

OFFALY COUNTY COUNCIL



BIRR MAIN DRAINAGE SCHEME

PRELIMINARY REPORT

REVISION C

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- Appendix B – Letter From Shannon Regional Fisheries Board
- Appendix C – Birr S.I.S Land Development at Syngfield – Archaeological Impact Assessment Report

1. INTRODUCTION & SCOPE OF WORK

1.1 General

Birr is a medium sized town situated in West Offaly close to the border with North Tipperary. The town is situated at the confluence of the Little Brosna and the Camcor Rivers.

In the 2003-2009 Offaly County Development Plan, Birr is designated as a District Centre along with Tullamore (the county town) and Edenderry. Birr's role is further defined by its status as a heritage town. The Development Plan for Birr and Environs 2004 aims to facilitate an increased regional role for Birr by furthering its role as a socio-economic centre for the South Offaly and North Tipperary sub region.

1.2 Scheme Objectives

The Birr Main Drainage Scheme provides for the immediate and long term improvement and expansion of the existing scheme of collection, treatment and disposal of wastewater generated from the town of Birr and its environs.

1.3 Terms of Engagement

This Report has been prepared in accordance with the original Brief prepared by Offaly County Council in June 2003 and subsequent letter of appointment of 23rd December 2004. The Brief was extended to include the CCTV and SUS survey of the outlying catchments of Crinkill and Riverstown by verbal instruction on 25th August 2004.

The Scope of Work as set out in the brief and agreed with Offaly County Council is summarised below:

1. Examine the foul and surface water collection systems by means of a CCTV survey where necessary and advise on their condition and any remedial action required.
2. Detail any works required to upgrade the capacity of the existing foul network either through stormwater separation or the provision of new sewers and/or pumping stations.

3. Recommend as to whether the existing system should be separate or partially combined. Make recommendations on the suitability of storm overflows
4. Detail any extensions required to the network to serve the development needs of the town.
5. Submit proposals for dealing with infiltration and damage to existing sewers
6. Examine existing stormwater discharges and make recommendations on any alterations or modifications required. Provide general recommendations in relation to the management of surface water runoff.
7. Determine projected flows from Domestic, Commercial, Institutional and Industrial Users over a 25 year horizon and incorporate these flows into the design of the new collection system.
8. Identify the relevant characteristics of the waste water to be treated.
9. Examine the existing treatment works site and advise on the feasibility of extending it.
10. Determine the effluent quality parameters required taking into account the quality of the receiving waters.
11. Put forward proposals for the extension of the existing treatment works including phasing of the construction.
12. Prepare a preliminary design of the treatment and disposal system for sludge which will be in accordance with the Sludge Management plan for County Offaly and which is sufficiently detailed to prepare cost estimates.
13. Make a comparison of different treatment options which would be suitable from an environmental and economic standpoint and produce an indicative layout.
14. Advise on phasing of the expansion of the WWTW's.

15. Advise on Environmental Standards to be adopted for the proposed development.
16. Prepare detailed estimates for the construction costs and advise on strategy of the scheme.
17. Recommend the most cost-effective solution with reference to the application of value engineering principles.
18. Prepare a Polluter Pays Report in line with current Water Pricing Policies. (This is submitted as a separate document.)

1.4 Scope of Work

This Section describes the particular scope of work used in the preparation of this Preliminary Report prepared in accordance with the terms of engagement.

To address the Brief the Report includes the following components:

- i) Current and future population projections to the year 2029.
- ii) Current and future effluent loads for domestic and industrial contributions.
- iii) Review of the Development Plan together with a review of possible staged development of the scheme based on projected population equivalents and loads.
- iv) Review of flows and assimilative capacity of the Little Brosna River.
- v) Review of storm overflows and pumping stations.
- vi) Review of the treatment process and treatment standards selected in the light of current EC requirements and regulations.
- vii) Review of sludge treatment and disposal options in line with the current Sludge Strategy Plan for Co. Offaly.
- viii) Preparation of Preliminary Plans and Drawings of pipelines, pumping stations and treatment works for inclusion in the Report.

- ix) Preparation of a flood study. (This is to be submitted as a separate document.)
- ix) Preparation of a Preliminary Report.

1.5 Staging of Scheme

The Preliminary Report estimates the needs and makes recommendations for the provision of wastewater collection and treatment facilities for the Scheme horizon of 25 years to the year 2029 and beyond. The development under this report is envisaged in three Phases, Phase 1 to the year 2020 and Phase 2 to the year 2029 and Phase 3 to a year far beyond the Scheme horizon.

1.6 Environmental Impact Statement

In view of the estimated future population equivalents of greater than 10,000 an Environmental Impact Statement is required for the expansion of the Wastewater Treatment Works. The EIS has been prepared as a separate document based on the projected population equivalents, effluent standards and indicative layouts set out in this Preliminary Report.

1.7 Scheme Catchment Area

The Scheme Catchment Area covers Birr and its environs and is primarily (apart from the town of Riverstown in Tipperary) within the boundary of Offaly County Council.

1.8 Importance of the Scheme

The scheme is important in respect of improving the quality of the receiving waters to which the treated wastewater effluent from the catchment area is discharged. This has a direct bearing on the collection, treatment and disposal facilities to be provided for under the scheme.

As development pressures are expected to continue for the foreseeable future due to the strategic location of the town an upgraded sewerage scheme is of critical importance to ensure the proper development of the area.

2. DATA COLLECTION AND EXISTING CONDITIONS

2.1 Wastewater Disposal and Population Served

Data has been collected on the current population served by the sewerage system in Birr and Environs and the future population projections are based on these figures.

Data on the present wastewater collection system serving the population in Birr and its environs was collected and sample verification has been undertaken in the field.

2.2 Wastewater Generation and Pollution Load

The present domestic commercial and industrial pollution load being discharged to the existing works is estimated to be 438 kg BOD₅ /day. The present dry weather flow (DWF) is estimated at 1,220 m³/day. Data on the current influent and effluent is discussed in Section 3.8 of this Report. The plant is a conventional extended aeration process, designed for a population equivalent of 12,000 p.e. with a BOD load of 720 kg/day (60 g/h/day) and a hydraulic load of 2,700 m³/day (225 l/h/day).

2.3 Stormwater and Groundwater Infiltration

The existing collection network is generally a combined network with an element of stormwater sewers. Surcharging and overflow to the river occur in some areas at normal rainfall conditions each year. The groundwater infiltration is dealt with in Section 7 – Wastewater Network Proposals.

2.4 Wastewater Disposal Facilities

There is an existing Wastewater Treatment Plant for the town of Birr. Details of these existing facilities were collected and examined and are presented in Section 3 of this report.

2.5 Receiving Waters

Data in respect of the receiving waters of the Little Brosna River was obtained from the Interim Report on the biological survey of River Quality 2002 published by the Environmental Protection Agency and from E.P.A. analysis data on the Little Brosna from 2001-2003.

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3. CONDITION OF SEWERAGE SYSTEM

3.1 General

The following section outlines the general condition of the sewer system in Birr Town, Crinkill Village and Riverstown Village. This section should be read in conjunction with the following Drawings.

Drawings

- 20305 / 00 List of Drawings Birr – Crinkill – Riverstown
- 20305 / 01 Key Plan Birr – Crinkill – Riverstown
- 20305 / 02 Existing Sewerage Network (Sheet 1 of 5)
- 20305 / 03 Existing Sewerage Network (Sheet 2 of 5)
- 20305 / 04 Existing Sewerage Network (Sheet 3 of 5)
- 20305 / 05 Existing Sewerage Network (Sheet 4 of 5)
- 20305 / 06 Existing Sewerage Network (Sheet 5 of 5)
- 20305 / 07 Crinkill – Existing Sewerage Network
- 20305 / 08 Riverstown – Existing Sewerage Network (Sheet 1 of 2)
- 20305 / 09 Riverstown – Existing Sewerage Network (Sheet 2 of 2)
- 20305 / 10 Existing Network Condition and Proposed Works (Sheet 1 of 5)
- 20305 / 11 Existing Network Condition and Proposed Works (Sheet 2 of 5)
- 20305 / 12 Existing Network Condition and Proposed Works (Sheet 3 of 5)
- 20305 / 13 Existing Network Condition and Proposed Works (Sheet 4 of 5)
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- 20305 / 15 Crinkill – Existing Network Condition
- 20305 / 16 Riverstown – Existing Network Condition (Sheet 1 of 2)
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- 20305 / 18 Manhole Conditions (Sheet 1 of 5)
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- 20305 / 34 Syngefield Industrial Site - Location Map
- 20305 / 35 Syngefield Industrial Site - Proposed Route for Gravity Foul Sewer and Storm Sewer
- 20305 / 36 Figure 1 – Proposed Layout Plan Option 1 (Sheet 1 of 2)
- 20305 / 37 Figure 2 – Sections Through Site Option 1 (Sheet 2 of 2)
- 20305 / 38 Figure 3 – Proposed Layout Plan Option 2 (Sheet 1 of 2)
- 20305 / 39 Figure 4 – Sections Through Site Option 2 (Sheet 2 of 2)
- 20305 / 40 Figure 5 – Proposed Layout Plan Option 3 (Sheet 1 of 2)
- 20305 / 41 Figure 6 – Sections Through Site Option 3 (Sheet 2 of 2)
- 20305 / 42 Proposed Layout Plan of Storm Tanks
- 20305 / 43 Flow Directions

3.2 Existing Network System

3.2.1 General

The Birr Sewerage Scheme consists of a Combined Sewer Collection Network System and Wastewater Treatment Works with an outfall pipeline to the Little River Brosna.

The Wastewater Collection Network System serving Birr Town Catchment has been in operation for a number of years. The capacity and structural condition of the system is discussed in Sections 3.2, 3.3 and 3.4.

The Existing Wastewater Treatment Works is designed to cater for a population equivalent to 12,000 p.e. A description of the treatment process together with current operational details is provided under Section 3.7 of the Report.

The layout of the existing sewer system for Birr Town including Crinkill and Riverstown together with details of the location and layout of the existing and proposed Wastewater Treatment Works are shown on Drawing Nos. 20305 / 01 to 20305 / 42 enclosed with this report.

3.2.2 Birr Town Wastewater Collection Network System.

3.2.2.1 Introduction

The Birr Town catchment area is served by an interconnecting foul/combined sewer system gravitating to manhole 5.10B via three contributories, within the Model School road, Pound Street and Eden Road, and from there continues to the Wastewater Treatment Works located off the Croghan Road, North / West of Birr Town. Three number pump stations, Tullamore Road Pump Station, Crinkill Pump Station and Riverstown Pump Station (also discharge into the Network System).

The town is also served by a small number of surface water pipelines / culverts that discharge to the Little Brosna River.

There are three Storm Water Overflow Chambers on the foul / combined system and these discharge to the Camcor River and Little Brosna River.

3.2.2.2 Foul / Combined and Surface Water Sewers

The existing foul / combined sewer network is made up of a number of main lines and these lines have a number of contributory sewers, draining towards Birr Town Centre and from there merging at the Eden Road / Croghan Road Junction. These are described hereunder.

The Foul Sewer Network System is routed to the sewer lines within Model School Road, Pound Street, and Eden Road. From there it merges into the 900mm diameter Foul Sewer Manifold located at Eden Road / Croghan Road Junction. The sewer flow continues along Croghan Road to the Storm Overflow Chamber adjacent to the Wastewater Treatment Works Access Road. From this Overflow Chamber the foul sewer gravitates, via the 525mm diameter line, to the north / east end of the Wastewater Treatment Works Site and continues to the Wastewater Treatment System.

The existing sewerage system flows are predominantly by gravity. As stated there are three Foul Sewage Pump Stations pumping into the network system in Birr Town.

- **Tullamore Road Pump Station** located adjacent to the Tullamore Road to the North of Birr Town opposite the LiDL Supermarket, pumps into a manhole in Melsop Street.
- **Crinkill Pump Station** situated in Crinkill Village to the South of Birr Town pumps into a manhole on the Roscrea Road, and from there gravitates to the "Sewer 5 Line".
- **Riverstown Pump Station** situated in Riverstown Village to the South of Birr Town is owned and operated by North Tipperary County Council, pumps into a manhole on the Portumna / Nenagh Road, and from there gravitates to the Railway Road / Orchard Lane Junction.

There are three siphon crossings of the Camcor River.

- A siphon consisting of two number 300mm diameter pipes cross the River, some 350 metres on the northern side of Kinnitty Road near Newbridge Bridge.
- A siphon consisting of three pipes, 150mm, 225mm, and 300mm in diameter cross the River from the south / west side of Oxmantown Bridge, adjacent to the Roscrea Road.
- A siphon consisting of one pipe 375mm in diameter cross the river from manhole I.4 to manhole I.3 near the Bridge Street Bridge.

There are three storm overflows on the Foul Sewer Network System that discharge to the Camcor River / Little Brosna River.

- An existing storm overflow manhole on the "Sewer 5 Line" is located south / west of Oxmantown Bridge adjacent to the Roscrea Road. There is an existing 600mm diameter overflow pipe from this manhole to the Camcor River.
- An existing storm overflow manhole on the "Sewer I Line" is located on the South side of the Bridge on Bridge Street. There is an existing 80mm dia. overflow pipe from this manhole to the Camcor River.
- An existing Overflow Chamber is located adjacent to the access road to the Waste Water Treatment Works. There is an existing 375mm diameter overflow pipe from this chamber to the Little Brosna River. There are coarse

screens, with approximately 13 mm gaps between bars, on the outlet. After heavy rainfall the screens are power jetted for cleaning.

A full description of the network is given in Appendix A.

3.3 Findings of CCTV Survey

A CCTV survey was carried out principally to establish the integrity or otherwise of the sewer system and to locate or pin point all structural, service and construction defects. Birr Town was surveyed in May/June 2004 and the survey was extended to include Crinkill and Riverstown in November/December 2004.

All sewer lines were graded in accordance with 'The Sewer Rehabilitation Manual (SRM Fourth Edition), published by the Water Research Centre (WRC)'. This system grades pipelines from 1 to 5, as detailed in Table 3.1 and 3.2 below.

Table 3.1 - Internal Condition Grades - Structural Grades

Internal Condition Grade	Typical Defect Descriptions
5	Already Collapsed or Deformation >5%.
4	Broken and Multiple Fractures, Intruding Lateral Connections
3	Fractures, Multiple Cracks (longitudinal and circumferential)
2	Cracks (longitudinal and circumferential) Large Open Joints, Medium and Large Displaced Joints
1	Slight Open Joints, Slight Displaced Joints

Table 3.2 - Service Grades

Internal Condition Grade	Typical Defect Descriptions
5	Infiltration Gusher, Mass Roots, Heavy Encrustation, Heavy Scale.
4	Infiltration Runner, Medium Encrustation, Medium Scale.
3	Tap Roots.
2	Fine Roots, Infiltration Seeper or Dripper Obstruction.
1	Debris Silt, Debris Grease, Light Encrustation, Light Scale.

Many of the pipelines in Birr graded 1 contain silt. The sewers in Crinkill were heavily silted and these lines were cleaned to facilitate the CCTV survey. The CCTV findings are detailed in the CCTV report and the internal condition grades

are shown on Drawing Nos. 20305 / 10 to 20305 / 17 inclusive. A summary of these findings is detailed in Table 3.3.

Table 3.3 - Table of Pipe Grades

Internal Condition Grades	Length of Pipelines (m)	Length of Culverts (m)	Total
BIRR TOWN			
Grade 1	10,400	830	11,230
Grade 2	550	-	550
Grade 3	770	140	910
Grade 4	5,280	830	6,110
Grade 5	1,650	-	1,650
Not Graded	310	-	310
TOTAL	18,960	1,800	20,760
CRINKILL			
Grade 1	1,800	-	1,800
Grade 2	70	-	70
Grade 3	-	-	-
Grade 4	1,680	-	1,680
Grade 5	300	-	300
TOTAL	3,850	-	3,850
RIVERSTOWN			
Grade 1	2,000	-	2,000
Grade 2	50	-	50
Grade 3	250	-	250
Grade 4	2,400	-	2,400
Grade 5	180	-	180
TOTAL	4,880	-	4,880
TOTAL FOR BIRR TOWN, CRINKILL AND RIVERSTOWN			29,490

Birr Town

As can be seen from Table 3.3 above, 55% of the pipelines / culverts surveyed are given a Grade 1 Classification and approximately 3% a Grade 2 Classification. However a further 42% lie within Grades 3, 4 and 5 and thus require remedial work to ensure the network provides a better service performance.

A breakdown of the pipelines / culverts graded 3, 4 and 5 is given in Table 3.4 hereunder and shows that 150 mm, 225 mm and 300 mm diameter pipelines account for 68% of those requiring repairs.

Crinkill

47% of the pipelines surveyed are given a Grade 1 Classification and 2% to Grade 2 Classification. Grade 3, 4 and 5 account for 51% of the network and these pipelines will require attention.

A breakdown of the pipelines / culverts graded 3, 4 and 5 is given in Table 3.4 hereunder and show that 225 mm diameter pipelines account for 65% of those requiring repairs.

Riverstown

41% of the pipelines surveyed are given a Grade 1 Classification, and 1% to Grade 2 Classification. Grade 3, 4 and 5 account for 58% of the network and these pipelines will require attention.

A breakdown of the pipelines / culverts graded 3, 4 and 5 is given in Table 3.4 hereunder.

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Table 3.4 - Pipe Lengths and Diameters, Grades 3, 4 and 5

Diameter (mm)	Grade 3 Length (m)	Grade 4 Length (m)	Grade 5 Length (m)	Total
BIRR TOWN				
100	0	10	0	10
150	90	930	670	1,690
225	450	2,620	970	4,040
300	30	370	0	400
375	0	110	10	120
450	30	610	0	640
525	130	380	0	510
900	40	250	0	290
Culverts	140	830	0	970
TOTAL	910	6,110	1,650	8,670
CRINKILL				
150	-	450	205	655
225	-	1,190	95	1,285
300	-	40	-	40
TOTAL	-	1,680	300	1,980
RIVERSTOWN				
100	-	-	-	-
150	-	-	-	-
225	250	2,400	180	2,830
TOTAL	250	2,400	180	2,830
TOTAL FOR BIRR TOWN, CRINKILL AND RIVERSTOWN				13,480

In Birr Town there are a number of pipe lengths, approximately 3% of the total surveyed, which are given a grade of 2 and have cracks along the lengths. Crinkill and Riverstown also have some cracks on the Grade 2 pipelines surveyed and these account for 2% and 1% respectively of the total surveyed. While circumferential and longitudinal cracks will not cause problems at present, they will eventually develop into fractures. These pipelines will need to be monitored to check their condition. Table 3.5 gives a breakdown of the lines containing such cracks with a Grade 2 Classification. Cracking accounts for 443.4m of the 675m of grade 2 classification.

Table 3.5 - Pipe Lengths and Diameters, Contain Cracks and are Graded 2

Diameter (mm)	Grade 2 Length (m)
BIRR TOWN	
150	10
225	550
TOTAL	560
CRINKILL	
225	70
TOTAL	70
RIVERSTOWN	
225	45
TOTAL	45
TOTAL FOR BIRR TOWN, CRINKILL AND RIVERSTOWN	675

3.4 Findings of the SUS Survey

A SUS survey was carried out at each manhole in the network system. The SUS Survey has produced a precise account of the exact position of manholes (to National Grid Co-ordinates), ground levels, floor levels, chamber areas, shaft dimensions, etc. The inverts of incoming and out going pipes, their material, shape and diameters were also recorded. The survey also produced a condition report on all manholes providing details and recommending upgrading works to specific areas.

A break down of results from the SUS Survey is used to produce the Refurbishment Schedule.

3.5 Manhole Condition

A SUS survey was carried out at each manhole in the network system. A summary of the manhole conditions based on the SUS Survey is included below.

Birr Town

A total of 420 manholes require attention which includes the replacing of 10 No. Manhole Covers and Frames, making necessary repairs to Manhole Shafts and the replacing / repairing of Manhole Benching. Approximately 50 N^o. Manhole Covers need to be raised to ground surface level. Refer to Table 3.6 below.

Crinkill Village

A total of 109 No. Manholes require attention, 2 No. Manhole Cover and Frames require replacing. Repairs to Shafts and Benching are also required. Approximately 12 No. Manhole Covers should be raised to ground surface level.

Riverstown Village

A total of 96 No. Manholes require attention; one Manhole Cover and Frame need to be replaced; attention is required to Shafts and Benching; approximately 5 No. Manhole Covers should be raised to ground surface level.

Table 3.6 - Manhole Refurbishment Schedule

Diameter (mm)	No. of Manholes
BIRR TOWN	
Replace Covers and Frame	10
Repairs to Manhole Shafts	210
Replace / Repair Benching	150
Raise Buried Manhole Covers	50
TOTAL	420
CRINKILL	
Replace Covers and Frame	2
Repairs to Manhole Shafts	64
Replace / Repair Benching	32
Raise Buried Manhole Covers	12
TOTAL	110
RIVERSTOWN	
Replace Covers and Frame	1
Repairs to Manhole Shafts	43
Replace / Repair Benching	47
Raise Buried Manhole Covers	5
TOTAL	96
TOTAL FOR BIRR TOWN, CRINKILL AND RIVERSTOWN	626

3.6 Flow and Rainfall Survey

A Flow Survey was carried out by Capital Water Systems Ltd., between 6th April 2004 and 25th May 2004 and consisted of 14 Flow Monitors and 4 Raingauges.

The locations of the Flow Monitors are given in Table 3.7.

Table 3.7 - Flow Monitor Locations

Flow Monitor	Location	Pipe Size (mm)
01	Kinnitty Road, over Elm Grove Bridge	225
02	In Field at Elm Grove bridge	300
03	In Square outside Market House Tavern	525
05	Connaught Street, outside Whelehan's Pub	450
06	In Square beside Market House Tavern	1240 x 885
07	Outside Parsonstown National Model School	930 x 625
08	Pound Street, outside Mart	1370 x 292
09	Pound Street	525
10	Junction Burke's Hill and Burke's Hill Road	225
11	In field beside Loughnane's Filling Station	225
12	Overflow from M.H. 5.5 inside WWTW	750
13	Inside gate of S.T.P	900
14	Grounds of S.T.P opposite "Wild Owl Sanctuary" sign	525
15	Grounds of S.T.P next to manhole downstream of Flow Monitor 14	525

The locations of the Raingauges are given in Table 3.8.

Table 3.8 - Schedule of Raingauge Sites

Rain Gauge	Location	Storey
01	Birr WWTW on roof	1
02	Loughnane's Filling Station, on canopy (Tullamore Road)	1
03	Waterworks, on roof	1
04	Waterworks, on roof	1

3.7 Existing Wastewater Treatment Plant

3.7.1 Introduction

The existing Birr Wastewater Treatment Works lies to the north east of Birr Town adjacent to the Little Brosna River. The treatment facility was constructed at a site some 300m north of the original Birr WWTW during the period 1989-1991 with a design capacity of 12,000 p.e.

The WWTW (sized for 12,000 p.e.) consists of an Inlet works with screw pumps, inlet screening and degritting facilities, two aeration basins with centrally mounted surface aerators, two clarifiers and two picket fence thickeners feeding two belt presses housed within a sludge dewatering building. An Administration Building is located adjacent to the site entrance.

The existing works can treat loads up to 3 DWF and anything in excess of this is discharged into the Little Brosna River following manual screening at the storm overflow chamber adjacent to the access road. The location of the overflow is detailed on drawing 20305 / 02

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3.7.2 Existing Wastewater Treatment Works Overview

3.7.2.1 General

The Birr Wastewater Treatment process is a conventional extended aeration process and incorporates the following components.

1. Mechanically Raked screen and de-gritting facility (Jeta grit trap).
2. Screening washer/compactor unit.
3. Two Aeration basins each designed to accept 360 kg BOD/day.
4. Two Clarifiers with a discharge to the Little Brosna River.
5. Sludge thickening and dewatering facilities.
6. Ferric Sulphate dosing facility.
7. Administration Building.
8. Foul, RAS and SAS pumps.

The existing plant has a design capacity of 12,000 p.e. and a design effluent quality of 20 mg/l BOD, 30 mg/l suspended solids and Total Phosphorus of 1 mg/l.

3.7.2.2 Inlet Works

The existing inlet works consists of the following:

- Two Screw Pumps which have been recently repaired and refurbished
- Hand Raked Screen and J&A Mechanically Raked Screen which have been recently refurbished due to operational difficulties
- Jeta 200 Grit Trap
- Grit Classifier which has been recently refurbished
- Grit Collection Chamber
- Washer and Compaction Unit
- Open top skips

A flowmeter for inlet flow recording to the treatment units is also provided

3.7.2.3 Aeration Basins

The main treatment process is by means of extended aeration. The aeration tank is 19.5 metres wide by 19.5 metres long with a liquid depth of 3.9 metres. Aeration is by means of centrally mounted mechanical surface aerators.

This process is running without any major problems since being commissioned in 1991. The MLSS content of the aeration basin most recently ranges from about 2,300 mg/l to about 5,700 mg/l.

3.7.2.4 Clarifier

Final settlement is achieved in 2 No. 16 m diameter hopper bottomed clarifiers. Settled sludge is withdrawn from the clarifier and feeds by gravity to a sludge draw off chamber and on to the sludge pumping station. From the sludge pumping station sludge is either returned to the aeration tank or wasted to the sludge thickening tank. The clarifier is running efficiently and is producing a good quality effluent.

3.7.2.5 Picket Fence Thickener

Settled waste sludge drawn from the clarifier is stored in 2 No. 5.5 m diameter sludge holding tanks. These sludge holding tanks are sized for 12,000 p.e. and also double as picket fence thickeners (PFT), thickening the sludge before being pumped on to the sludge dewatering building. The PFTs have no cover and thus are exposed to the elements. The PFTs are located near the south west corner of the WWTW site.

3.7.2.6 Dewatering

The sludge is then dewatered using the belt presses to 16% d.s. and the cake is conveyed to skips/trailers for removal off site. The dewatering facilities have the two belt presses functioning on a duty/standby basis with each one capable of processing 12,000p.e. of sludge in a 38hour period. The control panel is isolated off from the Belt Presses which under current Health and Safety regulations constitutes an electrical risk. The Belt press room is being used as a storage area as there is no other storage facility at the WWTW.

3.7.2.7 Phosphate Dosing Facility

Chemical Dosing (Ferric Sulphate) is carried out at the works. The introduction of chemical dosing was carried out in order to remove orthophosphate in the effluent. The Ferric Sulphate is stored in 1 m³ IBCs on site.

3.7.2.8 Administration Building

The controls for the plant are within the Administration Building. The plant automated and designed on the basis of a full time operator not being required. The Administration Building consists of a control panel room, canteen, toilet / shower room, laboratory and store. It is noted that the building does not have a changing room or office.

3.7.2.9 Effluent Outfall

The existing outfall (525 mm AC) discharges from the Washwater pumping station following a route south along the WWTW access road for 90m before turning perpendicular to the road and discharging to the Little Brosna River approximately 100 meters west. This route is detailed in Drawing 20305 / 02

3.7.2.10 Stormwater Facilities

There is storm water screening but no detention tanks adjacent to the access road to the works. Flows in excess of 93.75 l/s (3DWF for the design of the process units) are screened by means of manual 13 mm bar storm overflow screens before discharging into the Little Brosna River. The screens are cleaned manually using power jetting equipment.

3.7.2.11 Odour Control Facilities

The WWTW has no odour control facilities. During site visit there seemed to be little or no odour nuisance at the site boundary. This issue is dealt with in detail in the Environmental Impact Statement (EIS) and the EIS recommends that odour control is provided at the WWTW.

3.7.3 Operation and Maintenance

3.7.3.1 Responsibilities and Practices

The operation and maintenance aspects are two important components for an efficient wastewater disposal system. The number of person employed for operation and maintenance of the Wastewater collection and disposal facilities is summarised as follows:

Table 3.9 - Persons Employed at Birr WWTW

Birr Wastewater Treatment Works	
Persons employed (2 Caretakers operating in	2 (50 % of time)
Supervisor	1 (part time)
Population served	12,000

The operation and maintenance of the sewerage system and sewage treatment facilities are undertaken by the Sanitary Services Section of Birr Town Council. The overall process performance of the plant meets the required standards, a fact reflected in the EPA Report "Urban Waste Water Discharges in Ireland with population equivalents greater than 500 persons – A report for the years 2002 and 2003" published in 2004 which shows compliance with the Urban Wastewater Treatment Regulations at Birr WWTW.

3.7.3.2 Examination of Operational Issues

Discussions were held with the works supervisor regarding any operational issues on the site. The following areas had difficulties which were reported by the Plant Supervisor.

1. Aeration Tank Outlet weirs
2. Return Activated sludge Pumps
3. Picket fence thickeners
4. Sludge dewatering Building
5. Wash water boost pumps
6. Health and Safety

A recent visit from the Health and Safety Authority outlined a number of concerns including access ladders, tank covers and the security of the perimeter fence on site. With the exception of the security of the perimeter fence the other issues have been resolved.

It is noted that the plant is now 15 years old and as such some of the mechanical and electrical equipment is nearing the end of its design life.

3.8 Flow and Load Survey

3.8.1 Plant Design Capacity

The original plant design parameters are summarised as follows:

Population Equivalent PE	BOD Load		Hydraulic Load	
	g/h/day	Kg/day	l/h/day	m ³ /day
12,000	60	720	225	2,700

Flows in excess of 93.75 l/s (3 DWF for the design of the process units) are discharged to the Little Brosna River.

A seven day flow and load survey was carried out between 26th April and 2nd May 2004 at three locations. These were;

- (a) at the inlet to the Birr WWTW,
- (b) at the Effluent from Birr WWTW and
- (c) at the outlet from Milne foods (hereafter referred to as the Milne location).

Continuous flow measurement was taken at the three locations and BOD, SS and Orthophosphate were sampled on a four hour composite sample basis over the testing period. Additionally Total Nitrogen was measured at the Inlet to the Birr WWTW. Five days of sampling were conducted at the Milne location from 8am Monday the 26th April until 10pm on Friday the 30th April.

3.8.2 Flows

Flows from the Birr Town and environs Catchment (see Figure 3.1) arriving at the WWTW average 1220m³/day and flows from the Milne foods plant average 162m³/day. The flow to the WWTW follows a normal diurnal pattern which peaks around 12 noon each day. The low flows occur at about 5am each day. The effluent flow pattern from Milne foods is variable and seems to depend more on the work being done at the factory. From the flow pattern it would appear that some activity takes place at the factory 24 hours a day. There was significant flow from 8am on the first day of sampling until 10pm on the last day. This is indicative of periodic 7 day a week operation.

Offaly County Councils Environmental Section have issued Milne foods with a discharge licence, part of which relates to flow with a maximum of 10 m³/hr and

70 m³/day permitted. The permitted flow of 70 m³/day was exceeded every day of the flow survey.

3.8.3 WWTW Influent and Effluent Load and Concentration Data

3.8.3.1 WWTW Influent BOD Load

The Flow and Load survey results for the BOD loads measured at the WWTW (Figure 3.2) show a 1,194 kg load (almost twice the WWTW capacity) arriving on the first day of the survey. The cause of this shock load was not initially apparent. The origins are not industrial as the only industry is Milne foods and analysis of this load (Figure 3.3) shows that it does not have its origin there. The load is not the result of imported sludge at the inlet works as no sludge came into the works at the time of the shock load. However there are two factors which indicate the origin of this load, firstly the floc-like nature of the samples when examined (which indicates that the sludge is a product of a treatment process) and secondly a spike in the flow to the inlet works at the same time that the shock load first appears (Figure 3.4). Examination of the WWTW layout reveals that it is possible to direct sludge back to the inlet works via a series of manholes. The spike occurs at approximately 10:00 am on a Monday and is consistent with a plug of 1-3% dry solids activated sludge. Essentially this appears to be a load caused by an operational issue in dealing with the previous weekend's sludge rather than any external source.

Similarly there is a BOD surge on the afternoon of the 30th April of a 818kgBOD contribution to the works and again there are unusual flow spikes on the afternoon of the 30th April at the inlet as Figure 3.5 shows. The BOD load from Milne foods is again insufficient at that time to be the cause of this spike (Figure 3.3). Consultation with the Supervisor at the WWTW confirmed that this load was the result of imported sludge from Croghan being delivered to the inlet works. As this practice has a negative impact on the WWTW process it has been discontinued and imported sludge is now brought directly to one of the picket fence thickeners.

3.8.3.2 WWTW Effluent BOD Concentration and Load

The results of the effluent concentrations obtained over the sampling period at the WWTW are presented in Figure 3.6. The impact of the shock loadings is visible in the effluent results. The time lag from influent to effluent is different for

both events due to the greater hydraulic load associated with the second shock event.

The average effluent BOD load to the little Brosna river over the sampling period from the WWTW is 11.65 kgBOD/day.

3.8.3.3 WWTW Influent Suspended Solids Load

The Suspended Solids (SS) loading to the works peaks at the same time and with the similar intensity as the BOD loads to the works. Figure 3.7 clearly illustrates the SS load peaking on the 26th April and the 30th April, (i.e. at the same time that the Influent BOD load peaks). The SS loading to the works peaks with the 26th of April recording a figure of 965kg SS for the day. In the absence of the shock loads the Average daily SS load to the WWTW is reduced to 182kg/day.

3.8.3.4 WWTW Effluent Suspended Solids Concentration and Load

Figure 3.8 shows the failure of the WWTW to meet its design effluent figure of 30 mg/l on the 1st May 2004 (i.e. at the same time that the effluent BOD peaks due to the imported sludge load of the 30th April). However, as with the BOD effluent concentration result, a 24 hour composite effluent sample taken over the 1st May would have a concentration less than the design effluent limit.

3.8.3.5 WWTW Influent OrthoPhosphorus Load

The OrthoPhosphorus (PO₄) peak loading to the works does not show shock loadings similar to the aforementioned shock loadings of BOD and SS. This is explained by the nature of the shock loadings to the works.

In the first case, shock loading due to the Sludge returned from the dewatering process, has no PO₄ component because it would be in an inert form as a result of chemical precipitation and would be a compound of Iron (FePO₄). Therefore it cannot contribute to a shock load as with BOD and SS.

In the second case, the sludge imported from Croghan would have an insignificant PO₄ element due to the lack of phosphorus removal facilities at Croghan.

The PO₄ load to the works peaks after midday and the load is low at approximately 6am. Figure 3.9 illustrates the diurnal nature of the PO₄ load. The PO₄ loading to the works averages 6.8 kgPO₄/day.

3.8.3.6 WWTW Effluent OrthoPhosphorus Concentration and Load

Figure 3.10 shows the ability of the WWTW to meet its effluent figure of 1 mg/l during the sampling period. The average effluent figure is 0.207 mg/l and the average effluent load to the river is 0.25 kgPO₄/day.

3.8.3.7 WWTW Influent Total Nitrogen Load

The first day of the sampling period has a peak nitrogen load of 63kgTN which is almost certainly due to the operational problem referred to earlier. However the Total Nitrogen loading to the works peaks on a diurnal basis in a manner that seems broadly unrelated to the second shock loading to the works. The Total Nitrogen load to the works peaks after midday and the load is low at approximately 6am. Figure 3.11 illustrates the diurnal nature of the Total Nitrogen Load. The Total Nitrogen (TN) loading to the WWTW averages 50kgTN/day.

3.8.4 Milne Foods Effluent Concentration and Load

3.8.4.1 BOD Concentration and Load

The effluent BOD concentration limit on the discharge licence of 1,200 mg/l is exceeded on several occasions over the 5 day sampling period at Milne (see Figure 3.12). When considering the load flow is an important factor and as mentioned in Section 3.8.2, the flow from Milne exceeds the licensed flow. The licensed BOD load from Milne Foods is 80.5 kg/day. However over the survey period the daily BOD loads from Milne Feeds were 39.8 kg/day, 157.9 kg/day, 216 kg/day, 188.5 kg/day and 325 kg/day. The BOD loads from Milne Foods are illustrated in Figure 3.3.

3.8.4.2 SS Concentration and Load

The effluent SS concentration limit of 500mg/l on the Milne Foods discharge license is exceeded on several separate occasions over the 5 day sampling period at Milne (see Figure 3.13). The permitted SS load from Milne Foods is 35 kg/day. Over the survey period the daily loads from Milne were 57.4 kg/day, 68.5 kg/day, 96.2 kg/day, 127 kg/day and 105 kg/day. The SS loads from Milne foods are illustrated in Figure 3.14.

3.8.4.3 Ortho Phosphorus Concentration and Load

The effluent concentration restraint of 1 mg/l total phosphorus on the Milne Foods discharge license is exceeded at all times over the 5 day sampling period at Milne (see Figure 3.15). A total phosphorus load of 0.07 kg (approximately 0.04 kg PO₄) is permitted to leave Milne on any one day. Over the survey period the daily PO₄ loads from Milne were 0.37 kg/day, 0.91 kg/day, 1.25 kg/day, 0.91 kg/day and 1.3 kg/day respectively. The PO₄ loads from Milne Foods are illustrated in Figure 3.16.

3.8.5 Conclusions from Flow and Load Survey

The daily flows and loads recorded at the inlet to the WWTW, at the WWTW outfall to the river and from Milne Foods over the sampling period are summarised in tables 3.10, 3.11 and 3.12.

Table 3.10 - Daily Flows and Loads to Inlet to the Birr WWTW

Date	Flow m ³ /day	kgBOD/day	kgSS/day	kgPO ₄ /day	kgTN/day
26 th April	960	1194	965	8.2	63
27 th April	1211	497	173	7.2	52.5
28 th April	1280	286	129	7.8	49.3
29 th April	1304	285	110	5.3	48.2
30 th April	1360	818	425	7.4	52.2
1 st May	1245	699	313	7.2	46
2 nd May	1186	422	187	4.7	39

Table 3.11 - Daily Flows and Loads at the Birr WWTW Outfall to the Little Brosna River

Date	Flow m ³ /day	kgBOD/day	kgSS/day	kgPO4/day
26 th April	998	5.2	6	0.164
27 th April	1249	6.4	14.45	0.245
28 th April	1283	5.7	9.8	0.185
29 th April	1241	8.1	11.9	0.171
30 th April	1304	12.5	17.8	0.254
1 st May	1202	24.2	35	0.303
2 nd May	1124	19.5	14.33	0.411

Table 3.12 - Daily Flows and Loads from Milne Foods

Date	Flow m ³ /day	kgBOD/day	kgSS/day	kgPO4/day
26 th April	74	39.8	57.4	0.37
27 th April	140	157.9	68.5	0.91
28 th April	140	216	96.2	1.25
29 th April	185	188.5	127	0.91
30 th April	270	325	105	1.3

Having examined all the data obtained from the flow and load survey the existing population equivalent for the Works at the time of the survey has been determined as **7,300p.e.**

The WWTW is achieving good effluent results apart from the occasions when operational problems have been noted. The operational problems discussed could be easily rectified and the importation of sludge to the inlet works has been discontinued as noted.

During the Flow and Load survey the Milne Foods factory failed to meet its effluent discharge standard. Since this flow and load survey was conducted Milne Foods have moved premises and now operate a new Wastewater Treatment Plant. This Milne Foods wastewater treatment plant is now meeting the requirements of the discharge license.

Figure 3.1 Flows from the WWTW and from Milne Foods

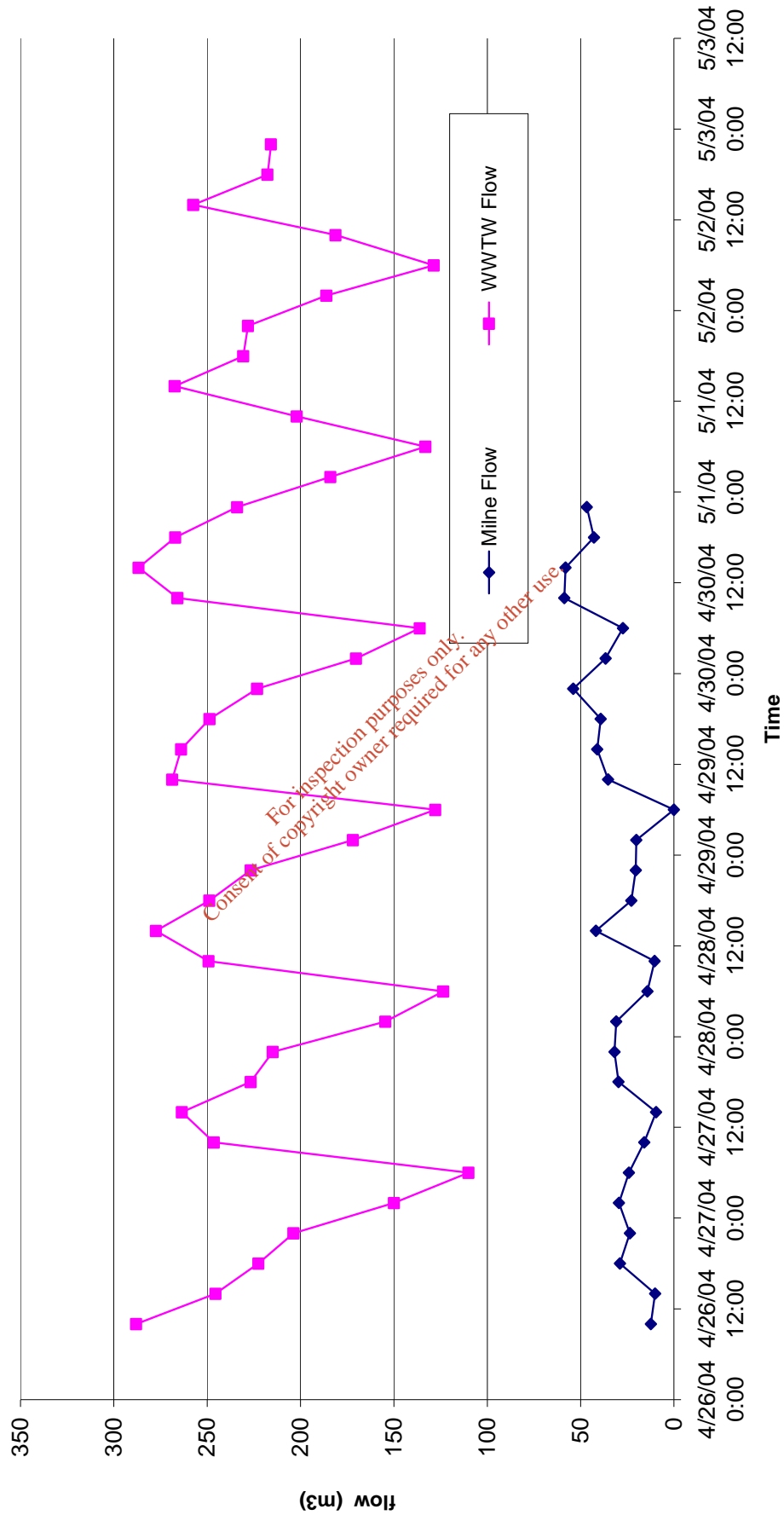


Figure 3.2 - BOD Load to the WWTW

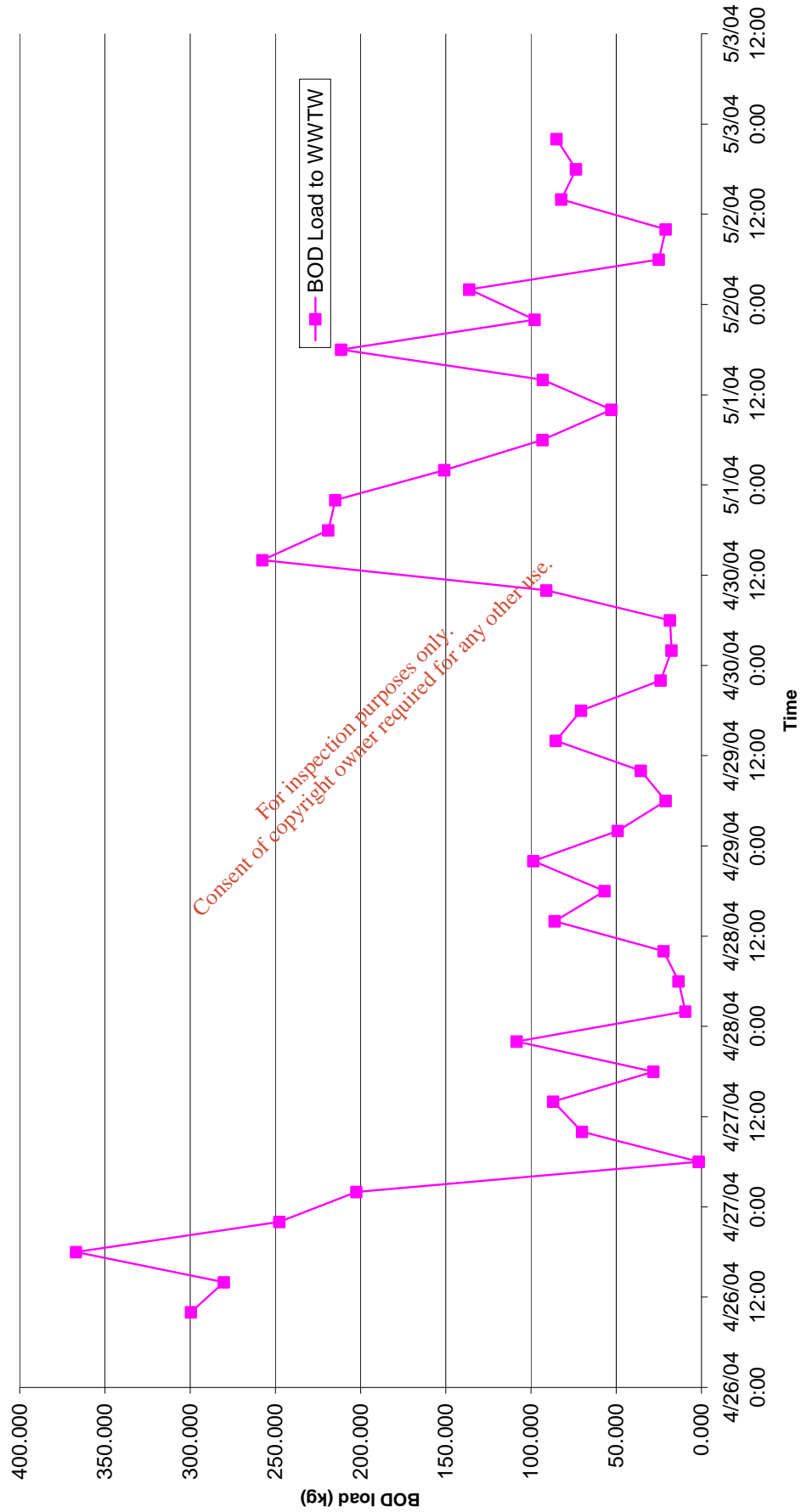


Figure 3.3 BOD load from Milne Foods

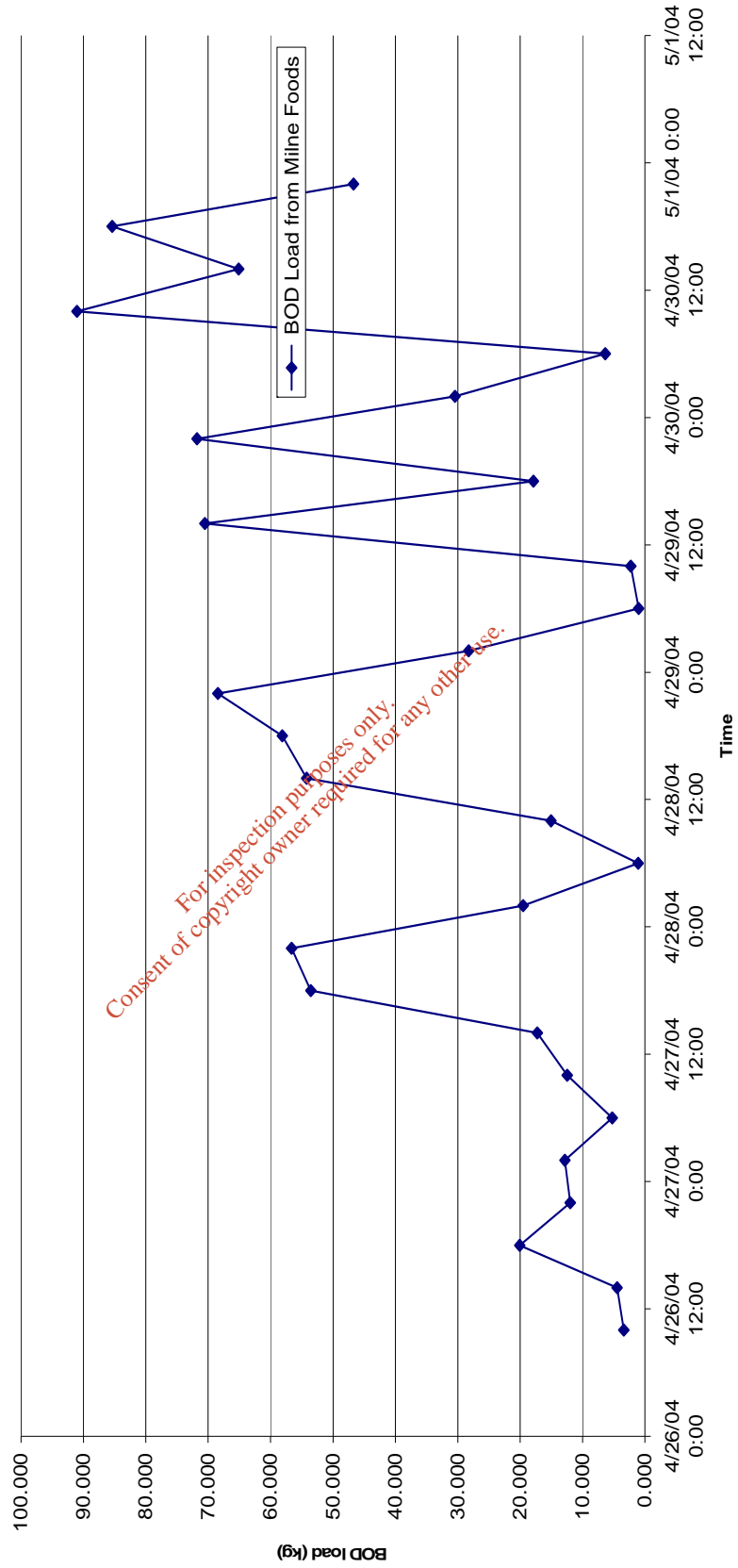


Figure 3.4 Spike In Inlet flow at 10am Monday 26th April 2004

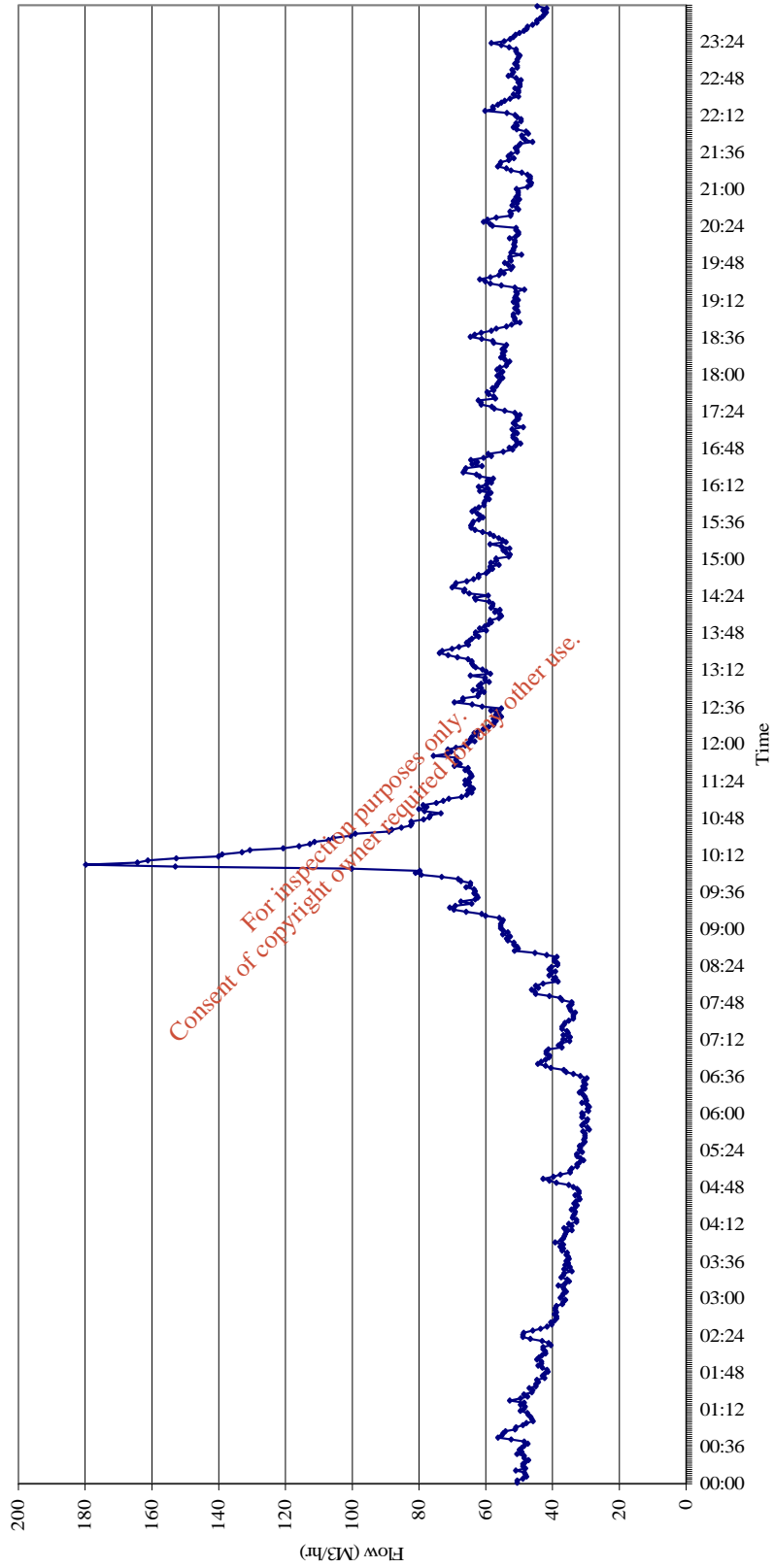


Figure 3.5 Multiple Spikes in Inlet flow Friday afternoon 30th April 2004

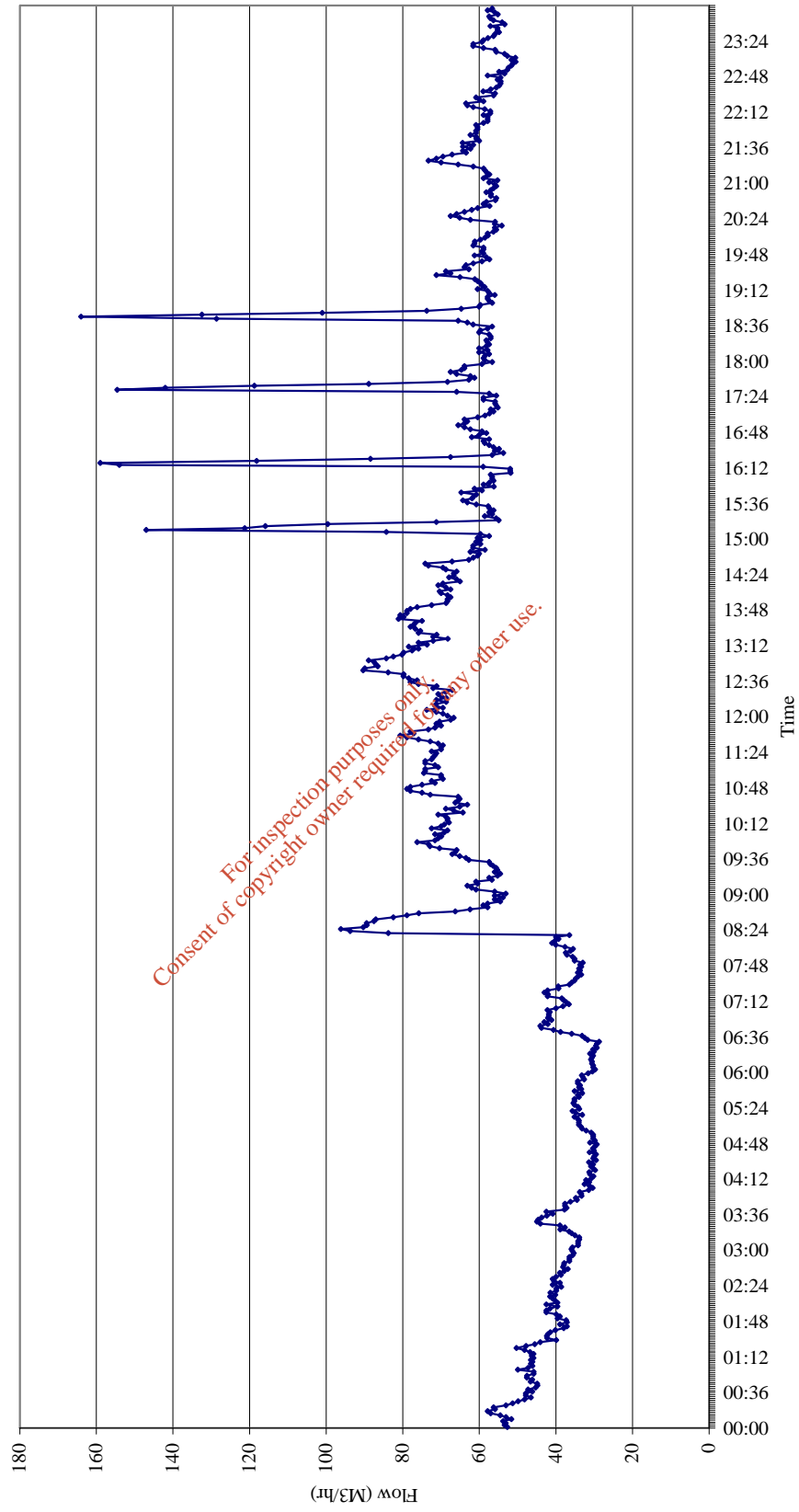


Figure 3.6 - Effluent BOD concentrations at the WWTW during survey period

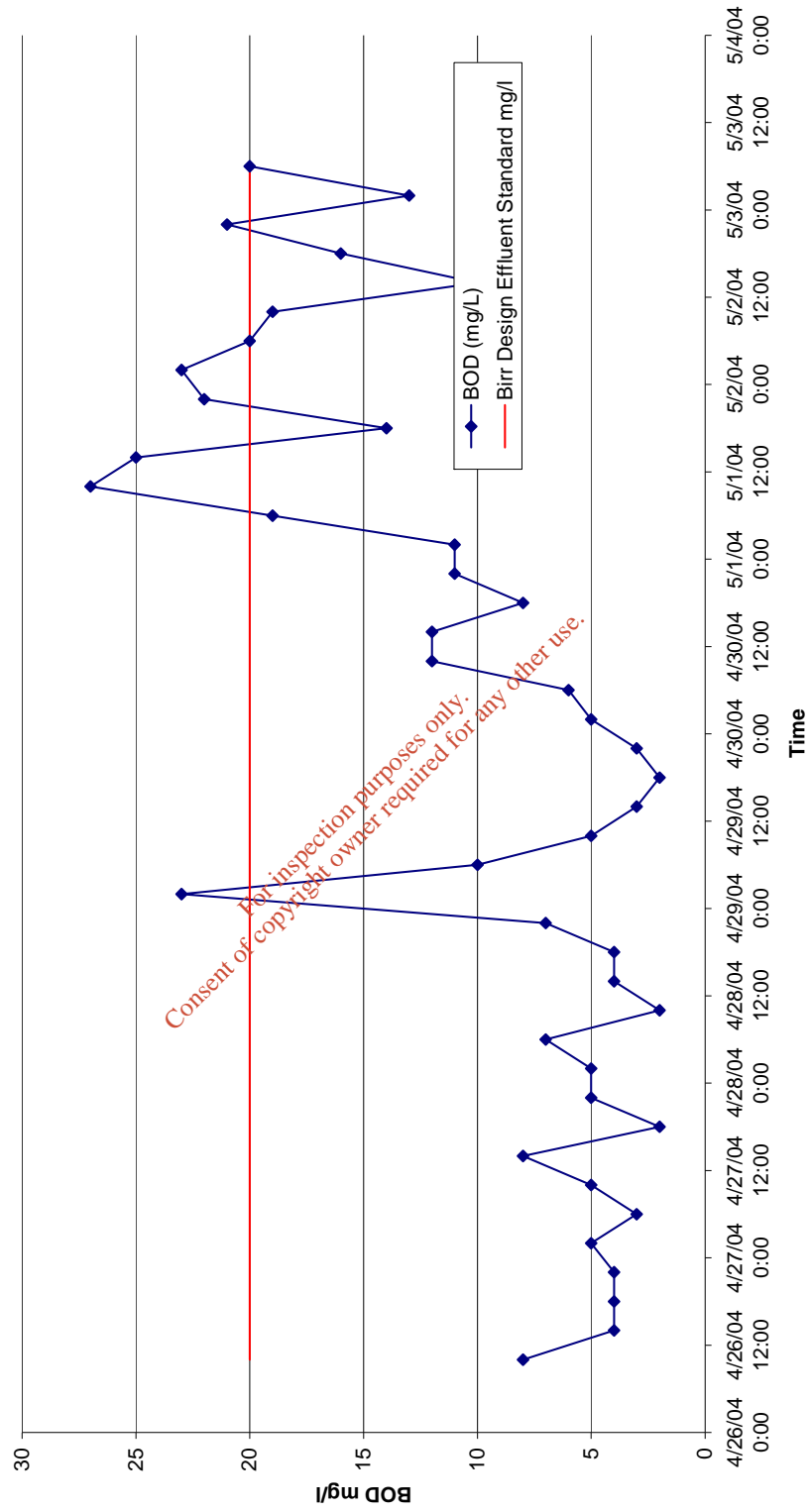


Figure 3.7 - SS load to the WWTW.

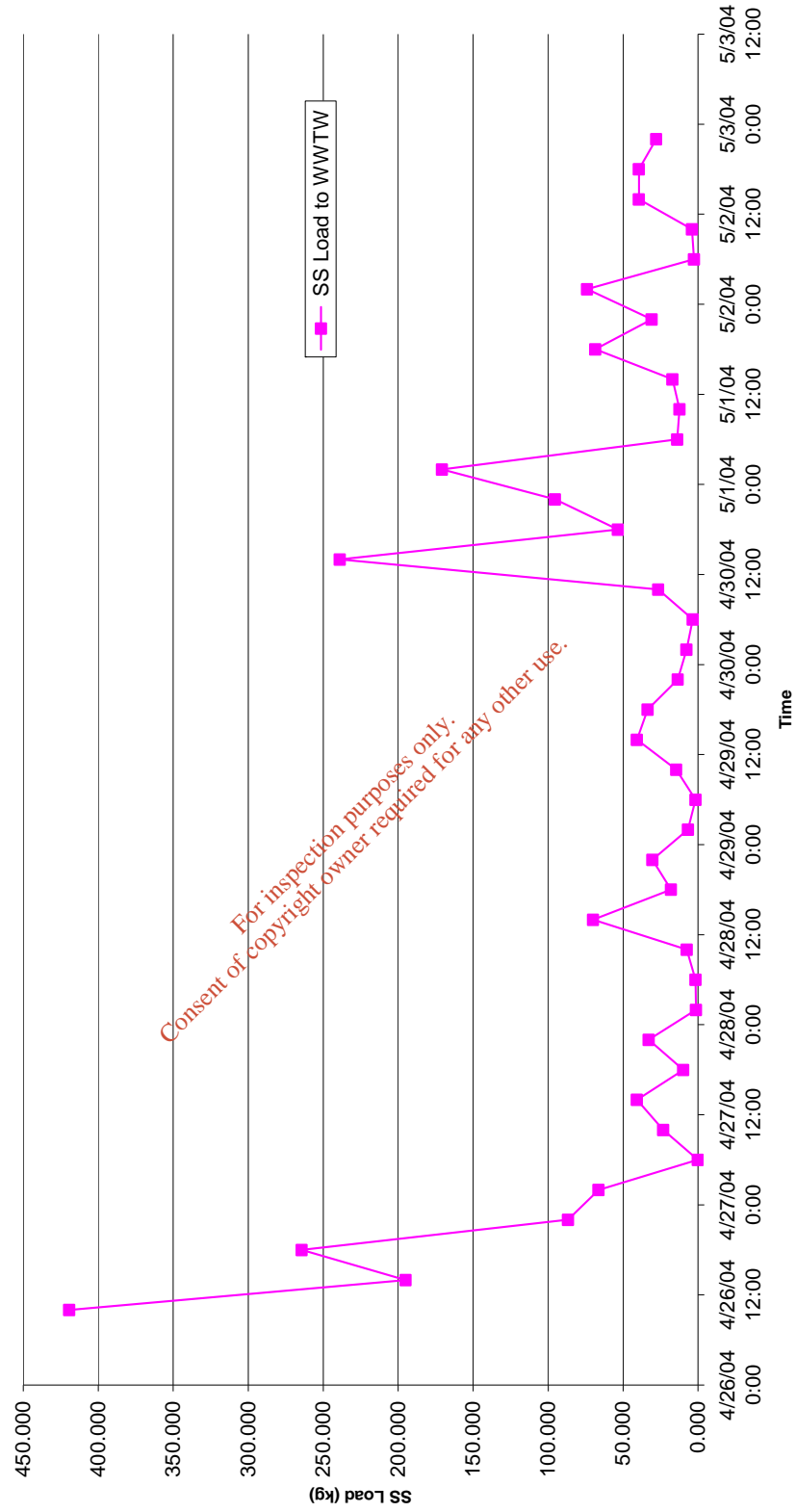


Figure 3.8 - Effluent SS concentration from the WWTW

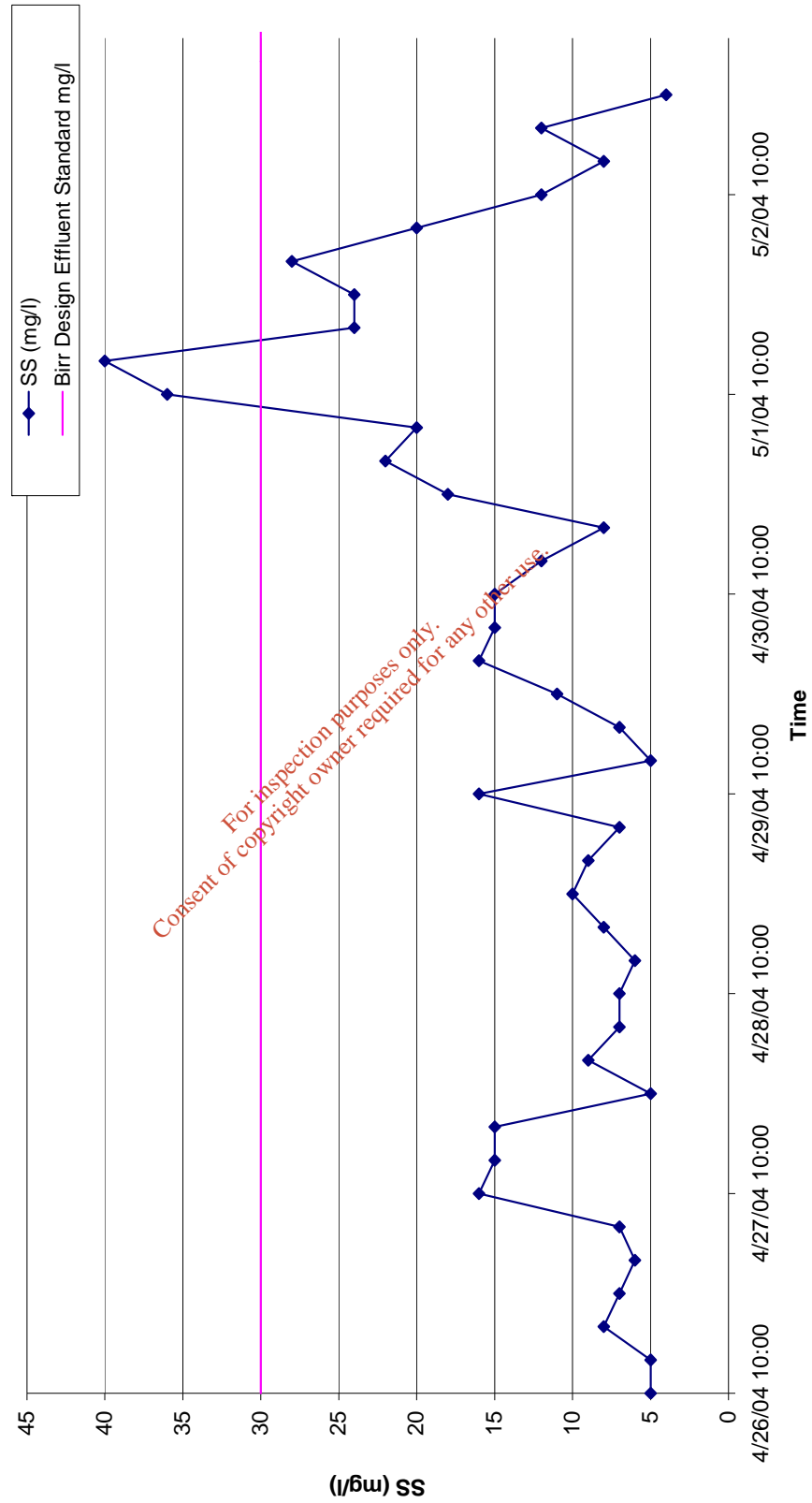


Figure 3.9 - PO4 load to the WWTW.



Figure 3.10 - Effluent PO4 concentration from the WWTW

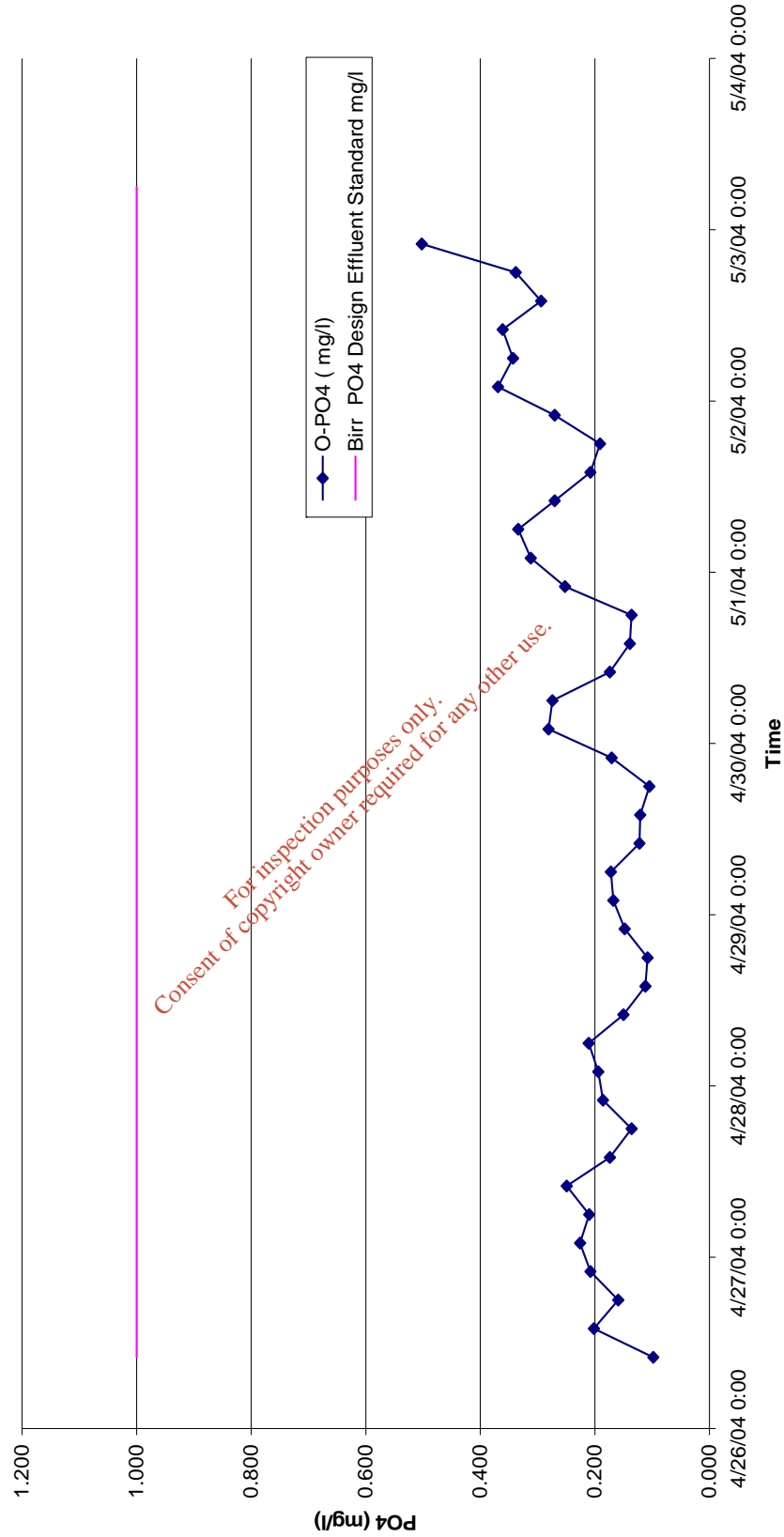


Figure 3.11 - Total N load to the WWTW

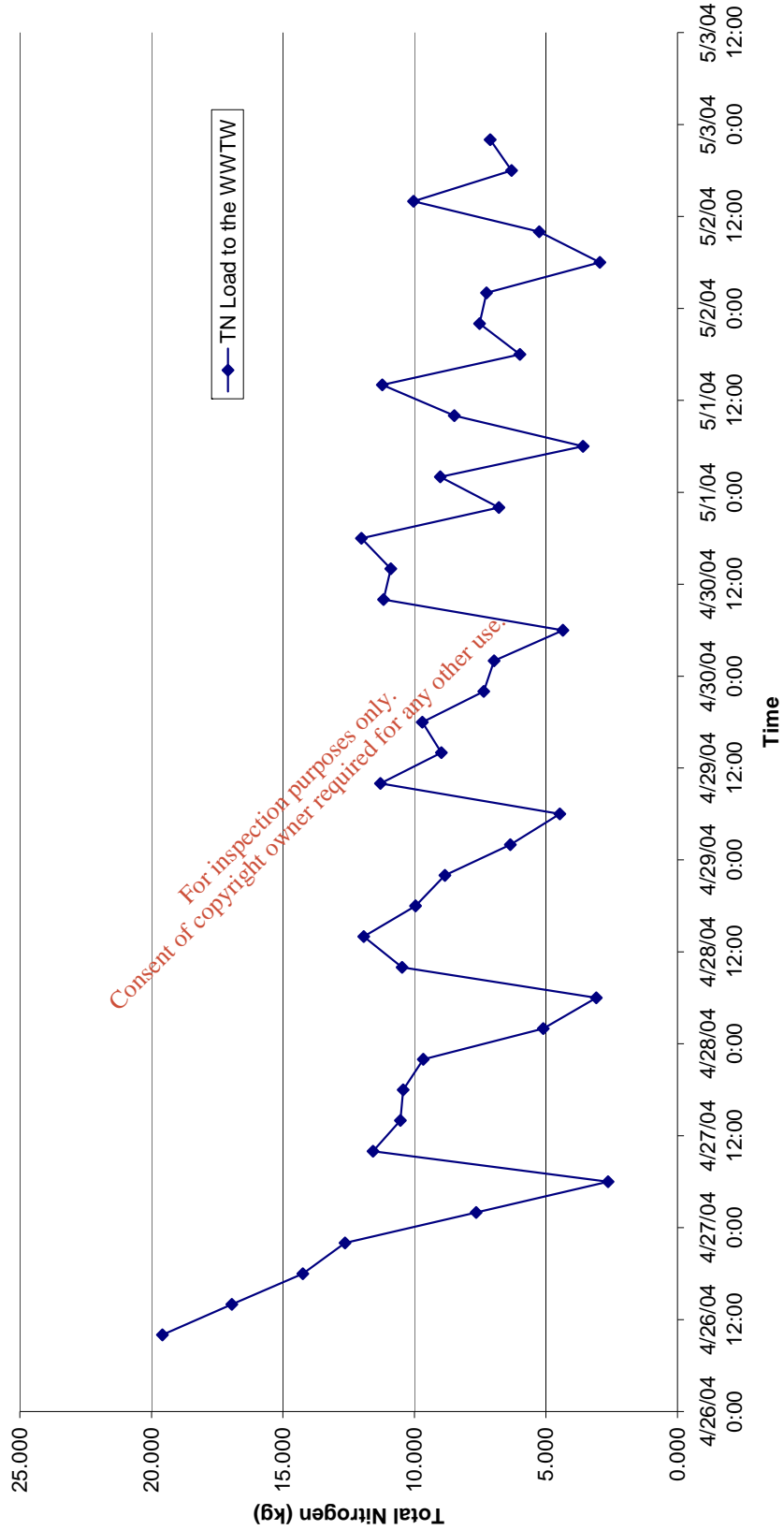


Figure 3.12 - BOD concentration from Milne Foods

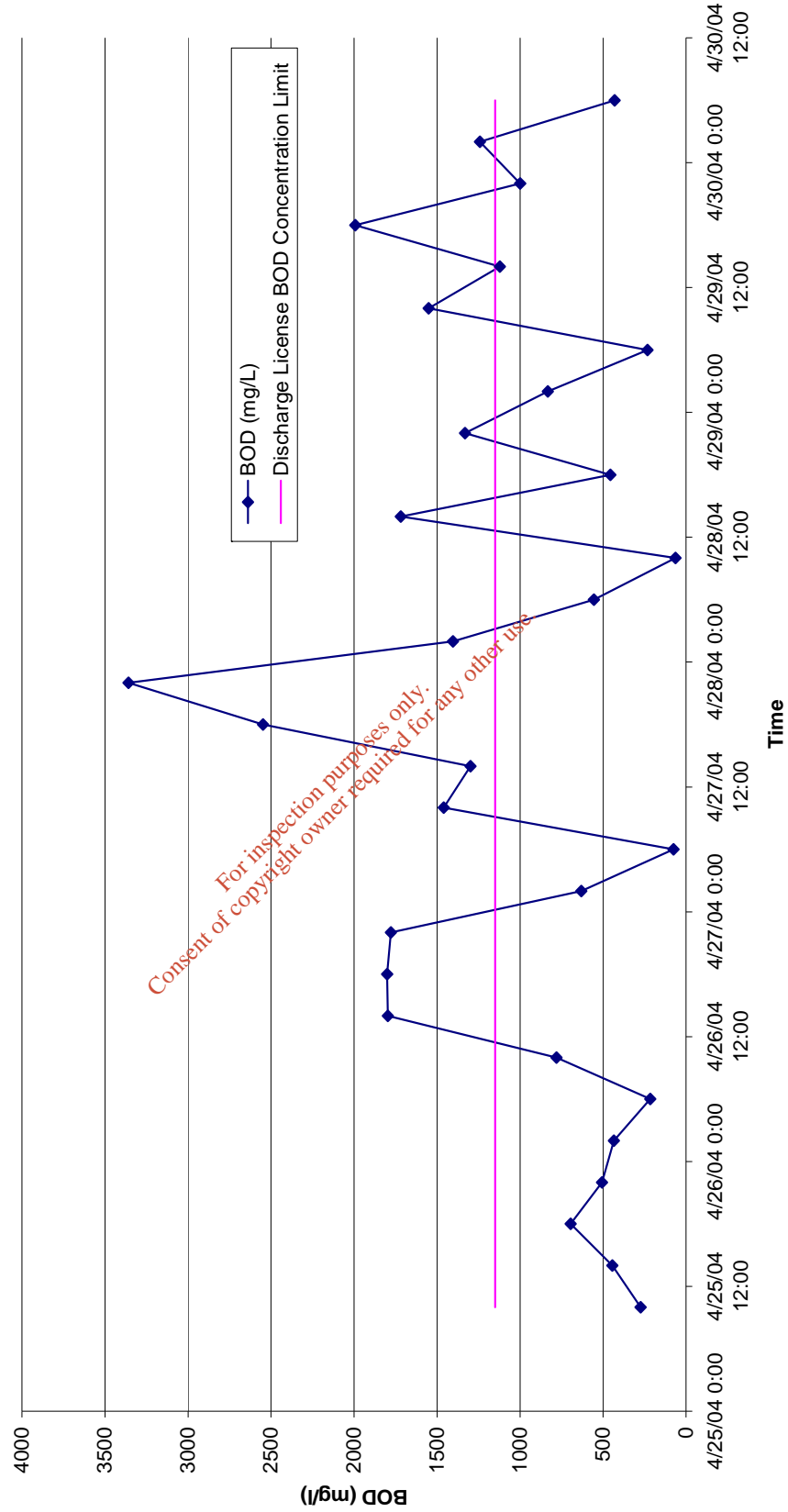


Figure 3.13 - SS concentration from Milne Foods

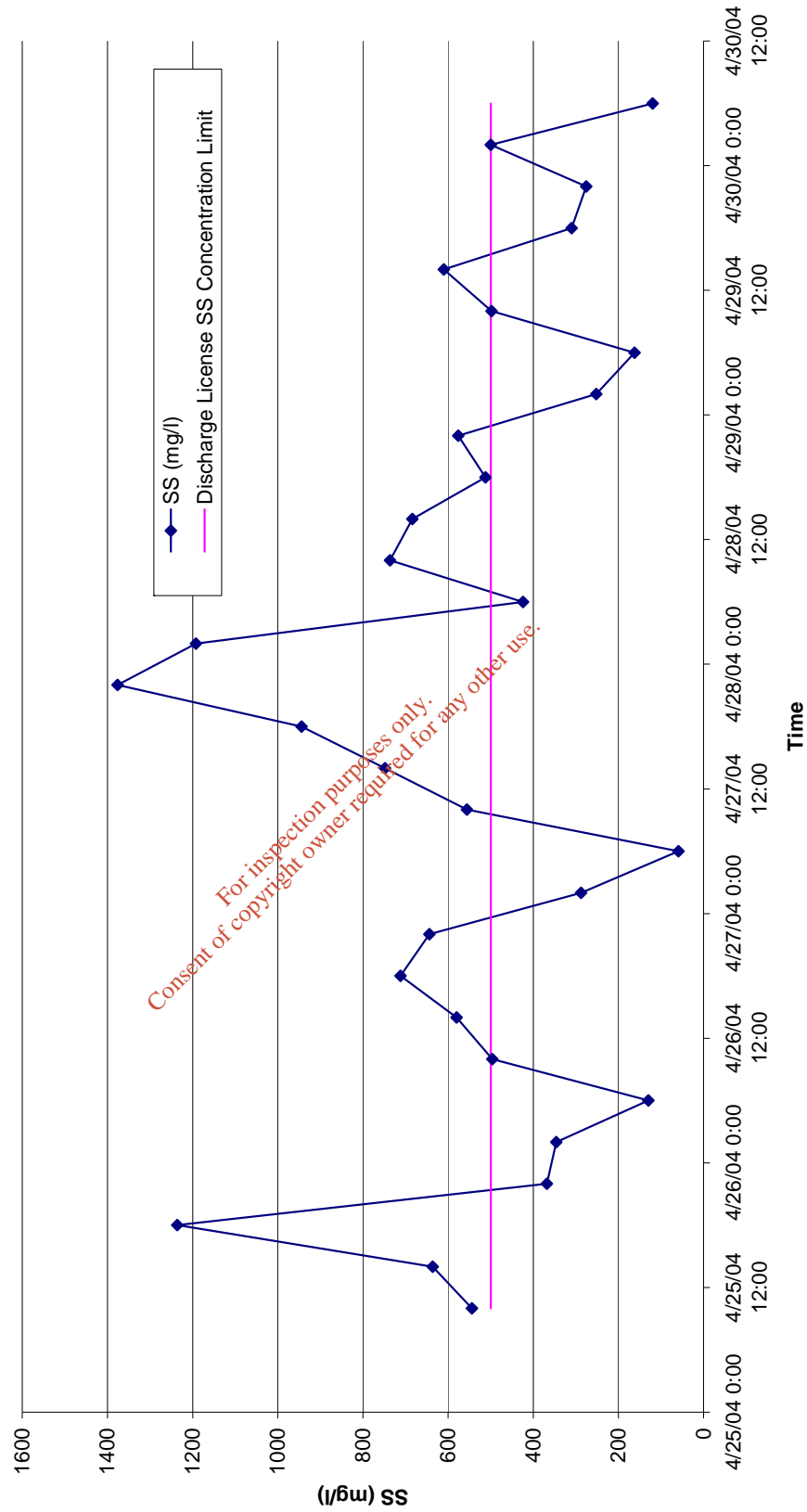


Figure 3.14 SS load from Milne Foods

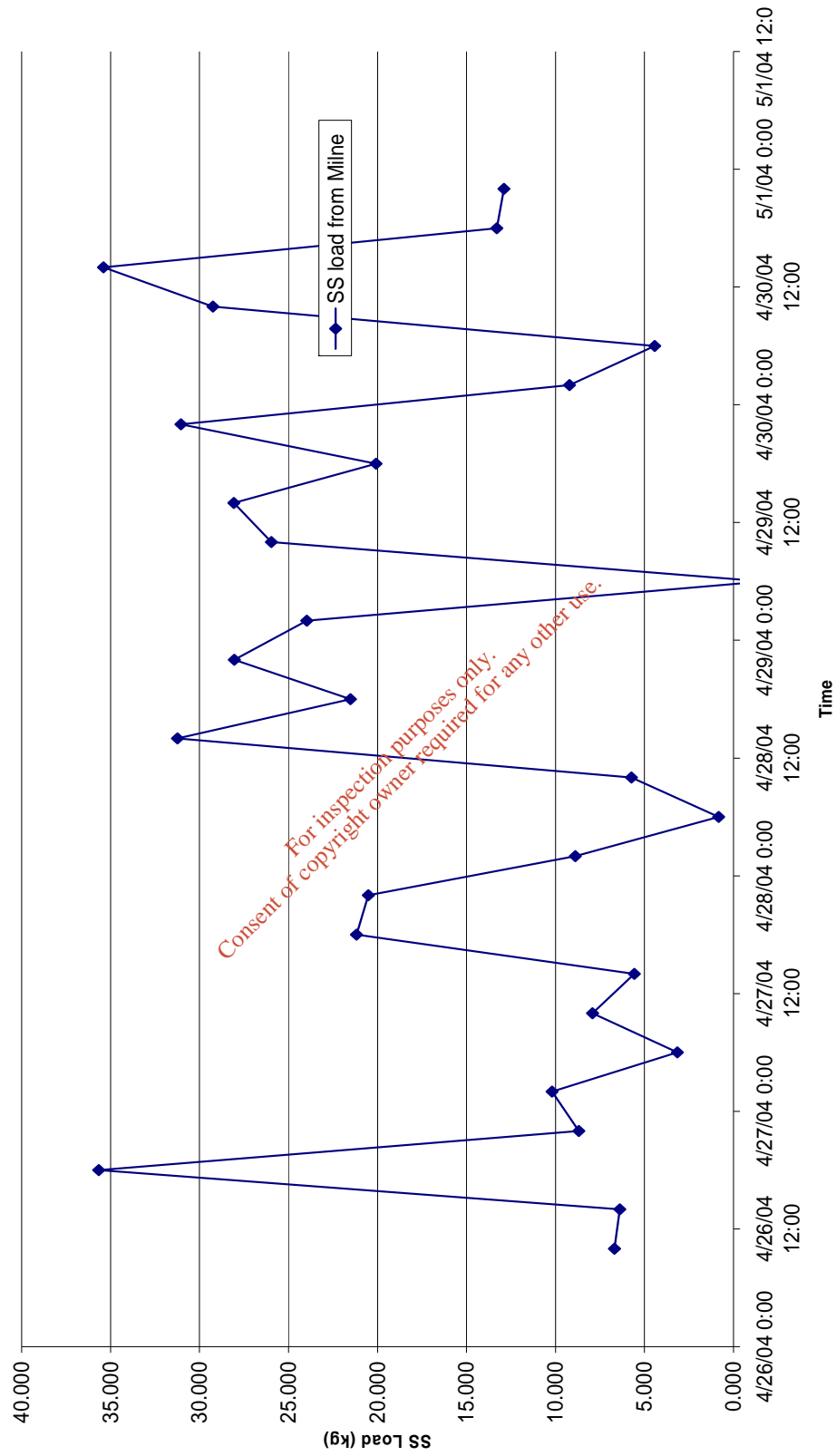


Figure 3.15 - PO4 concentration from Milne Foods

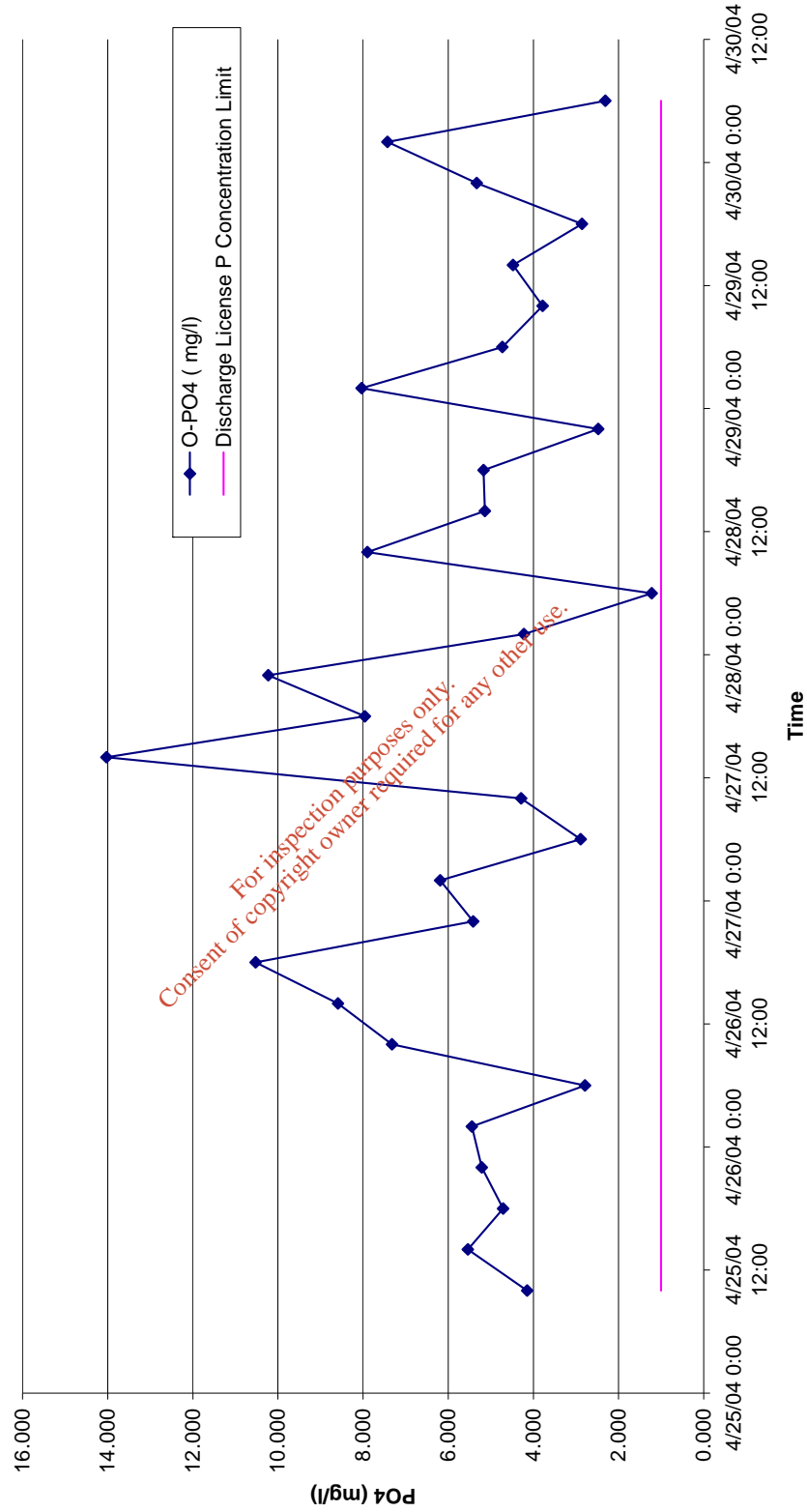
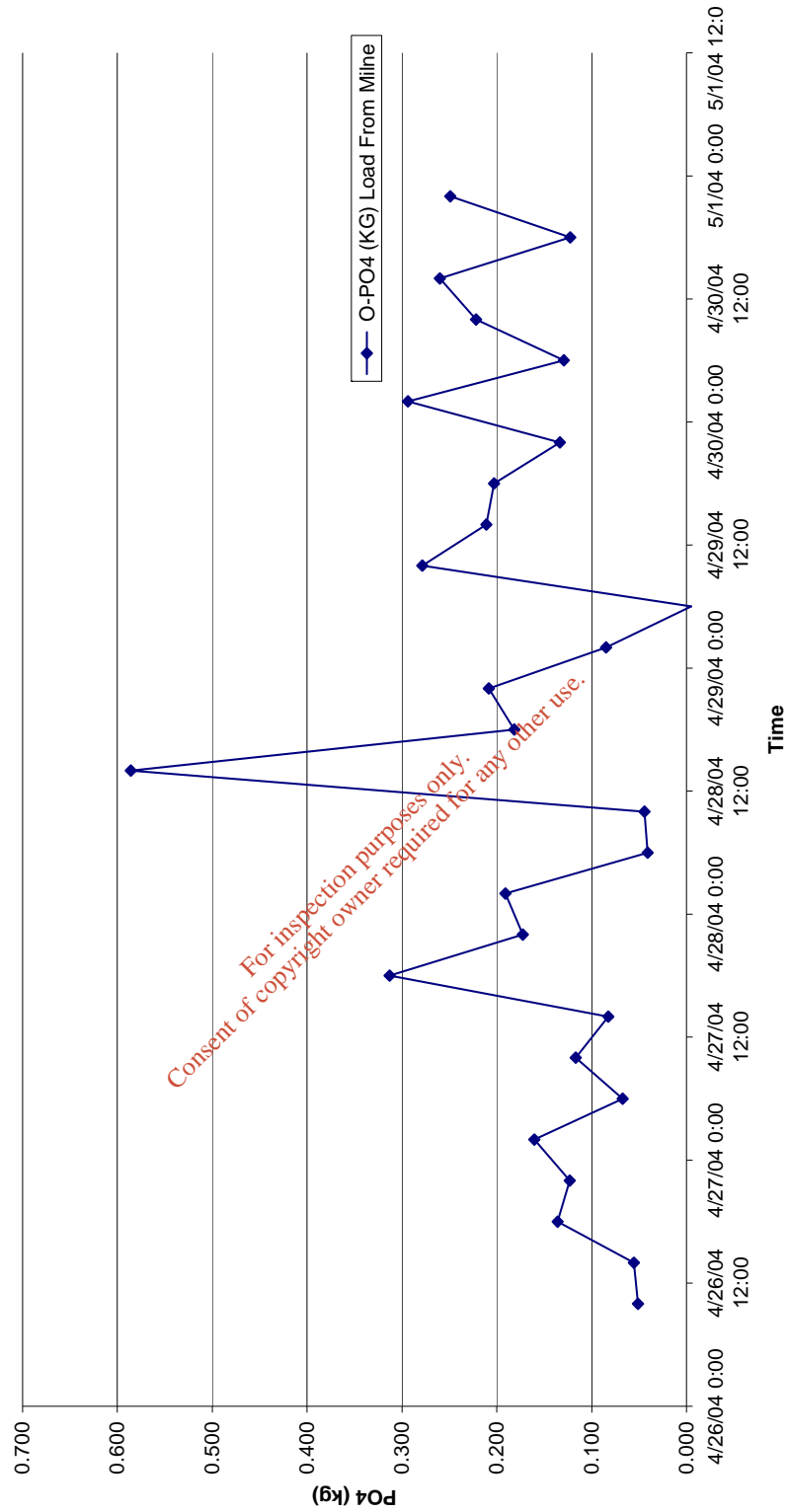


Figure 3.16 P04 Load from Milne Foods



4.0 POPULATION PROJECTIONS, WASTEWATER FLOWS AND STAGING OF THE SCHEME

4.1 General

In this section, each component of the wastewater flow is assessed in turn by reference to the most relevant data available on forward projections.

4.2 Population Projections

The population growth rate and population projections for the scheme have been examined on the basis of High, Medium and Low estimates of growth. The figures for Birr Town and Environs are the basis for the population figures as these areas are within the towns' sewer network. The population projections are based on a scheme horizon of 25 years to the year 2029.

One significant factor in the population projection is the population growth coming to Birr as part of the decentralization of 250 civil servants from Dublin to the town. Assuming a family (spouse and 2 children) coming with each civil servant, a total of 1,000 people will resettle in the vicinity of Birr over 2005-2008. It is assumed that only 800 of these people will settle within the catchment of the Birr sewerage network with the rest relocating outside the catchment either in rural areas or in other urban areas such as Tullamore. This influx is added to each of the population projections. This increase amounts to a 16% increase in Birr's current (2004) domestic population of 4,904 in a matter of 1 or 2 years. The other significant factor is the amount of land residentially zoned under the Development Plan for Birr and Environs adopted on the 31st May 2004. It is proposed that this land would be inhabited at the rate of 17 houses per hectare and 2.9 people per house (national average).

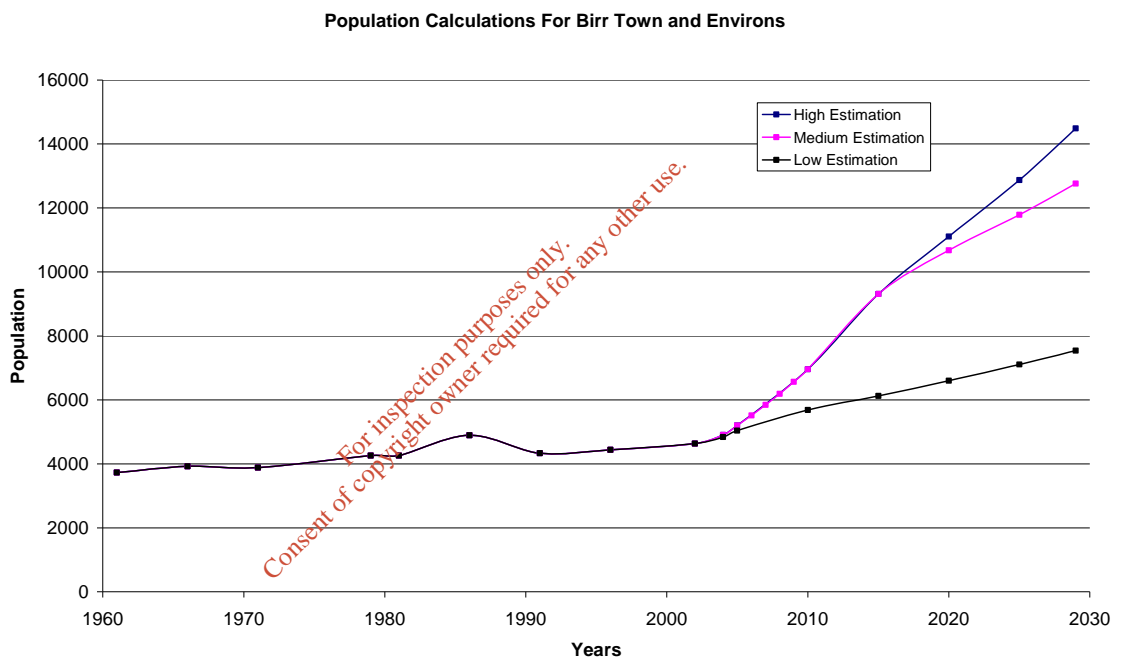
The high, medium and low categories are based on the following information:

- a) *High* - This projection is based on the figures as presented in the census reports from 1961 to 2006, the geodirectory data and on full occupation of all residentially zoned land by the project horizon. The 800 new arrivals who are spread evenly over 2005-2008 would make up the start of this growth. It is assumed that this rapid influx will spark considerable development to cater for the needs of the increased population. The growth rates required to achieve this population are shown in Figure 4.1.
- b) *Medium* - The medium projection is based on the figures as presented in the census reports from 1961 to 2006, the geodirectory and on the 800 new arrivals who are spread evenly over 2005-2008. Again assuming that this

rapid migration will ignite significant development to cater for the needs of the increased population again a growth rate of 6% per annum is used for the period from 2004 – 2016. A reduced growth rate of 2% is assumed for the remainder of the projected period. The growth rates required to achieve this population are shown in Figure 4.1.

- c) *Low* - This projection is based on the figures from the census reports from 1961 to 2006 and the geodirectory. The growth rate beyond 2006 is estimated using the 1971-1979 growth rate of 1.2%. Again the 800 new arrivals are spread evenly over 2005-2008.

Figure 4.1 – Birr Population Projections



The three categories yielded the following populations for the year 2029:

High	-	14,488
Medium	-	12,762
Low	-	7,542

As with the projection of any future populations some assumptions have to be made and assessed.

From the population figures it is clear that, like many rural Irish towns, the population in Birr town has fluctuated over the last 40 years but that it has

remained within a band of 3,800-5,000 people. On average Birr has grown by about 22 people per annum. The influx of as many as 800 people will have a major impact on the town.

The low growth rate presents a population of 7,542 in 2029. This is a likely figure to be reached by 2029 as, in addition to covering current growth trends and the large influx into Birr, it also takes into account the sustainability of this influx with 250 permanent jobs created in Birr. These government jobs will provide considerable ancillary employment stability to the town for the foreseeable future.

The medium growth rate gives a population of 12,762 in 2029. This is also an achievable figure to be attained by 2029 as, in addition to incorporating current growth trends and the large inward migration into Birr, it also takes into account the long term sustainability of this growth with 250 permanent jobs created in Birr. These government jobs will bring many other associated jobs to the town for the foreseeable future. It has also been pointed out by Offaly County Council that Birr is a desirable location to live with few social problems, good amenities, a pleasant atmosphere and it is an attractive commuter town to Tullamore and Roscrea. The average price of housing is also substantially (20-30%) lower in Birr than Tullamore which further increases its appeal. The figure of 12,762 perhaps better reflects the potential organic growth of population as it allows for the knock-on effects of the town almost trebling in size. These effects include more local employment, more local amenities and services and better prospects overall. This growth assumes that approximately 50% of the available residentially zoned land will be utilised by 2016 and that 80% will have been utilised by the end of the project horizon.

The high growth rate would produce a 14,488 population in 2029. This is a population figure which is slightly higher than that given by the medium growth rate and is based on the premise of all the available residentially zoned land in Birr being fully utilised. This growth rate would require a further catalyst to the growth rates previously discussed. At this moment in time such a catalyst is unknown.

By taking the above into account it has been assumed that the medium growth rate should be used in determining the size of the 2029 wastewater treatment plant.

4.3 Industry

Birr is not a highly industrialised town. However there is one major contributor to the current load to the WWTW. This is Milne Foods, a vegetable processing company. The factory has been recently issued with a discharge license of 1,350 p.e. in BOD terms. Apart from Milne Foods there are a few small industries contributing to the sewer network. Most of these industries could be described as dry industries producing little effluent or effluent that is domestic in nature.

The Syngefield industrial estate, to the south-east of the town, is a good example of the type of industries that are contributing to the sewer network. An archaeological impact assessment report has been carried out at Syngefield and the future growth of the Industrial Estate will be limited by sites of archaeological interest. A site layout for this site is detailed in drawings 20305 / 034 & 20305 / 035 and indicates an archaeological exclusion zone which is in line with the recommendations of the report. The report can be found in Appendix C.

The industrial contribution to the works is taken as being 1,500 p.e. of BOD at the end of the project horizon.

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4.4 Educational

There are five primary schools and one secondary school served by the Birr network. Details of the current sizes of these establishments were obtained from

the staff of each institution and the results are given in Table 4.1. All of the schools apart from the community school are primary schools.

Table 4.1 - Loading from Educational Institutions

Facility	Numbers		BOD Load	Hydraulic Load
	Teachers	Pupils	kg/day	M ³ /day
Convent of Mercy	16	231	4.94	9.88
St Brendan's	21	210	4.62	9.24
Oxmantown National School	3	78	1.62	3.24
Crinkill National School	11	190	4.02	8.04
Killeen National School	5	82	1.74	3.48
Birr Community School(Secondary School)	56	720	15.52	31.04
Total	112	1,511	32.46	64.92

The population equivalent derived from Table 4.1 has been determined as 541 p.e.

4.5 Commercial

Details of the commercial contributions have been established on the basis of the Geodirectory data for the catchment area of the scheme. An analysis of the geodirectory data reveals a population equivalent of 864 p.e.

4.6 Present and Future Loading to the Treatment Works

Based on the topics discussed in this section the biological loading to the treatment works is summarised in Table 4.2. It should be noted that the educational and commercial loadings are deemed to rise in line with the domestic growth.

Table 4.2 - Current and Future WWTW Population Equivalents

Component	Population Equivalent (p.e.)		
	2004	2020	2029

Domestic	4,904	10,678	12,762
Commercial	864	1881	2248
Educational	541	1,239	1,481
Industrial	1,350	1,439	1500
Total	7,659	15,237	17,991

Although a population equivalent of **7,300 p.e.** for the town (including industry) was measured from the Flow and Load survey data as reported in section 3.8, it should be noted that the survey was carried out at the end of April, prior to the summer tourist season and it is felt that this is the cause of the slight discrepancy between the calculated population equivalent of 7,659 above and the measured population equivalent of 7,300.

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5. EFFLUENT QUALITY

5.1 Receiving Waters

The Little Brosna River is the main watercourse in the region and flows from the South to the North through the West of the Birr catchment area. The existing treatment works site is located to the North of the town and the existing outfall is to the Little Brosna River. The outfall is approximately 197 m long. The outfall from the WWTW proceeds parallel to and one meter from the WWTW access road, for a distance of approximately 92m, before turning at right angles away from the road and proceeding approximately 105m directly to the Little Brosna River, as shown on Drawing 20305 / 02. The impact of the proposed scheme on the Little Brosna River will be examined in detail in this section of the Report.

5.2 Effluent Quality

It is proposed to discharge the treated effluent from the Wastewater Treatment Works to the Little Brosna River. The primary objective in setting an effluent quality standard for the works is to ensure that the effluent quality must comply with all current statutory environmental regulations applying to discharges to freshwaters. The relevant regulatory guidelines in this case are found in the following documents:

- Urban Wastewater Treatment Regulations, 2001 (S.I. No. 254 of 2001) as amended by SI440 of 2004. These regulations revoke the EPA Act 1992, giving further effect to the Council Directive 91/271/EEC as amended by Council Directive 98/15/EC.
- Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations, 1998. S.I. No. 258 of 1998.
- The Upper Shannon Water Quality Management Plan, 1990.

5.3 Urban Wastewater Treatment Regulations

Since this stretch of the Little Brosna River has not been classified as a “sensitive” water under the terms of the Urban Wastewater Treatment Regulations, the minimum effluent standards to be applied, as set out in the Second Schedule, Part I of S.I. 254, are given in Table 5.1.a

Table 5.1a – Urban Wastewater Treatment Regulations Effluent Standards

Parameter	Concentration	Min. % Reduction *
BOD ₅ (without nitrification)	25 mg/l O ₂	70 – 90
COD	125 mg/l O ₂	75
Total Suspended Solids	35 mg/l	90

* Reduction in relation to influent load.

The Little Brosna discharges into the catchment of the section of the Shannon which discharges into Lough Derg. The Little Brosna flows North-West for 15 km before entering the Shannon and the Shannon flows South-West for another 15 km to Lough Derg which is classed as “sensitive”. Additionally the Little Brosna upstream of Birr from Roscrea WWTW down to Brosna House is also classed as sensitive. The EPA in their report entitled “Urban Waste Water Discharges in Ireland with population equivalents greater than 500 persons – A report for the years 2002 and 2003” published in 2004 list the waters into which the WWTW discharges as being “Sensitive”. Furthermore in correspondence with the Shannon Regional Fisheries Board (see Appendix B) the following opinion was expressed “Because of the importance of the Little Brosna and Camcor Rivers in terms of salmonid fishing and in particular their Croneen Trout, the Board would regard these rivers as sensitive.” The Croneen Trout is a unique trout species and has had its range reduced to the Little Brosna River. Phase 1 of the proposed new works will have a p.e. of more than 10,000. Under S.I.254, Article 4., Part 2 (a) “a sanitary authority shall provide treatment plants which provide more stringent treatment than secondary treatment or an equivalent treatment in respect of all discharges from agglomerations of *more than 10,000* into sensitive areas or into the *relevant catchment* of sensitive areas where the discharges contribute to the pollution of these areas.” Thus for the purposes of this report the Little Brosna River will be treated as a sensitive river. The additional minimum effluent

standards which apply to watercourses which are designated as sensitive are set out in Table 5.1b. These standards are applied on a basis of either standard or both standards depending on the local conditions.

Table 5.1b – Urban Wastewater Treatment Regulations Effluent Standards – “Sensitive”

Parameter	10,000 – 100,000 p.e.	
	Concentration	Min. % Reduction *
Total Phosphorus	2mg/l	80
Total Nitrogen **	15 mg/l	70-80

* Reduction in relation to influent load.

** Total Nitrogen meaning the sum of total Kjeldahl nitrogen, nitrate- nitrogen and nitrite-nitrogen

5.4 Upper Shannon Water Quality Management Plan (WQMP)

The WQMP for the Upper Shannon River provides a comprehensive evaluation of the water resource, including catchment hydrology, water quality, water uses and pollutional loads. Although the Little Brosna is part of the Lower Shannon Hydrometric Area it is incorporated into the Upper Shannon Water Quality Management Plan (WQMP). The water quality standards recommended in the WQMP are set out in Table 5.2.

Table 5.2 - WQMP Water Quality Standards

Parameter	Recommendation
Dissolved Oxygen (mg/l O ₂)	≥ 4 for 99.9% of the time ≥ 6 for 95% of the time ≥ 9 for 50% of the time
BOD ₅ (mg/l O ₂)	≤ 5 for 95% of the time ≤ 3 for 50% of the time
Non-Ionised Ammonia (mg/l NH ₃)	≤ 0.02 for 95% of the time
Total Ammonium (mg/l NH ₄)	≤ 0.5 for 95% of the time ≤ 0.2 for 50% of the time
Nitrate + Nitrite (mg/l N)	≤ 11 for 99.9% of the time ≤ 5 for 95% of the time ≤ 3 for 50% of the time
Orthophosphate(mg/l P)	≤ 0.15 for 95% of the time ≤ 0.05 for 50% of the time

5.5 Quality of Salmonid Waters SI 293/88

The River Little Brosna is not included in the designated salmonid rivers in Schedule 1 of the European Communities (Quality of Salmonid Waters) Regulations, S.I. 293/88. This Statutory Instrument (S.I.) gives effect in Ireland to EU Directive 78/659/EEC, which governs the quality of fresh waters needing protection or improvement in order to support fish life. However the Fisheries Board have indicated the importance in terms of fisheries and trout. The water quality requirements of S.I. 293/88 are given in Table 5.3.

Table 5.3 - European Communities (Quality of Salmonid Waters) Regulations, S.I. 293/88

Parameter	Value
Dissolved Oxygen (mg/1O ₂)	50% ≥ 9
PH	≥ 6 ≤ 9
Suspended Solids (mg/1)	≤ 25
BOD ₅ (mg/O ₂)	≤ 5
Nitrite (mg/1 NO ₂)	≤ 0.05
Non-Ionised Ammonia (mg/1 NH ₃)	≤ 0.02
Total Ammonium (mg/1 NH ₄)	≤ 1

5.6 Aspects of Little Brosna Catchment Hydrology

There is one hydrometric station in the Little Brosna River catchment 300m upstream of the Birr WWTW outfall at the Croghan Bridge (Station Number 25021). This station has been in operation since September 1961. The catchment characteristics are given below:

Catchment Area	493 km ²
95 Percentile Flow	1.5 m ³ /sec
Average Flow	7.49 m ³ /sec

The 95 percentile flow and the Catchment Area are the values reported by the EPA for the Croghan Bridge Station. The average flow has been provided by the Office of Public Works.

5.7 Little Brosna River Water Quality

Water Quality Data for the Little Brosna River are given in Table 5.4. This data is derived from raw data provided by the EPA of samples taken between January 2001 and November 2003 at both Croghan and Derrinsallow Bridges. Croghan Bridge is located 0.3 km upstream of the existing discharge point and Derrinsallow Bridge is located approximately 3 km downstream of the discharge point.

Q values for the Little Brosna River station at Croghan Bridge 0.3 km upstream of the existing discharge point and at Derrinsallow Bridge and New Bridge approximately 3 km and 4 km downstream of the discharge point respectively are presented in Table 5.5.

Table 5.4 - Water Quality Data (Environmental Protection Agency) for the Little Brosna River (Chemical Analysis) 2001-2003

Parameter	Total Oxidised Nitrogen (mg/l N)			BOD (mgO ₂ /l)		
	Min	Med.	Max.	Min.	Med.	Max.
0.3 km U/S	1.5	2.85	4.3	0.4	1.0	1.8
3 km D/S	1.8	2.9	14.4	0.5	1.0	1.9

Parameter	Total Ammonium (mg/l N)			Orthophosphate (mg/l P)		
	Min	Med.	Max.	Min.	Med.	Max.
0.3 km U/S	0.01	0.022	0.11	0.007	0.02	0.028
3 km D/S	0.006	0.022	0.10	0.011	0.02	0.086

Table 5.5 - Water Quality Data (EPA) 2002 for Little Brosna River at Birr (Q Values)

Year	Biological Quality Rating Q Value									
	1973	1975	1977	1981	1984	1987	1993	1996	1999	2002
0.3 km u/s	5	-	5	4	4	4-5	4	3-4	3-4	3-4
3 km d/s	-	-	5	4	5	5	3-4*	3-4*	3-4*	3-4*

* Taken at New Bridge 4 km d/s

where: Q5, Q4-5, Q4 : Unpolluted
 Q3-4 : Slightly Polluted
 Q3, Q2-3 : Moderately Polluted
 Q2, Q1-2, Q1 : Seriously Polluted

The river upstream and downstream of the outfall is classified as being slightly polluted. The impact of the WWTW effluent at Birr on the BOD, Total Ammonia, Total Nitrogen and Orthophosphate figures downstream of the river appears to be negligible based on the median figures. This is clearly illustrated in Table 5.4. However, it should be noted that the water quality data (chemical analysis) is based on grab samples.

5.8 Required Effluent Standards

The primary regulatory guideline for effluent standards is the EU Urban Wastewater Treatment Directive which is implemented in Ireland through S.I. 254 of 2001 and the Water Quality Standards for Phosphorus (S.I. 258 of 1998).

While the requirements of the Urban Wastewater Treatment Regulations are set, water quality requirements are dependent on the background values and the 95 percentile flow in the river (i.e. assimilation capacity).

The **BOD** Waste Assimilation Capacity (WAC) is defined as:

$$WAC = (C_{\max} - C_{\text{back}}) \times F_{95} \times 86.4 \text{ kgBOD/day}$$

Where: C_{\max} = maximum permissible BOD concentration (= 4 mg/l)

C_{back} = background (upstream) BOD concentration

F_{95} = 95 percentile flow (m^3/s)

86.4 = conversion factor

From analysis of the sampling results presented in Table 5.4 the background value for BOD is taken as 1 mg/l.

$$\text{BOD WAC} = (4-1) \times 1.5 \times 86.4 = 388.8 \text{ kg BOD/day}$$

Phosphorus

The phosphorus loads permitted in the river are governed by the Phosphorus Regulations (S.I. 258 of 1998). The salient features of these regulations are summarised below:

- a) The standards quoted are in terms of Molybdate – Reactive Phosphate.
- b) The concentrations measured are median values determined using a minimum of 10 samples taken at intervals of four weeks or longer in any 12 consecutive month period.
- c) The existing biological quality rating / Q index is to be improved to meet the minimum target biological quality rating / Q index as detailed in the Regulations.

The regulations state that the existing biological quality rating assigned between 1st January 1995 and 31st December 1997 is the rating upon which the

improvements in Water Quality will be judged. In the case of the Little Brosna River the Q index upstream of the existing treatment plant at Croghan Bridge was determined as Q3-4 in 1997 and downstream received a Q index of Q3-4.

The minimum target ratings and concentrations for these stretches of water as defined in the Phosphorus regulations are given in Table 5.6.

Table 5.6 - Phosphorus Regulations Target Ratings and Concentrations

	Existing Biological Quality (Q) Rating/Q Index	Minimum Target Biological Quality (Q) Rating /Q Index	Molybdate Reactive Phosphate Median Concentration ($\mu\text{g P/L}$)
U/S	3-4	4	30
D/S	3-4	4	30

The assumption is made that the upstream water quality will improve to a Q4 rating (i.e. 30 $\mu\text{g P/l}$) and the stretch into which the WWTW discharge is proposed will be improved to a Q4 (i.e. 30 $\mu\text{g P/l}$). Therefore, based on the above there is no allowable increase in the MRP Median Concentration. However as shown in Table 5.4 the upstream water quality has improved to a median level of 20 $\mu\text{g P/l}$ (equivalent under the Phosphorus regulations of an improvement to a Q4-5). Therefore the allowable increase in the river is 10 $\mu\text{g P/l}$.

Using the Waste Assimilation Capacity calculation the allowable increase in MRP concentration equates to the following loads to the river:

At 95% ile flow : 1.296 kg MRP/d.

As the regulations determine the Q index using the median of 10 samples over 12 months the enforcement of the load determined from 95%ile flows (1.5 m^3/sec) is extremely onerous. The more realistic load is given by using the average flow in the river as this is more representative of the variable flows to be encountered during the 12month sampling period. Therefore using the Waste Assimilative Capacity calculation with average flow the allowable increase in MRP concentration equates to the following load.

At Average Flow = 6.4 kg MRP/day.

In the flow and load survey for the existing works the average effluent MRP concentration was 0.207 mg/l with a maximum MRP concentration of 0.5 mg/l. For all three phases of the works this target load to the river will permit an acceptable effluent MRP concentration in excess of 1 mg/l. For Phase I an effluent MRP concentration of 1.9 mg/l, for Phase II an effluent MRP concentration of 1.4 mg/l and for Phase III an effluent MRP concentration of 1.1 mg/l.

Nitrogen standards

As the receiving waters are treated as 'sensitive' for the purpose of this report a Total Nitrogen Standard may apply depending on local conditions. The Urban Wastewater Treatment Regulations, 2001 (S.I. No. 254 of 2001) makes a statement with regard to Total Phosphorus and Total Nitrogen removal as follows: "one or both parameters may be applied depending on the local situation." The Total Phosphorus limits have been determined above. The local situation for Total Nitrogen is examined hereunder.

The water quality management plan for the Upper Shannon has standards which provide a mechanism for judging whether the local situation requires Total Nitrogen removal in the form of water quality standards for Total Ammonia ($\text{NH}_4 + \text{NH}_3$) and Total Oxidised Nitrogen effluent. Using WAC calculations and the WQMP standards:

The Waste Assimilation Capacity (WAC) defined earlier in this section is used to derive the Total Ammonia water quality parameters.

From analysis of the sampling results presented in Table 5.4 the background value for Total Ammonia is taken as 0.02 mg/l. The maximum permissible concentration is given as 0.5 mg/l in the Water Quality Management Plan. Therefore:

$$\text{Total Ammonia WAC} = (0.5 - 0.02) \times 1.5 \times 86.4 = 62.2 \text{ kg Ammonia/day}$$

The Waste Assimilation Capacity (WAC) as defined earlier is again used to derive the Total Oxidised Nitrogen water quality parameters.

From analysis of the sampling results presented in Table 5.4 the background value for Total Oxidised Nitrogen is taken as 2.85 mg/l. The maximum

permissible concentration is given as 5 mg/l in the Water Quality Management Plan. Therefore:

$$\begin{aligned}\text{Total Oxidised Nitrogen WAC} &= (5-2.85) \times 1.5 \times 86.4 \\ &= 278.64 \text{ kg Total Oxidised Nitrogen/day}\end{aligned}$$

Total Nitrogen is made up of Total Ammonia, Total Oxidised Nitrogen and Organic Nitrogen. Taking just the Total Ammonia and Total Oxidised Nitrogen figures on their own there is a combined assimilative capacity of 340 kg/day.

5.9 Recommended Effluent Standards for the Little Brosna River at Birr

The main considerations that determine the effluent standards to set are derived from the following:

- The statutory requirement to meet the minimum effluent standards as set out in SI 254 of 2001.
- The statutory requirement as set out in the Phosphorus Regulations to improve the Biological Quality Rating of the receiving waters in line with preset target ratings.
- The requirement to meet the receiving water quality standards as set out in the WQMP.
- Existing Effluent Standards

The receiving water quality issues have been reviewed in the previous subsection. Before selecting target effluent parameters it is necessary to assess the effects of critical parameters on the receiving waters.

With a proposed Phase I population equivalent of 15,000 p.e., and a Phase II population equivalent of 20,000 p.e. the projected flows and loads are as follows:

Table 5.7 - Projected Flows and Loads

	Contribution / p.e./day	Phase I	Phase II	Assimilative Capacity
		15,000 p.e.	20,000 p.e.	
BOD Load	60 g/head/day	900 kg/day	1200 kg/day	389 kg/day
Total Nitrogen	10 g/head/day	150 kg/day	200 kg/day	340 kg/day (1)
Total Phosphorus	2.5 g/head/day	37.5 kg/day	50 kg/day	6.4 kg/day (2)

(1) Total Oxidised Nitrogen and Total Ammonia only does not include Organic Nitrogen.

(2) Molybdate Reactive Phosphorus limit

Table 5.7 illustrates the significant assimilative capacity that is afforded to a discharge at the Birr WWTW. A significant factor in this capacity is the available dilution at the existing outfall location. The dilution factor is given in Table 5.8.

Table 5.8 - Available Dilutions

Phase	DWF from WWTW	95% Flow in the Little Brosna River	Dilution Factor
I (15,000 p.e.)	3,275 m ³ /day	129,600 m ³ /day	39.6
II (20,000p.e.)	4,500 m ³ /day	129,600 m ³ /day	28.8

The assimilative capacity available in terms of DWF would produce an effluent concentration in excess of the minimum requirements of the Urban Wastewater Treatment Regulations (i.e. 25 mg/l). It must also be considered that the effluent standard for the existing works is 20 mg/l. The UWWTR and the existing effluent standard complement each other as 25 mg/l is a "minimum" standard. It is also noted that the same treatment process that will also achieve a 25 mg/l standard will also achieve a 20 mg/l standard. Therefore given the assimilative capacity the UWWTR and the existing effluent standard a BOD effluent concentration of 20 mg/l will be adopted for both Phase I and Phase II.

With regard to Total Phosphorus the UWWTR requires a concentration of 2 mg/l and a minimum reduction of 80% for discharges to "sensitive" locations. The

phosphorus regulations indicate that an assimilative capacity of 6.4 kg/day in terms of Molybdate Reactive Phosphorus is available. The relationship between MRP and Total Phosphorus is variable and can range from 60% to 90%. An analysis of this variability and comparison to the UWWTR requirements indicates that a concentration of 2 mg/l should be adopted. However, given the requirements of the Water Framework Directive to achieve 'good ecological standards' by 2015 it is recommended that the BATNEEC principle be adopted for the Total Phosphorus limit. Therefore a Total Phosphorus concentration of 1 mg/l will be used.

An examination of the Total Nitrogen requirements highlights that no removal is required in terms of assimilative capacity (see Table 5.7). Therefore as the local situation has shown no requirement for a Total Nitrogen limit and a Total Phosphorus limit has been applied it is considered that the requirements of the UWWTR are satisfied. That is the discharge has been examined in terms of its release to the "catchment" of a "sensitive" water and one rather than both of the nutrient standards is applied.

5.10 Summary of Effluent Standards Adopted for Discharge to the River Little Brosna at Birr

The final effluent standards adopted for treatment process selection and preparation of preliminary designs and layouts are summarised as follows:

Table 5.11(a) - Effluent Standards for the Birr WWTW (Phase I and II)

Parameter	Concentration (mg/l)	% Removal
BOD	20	≥ 92.5
S.S *	30	≥ 91
Total Phosphorus	1	≥ 91
Total Nitrogen	N/A	N/A

* Existing standard.

5.11 Discharge Options to the Little Brosna River

The existing outfall pipeline to the Little Brosna River has adequate hydraulic capacity to handle increased flows up to the Phase III ultimate DWF at 5,625 m³/day. The pipeline is also capable of handling peak flows up to 3 DWF at the ultimate (Phase III) loading. Storm flows in excess of 3DWF are passed to the Stormwater holding Tank where 3hours storage will be provided for a flowrate of to 3 DWF. It is noted that the storage period of 3 hours has been requested by the Fisheries Board. Flows in excess of this are screened at the Stormwater Holding Tank and overflow by gravity to the existing 750mmID storm overflow pipe and discharge to the river.

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6. WASTEWATER TREATMENT OPTIONS

6.1 General

The broad function of a municipal wastewater treatment system is the separation of the polluting load from its carrier water. The processes which effect this separation generate a number of solid residue streams as well as the treated effluent stream. The solid residue streams may require further processing to render them suitable for environmental disposal.

The liquid treatment stream may incorporate some or all of the following stages of treatment:

- preliminary treatment
- primary treatment
- secondary treatment
- tertiary treatment

A preliminary treatment stage is invariably included in municipal treatment systems, typically incorporating screening and grit separation. It generates two categories of waste solids: screenings and grit.

Primary treatment involves the removal of suspended particulate matter from the wastewater by sedimentation or flotation processes. It generates clarified effluent and primary sludge streams.

Secondary treatment involves the removal of suspended and colloidal particular matter in addition to dissolved organic matter, using biological, physiochemical or membrane processes. Biological processes are invariably used in municipal wastewater treatment systems where secondary treatment is required. Secondary treatment generates a clarified liquid effluent and a sludge residue.

Tertiary or advanced treatment is included in municipal wastewater treatment streams where low residual effluent nitrogen and phosphorus levels are required or where the residual BOD or suspended solids must be reduced to a very low level. Advanced nitrogen removal is typically achieved by biological processes; advanced phosphorus removal may be achieved by biological and/or chemical precipitation processes; filtration processes are applied to achieve an advanced level of BOD or suspended solids removal.

The technical considerations to be taken into account in the selection and design of appropriate treatment technologies for the liquid and solids streams can be conveniently grouped for discussion purposes under the following headings:

- (i) size of works, including phased development
- (ii) required effluent quality
- (iii) options for sludge disposal
- (iv) site constraints, including environmental impacts

Economic evaluation is also applied to the selection/design process to ensure that the treatment system represents good value for money, taking into account capital and running costs.

6.2 Treatment Plant Capacity

The treatment works is to be developed in three phases for the following design loadings:

(a) Organic Loading

	P.E.	BOD (kg/d)
Phase I	15,000	900
Phase II	20,000	1200
Phase III	25,000	1500

(b) Hydraulic Loading

Modifications are required at the Inlet works of the WWTW in particular to the actuated inlet penstock arrangement to facilitate greater flows being permitted through to the treatment process. Under each phase of the project 3 DWF will be treated through the WWTW. Flows greater than 3 DWF will be diverted to new storm tanks adjacent to the works (Ref. Drawing No. 20305 / 42). A detention time of 3 hours for 3 DWF will be provided for at these new storm tanks. The detention time of three hours is a specific request of the Shannon Regional Fisheries Board (See Appendix B).

	DWF m ³ /day	Flow to Full Treatment m ³ /day	Flow to Storm Treatment m ³ /day
Phase 1	3,375	10,125	10,125
Phase 2	4,500	13,500	13,500
Phase 3	5,625	16,875	16,875

6.3 Treatment Process Selection

In this Section various Process Options for the treatment of wastewater will be discussed.

Process Option 1	Extended Aeration Plant Secondary Clarifier Stormwater Holding Tank
Process Option 2	SBR Activated Sludge System Stormwater Holding Tank
Process Option 3	Membrane Bioreactor Stormwater Holding Tank

The stormwater holding tank is common to all the above options and includes the following in line with the requests detailed in correspondence from the Shannon Regional Fisheries Board (See Appendix B) :

- Stormwater holding tanks with a retention of 3 hours at peak flows and tank flushing units for automatic cleaning of tanks

- A series of baffles and a fine screen on the storm overflow weir to prevent solids and oils from passing over the storm overflow weir in the event of flows greater than the storage capacity of the tanks occurring.
- A diffused air system to oxygenate the storm water stored in the storm tank and to prevent septicity.
- Mixers in the storm tank to resuspend settled solids material during tank drawdown.
- Stormwater return pumping station

An examination of the three selected Process Options was carried out with the following observations:

6.3.1 Process Option 1 (Extended Aeration Plant)

The extended aeration process is an activated sludge reactor designed to produce a fully compliant final effluent and an aerobically stabilised sludge. It is normally used without pre-sedimentation, based on a retention time of 24 to 30 hours. It is normally operated as a continuous process in conjunction with a downstream sedimentation process from which settled sludge is recycled back to the aeration basin.

A fine bubble diffused air aeration system will be installed in the aeration basin. Chemical dosing for phosphorus reduction will also be provided. An anaerobic zone could also be provided to encourage biological removal of phosphorus, but would need to be operated in conjunction with chemical dosing to guarantee the required effluent standard.

As this is the process currently in operation at the WWTW it may be decided that for the first phase of the works taking the WWTW to 15,000 p.e. a retrofit of the existing plant will take place installing Fine Bubble Diffused Aeration (FBDA) in the existing aeration basins. However as the work will probably proceed under a Design/Build or a Design/Build/Operate contract there is a possibility that this process will not be utilised. Nevertheless on the balance of probabilities it is highly likely that this will be the process option for any Phase 1 work. Accordingly all Phase 2 work is assumed to utilise a modified extended aeration process.

Preliminary Designs have sized this process option as follows:

Phase 1:

Modification of the existing 2 No. Aeration Tanks each with its own Anaerobic, Anoxic and Aerobic Zones and each suitable for 7,500 p.e. Each Aerobic Zone will have a volume of 1,330 m³ (i.e. Dimensions 19.5 x 15.5 x 4.4 m). Each Anaerobic zone will have a volume of 158 m³ (19.5 x 1.85 x 4.4). Each Anoxic zone will have a volume of 158 m³ (19.5 x 1.85 x 4.4).

The modifications to the existing works would be as follows:

1. Alteration to the Inlet works penstock.
2. Raising the top water level of the aeration and final clarifiers by 0.5m to accommodate the additional flows. It is not envisaged that this will require any civil work to be done at the existing inlet works.
3. The aeration basin will be modified internally to provide separate aerobic, anoxic and anaerobic zones. Generally Anaerobic zones are used to biologically remove phosphorus from the wastewater and Anoxic Zones to remove Total Oxidised Nitrogen. However even though in this case there is no Nitrogen removal requirement for the plant the provision of an anoxic zone to remove Total Oxidised Nitrogen is essential to the biological removal of phosphorus and will be provided.
4. The level of the overflow from the aeration basin to the final clarifiers must also be raised by 0.5m to facilitate the increase in the hydraulic depth of the tank.
5. Installation of Fine Bubble Diffused Aeration Systems (FBDA) in the aerobic zone.
6. Raising of the Sidewall depth of the final clarifiers by 0.5m and the installation of Stamford baffles to accommodate the extra flows through the final settlement tanks.

These figures assume a sludge age of >7.5 days and a MLSS concentration of 2,500 mg/l. Flow will then continue onward to the existing 2 No. Final Clarifiers, each clarifier is sufficiently large to accommodate 7,500 p.e. with the modifications noted in item 6 above.

The final dimensions of the refurbished clarifiers will be as follows:

Diameter 16 m

Sidewall depth 2.3 m

Slope of floor 7.5°

Phase 2:

Phase 2 will be new build as shown on Drawing No. 20305 / 36. The outline design details are given hereunder.

1 No. Aeration Tank Aerobic Zone and sized for 5000 p.e.

The Anaerobic Zone will have a volume of 135 m³ (i.e. Dimensions 15 x 1.5 x 6 m)

The Aerobic Zone will have a volume of 1,050 m³ (i.e. Dimensions 15 x 12 x 6 m)

The Anoxic Zone will have a volume of 135 m³ (i.e. Dimensions 15 x 1.5 x 6 m)

These figures assume a sludge age of >7.5 days and a MLSS concentration of 3,000 mg/l. Flow will then continue onward to the Final Clarifier; the clarifier is sized for 5,000 p.e.

The final dimensions of the clarifier are as follows:

Diameter 12 m

Sidewall depth 3.5 m

Slope of floor 11°

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Phase 3:

This Phase is again new build but will benefit from some common walls from Phase 2. The outline design details are given hereunder.

1 No. Aeration Tank Aerobic Zone and sized for 5,000 p.e.

The Anaerobic Zone will have a volume of 135 m³ (i.e. Dimensions 15 x 1.5 x 6 m)

The Aerobic Zone will have a volume of 1,050 m³ (i.e. Dimensions 15 x 12 x 6 m)

The Anoxic Zone will have a volume of 135 m³ (i.e. Dimensions 15 x 1.5 x 6 m)

These figures assume a sludge age of >7.5 days and a MLSS concentration of 3,000 mg/l. Flow will then continue onward to the Final Clarifier; the clarifier is sized for 5,000 p.e.

The final dimensions of the clarifier are as follows:

Diameter 12 m

Sidewall depth 3.5 m

Slope of floor 11°

This process will produce a 20:30 BOD 30:SS effluent. Layout details and sections of this proposed arrangement are shown on Drawing Nos. 20305 / 36 and 20305 / 37.

6.3.2 Process Option 2 for Phases 2 and 3 (SBR)

The SBR activated sludge system combines aeration and sedimentation in the same tank, through operation in a batch mode, based on a cycle of fill, aerate, settle and decant. The overall cycle time is typically 12-24 hours dependent on the nature of the influent wastewater. With a single SBR basin influent flow balancing is required to store the wastewater during the settle and decant phases of the cycle. With two or more basins, the basin cycles can be staggered to allow continuous inflow. In this case each of the SBR basins have been sized for 1.66 times DWF (i.e. 3.32 DWF total) so that balancing can take place within the tanks themselves so that there is no requirement for separate balancing tanks. More recent advanced SBR processes (e.g. Unitank) include multi stage tanks for biological nitrogen and phosphorus removal.

Phase 2:

Two No. SBR tanks each sized for 5,000 p.e. As each of the tanks are sized to have a holding capacity in excess of 1.66 DWF the combined tank volume will be 1,875 m³ with each tank having a 15.5 m diameter and liquid depth of 5 m.

Phase 3:

Two No. SBR tanks each sized for 5,000 p.e. As the tanks are sized to have a holding capacity in excess of 3 DWF the combined tank volume will be 1,875 m³ with each tank having a 15.5 m diameter and liquid depth of 5 m.

No balancing tank would be required with this arrangement.

Nominally this process will produce a 20 BOD 30 SS effluent. Layout details and sections of this proposed arrangement are shown on Drawing Nos. 20305 / 38 and 20305 / 39.

6.3.3 Process Option 3 for Phases II and III (Membrane Bioreactor)

MBR Technology is a recently developed process for the treatment of wastewater to a high standard. The final effluent produced is fully disinfected and the plant footprint is smaller than conventional treatment plants. The process is a single stage process and has a low sludge yield, typically 0.45 kg d.s./kg BOD and surplus sludge is removed at between 2-3%. The process also produces low odour emissions. The process does not require a primary or secondary settlement stage and removal rates of greater than 96% have been achieved for BOD and S.S. removal. Typically effluent standard of 5:5 for SS and BOD are achieved.

The potential for future more stringent effluent discharge levels which are required to be met in the long term may make this process seem more attractive. At present the operating and installation costs are higher than the conventional treatment plant.

Layout details and sections of this proposed arrangement are shown on Drawing Nos. 20305 / 40 and 20305 / 41.

6.3.4 Conclusions

Process Options 1 and 2 are activated sludge-based with a design sludge age of slightly more than 7.5 days, thereby producing an aerobically stabilised sludge residue. This sludge is suitable for transfer to the sludge holding tanks (up to 25,000 p.e.) for further processing, dewatering and removal to the Tullamore hub centre. The hydraulic capacity of the process options are limited to 3 DWF, hence stormwater storage is required. The quality and quantity of sludge generated by each of these treatment options is effectively the same. There is also little to differentiate them in terms of operating costs, maintenance costs, and overall process reliability.

Process Option 3 is a new process technology which could prove attractive should more stringent effluent requirements be required in the long term, as the membrane process effectively produces a fully disinfected effluent.

6.3.5 Recommendations

The foregoing evaluation leads to the following recommendations:

Process Options 1, 2 and 3 provide appropriate solutions for secondary treatment, each of which produces an aerobically aerated sludge, suitable for processing and final disposal. As there is little to differentiate between these systems in terms of process performance, the selection of the most economically advantageous option is most reliably made through the competitive tendering process based on a treatment process performance specification.

6.4 Treatment and Disposal of Solids Residues

In treating the liquid stream, three types of solids residue are produced, screenings, grit and sludge.

6.4.1 Screenings & Grit

At the scale of the Birr works the most appropriate treatment of screenings is washing and compaction with disposal to landfill.

6.4.2 Sludge

The Sludge Management Plan, 2001, for County Offaly examines a number of options for the disposal of sewage sludges in the County. It was recommended in this report that dewatering facilities be provided at the Birr WWTW site and thus it would become a local hub centre for the area. At present the dewatering facilities at Birr WWTW, which consist of picket fence thickeners and belt presses, have a capacity of 12,000 p.e.

For Phase I of the works it is proposed that a refurbishment of the dewatering facility take place including:

1. Provision of a sludge acceptance facility

A proper sludge acceptance facility should be provided at the WWTW in line with the Sludge Management Plan for County Offaly which requires acceptance of sludge from up to 1,500 p.e. from outlying areas of Birr town. As was seen in Section 3.8 a shock loading to the plant took place because of the lack of a sludge acceptance facility. Incoming sludge tankers currently transfer sludge to the existing picket fence thickeners. However, this is not a best practice as no screening or degritting facility is available. Thus it can be reasonably assumed both screenings and grit will be passed on through pumps, the Picket fence Thickeners and the Dewatering Belt Press increasing wear and tear on these items of plant and reducing their operational life considerably. It will also cause difficulties at the sludge hub centre due to the variability in the quality of dewatered sludge from Birr.

2. The replacement of the current picket fence thickeners

The current picket fence thickeners have a total capacity of 190 m³ which allows for little leeway for storage of sludge even at current levels of loading to the plant. At the current levels of loading the picket fence thickeners provide for between 3 and 6 days of sludge storage. A failure of the picket fence mechanism or the dewatering plant would necessitate costly tankering to Tullamore within a week. Additionally, in light of the requirement for sludge acceptance at the WWTW, additional capacity in the picket fence thickeners is necessary to cater for the possibility of 28 m³ tankers (i.e. the largest currently operating in County Offaly) making more than one delivery in a single day.

3. The replacement of the existing dewatering equipment.

Although the Belt Presses are maintained and are functioning well, the likely mechanical life of these units is approximately 20 years and they are due for replacement before 2010. It would be prudent to replace these units in advance of any mechanical problems as the cost of transporting undewatered sludge from Birr to Tullamore would be prohibitive during the period of repair or more likely replacement.

4. A restructuring of the dewatering building.

The Dewatering Building currently has no separate and dedicated storage area for polyelectrolyte. It is proposed that a storage area be created and used to store polyelectrolyte and other site materials. There is no isolation for the main control panel with the result that some corrosion has been noted on it and on the electrical conduits in the building. Isolation of the Control Panel area by construction of a separate room with access only to the outside of the building will halt corrosion on the current panel and also protect any future panel that may be installed.

Altogether these refurbishments will provide dewatering facilities for an excess of 16,500 p.e. which will meet the demands both of the WWTW at the Phase I horizon and for the WWTW responsibilities to act as a satellite for local wastewater sludges (1,500 p.e.).

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7. WASTEWATER NETWORK PROPOSALS

7.1 General

As mentioned in Section 3 the existing network in Birr Town, Crinkill Village and Riverstown Village is for the most part combined with some storm separation.

Birr Town

The length of the Foul Sewer Pipeline Network is approximately 22 km in length and approximately 17 km is less than 450 mm in diameter. This represents approximately 79% of the total network system.

Crinkill Village

The Foul Sewer Pipeline Network is 150mm, 225mm and 300mm in diameter. It is approximately 5.1 km in length, approximately 3.1 km consist of 225mm diameter, this represents 61% of the total network system.

Riverstown Village

The Foul Sewer Pipeline Network is 100mm and 225mm in diameter. It is approximately 6 km in length and the pipeline is mainly 225mm in diameter. This accounts for approximately 97% of the total Network System.

7.2 CCTV and SUS 25 Survey

A CCTV and SUS 25 Survey was carried out in May / June 2004 on the Foul Sewer Combined Network System for Birr Town. Following instruction from Offaly County Council a similar survey was carried out for Crinkill and Riverstown in November / December 2004 and an examination of these records produced a sewer classification for both foul and storm sewers. A full breakdown of sewer classifications is given in Table 3.3 and summarised in Table 7.1 below.

Table 7.1 - Pipeline Gradings

Grade Types	Length of Pipelines (m)	Length of Culverts (m)	Total
Grade 1	14,200	830	15,030
Grade 2	670	0	670
Grade 3	1,020	140	1,160
Grade 4	9,360	830	10,190
Grade 5	2,130	0	2,130
Not Graded	310	0	310
TOTAL	27,690	1,800	29,490

The above gradings can be defined from the CCTV Survey as follows:

Grade 1 - This indicates that the pipe is in good condition and the minor effects such as slight open and displaced joints, light encrustation and light scaling does not require any immediate rehabilitation.

Grade 2 - Some service defects are evident in the pipeline such as minor cracking (circumferential / longitudinal), fine roots, obstruction and infiltration. Does not require immediate attention but should be monitored over time.

Grade 3 - Performance of the sewer is affected with this classification as a result of infiltration, roots, fractures and multiple cracks (circumferential / longitudinal) As a result close monitoring would be advised.

Grade 4 - These sewers need attention due to defective connections, multiple fractures, broken pipes and infiltration, medium encrustation and medium scaling which seriously affect the sewer performance.

Grade 5 - Sewers with a classification of Grade E will require immediate attention. This is due to already collapsed or deformation of the sewer or serious breaking and also gushing infiltration, mass roots, heavy encrustation, and heavy scaling.

Therefore from these results it is evident that those pipelines with a classification of Grades 4 and 5 require immediate attention which in this case is a length of approximately:-

- 7,760 m or 38% of the network system surveyed for **Birr Town**
- 1,980 m or 51% of the network system surveyed for **Crinkill Village**
- 2,580 m or 53% of the network system surveyed for **Riverstown Village**

These pipe gradings are illustrated on the following Drawings.

20305 / 10 Existing Network Condition and Proposed Works (Sheet 1 of 5)
20305 / 11 Existing Network Condition and Proposed Works (Sheet 2 of 5)
20305 / 12 Existing Network Condition and Proposed Works (Sheet 3 of 5)
20305 / 13 Existing Network Condition and Proposed Works (Sheet 4 of 5)
20305 / 14 Existing Network Condition and Proposed Works (Sheet 5 of 5)
20305 / 15 Crinkill – Existing Network Condition
20305 / 16 Riverstown – Existing Network Condition (Sheet 1 of 2)
20305 / 17 Riverstown – Existing Network Condition (Sheet 2 of 2)

7.3 Proposed Extension to Wastewater Collection Network System

General

As stated earlier a detailed CCTV / SUS Survey was carried out on the existing sewer network system for Birr Town, Crinkill Village and Riverstown Village. This Survey pinpoints the areas within the network system that require attention which will allow for better flows and allow the design of future areas to be developed, within the Development Plan, into the network system.

The following drawings show the existing collection network system and the proposed foul sewer line, to be carried out under a separate scheme, to the Northern end of Birr Town. The Drawings also show the areas for future Residential and Industrial Development at Syngfield.

20305 / 02 Existing Sewerage Network (Sheet 1 of 5)
 20305 / 03 Existing Sewerage Network (Sheet 2 of 5)
 20305 / 04 Existing Sewerage Network (Sheet 3 of 5)
 20305 / 05 Existing Sewerage Network (Sheet 4 of 5)
 20305 / 06 Existing Sewerage Network (Sheet 5 of 5)
 20305 / 07 Crinkill – Existing Sewerage Network
 20305 / 08 Riverstown – Existing Sewerage Network (Sheet 1 of 2)
 20305 / 09 Riverstown – Existing Sewerage Network (Sheet 2 of 2)

North-End of Town

To service the present and future needs, for the Northern End of Birr Town, it is proposed that a New Gravity Sewer Line be laid from the Frankford Road to the north/ eastern Side of the Waste Water Treatment Works. This new line is to be carried out under a separate (SLI) scheme. The location of the line is shown on Drawing No. 20305 / 10 to 20305 / 14.

Storm Water Tanks and Overflow to the Little Brosna

The Shannon Regional Fisheries Board recommends that the network is to include storm tanks to hold 3 x DWF for three hours (1,266 m³) (see Appendix B).

7.4 Refurbishment of Existing Four and Storm Sewers

From Section 3.2 it is possible to pinpoint the existing pipes with classifications 4 and 5 that require immediate attention.

Therefore the total length of pipeline in need of repair is shown in Table 7.3 hereunder:-

Table 7.3 - Pipework that is specifically in need of repair

Classification	Length (m)
Grade 4 – Pipelines	9,360
Grade 4 – Culverts	830
Not Graded	310
Grade 5 – Pipelines	2,130
TOTAL	12,630

It should be noted that the above figure includes both foul and stormwater sewers.

Due to the sensitivity of Birr Town in terms of traffic, narrow streets and archaeology it is recommended that the majority of this refurbishment work be carried out using pipe relining techniques.

As stated in Section 3.3 the sewers in Crinkill were heavily silted and thus were cleaned to facilitate the CCTV survey. Therefore to ensure that the correct service level is maintained in this network a monitoring / cleaning regime should be implemented.

7.5 Proposals from Birr Network Model Study

7.5.1 Introduction

As part of the Birr Main Drainage Scheme a complete study of the existing sewer network was carried out. A comprehensive SUS Survey of all the manholes was conducted in conjunction with a detailed CCTV Survey of all the conduits in the network. Flow and Rainfall Surveys were also recorded for a period of time to represent actual conditions. As part of this survey, rain gauges and flow monitors were placed at strategic positions within the catchment. The results of all the surveys were combined to produce a working model of the network. The WRC publication "a guide to Short Term Flow Surveys of Sewer Systems" provides recommendations for the sewer flow survey in terms of catchment response standards and minimum magnitude for use of the data in the model verification. The software used to verify the model is *Wallingford Software - Info Works, Version 5.01-5.33*. The verification of the Model was undertaken in accordance with the recommendations of the WAPUG Code of practice for the Hydraulic Modelling of Sewer Systems, Version 3.001, (December 2002). The completed "Birr Model Study Report" is submitted as a separate report..

For the purpose of analysis and subsequent recommendations for this report the results from the design storms of 1 in 5 years and 1 in 40 years return period and duration of 90 minutes will be used.

7.5.2 Analysis of Model

The analysis of the model showed that several options exist which if carried out will reduce the spill volume of the existing network thus reducing flooding in many area's and reducing the volume of untreated waste water being discharged into the river via storm overflow pipes. The reduction of this volume will improve

the overall water quality in the area. As there are a variety of options available to improve the existing network selective improvements have to be established.

7.5.3 General Description - The 'Birr Existing Network Model'

The plan of the model (Figure 7.1) highlights the position and scale of the flooding within the existing wastewater network under a M40-90 storm event. The Model for the existing network has highlighted the fact that there is a combined spillage of 1,175.1 m³ under a M40-90 storm event (i.e. a storm of 90 minutes duration occurring no more often than once in 40 years) occurring at several locations around the network. Factors contributing to the spillage are constructional defects, cracks, silting, etc as discussed in Section 3 of this report. Any manholes that have a spill volume of greater than 25 m³ require upgrading. As per the standard in WPUG Code of Practice for the Hydraulic Modelling of Sewer System any manhole in the model that predicts spill volume less than 25 m³ can be discounted due to the models over conservative estimates. The upgrading works required to relieve the spill should include work to the contributing conduits and where stated manhole reconstruction.

7.5.4 Recommendations to the 'Birr Existing Model'

The existing network is compromised in 17 Areas (i.e. Spill \geq 25m³). The number of areas currently experiencing flooding needs to be reduced to an acceptable level. If the works recommended in the CCTV Report were carried out it will reduce to some extent the spill volume but restorative works will not prevent flooding in the future. For the existing network to function properly in transferring wastewater to the treatment works without causing flooding then the measures suggested below are required.

7.5.5 General Description - The 'Birr Future Model – Option 1'

After graphically displaying the condition and performance of the existing network a list of the possible counteractive measures to flood relief was compiled. This **Option 1** analysis includes all the information and areas identified in the Draft Development Plan 2003 as area for proposed development. The relief works proposed are to have the effect of initially reducing the number of areas that currently flood (>25 m³) and then reduce the volume of wastewater discharging into the Camcor River. After careful investigation it was established that corrective measures could reduce the number of areas flooding from 17 (existing)

to 7 (Option 1). The overall reduction in the volume of spill is from 1,177.6 m³ to 551.9 m³ (i.e. reduced by 625.7 m³.)

The plan of the model (Figure 7.2) highlights the position and scale of the flooding with all the changes proposed for Option 1.

7.5.6 Recommendations to the 'Birr Future Model – Option 1'

To reduce the number of areas flooding in the network the following measures are required:

1. Increase overflow pipe dia. at MH8607/MHI.4 from 80mm dia to 300 at existing invert level of 46.125 m AOD (Ref. Drawing No. 20305 / 11)
2. Upsize pipeline dia. between MH8608/MHI.3 and MH8703/MH5.15 from 375 mm dia. to 600 mm dia. at existing inverts levels. (Total length = 91m) (Ref. Drawing No. 20305 / 14)
3. Construct a new proposed sewer line from Burke's Hill to the WWTW's site (construction is proposed under a separate contract and the costs for this sewer are not included in this report) and decommission the Tullamore Road Pump Station upon completion of sewer line mentioned in the item above. (Ref. Drawing Nos. 20305 / 10 and 20305 / 13).

After the corrective measures stated above were put into the model it highlighted the fact that as a consequence to the relief provided in the network an increase in the volume of wastewater discharging at the two overflow locations was increased.

7.5.7 General Description - The 'Birr Future Model – Option 2'

After graphically displaying the condition and performance of the network with the changes made for Option 1 the model was still flooding in residential areas. As above a list of the possible counteractive measures to flood relief was rechecked. The works proposed were to have the effect of further reduction to the number of areas that are still flooding. After careful investigation it was established that further curative measures would reduce the number of areas flooding from 7 (Option 1) to 3 (Option 2). The overall reduction in the volume of spill is from 551.9m³ to 481.3m³ (70.6m³).

The plan of the model (Figure 7.3) highlights the position and scale of the flooding within changes proposed for Option 2.

7.5.8 Recommendations to the 'Birr Future Model – Option 2'

Option 2 to contain all the changes as recommended for Option 1 plus the following alterations:

1. Upsize pipeline from SN06034901/MH7.12 to SN06036804/7.42 from 150mm dia. to 225mm dia. Lay at existing invert levels (Length = 181m). (Ref. Drawing No. 20305 / 11)
2. Upsize pipeline from SN06042001/MH7.8 to SN06042102/MH7.6 from 225mm dia. to 300mm dia. Lay at existing invert levels (Length = 160m). (Ref. Drawing No. 20305 / 11)
3. At SN06042102/MH7.6 cap existing conduit flowing towards MH7.5
4. Lay new 300mm dia. pipe from SN06042102/MH7.6 to SN06042201/MH7.4. U/S invert 49.714, D/S invert 47.446. (Ref. Drawing No. 20305 / 11)

After the corrective measures stated above were put into the model it highlighted the fact that as a consequence to the relief provide in the network an increase in the volume of wastewater discharging at the two outfall locations was increased. To control the volume of untreated wastewater discharging into the River the following works is recommended:

5. Construct Storm Water retention tanks to hold the spill volume for M5-90 storm event. Retention volumes required are 209.54 m³ and 110.05 m³. The location of these proposed tanks is shown on Drawing Nos. 20305 / 11 and 20305 / 14.
- A preliminary design (Option 2) suggests that a DN1800 x 30 m x 2 No. (150m³ storm tank) must be installed at SN05048607/MHI.4 and DN1800 x 30m x 2No (150m³ storm tank) must be used at SN06042603/MH5.24A. (Ref. Drawing Nos. 20305 / 11 and 20305 / 14).

7.5.9 Overview

The existing network requires immediate attention. Upon completion of the recommendations from the CCTV Report, the SUS Report and the additional modifications suggested from Model Analysis, relief from flooding in the town would be achieved. The overall volume of untreated wastewater flowing into the Camcor River and spilling at the identified areas around the town will be dramatically reduced i.e. from 1,175.1 m³ to 481.3 m³ (Table 7.4) and consequently the spill volumes at the overflow locations (combined) will increase from 817.03 m³ to 1,189.0 m³. To compensate this increase in the spill volumes at the overflow locations, the construction of two storm tanks is proposed. The tanks will reduce the spill by 300 m³.

Table 7.4 - Model Flooding Results (Vol. m³)

Design Storm	Existing	Existing + future development	Existing + future development - Option 1	Existing + future development - Option 2
M1-90 min	130.8	131	61.2	38.8
M5-90 min	363.5	366.4	144.8	96.2
M10-90 min	560.3	561	225.5	163.5
M40-90 min	1175.1*	1177.6*	551.9*	481.3*

* For the purpose of analysis and subsequent recommendations for this report the results from a design storm of 1 in 40 years return period and duration of 90 minutes will be used.

The existing network has two overflow pipes that discharge straight into the Camcor River at Bridge Street and at the Weir adjacent to Railway Road. Any solution that will reduce the number of areas being flooded, (Table 7.5), will lead to an increase of discharge at these points.

Table 7.5 - Overflow Manholes (Spill for Design Storm M40-90)

Overflow I.D.	Existing	Existing + future development	Existing + future development - Option 1	Existing + future development - Option 2
SN05048607/MH1.4	80.18	76.34	648.67	653.45
SN06042603/MH5.24A	736.83	735.16	443.16	535.57

7.5.10 Summary of Proposed Improvements from Model Analysis

When all the recommended changes have been input into the model the results are as follows

- The volume of flooding for M1-90 storm event will be reduced from 130.8 m³ to 38.8 m³. No area floods greater than 25 m³ during this event, thus no flooding is predicted.
- The volume of flooding for M5-90 storm event will be reduced from 363.5 m³ to 96.2 m³. The number of areas flooding greater than 25 m³ will be reduced from 4 to 0; thus no flooding is predicted.
- The volume of flooding for M10-90 storm event will be reduced from 560.3 m³ to 163.5 m³. The number of areas flooding greater than 25 m³ will be reduced from 8 to 0; thus no flooding is predicted.
- The existing network for M40-90 storm event shows that 17 areas flood greater than 25m³, the spill volume is 1,175.1m³ and the volume of discharge to the Camcor River via overflows is 817 m³. The total spill volume in the existing network is 1,992.11 m³.

Improvements recommended from the model analysis are as follows:

- Upsize the overflow pipe at SN8607 from 80mm to 300mm.
- Connect new storm tank with a 150 m³ capacity to proposed overflow at SN 8607. Construct new overflow to Camcor River from storm tank.
- Upsize pipe between SN8608 and SN8703 from 375 mm to 600 mm, length of 91 meters.
- Upsize pipe between SN4901 and SN6804 from 150 mm to 225 mm, length of 181 meters.
- Construct new pipeline from Burke's Hill to the WWTW's (Proposed under a Separate Scheme).
- Upsize pipe between SN2001 and SN2102 from 225 mm to 300 mm, length of 160 meters.
- At SN2102 cap pipe flowing to SN1202
- Construct new pipeline from SN2102 to SN2201, 300 mm, length of 84 meters.
- Connect new storm tank with 150 m³ capacity to intercept existing overflow from SN2603. Construct new overflow to Camcor River from storm tank.

Thus, with the modifications completed, the result from the model's **Option-2** network for M40-90 storm event shows that 4 areas flood greater than 25 m³, the spill volume is 481.3 m³ and the volume of discharge to the Camcor River via overflows is 889.02 m³. Total spill volume 1370.32 m³.

7.5.11 Conclusion - Existing vs. Proposed Improvements

Parameter	Existing	Proposed	Difference	
			m ³	%
Areas flooding (>25m ³)	17	4	- 11	(-76)
Spill Volume (m ³)	1175.1	481.3	-693.8	(-59)
Overflow to Camcor (m ³)	817.01	889.02	+72.01	(+8)
Total Spill (m³)	1992.1	1370.32	-621.78	(-31)

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7.6 CRINKILL

7.6.1 Hydraulic Loading

Modifications are required at Crinkill Pump Station No. 1. The site is located beside the Rock River and adjacent to the Birr/Roscrea N62 Road. The existing imhoff tank which was converted to a pumping station is to be replaced by a new Pump Station and Detention Tank.

7.6.2 Pump station No.1 / Detention Tank

The pump station shall be capable of pumping flows of up to 3DWF to the existing MH7.8 located on the Roscrea Road. Flows in excess of 3DWF will be diverted to the new Detention Tank. A detention time of 3 hours for 3DWF will be provided. The detention time of 3 hours is a specific request of the Shannon Regional Fisheries Board (See Appendix B). A preliminary design would suggest that a 16m x 4m x 1.5m twin compartment 96m³ storm tank must be constructed within the Crinkill Pump Station Site.

7.6.3 Pipeline

The pipeline within the pumping station site shall be upsized from 300mm diameter to 525mm diameter. The pipeline (length 25m) shall be laid to new invert levels at a gradient of 1 in 300 as shown on Drawing 20305/15B.

7.6.4 Pump Station No. 2

Upgrading of the pumps and some electrical modifications are required within Pump Station 2, located at the junction of Swag Street and School Street. However, it is noted that the diversion of all flows by gravity from this pumping station to pumping station No.1 is proposed by a developer.

7.6.5 Summary of Proposed Improvements

- New pumping station / Detention tanks on site of pumping station No.1 with a retention of 3 hours at peak flows and tank flushing units for automatic cleaning of tanks
- A fine screen (6mm) on the storm overflow will be required to prevent solids discharge to the adjacent stream.

- A system to oxygenate the storm water stored in the storm tank and thus prevent septicity
- Mixers in the storm tank to resuspend settled solids material during tank drawdown
- Upsize pipelines
- Modifications to pumping station No.2

7.6.6 Recommendations to the Crinkill Network

To avoid surging of the pipelines and allow for the removal of storm overflow MH6401/MH4.22

- a. Upsize pipeline from storm overflow MH6401/MH4.22 to MH5401/MH4.21 from 225mm diameter to 300mm diameter. The pipeline, length 156m, shall be laid at existing pipe invert Levels. Refer Drawing 20305/15B.
- b. Upsize pipeline from MH5401/MH4.21 to MH4402/MH42A from 225mm diameter to 300mm diameter. The pipeline, length 90m, shall be laid at existing pipe invert levels. Refer Drawing 20305/15B.

7.7 Riverstown

Remediation works are required to the site levels at the Riverstown Pump Station, located on the Nenagh Road, to prevent the runoff of storm water to the Pump Station entering via the covers.

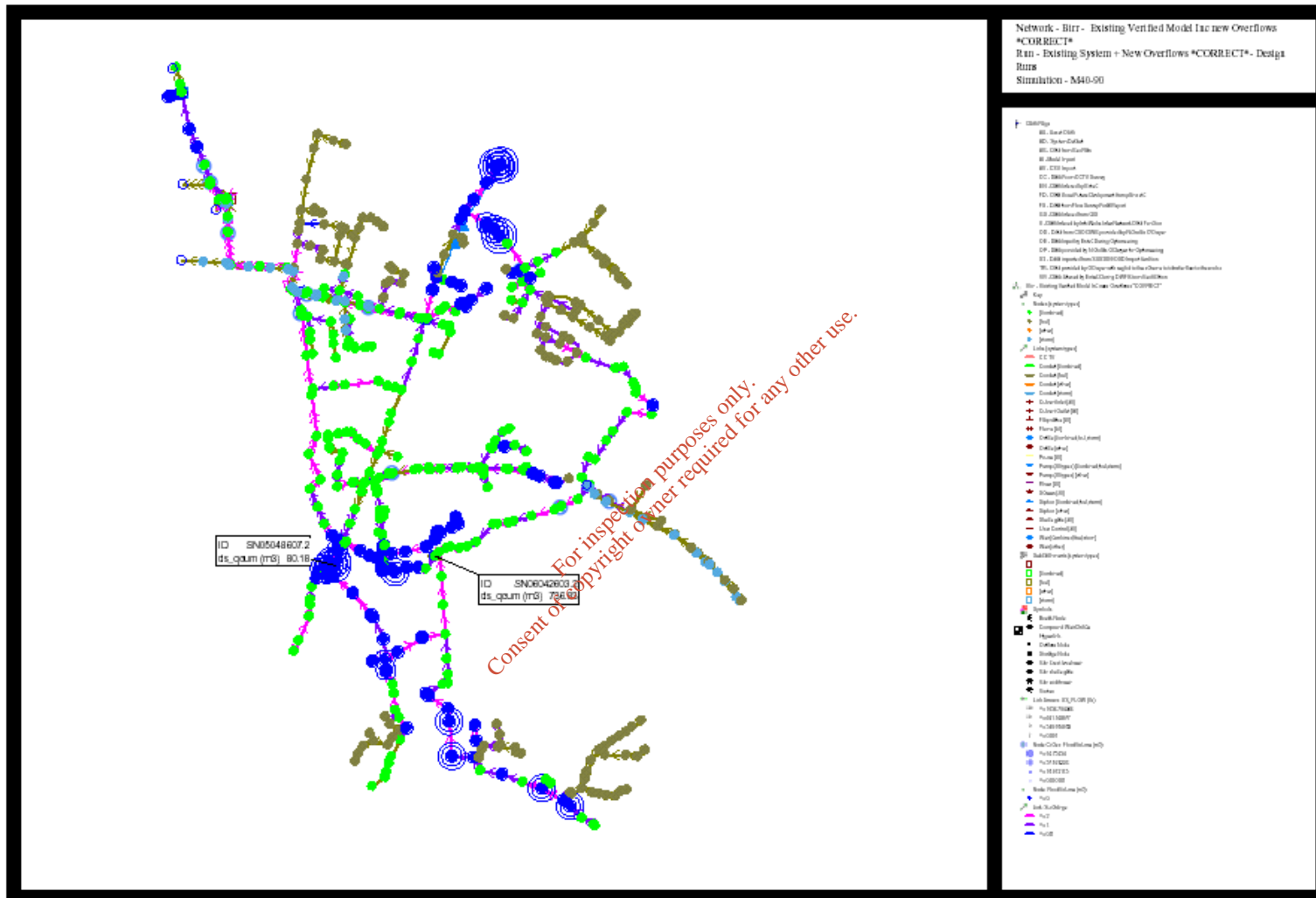


Figure 7.1 – Schematic representation of network from infoworks model high lighting flooding.

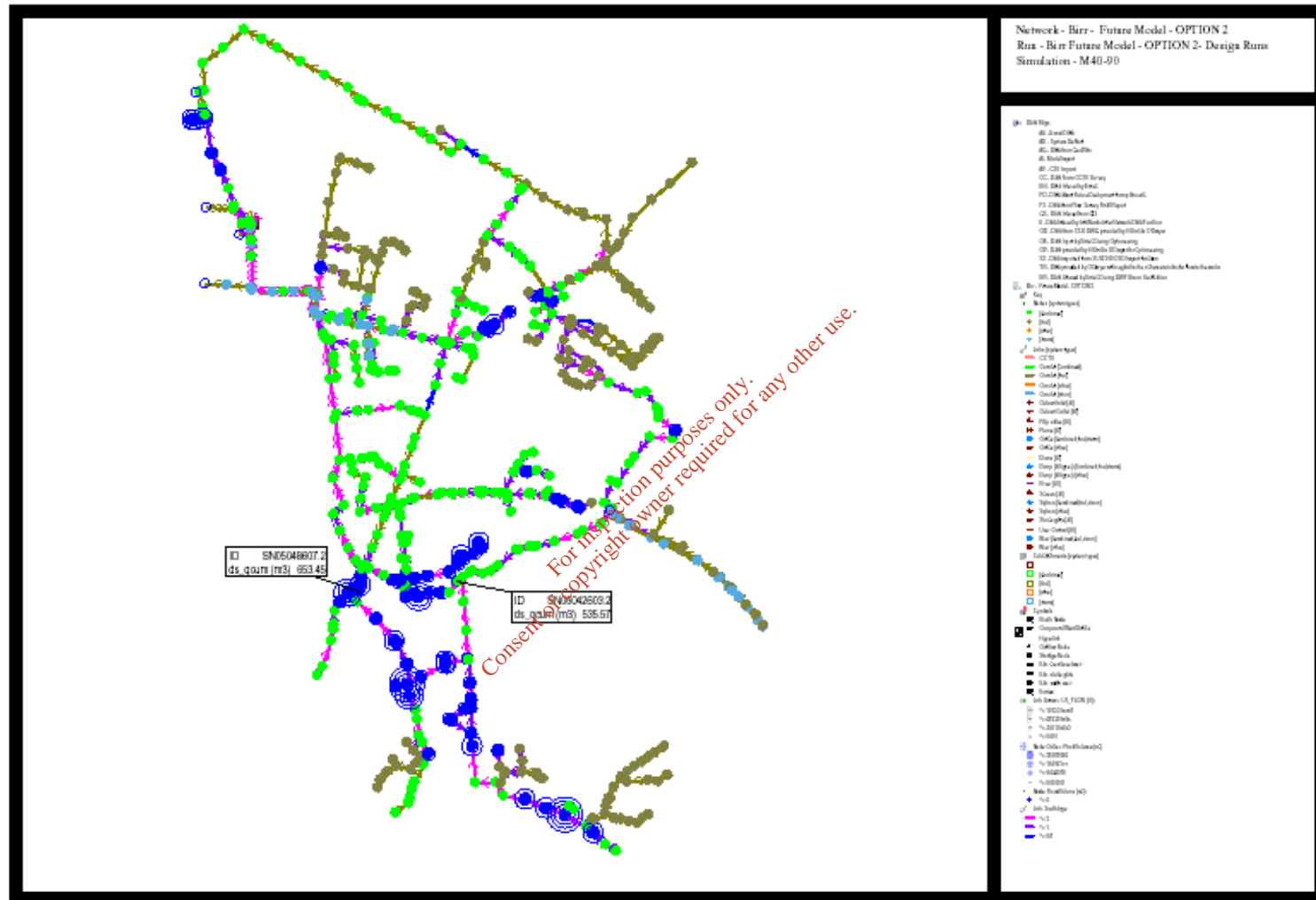


Figure 7.3 – Schematic representation of network from infoworks model high lighting flooding.

8. DESIGN PARAMETERS AND LAYOUT OF WASTEWATER TREATMENT PLANT

8.1 Summary of Design Parameters

The basic design parameters for the wastewater treatment plant can be summarised as follows:

	Phase 1	Phase 2	Phase 3
Population Equivalent	15,000	20,000	25,000
Wastewater Flow l/h/d	225	225	225
DWF m ³ /day	3,375 m ³ /d	4,500 m ³ /d	5,625 m ³ /d
l/sec	39.06 l/sec	52.08 l/sec	65.10 l/sec
Max. Flow to Full Treatment (3 DWF)	10,125 m ³ /d 117.19 l/sec	13,500 m ³ /d 156.25 l/sec	16,875 m ³ /d 195.31 l/sec
Storm Tank Volume Required (3 DWF for 3 Hours)	1,266 m ³	1,687.5 m ³	2,110 m ³
Storm Tank Volume Provided	1266m ³	1687.5 m ³	2,110 m ³
Retention Time	3 hrs. at peak flow	3 hrs. at peak flow	3 hrs. at peak flow

8.2 Preliminary Layout of the Wastewater Treatment Works

Section 6 of this Preliminary Report set out the various process options which were examined to cater for the requirements of an expanded Wastewater Treatment Works. Indicative layout drawings and elevation details for each option and for the proposed stormwater tanks are shown on Drawing Nos. 20305 / 36 and 20305 / 42. These indicative arrangements are also used in the Environmental Impact Statement for the expanded Wastewater Treatment Works.

New sludge holding and dewatering facilities will be provided under Phase 1.

As a minimum the 3 options for expansion of the works shall have the following common units:

- A New Stormwater Holding Tank shall be provided at Phase I to cater for the Phase I flows and hydraulic detention time requirements.
- Phosphorus removal Facilities.
- Increased Sludge Holding, Treatment and Acceptance Facilities (16,500 p.e.) will be provided at the Phase I expansion.

Other facilities to be provided under Phase I include the following:

- (1) Refurbished Dewatering building
- (2) Air Blower Building
- (3) Site roads and fencing
- (4) Process and drainage pipework
- (5) Telemetry and Scada control system
- (6) Landscaping

8.3 Stormwater Tanks

A retention time of 3 hours will be provided for Phase III peak flows. This volume has been determined in consultation with Shannon Regional Fisheries Board (see Appendix B). A Weir mounted storm overflow screen will be installed in the storm tank overflow channel (6 mm screen) to ensure that solids will be retained in the Stormwater flows and pumped back to the main incoming flow to receive full treatment when the main flow to treatment drops to 1.5 DWF. The overflow from the tank will discharge to the existing 750 mm diameter storm overflow pipe to the Little Brosna River. An analysis of the existing 525 mm diameter outfall from the WWTW which is completely separate from the 750 mm diameter stormwater overflow shows that it has sufficient capacity at peak flows up to and including the peak flows at the ultimate load of 25,000 p.e. Details of the proposed storm tank are given on Drawing No. 20305 / 42.

9. SEPTICITY AND ODOUR CONTROL

9.1 Causes

Septicity is a bacterially caused and controlled process which begins with the formation of a slime layer below the water level in a sewer. "Zooglea" is the biologically secreted protein which holds the layer of bacteria and inert solids together. This takes approximately two weeks to form and become fully productive. At this point the Zooglea is thick enough to prevent the penetration of dissolved oxygen and an anoxic zone develops within the slime layer. Within this anoxic zone sulphate reducing bacteria use SO_4 for the four oxygen atoms in a way analogous to the absorption of dissolved oxygen by aerobic bacteria in an aeration basin. S (Sulphur) is the by product of this process and immediately forms HS (hydrosulphide) and H_2S (hydrogen sulphide). An aerobic bacterium "Thiobacillus", which commonly colonises pipe crowns walls and other surfaces above the waterline, consumes the H_2S and produces H_2SO_4 or sulphuric acid. In severe instances lowering the pH level at the pipe to 0.5pH. Unsurprisingly this can cause severe damage.

The factors that effect Sulphide concentration include:

Temperature

As higher wastewater temperatures increase the metabolic activity of the Sulphur producing bacteria. A 7°C increase in temperature will double the production of Sulphur which in turn will double the production of both H_2S and H_2SO_4 .

Settleable Solids

Low flow velocities allow settleable solids such as grit to settle in the sewer which increases the mass and surface area that the slime layer can grow on which in turn leads to an increased conversion of SO_4 to S. This then creates dissolved S spikes which are subsequently released as H_2S in areas of high turbulence.

Flow Turbulence

Any action that serves to increase the surface area of the liquid in a sewer network increases the driving force that pushes H₂S from the liquid or aqueous phase to the gas phase. The effects of H₂S odour and corrosion can be magnified hundreds of times at structures which cause turbulence.

Additionally it should be noted that the same release mechanism occurs whenever wastewater rich in H₂S is *aerated*.

It is important to reduce, if not eliminate, septicity of sewage within the various components of the sewage collection and treatment facilities.

9.2 Effects

Odour

Hydrogen sulphide is a very poisonous gas with the odour of rotten eggs. The odour can be noticed at levels as low as 1ng/l. At higher levels the smell is lost to human senses which makes it very dangerous at high levels. At levels above 300 ppm by volume in air H₂S is odourless and will quickly cause unconsciousness and death.

Below the lethal levels H₂S can be made more unpleasant by other foul smelling compounds in particular mercaptans (or Thiols) which may also be formed in the anaerobic sewage.

Structural Corrosion

The Thiobacillus which have the ability to consume H₂S and oxidize it to H₂SO₄ depend on a supply of H₂S greater than 2 ppm, high relative humidity and atmospheric oxygen in order to form H₂SO₄. For part of the year these conditions exist in most wastewater collection systems. For high H₂S concentrations (in excess of 50ppm in air) a pH of as low as 0.5 has been measured at the surface exposed to the high H₂S environment. H₂SO₄ exposure corrodes copper and its alloys, bronzes, Monel metal and silver as a result it can destroy electrical equipment at pumping stations. Metalwork such as step-irons, ladders, manhole covers and penstocks will be destroyed unless made of corrosion resistant materials and even cast iron and some grades of *stainless steel* will be corroded or pitted.

The corrosion of concrete sewers and structures under a high sulphide environment is dependent on several factors. Freshly poured concrete has a ph

of about 11 or 12 as the result of the formation of Ca(OH)_2 (Calcium Hydroxide), a by-product of the hydration of cement. In this caustic environment the growth of the Thiobacillus is impossible. However, due to the presence of both CO_2 and H_2S in wastewater and the resulting weak Carbonic (for CO_2) and Thiosulphuric and Polythionic (for H_2S) acids they respectively form over time, they react with the Ca(OH)_2 and reduce the pH of the surface layer of the concrete until it eventually is reduced to a pH of 9 or 9.5 which is capable of supporting the growth of Thiobacillus. This process can take anywhere from years to a few months in severe cases. Corroded concrete surfaces can often be distinguished by a characteristic yellow colour which is caused by the direct oxidation of H_2S to Sulphur. This occurs where high concentrations of atmospheric oxygen or other oxidants are available. H_2SO_4 also causes the formation of Ettringite or Calcium Sulfbaluminate Hydrate ($\text{CaO}\cdot\text{Al}_2\text{O}_3\cdot 3\text{CaSO}_4\cdot 32\text{H}_2\text{O}$) or Gypsum ($\text{CaSO}_4\cdot 2\text{H}_2\text{O}$) both of which are produced by the incomplete reaction between H_2SO_4 and cement. It forms at the boundary between the soft CaSO_4 layer and the uncorroded concrete surface. Ettringite is an expansive compound because it occupies more space than its constituents with the result that, as it forms, it lifts the corroded concrete away from the good concrete exposing more layers to corrosion. Although the rate of concrete loss depends on a series of factors including ettringite formation it is not uncommon to see concrete loss of as much as 25 mm per year in high sulphide environments.

Explosion

H_2S is also a highly explosive gas and build up of H_2S gas in isolated pumping stations has been known to cause explosions and severe damage. Plugs of H_2S gas entering enclosed inlet works have also caused explosions. As a result many stations and enclosed inlet work have to be made explosion proof with high Ex ratings and additional construction and maintenance costs.

Impairment of Treatment Process

Septic wastewater with its high H_2S loads and low pH can be very demanding on WWTW operation due to its effects on biological processes and the potential for corrosion of equipment and infrastructure. Septic wastewaters also tend to promote the growth of filamentous bacteria which easily clog filters in treatment plants.

9.3 Prevention

Prevention of septic conditions in sewer networks can be most simply implemented by ensuring two things:

1. For any pipe, flow at the current (not the ultimate design) DWF through the pipe achieves the minimum self cleansing velocity of 0.75 m/s.
2. Eliminate as much as possible structures which cause turbulence. Where this is not possible they should be designed to avoid hydraulic jump, improve streamline transmission and thus reduce H₂S releases.

The 0.75 m/s self cleansing velocity will not completely avoid the formation of sulphide in accumulated debris which is why the application of these two rules in concert is the best way of preventing septicity in the sewers..

9.4 Remediation

Where there is a problem of septicity, ideally the application of the prevention measures should be implemented. Frequently this is impossible and as a result numerous methods exist for the prevention of septicity in sewer networks prone to septic sewage. These include:

Inhibition

Dosing with chlorine, sodium hypochlorite or organic chemicals (mostly chlorinated hydrocarbons) all of which are bactericidal chemicals and need to be dosed continuously and where the need arises in high quantities. This is expensive and can cause problems at the treatment works particularly with biological processes that depend on bacteria to function properly.

Maintaining Aerobic Conditions

This can be done by injecting air into rising mains thus maintaining a DO content in the wastewater and aerobic conditions which prevent the formation of anaerobic bacteria. This system has the advantage of not affecting the biological processes and also avoids the problem of residual nitrogen gas.

Maintaining Anoxic Conditions

This is achieved by dosing nitrate which causes anoxic rather than anaerobic conditions to occur in the wastewater. Various proprietary chemicals including Nutriox utilise this method but these will only be effective if the nitrate dose is adequate. Generally these chemicals contain a mixture of Ferric Sulphate and nitric Acid. If there is insufficient nitrate dosed the sulphate anion of the Ferric Sulphate can be reduced to Sulphide and the overall effect can be to increase odours and cause greater corrosion at the end of a long rising main.

Chemical to Increase pH

Chemical addition of lime or sodium hydroxide to increase the pH of the wastewater above 9 at all times will prevent completely the growth of the Slime layer, the bacteria therein and the formation of H₂S. Unfortunately this can be more expensive and can result in the release of Alkali Odours thus causing a different odour nuisance.

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10. COST ESTIMATES

10.1 Preparation of Cost Estimates

The cost estimates for the Scheme are prepared under three categories, namely:

- (a) Wastewater Treatment Works Expansion (Phase I, II and III)
- (b) Improvements to Existing Wastewater Collection Network

The estimates are based on extensions to quotations received from suppliers and on recent Contract prices for similar work.

10.2 Wastewater Treatment Works Expansion

10.2.1 Estimated Cost of Phase I

The estimated cost for Phase I of the wastewater treatment plant and sewerage network is summarised below:

Wastewater Treatment Works (excl. VAT) €3,670,000

A breakdown of these costs is given in Table 10.1

10.2.1.1 Description of the Phase 1 works

The phase 1 works come under four main headings:

1. The provision of a stormwater tank and all ancillaries detailed in table 10.1. This work is necessitated by the Shannon Regional Fisheries Board requirements for detention times and also for the screening of stormwater overflow.

2. The improvements to the existing sludge building and the provision of a sludge acceptance plant are driven by the requirements of the Sludge Management Plan for County Offaly which designates Birr and a satellite centre and by Health and Safety considerations. As mentioned in section 3.7.2.6, for example, the control panel is not cordoned off from the belt presses. At the time of construction this was in compliance with health and safety regulations but since its construction more stringent legislation has been passed. The lack of separation between the control panel and the belt presses constitutes an electrical risk and should be addressed.

3. More stringent legislation to ensure that appropriate welfare facilities are made available for workers has been enacted since the plant was constructed. Most of the refurbishment of the administration building can be traced back to this legislative requirement.

4. As was noted in section 3.7.3.2 the plant is now 15 years old and as such the mechanical and electrical equipment is reaching the end of its design life. Left unaddressed most of this equipment will need to be replaced over the next 3-5 years. There are two options for dealing with this situation, the equipment can be replaced, item by item, as it fails or the plant can be refurbished under one contract carried out at the same time as the rest of the works required for Birr Town. The first option has two main drawbacks, firstly, critical items of equipment could fail (e.g. surface aerators, clarifier tank bridges) necessitating expensive temporary on site treatment facilities as a stopgap measure while repairs and replacement are carried out, and secondly, carrying out several contracts in a piecemeal fashion at the same site with some of them being "Emergency Works" is going to be considerably more costly than carrying out one well planned and implemented single contract. Further cost savings could be made by the installation of new, improved, more efficient and more modern equipment making full use of modern information technology available to better control and thus "fine tune" the wastewater treatment process. This should enable operational cost savings to be made. If the work to replace and upgrade this equipment included increasing the hydraulic capacity of the Aeration basins and clarifiers and was carried out at the same time as the rest of the works required for Birr there should be considerable saving due to the single mobilisation by contractors.

10.2.2 Estimated Cost of Phase II

The estimated cost for Phase II of the Scheme is summarised below:

Wastewater Treatment Works (excl VAT) €2,250,000

A breakdown of these costs is given in Tables 10.2.

10.2.3 Estimated Cost of Phase III

The estimated cost for Phase III of the Scheme is summarised below:

Wastewater Treatment Works (excl VAT) €2,040,000

A breakdown of these costs is given in Tables 10.1, 10.2 and 10.3.

Table 10.1 - Wastewater Treatment Works - Phase 1 Costs

A.	Preliminary Treatment Plant	Cost	Total
	Minor Works to modify penstock arrangement	15,000	15,000
B.	Storm Treatment Plant		
	Provision of Phase 1 Storm tank	475,000	
	Cleaning mechanism	65,000	
	Storm overflow screen	40,000	
	Storm pumps	15,000	595,000
C.	Secondary Treatment Plant		
	Provision of Baffle walls	80,000	
	Raising of Tank wall	15,000	
	Provision of diffused air system	155,000	250,000
D.	Clarifiers		
	Civil Works to Raise Walls	75,000	
	Refurbishment of Clarifier Bridges	65,000	140,000
E	Sludge Treatment Plant		
	Sludge holding tank (glass-lined steel)	95,000	
	Picket fence thickener equipment:	60,000	
	Sludge Centrifuges and ancillaries	185,000	
	Sludge pumping equipment	30,000	
	Pipework / instrumentation	25,000	
	Washwater and drainage pumps	45,000	440,000
F	Odour Removal Plant		
	Sludge Odour Removal	50,000	50,000
G	Sludge Acceptance Plant (incl. Building)	450,000	450,000
H	General Items		
	Electrical installation	185,000	
	Control panels	155,000	
	Alteration to existing pipework / ducting	125,000	
	Instrumentation and control systems	55,000	
	Miscellaneous items / drawings / manuals / training	65,000	
	Siteworks	95,000	680,000
I	Refurbishment of Buildings		
	Refurbishment of Dewatering Building	160,000	
	Refurbishment of Administration Building	45,000	
	New Air Blower Building	110,000	315,000
	Sub-Total		2,935,000
	Add 25% for Preliminaries and General Items		733,750
	TOTAL €		3,668,750
	SAY €3,670,000		

Table 10.2 - Wastewater Treatment Works - Phase II Costs

A.	Preliminary Treatment Plant	Cost	Total
	Further Minor Works to modify penstock arrangement	10,000	10,000
B.	Storm Treatment Plant		
	Provision of Phase 2 Storm tank	210,000	
	Storm pumps Modification	10,000	220,000
C.	Secondary Treatment Plant		
	Provision of New Aeration Basin	190,000	
	New Air Blower Building	110,000	
	Provision of RAS/WAS pumping Station	40,000	
	Provision of diffused air system	155,000	495,000
D.	Clarifiers		
	Provision of New Clarifier	150,000	
	Provision of Clarifier Bridges	65,000	215,000
E	Sludge Treatment Plant		
	Sludge holding tank (glass-lined steel)	45,000	
	Picket fence thickener equipment:	25,000	
	Sludge Centrifuge Modifications and ancillaries	110,000	
	Modifications to Sludge pumping equipment	15,000	
	New Pipework	70,000	
	New Instrumentation	30,000	295,000
F	Odour Removal Plant		
	Sludge Odour Control on new PFT	10,000	10,000
G	General Items		
	Electrical installation	100,000	
	Control panels	110,000	
	Alteration to existing pipework / ducting	125,000	
	SCADA control systems	55,000	
	Miscellaneous items / drawings / manuals / training	65,000	
	Siteworks	95,000	550,000
	Sub-Total		1,795,000
	Add 25% for Preliminaries		448,750
	TOTAL €		2,243,750
	SAY €2,250,000		

Table 10.3 - Wastewater Treatment Works - Phase III Costs

A.	Preliminary Treatment Plant	Cost	Total
	Further Minor Works to modify penstock arrangement	10,000	10,000
B.	Storm Treatment Plant		
	Provision of Phase 3 Storm tank	210,000	
	Storm pumps Modification	10,000	220,000
C.	Secondary Treatment Plant		
	Provision of New Aeration Basin	130,000	
	Provision of RAS/WAS pumping Station	40,000	
	Provision of diffused air system	155,000	325,000
D.	Clarifiers		
	Provision of New Clarifier	150,000	
	Provision of Clarifier Bridges	65,000	215,000
E	Sludge Treatment Plant		
	Sludge holding tank (glass-lined steel)	45,000	
	Picket fence thickener equipment:	25,000	
	Sludge Centrifuge Modifications and ancillaries	110,000	
	Modifications to Sludge pumping equipment	15,000	
	New Pipework	70,000	
	New Instrumentation	30,000	295,000
F	Odour Removal Plant		
	Sludge Odour Control on new PFTs	10,000	10,000
G	General Items		
	Electrical installation	100,000	
	Control panels	110,000	
	Alteration to existing pipework / ducting	125,000	
	SCADA control systems	55,000	
	Miscellaneous items / drawings / manuals / training	65,000	
	Siteworks	95,000	550,000
	Sub-Total		1,625,000
	Add 25% for Preliminaries		406,250
	TOTAL €		2,031,250
	SAY €2,040,000		

10.3 Operational and Maintenance Costs per Annum for the 15,000 p.e. plant proposed

Costs for Operation and Maintenance of the Phase 1 WWTW per Annum	
FIXED	
Labour: 1/2 manager, 2 operators, 1/2 technician, 1/4 chemist	€205,000
Insurance / overheads	€165,000
Capital replacement	€45,000
Scheduled maintenance materials	€65,000
Laboratory costs	€25,000
Transport	€20,000
	€525,000
VARIABLE	
Electricity costs	€80,000
Materials/consumables costs	€30,000
Chemicals	€70,000
Sludge treatment and transport	€100,000
	€280,000
Total Cost per Annum (excluding VAT)	€805,000

10.4 Improvements to Existing Wastewater Collection Network

The improvements required to the existing sewerage system have been detailed previously. The proposals given are costed below.

10.4.1 Relining

There are 17 number Sewer Lines totalling approximately 1160 linear metres in **Birr Town** and approximately 95 linear metres in **Riverstown** that require attention. These lines require full length lining, including CCTV Survey prior to commencement of work, cleaning removal of intrusions, reopening of laterals after lining, and CCTV Survey on completion of works. Table 10.4 below gives the cost for this work.

Table 10.4 - Relining of Pipelines Schedule

Pipe Diameter (mm)	Length to Line (m)	Structural Grade	Approximate Cost of Works
BIRR TOWN			
180	130	3-4	€26,650
225	940	3-5	€225,600
375	90	5	€27,900
<i>TOTAL</i>	1,160		€280,150
CRINKILL			
Nil	Nil	<i>Nil</i>	<i>Nil</i>
RIVERSTOWN			
225	270	<i>1-4</i>	<i>64,800</i>
TOTAL FOR BIRR TOWN, CRINKILL AND RIVERSTOWN			344,950

10.4.2 Manhole Refurbishment

Birr Town

- In all, approximately 550 Manholes exist on the network system in **Birr Town**; of these 295 manholes require attention. As stated this includes the replacing of 10 No. Manhole Covers and Frames, making necessary repairs to Manhole Shafts and the replacing / repairing of Manhole Benching. Approximately 50 No. Manhole Covers are buried and should be raised to the existing ground surface level. A cost for carrying out this work is included in Table 10.5 below.

Crinkill

- There are approximately 142 manholes on the network system in **Crinkill Village**; of these 60 Manholes require attention. The replacing of 2 No. Manhole Covers and Frames are required, repairs / replacing to Shafts and Benching are also required. Approximately 12 No. Manhole Covers should be raised to existing ground surface level.

Riverstown

- There are approximately 166 manholes on the network system in **Riverstown Village**; of these 58 Manholes require attention. The replacing of one Manhole Cover and Frame is required, repairs / replacing to Shafts and Benching is also required. Approximately 5 No. Manhole Covers should be raised to existing ground surface level.

Table 10.5 - Manhole Refurbishment Schedule

Works	Number of Manholes	Approximate Cost of Works
BIRR TOWN		
Replace Cover and Frame	10	€6,000
Repairs to Manhole	210	€310,000
Repairs to Benching	150	€96,000
Raise buried Manhole	50	€50,000
TOTAL	420	€462,000
CRINKILL		
Replace Cover and Frame	2	€1,200
Repairs to Manhole	64	€94,500
Repairs to Benching	32	€20,800
Raise buried Manhole	12	€12,000
TOTAL	110	€128,500
RIVERSTOWN		
Replace Cover and Frame	1	€600
Repairs to Manhole	43	€63,500
Repairs to Benching	50	€32,500
Raise buried Manhole	6	€6,000
TOTAL	100	€102,600
TOTAL FOR BIRR TOWN, CRINKILL AND RIVERSTOWN		€693,100

10.4.3 Pipeline Refurbishment

Birr Town

There are 173 number Sewers totalling approximately 10,100m that have been identified for attention. These pipe lengths include for localised repairs and rectifying Intrusions / Laterals. Table 10.6 below gives the cost of these repairs.

Crinkill

In Crinkill 36 No. sewers, approximately 2,600 metres in length have been identified for attention. The pipe lengths include for localised repairs and rectifying intrusions / laterals. Refer Table 10.6 for the cost of these repairs. In addition to these repairs the overflows at the Crinkill Pumping Station are to be removed and a detention tank is to be built to store overflows during rainstorms or other high flow conditions.

Riverstown

In Riverstown 48 No. sewers, approximately 3,100 metres in length have been identified for attention. The pipe lengths include for localised repairs and rectifying intrusions / laterals. Refer Table 10.6 for the cost of these repairs

Table 10.6 - Pipeline Refurbishment Schedule

Pipe / Culvert Size (mm)	Length (m)	Grade	Intrusions Laterals	Repairs / Sealing Laterals	Localised Repairs	Approximate Cost of Rehab. Works
BIRR TOWN						
150	2,080	1 - 5	15	17	66	€125,000
225	5,160	1 - 5	93	95	163	€375,000
300	450	1 - 4	8	8	19	€40,000
340-375	140	4	2	2	0	€6,000
450-490	880	4	15	17	22	€60,000
500-550	520	3 - 4	11	11	17	€45,000
900	560	3 - 4	6	6	4	€25,000
N / G	310	4	30	30	0	€45,000
TOTAL	10,100		180	186	291	€721,000
CRINKILL						
150	850	4 - 5	13	19	11	€60,000
225	1,710	2 - 5	26	58	21	€115,000
300	40	4	1	1	1	€3,000
TOTAL	2,600		40	78	33	€178,000
RIVERSTOWN						
225	3,100	1 - 5	14	68	35	€125,000
TOTAL	3,100		14	68	35	€125,000
TOTAL FOR BIRR TOWN, CRINKILL AND RIVERSTOWN						€1,024,000

10.4.4 Network Upgrades Recommended from Model Study

A break down of the cost involved with the construction of the recommendations made in section 7.5 of this report is as follows:

Location	Item	Size	Length	€/m or €/unit	Estimated Cost
SN8607	Overflow Pipe	300	20	245	4,900
SN8607	Storm Tank	150m ³	To Suit	8,000	8,000
SN8608-SN8703	Pipe	600	91	370	33,670
SN4901-SN6804	Pipe	225	181	220	39,820
SN2001-SN2102	Pipe	300	160	245	39,200
SN2102-SN2201	Pipe	300	84	245	20,580
SN2603	Storm Tank	150m ³	To Suit	8,000	8,000
SN2102	Cap	225	1	300	300
				Total	€ 154,470

10.4.5 Network Improvement Cost Summary

The estimated cost for the network improvements is given below:

	€
Pipeline Relining	344,950
Manhole Refurbishment	693,100
Pipeline Refurbishment	1,024,000
Network Upgrades	154,470
	<hr/>
	2,216,520
Add Preliminaries (@ 25%)	554,130
	<hr/>
Total	€2,770,650
	<hr/>
	SAY €2,770,000

10.4.6 Crinkill

The estimated cost for the Pump Stations and Site Remediation Works:

	€
Pump Station / Detention Tank	230,000
Associated Site Works	50,000
*Pump Station 2 Remedial Works	16,500
Sub-Total	<u>296,500</u>
Add Preliminaries (@ 25%)	74,125
Total	<u>€370,625</u>

* This may need to be removed subject to developer carrying out the work.

10.4.7 Riverstown

The estimated cost for the Pump Stations and Site Remediation Works:

	€
Pump Station	50,000
Associated Site Works	3,500
Sub-Total	<u>53,500</u>
Add Preliminaries (@ 25%)	13,375
Total	<u>€66,875</u>
Total	<u>€437,500</u>
	SAY €440,000

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10.5 Summary of Estimated Costs

The Scheme costs (excluding VAT) are detailed below:

Wastewater Treatment Works

Phase I	€3,670,000
Phase II	€2,250,000
Phase III	€2,040,000
Network	€2,770,000
Crinkill & Riverstown Pumps Stations	<u>€440,000</u>
	€11,170,000
Consultants Fees	€380,000
Resident Engineer	<u>€310,000</u>
Estimated Scheme Capital Cost	€11,860,000

Phase I Cost**Construction**

WWTW	€3,670,000
Network	€2,770,000
Crinkill & Riverstown Pumps Stations	<u>€440,000</u>
	€6,880,000
VAT at 13.5%	<u>€928,800</u>
Construction Total	<u>€7,808,800</u>

Project Supervision

Consultants Fees	€266,000
Resident Engineer	<u>€215,000</u>
	€481,000
VAT at 21%	<u>€101,010</u>
Project Supervision Total	€582,010

Total Estimated Capital Cost (including VAT) €8,390,810

Annual Operation and Maintenance Cost

Total Fixed Cost	€525,000
Total Variable Cost	<u>€280,000</u>
*Total Operation and Maintenance Cost	€805,000
VAT at 13.5%	<u>€108,675</u>
Total Operation and Maintenance Cost (including VAT)	€913,675

* At Tender Stage this estimate will have to be reviewed to take account of the implications of the new Government Conditions of Contract with regard to price variations, unforeseen ground conditions and unforeseen services.

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11. PROCUREMENT STRATEGY AND IMPLEMENTATION

11.1 Benefits of Traditional Procurement vs. DB/DBO Contracts

The advantages and disadvantages of a DB/DBO approach as against the traditional procurement approach of separate civil works and mechanical and electrical plant contracts needs to be examined. Consideration needs to be given to issues of cost, performance, time and risk as well as the overall feasibility of promoting the scheme using the DB/DBO approach.

It has been the experience with DB/DBO contracts that submissions from Contractors/Consortia at Tender Stage invariably include a variety of proposals intended to address the needs of the project. Each proposal generally brings together the expertise of Civil Works and Process Plant contractors. In a competitive situation these will strive to provide the most economical solution to the problem. Subject to adherence to the specified requirements of the project this tendering process can present the project promoter with a number of different and perhaps innovative solutions.

At the construction stage the co-ordinated approach of the construction team will eliminate many of the scheduling conflicts inherent in the traditional method where Civil Works and Plant Contractor interaction often leads to delay and disruption, with a consequent adverse affect on project cost.

An added advantage offered by a DB/DBO contract is that at an early stage in the project the likely out-turn can be established with greater certainty than with the traditional procurement method. This facilitates a more effective financial management of the project and indeed can have beneficial effects also for other projects whose funding is derived from the same source.

11.1.1 Design and Build

For the procurement of a Wastewater Treatment Works the benefits of a design and build approach are clear. Flexibility can be exercised to ensure acquisition of the best value plant. The performance risk associated with advanced technologies is carried by those most able to manage it, the contractors. The advantages of the Design Build approach however do not benefit the pipelaying contract as this contract has little scope for innovation and would be very

prescriptive. It is also noted that the scale of this contract is relatively small and consideration should be given to grouping the WWTW element with other contracts in the county.

11.1.2 Operation and Maintenance

Plants of this nature require well trained personnel to manage and operate them. This may be done by suitably trained council staff or let as an operating contract. If let as an operating contract there is no reason to divorce the plant operation from the design and build functions. There is also merit in tying operation to design as this ensures that the operation of the plant is clearly in the mind of the designers at an early stage.

The direct cost of operation may be higher if it is let as an operating contract. This takes account of the profit and transfer of risk elements. However the higher direct cost may be more than covered by the indirect savings gained through efficient operation of the plant. It is important when drawing up the operating contract to consider carefully who is best able to manage potential risks. Often a policy of maximum transfer of risk results in higher than necessary operating costs.

The option of including the operation of the network in a DBO for the WWTW is a possibility however this would represent a large risk to any potential Contractor given the current condition of the network and uncertainty of the results of repair at tender stage. Therefore the inclusion of the operation of the network in this Contract is not recommended. However including the new stormtanks in a DBO contract allows the contractor the ability to exercise control on the flows to the plant at the same time as making him responsible for the construction and operation of the new storm tank.

11.1.3 Programme

From contract award onwards a design and build approach is generally accepted to be quicker than a conventional contract. However preparation of the tender documentation, tender assessment and dealing with the planning aspects of a wider scope approach, takes a considerably longer time. On balance, there is no great time saving to be gained by either approach.

11.2 Procurement Strategy

Having considered all the matters discussed above, the procurement strategy suitable for the Birr Sewerage Improvement Scheme is as follows:

Contract	Strategy
Wastewater Treatment Works Including Storm Tank	Design Build and Operate for 20 years As part of a bundle *
Wastewater Collection System	Traditional
Pumping Stations	Traditional

* Edenderry is a suitable candidate for part of a bundle with Birr.

This procurement strategy will be subject to the findings of a Public Private Partnership Assessment Report to be carried out in accordance with the "A Policy Framework for Public Private Partnership – Guidance Notes 1 to 15" published by the Department of the Environment, Heritage and Local Government.

12. CONCLUSIONS AND RECOMMENDATIONS

12.1 Conclusions

On the basis of the examination set out in this Preliminary Report the following conclusions are drawn:

- a) A refurbishment and expansion of the existing Wastewater Treatment Works is necessary to cater for the wastewater flows and increased effluent standards over the coming years.
- b) This expansion should take place on a phased basis in accordance with development pressures up to the year 2029.
- c) The effluent quality standards from the selected treatment process must meet the requirements of all current statutory environmental regulations applying to discharges to fresh waters.
- d) The existing outfall pipe to the Little Brosna River has adequate capacity to cater for the projected flows.
- e) An Environmental Impact Assessment will be required for the expansion of the Wastewater Treatment Works.
- f) The option of Design, Build and Operate for 20 years has been identified as a suitable Procurement Strategy for the Wastewater Treatment Works Contract.
- g) A mathematical model of the Wastewater Collection System has indicated that the network is operating reasonably well in times of dry weather.
- h) During wet weather and storm conditions many sections of the network are surcharged leading to localised flooding and unnecessary discharges at overflows.
- i) Relief sewers and balancing capacity need to be constructed in order to insure the system can cater for future flows.
- j) Extensions to the collection network shall be required to cater for area zoned for future development.
- k) A new pump station and detention tank at Crinkill need to be constructed to cater for waste water flows and increased effluent standards.
- l) Refurbishment works are necessary to the Riverstown Pump Stations to cater for overflow facilities and the prevention of surface water accessing the pump stations.
- m) A CCTV and SUS survey of the existing pipeline system, manholes and pumping stations has highlighted areas which shall require repair and remediation.

- n) All proposed works to the Wastewater Collection System should be procured using the Traditional Method.

12.2 Recommendations

In consideration of the above, we recommend the following:

- a) Expansion of the Wastewater Treatment Works and the Wastewater Network should proceed on a phased basis to 2029. Phase I to a population equivalent of 15,000 p.e. and at a total cost of €8,390,810 should proceed.
- b) The proposed extension to the Wastewater Treatment Works should be constructed on lands adjacent to the existing works inside the existing site boundary.
- c) The Wastewater Treatment Works and Stormtank should be procured under the PPP model and consideration should be given to its inclusion in a bundled contract.
- d) An Environmental Impact Assessment is required to be prepared for the expansion to the Wastewater Treatment Works.
- e) Improvements to the existing Wastewater Collection System, including repair and rehabilitation to pipelines should proceed.
- f) Construction of Crinkill Pump Station 1 and remedial works to Pump Station 2 should proceed.
- g) Refurbishment works including overflows to the Riverstown Pump Stations should proceed.
- h) Extensions to the existing Wastewater Collection System should proceed in parallel with new development.
- i) Detailed topographical and site investigation surveys of the catchment will be necessary to produce Contract Documents.
- j) Generally the works for the Birr Main Drainage Scheme as set out in this report should proceed in order to allow the planned progressive development of the town.

We trust this report meets your current requirements. We are available at any stage to discuss any aspect of the report and in the meantime we await your further instructions.

APPENDIX A

Description of Sewer Network

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A Sewer Lines South of Birr Town Centre and the Camcor River

Sewer 5 Line – South of Camcor River

The "Sewer 5 Line" is a Major Collection Line, varying in diameters from 300mm to 900mm, part of this line is a box culvert. It commences on the northern side of the Camcor River on the east side of Birr Town. It siphons across the Camcor River and from there runs parallel with the Camcor River on its south side. The sewer line continues along the South side of the River, crosses the Roscrea Road and then crosses over the River to the north side, and continues to the junction of Mill Street and Brendan Street. From there it runs along Brendan Street and Castle Street. It continues along William Street, Rosse Row and along Model School Road. It continues from there until it joins up with the Pound Street Sewer Lines and from there it joins up with the sewer line from Eden Road. The "Sewer 5 Line", now a manifold line, continues to flow to the Wastewater Treatment Works located on the north / west side of Birr Town.

Storm Overflow

A storm overflow exists on the "Sewer 5 Line". It is located west of Oxmantown Bridge adjacent on the West side of the Roscrea Road. A 600mm diameter overflow pipe facilitates discharges from this manhole to the Camcor River.

Siphon Crossings

There are two siphon crossings of the Camcor River by this sewer line as follows:

- A siphon consisting of two number 300mm diameter pipes cross the river, some 350 metres on the northern side of Kinnitty Road near Newbridge Bridge.
- A siphon consisting of three pipes, 150mm, 225mm, and 300mm in diameter cross the River on the west side of Oxmantown Bridge, adjacent to the Roscrea Road.

The "**Sewer 5 Line**" is also the main collecting line for the following sewer lines described hereunder:-

Sewer 12 Pipeline - Flowing to Sewer 5 Line

This sewer line is 225mm in diameter, it commences near Syngefield and flows along Kinnitty Road.

Sewer 7 Pipeline - Flowing to Sewer 5 Line

This sewer line 150mm and 225mm in diameter commences at the Residential Housing Development near the Birr Town Water Treatment Works and flows to a manhole 5 located on the Roscrea Road. **Crinkill Pump Station** located in Crinkill Village pumps into this manhole 7 on the Roscrea Road, and from there flows through the "Sewer 7 Line" until it meets up with the "Sewer 5 Line".

Sewer 6 Pipeline - Flowing to Sewer 5 Line

This sewer line is 225mm in diameter and commences at Westgate Residential Housing. It continues along the Portumna / Nenagh Road south of Orchard Lane before it crosses over to a manhole located at the Junction of Orchard Lane and Railway Road, from there the sewer flows to the "Sewer 7 Line" on Railway Road.

Riverstown Pump Station, owned and operated by North Tipperary County Council, pumps into the "Sewer 6 Line" on the Portumna / Nenagh Road.

Sewer I Pipeline - Flowing to Sewer 5 Line

This sewer line 225mm in diameter commence just South of Orchard Lane and runs along Moorpark Street until it crosses under the Camcor River and joins up with the "Sewer 5 Line" in Castle Street near Market Square.

Storm Overflow Manhole

A storm overflow manhole exists on the "Sewer I Line". It is located on the south side of the bridge on Bridge Street. An 80mm dia. overflow pipe exists from this manhole to the Camcor River.

Siphon Crossing

A siphon consisting of one pipe 375mm in diameter cross the river on the Sewer I Pipeline near the bridge on Bridge Street.

Sewer J Pipeline

This sewer line 225mm in diameter joins up with the "Sewer I Line" at Moorpark Street / High Street Junction.

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B Birr Town Centre and North of the Camcor River***Sewer M Pipeline***

This sewer line 150mm and 225 mm in diameter runs along Chapel Lane and joins up with the "Sewer 5 Line" at Main Street / Mill Street Junction.

Sewer N Pipeline

This sewer line is 225mm in diameter, it runs South along Mill Street and joins up with the "Sewer M Line".

Sewer 13 Pipeline

This sewer line is 225mm in diameter, it commences at Burke's Hill and it is laid through fields where it discharges into the "Sewer 5 Line" north of the Camcor River.

Sewer A Culvert Line

This sewer culvert is a Major Collection Line and is of the box culvert type, it varies in size from 300mm x 450mm at Emmet Street to 1240mm x 900mm at Main Street. The culvert commences at Emmet Street and continues along O'Connell Street via Emmet Square and along Main Street until it meets up with the 900mm diameter "Sewer 5 Line" located in Market Square.

Sewer 14 and O Pipelines

The Sewer 14 Line is 225mm to 450mm in diameter and the "Sewer O Line" is 225mm and 300mm diameter. These sewer lines run along Johns Place and Connaught Street and both of these lines discharge into sewer A culvert line at the Cross Roads of O'Connell Street, Main Street, Church Street and Connaught Street.

The "Sewer O Line" has a sewer line connection from the Residential Housing near Bengal Lodge. This sewer line is 150mm and 225 mm in diameter and discharges into a manhole located East of John Street.

Sewer U Pipeline

This sewer line is 225mm in diameter it commences at The Green and flows via Emmet Square to the "Sewer A Line".

Sewer T Pipeline

This sewer line is 225mm in diameter, it commences at The Green and flows along Cornmarket Street and Church Street before discharging into the "Sewer A Line".

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C Tullamore Road Pump Station

The Tullamore Road Pump Station located North of Birr Town opposite the LIDL Supermarket is the Main Collection Station for the combined sewer flows from the Frankford Road, Burkes Hill, Meadon Court and Melsop Street. The Rising Main from the Pump Station discharges into a manhole located in Melsop Street that gravitates along the "Sewer C Line" until it meets up with the "Sewer 17 Line" in Pound Street.

There are 2 submersible pumps that operate in the Wet Well, located under the Pump Station floor. Pump No. 2 is not in service as there are zero hours shown on the meter, this would indicate that there is no standby / assist in operation. One number pipe enters the well and an overflow exists to the adjacent stream. Inflow over several hours of dry weather was constant at approximately 0.6 l/s. The Security Fence and Pump Station are in a poor condition.

The maximum Pumping Rate at this station is 9.5 l/s.

Sewer e Pipeline

This sewer line is 150mm and 225mm in diameter, it commences on the Frankford Road and flows towards Burkes Hill. The sewer then crosses the fields to locate on the Tullamore Road and continues to flow to the Tullamore Road Pump Station.

Sewer f, g, j, k and l Pipelines

These sewer lines are 150mm to 225mm in diameter, all of these sewer lines are laid within Burkes Hill Residential Housing Roads and flows to the "Sewer e Line".

Sewer m, and n Pipelines

These sewer lines are 150mm and 225mm in diameter, the "Sewer m Line" commences at Melsop Street and flows to the "Sewer e Line". The "Sewer n Line" flows into the "Sewer m Line".

D North of Birr Town Centre.***Sewer 17 Culvert and Sewer 16 Pipelines***

The "Sewer 17 Culvert" and "Sewer 16 pipeline" are Major Collecting Lines. The "Sewer 17 Culvert Line" is approximately 560mm x 450mm and the "Sewer 16 Pipeline" is 525mm in diameter. Both of these sewer lines are located in Pound Street and join together approximately midway along the street. The sewer flows from these lines into the "Sewer 5 Line" located at the Junction of Eden Road and Pound Street.

Sewer F Pipeline

This sewer line is 225mm in diameter, it runs along the rear of the Residential Housing North of Pound Street and flows to a manhole on the "Sewer 5 Line" located in Pound Street.

Sewer c Pipeline

This sewer line is 150mm and 225mm in diameter, it commences at the Residential Housing off Melsop Street. It runs along Melsop Street to the "Sewer 17 Culvert Line" at the Junction of Pound Street and Melsop Street.

Sewer a Pipeline

This line is 225mm in diameter, it commences at Burkes Hill and flows through the Crescent to a manhole located at the junction of Townsend Street, Melsop Street and Pound Street. It flows from here via a 525mm diameter line to the "Sewer 16 Line", located at Pound Street.

Sewer b Pipeline

This Sewer Line is 150mm to 225mm in diameter, it commences in Glebe Street and flows along New Road East located at the junction of Townsend Street, Melsop Street, and Pound Street.

Sewer N Pipeline and Sewer a Culvert

The "Sewer N Line" is 225mm in diameter, it commences in Oxmantown Mall and flows to the "Sewer a Culvert Line" located in Emmet Street, Townsend Street. It varies in size from 400mm x 450mm to 660mm x 500mm.

Sewer 17 Pipeline

This sewer line is 225mm in diameter, it commences in the Residential Housing North of Pound Street and flows to the "Sewer 17 Culvert Line" located in Pound Street.

Sewer 16 Pipeline

This sewer line is 150mm and 225mm in diameter, it commences in the Residential Housing at the end of Fairview Road located South of Pound Street, it flows to the "Sewer 16 Line" located in Pound Street.

Sewer 15 Pipeline

This sewer line is 225mm in diameter, it commences in the Residential Housing North of Pound Street and flows to the "Sewer 16 Line" in Pound Street.

Sewer G and H Pipeline

These sewer lines are 150mm and 225mm in diameter, they commence at the Bulfin Park Residential Housing area. The sewer flows along Model School Road to the "Sewer 5 Line" located in Eden Road / Model School Road.

The "Sewer H Line" flows to manhole G.2 located on the "Sewer G Line".

Sewer B Pipeline

This sewer line is a, Main Collection Pipeline, it is 150mm and 225mm in diameter. It commences in the Residential Housing area adjacent to the Banagher Road. This sewer line flows to the "Sewer 5 Line" at the Junction of Eden Road / Croghan Road.

Sewer C and D Pipeline

These sewer lines are 225mm in diameter, they commence in the Presentation Place area adjacent to the Eden Road. The Sewer from these lines flow to the "Sewer B Line" on Eden Road.

Sewer 5 Pipeline

The Major Collection Sewers (A culvert line, Tullamore Road Pumping Station 17 Culvert 16 Pipeline and B Pipeline) from Model School Road, Pound Street and Eden Road merges at the Sewer 5 Pipeline and flow along Croghan Road in a 900mm diameter Pipeline to the Storm Overflow Chamber located adjacent to the Wastewater Treatment Works Access Road. The sewer continues in a 525 mm

diameter pipeline from the Storm Overflow Chamber the North / East side of the Wastewater Treatment Works Site and from there through the Wastewater Treatment System.

E Storm Overflow Chamber

This storm overflow line is 375mm in diameter, it is located on the Access Road to the Wastewater Treatment Works and discharges into the Little Brosna River.

F Storm A Sewer Line

The storm sewer is 525mm in diameter, it commences at Pound Street and it flows along Eden Road and Croghan Road until it discharges into the Little Brosna River at Croghan Bridge.

Storm S Sewer Line

This storm line is 750mm in diameter, it runs parallel to the Wastewater Treatment Works Access Road and discharges to the Little Brosna River.

The Survey of this line was not extended further then S.I. manhole located near the Storm Overflow Chamber.

G Crinkill Sewer Network System

Crinkill lies South of Birr Town on the Eastern Side of the Roscrea Road. The Sewer System is served mainly by gravity feed to Crinkill Pump Station N^o. 1. The Gravity Sewer consists of 150mm, 225mm and 300mm diameter pipes. Part of Ely Place is served by a 225mm diameter pipeline and discharges to Crinkill Pump Station N^o. 2. From Pump Station N^o. 2 it is pumped by rising main up to a gravity system and from there drains to Crinkill Pump Station N^o. 1. The Pump Station and gravity system are located on the Northern Side of Ely Place.

Pump Station N^o. 1

This Pump Station located, in the compound of the old Sewage Treatment Works, on the South Side Bank of the Rock River and some sixty metres on the Eastern Side of the Roscrea Road. The existing sludge hopper has been utilised as a Wet Well which house the 2 submersible pumps, the pumps operate duty / standby.

There is an overflow from the Wet Well discharging to an open topped soakway and evidence shows that it operates. The pump controls are in the Pump Station, the Control Panel indicates the presence of a third pump but there is no evidence

of this on the site. The cover to the Wet Well is of the open mesh grid type, there are signs of ragging on this grid. There is visible infiltration into the Wet Well from around the circumference of the Rising Main Pipe and also from the ducting. The Flow Control Switch for Pump N^o 1 was not working at the time of the survey. The hours run meter for Pump N^o 2 appeared to show that the Pump was running but there was no draw down or change in the apparent rate of fill. It was noted that the duty "on" and the duty "off" switch positions were set at 40mm apart, this only allowed for the pumps to discharge c100 litres in each cycle, the pumps starting every 70 seconds and running for 18 seconds.

The Pump Station / Sump requires attention as does the Site in general.

The maximum Pumping Rate for this station is 7.2 l/s.

The sewer from Crinkill Pump Station No. 1 is pumped by rising main to the Sewer 7 Pipeline on the Roscrea Road South of Birr Town.

Part of Crinkill is served by surface water pipelines that discharges to the Rock River. The Rock River is located North of Crinkill Pump Station No. 1.

H Riverstown Sewer Network System

Riverstown is situated on either side of the Little Brosna River, south of Birr Town, near the Nenagh / Portumna Road Junction. The sewer is served by a two pronged system i.e. the Portumna Road and the Nenagh Road. The gravity sewer pipeline is mainly 225mm in diameter with some small quantity of 100mm diameter pipes, connecting into the 225 diameter pipelines. Part of the housing along the Nenagh Road is served by a gravity sewer pipeline 225mm in diameter and discharges into Riverstown Pump Station N^o 2, located at Toberkeen Birr Bridge, on the north / west side of the contributory stream, to the Little Brosna River. From Pump Station N^o 2 the Foul Sewer is pumped by Rising Main to the gravity system in Riverstown which in turn gravitates to Pumping Station No. 1.

Pump Station N^o 1

This Pump Station was recently constructed and is situated in Riverstown Village on the South Side Bank of the Little Brosna River. The existing Wet Well contains 2 submersible pumps. A 225mm diameter pipe and a 100mm diameter pipe also enter the Wet Well. There is no overflow from the Well. A Milltronics Hydroranger is installed but it has not been commissioned and is not connected.

The pumps operate on single duty only and are controlled by two float switches. There is no standby or assist function. An automatic gas monitoring system is also installed, the sensor is located at the side of the controls kiosk with the sample tube sucking gas from just under the cover of the Wet Well.

All covers to the Wet Well are well constructed but some have no handles or lifting eyes. Pipes entering the valve chamber are not sealed, as a result when the level in the Wet Well rises above the Rising Main Pipe leaving the Wet Well, sewage enters the valve chamber. As the pumps draw down the Wet Well, they also draw down the sewage in the valve chamber leaving the valve chamber heavily soiled. There is also other pipework within the valve chamber that is incomplete this is believed to be part of an overpumping system.

The maximum Pumping Rate at this station is 9.8 l/s.

The sewer from the Riverstown Pump Station N^o. 1 is pumped by rising main to the Sewer 6 Pipeline on the Portumna / Nenagh Road.

Some areas of the Portumna Road are served by surface water pipelines and discharges to a contributory stream to the Little Brosna River.

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1. Tullamore Road Pump Station

The following information was recorded / surveyed on 1st June 2004.

General	
i. Number of Pumps	2 N ^o .
ii Pump Location	Wet Well
iii Maximum Pump Rate	9.5 l/s
iv Screens Provided	No
v Overflow Provided	No
vi Evidence of Pollution	No
vii Rising Main Diameter	100 mm
viii Surge Protection Provided	No
ix Wet Well Area	4.3 m ²
x Test Volume	1.29 m ³
xi Pipe Inlet Diameter	225 mm
xii Generator Provided	No
Site Details	
Surroundings	Commercial
Distance from Pump Station to nearest Inhabited Building	100m
Vehicle Access	None
Fencing	Wire
Gates	Steel
Non-Operational Areas	Grassed

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2. Crinkill Pump Station

The following information was recorded / surveyed on 1st June 2004.

General	
i. Number of Pumps	2 N ^o .
ii Pump Location	Wet Well
iii Maximum Pump Rate	7.2 l/s
iv Screens Provided	No
v Overflow Provided	Yes
vi Evidence of Pollution	Yes
vii Rising Main Diameter	100mm
viii Rising Main Type	Cast Iron
ix Surge Protection Provided	No
x Wet Well Area (existing Sludge Hopper)	15.68 m ² Reducing to 2.56 m ²
xi Test Volume	1.586 m ³
xii Pipe Inlet Diameter	150 mm & 225 mm
xiii Generator Provided	No
Site Details	
Surroundings	Commercial
Distance from Pump Station to nearest Inhabited Building	500m
Vehicle Access	Yes
Fencing	Chain Link
Gates	Steel
Non-Operational Areas	Shingle / Grass

3. Riverstown Pump Station

The following information was recorded / surveyed on 2nd June 2004.

General	
i. Number of Pumps	2 N ^o .
ii Pump Location	Wet Well
iii Maximum Pump Rate	9.81/3
iv Screens Provided	No
v Overflow Provided	No
vi Evidence of Pollution	-
vii Rising Main Diameter	100 mm
vii Surge Protection Provided	No
ix Wet Well Area	2.09 m ²
x Test Volume	0.626 m ³
xi Pipe Inlet Diameter	225 mm
xii Generator Provided	No
Site Details	
Surroundings	Urban
Distance from Pump Station to nearest Inhabited Building	100 m
Vehicle Access	Yes
Fencing	Timber
Gates	Steel
Non-Operational Areas	Shingle

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APPENDIX B

Letter from Shannon Regional Fisheries Board

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APPENDIX C

Birr Sewerage Improvement Scheme Land Development At Syngefield Archaeological Impact Assessment Report

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