LIMERICK CITY COUNCIL
WASTE WATER DISCHARGE LICENCE APPLICATION

OPERATIONAL INFORMATION

The Waste Water Treatment Plant at Bunlicky is designed to treat the waste water from Limerick City and Environs. The plant is designed for a population equivalent (PE) of 130,000.

The plant treats imported sludge in addition to that produced in the Waste Water Treatment Plant. Centrate and filtrate produced during sludge drying are returned to the treatment plant inlet for processing.

The treatment process is based on the conventional activated sludge process with settling stages before and after the aerobic biological section of the plant. Nitrification and denitrification are provided for within the aeration tanks.

The final effluent from the secondary settling tanks is discharged via a 1.1 km long outfall pipe to the Shannon Estuary. Continuous on-line composite sampling, flow measurement and turbidity measurement are provided on the final effluent stream prior to discharge. The treated waste water enters the estuary through a diffusion chamber fitted with duck-bill non-return valves.

Flows from Corcanree Pumping Station in excess of the "flow to treatment" are collected in the storm water holding tank at Bunlicky and returned to the treatment works for full treatment when the flow conditions to the plant permit.

Samples collected from the influent and effluent, 24-hour composite samplers are collected each morning and tested in the on-site laboratory. Parameters tested for are:

- 5-day Biochemical Oxygen Demand;
- Chemical Oxygen Demand;
- Suspended Solids;
- Total nitrogen;
- Total phosphorus;
- Ammonical nitrogen.

In addition, two grab samples of the influent and effluent are taken each month. These samples are tested by an independent analytical laboratory (Mercury Analytical Ltd.) and the results forwarded to the Environmental Protection Agency. The laboratory is certified to ISO 9001:2000 and has SGS Certification.

Additional tests are carried out daily for the operator to monitor the hydraulic and biological load on the plant. Some of the critical process parameters recorded are:

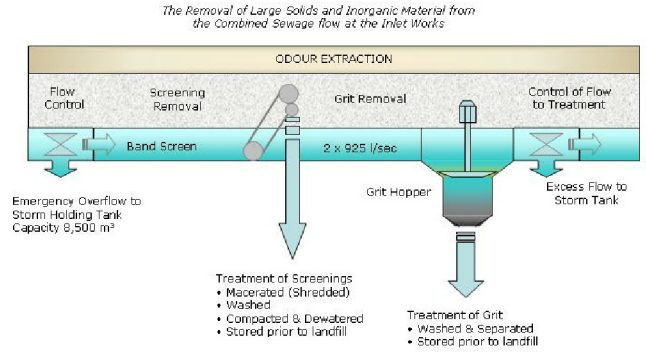
- Sludge Volume Index;
- Sludge age;
- Dissolved oxygen levels in aeration tanks;
- Mixed liquor concentrations;
- Excess sludge production levels.

All of the test data are collated and included in the monthly Performance Management System report.

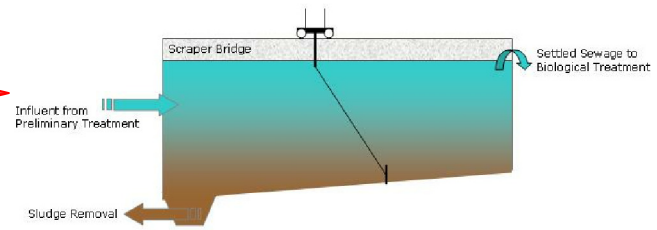
Notes:

1. Figured Dimensions only to be taken from this Drawing.

INLET



Preliminary Treatment

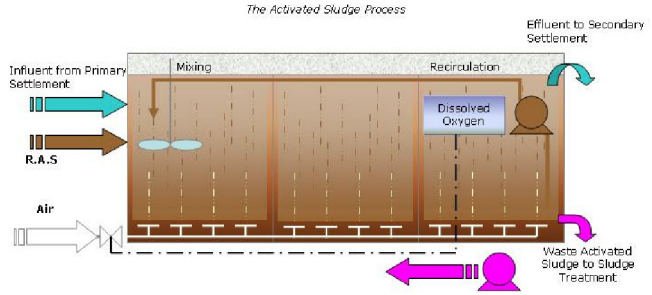


- Tank Volume – 1,550 m³ = (341 thousand gallons) per tank x 4 tanks
- SS Loading – 9,750 kg/day (67% Solids removed during Primary Settlement stage)
- BOD loading – 7,800 kg/day (30% BOD removal during Primary Settlement stage)
- Retention Time – 2 hours
- Automatic desludging of tanks (653 m³/day @ 1% D.S. to 163 m³/day @ 4% D.S.)
- Scum removal for treatment at Sludge Treatment Plant

Primary Settlement

Aeration

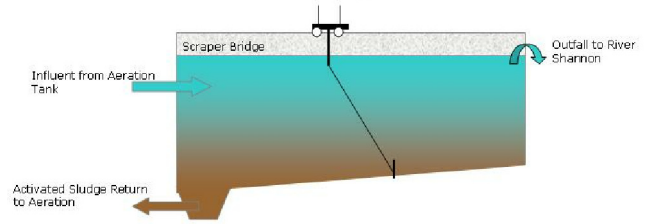
The Activated Sludge Process



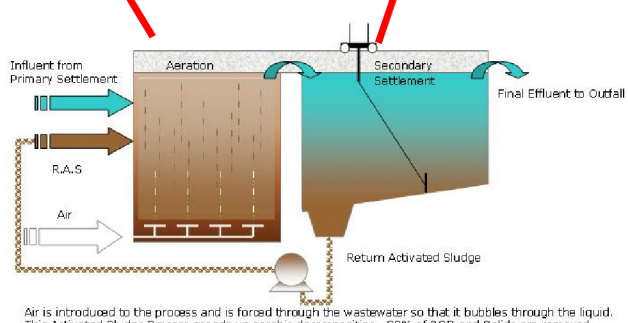
- Tank Volume – 4,735 m³ = (1 million gallons) per tank x 3 tanks
- SS Loading – 3,217 kg/day (90% Solids removed during Biological Treatment)
- BOD loading – 5,460 kg/day (90% BOD removal during Biological Treatment)
- Retention Time – 11.5 hours @ DWF 4.5 hours @ 3*DWF
- De-nitrification

Secondary Settlement

The Activated Sludge Process



- Tank Volume – 2,212 m³ = (487 thousand gallons) per tank x 5 tanks
- Retention Time – 4 hours
- Scum removal for treatment at Sludge Treatment Plant
- Treated Effluent Standards - 25mg/l BOD, 125 mg/l COD, - 20mg/l NH3, 35mg/l TSS



Air is introduced to the process and is forced through the wastewater so that it bubbles through the liquid. This Activated Sludge Process speeds up aerobic decomposition. 90% of BOD and Solids are removed during this process

Settlement produces an activated sludge containing millions of "active bacteria", which is returned to the Aeration Tank to mix with the incoming Influent.

Biological Treatment

The Activated Sludge Process

OUTFALL

DISCHARGE LICENCE APPLICATION	L.A.	SEPT. '07	A
Revisions:	By:	Date:	Rev.:

Client: LIMERICK CITY COUNCIL

Project: LIMERICK MAIN DRAINAGE (City & Environs)

THIS PROJECT IS RECEIVING 80% FINANCIAL ASSISTANCE FROM THE COHESION FUND OF THE EUROPEAN COMMUNITIES

Pat Dromey
Director of Transportation & Infrastructure
Limerick City Council,
City Hall,
Limerick.

LIMERICK MAIN DRAINAGE

Consulting Engineers:
BARRY & PARTNERS
Michael Punch & Partners CONSULTING ENGINEERS
White Young Green Ireland

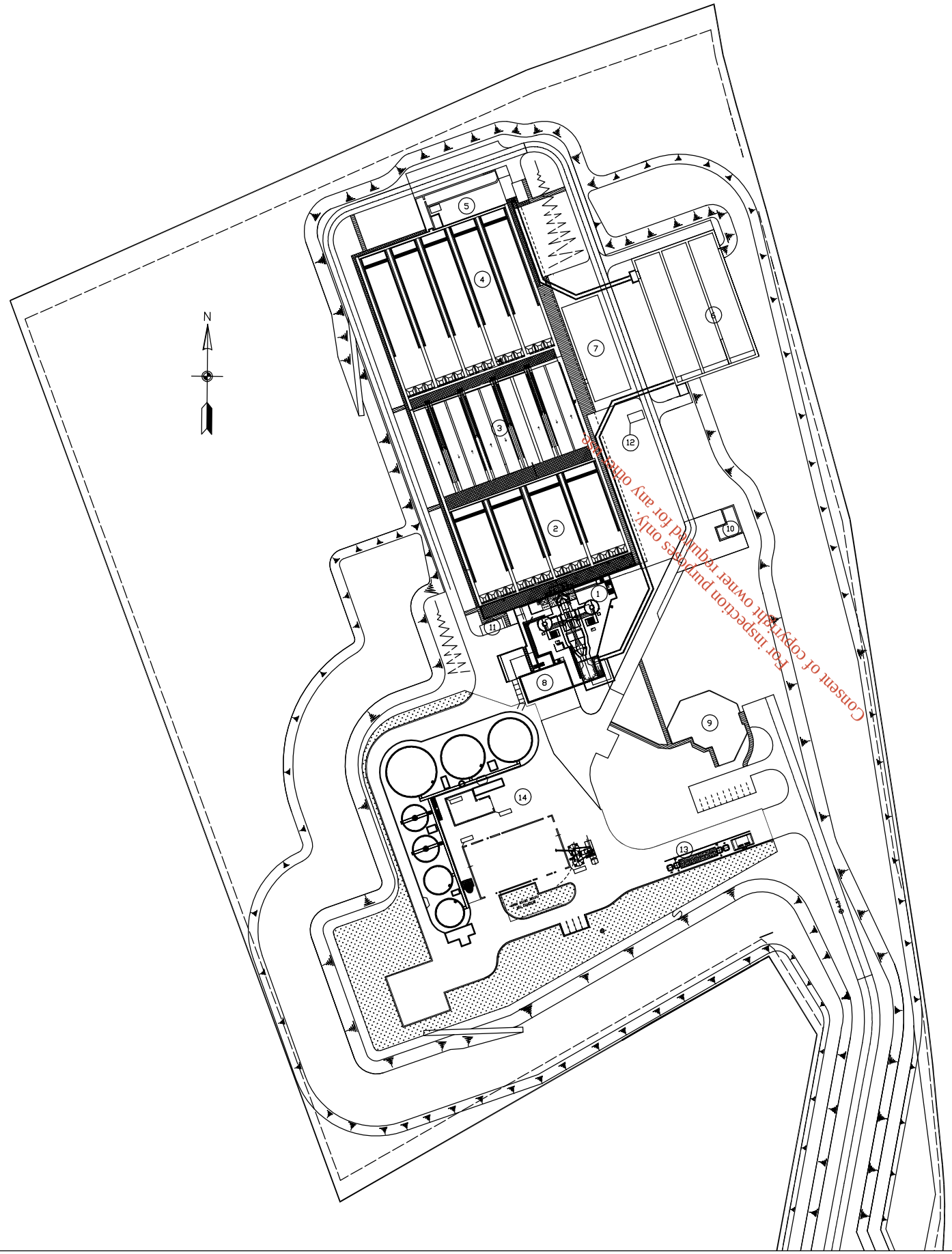
Project Office:
Limerick Main Dramage Project Office,
Limerick Business Centre,
Raheen Business Park,
Raheen, Limerick.
Tel: 353-61-484580
Fax: 353-61-484581
E-Mail: Info@lmdpo.com

Scales: 1:750@A1 1:1500@A3	Date: SEPT. 2007
Drawn By: L.A. / Checked By: D.L.H.	Revision: A
Approved By: K.McI	

Title: WASTE WATER TREATMENT PLANT WORKS PROCESS DIAGRAMS

Stage: DISCHARGE LICENCE APPLICATION

Drawing. No.: LMD-97120-DLA-11



1. INLET WORKS
2. PRIMARY SETTLING TANKS
3. AERATION SLUDGE TANKS
4. SECONDARY SETTLINGS TANKS
5. TREATED EFFLUENT DISCHARGE CHAMBER
6. STORM TANK
7. BUILDING - 3 (AIR BLOWER POWER DISTRIBUTION, WORKSHOPS AND MCC)
8. BUILDING - 2(GRIT AND SCREENINGS HANDLING ROOMS ,BOILER ,PLANT AND MCC)
9. BUILDING - 1(ADMINISTRATION/CONTROL AND STAFF FACILITIES)
10. MUNGRET PUMPING STATION
11. ODOUR SCRUBBING UNIT
12. BULK DIESEL TANK
13. WEIGHBRIDGE
14. SLUDGE PLANT

DISCHARGE LICENCE APPLICATION	L.A.	SEPT. '07	A
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Raheen, Limerick.
Tel: 353-61-484580
Fax: 353-61-484581
E-Mail: Info@lmdpo.com

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Drawn By: L.A.	Checked By: D.L.H.	Revision:	A
Approved By: K.McI			

Title:
WASTE WATER TREATMENT PLANT
WASTE WATER TREATMENT WORKS SITE PLAN

Stage: DISCHARGE LICENCE APPLICATION

Drawing. No.: LMD-97120-DLA-12

Limerick Main Drainage
Operation and Maintenance of Wastewater Treatment Plant

PLANT DESCRIPTION

The wastewater treatment plant consists of the following structures:

1. Mungret Road P.S.
2. Staff/Admin. Building
3. Inlet Chamber
4. Inlet Works
5. Screenings Building
6. Storm Water Holding Tank
7. Storm water Return P.S.
8. Flow splitting chamber
9. 4 No. Primary Settling Tanks
10. Flow splitting chamber
11. 3 No. Aeration Tanks
12. Flow splitting chamber
13. 5 No. Secondary Settling Tanks
14. Treated Effluent Discharge Chamber
15. Service Corridors No.1-4
16. Air Blower/Generator Building
17. Outfall Jetty

Inlet Chamber / Storm Tanks

Inflows to the Inlet Chamber come from the following sources:

- 900mm dia pipe from Corcanree pumping station.
- 900mm dia pipe from Corcanree pumping station.
- 500mm dia pipe from Mungret Road pumping station.
- 200mm dia pipe from Mungret Road pumping station.
- 400mm dia pipe Storm Water Return from Storm Tanks.

Magnetic flow meters are installed on each of the inlet pipes that monitor the flows from each pipe.

The flow at the Inlet Chamber is controlled by means of an actuated penstock that allows a maximum rate of 865 l/s (3 DWF) through to the treatment works for full treatment.

Flows in excess of 865 l/s up to the maximum of 1850 l/s will be overflowed to the storm water tanks where it is stored until the inflow recedes to below 2.5 DWF.

The storm water tank is divided into 3 cells arranged to fill sequentially in storm condition. Each cell is equipped with a tipping bucket that flushes the cell on completion of its operation cycle.

The storm water return pumping is situated beside the storm water tank. The storm water is returned to the inlet works by the storm water return pumps when the inflow reduces to below 2.5 DWF. If the storm water tanks fill to capacity before the inflow reduces sufficiently to allow return pumping, the storm overflow will discharge straight to the treated effluent outfall chamber.

Preliminary Treatment

From the Inlet Chamber, the influent is divided between the two inlet works channels where screenings are removed by means of two mechanically raked fine screens designed to remove screenings larger than 5 mm. The screenings are flushed to a Macerator pumpset and back to a Launder/ Dewaterer Unit that washes and compresses them before transferring them to a skip for disposal off site. The screened flow then passes through the grit traps where the grit is removed and transferred to a skip via a grit classifier for disposal off site.

The influent then passes through a storm overflow chamber while the two channels reconverge and on into the primary settling tanks splitter chamber. Here it is distributed by use of actuated penstocks between the four primary settling tanks. In normal operation, all penstocks will be set at the same level. Ultrasonic level detection at each weir will allow indirect measurement of flow into each tank.

The preliminary treatment stage and the inlet chamber are a covered area so as to allow proper odour control. An air extract system will feed the gases in these areas and in any associated plant items through the odour control unit located in the inlet works. The media used in the odour control unit to extract any odour is wet sea coral.

Primary Treatment

In the primary settling tanks, scraper bridges running the length of the tank will scrape the sludge from the bottom of the tanks into hoppers (4 per tank) for removal. These hoppers and the scum sump will be emptied by means of four primary sludge pumps (hydraulic ram pumps -1 per tank) located in service corridor no.2 and the contents pumped to contract 1.4. Desludging will take place for a set duration every hour. Operation of the primary sludge pumps is interlinked with the operation of the tank

scraper bridges. The bridges will also remove scum from the tank surface into a scum trough and back into a scum sump beside service corridor no.2.

Aeration Tanks

The flow to the aeration tanks is controlled in a splitter chamber by weir penstocks again. In normal operation, all penstocks will be set at the same level. Ultrasonic level detection at each weir will allow indirect measurement of flow into each tank.

The wastewater gravitates to the three aeration tanks where it is biologically treated by means of fine bubble diffused air aeration. Four air blowers (2 duty, 2 standby) situated in the air blower/generator building supply the air to the aeration tanks through a series of circular membrane disks installed on the floor of each tank. Each aeration tank is a 'round the end' multiple channel tank (3 cells per tank joined at the ends by penstock controlled opes). Control of the aeration system is to be determined by prevailing Dissolved Oxygen levels in various cells of each aeration tank. Air supply can be varied via actuated butterfly valves on air header Pipework serving each cell (3 headers per cell), in response to settings for the DO levels. The number of air blowers and the air delivery rate of each will in turn be varied according to criteria relating to DO levels and implemented by SPLC.

Three Waste Activated Sludge (WAS) pumpsets located in service corridor no.3 (1 per tank) will operate on a set duration every hour, returning excess sludge from the last cell of the aeration tanks to contract 1.4. This is determined by sludge age.

Internal recirculation pumps are installed in each tank to facilitate the operation of a de-nitrification regime. The recirculation pipework goes from the pumps in the last cell and terminates in a flap valve back into the first cell.

Secondary treatment

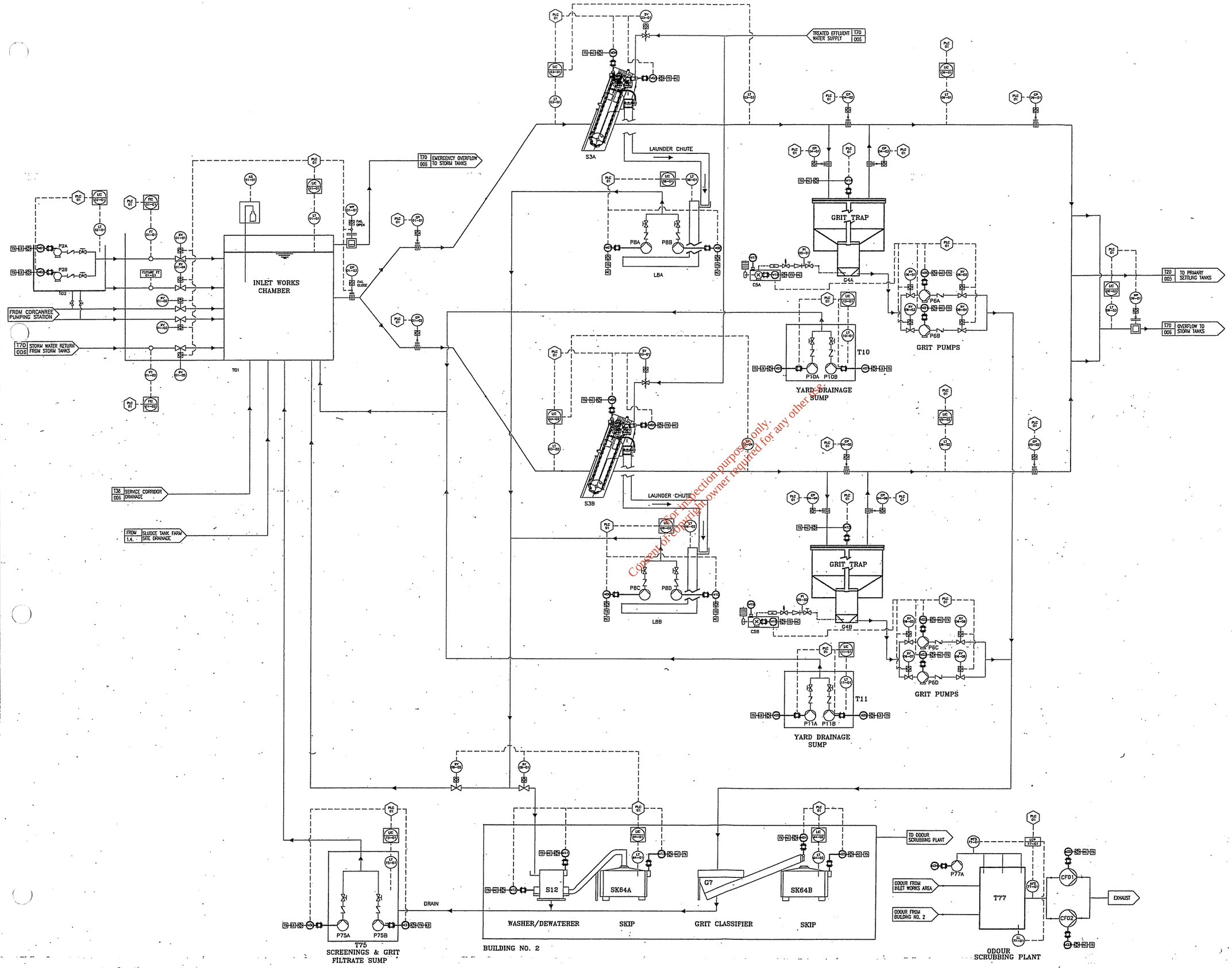
The mixed liquor passes to a flow splitter chamber that divides the flow equally to the five secondary settling tanks. The sludge settles in the clarifiers and is removed by scraper bridges running the length of the tank. These will scrape the sludge from the bottom of the tanks into hoppers (3 per tank) for removal. Return Activated Sludge (RAS) pumps located in service corridor 4 return the sludge to the first cell of the aeration tanks.

The clarified effluent overflows the weirs of the secondary settling tanks and gravitates to the treated effluent discharge chamber.

Treated Effluent Discharge

Treated effluent is discharged by gravity through a long outfall pipe and jetty to the Shannon Estuary. However, in adverse tidal conditions, three in-line treated effluent pumps will be initiated by a ultrasonic level sensor in the treated effluent discharge chamber. A booster pumpset in the treated effluent chamber will also supply treated water to the wash-down system supplied for the tanks and to run some of the plant items.

IF IN DOUBT ASK DO NOT SCALE OFF THIS DRAWING



NOTES

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH DRAWINGS LMD-97121-PC423-005,006 & 006A AND EPS LIST OF STARTERS, ACTUATORS & INSTRUMENTS REV.0 DATED 17/07/01

Rev.	Dwn	Chk	Apr	Date	Description
1	DU			06/09/01	Modified as per BDP Comments 17/08/01
0	DU			17/07/01	INITIAL ISSUE

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Project:
LIMERICK MAIN DRAINAGE (City & Environs)

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Limerick Corporation
S. O' Sullivan BE,CEng,FIEI
City Engineer,
Limerick Corporation,
City Hall,
Limerick.

LIMERICK MAIN DRAINAGE

Pumping & Treatment Systems
Quartertown Industrial Estate,
Mallow,
Co. Cork.
Phone: 022-31200
Fax: 022-31250
Email: contracts@epsireland.com
Ballyhaunis, Co. Mayo.
Phone: 0907-30226
Fax: 0907-30781
Mountrath, Co. Laois.
Phone: 0502-32279
Fax: 0502-32518

Job Title:
CONTRACT 1.3
WASTE WATER TREATMENT PLANT

Drawing Title:
PROCESS FLOW DIAGRAM NO.1
INLET WORKS & BUILDING NO.2

Scale:	NTS
Revision Suffix:	0 1
Job No.:	PC423
Drg No.:	LMD-97121-PC423-004
Workshop No.:	

IF IN DOUBT ASK DO NOT SCALE OFF THIS DRAWING

SCUM SUMP
TAG REF.: T76

FROM SECONDARY TANKS SCUM DRAW-OFF

SCUM RETURN PUMPS

PRIMARY SETTLING TANK CELL NO.1
TAG REFERENCE : T20A

PRIMARY SETTLING TANK CELL NO.2
TAG REFERENCE : T20B

PRIMARY SETTLING TANK CELL NO.3
TAG REFERENCE : T20C

PRIMARY SETTLING TANK CELL NO.4
TAG REFERENCE : T20D

FROM INLET WORKS 004

TO CONTRACT 1.4, BALANCING TANKS

BYPASS PIPE FOR COMMISSIONING ONLY.

STILLING CHAMBER TAG REF.: T20E

CENTRATE/FILTRATE FROM CONTRACT 1.4

AERATION TANK
TAG REFERENCE: T21A

AERATION TANK
TAG REFERENCE: T21B

AERATION TANK
TAG REFERENCE: T21C

CELL No.1 / CELL No.2 / CELL No.3

WAS PUMPS

BUILDING NO. 3
AIR BLOWER

C22A / C22B / C22C / C22D

FROM RAS PUMPS T23 006

WAS RETURN TO CONTRACT 1.4

723 TO SECONDARY SETTLING T 006

NOTES

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EPS Pumping & Treatment Systems
Quartertown Industrial Estate, Mallow, Co. Cork.
Phone: 022-31200
Fax: 022-31250
Email: contracts@epsireland.com
Ballyhaunis, Co. Mayo.
Phone: 0907-30226
Fax: 0907-30761
Mountrath, Co. Laois.
Phone: 0502-32279
Fax: 0502-32518

Job Title:
CONTRACT 1.3
WASTE WATER TREATMENT PLANT

Drawing Title:
PROCESS FLOW DIAGRAM NO.2
FLOW THRU' PRIMARY SETTLING & AERATION TANKS

Scale: NTS	
Revision Suffix:	0 1
Job No.:	PC423
Drg No.:	LMD-97121-PC423-005
Workshop No.:	

IF IN DOUBT ASK DO NOT SCALE OFF THIS DRAWING

SCUM MANHOLE
TAG REFERENCE : T23F

TO SERVICE CORRIDOR SCUM SUMP

T22 FROM AERATION 005 TANK

RAS PUMPS

SECONDARY SETTLING TANK CELL NO.1
TAG REFERENCE : T23A

SCUM DRAWOFF TO SCUM MANHOLE

SECONDARY SETTLING TANK CELL NO.2
TAG REFERENCE : T23B

SECONDARY SETTLING TANK CELL NO.3
TAG REFERENCE : T23C

SECONDARY SETTLING TANK CELL NO.4
TAG REFERENCE : T23D

TO AERATION T22 TANK 006

SECONDARY SETTLING TANK CELL NO.5
TAG REFERENCE : T23E

TREATED EFFLUENT TO SHANNON ESTUARY

TO INLET WORKS — 004

TO STORM TANK TIPPING BUCKETS T70 006

TO CONTRACT 1.4. — —

TO INLET CHAMBER T01 004

TREATED EFFLUENT DISCHARGE CHAMBER
TAG REFERENCE : T25

T25 FROM TREATED EFFLUENT 006 PROCESS PUMPS

T25 FROM INLET WORKS 006 STORM OVERFLOW

T25 FROM EMERGENCY STORM 006 IN INLET CHAMBER

TO INLET CHAMBER T01 004

T70A T70B T70C T70D T70E T70F

CELL NO.1 CELL NO.2 CELL NO.3

STORM HOLDING TANK
PUMP SUMP
TAG REFERENCE : T72

STORM HOLDING TANK
TAG REFERENCE : T70

T38A T38B T38C T38D T38E T38F

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Job Title:
CONTRACT 1.3
WASTE WATER TREATMENT PLANT

Drawing Title:
PROCESS FLOW DIAGRAM NO. 3
SECONDARY SETTLING TANKS, FINAL EFFLEUNT CHAMBER & STORM TANK

Scale: NTS	
Revision Suffix:	0 1
Job No.:	PC423
Drg No.:	LMD-97121-PC423-006
Workshop No.:	

Limerick Main Drainage

Treatment Works Performance

Treatment works performance is a function of the standard of operations and the site conditions at any one time. A number of checks and balances are used to continuously monitor the performance of the works at various levels.

The most obvious parameters regularly checked are the quality of the treated effluent leaving the treatment plant, sludge quality, odour and noise. Certain standards will have been set by the client, either through the Urban Wastewater Treatment Directive or at a local level depending on location etc.

These consent limits are the maximum allowable discharge levels. However, most treatment plants will operate to maintain standards well below these levels.

Levels are set by management whereby process scientists or plant managers are alerted to anticipated problems in the early stages by means of analytical testing.

Final Effluent Quality

Required by UWWD

BOD_5	**25 mg/l**
COD	**125 mg/l**
SS	**35 mg/l**

Alert Levels

BOD_5	15 mg/l
COD	50 mg/l
SS	20 mg/l

When analytical results show final effluent levels above these levels, management must be made aware of the most recent trends.

Alternatively, under normal operating conditions (dependent on time of year or seasonal discharge from industry) an average final effluent quality can be established. Should the final effluent quality differ by **50% of the norm**, but still remain below the Alert levels mentioned above, management or process scientist should be notified immediately.

Sludge Dewatering

Sludge dewatering is another area where performance is critical. Poor operational techniques will result in increased cost in some or all of the following areas:

- Power
- Polyeletcrolyte usage
- Skip hire
- Sludge removal
- Sludge treatment

Depending on the nature of the sludge produced (primary, primary and secondary, secondary only, digested primary and secondary etc) the dewatering equipment will be expected to produce dewatered cake of a certain quality.

Eg Undigested Primary and secondary – Sludge Press

Target
23% Dry Matter

Acceptable Performance
19% Dry Matter

Normal Performance
20% Dry Matter

Once analytical results show the quality of the sludge deteriorates to the point of unacceptable quality the plant manager/process scientist must be notified immediately.

The plant manager/process scientist will initiate a series of tests and checks to determine the cause of the deterioration in sludge quality

These can consist of

- Sludge levels in picket fence thickener (dry matter of incoming sludge)
- Wastage rates from primary and secondary treatment systems
- Polyelectrolyte dosing and delivery rates
- Dilution water pressure and delivery
- Quality of thickened sludge (shock loads etc can introduce changes in sludge quality)

Odour

Odour checks are performed at regular intervals to ensure compliance with performance standards. These are usually performed at differing site locations and at different times of the operational phase (morning, afternoon, night). For instance, odour control units are tested for particular indicator compounds (H_2S) at frequent intervals to warn of early failure

Odour – Cont'd

Target H_2S concentration at Point Emission
1 ppm H_2S

Normal Operating Conditions
0.3 ppm H_2S

Warning Concentration
0.6 ppm H_2S

As treatment plant age and the performance of various plant and equipment deteriorate with time, a once compliant site may find it fails periodically on odour. As with other performance parameters regular checks ensures that failing assets can be repaired, overhauled or replaced in order to remain compliant.

Regular tests will warn plant operators of a failure and the plant manager or process scientist should be informed immediately.
The process scientist will then initiate a series of tests and checks to identify problem.

The failure may be the result of:

- Spent media in odour control units
- Failed recirculation pumps
- Dry media
- Receipt of septic flows from catchments
- Septic areas on site
- Leaking odour equipment ductwork

The maintenance crews can then be alerted to suspect plant, and checks, overhauls, repairs or replacements as per manufacturers recommendations can be performed to rectify the problem

Noise

Noise checks, like odour checks, are performed at regular intervals to ensure compliance with performance standards. These are usually performed at differing site locations and at different times of the operational phase (morning, afternoon, night). The tests consist of analysing the noise for level and variance. Proprietary equipment is needed for these tests. However, daily checks performed by plant operators should, if performed correctly, alert plant staff to failing plant and equipment. The daily checklists perform this function by requiring the plant operator to note unusual noises.