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NEW BELLOZANNE STW

STATES OF JERSEY DEPARTMENT FOR INFRASTRUCTURE

NEW BELLOZANNE STW EFFLUENT DISCHARGE OBJECTIVES & CONSENT

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Effluent Discharge Consent

The new Bellozanne STW design addresses many of the problem areas that occur on the current STW and it has been agreed with the Regulator that with these improvements, the TN load of the discharge from the new Bellozanne STW will not be greater than that of the current plant. These improvements include: -

1. reduced number of storm spills from the new STW with storm water captured within the storm water tanks thus reducing the number and volume of storm water overflows;
2. higher flow sent to full treatment through the works and therefore a larger treated volume;
3. balanced load entering the works thus reducing the high peak loads currently seen and thereby achieving a more robust process; and,
4. better settlement and removal of some of the process issues currently experienced - flow distribution etc.

Based on the predicted population equivalent, PE, of 118,000, and the corresponding design flow and load to the works, the Concept Design and discussions with the DoE have led to the following effluent discharge limit being agreed.

- Biological Oxygen Demand (BOD): 25 mg/l (95%ile, daily composite samples)
- Chemical Oxygen Demand (COD): 125 mg/l (95%ile, daily composite samples)
- Total Suspended Solids: 35mg/l (95%ile, daily composite samples)
- Total Nitrogen (TN): 35mg/l as total N based on an annual average. (daily composite samples)
- Disinfection of all final effluent and storm overflows by UV measured applied dose of 30 $mW.s.cm^{-2}$ at 254nm.

The Effluent Discharge Consent Limit is a legally enforceable effluent requirement.

Addition of an Anoxic Tank

An anoxic tank of 2,200m^3 capacity has been assessed by DfI due to the following advantages and considerations: -

1. An anoxic tank will provide energy savings as the fixed oxygen in the nitrate returned in the RAS stream will be utilised by denitrifying bacteria to reduce the carbonaceous BOD entering the secondary treatment stage. This in turn reduces the aeration required thus leading to lower blower run times. This meets DfI's objective of lower operating cost and reduced carbon footprint.
2. There is uncertainty over the C/N ratio of the raw sewage entering the works and this is a critical parameter in the rate of denitrification achieved. The process model undertaken by DEL was based on the C/N ratio as determined from the Alcontrol Laboratory data. The local unaccredited Jersey lab indicated a lower C/N ratio. Whilst it is generally agreed that there is more confidence in the Alcontrol data there

is still an element of uncertainty over the differing results and the C/N ratio appears to be low. This has a negative effect on the rate of denitrification. The inclusion of an anoxic zone gives a degree of contingency to the process and its ability to achieve the required Discharge Consent.

3. Input to the bay model includes questionable historical effluent water quality data for the existing STW, obtained from the Jersey testing lab, and inputs from the Sewerage Network Model and the STW Process Model. A combined effect of these inputs creates another level of uncertainty.
4. The original bay model run in March 2015 indicated a marginal increase of TN level in the bay water for a short duration in August/ September with the Concept Design of a standard carbonaceous BOD removal plant.
5. Due to the position required by the anoxic tank in the process flow and the positioning of the works itself, it would be extremely difficult to construct an anoxic tank after the activated sludge plant and primary tanks have been constructed. The decision for its inclusion therefore has to be made now rather than waiting until sufficient effluent data is available for the new STW to prove or disprove its requirement and inclusion.
6. Notwithstanding the predicted improvements within the design of the new STW and the agreed Discharge Consent as detailed above, DfI have considered spending the extra capital cost of a 2,200m^3 anoxic tank to provide an added insurance for the performance of the STW and enhance the bay water quality.

In view of the advantages and considerations of the anoxic tank as noted above, the decision has been made to include an anoxic tank between the primary tanks and the aerobic activated sludge tanks as part of the Final Design.

Effluent Discharge Objectives

Effluent Discharge Objectives are used where the available data on the parameters to be controlled are insufficient to form the basis for a legally enforceable limit.

Two main areas of uncertainty with regard to available data and parameters exist: -

1. C/N ratio
   As detailed above, there is uncertainty on the C/N ratio of the raw sewage and this affects the performance of the denitrification stage. The local Jersey lab indicated an even lower C/N ratio than the accredited Alcontrol lab and both labs indicated a C/N ratio lower than would normally be expected.

2. Influent load profile
   The model for the design 118,000Pe situation used the same influent biological concentration and flow profile as currently seen at the works but increased the flow value to account for the increase in population. This should provide a sensible output but again there is an element of uncertainty as the future flow profile isn't known. This may affect the extent of nitrification achieved in the future.

The above points mean that there is a degree of uncertainty as to the actual C/N ratio experienced and the variation that occurs both in the C/N ratio and the future flow and load profile. Thus the future performance of the plant in relation to the actual TN standard achievable is difficult to ascertain.

Clearly the addition of the anoxic tank can only improve the TN concentration in the effluent and this gives an element of contingency to the quality of the effluent that the plant will achieve. However since the degree of improvement is dependent on factors such as the C/N ratio (which appears to be low at Bellozanne giving a low reaction rate) and the extent of nitrification achieved in the aerobic zone, it is difficult to determine exactly what the performance of the additional plant will be for the future design load. In addition, it should be emphasised that the New STW is designed as a carbonaceous BOD removal plant and not as a nitrifying plant.

There is therefore a degree of uncertainty over the 'extra' performance that can be achieved by the addition of an anoxic tank and therefore a reluctance to remove the contingency achieved in adding the anoxic tank by agreeing a reduced discharge TN standard. That said, providing the C/N ratio is as anticipated and the flow/ concentration profile remains as per the current influent, an annual average TN standard of 28mg/l ought to be achievable and therefore to have it as an objective that the operation of the plant endeavours to achieve is reasonable.

This is reinforced if the ongoing work being carried out by DoE to reduce nitrates in the Island's catchments is continued and the current good progress is maintained.

It is therefore recommended to maintain the formal Effluent Discharge Consent as detailed above which is a legally enforceable effluent requirement, but in addition, set Effluent Discharge Objectives which, whilst not enforceable under the law, is a treatment level that DfI will make every effort to achieve for as much of the time as possible. The Final Design has taken this into consideration by adding an anoxic tank to the Concept Design and selecting a process that gives DfI greater opportunity to meet the discharge objective.

Effluent Discharge Objectives and Consent would be the same for all parameters other than the TN, which would reduce from an annual average of 35mg/l to 28mg/l. This is summarised below: -

Parameter	Effluent Discharge Objectives		Effluent Discharge Consent (Non Compliance Criteria)	
	mg/l	Basis	mg/l	basis
Carbonaceous Biochemical Oxygen Demand (cBOD)	25	95%ile,	25	95%ile,
Chemical Oxygen demand (COD)	125	95%ile	125	95%ile
Suspended Solids (SS)	35	95%ile	35	95%ile
Total Nitrogen (TN)	28	Annual average	35	Annual average

All samples are daily composite samples.

In addition, disinfection of all final effluent and storm overflows will be by a UV measured applied dose of 30mW.s.cm^{-2} at 254nm.

Should the effluent discharge standard exceed the Effluent Discharge Objectives, DfI will undertake a study to ascertain the impacts and causes of the exceedance. This provides the basis by which DfI can assess what corrective action is required, if any, to lessen the effluent discharge concentration.

Clearly the Effluent Discharge Consent is a legally enforceable effluent requirement but DfI will endeavour to achieve the Effluent Discharge Objectives.