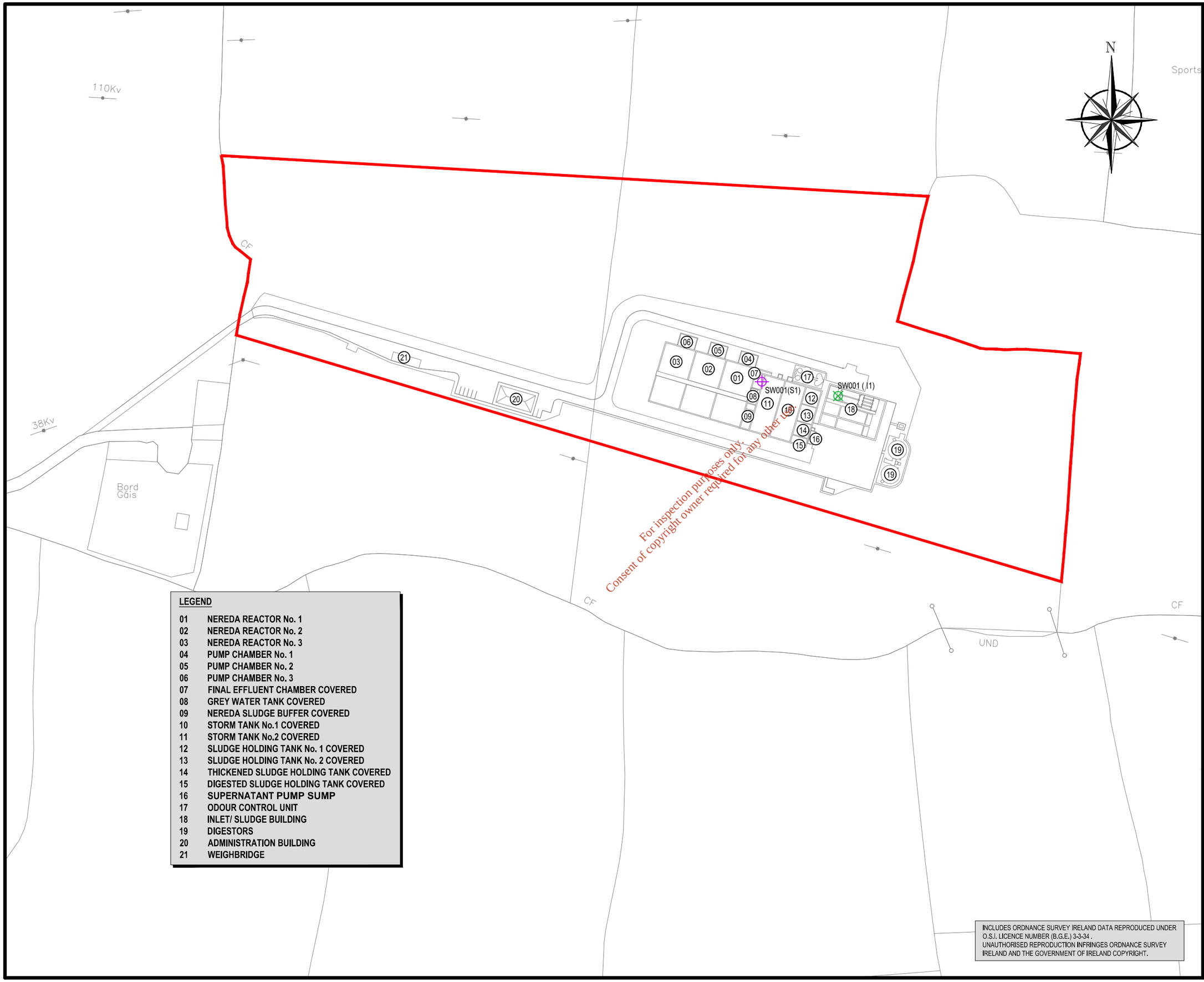
Attachment B.2: Agglomeration Details

Attachment B.2.6: WwTP site layout

Attachment B.2.7: WwTP process flow

Attachment B.2.8: WwTP details



LEGEND

01	NEREDA REACTOR No. 1
02	NEREDA REACTOR No. 2
03	NEREDA REACTOR No. 3
04	PUMP CHAMBER No. 1
05	PUMP CHAMBER No. 2
06	PUMP CHAMBER No. 3
07	FINAL EFFLUENT CHAMBER COVERED
08	GREY WATER TANK COVERED
09	NEREDA SLUDGE BUFFER COVERED
10	STORM TANK No.1 COVERED
11	STORM TANK No.2 COVERED
12	SLUDGE HOLDING TANK No. 1 COVERED
13	SLUDGE HOLDING TANK No. 2 COVERED
14	THICKENED SLUDGE HOLDING TANK COVERED
15	DIGESTED SLUDGE HOLDING TANK COVERED
16	SUPERNATANT PUMP SUMP
17	ODOUR CONTROL UNIT
18	INLET/ SLUDGE BUILDING
19	DIGESTORS
20	ADMINISTRATION BUILDING
21	WEIGHBRIDGE

NOTES

LEGEND

INLET SAMPLING POINT
SW00X (iX)

POINT	EASTING	NORTHING
SW001 (I1)	175225	063771

WWTP TREATED EFFLUENT SAMPLING POINT SW001 (S1)

POINT	EASTING	NORTHING
SW001(S1)	175167	063448

SIGNED :	
PRINT NAME :	
POSITION :	
DATE :	
FOR IRISH WATER	

REV	DATE	DESCRIPTION	D	C	A

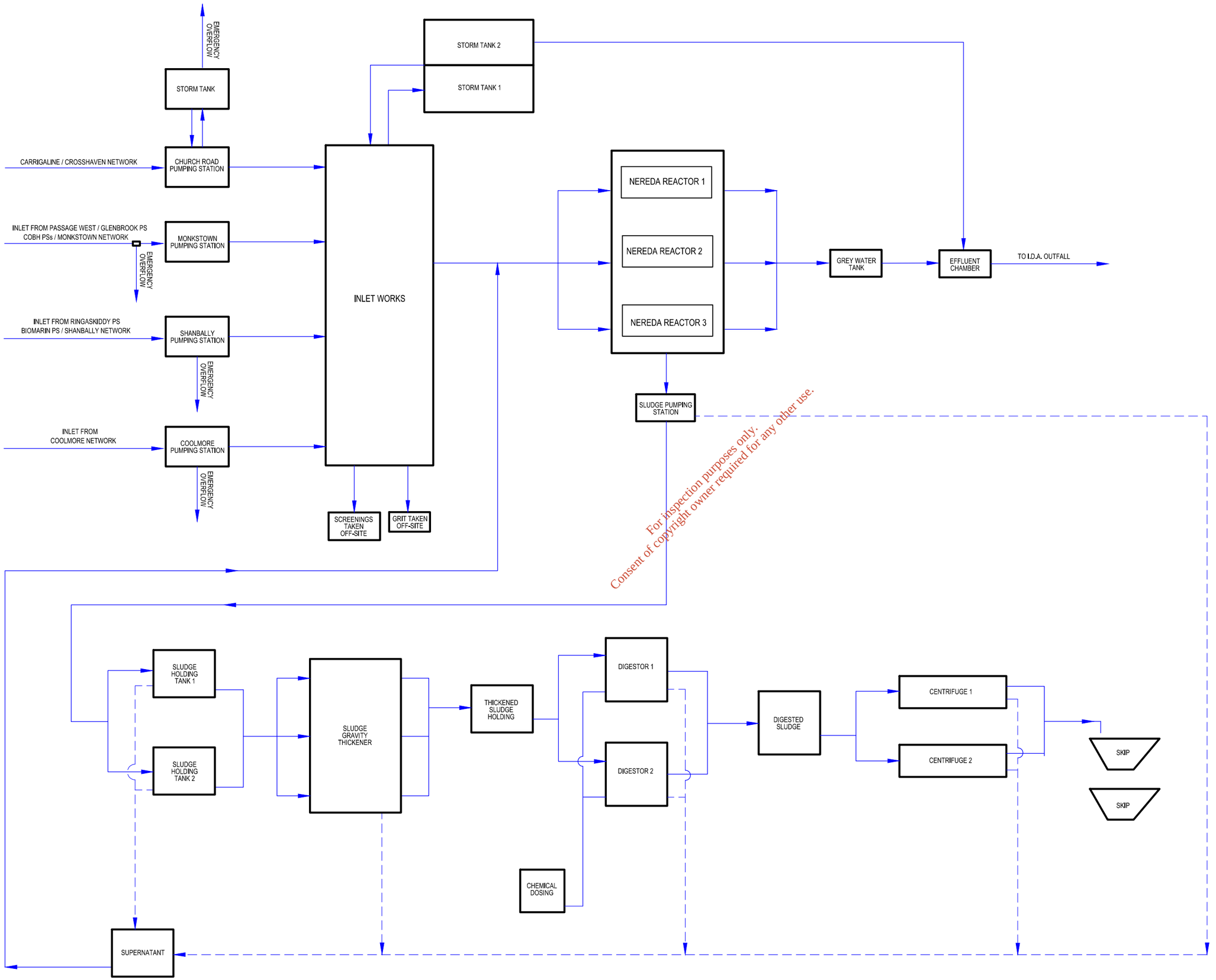
WASTE WATER DISCHARGE LICENCE TECHNICAL REVIEW

CLIENT
IRISH WATER
Colvill House,
24-26 Talbot Street,
Dublin 1.

PROJECT
CORK LOWER HARBOUR
WASTE WATER DISCHARGE
LICENCE TECHNICAL REVIEW

TITLE
WWTP LAYOUT PLAN

SCALES 1:500	DRAWN D. Smithers		
	DATE 04.05.2018		
CAD REFERENCE B.4 20506-DL-07	SECTION B.4	DRAWING No. 07	REV -



NOTES

SIGNED :	
PRINT NAME :	
POSITION :	
DATE :	
FOR IRISH WATER	

REV	DATE	DESCRIPTION	D	C	A

WASTE WATER DISCHARGE LICENCE TECHNICAL REVIEW

CLIENT

IRISH WATER
Colvill House,
24-26 Talbot Street,
Dublin 1.

PROJECT

CORK LOWER HARBOUR
WASTE WATER DISCHARGE
LICENCE TECHNICAL REVIEW

TITLE

WWTP
PROCESS FLOW DIAGRAM

SCALES	DRAWN			
N.T.S.	D. Smithers			
	DATE			
	04.05.2018			
CAD REFERENCE	SECTION	DRAWING No.	REV	
B.4 20506-DL-08	B.4	08	-	

Attachment B.4 (i) Details of the WwTP, Process Capacity and Systems

Cork Lower Harbour Waste Water Treatment Plant (WwTP)

Introduction

The newly constructed WwTP at Shanbally, providing secondary treatment with a design capacity of 65,000 PE (expandable to 80,000 PE) completed construction in 2016 and took first flows from Carrigaline and Crosshaven in December 2016. The treatment works consists of preliminary treatment and secondary treatment based on Nereda® Aerobic Granular Reactors technology prior to gravity discharge to the Cork Harbour near Dognose Bank.

The WwTP at Shanbally is operated by EPS Group on behalf of Irish Water and is manned from 8 am to 5 pm Monday to Thursday and 4pm on Friday with on-call outside of these hours.

Design Parameters

The basic design parameters for the 65,000 PE Waste Water Treatment Plant are summarised as follows:

Parameter	**m^3/d**	**m^3/h**
DWF (Dry Weather Flow)	14,625	609
FFT (Flow to Full Treatment)	43,875	1,828
	l/s	**m^3/h**
Outfall Max flow rate	988	3,556.8

Overview of Treatment Plant Process

Preliminary Treatment – Inlet Screens

All foul flows from pumping stations from the catchments including the towns of Cobh, Passage West, Monkstown, Ringaskiddy, Carrigaline and other adjoining areas will arrive at the inlet works on the treatment plant site. Flows are then discharged to an inlet channel, containing one automatic storm screen, two automatic foul inlet screens and one hand raked screen followed by grit removal channels. Each screen is capable of being isolated for maintenance or removal by penstocks in front of and behind each unit complete with a by-pass facility.

During normal operation both foul screens accept flows, even though one unit on its own is capable of accepting the entire flow of 1,828 m^3/h (65,000 PE at FFT).

Flows pass through each foul screen, depositing screenings on the mechanical screen. A carpet of screenings will eventually build-up on the unit, and as the screen becomes blinded the level in the pre-cast channel will rise. An ultrasonic level detector in the channel measures levels and once a pre-determined high level is attained, the screen cleaning is activated and this results in a clean section of screen at the bottom of the unit through which effluent will pass.

Screenings fall from the screens to an auger; which transports screenings to a cleaning and compressing unit. Screenings are washed using final effluent, and then compressed to

remove water from the screenings. Washed and dewatered screenings are augured to a screenings bin for removal off-site.

The inlet works includes:

- 2 no. 2 mm inlet screens (Duty/Standby) with a capacity of FFT plus 50%
- 1 no. 6 mm storm screens (Duty) with a capacity of storm flows
- 1 no. 12 mm Manual by-pass screen

Preliminary treatment – Grit Removal

Screened flows pass to the grit/grease removal chamber, which is divided in two by a vertical wall running the length of the chamber. Both halves are tapered from the top to bottom by a sloped wall, a steel baffle plate sits above this wall controlling the passage of flow.

Duty/standby air blowers inject air into the chamber from a number of feed pipes attached to the central wall. Both the duty/standby grit channels and duty/standby air lift blowers are designed to cater for 80,000 PE full flow to treatment. Grit is removed from the bottom of the tank using duty/standby air blowers to air-lift the grit, and discharge it to a grit classifier, where grit is washed and augured to a grit bin for removal off-site.

Storm Tankage

Flow in excess of the FFT of 508 l/s, up to the max flow to the treatment plant of 988 l/s, passes through the storm screen into the storm water holding tank. The storm tank is divided into 2 cells, each with a working volume of 2,250 m^3. Once flows to the treatment plant have reduced below 2.0-2.5 DWF, the duty/standby storm return pumps return the contents of the storm tank to the treatment plant. There is a tipping bucket arrangement to clean tanks and one hydro-ejector pump per cell for septicity management during long retention periods.

If the working volume of the storm tanks reach capacity, storm water overflows *via* an overflow weir to the final effluent chamber where it mixes with the treated effluent before discharging by gravity to the outfall. This overflow (SW021) is a Dual Function Overflow as it can also act as an Emergency Overflow in the event that all biological treatment systems and their redundancies fail. The influent flows are discharged to the storm tanks, which discharge *via* the overflow if the working capacity of the storm tanks is reached.

Biological Treatment

Flows gravitate into the biological treatment stage following preliminary treatment. The system is based around three Nereda® Aerobic Granular Reactors. The Nereda® Aerobic Granular Process operates as a batch process.

The following consecutive steps and processes take place within a Nereda® reactor:

1. *Fill and decant:* During the fill phase the waste water is introduced in the reactor. Under (near) plug flow conditions the waste water is flowing through the settled biomass. This generates a high substrate gradient leaving the biomass saturated with substrate. As a result of the plug flow conditions and the settling characteristics of the Nereda® biomass, there is no contact between the purified effluent at the top of the reactor and the raw waste water. This allows for the decant flow to be "*pushed*" out of the reactor during feeding. Contrary to conventional sequencing

batch reactor systems no separate decant phase is required. Typically at each batch, 15% to 70% of the reactor volume is replaced with each cycle.

2. *Reaction*: During the (aerated) reaction phase, the compact structure of the biomass generates an oxygen gradient, with the outer layer of the biomass being *"oxic"* and the core anoxic/anaerobic. In the outer layer nitrifiers accumulate, with the nitrate produced being denitrified in the core of the biomass. Due to the saturation with organic substrate in the fill phase there is sufficient carbon source available. The aeration also facilitates the phosphate uptake necessary for an efficient biological phosphate removal.
3. *Settling*: In this phase the biomass is separated from the effluent. Due to the settling characteristics of the biomass, the duration of this phase is relatively short.

The Nereda® process is controlled through the specifically developed Aquasuite Nereda® controller, which is responding to the actual conditions within each Nereda® unit.

The tanks are sized to treat a 3 DWF hydraulic flowrate continuously. These conditions are monitored on the following parameters:

- Oxygen meter (each reactor)
- Redox meter (each reactor)
- Ammonia probe (each reactor)
- pH and Temperature probe (combined influent)
- Turbidity (combined effluent)

Characteristic to the Nereda® Process is the development of granular biomass. The reactors will be started up by inoculation with a substantial amount of granular sludge. This involves decanting (part) of the poorest settling sludge in a dedicated start-up mode. Sludge is drawn from each Reactor by anactuated valve. During settling phase and at a predicted time the actuated valve is opened and sludge is drawn off from Nereda® Reactor into a dual sludge holding tanks.

Aeration System

Aeration systems comprise of a lattice of fine bubble air diffusers and supply networks mounted on the cell floor. Diffusers are arranged so that, the cell contents will maintain a dissolved oxygen level, which can be varied from 0 - 2.5 mg/l.

Air is supplied by 5 No. duty/duty/assist/assist/standby blowers. Diffusers are capable of providing fine bubbles with clog free design capable of preventing inflow to pipe-work when not in operation.

Outfall Monitoring

The treated effluent flows by gravity and discharges at the Cork Lower Harbour *via* an outfall. The flow meter at the plant measures the outlet flow in tandem with a composite flow proportional sampler. Treated effluent is sampled at the WwTP (for UWWD purposes) and also at the current EPA licensed point which includes for IPC/IED licences contributing to the sewers between the WwTP and the official sampling point *i.e*. this is a combined effluent.

Additional Systems at Plant

Additional systems in use at the treatment plant include sludge treatment processes for sludge thickening and digestion, odour control systems and Combined Heat and Power

(CHP) systems using methane created during sludge digestion for heat and electricity generation.