geology within the site area is the Kinnerton Sandstone. The Kinnerton Sandstone is a fine to medium grained Triassic sandstone, which is overlain stratigraphically by the Chester Formation (formerly the Pebble Beds). There are however several geological faults in the vicinity of

[4] British Geological Survey (BGS) | large image viewer | IIPMooViewer 2.0

the site which juxtapose the younger strata against the Kinnerton Sandstone to the west and east of the site.

The regional geological sequence for the local area is illustrated in Figure 5.

Figure 4 - Bedrock Geology (Extract from BGS Solid Sheet 97[5])



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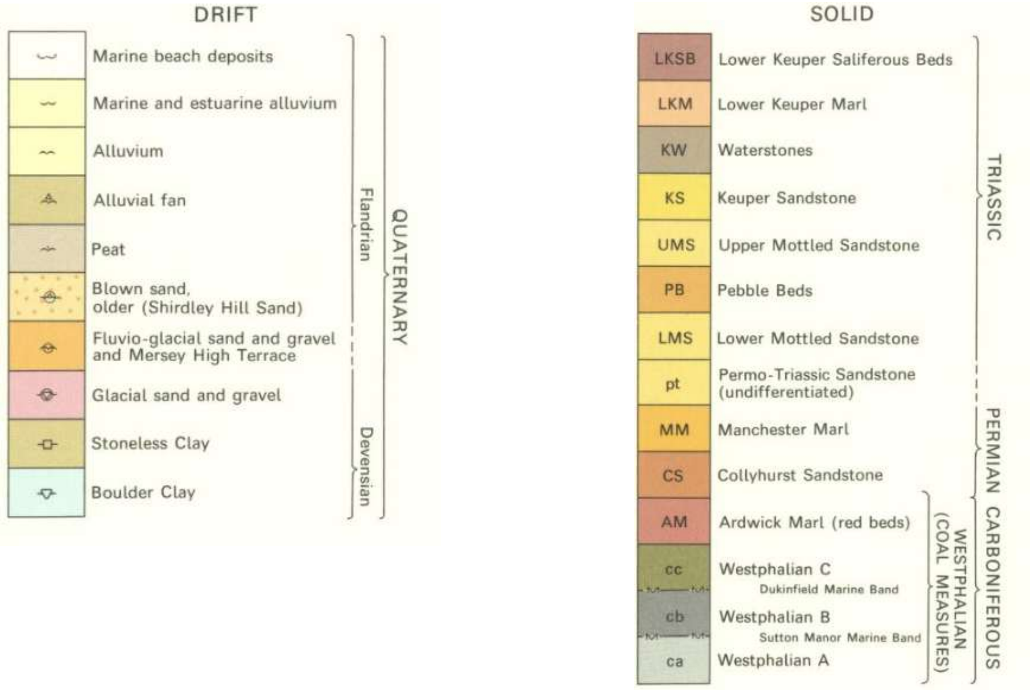
[5] https://largeimages.bgs.ac.uk/iip/mapsportal.html?id=1001587

Figure 5 - Regional Geological Sequence (Extract from BGS Map 97)



[3.2] Hydrogeology and Hydrology

There are no designated groundwater Source Protection Zones (SPZs) at the site. The closest SPZ is located some 2.7km to the south-east. The site is not located within or near to a Drinking Water Safeguard Zone for groundwater or surface water. Nor is the site located within or near to a Drinking Water Protected Area.

The superficial deposits beneath the site are classified as a Secondary Aquifer (undifferentiated) which comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers (Figure 6). In this case the superficial deposits are peaty silty clays formed by the adjoining river system. Water levels are at or about the tidal range, and therefore saline ingress is expected.

The various bedrock sandstone units at and in the vicinity of the site are classified as a Principal Aquifer (Figure 7) by the Environment Agency who describe this type of aquifer as strategically important rock units that have high permeability and water storage capacity. However, at a depth of 10mbgl the bedrock will be in direct continuity with the Mersey estuary and therefore saline intruded. The classification designation at and downgradient of the site is therefore not appropriate for this setting and is a simplified expression of an extrapolation of the rock type as a whole across the estuary.

Figure 6 - Superficial Aquifer Designation

Figure 7 - Bedrock Aquifer Designation

The River Mersey is the main river in the vicinity of the site. There are several smaller watercourses and a series of land drains around the site which are all tributaries of the River Mersey (Figure 8), these include:

- Hoolpool Gutter

- Hornsmill Brook
- Marsh Lane Drains

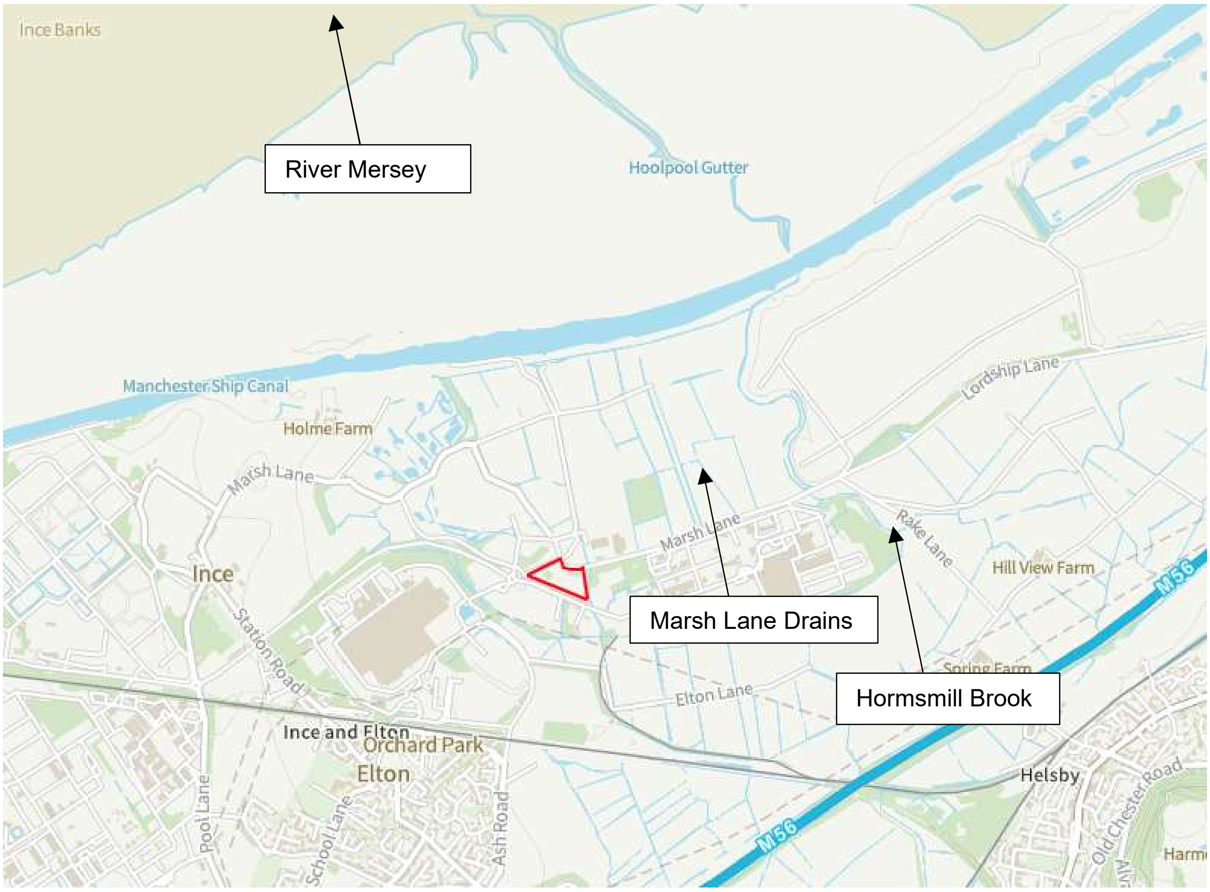
The Manchester Ship Canal is a man-made water course with the channel is constrained between levees and is being managed as a “high-land” carrier perched above and hydraulically separate from the surrounding hydrogeological and hydrological systems.

The Hornsmill Brook flows into the Hoolpool Gutter which is siphoned under the Manchester ship canal and enters the River Mersey. The surrounding land drains all feed the Hoolpool Gutter and are discharged into the River Mersey.

The network of constructed land drainage channels are a series of ditches that are subject to modification and re-alignment as the Protos Resource Recovery Park develops and some only carry water to the Hoolpool Gutter during periods of heavy rain fall.

Any baseflow from groundwater in this location is expected to be at least in part tidally influenced.

Figure 8 - Surface water features within the local vicinity of the Site



The Flood Map for Planning[6] identifies that the site lies within Flood Zone 3 which is defined as ‘*Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater*

[6] https://flood-map-for-planning.service.gov.uk/

annual probability of sea flooding'. The flood map for planning does however identify that there are flood defences in place near to the site and as such the probability of flooding is reduced.

The most recent assessment of flood risk is contained within the Protos, Surface Water Management Plan (SWMP) dated 2018. The SWMP requires floor levels to be set at a minimum of 5.063 mAOD and access roads set no lower than 4.763 m AOD. The development platform level of the site is to be set at 6.45 m AOD, *i.e*. above the minimum prescribed levels for flood protection. It should also be noted that it is proposed to raise finished floor levels of the PRF building 150mm above the surrounding hard standing to ensure that overland flow of water during storm events does not flood the building.

[3.3] Sensitive habitats

The Mersey estuary is designated for the following:

- Mersey estuary – SSSI (Site of Special Scientific Interest)
- Mersey estuary – SPA (Special Protection Areas)
- Mersey estuary – Ramsar Site

Frodsham and Helsby and Ince Marshes Local Wildlife Site (LWS) is located adjacent to the north boundary of the site.

The site is designated as protected habitat for deciduous woodland and coastal and floodplain grazing marsh. An area of broadleaved plantation woodland located within the Planning Boundary is to be protected and managed in accordance with the Plot 13 Woodland Management Plan prepared by Ramball UK Limited (Report Ref: 1620006668-021 Version 1 dated 5 November 2021).

Protected species were identified in the drainage ditches to the north, south and east of the site and within a 100 m section that traverses the site. The protected species comprises a population of water voles and European eels. The ditch traversing the site is required to be infilled as part of the development. A mitigation method statement was prepared by Ramball UK limited (Report Ref: 1620006668-021 version 2 dated 5 November 2021) for the mitigation of water voles. This included the live trapping and translocation under licence of the water vole population to a ditch located approximately 800m to the northwest of the site, part of the Protos Ecology Mitigation Area discussed further below.

This new location is not downstream of the proposed discharges from the site and therefore protected species at the new location will not be impacted by the discharges from the WwTP, PTPs, and surface run-off. As such, the impacts of the discharges on these protected species do not require further assessment within this risk assessment.

The protected habitats and local wildlife site are to be directly affected by the development of the land as part of the wider Protos Resource Recovery Park, however not by the discharges from the site to the local ditch network. Compensatory habitat has been provided for as part of the planning conditions which is underway north of the site. RSK prepared a Habitat Creation and Management Plan (HCMP) for a c. 49ha mitigation area associated with the development of the Protos Resource Recovery Park at Ince Marshes (Report Ref: P660444/03/11/01 Rev 15 dated July 2021). The impact of the site with regards to habitats are considered to have been undertaken as part of the planning process for the wider Protos Resource Recovery Park and for the planning applications submitted for this site.

An Environmental Risk Assessment (Report Ref: K0419-AYE-R-ENV-00002) has been undertaken which details the control measures and management to be employed to ensure the activities at the site do not cause harm to human health or the environment. A copy of the Habitats Regulations Assessment and Ecological Risk Assessment is provided at Appendix A. The site will be operated in accordance with the Technical Standards Report (K0419-AYE-R-ENV-00003) and associated regulatory requirements.

The River Mersey is therefore considered the principal sensitive receptor for any discharge from the proposed WwTP and PTPs.

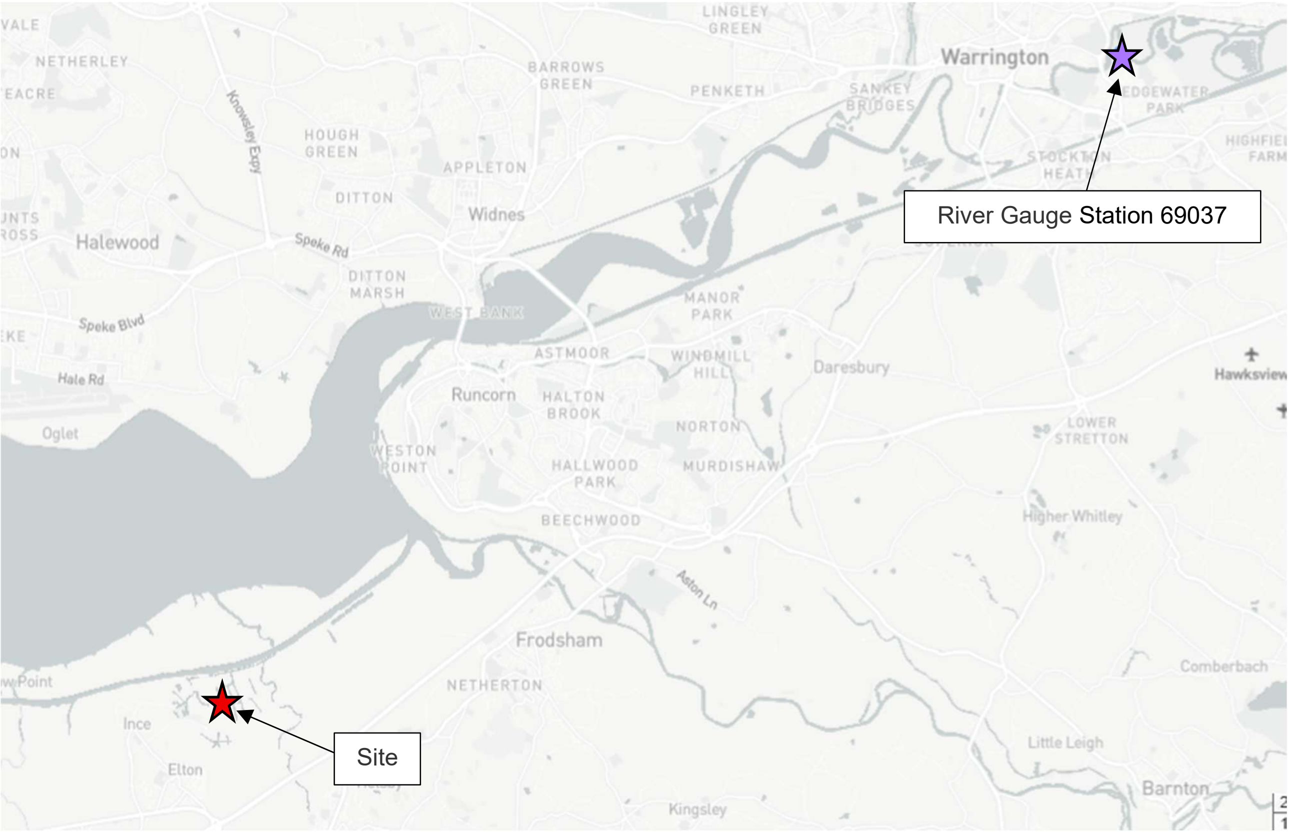
[4] Discharge Conceptualisation

This hydrogeological and hydrological setting is of a discharge to land drainage channel and then to the River Mersey via the Hoolpool Gutter. The principal receptor for the effluent is the River Mersey.

[4.1] Receiving Surface Water Course Flow Conditions

Flow rate monitoring is available for the River Mersey from the National River Flow Archive[7]. Monitoring is taken on the River Mersey at West Woods (Ref:69037) at National Grid Reference (NGR) SJ628883 before it turns tidal within the estuary (Figure 9) some 20km upstream of the site.

Figure 9 - Flow Monitoring Location for the River Mersey



[7] https://nrfa.ceh.ac.uk/data/station/info/69037 Mersey at Westy

The monitoring station shows the River Mersey flow to be:

- Base Flow Index: 0.59
- Mean Flow: 36.6 m^3/s
- Low Flow (Q95): 9.27 m^3/s
- 70% Exceedance (Q70): 19.7 m^3/s
- Median Flow (Q50): 28.9m^3/s
- 10% Exceedance (Q10): 72.8 m^3/s
- 5% Exceedance (Q5): 93.6m^3/s

This is a conservative estimation of flow in the Mersey Estuary at the point of discharge. These values have been used in the below screening calculations.

In reality the flow within the Mersey Estuary at the discharge location will also contain inputs from the River Weaver (inclusive of the Dane and Wincham Brook), the Bridgewater Canal and the Gowy which all discharge into the Mersey at or upstream of Ince Marshes, which combined add at least a further 2.8m^3/s under Q95 conditions, 5.6m^3/s under Q70 conditions and 8.5m^3/s under median (Q50) flow conditions.

[4.2] Receiving Water Course Background Quality Conditions

Background data for the River Mersey was obtained for the Environment Agency's Water Quality Archive[8] from the sampling point Mersey Estuary at Hale Head Heli Pt14 (ref: NW-88002762) and is summarised in Table 7. The sampling location (Figure 10) is upstream of the point where the discharged effluent will reach the River Mersey.

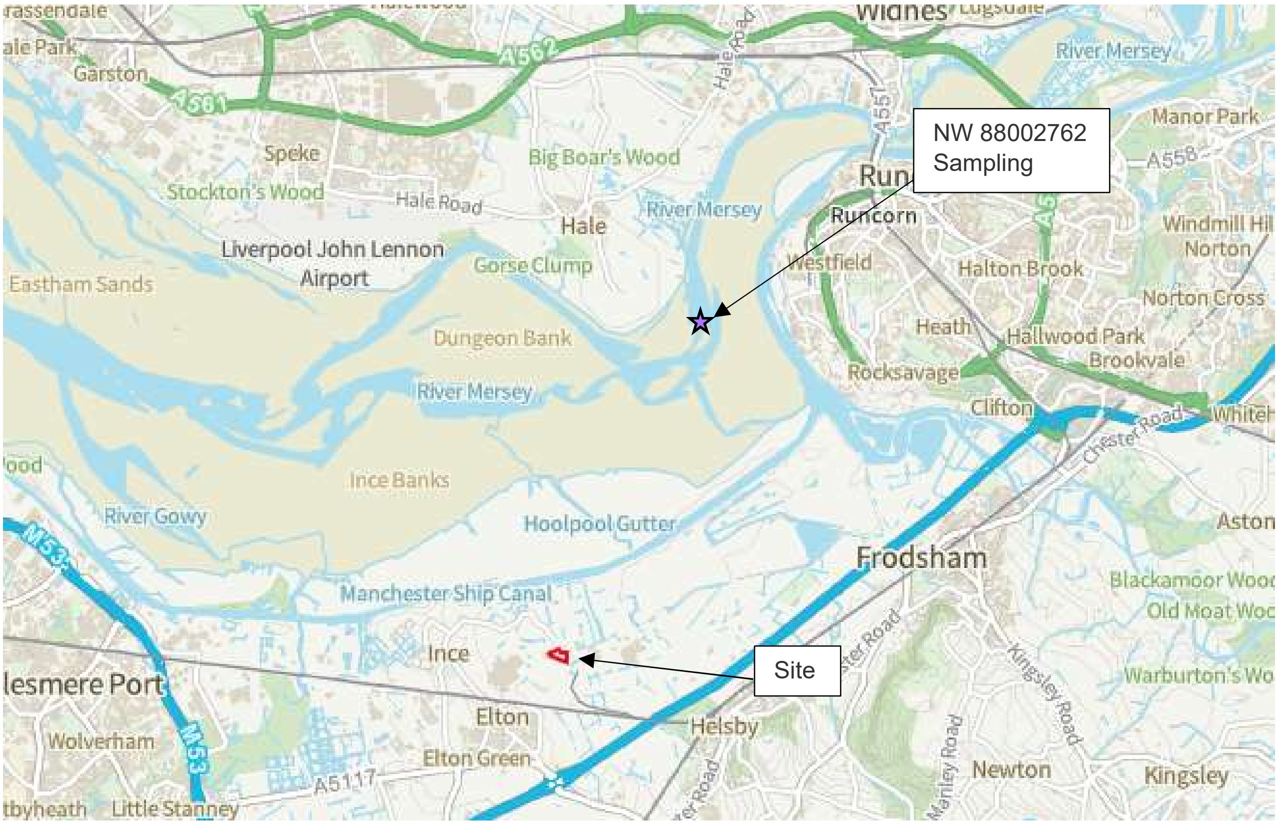
Table 7 - River Mersey Estuary Background Quality Summary at NW-88002762

Date	NH_4-N mg/l	NO_2^- mg/l	NO_3-N mg/l	PO_4^3 mg/l	DO mg/l	DOC mg/l	TON mg/l	Cd µg/l	Cu µg/l	Ni µg/l	Zn µg/l	Pb µg/l
Average	**0.28**	**0.11**	**2.4**	**0.19**	**8.3**	**4.2**	**2.5**	**0.04**	**2.2**	**2.0**	**11**	**0.20**
13/08/2022	0.15	0.09	2.0	0.23	6.1	3.8	2.1	0.04	1.9	2.1	11	0.19
12/09/2022	0.25	0.12	1.9	0.27	6.1	3.4	2.0	0.04	2.0	2.3	12	0.15
10/10/2022	0.34	0.16	2.5	0.23	7.9	3.8	2.7	< 0.03	2.2	2.0	14	0.19
09/11/2022	0.25	0.16	2.4	0.19	8.4	4.2	2.6	0.04	2.2	1.9	12	0.27
08/01/2023	0.36	0.08	3.2	0.14	10.3	7.1	3.3	< 0.03	2.9	2.4	11	0.24
08/02/2023	0.38	0.07	2.3	0.14	9.4	3.7	2.4	0.03	1.9	1.7	12	0.18
12/03/2023	0.44	0.09	2.8	0.18	9.5	3.4	2.9	0.04	1.7	1.9	14	0.20
02/06/2023	0.05	0.10	2.3	0.17	8.8		2.4	0.04	3.1	2.0	9	0.17

Note: Where concentrations are reported below the limit of detection (LOD), the LOD value has been utilised within the average calculation.

[8] https://environment.data.gov.uk/water-quality/view/sampling-point/NW-88002762

Figure 10 - Water Quality Sampling Locations



[5] Quantitative Risk Assessment

[5.1] Overview

The risk assessment has been carried out to assess the impact of the proposed discharges from the WwTP and the two PTPs on the receiving watercourse with reference to the following Environment Agency guidance:

- Environment Agency (2014) LIT 10419 Modelling: surface water pollution risk assessment risk assessment[9];
- Environment Agency (2014) H1 Annex D2. Assessment of sanitary and other pollutants within Surface Water Discharges[10];
- Environment Agency (2016) Guidance: Risk assessments for your environmental permit (updated 21st November 2023)[11]; and;
- Environment Agency (2016) Surface water pollution risk assessment for your environmental permit (updated 25th February 2022)[12].

The risk assessment process is a mechanism which applies a series of steps to screening and determining the significance of a potential emission taking into account the loading of individual substances onto a receiving water course, background water quality, flow and mixing within the receiving watercourse. The objective of the risk assessment is to identify the impact an emission could have on a receiving water course in the context of water quality standards and the background water composition.

Each discharge, the WwTP and the PTP, will be assessed individually, and then the cumulative impact of the discharges together will be assessed.

For the new WwTP discharge, there is not a direct knowledge of the effluent quality as the discharge is yet to commence. Notwithstanding this, data is available for similar facilities, and the risk assessment process can be used to establish suitable risk-based release concentrations for parameters which are applicable to the receiving water course conditions.

Effluent quality data is provided for the proposed PTPs, and this will be used for the risk assessment for the discharges from the two PTPs.

Due to the difference in the type of performance data available for the WwTP discharge and the PTP discharges, assessments have been made that assess the individual impacts from each discharge and cumulative impact from both discharges together.

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[9] Environment Agency (2014) LIT 10419 Modelling: surface water pollution risk assessment risk assessment

[10] Environment Agency (2011) Horizontal Guidance Note H1 – Environmental Risk Assessment for Permits. Annex (d) Surface Water Discharges (basic) with Environment Agency (2014) H1 Annex D2. Assessment of sanitary and other pollutants within Surface Water Discharges; and the 2016 update accessed at https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit

[11] Environment Agency (2016) Guidance: Risk assessments for your environmental permit accessed at https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit

[12] Environment Agency (2016) Guidance: Surface water pollution risk assessment for your environmental permit. Accessed via https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit Last updated 25 February 2022

The Environment Agency's Guidance on 'Surface water pollution risk assessment for your environmental permit' sets out the following steps for assessing a potential discharge

1. Evaluate and assess any hazardous chemicals (specific substances) and elements you plan to release into surface water.
2. Carry out screening tests on these substances to check if they're a risk to the environment also known as a 'specific substances assessment'. The methodology for completing the screening tests is set out in more detail in Section [5.1.1] below.
3. If your screening tests show there's a risk to the environment *i.e.* substances do not pass the initial screening tests, then further modelling may be required.
4. Additional screening is required for all priority hazardous pollutants, even if the pollutants were screened out during the specific substances assessment. This additional screening involves a comparison of the annual limit of pollutants you discharge with the 'significant load limit' set by the Environment Agency. The methodology for completing the significant load assessment is set out in more detail in Section [5.1.2] below.

[5.1.1] Screening Assessment Methodology

The first part of the assessment process consists of up to 4 tests or steps that assess whether or not the effluent is a risk to the environment. Each step is designed to screen out substances which are not considered to pose an environmental risk, and these substances are not then carried forward to the next step. The various steps are detailed below.

The four step screening protocol has the following test objectives. These four steps are to be carried out in turn where the test threshold is exceeded. As such, the Test 2 threshold is considered as the point where the discharge causes a negligible impact on the receiving water quality.

Test 1 Does the discharge contain substances at >10% of the EQS

Test 2 Does the Process Contribution (after dilution) exceed 4% of the EQS

Test 3 Does the Predicted Environmental Concentration (after mixing) increase by more than 10% of the EQS

Test 4 Does the Predicted Environmental Concentration exceed the EQS

The Process Contribution and the Predicted Environmental Concentration can be calculated using the following equations

$$PC = \frac{\text{EFR x RC}}{EFR+RFR} \quad \text{(Equation 1)}$$

$$PEC = \frac{\text{(EFR x RC)+(RFRx Bgrd)}}{EFR+RFR} \quad \text{(Equation 2)}$$

where

PC = Process Contribution

PEC = Predicted Environmental Concentration

RC = Release Concentration

Bgrd = Background Concentration

EFR = Effluent Flow Rate

[5.1.2] Significant Load Assessment

The Environment Agency's guidance sets out the following approach for assessing 'significant loads' of hazardous substances:

- Calculate the significant load by
  - multiplying the average discharge concentration (mg/l) by the average flow (litres per day) to derive a mg/day value followed by
  - dividing the result by 1,000,000,000 to convert mg/day to kg/day
  - multiplying the result by 365 to give kg/year
- If the calculated load is less than the significant load limit for the substance and the substance passed the screening tests, then no further assessment is required.
- If the calculated load is more than the significant load limit[12] for the substance, then the assessment is repeated using cleaned up data.

Methodology for 'cleaning up' data

To 'clean up' the data, the number of samples in assessment period which have exceeded the minimum reporting value (MRV) is reviewed. If a minimum number (as set out by the Environment Agency) of samples do not exceed the MRV, the pollutant is not a risk to the environment and assessment is not required.

The Environment Agency also recommend that the following steps are taken:

- Check whether there are significant changes in the data over a period of time;
- Select a time period which reflects the current discharge quality even if this means using less than 3 years' data (a minimum of 12 samples should however be used);
- Consider uneven spread *e.g.* seasonality.
- Check your data for 'outliers'.

[5.2] Wastewater Treatment Plant Screening Assessment

[5.2.1] WwTP substances to be assessed

The WwTP has not yet been installed. However, information on the expected influent quality is readily available from a similar facility (see Table 3). Furthermore, the WwTP is being built to meet the BAT-EALs.

To determine the risk-based emission limits for the proposed effluent, the screening assessment has been carried out to 'back calculate' a worst-case concentration which needs to be achieved to meet Test 2 and hence is considered to be insignificant.

In order to carry out this assessment, representative substances have been used and justification for the use of these is summarised in Table 8. Utilising these representative substances will ensure that the watercourse is protected against significant contributions from all substances which may be present within the treated effluent.

Calcium, magnesium, sodium, potassium, chloride and sulphate are not expected to be present at environmentally significant concentrations. The discharge will be into a saltwater environment, where EQS for chloride, calcium, magnesium, potassium and sulphate are not applicable due to high background concentrations. Hence, these substances are excluded from the screening assessment.

Table 8 - Representative WwTP substances to be assessed

Representative substance	Justification
Ammoniacal-N	Ammoniacal-N may be present from organic residue present on the incoming plastic wastes. It is expected to be reduced to less than 10mg/l within the WwTP but is likely to be above the 0.6mg/l EQS for a good water quality within the discharge (based on similar treatment plants). Hence, an assessment of this substance is considered necessary.
BOD / COD/ TOC	BOD, COD and TOC are used to determine the organic content of a water. BOD, COD and TOC are expected to be reduced by the WwTP but will still be present following treatment. BOD is however the only component with an EQS and therefore this substance has been modelled. The BOD will be proportional to the COD and TOC within the final discharge; hence it is suitable as a representative determinand. COD and/or TOC are expected to be monitored in accordance with process requirements to achieve their BAT-AELs. COD and/or TOC provide a more efficient analysis and are therefore routinely used for process monitoring (rather than BOD which has a minimum 6-day turnaround time).
Orthophosphate (as PO_4-P)	Orthophosphate, which is also known as reactive phosphorous has been included within the screening tests as it may be present from organic residue present on the incoming plastic wastes. The EQS of 0.12mg/l utilised in the assessment is derived from Table 1.3 of the Environment Agency's H1 Annex D2 Guidance10 on Assessment of sanitary and other pollutants within Surface Water Discharges.
Total Nitrogen	Total Nitrogen has been included within the screening tests as it may be present from organic residue present on the incoming plastic wastes. The EQS of 2.52mg/l utilised in the assessment is derived from Table 14 of the Environment Agency's H1 Annex D2 Guidance[10] on Assessment of sanitary and other pollutants within Surface Water Discharges (converted from micromoles per litre for a medium turbidity water).
Mercury, lead and arsenic	Mercury, lead and arsenic are not expected to be present within the discharge at environmentally significant concentrations. Nevertheless, in the absence of any source term data these substances have been included within the screening assessment.
Other Minor Metals/ Metalloids	Cadmium, chromium, copper, nickel and zinc may be present within the influent at low levels and have therefore all been included within the screening assessment. Manganese is excluded due to the absence of an EQS.
Iron and aluminium	Iron and/or aluminium dosing may be carried out, for example as a DAF flocculant, and have therefore been included within the screening assessment.
Boron and free cyanide	Antimony, molybdenum, selenium and boron may be present within the influent at low levels. Free cyanide is not expected to be present. Boron and free cyanide are the only substances with Environmental Quality Standards (EQS) assigned; these have been included within the assessment.
Dichloromethane and dichloro benzene	In accordance with the BREF document, the measurement of AOX is a requirement. AOX measures the amount of chlorine, bromine, and iodine that are adsorbed on activated carbon. Given the broadness of the analysis and absence of site-specific data, only representative substances can be utilised within the screening test. Most AOX are chlorinated and therefore dichloromethane and dichlorobenzene have been used.

Representative substance	Justification
Phenol	Bisphenol A is widely used in the manufacturing of plastics and therefore may be present within the wastewater. However, there is no EQS set for bisphenol A and therefore phenol has been used as a representative surrogate substance for modelling purposes.
Benzene, toluene and xylene	In the absence of data for the influent, benzene, toluene and xylene have been included within the screening assessment as a representative substance for any BTEX substances which may be present derived from the plastic wastes.
Naphthalene and anthracene	In the absence of data for the influent, naphthalene and benzo(a)pyrene have been included within the screening assessment as a representative substance for any polyaromatic hydrocarbons which may be present derived from the plastic wastes.
Di(2-ethylhexyl)-phthalate (DEHP) and dibutyl phthalate (DnBP)	In the absence of data for the influent, DEHP and DnBP have been included within the screening assessment as a representative substance for any phthalates which may be present derived from the plastic wastes. These are common plasticisers.
Mecoprop	In the absence of data for the influent, mecoprop has been included within the screening assessment as a representative substance for any herbicides which may be present as a result of organic residue present in the incoming plastic wastes.

[5.2.2] Wastewater Treatment Plant Screening Assessment Results

The screening assessment is based on the following conditions:

- A discharge rate to surface water of
  - 0.0028 m^3/s which represents the maximum daily discharge (240m^3/day or 10m^3/hr) throughput through the WwTP; and
  - 0.0056 m^3/s to simulate occasional increases to 20m^3/hour in throughput through the WwTP in response to operational requirements.
- A receiving River Mersey flow rate of
  - 28.9 m^3/s equivalent to the median annual flow rate (Q50);
  - 19.7 m^3/s equivalent to the Lower Quartile annual flow rate (Q70); and
  - 9.27 m^3/s equivalent to the low flow (Q95) rate.

As a first stage screening assessment it is expected that the effluent would contain substances such as ammoniacal-N and BOD (as well as others) above 10% of their respective EQS. A generic screening assessment can be undertaken to establish the conditions whereby the effluent alone could cause the receiving water to exceed its EQS under the majority of flow conditions using a simple dilution estimate and the dilution factors illustrated within Table 9.

Table 9 - WwTP Dilution Potential in Receiving Water (River Mersey, minimum freshwater baseflow contribution)

Discharge Rate		Dilution Factor According to Flow Percentile		
m^3/d	m^3/s	Q95 9.3m^3/s	Q70 19.7m^3/s	Q50 28.9m^3/s
240	0.0028	3,337	7,092	10,404

This screening assessment demonstrates that the raw effluent could not cause direct harm to the Mersey if released untreated (Table 10), as the actual untreated site effluent is (Table 3) or is expected to be at a lower concentration than these concentrations. However, it is appreciated that this simplistic overview does not consider the wider implications of a discharge if the effluent was released untreated.

Table 10 - WwTP Discharge Sensitivity Screening Assessment

Substance	Discharge Rate		EQS	Effluent Concentration for load to be equivalent to EQS		
				Q95 (9.3m³/s)	Q70 (19.7m³/s)	Q50 (28.9m³/s)
	m³/d	m³/s	mg/l	mg/l	mg/l	mg/l
Ammoniacal-N	240	0.0028	0.6	2,002	4,255	6,242
Total Nitrogen	240	0.0028	2.52	8,410	17,872	26,218
BOD	240	0.0028	5	16,686	35,460	52,020
Orthophosphate (as PO_4-P)	240	0.0028	0.12	400	851	1,248
Iron	240	0.0028	1	3,337	7,092	10,404
Aluminium	240	0.0028	1	3,337	7,092	10,404
Mercury	240	0.0028	0.07	234	496	728
Lead	240	0.0028	0.0013	4	9	14
Arsenic	240	0.0028	0.025	83	177	260
Chromium (VI)	240	0.0028	0.0006	2	4	6
Cadmium	240	0.0028	0.0002	1	1	2
Copper	240	0.0028	0.0080	27	57	84
Nickel	240	0.0028	0.0086	29	61	89
Zinc	240	0.0028	0.0178	59	126	185
Antimony	240	0.0028	0.005	17	35	52
Molybdenum	240	0.0028	0.07	234	496	728
Selenium	240	0.0028	0.01	33	71	104
Boron	240	0.0028	2	6,674	14,184	20,808
Cyanide (free)	240	0.0028	0.001	3	7	10
Dichloromethane	240	0.0028	0.02	67	142	208
Dichlorobenzene	240	0.0028	0.02	67	142	208
Phenol	240	0.0028	0.0077	26	55	80
Benzene	240	0.0028	0.008	27	57	83
Toluene	240	0.0028	0.074	247	525	770
Xylene	240	0.0028	0.03	100	213	312
Naphthalene	240	0.0028	0.002	7	14	21
Anthracene	240	0.0028	0.002	0.33	0.71	1.04
Di(2-ethylhexyl)-phthalate	240	0.0028	0.0013	4	9	14
Dibutyl phthalate	240	0.0028	0.008	27	57	83
Mecoprop	240	0.0028	0.18	601	1,277	1,873

Notwithstanding the above, the Environment Agency's screening test[12] methodology has been used to calculate the maximum steady-state discharge "Release Concentration" (RC) for each parameter such that the resultant Process Contribution from the discharge would be equivalent to an insignificant impact on the Mersey.

This calculation has been undertaken as a "back calculation" in which the PC (process contribution) has been limited to 4% of the EQS *i.e.* the criteria to pass 'Test 2'. The back calculated 'maximum allowable discharge concentrations' to meet Test 2 are set out within Table 11.

The screening assessment demonstrates that, under low flow (Q95) conditions:

- The RC for ammoniacal-N, total nitrogen and orthophosphate would need to be above the influent concentration into the WwTP to fail Test 2. Hence, there is no risk to river from ammoniacal-N, total nitrogen and orthophosphate;

- BOD within the WwTP will be reduced to less than 20mg/l[13] which is significantly less than the RC required for the influent concentration to fail Test 2. Hence, there is no risk to river from BOD;
- The RC for iron and aluminium to fail Test 2 is significantly above the solubility limit for these substances. Iron and aluminium may be introduced through dosing to the WwTP which will be controlled autonomously but will be removed at the DAF stage, and prior to further precipitation within the MBR. Iron and aluminium would then be removed the filtration membrane. Iron and aluminium will therefore not be present at the concentrations (60 – 420mg/l) required to fail Test 2 and are not considered to pose a risk to the receiving river.
- The RC required for minor metals mercury, arsenic, copper, nickel and zinc as well as free cyanide to pass Test 2 are above the BAT-EAL. Where the BAT-EALs are met, these substances will therefore not pose a risk to the watercourse. The wastewater characterisation during the commissioning process will identify if these substances are present within the influent. If these substances are identified as present above the BAT-EALs within the influent during the commissioning process it may be prudent to introduce a process control limit at the BAT-EAL. Mercury, arsenic, copper, nickel and zinc as well as free cyanide are not expected to persist through the various stages of the WwTP at concentrations consistent with that required to fail Test 2 and therefore permit limits are not considered to be necessary.
- Lead, chromium (VI) and cadmium are expected to be absent within the influent or at low levels. As the risk-based concentration for these substances is below the BAT-EAL, where they are identified within the influent during the commissioning process, a permit limit is recommended for these substances to be set at the BAT-EAL. It is however noted that the RC required to meet Test 2 for lead (170µg/l), chromium (VI) (80µg/l) and cadmium (30µg/l) are unrealistically high concentrations for this type of effluent.
- Antimony, molybdenum, selenium and boron are expected to be present within the influent at low levels consistent with a background contribution. Due to the nature of the facility, there is no expectation for these substances to be present in the influent at environmentally significant concentrations as a result of the site operations. In the absence of a BAT-EAL, where it is demonstrated that concentrations within the influent are below the RC to pass Test 2, no process or permit limits are proposed.
- The RC required to meet Test 2 for the organic substances are high and inconsistent with that expected for this type of effluent. Organic substances are unlikely to persist through the various stages of the WwTP at these concentrations and therefore the risk to the receiving river is expected to be low. The wastewater characterisation during the commissioning process will identify whether or not these substances are present within the influent. If these substances are identified as present above the BAT-EALs within the influent during the commissioning process it may be prudent to introduce a process control limit at the BAT-EAL. However, as these substances are not expected to persist through the various stages of the WwTP at concentrations consistent with that required to fail Test 2, permit limits are not considered to be necessary.

[13] Environment Agency (2014) Guidance for the treatment of landfill leachate: part 2 (withdrawn January 2020)

Table 11 - Test 2 Calculated WwTP Release Concentration to Achieve a Process Contribution of 4% of EQS

Substance	EQS	Max Influent Conc.	BAT-AEL	Required Release Concentration (RC) for load to be equivalent to a PC of 4% of EQS					
				10m³/hr (0.0028m³/s)			20m³/hr (0.0056m³/s)		
				Q95 9.3m³/s	Q70 19.7m³/s	Q50 28.9m³/s	Q95 9.3m³/s	Q70 19.7m³/s	Q50 28.9m³/s
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Ammoniacal-N	0.60	40		80	170	250	40	85	125
Total Nitrogen	2.52	52	60	336	715	1,049	168	357	524
BOD	5			667	1,418	2,081	334	709	1,040
Orthophosphate (as PO_4-P)	0.12	14	3	16	34	50	8	17	25
Iron	1			133	284	416	67	142	208
Aluminium	1			133	284	416	67	142	208
Mercury	0.07		0.01	9.3	19.9	29.1	4.7	9.9	14.6
Lead	0.0013		0.3	0.17	0.37	0.54	0.09	0.18	0.27
Arsenic	0.025		0.1	3.34	7.09	10.40	1.67	3.55	5.20
Chromium (VI)	0.0006		0.1	0.08	0.17	0.25	0.04	0.09	0.12
Cadmium	0.0002		0.1	0.03	0.06	0.08	0.01	0.03	0.04
Copper	0.0080		0.5	1.1	2.3	3.4	0.5	1.1	1.7
Nickel	0.0086		1	1.2	2.4	3.6	0.6	1.2	1.8
Zinc	0.0178		2	2.4	5.1	7.4	1.2	2.5	3.7
Antimony	0.005			0.7	1.4	2.1	0.3	0.7	1.0
Molybdenum	0.07			9.3	19.9	29.1	4.7	9.9	14.6
Selenium	0.01			1.3	2.8	4.2	0.7	1.4	2.1
Boron	2			934	1,986	2,913	467	993	1,457
Cyanide (free)	0.001		0.1	0.1	0.3	0.4	0.1	0.1	0.2
Dichloromethane	0.02		1	2.7	5.7	8.3	1.3	2.8	4.2
Dichlorobenzene	0.02		1	2.7	5.7	8.3	1.3	2.8	4.2
Phenol	0.0077		0.3	1.0	2.2	3.2	0.5	1.1	1.6
Benzene	0.008			1.1	2.3	3.3	0.5	1.1	1.7
Toluene	0.074			9.9	21.0	30.8	4.9	10.5	15.4
Xylene	0.03			4.0	8.5	12.5	2.0	4.3	6.2
Naphthalene	0.002			0.27	0.57	0.83	0.13	0.28	0.42
Anthracene	0.0001			0.01	0.03	0.04	0.01	0.01	0.02
Di(2-ethylhexyl)-phthalate	0.0013			0.17	0.37	0.54	0.09	0.18	0.27
Dibutyl phthalate	0.008			1.07	2.27	3.33	0.53	1.13	1.66
Mecoprop	0.18			24	51	75	12	26	37

*In absence of EQS, DWS used for Se and WHO health standard used for Mo. This approach is considered conservative for Se as it is similar to arsenic and therefore use of the higher arsenic EQS may be more appropriate.

[5.2.3] Wastewater Treatment Plant Significant Loads Assessment

The significant load assessment applies to all priority hazardous substances (PHS) which are expected to be present within the effluent discharge. The annual significant load limits for priority hazardous substances are summarised in Table 12.

Table 12 - WwTP Annual significant load limits

Pollutant	Annual significant load limit in kg
Anthracene	1
Brominated diphenyl ether	1
Cadmium	5
Chloroalkanes C10-13	1
Dioxins	0.0001
Endosulphan	1
Hexachlorobenzene	1
Heptachlor	1
Hexachlorobutadiene	1
Hexachloro-cyclohexane	1
Mercury and its compounds	1
Nonylphenol (4-Nonylphenol)	1
Pentachlorobenzene	1
Polycyclic aromatic Hydrocarbons (PAHs)	5
Tributyltin compounds (Tributylin-cation)	1

No data is available for the WwTP as the plant has not yet been built. However, it is anticipated that the substances listed in Table 12 will be at negligible concentrations within the discharge. In the absence of real data, a back calculation has been undertaken to determine a significant load limit from the threshold.

These are summarised in Table 13 below and utilise the following formula:

- Discharge Rate = 10 m^3/hr or 20 m^3/hr converted to a L/annum value
- Substance Load Limit = in kg converted to mg
- Threshold Conc. Limit = mg/ annum value divided by L/annum value

The Environment Agency's guidance[12] states that '*If your calculations with cleaned-up data are more than the significant load for the pollutant, the Environment Agency will include an emission limit in your permit which will tell you how to control the pollutant.* As data is not yet available for the WwTP, it cannot be determined whether or not an emission (permit) limit should be applied. Nevertheless, the thresholds below can be used in the future alongside concentration data collected through the commissioning process to determine whether or not a permit limit should be applied.

Due to the nature of the WwTP, it is however anticipated that none of the thresholds will be exceeded and therefore no permit limits should be set. Organic substances are not expected to persist through the various stages of the WwTP at these concentrations.

Table 13 – Calculation of Threshold Limits for WwTP Specific Load Assessment

	Annual significant load limit		Discharge Rate (L/annum)		Threshold Limit (mg/l)	
Pollutant	**in kg**	**in mg**	**$10m^3/hr$ in L/annum**	**$20m^3/hr$ in L/annum**	**$10m^3/hr$**	**$20m^3/hr$**
Anthracene	1	1000000	87600000	175200000	0.011	0.006
Brominated diphenyl ether	1	1000000	87600000	175200000	0.011	0.006
Cadmium	5	5000000	87600000	175200000	0.057	0.029
Chloroalkanes C10-13	1	1000000	87600000	175200000	0.011	0.006
Dioxins	0.0001	100	87600000	175200000	0.000001	0.000001
Endosulphan	1	1000000	87600000	175200000	0.011	0.006
Hexachlorobenzene	1	1000000	87600000	175200000	0.011	0.006
Heptachlor	1	1000000	87600000	175200000	0.011	0.006
Hexachlorobutadiene	1	1000000	87600000	175200000	0.011	0.006
Hexachloro-cyclohexane	1	1000000	87600000	175200000	0.011	0.006
Mercury and its compounds	1	1000000	87600000	175200000	0.011	0.006
Nonylphenol (4-Nonylphenol)	1	1000000	87600000	175200000	0.011	0.006
Pentachlorobenzene	1	1000000	87600000	175200000	0.011	0.006
PAHs	5	5000000	87600000	175200000	0.057	0.029
Tributyltin compounds	1	1000000	87600000	175200000	0.011	0.006

[5.2.4] Wastewater Treatment Plant Nutrient Effects

The Operator is proposing to discharge at a rate of $240m^3$/day and in accordance with the BAT requirements which are as follows:

- 60mg/l for total nitrogen
- 3mg/l for total phosphorous

Noting that nitrogen in the influent prior to treatment is lower than the BAT limit, and that phosphorus approximates to the BAT limitation, then for a release at the BAT limit, the risk assessment demonstrates that this equates to a Process Contribution within the receiving waters of

- 18µg/l for nitrogen
- 0.9µg/l for phosphorous

which is a negligible concentration in comparison to the background concentrations of

- 2,800µg/l for nitrogen
- 200µg/l for phosphorous

Hence, the potential impact on the available nutrients in the river will be environmentally insignificant and no further controls are required.

[5.2.5] Wastewater Treatment Plant Risk Assessment Summary and Recommendations

The sequential screening tests have been undertaken for the maximum release rate of $240m^3$/day and for various typical to low flow conditions (Q95, Q70 and Q50) with the results presented within Table 11.

The screening test calculations demonstrate that the threshold concentrations for increasing the Mersey concentrations by up to 4% of the EQS (*i.e.* to meet Test 2) are greater than the expected source concentrations in the untreated effluent under low flow condition (Q95). The simple dilution calculations demonstrate that there is little to no potential for harm to occur to the receiving waters under any flow conditions. A similar conclusion can be made for a release rate of 20m^3/hr which has been carried out to assess occasional increases in accordance with operational requirements.

Hence, in accordance with the risk assessment there is no risk-based requirement for additional monitoring or process controls.

Nevertheless, there is a requirement for the WwTP to achieve the BAT objectives set out within the BAT Regulations[14] and BREF document. The WwTP is therefore being designed to achieve the BAT-EALs which are either lower or approximately equivalent to the risk-based concentration. Given the lower concentrations warranted by the BAT regulations, under this approach the discharge could not cause harm to the Ince Marshes, and by extension to the Mersey.

The BREF document sets out requirements to monitor for a set list of determinands within the influent and effluent (where they are expected to be present). To further characterise the wastewater, it is recommended that the monitoring schedule set out within Table 14 is used during the commissioning phase to confirm whether or not substances are present at significant concentrations. It is recommended that following the collection of data during the commissioning stage, a long-term monitoring and compliance schedule is agreed with the Environment Agency.

Table 14 – Proposed WwTP Monitoring Schedule for Commissioning Stage (3-month programme)

Parameter	Monitoring Frequency	Analytical Methodology Standard[1]
	mg/l	mg/l
COD	Daily	UKAS lab
Suspended Solids	Weekly	EN 872
Ammoniacal-N	Weekly	UKAS lab
BOD	Weekly	UKAS lab
TOC	Weekly	UKAS lab
Total Nitrogen	Weekly	EN 12260, EN ISO 11905-1
Total Phosphorous	Weekly	Various *e.g.* EN ISO 15681-1
Orthophosphate (as PO_4-P)	Weekly	UKAS lab
Arsenic	Weekly	Various EN standards available (e.g. EN ISO 11885, EN ISO 17294-2, EN ISO 15586)
Cadmium		
Chromium		
Copper		
Lead		
Nickel		
Zinc		
Manganese		
Chromium (VI)	Weekly	EN ISO 10304-3 or 23913
Mercury	Weekly	EN ISO 17852 or 12846
Antimony	Monthly	UKAS lab
Molybdenum	Monthly	UKAS lab
Selenium	Monthly	UKAS lab
Boron	Monthly	UKAS lab
Hydrocarbon oil index (HOI)	Monthly	EN ISO 9377-2
Phenol Index	Monthly	EN ISO 14402

[14] COMMISSION IMPLEMENTING DECISION (EU) 2016/902 (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for common wastewater and waste gas treatment/ management systems in the chemical sector

Parameter	Monitoring Frequency	Analytical Methodology Standard[1]
	mg/l	mg/l
Free Cyanide	Monthly	EN ISO 14403-1 and -2
Adsorbable organically bound halogens (AOX)	Monthly	EN ISO 9562
Benzene, toluene, ethylbenzene & xylene	Monthly	EN ISO 15680
PFOA (perfluorooctanoic acid)	Once during period	None
PFOS (perfluorooctanesulphonic acid)		None

Control limits are proposed for key substances to demonstrate that the BAT objectives are met as follows:

- 300mg/l COD
- 60mg/l Total Nitrogen

These concentrations are over an order of magnitude lower than that required by risk assessment and as the process is aerobic, ammoniacal-N, the toxic form of nitrogen will be converted to nitrate, consequently, a total nitrogen limit is appropriate.

Given the mechanisms for treatment and the reduction in the potential “carrier” of elevated metal concentrations, *i.e.* the holistic removal of the organic content, it is not considered that heavy metals or organics could persist through the process. Nevertheless, where data collected during the commissioning process demonstrates that substances are present then proposals for further monitoring will be proposed.

The proposed approach for setting process and emission limits after the commissioning phase are set out in Table 15.

Table 15 – Proposed WwTP Approach to Setting Process and Permit Limits

Representative substance	Justification	Process Control Limit	Permit Limit
Proposals based on wastewater data from similar activity			
Ammoniacal-N	No process control or emission limits due to negligible risk to surface water.	Not required	Not required
BOD / COD/ TOC	Process control limit proposed for COD to demonstrate BAT-EAL met. No permit limits proposed. No process control or emission limits proposed for BOD due to negligible risk to surface water.	300mg/l	Not required
Orthophosphate (as PO_4-P)	No process control or emission limits due to negligible risk to surface water.	Not required	Not required
Total Nitrogen	No process control or emission limits due to negligible risk to surface water. Nevertheless, a 60mg/l process control limit has been proposed to demonstrate BAT-EAL met.	60mg/l	Not required
Proposals to be agreed following commissioning			
Mercury, arsenic, copper, nickel and zinc as well as free cyanide	If these substances are identified as present above the BAT-EALs within the influent during the commissioning process a process control limit at the BAT-EAL will be set. Mercury, arsenic, copper, nickel and zinc as well as free cyanide are not expected to persist through the various stages of the WwTP at concentrations consistent with that required to fail Test 2 and therefore permit limits are not considered to be necessary.	BAT-EAL (only if identified in influent)	Not required
Lead, chromium (VI) and cadmium	As the risk-based concentration for these substances is below the BAT-EAL, where they are identified within the influent during the commissioning process, a permit limit is recommended for these substances to be set at the BAT-EAL.	Risk-based limit (only if identified in influent)	BAT-EAL (only if identified in influent)

Representative substance	Justification	Process Control Limit	Permit Limit
Antimony, molybdenum, selenium and boron	No process control or emission limits due to negligible risk to surface water.	Not required	Not required
Other substances identified during commissioning stage (including any hazardous and non-hazardous organics)	The wastewater characterisation during the commissioning process will identify whether or not other substances are present within the influent. If other substances are identified as present above the BAT-EALs within the influent during the commissioning process it may be prudent to introduce a process control limit at the BAT-EAL. As organics substances are not expected to persist through the various stages of the WwTP at concentrations consistent with that required to fail Test 2 as demonstrated by this risk assessment, permit limits are not considered to be necessary.	BAT-EAL (only if identified in influent)	Not required

[5.3] Package Treatment Plants Screening Assessment

[5.3.1] PTP substances to be assessed

The proposed discharge rate from the two PTPs together will be $9.8m^3/d$, which is a negligible addition to that of the discharge from the WwTP at $240m^3/d$, as such, the contributions by the PTP discharges will be a negligible increase above that of the WwTP design contributions. Notwithstanding this, an assessment of the discharges from the PTPs must be made to quantify the contribution from the PTPs on the receiving waters.

The process capability of the PTPs and the expected effluent quality is available from the manufacturer's plant performance certifications[2].

As the influent into the PTPs will be limited to only sanitary wastewater from toilets and welfare facilities, the manufacturer has provided specific ammoniacal nitrogen, BOD, COD and suspended solids performance expectations for the PTPs' effluent. Of these, only ammoniacal nitrogen and BOD have EQS levels with which to conduct the risk assessment of the potential impact from the discharges from the PTPs on the surface water environment (Table 16). Neither COD nor suspended solids have EQS levels with which to conduct a risk assessment, therefore neither substance is included within the following screening tests.

Metals and metalloids, calcium, magnesium, sodium, potassium, chloride, sulphate and hazardous organic substances are not expected to be present at environmentally significant concentrations in domestic type sanitary effluents. Notwithstanding this, the PTP discharge will be into a saltwater environment, where EQS for chloride, calcium, magnesium, potassium and sulphate are not applicable due to high background concentrations, hence, these substances are not considered further in this assessment.

Table 16 – Representative PTP substances to be assessed

Representative substance	Justification
Ammoniacal-N	Ammoniacal-N it is expected to be present within the human waste of the influent into the PTP. It is expected to be reduced by up to 88.6%, to less than 4mg/l within the PTP but will still be above the 0.6mg/l EQS for a good water quality within the discharge (based on the Klargester Biodisc BA to BF specifications). Hence, an assessment of this substance is considered necessary.

Representative substance	Justification
BOD	BOD and COD are used to determine the organic content of a water. BOD and COD are expected to be reduced by the 95.7% and 89.4% in PTP but will still be present following treatment. BOD is the only component with an EQS (5mg/l) hence it is suitable as a representative determinand and therefore this substance has been modelled.

[5.3.2] Screening Assessment Results

The screening assessment is based on the following conditions:

- A discharge rate to surface water from both PTPs of
    - 0.000113 m^3/s which represents the maximum daily discharge (1.92m^3/day for the Bio-tec+2 PTP and 7.872m^3/day for the Bio-tec+8 PTP, which equals a total of 9.792m^3/day for the two PTPs) throughput through the two PTPs;
- A receiving River Mersey flow rate of
    - 28.9 m^3/s equivalent to the median annual flow rate (Q50);
    - 19.7 m^3/s equivalent to the Lower Quartile annual flow rate (Q70); and
    - 9.27 m^3/s equivalent to the low flow (Q95) rate.

The screening tests for the PTP discharges are forward calculations following the Environment Agency's guidance[11,12] on conducting discharges to surface water. The screening assessment is conducted under the worst-case scenario of no dilution from other sources within the discharge. In reality, during periods of rain there will be dilution of the PTP effluent from the clean rainwater running off the roofs of the on-site buildings.

In the first instance, the initial screening tests are split into a Part A, comprising of successive screening exercises, which are progressed for substances that cannot be demonstrated to pass an earlier screening tests. Part B requires a loading assessment and is run in parallel with the Part A screening.

[5.3.3] Part A Screening Test 1 – Release Concentration

The first Part A screening test of the H1 Assessment assesses whether the maximum Release Concentration (RC) is greater than 10% of the EQS. The results of Test 1 are presented in Table 17.

Table 17 – Part A Test 1 Results for the PTP Discharges

Substance	Units	RC	EQS	10% EQS	Is RC >10% EQS
Ammoniacal Nitrogen	mg/l	3.8	0.6	0.06	Yes
BOD	mg/l	10	5	0.5	Yes

The results of Screening Test 1 show that the release concentrations for both substances assessed were above 10% of their EQS and are therefore progressed to Screening Test 2.

[5.3.4] Part A Screening Test 2 – Process Contribution

The second screening test of the H1 Assessment assesses whether the Process Contribution (PC) is greater than 4% of the EQS or equivalent environmental standard. The results of the screening Test 2 are presented in Table 18.

Table 18 – Part A Test 2 Results for the PTP Discharges

Substance	Units	RC	EQS	PC	4% EQS	Is RC >4% EQS
Ammoniacal Nitrogen	mg/l	3.8	0.6	0.00005	0.02	No
BOD	mg/l	10	5	0.00012	0.2	No

Both substances assessed were shown to have process contributions many orders of magnitude below 4% of their respective EQS, and therefore can all be screened out at Screening Test 2.

Due to the very small discharge rate of a combined 9.8m^3/day, the dilution within the River Mersey renders the process contributions to be negligible. The Part A Screening Tests illustrate that the proposed discharge from the two PTPs will not present a risk to the surface water environment.

[5.3.5] PTP assessment for ammonia and BOD

The H1 guidance[10] requires a further consideration of ammonia (which will be in the ammonium form, and is analysed as ammoniacal-N) and BOD using a mass balance calculation rather than through the H1 Specific Substances Screening Risk Assessment.

The mass balance is designed to determine whether there will be a deterioration in the downstream quality in respect to ammoniacal nitrogen and phosphate in terms of load; this differs from the process contribution, which show less than a 4% of EQS change. If the downstream quality deteriorates by more than 10% of the upstream quality, then the discharge is required to be referred to the Environment Agency for further modelling.

The calculation for the mass balance is performed using the formula shown in Equation 2 to derive a downstream concentration. This is then compared to the background concentration to calculate a percentage deterioration.

The background ammoniacal nitrogen for the mass balance is the observed mean concentration of 0.28mg/l, as presented in Table 7. BOD is not reported at the same location, and therefore as a measure of conservatism, a minimal background BOD of 0.01mg/l is assumed for the mass balance.

The results of the mass balance calculations are presented in Table 19.

Table 19 – PTP mass balance test results

Parameter	Units	Ammoniacal Nitrogen	BOD
Discharge Rate	m^3/d	0.000113	0.000113
Discharge Concentration	mg/l	3.8	10
River flow rate (Q95)	m^3/d	9.27	9.27
Background Concentration	mg/l	0.28	0.01
Downstream Concentration	mg/l	0.28	0.0101
Change from upstream concentration	%	0	1

Due to the very small discharge rate from the PTPs, there is calculated to be negligible change in downstream quality of the River Mersey. Although ammoniacal nitrogen in the discharge is an order of magnitude greater than in the background, and the BOD is three orders of magnitude greater in the discharge than the background, the dilution within the River Mersey results in negligible observable change downstream of the discharge from the PTPs.

[5.3.6] Package Treatment Plant Risk Assessment Summary and Recommendations

The sequential screening tests undertaken under the conservative worse-case scenario of no dilution of the PTP discharges from rainfall on roofs from on-site buildings. The screening test calculations demonstrate that the process contribution from the two PTP discharges into the River Mersey under Q95 low flow conditions will be below 4% of the EQS for each substance assessed.

The mass balance calculations for ammoniacal nitrogen and BOD demonstrate that the level of dilution within the River Mersey, even during Q95 low flow conditions, is such that discharge concentrations at orders of magnitude greater than the background concentrations will cause a deterioration in the downstream river quality.

Due to the small volume of the two PTP discharges, and the negligible risk posed to the river quality in the River Mersey, it is not proposed to include any monitoring requirements on the discharges above those included in the assessment of the WwTP discharge.

[5.4] Combined Discharges Screening Assessment

[5.4.1] Substances to be Assessed – Combined Discharge

Ammoniacal nitrogen and BOD are the only two substances that are considered likely to be present within the discharge from both the WwTP and the PTPs. As such, these are the two substances that require assessment for the combined discharge, as all other substances are specific to each individual discharge and are therefore fully assessed in the above assessments for each individual discharge.

The assessment for the WwTP back calculated the following maximum release concentrations during Q95 low flow conditions in the River Mersey:

- ammoniacal nitrogen release concentrations of 40mg/l and 80mg/l, when discharging at 20m^3/hr (480m^3/d) and 10m^3/hr (240m^3/d)
- BOD release concentrations of 334mg/l and 667mg/l, when discharging at 20m^3/hr (480m^3/d) and 10m^3/hr (240m^3/d)

PTP performance certification identify an expected discharge of up to:

- 3.8mg/l of ammoniacal nitrogen and 10mg/l of BOD, at a discharge rate of 0.41m^3/hr (9.8m^3/d)

The PTP discharge is therefore a limited load contribution to that of the risk-based limits derived for the WwTP.

[5.4.2] Combined Discharge Assessment

The assessment for the discharge from the WwTP was a reverse calculation which derived maximum release concentrations for each substance at the proposed discharge rates that would result in the process contribution not exceeding 4% of the EQS.

For this combined discharges assessment, a maximum daily load for ammoniacal nitrogen and BOD is derived for the WwTP. This is achieved by using the maximum release concentration for each substance that when released at the combined discharge rate will result in a process contribution below 4% of each EQS and multiplying it by the daily discharge volume.

The daily load for the two substances is calculated for the PTPs discharge using the PTP discharge rate and concentration, and then the available load for the WwTP can be calculated by subtracting the PTPs discharge load from the standalone WwTP discharges load.

The maximum possible concentration for the WwTP is back calculated from the calculated available load for the WwTP at the WwTP discharge rate (240m^3/d and 480m^3/d).

[5.4.3] Combined Discharge Screening Test Results

The first step calculated the daily load from the WwTP discharge, when discharging at the maximum concentration as calculated in Table 11 of Section 5.2.2. The results of these calculations are presented in Table 20 below.

Table 20 – Calculated Maximum Daily Load for the WwTP Discharge

Parameter	Units	Ammoniacal Nitrogen		BOD	
WwTP Discharge Rate	l/d	240,000	480,000	240,000	480,000
WwTP Maximum Release Concentration	mg/l	80	40	667	334
WwTP Maximum Daily Load	mg/d	19,200,000	19,200,000	160,080,000	160,080,000
	g/d	19,200	19,200	160,080	160,080

The same release load calculations are also made for the discharge from the PTPs alone, with the results presented in Table 21.

Table 21 – PTPs Discharge – Calculated Daily Load

Parameter	Units	Ammoniacal Nitrogen	BOD
PTP Discharge Rate	l/d	9,792	9,792
PTP Maximum Release Concentration	mg/l	3.8	10
PTP Maximum Daily Load	mg/d	37,210	97,920
	g/d	37.21	97.92

The available load for the discharge of the WwTP can then be derived from the calculated load for the standalone WwTP discharge minus the load from the PTPs, and an acceptable release concentration for the WwTP can be calculated by dividing the resulting available WwTP load with the cumulative discharge rates. The results of these calculations are presented Table 22.

Table 22 – Calculated Available WwTP Daily Load and Maximum Release Concentration

Parameter	Units	Ammoniacal Nitrogen		BOD	
WwTP Daily Load	g/d	19,200	19,200	160,080	160,080
PTP Daily Load	g/d	37.2	37.2	97.9	97.9
Available WwTP Daily Load	g/d	19,162.8	19,162.8	159,982	159,982
Cumulative Discharge Rate	l/d	249,792	489,792	249,792	489,792
Maximum available WwTP Release Concentration	mg/l	76.7	39.1	641	327

[5.4.4] Combined Discharge Risk Assessment Summary and Recommendations

Acceptable discharge concentrations from the WwTP, when the combined discharges of the WwTP and the PTPs are assessed, have been derived from a calculated available daily load for the discharge from the WwTP. The two substances assessed were ammoniacal nitrogen and BOD, as these are the only two substances which are expected to be present in both discharges.

Calculations of the daily load for both ammoniacal nitrogen and BOD on the receiving River Mersey waters from the PTPs discharges were subtracted from the calculated daily load for the same substances for the standalone WwTP discharge to provide an available daily load for the WwTP. From this, acceptable maximum discharge concentrations were derived for the WwTP for ammoniacal nitrogen and BOD, when the discharge from the WwTP is discharged with the two PTP discharges.

The flow proportional release concentrations are summarised for ammoniacal-N and BOD as Table 23 – Calculated Flow Proportional Release Concentrations for WwTP

Table 23 – Calculated Flow Proportional Release Concentrations for WwTP with PTP Contributions

Discharge Rate	Ammoniacal Nitrogen	BOD
m^3/day	mg/l	mg/l
240	80	667
249.792	76.7	641
480	40	334
488.792	39.1	327

The results indicate that the addition of the PTPs discharges makes a minimal change to the maximum discharge concentration from the WwTP and are within analytical precision capabilities of modern laboratories, which is due to the relatively minimal discharge rates from the PTPs.

The calculated release concentrations are for a worst-case scenario, whereby the discharge occurs during Q95 low flows, and has the maximum concentration of each substance. This is unlikely to occur during the site's operations, and once the treatment works and sewerage is set up for the whole Protos Resource Park, the discharges to surface water will be lower than those assessed.

[6] Summary and Conclusion

Enviroo Limited are applying for a discharge consent for the proposed Plastic Recycling Facility at the Protos Ince Resource Recovery Park. The discharge consent will primarily comprise the discharge from a WwTP treating a wash water influent from the Polymer Washing Plant Process, with a secondary component from two PTPs treating the factory's welfare facility effluents.

A direct discharge to the environment is required as there is no available capacity in the foul sewer network and Helsby WwTW.

Effluent from the Enviroo Plastic Recycling Facility is to be discharged via a WwTP at a rate of 240m^3/day into the Ince Marshes drainage channels and then via the Hoolpool Gutter siphon under the Mersey Ship Canal to the River Mersey. A short-term higher discharge rate to 20m^3/hr has also been considered within this risk assessment.

It is considered that the key treatment stages are:

1) A sand filter/screening stages to remove large particulates and solid detritus
2) DAF to remove the recalcitrant organic content and small particulate organic matter

3) An MBR stage to

   a) convert ammonium to nitrate; as well as

   b) the removal of degradable dissolved organic matter

The site is within a naturally saline environment, i.e. an estuarine setting and therefore there is not a further need to remove salts from the effluent as an additional treatment stage.

This risk assessment demonstrates that there is a low potential to cause actual harm to the receiving River Mersey, the controlled waters receptor at the site.

Consequently, it is considered that the most appropriate mechanism for regulating the discharge is to set the conditions based on BAT guidance, namely at

- 300mg/l COD and
- 60mg/l Total Nitrogen as the nitrogen content of the treated effluent will be in an inorganic nitrate form

Proposals have been set out for monitoring to be carried out within the commissioning phase. Where the BAT-AELs set out in Table 4 above and the risk-based concentrations as established by the quantitative risk assessment in this document are met for all substances, then a discharge will be made to the watercourse. If the BAT-AELs and/or the risk-based concentrations are not met, then further consideration of the risk to the environment will need to be carried out during the commissioning stage on a substance-by-substance basis. An appropriate approach for monitoring and compliance will be agreed with the Environment Agency following the collection of data during the commissioning stage.

The two PTPs treat sanitary effluents using the same mechanistic processes as that of the main WwTP, and at a release rate of 9.8m^3/day comprise a negligible additional volumetric load (<4.1%) to that of the WwTP and are expected to treat their effluent to the same, if not higher standard than the WwTP. The PTPs are intended as a short-term measure that could be decommissioned when the site wide sanitary effluent management system is commissioned.

The proposed treated effluent discharges from the Enviroo Plastics Recycling Facility have been demonstrated to not present a risk of causing harm to the surface water environment of the River Mersey.

Appendix A – Risk Assessment Calculations

WwTP - Calculated Release Concentrations to Achieve a Process Contribution of 4% of EQS at a Discharge Rate of 10m^3/hr During Q95 Flow Conditions

	Q95	Q70	Q50	
	Discharge Consent			
Discharge Rate (C)	10	10	10	m^3/hr
Discharge Rate (C)	240	240	240	m^3/day
	0.0028	0.0028	0.0028	m^3/s
Receiving Watercourse Flow Rate (D)	9.27	19.7	28.9	m^3/s
Dilution Factor	3,338	7,093	10,405	
Sewage Reduction Factor (E)	1	1	1	

Substance	Discharge Conc (Site)	Discharge Rate	River Flow Rate Q95	STW Reduction	Discharge Conc (to River)	Background Conc (River)	Process Contribution	Conc After Mixing	EQS	Test 1 (% of EQS)	Test 2	Test 3	Test 4
	RC-Source	EFR	RFR	STRF	RC-Process	BC	PC	PEC		Test Threshold 10%	Test Threshold 4%	Test Threshold 10%	+ / -
	mg/l	m^3/s	m^3/s	Factor	mg/l	mg/l	mg/l	mg/l	mg/l				
Ammoniacal-N	80	0.0028	9.27	1	80	0.28	0.02	0.30	0.60	13349%	4%	4%	0.3
Total Nitrogen	336	0.0028	9.27	1	336	2.8	0.1	2.9	2.52	13349%	4%	4%	-0.4
BOD	667	0.0028	9.27	1	667	0.5	0.2	0.7	5	13349%	4%	4%	4.3
Orthophosphate (as P)	16	0.0028	9.27	1	16	0.2	0.0	0.2	0.12	13349%	4%	4%	-0.1
Iron	133	0.0028	9.27	1	133	0.1000	0.0400	0.13996	1	13349%	4%	4%	0.9
Aluminium	133	0.0028	9.27	1	133	0.0200	0.0400	0.05998	1	13349%	4%	4%	0.9
Mercury	9.3	0.0028	9.27	1	9	0.0070	0.0028	0.00980	0.07	13349%	4%	4%	0.1
Lead	0.17	0.0028	9.27	1	0	0.0000	0.0001	0.00007	0.0013	13349%	4%	4%	0.0
Arsenic	3.34	0.0028	9.27	1	3	0.0025	0.0010	0.00350	0.025	13349%	4%	4%	0.0
Chromium (VI)	0.08	0.0028	9.27	1	0	0.0001	0.0000	0.00008	0.0006	13349%	4%	4%	0.0
Cadmium	0.03	0.0028	9.27	1	0	0.00004	0.0000	0.00005	0.0002	13349%	4%	4%	0.0
Copper	1.07	0.0028	9.27	1	1	0.0022	0.0003	0.00252	0.0080	13349%	4%	4%	0.0
Nickel	1.15	0.0028	9.27	1	1	0.0020	0.0003	0.00234	0.0086	13349%	4%	4%	0.0
Zinc	2.38	0.0028	9.27	1	2	0.0110	0.0007	0.01171	0.0178	13349%	4%	4%	0.0
Antimony	0.67	0.0028	9.27	1	1	0.0005	0.0002	0.00070	0.005	13349%	4%	4%	0.0
Molybdenum	9.34	0.0028	9.27	1	9	0.0070	0.0028	0.00980	0.07	13349%	4%	4%	0.1
Selenium	1.33	0.0028	9.27	1	1	0.0010	0.0004	0.00140	0.01	13349%	4%	4%	0.0
Boron	934	0.0028	9.27	1	934	0.7000	0.2800	0.97971	7	13349%	4%	4%	6.0
Cyanide (free)	0.13	0.0028	9.27	1	0	0.0001	0.0000	0.00014	0.001	13349%	4%	4%	0.0
Dichloromethane	2.67	0.0028	9.27	1	3	0.0020	0.0008	0.00280	0.02	13349%	4%	4%	0.0
Dichlorobenzene	2.67	0.0028	9.27	1	3	0.0020	0.0008	0.00280	0.02	13349%	4%	4%	0.0
Phenol	1.03	0.0028	9.27	1	1	0.0008	0.0003	0.00108	0.0077	13349%	4%	4%	0.0
Benzene	1.07	0.0028	9.27	1	1	0.0008	0.0003	0.00112	0.008	13349%	4%	4%	0.0
Toluene	9.88	0.0028	9.27	1	10	0.0074	0.0030	0.01036	0.074	13349%	4%	4%	0.1
Xylene	4.00	0.0028	9.27	1	4	0.0030	0.0012	0.00420	0.03	13349%	4%	4%	0.0
Naphthalene	0.27	0.0028	9.27	1	0	0.0002	0.0001	0.00028	0.002	13349%	4%	4%	0.0
Anthracene	0.01	0.0028	9.27	1	0	0.0000	0.0000	0.00001	0.0001	13349%	4%	4%	0.0
Di(2-ethylhexyl)-phthalate	0.17	0.0028	9.27	1	0	0.0001	0.0001	0.00018	0.0013	13349%	4%	4%	0.0
Dibutyl phthalate	1.07	0.0028	9.27	1	1	0.0008	0.0003	0.00112	0.008	13349%	4%	4%	0.0
Mecoprop	24	0.0028	9.27	1	24	0.0180	0.0072	0.02519	0.18	13349%	4%	4%	0.2

WwTP - Calculated Release Concentrations to Achieve a Process Contribution of 4% of EQS at a Discharge Rate of 10m^3/hr During Q70 Flow Conditions

	Q95	Q70	Q50	
Discharge Consent				
Discharge Rate (C)	10	10	10	**m^3/hr**
Discharge Rate (C)	240	240	240	**m^3/day**
	0.0028	0.0028	0.0028	**m^3/s**
Receiving Watercourse Flow Rate (D)	9.27	19.7	28.9	**m^3/s**
Dilution Factor	3,338	7,093	10,405	
Sewage Reduction Factor (E)	1	1	1	

Substance	Discharge Conc (Site)	Discharge Rate	River Flow Rate Q70	STW Reduction	Discharge Conc (to River)	Background Conc (River)	Process Contribution	Conc After Mixing	EQS	Test 1 (% of EQS)	Test 2	Test 3	Test 4
	RC-Source	EFR	RFR	STRF	RC-Process	BC	PC	PEC		Test Threshold 10%	Test Threshold 4%	Test Threshold 10%	+ / -
Major Components	mg/l	m^3/s	m^3/s	Factor	mg/l	mg/l	mg/l	mg/l	mg/l				
Ammoniacal-N	170	0.0028	19.70	1	170	0.28	0.02	0.30	0.60	28368%	4%	4%	0.3
Total Nitrogen	715	0.0028	19.70	1	715	2.8	0.1	2.9	2.52	28368%	4%	4%	-0.4
BOD	1,418	0.0028	19.70	1	1,418	0.5	0.2	0.7	5	28368%	4%	4%	4.3
Orthophosphate (as P)	34	0.0028	19.70	1	34	0.2	0.0	0.2	0.12	28368%	4%	4%	-0.1
Iron	284	0.0028	19.70	1	284	0.1000	0.0400	0.13998	1	28368%	4%	4%	0.9
Aluminium	284	0.0028	19.70	1	284	0.0200	0.0400	0.05999	1	28368%	4%	4%	0.9
Mercury	19.9	0.0028	19.70	1	20	0.0070	0.0028	0.00980	0.07	28368%	4%	4%	0.1
Lead	0.37	0.0028	19.70	1	0	0.0000	0.0001	0.00007	0.0013	28368%	4%	4%	0.0
Arsenic	7.09	0.0028	19.70	1	7	0.0025	0.0010	0.00350	0.025	28368%	4%	4%	0.0
Chromium (VI)	0.17	0.0028	19.70	1	0	0.0001	0.0000	0.00008	0.0006	28368%	4%	4%	0.0
Cadmium	0.06	0.0028	19.70	1	0	0.00004	0.0000	0.00005	0.0002	28368%	4%	4%	0.0
Copper	2.28	0.0028	19.70	1	2	0.0022	0.0003	0.00252	0.0080	28368%	4%	4%	0.0
Nickel	2.44	0.0028	19.70	1	2	0.0020	0.0003	0.00234	0.0086	28368%	4%	4%	0.0
Zinc	5.05	0.0028	19.70	1	5	0.0110	0.0007	0.01171	0.0178	28368%	4%	4%	0.0
Antimony	1.42	0.0028	19.70	1	1	0.0005	0.0002	0.00070	0.005	28368%	4%	4%	0.0
Molybdenum	19.86	0.0028	19.70	1	20	0.0070	0.0028	0.00980	0.07	28368%	4%	4%	0.1
Selenium	2.84	0.0028	19.70	1	3	0.0010	0.0004	0.00140	0.01	28368%	4%	4%	0.0
Boron	1,986	0.0028	19.70	1	1,986	0.7000	0.2800	0.97986	7	28368%	4%	4%	6.0
Cyanide (free)	0.28	0.0028	19.70	1	0	0.0001	0.0000	0.00014	0.001	28368%	4%	4%	0.0
Dichloromethane	5.67	0.0028	19.70	1	6	0.0020	0.0008	0.00280	0.02	28368%	4%	4%	0.0
Dichlorobenzene	5.67	0.0028	19.70	1	6	0.0020	0.0008	0.00280	0.02	28368%	4%	4%	0.0
Phenol	2.18	0.0028	19.70	1	2	0.0008	0.0003	0.00108	0.0077	28368%	4%	4%	0.0
Benzene	2.27	0.0028	19.70	1	2	0.0008	0.0003	0.00112	0.008	28368%	4%	4%	0.0
Toluene	20.99	0.0028	19.70	1	21	0.0074	0.0030	0.01036	0.074	28368%	4%	4%	0.1
Xylene	8.51	0.0028	19.70	1	9	0.0030	0.0012	0.00420	0.03	28368%	4%	4%	0.0
Naphthalene	0.57	0.0028	19.70	1	1	0.0002	0.0001	0.00028	0.002	28368%	4%	4%	0.0
Anthracene	0.03	0.0028	19.70	1	0	0.00001000	0.0000	0.00001	0.0001	28368%	4%	4%	0.0
Di(2-ethylhexyl)-phthalate	0.37	0.0028	19.70	1	0	0.0001	0.0001	0.00018	0.0013	28368%	4%	4%	0.0
Dibutyl phthalate	2.27	0.0028	19.70	1	2	0.0008	0.0003	0.00112	0.008	28368%	4%	4%	0.0
Mecoprop	51	0.0028	19.70	1	51	0.0180	0.0072	0.02520	0.18	28368%	4%	4%	0.2

WwTP - Calculated Release Concentrations to Achieve a Process Contribution of 4% of EQS at a Discharge Rate of 10m^3/hr During Q50 Flow Conditions

	Q95	Q70	Q50	
Discharge Consent				
Discharge Rate (C)	10	10	10	**m^3/hr**
Discharge Rate (C)	240	240	240	**m^3/day**
	0.0028	0.0028	0.0028	**m^3/s**
Receiving Watercourse Flow Rate (D)	9.27	19.7	28.9	**m^3/s**
Dilution Factor	3,338	7,093	10,405	
Sewage Reduction Factor (E)	1	1	1	

Substance	Discharge Conc (Site)	Discharge Rate	River Flow Rate Q50	STW Reduction	Discharge Conc (to River)	Background Conc (River)	Process Contribution	Conc After Mixing	EQS	Test 1 (% of EQS)	Test 2	Test 3	Test 4
	RC-Source	EFR	RFR	STRF	RC-Process	BC	PC	PEC		Test Threshold 10%	Test Threshold 4%	Test Threshold 10%	+ / -
Major Components	mg/l	m^3/s	m^3/s	Factor	mg/l	mg/l	mg/l	mg/l	mg/l				
Ammoniacal-N	250	0.0028	28.90	1	250	0.28	0.02	0.30	0.60	41616%	4%	4%	0.3
Total Nitrogen	1,049	0.0028	28.90	1	1,049	2.8	0.1	2.9	2.52	41616%	4%	4%	-0.4
BOD	2,081	0.0028	28.90	1	2,081	0.5	0.2	0.7	5	41616%	4%	4%	4.3
Orthophosphate (as P)	50	0.0028	28.90	1	50	0.2	0.0	0.2	0.12	41616%	4%	4%	-0.1
Iron	416	0.0028	28.90	1	416	0.1000	0.0400	0.13999	1	41616%	4%	4%	0.9
Aluminium	416	0.0028	28.90	1	416	0.0200	0.0400	0.05999	1	41616%	4%	4%	0.9
Mercury	29.1	0.0028	28.90	1	29	0.0070	0.0028	0.00980	0.07	41616%	4%	4%	0.1
Lead	0.54	0.0028	28.90	1	1	0.0000	0.0001	0.00007	0.0013	41616%	4%	4%	0.0
Arsenic	10.40	0.0028	28.90	1	10	0.0025	0.0010	0.00350	0.025	41616%	4%	4%	0.0
Chromium (VI)	0.25	0.0028	28.90	1	0	0.0001	0.0000	0.00008	0.0006	41616%	4%	4%	0.0
Cadmium	0.08	0.0028	28.90	1	0	0.00004	0.0000	0.00005	0.0002	41616%	4%	4%	0.0
Copper	3.35	0.0028	28.90	1	3	0.0022	0.0003	0.00252	0.0080	41616%	4%	4%	0.0
Nickel	3.58	0.0028	28.90	1	4	0.0020	0.0003	0.00234	0.0086	41616%	4%	4%	0.0
Zinc	7.41	0.0028	28.90	1	7	0.0110	0.0007	0.01171	0.0178	41616%	4%	4%	0.0
Antimony	2.08	0.0028	28.90	1	2	0.0005	0.0002	0.00070	0.005	41616%	4%	4%	0.0
Molybdenum	29.13	0.0028	28.90	1	29	0.0070	0.0028	0.00980	0.07	41616%	4%	4%	0.1
Selenium	4.16	0.0028	28.90	1	4	0.0010	0.0004	0.00140	0.01	41616%	4%	4%	0.0
Boron	2,913	0.0028	28.90	1	2,913	0.7000	0.2800	0.97991	7	41616%	4%	4%	6.0
Cyanide (free)	0.42	0.0028	28.90	1	0	0.0001	0.0000	0.00014	0.001	41616%	4%	4%	0.0
Dichloromethane	8.32	0.0028	28.90	1	8	0.0020	0.0008	0.00280	0.02	41616%	4%	4%	0.0
Dichlorobenzene	8.32	0.0028	28.90	1	8	0.0020	0.0008	0.00280	0.02	41616%	4%	4%	0.0
Phenol	3.20	0.0028	28.90	1	3	0.0008	0.0003	0.00108	0.0077	41616%	4%	4%	0.0
Benzene	3.33	0.0028	28.90	1	3	0.0008	0.0003	0.00112	0.008	41616%	4%	4%	0.0
Toluene	30.80	0.0028	28.90	1	31	0.0074	0.0030	0.01036	0.074	41616%	4%	4%	0.1
Xylene	12.48	0.0028	28.90	1	12	0.0030	0.0012	0.00420	0.03	41616%	4%	4%	0.0
Naphthalene	0.83	0.0028	28.90	1	1	0.0002	0.0001	0.00028	0.002	41616%	4%	4%	0.0
Anthracene	0.04	0.0028	28.90	1	0	0.00001000	0.0000	0.00001	0.0001	41616%	4%	4%	0.0
Di(2-ethylhexyl)-phthalate	0.54	0.0028	28.90	1	1	0.0001	0.0001	0.00018	0.0013	41616%	4%	4%	0.0
Dibutyl phthalate	3.33	0.0028	28.90	1	3	0.0008	0.0003	0.00112	0.008	41616%	4%	4%	0.0
Mecoprop	75	0.0028	28.90	1	75	0.0180	0.0072	0.02520	0.18	41616%	4%	4%	0.2

Key:
10% of EQS
Upstream background (dissolved conc)

WwTP - Calculated Release Concentrations to Achieve a Process Contribution of 4% of EQS at a Discharge Rate of 20m³/hr During Q95 Flow Conditions

	Q95	Q70	Q50	
	Discharge Consent			
Discharge Rate (C)	20	20	20	m^3/hr
Discharge Rate (C)	240	240	240	m^3/day
	0.0056	0.0056	0.0056	m^3/s
Receiving Watercourse Flow Rate (D)	9.27	19.7	28.9	m^3/s
Dilution Factor	1,670	3,547	5,203	
Sewage Reduction Factor (E)	1	1	1	

Substance	Discharge Conc (Site)	Discharge Rate	River Flow Rate Q95	STW Reduction	Discharge Conc (to River)	Background Conc (River)	Process Contribution	Conc After Mixing	EQS	Test 1 (% of EQS)	Test 2	Test 3	Test 4
	RC-Source	EFR	RFR	STRF	RC-Process	BC	PC	PEC		Test Threshold 10%	Test Threshold 4%	Test Threshold 10%	+ / -
	mg/l	m^3/s	m^3/s	Factor	mg/l	mg/l	mg/l	mg/l	mg/l				
Ammoniacal-N	40	0.0056	9.27	1	40	0.28	0.02	0.30	0.60	6674%	4%	4%	0.3
Total Nitrogen	168	0.0056	9.27	1	168	2.8	0.1	2.9	2.52	6674%	4%	4%	-0.4
BOD	334	0.0056	9.27	1	334	0.5	0.2	0.7	5	6674%	4%	4%	4.3
Orthophosphate (as P)	8	0.0056	9.27	1	8	0.2	0.0	0.2	0.12	6674%	4%	4%	-0.1
Iron	67	0.0056	9.27	1	67	0.1000	0.0400	0.13992	1	6674%	4%	4%	0.9
Aluminium	67	0.0056	9.27	1	67	0.0200	0.0400	0.05996	1	6674%	4%	4%	0.9
Mercury	4.7	0.0056	9.27	1	5	0.0070	0.0028	0.00979	0.07	6674%	4%	4%	0.1
Lead	0.09	0.0056	9.27	1	0	0.0000	0.0001	0.00007	0.0013	6674%	4%	4%	0.0
Arsenic	1.67	0.0056	9.27	1	2	0.0025	0.0010	0.00350	0.025	6674%	4%	4%	0.0
Chromium (VI)	0.04	0.0056	9.27	1	0	0.0001	0.0000	0.00008	0.0006	6674%	4%	4%	0.0
Cadmium	0.01	0.0056	9.27	1	0	0.00004	0.0000	0.00005	0.0002	6674%	4%	4%	0.0
Copper	0.54	0.0056	9.27	1	1	0.0022	0.0003	0.00252	0.0080	6674%	4%	4%	0.0
Nickel	0.57	0.0056	9.27	1	1	0.0020	0.0003	0.00234	0.0086	6674%	4%	4%	0.0
Zinc	1.19	0.0056	9.27	1	1	0.0110	0.0007	0.01170	0.0178	6674%	4%	4%	0.0
Antimony	0.33	0.0056	9.27	1	0	0.0005	0.0002	0.00070	0.005	6674%	4%	4%	0.0
Molybdenum	4.67	0.0056	9.27	1	5	0.0070	0.0028	0.00979	0.07	6674%	4%	4%	0.1
Selenium	0.67	0.0056	9.27	1	1	0.0010	0.0004	0.00140	0.01	6674%	4%	4%	0.0
Boron	467	0.0056	9.27	1	467	0.7000	0.2800	0.97941	7	6674%	4%	4%	6.0
Cyanide (free)	0.07	0.0056	9.27	1	0	0.0001	0.0000	0.00014	0.001	6674%	4%	4%	0.0
Dichloromethane	1.33	0.0056	9.27	1	1	0.0020	0.0008	0.00280	0.02	6674%	4%	4%	0.0
Dichlorobenzene	1.33	0.0056	9.27	1	1	0.0020	0.0008	0.00280	0.02	6674%	4%	4%	0.0
Phenol	0.51	0.0056	9.27	1	1	0.0008	0.0003	0.00108	0.0077	6674%	4%	4%	0.0
Benzene	0.53	0.0056	9.27	1	1	0.0008	0.0003	0.00112	0.008	6674%	4%	4%	0.0
Toluene	4.94	0.0056	9.27	1	5	0.0074	0.0030	0.01035	0.074	6674%	4%	4%	0.1
Xylene	2.00	0.0056	9.27	1	2	0.0030	0.0012	0.00420	0.03	6674%	4%	4%	0.0
Naphthalene	0.13	0.0056	9.27	1	0	0.0002	0.0001	0.00028	0.002	6674%	4%	4%	0.0
Anthracene	0.01	0.0056	9.27	1	0	0.00001	0.0000	0.00001	0.0001	6674%	4%	4%	0.0
Di(2-ethylhexyl)-phthalate	0.09	0.0056	9.27	1	0	0.0001	0.0001	0.00018	0.0013	6674%	4%	4%	0.0
Dibutyl phthalate	0.53	0.0056	9.27	1	1	0.0008	0.0003	0.00112	0.008	6674%	4%	4%	0.0
Mecoprop	12	0.0056	9.27	1	12	0.0180	0.0072	0.02518	0.18	6674%	4%	4%	0.2

WwTP - Calculated Release Concentrations to Achieve a Process Contribution of 4% of EQS at a Discharge Rate of $20 m^3/hr$ During Q70 Flow Conditions

	Q95	Q70	Q50	
	Discharge Consent			
Discharge Rate (C)	20	20	20	m^3/hr
Discharge Rate (C)	240	240	240	m^3/day
	0.0056	0.0056	0.0056	m^3/s
Receiving Watercourse Flow Rate (D)	9.27	19.7	28.9	m^3/s
Dilution Factor	1,670	3,547	5,203	
Sewage Reduction Factor (E)	1	1	1	

Substance	Discharge Conc (Site)	Discharge Rate	River Flow Rate Q70	STW Reduction	Discharge Conc (to River)	Background Conc (River)	Process Contribution	Conc After Mixing	EQS	Test 1 (% of EQS)	Test 2	Test 3	Test 4
	RC-Source	EFR	RFR	STRF	RC-Process	BC	PC	PEC		Test Threshold 10%	Test Threshold 4%	Test Threshold 10%	+ / -
Major Components	mg/l	m^3/s	m^3/s	Factor	mg/l	mg/l	mg/l	mg/l	mg/l				
Ammoniacal-N	85	0.0056	19.70	1	85	0.28	0.02	0.30	0.60	14184%	4%	4%	0.3
Total Nitrogen	357	0.0056	19.70	1	357	2.8	0.1	2.9	2.52	14184%	4%	4%	-0.4
BOD	709	0.0056	19.70	1	709	0.5	0.2	0.7	5	14184%	4%	4%	4.3
Orthophosphate (as P)	17	0.0056	19.70	1	17	0.2	0.0	0.2	0.12	14184%	4%	4%	-0.1
Iron	142	0.0056	19.70	1	142	0.1000	0.0400	0.13996	1	14184%	4%	4%	0.9
Aluminium	142	0.0056	19.70	1	142	0.0200	0.0400	0.05998	1	14184%	4%	4%	0.9
Mercury	9.9	0.0056	19.70	1	10	0.0070	0.0028	0.00980	0.07	14184%	4%	4%	0.1
Lead	0.18	0.0056	19.70	1	0	0.0000	0.0001	0.00007	0.0013	14184%	4%	4%	0.0
Arsenic	3.55	0.0056	19.70	1	4	0.0025	0.0010	0.00350	0.025	14184%	4%	4%	0.0
Chromium (VI)	0.09	0.0056	19.70	1	0	0.0001	0.0000	0.00008	0.0006	14184%	4%	4%	0.0
Cadmium	0.03	0.0056	19.70	1	0	0.00004	0.0000	0.00005	0.0002	14184%	4%	4%	0.0
Copper	1.14	0.0056	19.70	1	1	0.0022	0.0003	0.00252	0.0080	14184%	4%	4%	0.0
Nickel	1.22	0.0056	19.70	1	1	0.0020	0.0003	0.00234	0.0086	14184%	4%	4%	0.0
Zinc	2.52	0.0056	19.70	1	3	0.0110	0.0007	0.01171	0.0178	14184%	4%	4%	0.0
Antimony	0.71	0.0056	19.70	1	1	0.0005	0.0002	0.00070	0.005	14184%	4%	4%	0.0
Molybdenum	9.93	0.0056	19.70	1	10	0.0070	0.0028	0.00980	0.07	14184%	4%	4%	0.1
Selenium	1.42	0.0056	19.70	1	1	0.0010	0.0004	0.00140	0.01	14184%	4%	4%	0.0
Boron	993	0.0056	19.70	1	993	0.7000	0.2800	0.97972	7	14184%	4%	4%	6.0
Cyanide (free)	0.14	0.0056	19.70	1	0	0.0001	0.0000	0.00014	0.001	14184%	4%	4%	0.0
Dichloromethane	2.84	0.0056	19.70	1	3	0.0020	0.0008	0.00280	0.02	14184%	4%	4%	0.0
Dichlorobenzene	2.84	0.0056	19.70	1	3	0.0020	0.0008	0.00280	0.02	14184%	4%	4%	0.0
Phenol	1.09	0.0056	19.70	1	1	0.0008	0.0003	0.00108	0.0077	14184%	4%	4%	0.0
Benzene	1.13	0.0056	19.70	1	1	0.0008	0.0003	0.00112	0.008	14184%	4%	4%	0.0
Toluene	10.50	0.0056	19.70	1	10	0.0074	0.0030	0.01036	0.074	14184%	4%	4%	0.1
Xylene	4.26	0.0056	19.70	1	4	0.0030	0.0012	0.00420	0.03	14184%	4%	4%	0.0
Naphthalene	0.28	0.0056	19.70	1	0	0.0002	0.0001	0.00028	0.002	14184%	4%	4%	0.0
Anthracene	0.01	0.0056	19.70	1	0	0.00001000	0.0000	0.00001	0.0001	14184%	4%	4%	0.0
Di(2-ethylhexyl)-phthalate	0.18	0.0056	19.70	1	0	0.0001	0.0001	0.00018	0.0013	14184%	4%	4%	0.0
Dibutyl phthalate	1.13	0.0056	19.70	1	1	0.0008	0.0003	0.00112	0.008	14184%	4%	4%	0.0
Mecoprop	26	0.0056	19.70	1	26	0.0180	0.0072	0.02519	0.18	14184%	4%	4%	0.2

WwTP - Calculated Release Concentrations to Achieve a Process Contribution of 4% of EQS at a Discharge Rate of 20m^3/hr During Q50 Flow Conditions

	Q95	Q70	Q50	
Discharge Consent				
Discharge Rate (C)	20	20	20	**m^3/hr**
Discharge Rate (C)	240	240	240	**m^3/day**
	0.0056	0.0056	0.0056	**m^3/s**
Receiving Watercourse Flow Rate (D)	9.27	19.7	28.9	**m^3/s**
Dilution Factor	1,670	3,547	5,203	
Sewage Reduction Factor (E)	1	1	1	

Substance	Discharge Conc (Site)	Discharge Rate	River Flow Rate Q50	STW Reduction	Discharge Conc (to River)	Background Conc (River)	Process Contribution	Conc After Mixing	EQS	Test 1 (% of EQS)	Test 2	Test 3	Test 4
	RC-Source	EFR	RFR	STRF	RC-Process	BC	PC	PEC		Test Threshold 10%	Test Threshold 4%	Test Threshold 10%	+ / -
Major Components	mg/l	m^3/s	m^3/s	Factor	mg/l	mg/l	mg/l	mg/l	mg/l				
Ammoniacal-N	125	0.0056	28.90	1	125	0.28	0.02	0.30	0.60	20808%	4%	4%	0.3
Total Nitrogen	524	0.0056	28.90	1	524	2.8	0.1	2.9	2.52	20808%	4%	4%	-0.4
BOD	1,040	0.0056	28.90	1	1,040	0.5	0.2	0.7	5	20808%	4%	4%	4.3
Orthophosphate (as P)	25	0.0056	28.90	1	25	0.2	0.0	0.2	0.12	20808%	4%	4%	-0.1
Iron	208	0.0056	28.90	1	208	0.1000	0.0400	0.13997	1	20808%	4%	4%	0.9
Aluminium	208	0.0056	28.90	1	208	0.0200	0.0400	0.05999	1	20808%	4%	4%	0.9
Mercury	14.6	0.0056	28.90	1	15	0.0070	0.0028	0.00980	0.07	20808%	4%	4%	0.1
Lead	0.27	0.0056	28.90	1	0	0.0000	0.0001	0.00007	0.0013	20808%	4%	4%	0.0
Arsenic	5.20	0.0056	28.90	1	5	0.0025	0.0010	0.00350	0.025	20808%	4%	4%	0.0
Chromium (VI)	0.12	0.0056	28.90	1	0	0.0001	0.0000	0.00008	0.0006	20808%	4%	4%	0.0
Cadmium	0.04	0.0056	28.90	1	0	0.00004	0.0000	0.00005	0.0002	20808%	4%	4%	0.0
Copper	1.67	0.0056	28.90	1	2	0.0022	0.0003	0.00252	0.0080	20808%	4%	4%	0.0
Nickel	1.79	0.0056	28.90	1	2	0.0020	0.0003	0.00234	0.0086	20808%	4%	4%	0.0
Zinc	3.70	0.0056	28.90	1	4	0.0110	0.0007	0.01171	0.0178	20808%	4%	4%	0.0
Antimony	1.04	0.0056	28.90	1	1	0.0005	0.0002	0.00070	0.005	20808%	4%	4%	0.0
Molybdenum	14.57	0.0056	28.90	1	15	0.0070	0.0028	0.00980	0.07	20808%	4%	4%	0.1
Selenium	2.08	0.0056	28.90	1	2	0.0010	0.0004	0.00140	0.01	20808%	4%	4%	0.0
Boron	1,457	0.0056	28.90	1	1,457	0.7000	0.2800	0.97981	7	20808%	4%	4%	6.0
Cyanide (free)	0.21	0.0056	28.90	1	0	0.0001	0.0000	0.00014	0.001	20808%	4%	4%	0.0
Dichloromethane	4.16	0.0056	28.90	1	4	0.0020	0.0008	0.00280	0.02	20808%	4%	4%	0.0
Dichlorobenzene	4.16	0.0056	28.90	1	4	0.0020	0.0008	0.00280	0.02	20808%	4%	4%	0.0
Phenol	1.60	0.0056	28.90	1	2	0.0008	0.0003	0.00108	0.0077	20808%	4%	4%	0.0
Benzene	1.66	0.0056	28.90	1	2	0.0008	0.0003	0.00112	0.008	20808%	4%	4%	0.0
Toluene	15.40	0.0056	28.90	1	15	0.0074	0.0030	0.01036	0.074	20808%	4%	4%	0.1
Xylene	6.24	0.0056	28.90	1	6	0.0030	0.0012	0.00420	0.03	20808%	4%	4%	0.0
Naphthalene	0.42	0.0056	28.90	1	0	0.0002	0.0001	0.00028	0.002	20808%	4%	4%	0.0
Anthracene	0.02	0.0056	28.90	1	0	0.00001000	0.0000	0.00001	0.0001	20808%	4%	4%	0.0
Di(2-ethylhexyl)-phthalate	0.27	0.0056	28.90	1	0	0.0001	0.0001	0.00018	0.0013	20808%	4%	4%	0.0
Dibutyl phthalate	1.66	0.0056	28.90	1	2	0.0008	0.0003	0.00112	0.008	20808%	4%	4%	0.0
Mecoprop	37	0.0056	28.90	1	37	0.0180	0.0072	0.02520	0.18	20808%	4%	4%	0.2

Key:
10% of EQS
Upstream background (dissolved conc)

WwTP - Specific Substances Load Assessment

Pollutant	Annual significant load limit in kg	Annual significant load limit in mg	Discharge Rate @ 10m3/hr in L/annum	Discharge Rate @ 20m3/hr in L/annum	Concentration Limit for 10m3/hr discharge (mg/l)	Concentration Limit for 20m3/hr discharge (mg/l)
Anthracene	1	1000000	87600000	175200000	0.011	0.006
Brominated diphenyl ether	1	1000000	87600000	175200000	0.011	0.006
Cadmium	5	5000000	87600000	175200000	0.057	0.029
Chloroalkanes C10-13	1	1000000	87600000	175200000	0.011	0.006
Dioxins	0.0001	100	87600000	175200000	0.000001	0.000001
Endosulphan		0	87600000	175200000	0.000	0.000
Hexachlorobenzene	1	1000000	87600000	175200000	0.011	0.006
Heptachlor	1	1000000	87600000	175200000	0.011	0.006
Hexachlorobutadiene	1	1000000	87600000	175200000	0.011	0.006
Hexachloro-cyclohexane	1	1000000	87600000	175200000	0.011	0.006
Mercury and its compounds	1	1000000	87600000	175200000	0.011	0.006
Nonylphenol (4-Nonylphenol)	1	1000000	87600000	175200000	0.011	0.006
Pentachlorobenzene	1	1000000	87600000	175200000	0.011	0.006
Polycyclic aromatic Hydrocarbons (PAHs)	5	5000000	87600000	175200000	0.057	0.029
Tributyltin compounds (Tributylin-cation)	1	1000000	87600000	175200000	0.011	0.006

PTP Discharges - Part A Screening Tests

Part A Test 1 - Release Concentration						Part A Test 2 - Process Contribution			Part A Test 3 - Predicted Enviromental Conc. (PEC)					Part A Test 4 - Is PEC > EQS
Substance	**Units**	**RC**	**EQS/DWS**	**10% EQS**	**Is RC > 10% EQS**	**PC**	**4% EQS**	**Is PC > 4% EQS**	**BC**	**PEC**	**PEC-BC**	**10% EQS**	**Is PEC-BC > 10% EQS**	**Is PEC > EQS**
Ammoniacal-N	mg/l	3.8	0.6	0.06	Yes	0.00005	0.02	No						
BOD	mg/l	10.0	5	0.5	Yes	0.00012	0.20	No						

Discharge rate (m3/s)	m3/s	0.000113
River Mersey Q95 (m3/s)	m3/s	9.27000

PTP Discharge - Ammonia and BOD Mass Balance

The Basis of the calculations (Environment Agency, 2014, pg. 17)

The mixing of a discharge with a river is described by the Mass Balance Equation below:

$$T = \frac{FC + fc}{F + f}$$

where:

- F is the river flow upstream of the discharge
- C is the concentration of pollutant in the river upstream of the discharge
- f is the flow of the discharge
- c is the concentration of pollutant in the discharge
- T is the concentration of pollutant downstream of the discharge

If deterioration is in excess of 10% then refer to the EA for further modelling.

Ammoniacal Nitrogen		
		River Mersey
River Flow Rate (Q95)	F	9.2700
Background Conc. (mean)	C	0.28
Discharge rate	f	0.000113
Release Conc. (mean)	c	3.80
Downstream Conc. (Q95 flow)	T	0.28
% change from background conc.		0

BOD		
		River Mersey
River Flow Rate (Q95)	F	9.2700
Background Conc. (mean)	C	0.01
Discharge rate	f	0.000113
Release Conc. (mean)	c	10.0
Downstream Conc. (Q95 flow)	T	0.0101
% change from background conc.		1

Calculations of the Available Daily Load and Release Concentration from the WwTP during the Combined Discharge

Calculations for 240m^3/d WwTP discharge

WwTP Release Concentration			
Substance	**Units**	**Max**	**EQS/DWS**
NH4-N	mg/l	80.00	0.6
River Mersey Q95 (m3/s)	mg/l	667.00	5

Average WwTP discharge rate		
	m3/s	0.002795
	l/s	2.795138889
	l/d	240000

WwTP Load			
Substance	mg/d	g/d	kg/d
NH4-N	19200000	19200	19.2
BOD	160080000	160080	160.08

Release Concentration			
Substance	**Units**	**Max**	**EQS/DWS**
NH4-N	mg/l	3.80	0.6
BOD	mg/l	10.00	5

Average discharge rate		
	m3/s	0.000113
	l/s	0.113333333
	l/d	9792

PTP Load			
Substance	mg/d	g/d	kg/d
NH4-N	37210	37.2096	0.0372096
BOD	97920	97.92	0.09792

Available WwTP Load		
	mg/d	mg/l @ 249.8m3/d
NH4-N	19162790	76.7
BOD	159982080	640.5

Calculations for 480m^3/d WwTP discharge

WwTP Release Concentration			
Substance	**Units**	**Max**	**EQS/DWS**
NH4-N	mg/l	40.00	0.6
BOD	mg/l	334.00	5

Average WwTP discharge rate		
	m3/s	0.005573
	l/s	5.572916667
	l/d	480000

WwTP Load			
Substance	mg/d	g/d	kg/d
NH4-N	19200000	19200	19.2
BOD	160320000	160320	160.32

PTP Release Concentration			
Substance	**Units**	**Max**	**EQS/DWS**
NH4-N	mg/l	3.80	0.6
BOD	mg/l	10.00	5

Average PTP discharge rate		
	m3/s	0.000113
	l/s	0.113333333
	l/d	9792

PTP Load			
	mg/d	g/d	kg/d
NH4-N	37210	37.2096	0.0372096
BOD	97920	97.92	0.09792

Available WwTP Load		
	mg/d	mg/l @ 489.8m3/d
NH4-N	19162790	39.1
BOD	160222080	327.1