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Comhairle Contae Chorcaí
Cork County Council

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Reg. No: D0044-01
Cork County Council
Southern Division
Carrigtwohill.
Additional Information rec'd 21/12/07
Original

Wastewater Authorisation Regs Section
Licencing Unit
Office of Climate Change,
Licencing and resource Use,
Environmental Protection Agency
Johnstown Castle Estate
County Wexford
Ireland

8th November 2007

Subject : Wastewater Authorisation Regulations Application- Agglomeration of Carrigtwohill

Dear Sir or Madam ,

The attached documents are section C of the Cork County Council application for Carrigtwohill wastewater treatment plant and agglomeration. This is composed of the relevant page from the application form , written text document outlining the wastewater works ,a map of the wastewater works labelled B2-02 and a map attachment C1-01which outlines the outfall pipe which is also detailed on the application form page. An original and 2 hard copies are provided . As required 2 PDF discs are also supplied with the drawings and text and an autocad version of the maps.

Should you have any queries or clarification my contact details are supplied below
Phone no. 021-4532700/E mail valerie.hannon@corkcoco.ie

Yours Sincerely

Valerie Hannon

Valerie Hannon,
A/Snr Executive Scientist,
Environment Directorate,
Cork County Council.

c.c. Pat O'Mahony , Senior Engineer Water Services ,Cork County Council

SECTION C: INFRASTRUCTURE & OPERATION

Advice on completing this section is provided in the accompanying Guidance Note.

C.1 Operational Information Requirements

Provide a description of the plant, process and design capacity for the areas of the waste water works where discharges occur, to include a copy of such plans, drawings or maps, (site plans and location maps, process flow diagrams), and such other particulars, reports and supporting documentation as are necessary to describe all aspects of the area of the waste water works discharging to the aquatic environment. Maps and drawings must be no larger than A3 size.

Attachment C.1 should contain supporting documentation with regard to the plant and process capacity, systems, storm water overflows, emergency overflows, etc., including flow diagrams of each with any relevant additional information. These drawings / maps should also be provided as geo-referenced digital drawing files (e.g. ESRI Shapefile, MapInfo Tab, AutoCAD or other upon agreement) in Irish National Grid Projection. This data should be provided to the Agency on a separate CD-Rom containing sections B.1, B.2, B.3, B.4, B.5, D.2, E.3 and F.2.

Attachment included	Yes	No
C1 – CARRIGTOHILL WASTEWATER TREATMENT WORKS	X	

C.2 Outfall Design and Construction

Provide details on the primary discharge point & secondary discharge points and storm overflows to include reference, location, design criteria and construction detail.
Main outfall is 1200mm diameter concrete pipe,
Secondary outfall SW2 is 1050mm diameter concrete pipe
Secondary outfall SW3 is 900mm diameter concrete pipe (not yet commissioned)

Attachment C.2 should contain any supporting documentation on the design and construction of any and all discharge outfalls, including stormwater overflows, from the waste water works.

Attachment included	Yes	No
C1—01carrig	X	

C1 – CARRIGTOHILL WASTEWATER TREATMENT WORKS

REVIEW OF EXISTING TREATMENT PLANT

The existing Carrigtohill wastewater treatment plant (WWTP) comprises two activated sludge streams, which are operated in series, as shown in schematic outline in Fig 1. Stream 1 has a rectangular aeration tank equipped with a floating surface aerator, followed by a circular clarifier (Clarifier 1). Stream 2 is a conventional oxidation ditch, equipped with two aeration rotors, also followed by a circular clarifier (Clarifier 2). Data on the process unit sizes are summarized in Table 1.

The influent wastewater is pumped from three pumping stations, one serving Carrigtohill and its environs, the second serving the local IDA Industrial Estate and the third coming from the Fota Golf & Hotel complex. The rising mains discharge directly to the rectangular aeration tank, without any preliminary treatment. The domestic wastewater coming from Carrigtohill village and its environs is macerated prior to pumping. In addition, leachate from the Rossmore and Youghal landfills is delivered by tanker to storage tanks at the WWTP site, whence it is normally pumped to the oxidation ditch but can also be sent to the rectangular aeration tank.

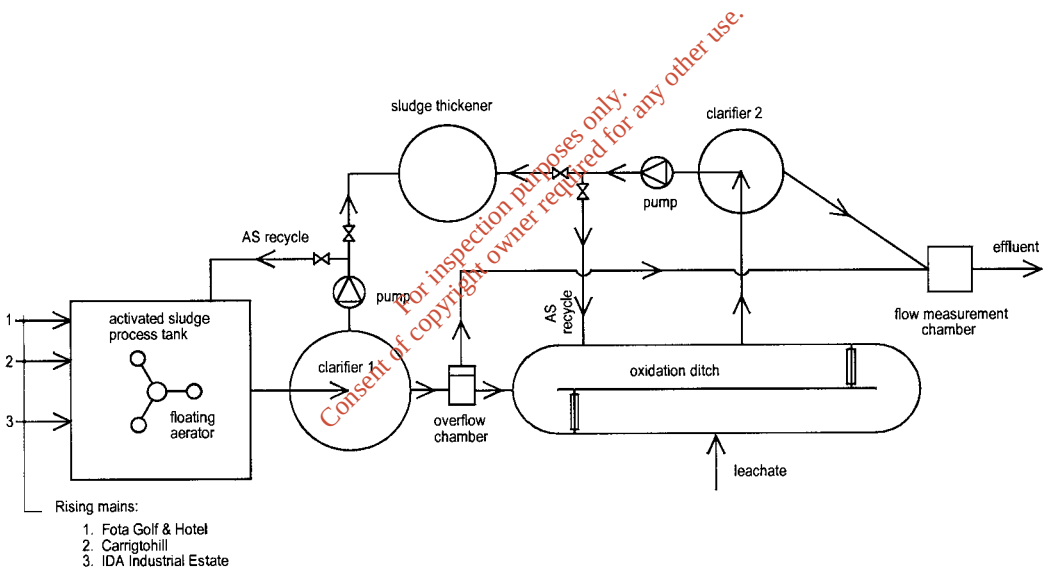

Fig 1 **Schematic layout of Carrigtohill WWTW**

Table 1
Tank sizes

Process unit	Size
Rectangular aeration tank	Plan dimensions: 17.6m x 17.6m x 3.6m deep; volume 1115m^3
Clarifier 1	Circular tank: 11.4m dia., plan area 102 m^2
Oxidation ditch	Plan area 311 m^2; liquid depth 2.0m; volume 621m^3
Clarifier 2	Circular tank: 8.0m dia., plan area 50m^2
Sludge thickening tank	Circular tank: 9.2m dia., plan area 66 m^2
Leachate storage tanks	6 no., each of capacity 36.4 m^3

CURRENT LOADING

Hydraulic load

The average daily WwTW influent volumes during April 2007 are given in Table 2.

Table 2
WwTW inflow

Source	Mean daily volume (m^3)
Carrigtohill pumping station	922
IDA Industrial Estate pumping station	1054
Fota Golf Course & Hotel pumping station	100
Leachate	150
Total	2226

The total rainfall depth recorded at Cork Airport during April 2007 was 27mm with less than 0.2mm on 24 days. Hence the above influent volumes provides a reasonable estimate of the dry weather flow to the WwTW. April 23 was the only day with a significant rainfall (16.5 mm at Cork Airport). The pumped volume from Carrigtohill was 50% above the monthly average on April 24 but the rainfall event had no discernible impact on the IDA Industrial Estate wastewater discharge rate.

The inflow volumes from the Carrigtohill and IDA Industrial Estate sewerage systems are roughly equal and constitute some 89% of the total inflow.

The pumping rate from Carrigtohill is about 190 m^3/h; hence, based on the above data, the pumping duration in dry weather conditions is about 5 hours per day.

The pumping rate from the IDA Industrial Estate is about 134 m^3/h; hence, based on the above data, pumping duration in dry weather conditions is about 8 hours per day.

Simultaneous inflow from the Carrigtohill and IDA pumping stations results in a WwTW inflow rate of about 324 m^3/h.

Organic load

There is a paucity of information on the organic strength of the influent wastewater to the Carrigtohill WwTW. Representative sampling is difficult due to the fact that there are four separate intermittent influent streams, which differ in volume and concentration. Influent quality data from 2003 is presented in Table 2.

Table 2
Influent wastewater
(based on 24h composite samples

Parameter	Sampling date	
	22/01/03	05/02/03
BOD_5 (mg/l)	180	195
COD (mg/l)	353	590
Suspended solids (mg/l)	140	130
Total P (mg/l)	-	2.4
NH_4-N (mg/l)	15	11.1
pH	7.4	7.3

For the purposes of estimating the current WwTW organic loading rate an average influent BOD_5 concentration of 200 mg/l is assumed. Combined with a dry weather flow of 2226 m^3/d the average current BOD_5 load to the WwTW is estimated to be about 445 kg/d or 7420 PE. This should be regarded as a provisional estimate, pending the availability of further survey data on the influent strength.

CURRENT OPERATIONAL MODE

Liquid stream

As shown in Fig 1, the rising mains from Carrigtohill PS, the IDA PS and the Fota Golf & Hotel PS discharge to the rectangular aeration tank. Assuming these flows constitute 90% of the influent BOD load (7420 x 0.9 = 6678 PE), it is estimated that this activated reactor would have a sludge age of about 10 days if operated at a mixed liquor suspended solids (MLSS) concentration of 4000 mg/l. It should therefore be capable of producing a nitrified effluent if operated at a dissolved oxygen (DO) concentration ≥2 mg/l.

Aeration of the rectangular AS reactor is by a floating vertical shaft surface aerator, driven by a 3-phase geared motor. The average current consumption for the motor was noted to be 35A (site visit of 15/05/07), corresponding to an estimated active power of about 12 kW. Assuming an oxygen transfer energy efficiency of 1.5 kg O_2/kWh, the oxygen transfer capacity of the aerator is estimated to be about 432 kg O_2/d to clean water. Under activated sludge process conditions this rate might be reduced to about 310 kg O_2/d.

The process respiration demand for operation at a sludge age of 10 days and a loading of 6678 PE is estimated to be about 735 kg O_2/d. Thus, there is a large deficiency in aeration capacity for operation in a nitrifying mode. However, the process could probably be operated satisfactorily at a low MLSS, although it would still be oxygen-limited.

As noted above, simultaneous delivery from the Carrigtohill and the IDA pumping stations results in an inflow of 324 m^3/h. At this flow rate the surface loading rate of Clarifier 1 is about 3.2 m/h, which is about three times the normal design rate for secondary clarifiers. This operating condition would be likely to occur in wet weather resulting in a significant increase in the on-time of the Carrigtohill pumps. Under dry weather conditions, there would be some attenuation of the flow due to storage in the aeration tank.

Thus, the rectangular tank activated sludge process, as currently operated, is severely overloaded both in respect of aeration capacity and secondary clarifier capacity.

As indicated in Table 1, the oxidation ditch has an operating volume of about 621 m^3. Oxidation ditches have been typically designed with a process volume of 300 l/PE. Hence, it is probable that the original design capacity of the oxidation ditch was 2000 PE. The associated secondary clarifier (Clarifier 2 in Fig 1) has a diameter of 8m and a clarification capacity of about 50 m^3/h or 1205 m^3/d, which corresponds to a hydraulic design value of 600 l/PE.d (3 DWF).

The oxidation ditch is equipped with two aeration rotors. Each rotor is 3.6m long, 700 mm diameter.

As shown in Fig 1, the rectangular tank and oxidation ditch activated sludge processes operate in series. The effluent from Clarifier 1 flows to an overflow chamber, which splits the flow into two streams, one going forward to the oxidation ditch and the second being diverted to the WwTw outflow. It would appear that about one third of the works through-flow is processed through the oxidation ditch and Clarifier 2. On the basis of the latter scenario the peak flow through Clarifier 2 would be 108 m^3/h corresponding to a surface loading of 2.16 m/h.

Sludge

Surplus sludge is transferred to the sludge thickener, as shown in Fig 1. The thickener has been designed for continuous operation but is currently operated in batch mode. Thickened sludge is withdrawn from the bottom of the thickener and is dewatered by belt press (Pressure Cleaners Model S2 750 LP). A cationic polymer is used for conditioning. The output of dewatered sludge is ca. 22.5 tonnes per week. Based on the plant operator's estimate of a dewatered sludge average dry matter content of 11% and an estimated plant loading of 7420 PE, the specific sludge yield is calculated to be 48 g/PE.d. This is a somewhat low value, which may reflect a significant loss of solids by effluent carryover from the clarifiers.

PERFORMANCE

Effluent quality data, based on monthly 24-h composite samples, are presented in Table 3. While the data do not provide a sufficient body of information on which to make a full assessment of performance, the results indicate a variable effluent quality in terms of both BOD_5 and SS content. This is not unexpected insofar as the WwTW is overloaded both hydraulically and organically.

Table 3
Effluent quality data

Parameter	2004	2005	2006
BOD_5 range (mg/l)			
BOD_5 average (mg/l)			
SS range (mg/l)			
SS average (mg/l)			

SUMMARY

1. The WwTW is operated as a 2-stage activated sludge process. However, about two thirds of the flow bypasses the second stage process.
2. Influent is pumped to the plant from three independent pumping stations. Simultaneous delivery from the three stations results in severe hydraulic overloading. This problem is aggravated in wet weather when there is a greater likelihood of simultaneous pump operation.
3. The current (May 2007) dry weather flow to the plant is estimated to be about 2226 m^3/d. This estimate is based on data taken from the WwTW flow records.
4. The current (May 2007) organic loading has been estimated at 7420 PE. This should be regarded as a provisional estimate that would need to be confirmed by a detailed sampling survey.
5. It is estimated that the peak surface loading on Clarifier 1 may sometimes be in excess of 3 m/h, which is about 3 times the recommended operational limit value for secondary clarification. Such high hydraulic loading results from the simultaneous delivery from all three external pumping stations.
6. The oxygenation capacity of the surface aerator in the rectangular aeration tank is not sufficient to allow it to be operated in a nitrifying activated sludge mode.
7. It is difficult to assess the loading on the oxidation ditch, which is dependent on the performance of the upstream activated sludge process and the liquid volume processed. The hydraulic capacity of the oxidation ditch is determined by Clarifier 2, which has a design capacity of about 50 m^3/h
8. The existing plant is hydraulically overloaded and subject to the risk of excessive suspended solids carryover, particularly in wet weather.

Treatment capacity of the existing works

The existing works is hydraulically overloaded due to pumped inflow rates that greatly exceed the average flow rate, combined with the fact that the two activated sludge processes operate in series. As indicated above, the combined pumping rate from the Carrigtohill and the IDA Industrial Estate pumping stations is estimated at 324 m^3/h, whereas the current average daily dry weather flow is estimated to 2226 m^3/d or 93 m^3/h.

The hydraulic capacity of Clarifier 1, at a design surface loading of 1 m/h, is 102 m^3/h. The hydraulic capacity of Clarifier 2 at a design surface loading of 1 m/h is 50 m^3/h. Thus, when operated in parallel, the two clarifiers have a combined hydraulic capacity of 152 m^3/h or about 1.6 times the current dry weather flow.

The organic load capacity of the existing works is determined by the oxygen transfer of the aeration systems. The oxygen transfer capacity (OTC) of the rectangular tank surface aerator has already been estimated at 432 kg O_2/d. On the basis of an OTC/BOD_5 ratio of 2, this equates to a BOD_5 load capacity of 216 kg/d or 3600 PE. The (OTC) rating of the oxidation ditch rotors is taken as 1.8 kg O_2/h per m length. The installed length of rotor is 7.2m giving an estimated rotor OTC of 311 kg O_2/d. On the basis of an OTC/BOD_5 ratio of 2, this equates to a BOD_5 load capacity of 155 kg/d or 3590 PE. For upgrade purposes, the following values are assumed:

	Treatment capacity (PE)
Oxidation ditch	2500
Rectangular tank	3500
Total	6000

NOTES TAKEN FROM:
DWG. 12042-01 REV A
PREPARED BY:
JONES ENVIRONMENTAL LTD
REVISION PREPARED ON:
21-05-'90

LANDFILL LEACHATE STORAGE TANKS

PLANT HOUSE

SLUDGE THICKENING TANK

CLARIFIER

AERATION TANK

CLARIFIER

OXIDATION DITCH

AMENDMENT DETAILS	DATE

T.J.O'CONNOR & ASSOCIATES
CONSULTING ENGINEERS
CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
Tel: 295 2321 Fax: 295 4541

PROJECT: CARRIGTOHILL – DISCHARGE L.A. APPLICATION
CLIENT: CORK COUNTY COUNCIL
DRAWING TITLE: WWTP PLANT LAYOUT

SCALE:	JOB NO:	DRAWING NO:
1:250	2783	B2-02 CARRIG
DATE:DEC'07 DRAWN BY: T.O'C		

N

SITE NOTICE
SW - 02 CARRIG

SW - 02 CARRIG
O.S. CO-ORDINATES
E - 181731
N - 072680

SITE NOTICE
SW - 03 CARRIG (NOT COMMISIONED)

Existing
WWTP

SW - 03 CARRIG (NOT COMMISIONED)
O.S. CO-ORDINATES
E - 180594
N - 072283

SITE NOTICE
SW - 01 CARRIG

SW - 01 CARRIG
O.S. CO-ORDINATES
E - 180594
N - 072283

LEGEND:

- EXISTING FOUL SEWER
- EXISTING STORM SEWER
- EXISTING COMBINED SEWER
- EXISTING RISING MAIN
- WWTP SITE BOUNDARY

AMENDMENT DETAILS	DATE

T.J.O'CONNOR & ASSOCIATES
CONSULTING ENGINEERS
CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
Tel: 295 2321 Fax: 295 4541

PROJECT: CARRIGTOHILL – DISCHARGE L.A. APPLICATION

CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: SITE NOTICE LOCATION MAP

SCALE: 1 : 5000 (A3)	JOB NO: 2783	DRAWING NO: C1–01 CARRIG
DATE: DEC'07	DRAWN BY: T.O'C	