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Waste Water Treatment Procedure		**Revision Number: 0**
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Surface Water Monitoring	
Purpose	To define and document the company's procedure for collecting, treating and monitoring run off surface water, detailing the following: - The origin of emissions - The treatment processes - Characteristics of the waste water - The sampling method - Suite of analysis and Emission Limits - The reporting details This document is aimed to enables the procedure to be communicated to employees of company and identifies responsibilities for their implementation.
Scope	This procedure applies to the treatment of run off surface water collected and treated at the WWTP at the Atlantic Recycling limited site.
Other Relevant Documents	Documents & Record (IMS01-01) Water Monitoring Schedule (IMS14-04) Drainage Layout - Drawing JCD0170-086. Surface Water Monitoring (IMS14-07)
References	EPR1.00 How to Comply with your Environmental Permit, Sector Guidance S5.06, Waste Treatment BREF environmental management tool kit- Waste handling industry
Responsibilities	The **Managing Director** has overall responsibility for the implementation of this procedure with support from the Compliance Director, Operations Manager and Technical Assessment Chemist to ensure compliance is maintained and training is kept up to date.
Action	**Methodology**
A. General Requirements	1. It is the responsibility of the site Operations Manager that the plant is operated, inspected, regularly maintained and kept in good operational conditions.

	2. It is the responsibility of the Technical Assessment Chemist to ensure that monitoring is carried out by relevant operative or assigned consultants according to the specified frequency at the right locations following the agreed sampling method and to include the complete suite of determinands. 3. It is his responsibility that the monitoring results are assessed against the agreed criteria and inform the Operations Manager of conformity or otherwise and the need for further treatment before discharging into the field ditches at the permitted emission point.
B. Origin of the Emission	The Waste Water Treatment plant is currently designated to treat only surface water run off collected from the various sealed drainage systems serving the different parts of the hardstanding on the Atlantic site. These sources are marked on Drawing JCD0170-086
C. The Treatment Process	**Overview** The WWTP has been specifically designed to treat the site's surface water to the limits specified in ARL's environmental permit. The WWTP will receive all surface water run offs from the site (other than rain water collected from the roof the RDF/SRF processing facility), treating the effluent before its controlled release into the local water environment at D2. The WWTP consists of a series of treatment phases, which collectively deliver a process to achieve the desired effluent quality standard. The biological treatment phase is the primary treatment within the system. Figure 1.1 (provided below) identifies the key phases in water treatment. The unit comprises of two multi cellular tanks, tank one, known as the nitrification tank, reduces the Biochemical Oxygen Demand (BOD) and converts excess ammonia to nitrite, then nitrate and then tank two, known as the denitrification tank, removes the nitrate. The initial nitrification phase will focus on the parameters below: • dissolved oxygen; • ammoniacal nitrogen; • nitrite; • nitrate; • BOD; • total suspended solids and • pH. Nitrification is a biological treatment process to remove ammonia from the incoming wastewater. This is achieved using two different types of autotrophic bacteria (Nitrosomonas and Nitrobacter). The Nitrosomonas bacteria oxidise ammonia to nitrite and then the Nitrobacter oxidise nitrite to nitrate. Both Nitrosomonas and Nitrobacter can only develop biochemical activity in an environment containing dissolved oxygen. The formed nitrate can be used by most micro-organisms in the biomass' sludge as a substitute for dissolved oxygen. In an anoxic environment, characterised by the presence of nitrate and the absence of dissolved oxygen, the nitrate ion can be reduced by organic matter to nitrogen gas: this process is called denitrification.

The alkalinity consumption by nitrification may result in a reduction of pH. The magnitude of this reduction depends on the initial alkalinity and the oxidised ammonium concentration. During denitrification, half of the alkalinity consumption for nitrification is recovered. Thus, the pH may not require correction when the full process is achieved.

If the first biological reactor is kept completely aerobic, the nitrified mixed liquor will need to flow to the second tank that acts as a dedicated settlement zone, where an adequate environment can be established for denitrification to occur. This will occur as soon as the oxygen is consumed.

As a result of the development of denitrification in the settler, nitrogen bubbles will be formed, and these will rise to the liquid surface. To optimise the treatment process flows will be retained within the system for a minimum of four hours.

Each biological reactor operates as a submerged aerated filter (SAF) for both the nitrification and denitrification process.

Pumped flow from the storage ditch enters the first reactor via a high-level inlet pipe and flows vertically via a down-pipe to enter above the membrane diffuser, then upwards through the crossflow block media. Flow exits the first cell through a cut out in the dividing wall, then down another pipe in the second reactor cell. The same flow path is then repeated through the remaining reactor cells. In this way, all flow is upwards, i.e. concurrent with the air.

Air is provided via a set of duty/standby 3kW side channel air blowers located in the adjacent enclosure. Air enters each reactor cell via removable fine bubble membrane diffusers. Butterfly valves are fitted to the airline to each manifold to allow adjustment to ensure the same air flow pattern in all four reactor cells when observed above via the inspection hatches.

Each reactor cell has a valve connected to the sludge outlet connected to a common sludge outlet pipework. One end of the outlet pipework is blanked off for cleaning purposes, whilst the other end is connected to the sludge holding tank. A 4 inch bauer coupling can be attached to this pipework for tankering away the SAF contents (sludges) if this is operationally required.

Water is heated to an optimum temperature of approximately 20°C using energy from the boiler which will be maintained throughout the process.

Tank water level monitors will provide additional mechanism for leak detection.

Heavy metals are ionised during the process in the ion exchange unit. During the process they become attached to ion exchange resin, which once spent is replaced. Resin removed will be disposed of at an appropriate facility.

The water then passes to a final filter for final polishing. Water passing out of the filter will then be discharged to the quality control section of the settlement ditch.

The settlement ditch will be divided into 2 sections: the quality control section and the storage section (see drawing JCD0170-086). Water will be pumped from the WWTP to the quality control section and will be tested for chemical properties and temperature. If all necessary parameters are met water will be pumped to point D2 and released. If any parameter including temperature is not met the culvert in the weir separating the two sections will be opened allowing the water to pass into the storage section of the settlement ditch and from there either pumped back into the WWTP, into the buffer tank if no capacity existed in the WWTP at the time or possibly recirculated to the culvert that receive the surface run off from the operational areas of the transfer station before discharge to the treatment system. The process of recirculation cools the water whilst the bioreactor takes a continual feed from the stored section and acts as a heat exchanger.

The biomass boiler will be used to heat the water going into the WWTP.

Any sludge and solids collected in the settlement tanks will be removed by vacuum tanker as necessary and disposed of at an appropriate facility.

D. Characteristics of the Waste Water

The Flow

Being surface water runoff, the flow of the water will be weather dependent and vary across the seasons and days. However, the WWTP is designed to handle circa 3.5 l/s, equivalent to approximately 302 m3/day, more than 100,000 m3/day (or tonnes) per annum when working at full capacity. However, to allow for breakdown and maintenance times and repeated batches, the expected actual capacity would be in the region of 70,000 tonnes per annum.

Daily run offs from all areas served by the WWTP, as identify in Drawing JCD0170-086, is estimated from the MET data to be in the region of 5898 m3 in the wettest month of the year which gives a daily average of 190 m3/day lower than the plant daily treatment capacity. However, the MET data also show that this monthly rainfall may fall within 15.5 days. This increases the daily average to 380 m3/day which is slightly greater than the plant daily capacity assuming the rain fall was continuous for the 15.5 days, an unlikely scenario. Based this unlikely scenario, the total flow above the plant capacity for the duration is estimated at ~1200 m^3.

The QC ditch and the storage ditch have capacities in excess of 300 m^3 and 1000 m^3 respectively while the culvert has a capacity in excess of 180 m^3. These in addition to the buffer tank which will be provided should it thought to be necessary are more than adequate to deal with the total flow at all times.

If under very unusual circumstances, the flow was greater than the plant capacity for treatment and greater than available storage volume, surplus water will be tankered off site for treatment at other facilities

The Chemistry

The quality of the run off from the operational area of the site is subject to monitoring and has been for a very long time. Data collected since August 2006 identified the following chemical characteristics of the water: The WWTP is designed to deal with this range and be adapted to deal with its variation.

The water will be heated to an optimum temperature of approximately 20°C (15 °C -25 °C) using energy from the boiler which will be maintained throughout the process as described in the above section.

The system is designed to operate efficiently at the expected range of PH identified from the long-term monitoring data (presented Table1 below). However, the alkalinity consumption by nitrification may result in a reduction of pH. The magnitude of this reduction depends on the initial alkalinity and the oxidised ammonium concentration. During denitrification, half of the alkalinity consumption for nitrification is recovered. Thus, the pH may not require correction when the full process is achieved.

Table 1: chemical characteristics of the waste water

Analyte	Unit	No. of Analyses	No. > LoD	Minimum	Maximum	Mean	SD
Ammoniacal Nitrogen as N	mg/l	64.00	64.00	0.10	77.10	14.87	18.15
BOD	mg/l	64.00	60.00	1.00	762.00	64.92	144.30
GRO C5-C12	ug/l	50.00	16.00	74.00	2450.00	184.42	481.48
Calcium	mg/l	64.00	64.00	31.50	16400.00	655.36	2161.26
Cadmium	ug/l	64.00	17.00	0.11	110.00	3.58	15.18
Cloride	mg/l	64.00	64.00	58.20	309.00	135.45	56.39
Conductivity	mS/cm	62.00	62.00	1.01	2.76	1.59	0.41
Dissolved Oxygen	mg/l	62.00	39.00	0.37	17.00	2.59	3.17
Nickel Dissolved	ug/l	64.00	64.00	3.00	29.10	11.12	5.81
Nitrite as N	mg/l	63.00	53.00	0.01	2.72	0.33	0.55
Nitrate as N	mg/l	64.00	37.00	0.03	9.83	0.68	1.74
Phosphate	mg/l	64.00	35.00	0.06	0.74	0.13	0.16
Lead Dissolved	ug/l	65.00	53.00	0.04	74.80	3.73	10.73
pH Value	pH Units	62.00	62.00	6.28	9.31	7.93	0.47
Sulphate (soluble)	mg/l	64.00	64.00	181.00	958.00	496.36	170.69
Total Suspended Solids	mg/l	64.00	62.00	3.50	44100.00	1344.14	6123.56
Total Oxidised Nitrogen as N	mg/l	64.00	25.00	0.12	11.30	0.75	1.93
Zinc	ug/l	64.00	64.00	3.81	41800.00	1311.51	5642.48
GRO C5-C10	ug/l	48.00	25.00	11.00	734.00	55.58	123.60
EPH Range >C10 - C40 (aq)	ug/l	41.00	41.00	65.20	530000.00	21382.42	83852.92

E. Sampling and Testing Method	**The Sampling procedure**: The laboratory shall be called to arrange sample pick-up time from an appropriate location. Ice packs shall be placed in all cool boxes to be used for sample storage and transportation to the designated laboratories. Prior to commencing sampling, a safe sampling position and any site-specific hazards of note (including bank stability / gradients; bank structure / surface conditions; ease of access to water; overhead constraints / hazards; and lateral constraints considering length of extendable pole) will be determined. The designated sampler shall have access to an inflatable life jacket / buoyancy aid when sampling. The sampler shall put the life jacket on whilst 10 m away from the water course before approaching the sample point. No watercourses shall be entered during these works. However, in the event any surveyor should get into difficulty in the water they will be rescued by the accompanying surveyor using a throw rope. A surface water sample shall be taken from the water course from a safe position on the bankside using an extendable pole and bottle holding attachment (i.e. grab sample). A clean sample container shall be fixed to the bottle holder attachment for the extendable pole. The designated sampler will not lean over the channel / water body when sampling. The sample pole bottle shall be submerged in the surface water course rinsed three times. Water shall be decanted into the required clean, pre-labelled sample containers. All personnel shall wear the appropriate PPE to avoid skin contact with the water whilst sampling. This should include long sleeves, nitrile gloves and safety glasses, To avoid injury / accident during sampling, over extension with the pole extended shall be avoided. The time of sampling shall be recorded. A record of the ditch characteristics shall be made including the presence of any hydrocarbon sheens and general water quality in the vicinity of the sample location. Where the sample is to be collected from the emission point, the sampling containers will be prepared ready to collect the sample from the discharge point. The sample should be collected as close as possible to the discharge point to avoid cross contamination. Sufficient sample shall be taken to enable the measurement of the parameters in the laboratory. The sample containers will be clearly labelled with date, sample location and project code. Sample containers will be rinsed before sampling. All sample containers shall be filled to the top, making all efforts not to trap any air within the container. Sample bottles shall be placed in cool box with ice packs. Samples from potentially contaminated locations shall be placed in a sealed plastic bag sealed or separate cool box. The sampling will be follow ISO 5667 standard on water quality sampling **Equipment to be used (tools, plant, safety, PPE etc):** <u>PPE</u> Buoyancy Aid / Life Jacket Throw Rope with a loop/knot tied at the end to make it easier to grasp

Hi Visibility clothing
Warm, waterproof clothing
Long sleeved jacket/top and suitable trousers to protect against scratches
Sturdy footwear with good ankle support
Joint support where individual considers necessary
Gloves (Disposable nitrile gloves)
Safety glasses

<u>Water Sampling</u>
Extendable pole and bottle holding head
Throw Rope with handle or knot at end
Bailers
String
Sample containers,
Cool boxes
Ice packs
Chain of Custody Forms

<u>General Equipment</u>
Camera
Note book
Pens / pencils
Permanent marker
Maps (sample locations)
Parcel tape

<u>Personal Hygiene / Cleaning / First Aid</u>
Bottled Clean Water for Rinsing
Blue Towel
First Aid Kit
Wipes & Hand gels

Testing

All samples are tested in a UKAS/MCERT accredited lab that operates according to current UK applicable standard including ISO 14001 and ISO17025.

F. Suite of Analysis and Emission Limits

Suite of Analysis and Emission Limits

The suite of analysis is as required by the current site permit. The emission limits are based on Permit existing criteria updated to include BAT requirements as presented in Table 2 below:

Table2: determinands and emission limits

Determinand	Emission limits
pH	6.8 - 8.5
Conductivity	>2000 microS/cm
Total Suspended Solids	5-60 mg/l
Biological Oxygen Demand (BOD)	>18 mg/l on one occasion 10+ mg/l on three consecutive occasions
Nitrite (NO_2)	>1 mg/l
Nitrate (NO_3)	>1 mg/l
Ammoniacal Nitrogen	>1 mg/l on one occasion >0.5 mg/l on 4 consecutive occasions
Total Oxidised Nitrogen (TON)	>2 mg/l
Orthophosphate	>1mg/l
Sulphates	>300 mg/l
Chloride	>300 mg/l
Calcium	>300 mg/l
Zinc	0.1-2 mg/l
Lead	0.05-0.1 mg/l (Limit is for Lead, expressed as Pb, includes all inorganic and organic lead compounds, dissolved or bound to particles).
Cadmium	>0.005 mg/l
Nickel	0.05-0.5 mg/l (Limit is for Nickel, expressed as Ni, includes all inorganic and organic nickel compounds, dissolved or bound to particles).
Total petroleum hydrocarbons C6-C40- fully speciated total petroleum hydrocarbons	0.5-10 mg/l

Other Testing

The supplier of the WWTP will carry out daily testing of ATP (Adenosine Triphosphate). ATP is developed to measure the bacterial growth and identify sources of toxicity. By identifying and removing the sources of toxicity, and introducing growth enhancing factors such as closely controlled temperature levels (15℃ to 25℃), nutrients and dissolved oxygen levels, the system is able to fully optimise its mechanical and biological operation.

ATP is the primary energy carrier in all living organisms. When biological cells metabolise, the energy released is transferred to ATP, which then moves to other parts of the cell to donate that energy to other functions. As the primary energy, ATP is central to the health

	and growth of all life. Without it, cells could not transfer energy from one location to another, making it impossible for organisms to grow and reproduce. Frequent ATP measurement of the living microbiological population enabled rapid and early identification of problems. Analysing cause and effect relationships helped to create solutions with the application of bio-augmentation.
G. Frequency of monitoring	**QC:** Initially daily for a while to be reduced to weekly if a pattern was identified after a satisfactory period of monitoring and a reduced monitoring frequency is agreed with NRW **Discharge point(D2):** Monthly **ATP:** Initially daily for a while to be reduced to any monitoring frequency deemed appropriate by the Expert who will be regularly analysing the data.
H. reporting	1. Monthly proformas will be submitted to NRW showing the discharge quality at the emission point (D2)- Time: middle of each calendar month.

G. Flow Diagram	Figure 1: