Site Notice

APPLICATION TO THE ENVIRONMENTAL PROTECTION AGENCY FOR A WASTE WATER DISCHARGE LICENCE

Pursuant to Regulation 9 of the Waste Water Discharge (Authorisation) Regulations, 2007 (S.I. No. 684 of 2007), Donegal County Council, County House, Lifford, Co. Donegal intends to apply to the Environmental Protection Agency for a licence for:

An existing discharge of waste water effluent from their Secondary Treatment Works at Kilconnell, Kilmacrennan, County Donegal (National Grid Ref. 214140E 420498N), discharging into the receiving waters of the River Lurgy at (National Grid Ref. 214155E, 420531N).

A copy of the following documents shall, as soon as is practicable after receipt by the Agency, be available for inspection or purchase at the headquarters of the Environmental Protection Agency, P.O. Box 3000, Johnstown Castle Estate, Co. Wexford and at Donegal County Council, County House, Lifford, Co. Donegal.

(i) the application for a waste water discharge licence
(ii) such further information relating to the application as may be furnished to the Agency in the course of the Agency's consideration of the application.

Submissions in relation to the application may be made to the Environmental Protection Agency at is headquarters at P.O. Box 3000, Johnstown Castle Estate, Co. Wexford.

	Drawing No	Attachment No	Description	Date	Check By
	KMC/LA/B8(i)	Attachment B.8	Site Notice	28/10/09	Donal Casey

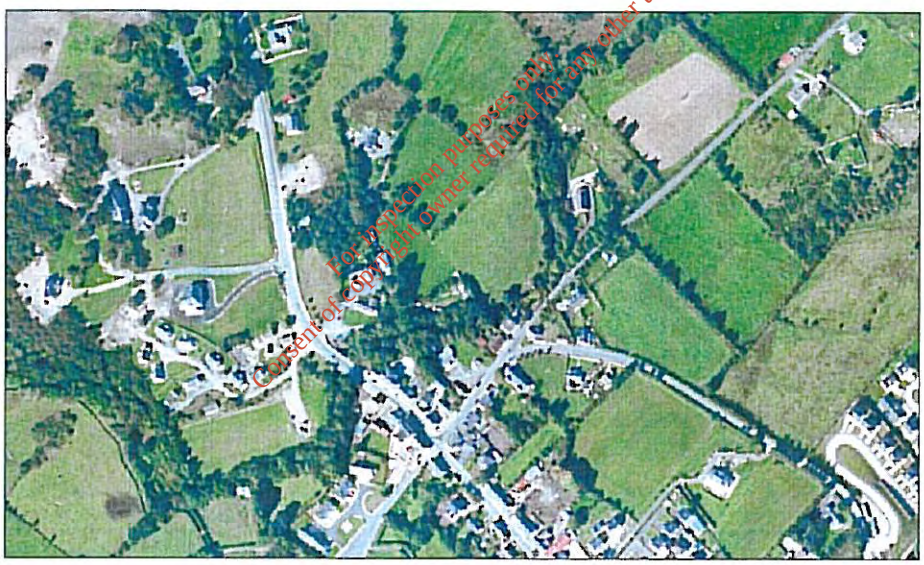
Preliminary Report on the Redevelopment of Kilmacrennan WWTP

	Text No	Attachment No	Description	Date	Check By
	KMC/LA/G1	Attachment G.1	Preliminary Report	07/10/09	Donal Casey

COMHAIRLE CHONTAE DHÚN NA NGALL
DONEGAL COUNTY COUNCIL

WATER & ENVIRONMENT
COUNTY HOUSE
LIFFORD

REDEVELOPMENT OF KILMACRENNAN WWTP



PRELIMINARY REPORT

JANUARY 2009
S249/KILMACRENNAN

PREPARED BY: STEPHEN GLACKIN

CONTENTS

APPENDICES

1.0 INTRODUCTION

The following report sets out to establish the most appropriate treatment process with regards to the redevelopment of Kilmacrennan's Wastewater Treatment Plant (WwTP).

The report looks at the existing and projected population equivalents, the existing treatment process, the assimilative capacity (with regards to both BOD and Phosphate) at the outfall of the works and two treatment alternatives available for the redevelopment of the works.

Finally the report identifies the preferred option with regards to the redevelopment of the WwTP at Kilmacrennan, giving a cost estimate of these works.

2.0 EXISTING DEVELOPMENT

From looking at the census figures (Appendix B) with regards to Kilmacrennan town it was noted that there has been an increase in population of 363 persons in 1996 to a total of 575 persons in 2006, which represents an annual increase in population of 4.7% over the last 10years.

Town	Year	Persons	Increase in Population
Kilmacrennan	1996	363	Na
	2002	430	18.5%
	2006	575	33.7%

Table 1:Information obtained from Central Statistic Office Censuses

A house count carried out on the 6th February 2008 (including developments under construction) found 338 housing units in Kilmacrennan. This gives a residential population equivalent of 1014 pe based on 3 persons per house. This study also estimated that businesses contribute a population equivalent of 177pe to the WwTP.

3.0 FUTURE DEVELOPMENT

The County Development Plan 2006-2012 has identified Kilmacrennan as providing a strong urban structure at the sub-gateway level which is essential not only in consolidating the Letterkenny-Derry gateway but also exists to filter and funnel the benefits of the gateway to all parts of the County. One of the measures indicated in the Development Plan is the upgrading of the infrastructure to facilitate the growth of such centres.

Assuming a population growth of 1.2% per annum was to occur over the next twenty years as projected in the CSO's " Regional Population Projections 2011-2026" for Border areas (under the M2F1 Transitional Scenario), it may be assumed that the residential population equivalent of Kilmacrennan will be in the region of 1303pe in the year 2029,based on its current residential population equivalent of 1014pe (Appendix B).

Allowing for future growth in commercial development of 60pe a total population equivalent of 1540 would be predicted for the year 2029.

4.0 Existing Infrastructure/Treatment Facilities

The existing works comprising inlet flume with screening facility, a primary sedimentation tank, twin rotating biological contactors, a humus secondary settlement tank and finally the outlet system.

The inlet channel and the screening facility are in reasonable condition however the screening unit is only partially effective, as screenings have passed through the flume to the primary settlement tank.

The primary settlement tank is a twin chamber Imhoff tank with plan dimensions of approximately 4.5 x 4.5m. From preliminary calculations the existing tank is capable of treating a population equivalent of approx 500. The existing tank is in a poor condition with cracked and spalling concrete walls.

The flow is then split between two Rotating Biological Contactors, manufactured by Butler Manufacturing Services Ltd and installed in 1988. The design Population Equivalent was 400 with a design life of 20 years. All rotating drums appeared in reasonable condition and in working order.

The secondary sedimentation is provided by a, horizontal flow, humus tank with twin chambers. The capacity of the humus tank is estimated at approximately 500 Population Equivalent. The condition of the tank is good and is thought to be only recently constructed (approximately 1987).

The outlet from the humus tank discharges to a junction manhole where it joins the storm overflow outlet. The effluent then discharges to the River Lurgy via a 12" ductile iron pipe.

A survey (Appendix C –Drawing No.S249/WwTP) of the existing works was carried out on the 10th July 2008, illustrating the existing treatment process used.

5.0 Water Quality & Assimilative Capacity

The River Lurgy is subject to the application of a number of pieces of legislation in addition to the Water Framework Directive (2000/60/EC). The river has been classified as a salmonid river under S.I. No. 293/1988: European Communities (Quality of Salmonid Waters) Regulations. These regulations place certain definitive standards upon river water quality, including Biochemical Oxygen Demand (BOD), Suspended Solids (SS) and Nitrites (NO_2). In particular the levels for these parameters are 5:25:0.05mg/l BOD: SS: NO_2.

The Q_{95} (Appendix D) of the river at the existing outfall point is estimated at **0.0613 m^3/s**, which is somewhat higher than the figure given by the EPA of **0.01m^3/s** (Appendix E -EPA,"Register of hydrometric stations in Ireland 2007"), which appears to be a very low value given the catchment area (Appendix A) involved.

Using the following formula the Q95 value is used to calculate the Waste Assimilative Capacity (WAC) of the River Lurgy at the outfall of the existing treatment works:

WAC=(C_{max} -C_{back}) x Q_{95} x (86.4) kg BOD per day

Where C_{max}= Maximum permissible BOD Concentration (taken as 2.6mg/ll)
C_{back} = BOD concentration in river prior to discharge (taken as 1mg/l)
Q_{95} = 95 percentile flow in m^3/s
86.4 = conversion factor

A Waste Assimilative Value (WAC) of **8.47kg BOD per day** was calculated based on the assumed maximum permissible BOD concentration of the River.

It was also established that for a projected population equivalent of 1540pe at the Urban Waste Water Treatment Directive 91/271/EEC of 25 mg/l the actual BOD discharge would amount to **8.66kg BOD per day**, which is slightly higher than the WAC value obtained.

The River Lurgy has also been identified as being subject to the Phosphorous Regulations. These regulations give a target value of 0.03mg P/l Molybdate Reactive Phosphorous (MRP) downstream of the works. The following formula was used in order to establish the permissible phosphate discharge into the River Lurgy from the proposed treatment works:

Downstream P=$\frac{\text{(Upstream flow xUpstream P)+(Discharge flow x Discharge P)}}{\text{Upstream flows +Discharge flow}}$

Where

Downstream P =0.03mg P/l as detailed in S.I. No. 258/1998(Water Quality Standard for Phosphorous)
Upstream Flow=95 percentile flow in m^3/d
Upstream P=Orthophosphates result (MRP-Molybdate Reactive Phosphate)
Discharge Flow= DWF m^3/d
Discharge P=Required Orthophosphate value to maintain Downstream P as detailed above.

It was established that for a projected population equivalent of 1540pe an Orthophosphate level of 0.37mg/l would be required to obtain a Downstream P of 0.03mg/l as detailed in S.I. No. 258/1998(Water Quality Standard for Phosphorous).

It has been noted that the EPA has classified the River Downstream of the works as having a Q value of 3, which shows that it is of a moderate ecological status. One of the goals set out in the Water Framework Directive (2000/60/EC) is that all waters of less than good status must at least be good status by no later than 2015, which would indicate that the EPA will be paying close attention to the standard of effluent discharged from these works.

6.0 Treatment Alternatives

In order to facilitate the existing and proposed development in Kilmacrennan, it is recommended that the WwTP be upgraded from its current 500pe (approx) capacity to a new 1540pe capacity WwTP.

Due to the existing site available to Donegal County Council and on the basis of no agreement being reached with regards to the purchase of lands adjacent to the works, two options were examined with regards to the most suitable treatment process available for the works.

Option 1 - 1540pe New Rotating Biological Contactors (RBC's) with Separate Settlement Tanks and Tertiary Treatment
(Appendix C-Drawing No.S249/WwTP 1)

Upgrade of the works using a new inlet channel, overflow weir, mechanical screening unit, 2 no. primary settlement tanks, 2 no. RBC units each with a design capacity of 770pe, 2no. final settlement tanks, a tertiary treatment tank (e.g. Upward flow clarifier), a sludge holding tank and a storm holding tank.

Option 2- 1540pe New Sequencing Batch Reactors (SBR's) with Tertiary Treatment (Appendix C-Drawing No.S249/WwTP 2)

Upgrade the works using a new inlet channel overflow weir, mechanical screening unit, a balancing tank, 2 no. SBR units each with a design capacity of 770pe, a tertiary treatment tank (e.g. Upward flow clarifier), sludge holding tank and a storm holding tank.

Option 2 offers the most economic use of available land although it requires a higher level of monitoring and more frequent process control to maintain the optimum level of effluent quality during diurnal and annual variations in flow and loading.

7.0 Cost Estimate for the Proposed Process

From looking at previously constructed/tendered WwTP works carried out by Donegal County Council a cost estimate (Appendix F) of €1,298,135.27 is anticipated for the construction of *Option 2*.

Summary of Costs

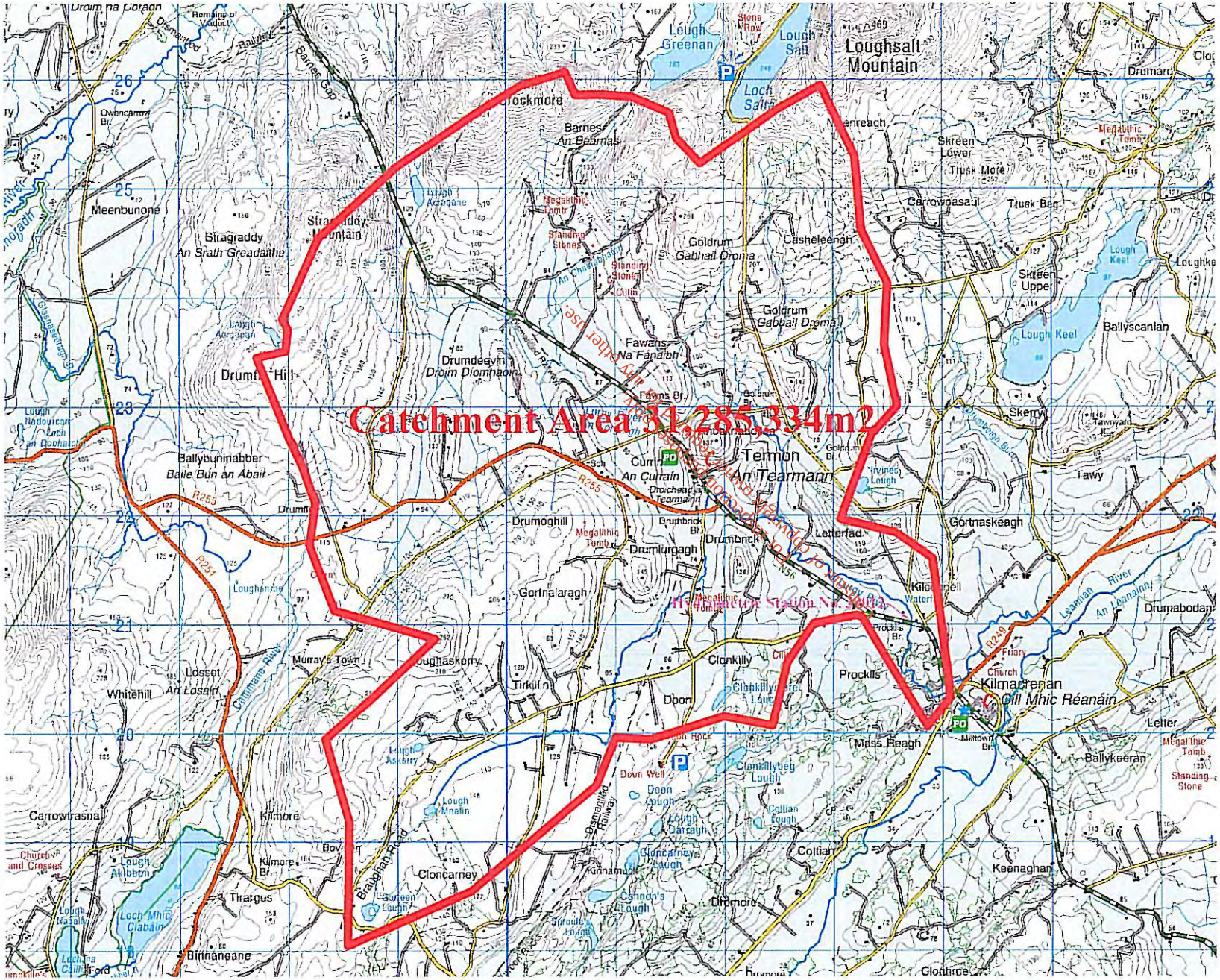
Non –Contract Costs

• Land	€70,000.00
• Site Supervision	€110,000.00
• Fees	€104,362.52
• Site Investigation	€19,295.00
• Archaeological	€11,000.00
• Ecological	€4,540.00
Sub-total (incl VAT)	**€319,197.52**

Contract Costs

• Civils	€286,549.10
• Mechanical & Electrical	€426,261.00
• Other	€149,690.12
Sub-total (excl VAT)	**€862,500.22**
Sub-total (incl VAT @ 13.5%)	**€978,937.75**
Total (incl VAT)	**€1,298,135.27**

APPENDIX A- CATCHMENT AREA



Comhairle Chontae Dhún na nGall
Donegal County Council
Water & Environment Section
Mr. Seamus Neely
Director of Services
County House
Lifford
Co. Donegal

Project: Kilmacrennan SS

Drawing Title: Catachment Area

Scale: Not to Scale

Drawn by: SG | Checked by: JMcE

Date: Jan 2009 | Date: Jan 2009

Job No.: S249/ | Drawing no.: 2 | Rev.: A

APPENDIX B- POPULATION

PE of existing development (incl. development under construction) 6th Feb 2009

Development Name	No. Built			PE per unit	PE		
Field's Court	9			3	27		
Lennon View	28			3	84		
Race course	22	1pe house occup.		3	66		
Milltown Court	15			3	45		
Abby Vale	66			3	198		
Opp Lennon View	12			3	36		
Rosemount	43			3	129		
Church View	17			3	51		
Co Co Housing A (opp timber yard)	8			3	24		
Hsg B Adj f/b pitch	9			3	27		
Co Co Housing C (Adj to lennon view)	41			3	123	Residential=	1014 pe
One off housing	68			3	204		
Churches	2	Worshipers	300	0.05	15		
Hall (Cofl)	1	people	20	0.17	3.33333		
Hall (General)	1	people	60	0.17	10		
Hairdresser	1	Staff	3	0.33	0.99		
School	1	pupils and staff	160	0.33	52.8		
Timber yard	1	Staff	5	0.33	1.65		
Doctor's surgery	1	Staff	4	0.33	1.32		
Garda Station	1	Staff	2	0.33	0.66		
Café (Hill Top)	1	Staff	4	0.33	1.32		
		Meals	20	0.25	5		
Post Office	1	Staff	2	0.33	0.66		
Shop (Kelly's)	1	Staff	2	0.33	0.66		
Pub & Restaurant (Millbridge)	1	Staff	6	0.33	1.98		
		Bar drinkers	30	0.17	5		
		Meals	20	0.25	5		
Shop & filling stn (Millbridge)	1	Staff	4	0.33	1.32		
Pub & Restaurant (Village Court)	1	Staff	6	0.33	1.98		
		Bar drinkers	30	0.17	5		
		Meals	20	0.25	5		
		rooms	13	3	39		
Pub (Angler's Haven)	1	Staff	4	0.33	1.32		
		Bar drinkers	30	0.17	5		
		Meals	5	0.25	1.25		
B&B (Angler's Haven)	1	rooms	4	3	12	Commercial=	177 pe
						Total=	1191 pe
PE of developments levied an SLI charge					347.98		

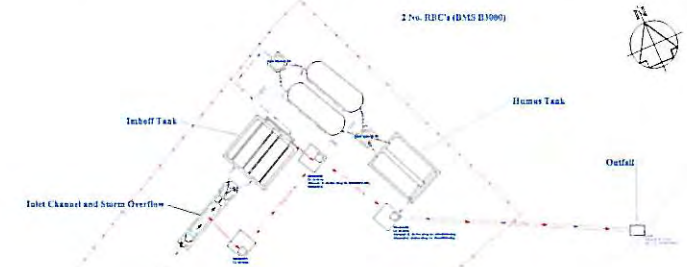
* **Note:** Figures obtained from Wastewater Treatment manual - Treatment systems for small communities, business, leisure centres and hotels - page 8 table 3

Kilmacrennan SS (Estimate of future population to be served based on house count values)

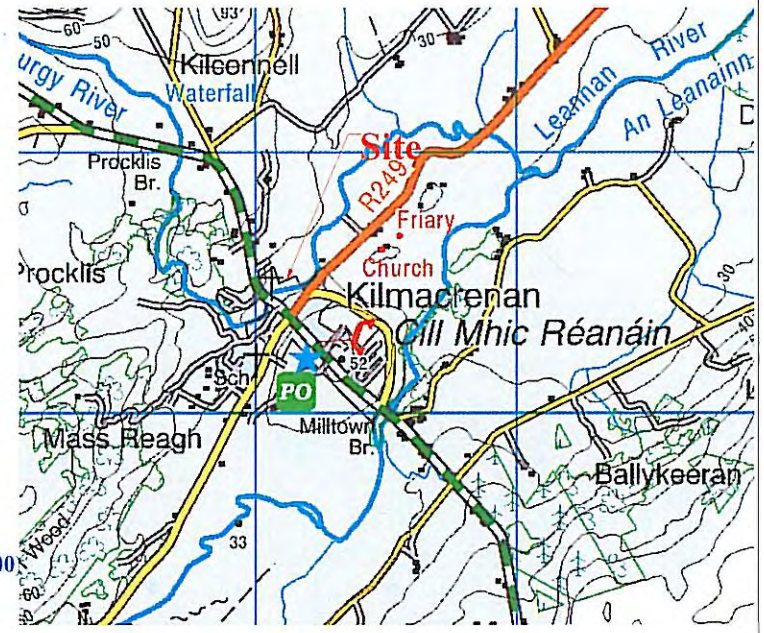
Year	Initial Population	Persons	Increase per Annum (%)
2009	1014	1014	1.2
2010		1026.168	
2011		1038.482	
2012		1050.944	
2013		1063.555	
2014		1076.318	
2015		1089.234	
2016		1102.304	
2017		1115.532	
2018		1128.918	
2019		1142.465	
2020		1156.175	
2021		1170.049	
2022		1184.09	
2023		1212.678	
2024		1227.231	
2025		1241.957	
2026		1256.861	
2027		1271.943	
2028		1287.206	
2029		1302.653	

1162 2016.

APPENDIX C- DRAWINGS



Existing Site Layout
Scale:-1:250



Site Location
Scale:-1:10,000

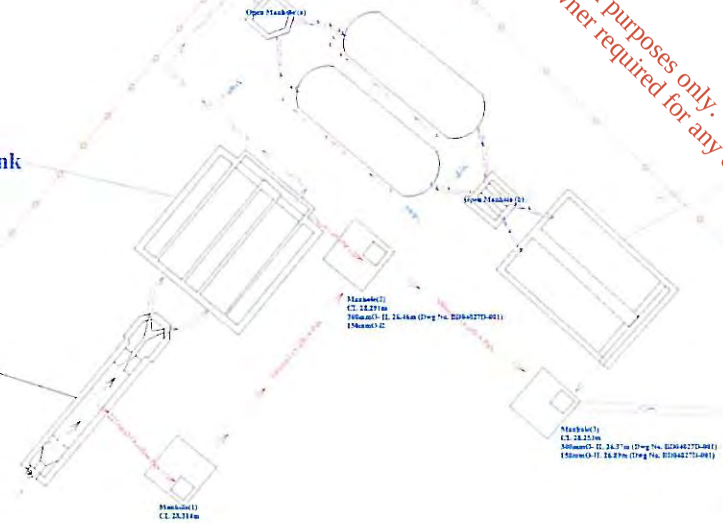
2 No. RBC's (BMS B3000)

Humus Tank

Imhoff Tank

Outfall

Channel and Storm Overflow

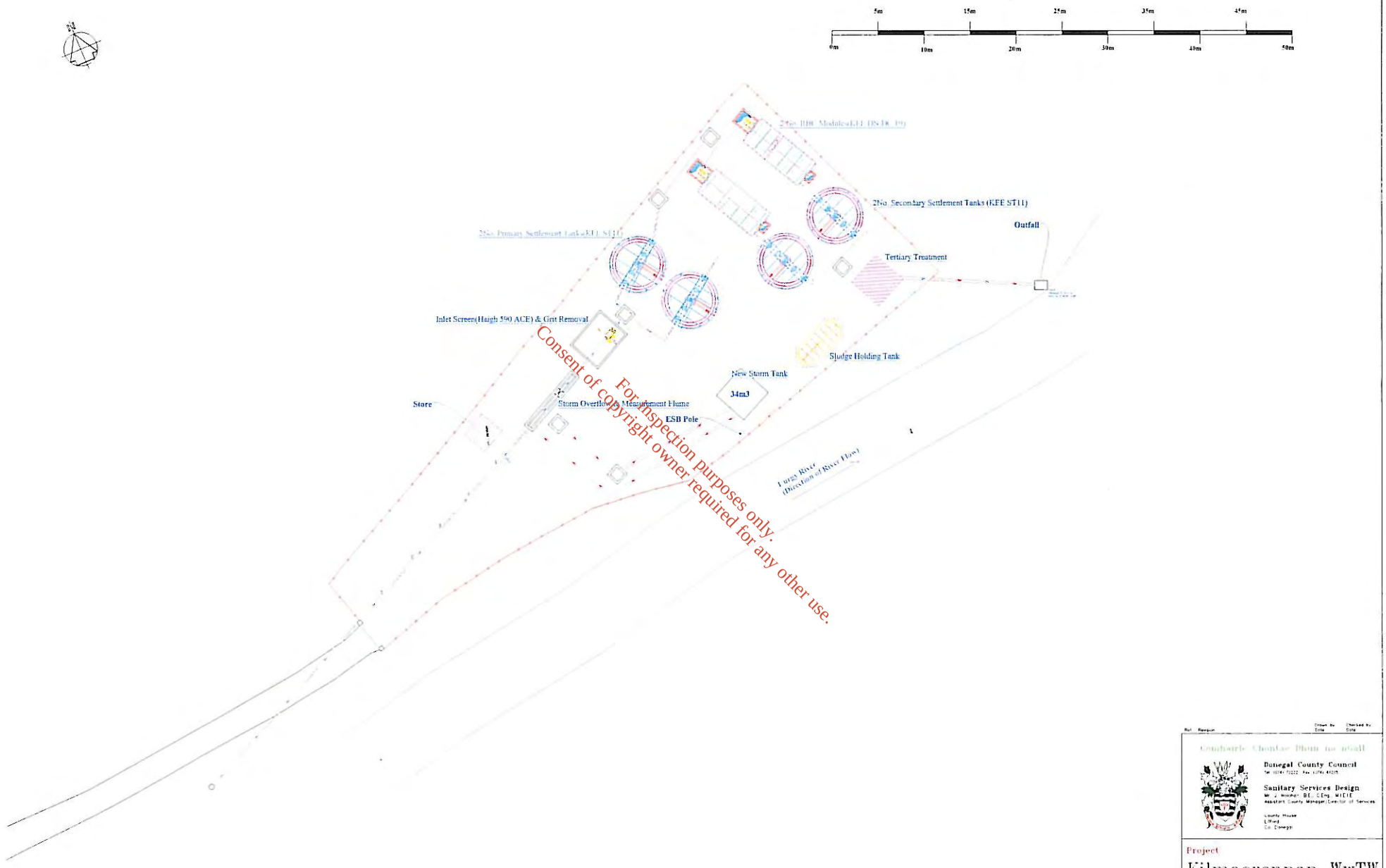


Treatment Process
Scale:-1:100

Donegal County Council
Sanitary Services Design

Project
Kilmacrennan WwTW
Drawing Title
Survey of Existing Site (10th July 08)

Scale	1:100,1:250,1:10000 @A1
Drawn by	SC
Checked by	JM.E
Date	10-07-08
Date	DATE
Job No.	5249
Drawing No.	5249/WwTP
Rev	A

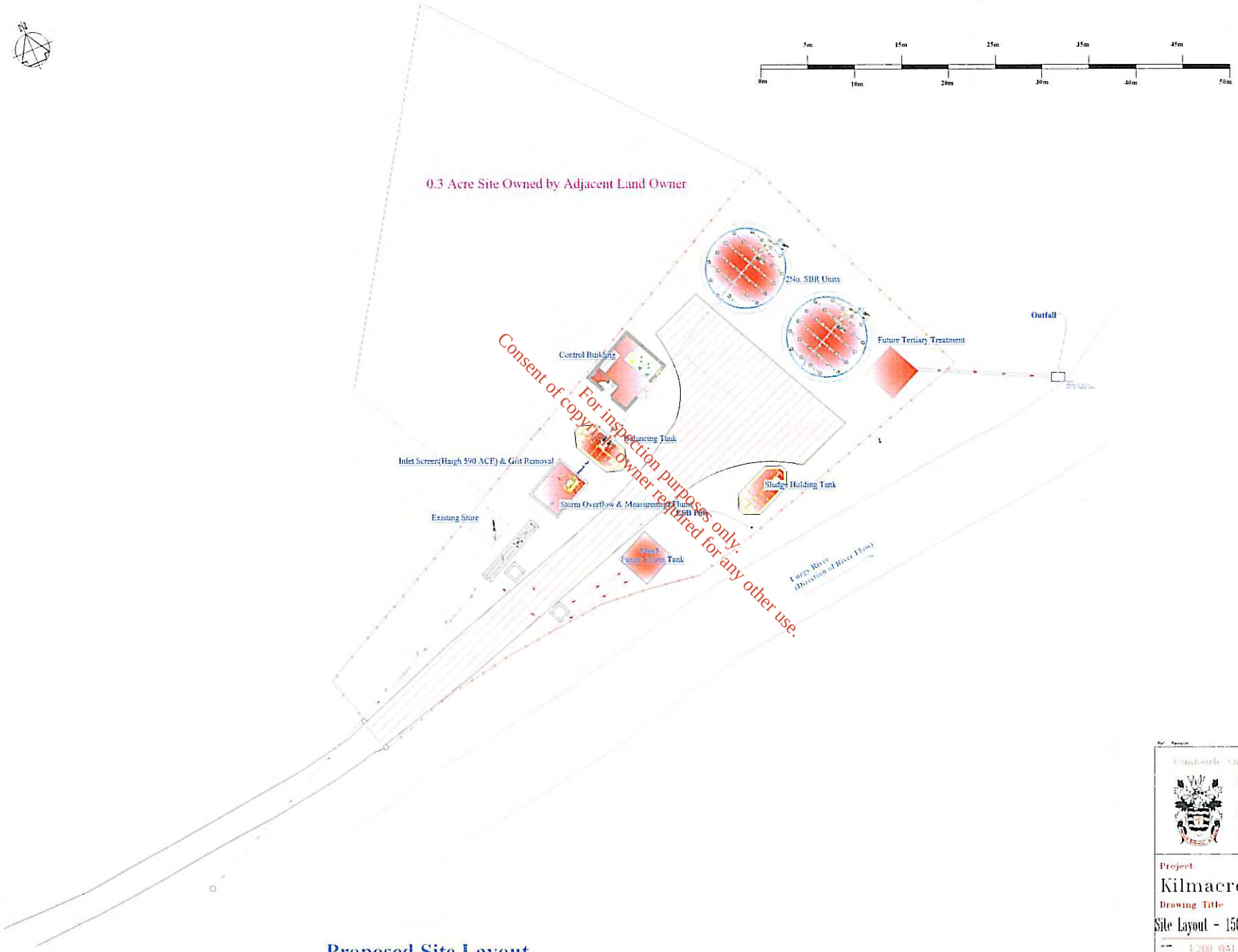


New Site Layout
Scale:-1:200

Comhairle Chontae Dhún na nGall
Donegal County Council
Sanitary Services Design
County House
Lifford
Co. Donegal

Project
Kilmacrennan WwTW
Drawing Title
Site Layout (Option 2)- 1500 PE RBC's

Scale	1:200 @A1		
Drawn by	SG	Checked by	JM-E
Date	08/12/2008	Issue	DATE
Job No.	5249	Drawing no.	5249/WwTP 1
		Rev	A



Proposed Site Layout
Scale:-1:200

Comhairle Chontae Dhún na nGall
Donegal County Council
Sanitary Services Design
Mr. J. Mahon, BE, C.Eng., MIEIE
Assistant County Manager/Director of Services
County House
Lifford
Co. Donegal

Project
Kilmacrennan WwTW
Drawing Title
Site Layout - 1500 PE SBR's

Scale	1:200 @A1		
Drawn By	SG	Checked By	JMcE
Date	11/12/2008	Date	DATE
Job No.	5249	Drawing No.	5249/WwTP 2
		Rev.	A

APPENDIX D- ASSIMILATIVE CAPACITY

Waste Assimilative Capacity

WAC=(Cmax -Cback) x Q95 x (86.4) kg BOD per day

Take maximum permissible River BOD(**Cmax**) = 2.6 mg/l

Take natural BOD of River(**Cback**)= 1 mg/l

WAC=(2.6 - 1)x 0.0613 X 86.4= 8.47 kg BOD per day

If the foul wastewater into the works for 1540Pe is 346.5 m^3/day and the BOD of the treated effluent is 25 mg/l then:

BOD discharged from plant =(346.5 x 25)/ 1000 = 8.66 kg/day

To achieve a BOD discharge of 8.47 kg/day the concentration of BOD in the treated effluent would have to be:

Allowable Concentration BOD=(8.47 X 1000)/ 346.5 = **24 mg/l**

Phosphate Assimilative Capacity

$$\text{DownStream P} = \frac{(\text{Upstream flow} \times \text{Upstream P}) + (\text{Discharge flow} \times \text{Discharge P})}{\text{Upstream flow} + \text{Discharge flow}}$$

Where

Downstream P = 0.03 mg/l as detailed in S.I. No. 258/1998(Water Quality Standard for Phosphorous)

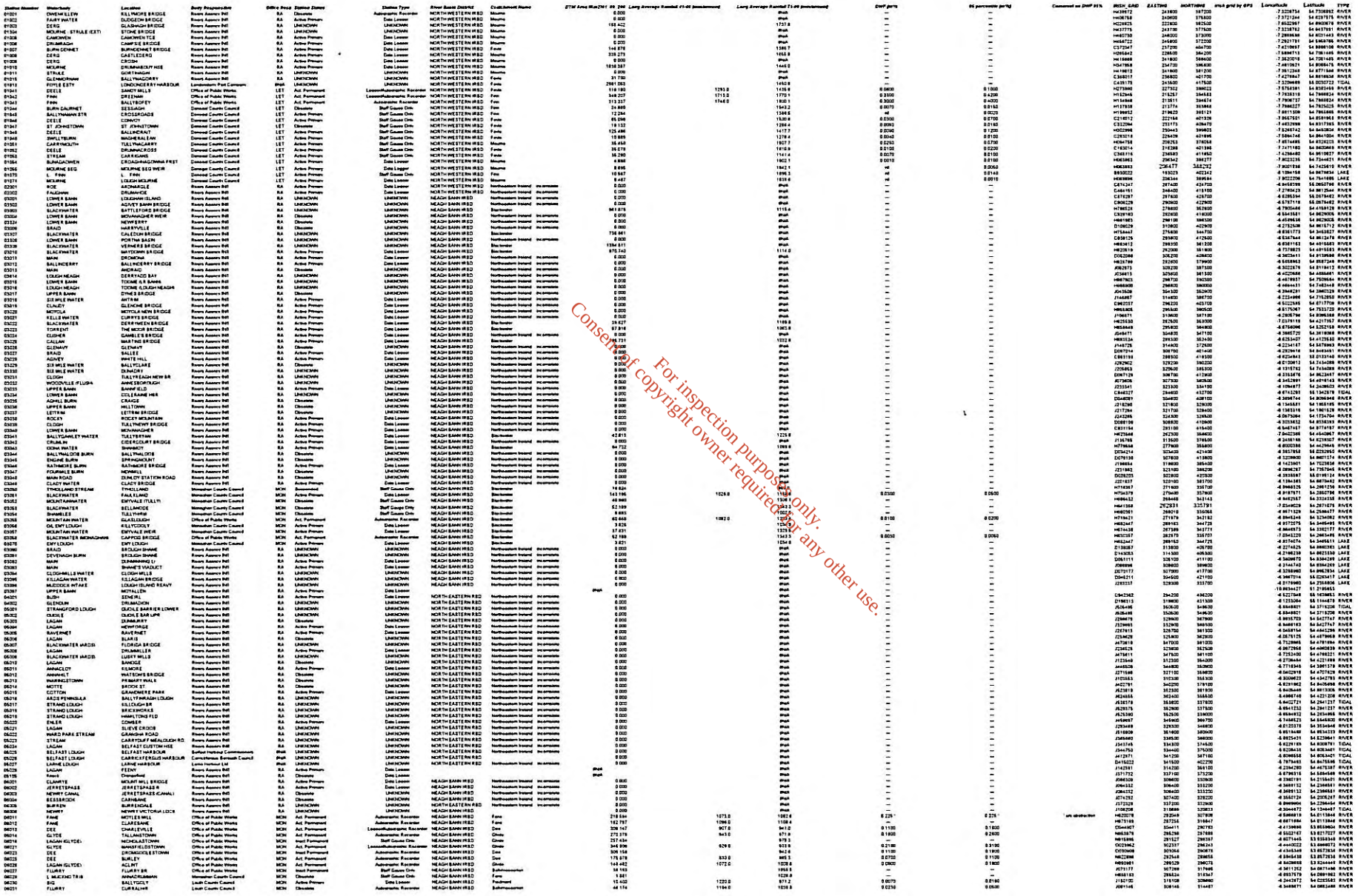
Upstream Flow(Q95) = 5297 m^3/day

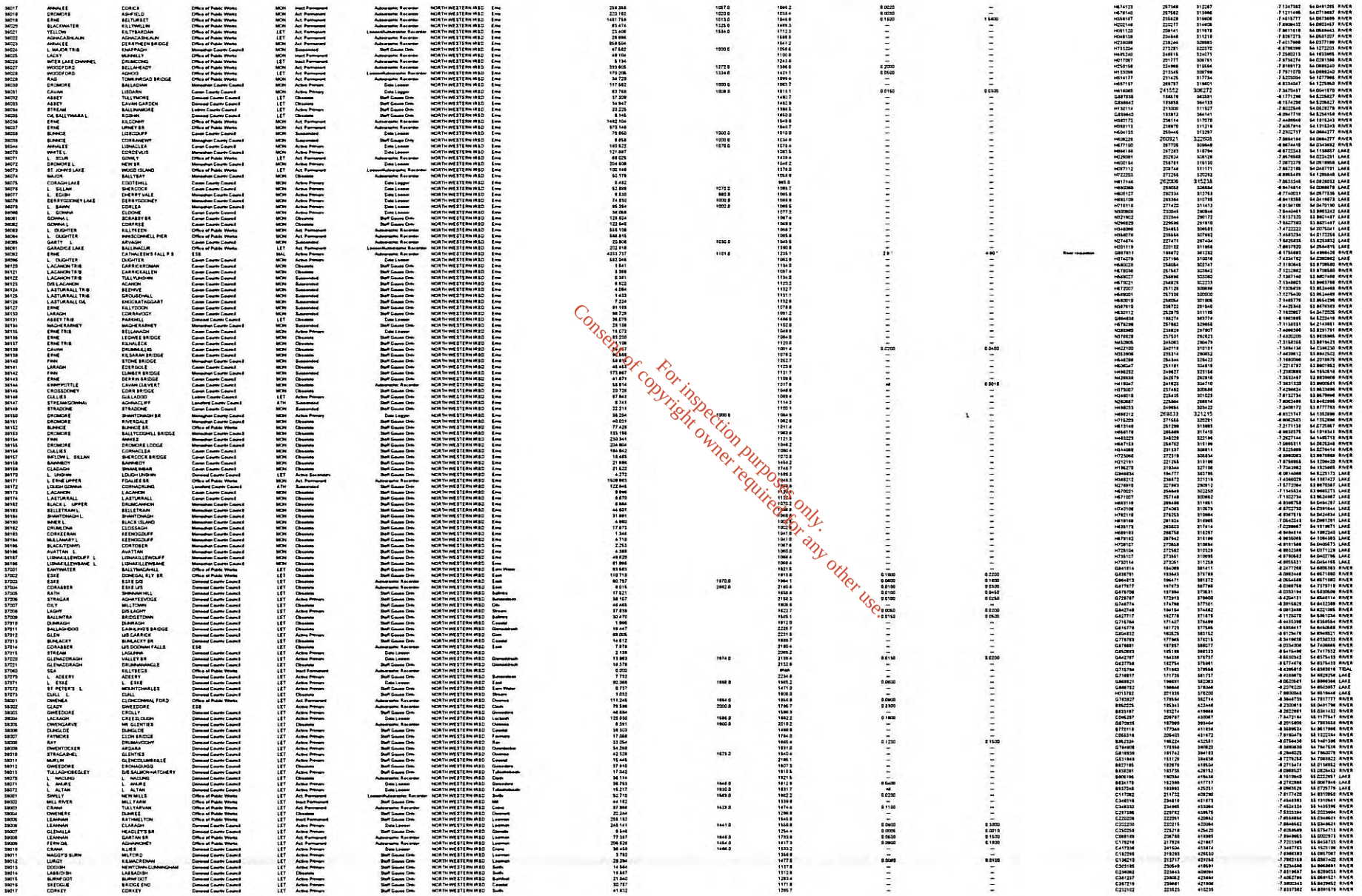
Upstream P(Ortho P)= 0.008 mg/l or g/m^3

Discharge Flow= 346.5 m^3/day

Therefore Discharge P= **0.37 mg/l or g/m^3**

APPENDIX E- EPA DATA





APPENDIX F- COST ESTIMATE

Kilmacrennan WwTP (Cost Estimate 1540PE SBR)

Non-Contract Costs

	Quantity	Unit	Rate (€)	Description	Cost (incl. VAT) (€)	Comments
Land		Sum	€70,000.00	Site adjacent to existing treatment works (0.3 Acres)	€70,000.00	Re-valuation by Auctioneer €60,000 (3rd December 2007)+€10,000 for replacement of existing sheds.
Site Supervision		Sum	€110,000.00	Resident Engineers-Salary wages & Travel Expenses	€110,000.00	Convoy SS
Fees @ 10% of Contract Costs		Sum	€104,362.52	Consultant Fees, Publicity & Advertising, Legal Expenses etc	€104,362.52	
Site Investigation		Sum	€19,295.00	Cores, Slit Trenches etc	€19,295.00	Convoy SS
Archaeological Costs		Sum	€11,000.00	Archaeological Surveys etc	€11,000.00	Convoy SS
Ecological Survey		Sum	€4,540.00	Survey of Flaura, Fauna etc	€4,540.00	Burnfoot Ecological Survey Quotations
					Sub-total:	€319,197.52

Contract Costs

Civil Works

	Quantity	Unit	Rate	Description	Cost (excl. VAT)	Comments
ESB Supply		Sum	€8,000.00	Connection to ESB	€8,000.00	Killygordan SS
Inlet Works	1	No.	€18,920.00	Construction of Storm Water Overflow Weir	€18,920.00	Convoy SS
Balancing Tank		Sum	€8,000.00	Site Excavation & Base Preparation	€8,000.00	
SBR No.1		Sum	€10,000.00	Site Excavation & Base Preparation	€10,000.00	
SBR No.2		Sum	€5,000.00	Site Excavation & Base Preparation	€5,000.00	
Tertiary Treatment	1	No.	€2,000.00	Site Excavation & Base Preparation	€2,000.00	
Outfall Works	50	m	€300.00	Construction of New 300mm Outfall from Treatment Plant/ Storm Tank	€15,000.00	
Sludge Holding Tank	1	No.	€1,000.00	Site Excavation & Base Preparation	€1,000.00	
Storm Tank	1	Item	€30,000.00	Storm Holding Tank (Including site excavation and Base Preparation) Retention time 2hrs at 3DWF	€30,000.00	Convoy SS
Control Building	1	Item	€20,000.00	5.1m x 4.1m Plan Area	€20,000.00	Killygordan SS
Road						
a. Excavation & Disposal	400.8	m^3	€8.00	334m^2x 1.2mDeep (4m wide road)	€3,206.40	
b. Capping Layer	300.6	m^3	€4.50	334m^2x 0.9mDeep	€1,352.70	
c. Road Base & Sub-base	334	m^2	€12.00	334m^2x 0.3mDeep	€4,008.00	
d. Double Surface Dressing	334	m^2	€8.00	Double Surfaced Dressed (14mm and 10mm chips respectively)	€2,672.00	
e. Road Embankment	1	Sum	€20,000.00	Construction of road embankment to raise road above flood level	€20,000.00	
Fencing	238	m	€105.00	2.4m High Close Boarded Timber Fencing	€24,990.00	
Landscaping/Finishing	1	Item	€20,000.00	Planting of indigenous trees/Kerbing etc	€20,000.00	
Manholes	2	No.	€1,200.00	2 No. Access Chambers for Storm overflow	€2,400.00	Convoy SS
Pipework		Sum	€40,000.00	Site Excavation, Installation of Pipework/Ducting to site, connect to existing Pipework	€40,000.00	
Demolition		Sum	€10,000.00	Removal of Existing Inlet works, Imhoff tank etc	€10,000.00	
SBR No.1		Sum	€20,000.00	Precast Option	€20,000.00	
SBR No.2		Sum	€20,000.00	Precast Option	€20,000.00	
					Sub-total:	€286,549.10

Mechanical & Electrical Works

	Quantity	Unit	Rate	Description	Cost (excl. VAT)	Comments
Screener system	1	No.	€34,761.00	Haigh Screen	€34,761.00	Killygordan SS
Balancing Tank	1	No.		(a)1 No. 8000 gallon Balance Tank, (b)2No. Forward feed Pumps,(c) Ultra Sonic Level Control, (d)Lifting Davitt & Socket, (e)UPVC pipework, (f)valves and fittings, (g)Inlet Flow Meter, (h)Inlet Sampler,(I)Surespan type SAC flush Aluminium Access Cover 1400x 800		
SBR's	2	No.		2No. 237 m^3 Aeration/ Settlement Tanks each Containing:(a)1 No. Access stairs and viewing platform, (b)Diffused aeration System, (c)Floating arm Decant c/w Winches,(d)Duty/ Standby blower unit c/w VSD & acoustic enclosure,(e) Air Manifold & valves,(f) 1 No. Actuated valve,(g) anoxic mixer c/w guide rail and winch,(h) WAS pumps DG150/4/80,(i) DO meter,(j) Sludge Outlet Pipework		
Sludge Holding Tank	1	No.		(a)1 No. Sludge holding tank 36m3, (b)Pipework & Valves, (c)Vent stack c/w, (d)Carbon Filter, (e)Bauer Connection		
Outlet Works	1	No.		(a)Outlet Flowmeter, (b)Outlet Sampler		
Plant Motor Control, Centre	1	No.	€345,000.00	(a)1 No. Motor Control Centre, (b)c/w PLC Control & local HMI, (c)Dial out alarm,(d) electrical installation, (e)wiring	€345,000.00	Quotation EPS (14th November 2008)
Tertiary Treatment	1	No.	€26,500.00	(a)Mechanical Sand Filter, (b)1 No. Culligan OFSY WGR 48, (c)C/w automatic backwash & compressor, (d)pipework,(e) valves & Fittings	€26,500.00	Quotation EPS (14th November 2008)
Storm Tank		Sum	€20,000.00	(a)Stormwater return Pumps & Ancillary Equipment, (b)Pipework & Valves,(c) Flowmeter & Ancillary Equipment, (d)Handheld Data Logger, (e)Ladders Flooring & Access Covers, (f)Lifting Davit & Sockets, (g)Controls & Kiosk, (h)Services & Cabling.	€20,000.00	Convoy SS
					Sub-total:	€426,261.00

Other

	Quantity	Unit	Rate	Description	Cost (excl. VAT)	Comments
Preliminaries @ 10% of Contract Costs		Sum	€71,281.01	Health & Safety, Bond, Insurances, Drawings, Project Management, Commissioning etc	€71,281.01	
Contingency @ 10% of Contract Costs		Sum	€78,409.11	Contingency	€78,409.11	
					Sub-total:	€149,690.12

Total Contract Cost (excl. VAT)	€862,500.22
Total Contract Cost (incl. VAT@ 13.5%)	€978,937.75
Total Non-Contract Cost (incl VAT)	€319,197.52
Total (Contract + Non-Contract Costs)	€1,298,135.27

Average Daily Flow on the Assimilative Value - Kilmacrennan

Catchment Area		31,285,334	m2
Average Annual Rainfall (SAAR)	1200 mm/year	1.2	m/year
Average Annual Loss		0.45	m/year
Average Annual Runnoff		0.75	m/year
Average Catchment Flow(ACF)		23464000.5	m3/year
		64240.9322	m3/day

Flow Exceeded 95% of the time,Q95

From previous work on various rivers it was concluded that an approximation for DWF is 4% of ACF and an approximation for Q95 is DWF multiplied by 2

DWF=	64240.93 x	4.00% =	2569.63729	m^3/day			
Q95=	2569.63729 x	2 =	5139.27458	m^3/day	=	0.0595	m^3/s

Using the Low Flow Studies Report (Wallingford)

$(Q_{95})^{0.5}=(7.6)(BFI)^{0.5}+(0.0263)(SAAR)^{0.5}-2.16$

Where : BFI = Base Flow Index, SAAR=Average Rainfall

$(Q_{95})^{0.5}$ =	(7.6)	0.3 $^{0.5}$ +	(0.0263)	1200 $^{0.5}$-	2.16
$(Q_{95})^{0.5}$ =	2.9138				
Q_{95} =	8.49 %				

This is a percentage of ADF.

Q_{95} =	64240.9322	x	8.49	/	100	=	5454.02 m^3/day
						=	0.0631 m^3/s

It is concluded that a fair estimate of Q95 for the River at the outfall point is 5297 m^3/day that is 0.0613 m^3/s

NS II FRESHWATER PEARL MUSSEL SUB-BASIN MANAGEMENT PLANS

REPORT ON BIOLOGICAL MONITORING OF SURFACE WATER QUALITY IN THE LEANNAN CATCHMENT, CO. DONEGAL

	Text No	Attachment No	Description	Date	Check By
	KMC/LA/F1(iii)	Attachment F.1	Report on Biological Monitoring of Surface Water Quality in the Leannan Catchment	07/10/09	Donal Casey

NS II FRESHWATER PEARL MUSSEL SUB-BASIN MANAGEMENT PLANS

REPORT ON BIOLOGICAL MONITORING OF SURFACE WATER QUALITY IN THE LEANNAN CATCHMENT, CO. DONEGAL

2009

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CONTENTS

1 INTRODUCTION

Lauren Williams, freshwater ecological consultant, has been commissioned by RPS Group to carry out biological sampling and water quality assessment in accordance with EPA Q-rating methodology at the following 11 sites in the Leannan catchment, County Donegal. These will form part of the baseline assessments required for the NS II freshwater pearl mussel sub-basin management plans.

	Site Name	Grid Reference
Site 1	Leannan R. 1 km US Ramelton	C 21265 21010
Site 2	Leannan R. Tully Bridge	C 19695 21021
Site 3	Leannan R. Ballydone Bridge	C 16505 21966
Site 4	Leannan R. Miltown Bridge	C 14499 19984
Site 5	Lurgy R. US Leannan confluence	C 14956 21049
Site 6	Lurgy R. Prockliss Bridge	C 13721 20995
Site 7	Leannan R. Dromore Bridge	C 12455 17638
Site 8	Leannan R. Barrack Bridge	C 09449 16004
Site 9	Leannan R. Gartan Bridge	C 06821 16993
Site 10	Bullabba River	C 02528 14068
Site 11	Glashagh R. (Upper)	C 09689 15304

2 METHODOLOGY

Sampling was carried out 25th and 26th of June, 2009 in fair weather. The Leannan is a long river, with considerable volume from it's headwaters at Lough Gartan to the confluence with Lough Swilly. The catchment area is extensive with an enormous number of both small and large tributaries. A study of this type can only provide very broad water quality information as there are many potential point and diffuse sources of inputs to watercourses within a catchment of this magnitude.

For the purpose of this study, therefore, the approach adopted was to focus on (i) sampling at a number of longitudinal points along the main channel of the Leannan; (ii) sampling a number of larger tributaries; (iii) conducting an upstream-downstream comparison on the Lurgy River near Kilmacrenan where water quality issues are apparent; (iv) sampling the Glashagh (Upper) due to a reported pollution incident in 2008; and ,(v) sampling a selection of EPA monitoring stations where the monitoring history had been sporadic.

By avoiding point sources on the Leannan, there was potential to characterise of a range of benthic communities and possibly detect longitudinal trends along the main channel, i.e., within reference range for pearl mussel populations.

2.1 HABITAT ASSESSMENT

Habitat assessment was carried out at each of the sites selected for invertebrate/water quality assessment. These sites were assessed in terms of:

- Stream width and depth
- Substrate type, listing substrate fractions in order of dominance, i.e. large rocks, cobble, gravel, sand, mud etc.
- Flow type, listing percentage of riffle, glide and pool in the sampling area
- Instream vegetation, listing plant species occurring and their percentage coverage of the stream bottom at the sampling site
- Dominant bankside vegetation, listing the main species overhanging the stream
- Estimated summer cover by bankside vegetation, giving percentage shade of the sampling site

The silt plume was observed during kick sampling and recorded on a scale of Very Slight – Slight – Moderate – Considerable – Significant. Any obvious siltation (e.g., in pools) was recorded. Grid references were recorded at all sites using GPS. Digital photographs were taken at each site.

2.2 INVERTEBRATE SAMPLING AND WATER QUALITY ASSESSMENT

Samples were taken using a 2-minute 'kick' sampling method in the fast flowing (riffle) areas of the river using a standard hand net (250 mm width, mesh size 1 mm; adhering to ISO Standard for kick sampling and utilising the EPA/WRBD protocols).). Stone washing was undertaken to ensure that species that cling to stone surfaces – e.g. leeches and gastropods were adequately collected. Macroinvertebrates collected from each sample were preserved *in situ* with 70% Industrial Methylated Spirits (IMS) and returned to the laboratory for identification.

Specimens were identified using the following literature, Elliott *et al*. (1988) for Ephemeroptera, Hynes (1977) for Plecoptera, Macan (1977) for Gastropoda, Edington & Hildrew (1981) for caseless caddis larvae, Wallace *et al.* (1990) for cased caddis larvae, Reynoldson & Young (2000) for triclads, Savage (1989) for Hemiptera, Friday (1986) for adult water beetles and Elliot & Mann (1979) for leeches.

Table 2 EPA water quality status summary

Biotic Index	EQR[1]	EPA Quality Status	Water Quality	WFD[2] Status
Q5	1.0	Unpolluted	Good	High
Q4-5	0.9	Unpolluted	Fair-to-Good	High
Q4	0.8	Unpolluted	Fair	Good
Q3-4	0.7	Slightly Polluted	Doubtful-to- Fair	Moderate
Q3	0.6	Moderately Polluted	Doubtful	Poor
Q2-3	0.5	Moderately Polluted	Poor-to-Doubtful	Poor
Q2	0.4	Seriously Polluted	Poor	Bad
Q1-2	0.3	Seriously Polluted	Bad-to-Poor	Bad
Q1	0.2	Seriously Polluted	Bad	Bad

The Biotic Index of Water Quality (BIWQ) was developed in Ireland by the Environmental Protection Agency (EPA). Q-values and water quality classes are assigned using a combination of habitat characteristics and structure of the macroinvertebrate community within the waterbody. Individual macroinvertebrate species are ranked for their sensitivity to organic

[1] EQR = Environmental Quality Ratio (Observed/Reference)
[2] WFD = Water Framework Directive (EPA, 2006)

pollution and the Q-value is assessed based, primarily, on their relative abundance within a biological sample. EPA indices, EPA water quality status and WFD status are interpreted in Table 2.

The EQR represents the relationship between the values of the biological parameters observed for a given body of surface water and the values for these parameters in the reference conditions applicable to that body. The ratio is expressed as a numerical value between zero and one, with high ecological status represented by values close to one and bad ecological status by values close to zero (EPA, 2006) In Ireland it is calculated as Observed Q-value/Reference Q-value (i.e., Q5). The EQR allows comparison of water quality status across the European Union as each member state has an EQR value for 'High'; 'Good' etc., based on an intercalibration of boundaries between water quality categories e.g., 'High-Good'; 'Good–Moderate' (John Lucey, pers. comm).

In addition biotic indices developed in Britain, based on aquatic macroinvertebrate assemblages, were calculated. The BMWP (Biological Monitoring Working Party) Score and ASPT (Average Score per Taxon) are useful in that each involve a precise calculation using scores that reflect species sensitivity to organic pollution from 1 (most tolerant) to 10 (least tolerant). This is in contrast to the EPA – BIWQ assessment, which is not a precise science, and whereby assignment to water quality classes can vary between operators. BMWP and ASPT values are reported here for each site, which may be useful for future comparisons.

Where sites are not optimal for Q-rating assessment, e.g. sites with an exclusively or almost exclusively peat substrate; Q-ratings are given the suffix '(t)' denoting a tentative Q-rating. Unless otherwise stated, Q-ratings with the suffix (t) can be confidently assigned to the water quality bracket within a ½ Q-rating point margin of error. For instance where a Q3-4(t) rating is given, the operator is stating with a high level of confidence that the rating is no lower than Q3 and no higher than Q4.

3 RESULTS

Data on habitat at each sampling location are tabulated in Appendix 1 and photographs of each sampling site are shown in Appendix 2. Appendix 3 contains detailed species lists and includes BMWP and ASPT values for each site.

The main issue identified during these surveys was the likelihood of there being a discharge to the Lurgy River that is impacting water quality downstream of Kilmacrenan. There was an obvious 'sewage' effluent smell from the water at site LN5, coupled with poor indications in the macroinvertebrate community there. See section 4.2 for a discussion of the upstream-downstream comparison at Kilmacrenan.

Maggy's Burn (C18536 24865) was visited to verify the cause of possible water quality problems there. EPA monitoring had recorded water quality at this site as between Q1 and Q3 for the past 36 years, however, ground truthing showed aquatic habitat at Maggy's Burn to be completely unsuitable for kick sampling, having sluggish flow and depositing (as opposed to eroding) substrata in the section upstream of Lough Fern (Plate 1) at Moyle Bridge. Q-assessment criteria for macroinvertebrates do not apply at such sites (Toner *et al.*, 2005). The low Q-value recorded at this site in past EPA monitoring is almost certainly due to the unsuitability of the habitat for Q-sampling.

Plate 1 View of Maggy's Burn upstream of Moyle Bridge C18536 24865

3.1 LEANNAN SITE 1

SITE CODE LN 1

DATE OF SAMPLING 24/6/09

GRID REFERENCE C 21265 21010

Q-RATING Q4

INDICATOR GROUP	TAXON	Number
Group A - Very Pollution Sensitive	Heptageniidae	20
Group B - Moderately Pollution Sensitive	Leuctridae	80
	Sericostoma personatum	2
	Lepidostoma hirtum	1
Group C - Moderately Pollution Tolerant	*Baetis rhodani*	50
	Caenis sp.	7
	Ephemerella sp.	45
	Rhyacophilidae	23
	Hydropsychidae	60
	Philopotimidae	7
	Chironomidae (ex *Chironomus*)	100+
	Simuliidae	2
	Tipulidae	1
	Hydraenidae	3
	Elmidae	90
	Gammarus sp.	100
	Potamopyrgus sp.	12
Group D - Very Pollution Tolerant	*Polycelis nigra*	1
	Asellus sp.	8
	Sphaeriidae	2
Group E - Most Pollution Tolerant	Oligochaetes	30

3.2 LEANNAN SITE 2

SITE CODE LN 2

DATE OF SAMPLING 26/6/09

GRID REFERENCE C 19695 21021

Q-RATING Q4

INDICATOR GROUP	TAXON	Number
Group A - Very Pollution Sensitive	Heptageniidae	35
Group B - Moderately Pollution Sensitive	Leuctridae	12
	Lepidostoma hirtum	9
	Aphelocheirus aestivalis	14
Group C - Moderately Pollution Tolerant	*Baetis rhodani*	100+
	Caenis sp.	5
	Ephemerella sp.	70
	Rhyacophilidae	15
	Hydropsychidae	95
	Chironomidae (ex. *Chironomus*)	30
	Simuliidae	17
	Elmidae	45
	Gammarus sp.	35
	Ancyclus fluviatilis	8
	Potamopyrgus sp.	2
Group D - Very Pollution Tolerant	Sphaeriidae	38
Group E - Most Pollution Tolerant	Oligochaetes	100

3.3 LEANNAN SITE 3

SITE CODE LN 3

DATE OF SAMPLING 24/6/09

GRID REFERENCE C 16505 21966

Q-RATING Q4

INDICATOR GROUP	TAXON	Number
Group A - Very Pollution Sensitive	Heptageniidae	32
Group B - Moderately Pollution Sensitive	Leuctridae	33
Group C - Moderately Pollution Tolerant	*Baetis rhodani*	50
	Ephemerella sp.	100+
	Rhyacophilidae	3
	Limnephilidae	3
	Chironomidae (ex. *Chironomus*)	100+
	Simuliidae	14
	Elmidae	100+
	Gammarus sp.	200+
	Potamopyrgus sp.	100+
Group D - Very Pollution Tolerant	None recorded	
Group E - Most Pollution Tolerant	Oligochaetes	15

3.4 LEANNAN SITE 4

SITE CODE LN 4

DATE OF SAMPLING 24/6/09

GRID REFERENCE C 14499 19984

Q-RATING Q4

INDICATOR GROUP	TAXON	Number
Group A - Very Pollution Sensitive	Heptageniidae	15
Group B - Moderately Pollution Sensitive	Leuctridae	100+
	Lepidostoma hirtum	3
Group C - Moderately Pollution Tolerant	*Baetis rhodani*	100+
	Ephemerella sp.	80
	Rhyacophilidae	16
	Chironomidae (ex. *Chironomus*)	100+
	Simuliidae	100+
	Hydraenidae	5
	Elmidae	50
	Gammarus sp.	80
	Ancyclus fluviatilis	8
	Potamopyrgus sp.	38
Group D - Very Pollution Tolerant	*Glossophonia complanata*	1
Group E - Most Pollution Tolerant	Oligochaetes	60

3.5 LEANNAN SITE 5

SITE CODE LN 5

DATE OF SAMPLING 25/6/09

GRID REFERENCE C 14956 21049

Q-RATING Q3

INDICATOR GROUP	TAXON	Number
Group A - Very Pollution Sensitive	None recorded	
Group B - Moderately Pollution Sensitive	Leuctridae	13
Group C - Moderately Pollution Tolerant	*Baetis rhodani*	100+
	Ephemerella sp.	75
	Psychomyiidae	1
	Limnephilidae	1
	Chironomidae (ex. *Chironomus*)	500+
	Simuliidae	300+
	Dytiscidae	1
	Elmidae	23
	Gammarus sp.	52
	Ancyclus fluviatilis	2
	Potamopyrgus sp.	6
Group D - Very Pollution Tolerant	None recorded	
Group E - Most Pollution Tolerant	Oligochaetes	100+

3.6 LEANNAN SITE 6

SITE CODE LN 6

DATE OF SAMPLING 25/6/09

GRID REFERENCE C 13721 20995

Q-RATING Q4

INDICATOR GROUP	TAXON	Number
Group A - Very Pollution Sensitive	Heptagenidae	27
Group B - Moderately Pollution Sensitive	Leuctridae	70
	Glososomatidae	1
	Hydroptilidae	1
Group C - Moderately Pollution Tolerant	*Baetis rhodani*	200+
	Ephemerella sp.	58
	Caenis sp.	5
	Rhyacophilidae.	17
	Hydropsychidae	1
	Chironomidae (ex. *Chironomus*)	100+
	Simuliidae	100+
	Hydraenidae	5
	Elmidae	6
	Helophoridae	1
Group D - Very Pollution Tolerant	None recorded	
Group E - Most Pollution Tolerant	Oligochaetes	5
	Chironomus sp.	2
Not assigned to an indicator group	Empididae	4

3.7 LEANNAN SITE 7

SITE CODE LN 7

DATE OF SAMPLING 25/6/09

GRID REFERENCE C 12455 17638

Q-RATING Q4

INDICATOR GROUP	TAXON	Number
Group A - Very Pollution Sensitive	Heptageniidae	26
	Isoperla sp.	5
Group B - Moderately Pollution Sensitive	Leuctridae	95
Group C - Moderately Pollution Tolerant	*Baetis rhodani*	100+
	Ephemerella sp.	25
	Rhyacophilidae.	11
	Hydropsychidae	4
	Limnephilidae	5
	Chironomidae (ex. *Chironomus*)	50
	Simuliidae	14
	Hydraenidae	3
	Elmidae	38
	Gammarus sp.	16
Group D - Very Pollution Tolerant	None recorded	
Group E - Most Pollution Tolerant	Oligochaetes	40
Not assigned to any indicator group	Empididae	6

3.8 LEANNAN SITE 8

SITE CODE LN 8

DATE OF SAMPLING 25/6/09

GRID REFERENCE C 09449 16004

Q-RATING Q4

INDICATOR GROUP	TAXON	Number
Group A - Very Pollution Sensitive	Heptageniidae	6
	Isoperla sp.	1
Group B - Moderately Pollution Sensitive	Leuctridae	55
	Athripsodes sp.	2
Group C - Moderately Pollution Tolerant	*Baetis rhodani*	30
	Ephemerellidae	60
	Rhyacophilidae.	12
	Hydropsychidae	100+
	Polycentropidae	1
	Philopotimidae	10
	Chironomidae (ex *Chironomus*)	6
	Simuliidae	50
	Gyrinidae	1
	Elmidae	13
	Gammarus sp.	11
	Ancyclus fluviatilis	16
Group D - Very Pollution Tolerant	None recorded	
Group E - Most Pollution Tolerant	Oligochaetes	22

3.9 LEANNAN SITE 9

SITE CODE LN 9

DATE OF SAMPLING 25/6/09

GRID REFERENCE C 06821 16993

Q-RATING Q4

INDICATOR GROUP	TAXON	Number
Group A - Very Pollution Sensitive	Heptageniidae	7
Group B - Moderately Pollution Sensitive	Leuctridae	40
	Athripsodes sp	15
Group C - Moderately Pollution Tolerant	*Baetis rhodani*	16
	Ephemerellidae	100+
	Rhyacophilidae.	10
	Hydropsychidae	96
	Polycentropidae	100+
	Philopotimidae	1
	Simuliidae	25
	Elmidae	2
	Gammarus sp	15
	Ancyclus fluviatilis	14
	Potamopyrgus sp.	3
Group D - Very Pollution Tolerant	*Lymnaea peregra*	4
	Sphaeriidae	18
	Trocheta sp.	1
	Glossophonis complanata	1
Group E - Most Pollution Tolerant	Oligochaetes	8

3.10 LEANNAN SITE 10

SITE CODE LN 10

DATE OF SAMPLING 25/6/09

GRID REFERENCE C 02528 14068

Q-RATING Q4

INDICATOR GROUP	TAXON	Number
Group A - Very Pollution Sensitive	Heptageniidae	19
Group B - Moderately Pollution Sensitive	Leuctridae	25
Group C - Moderately Pollution Tolerant	*Baetis rhodani*	100+
	Ephemerellidae	90
	Rhyacophilidae.	19
	Hydropsychidae	2
	Chironomidae (ex. *Chironomus*)	100+
	Simuliidae	35
	Hydraenidae	5
	Helophoridae	1
	Elmidae	20
	Gammarus sp.	65
	Ancyclus fluviatilis	11
	Potamopyrgus sp.	100+
Group D - Very Pollution Tolerant	None recorded	
Group E - Most Pollution Tolerant	Oligochaetes	50

3.11 LEANNAN SITE 11

SITE CODE LN 11

DATE OF SAMPLING 25/6/09

GRID REFERENCE C 09689 15304

Q-RATING Q4

INDICATOR GROUP	TAXON	Number
Group A - Very Pollution Sensitive	Heptageniidae	3
	Chloroperla torrentium	3
Group B - Moderately Pollution Sensitive	Leuctridae	100+
Group C - Moderately Pollution Tolerant	*Baetis rhodani*	50
	Ephemerellidae	46
	Rhyacophilidae.	12
	Hydropsychidae	12
	Limnephilidae	5
	Hydroptilidae	1
	Chironomidae (ex. *Chironomus*)	100+
	Elmidae	45
	Ancyclus fluviatilis	13
Group D - Very Pollution Tolerant	None recorded	
Group E - Most Pollution Tolerant	Oligochaetes	75
Not assigned to an indicator group	Empididae	2

3.12 LEANNAN CATCHMENT MONITORING 2009

EPA Site No	River	LW Site No	1973	1977	1979	1980	1981	1985	1988	1991	1996	1998	2001	2004	2007	LW 2009	EQR[3]	WFD Status
39L010800	Leannan	1														4	0.8	Good
	Leannan	2														4	0.8	Good
39L010500	Leannan	3	4-5	4	-	3-4	-	3-4	4	4-5	4	4-5	3-4	4	4	4	0.8	Good
	Leannan	4														4	0.8	Good
39L020300	Lurgy	5	4-5	4-5	-	3	-	4	3	4-5	3	4	4	-	3	3	0.7	Poor
39L020200	Lurgy	6	5	4-5	-	4	-	4-5	4-5	5	-	-	-	-	-	4	0.8	Good
39L010300	Leannan	7	5	4-5	-	5	-	5	4-5	4-5	4	5	4	3-4	3	4	0.8	Good
39L010200	Leannan	8	5	4-5	-	5	-	4-5	4-5	5	-	-	-	4	4	4	0.8	Good
39L010100	Leannan	9				5	-	4-5	4	4	4-5	4-5	4-5	4-5	4-5	4	0.8	Good
	Bullaba	10														4	0.8	Good
39G010400	Glashagh (Upper)	11	-	-	-	-	-	-	5	4-5	5	4-5	4-5	3	3-4	4	0.8	Good

[3] Figures highlighted in red indicate where EQR falls below the ecological quality objective target value for pearl mussel sites (see Appendix 4)

4 CONCLUSIONS

Macroinvertebrate EQR's (see Appendix 4) are below target value for pearl mussel sites (≥0.9) at all locations surveyed. This suggests water quality is not presently meeting optimum ecological objectives for pearl mussel sites (DEHLG, 2008) in much of the catchment.

Macro-algal growth exceeded optimum ecological objectives for pearl mussel sites (≤4%) at three sites on the Leannan River (LN2, LN3, LN8; see Appendix 1), amounting to 43% of the Leannan main channel survey sites. The Glashagh (Upper) tributary also had estimated macro-algal cover of about 15% in total which exceeds the target value for macro-algae.

Only one site, LN10, on the Bullaba River showed a significant problem with Filamentous Green Algal (FGA) growth (see Appendix 1). All other sites had very low estimated FGA coverage at the time of sampling. This result contrasts starkly with other rivers surveyed during this project, e.g., Newport River, Owenriff River; where filamentous algal growth has been a major characteristic of the catchment habitats.

4.1 LEANNAN RIVER

All sites along the length of the Leannan River merited Q4 rating, translating to 'Fair' water quality. The longitudinal trend is, therefore, that water quality remains quite constant despite the many inputs from small and larger tributaries on its course from Lough Gartan to the coast.

LN2 at Tully Bridge rates Q4 in terms of water quality, but it is worth noting that there are indications in the fauna that the site is slightly enriched. Worms and Hydropsychid caddisflies are numerous, often indicating some organic enrichment and/or an elevated level of organic detritus at a site. Macro-algal coverage was also reasonably high at this site (10-20%). These factors, combined, are negative indicators for pearl mussel success in this part of the catchment.

4.2 LURGY RIVER

The Lurgy River downstream of Kilmacrenan (site LN5) was clearly impacted and merited a rating of Q3 implying 'Doubtful' water quality and 'moderate pollution' at the site. In comparison the site upstream of the town (LN6) was assigned a Q4, indicating that the source of pollution at LN5 may be originating within the town, or at least very near to the town considering the level of impact and the obvious odour of sewage effluent. Flows were very low in the Lurgy at the time of sampling and it may be that the rivers' waste assimilation capacity is not sufficient for the discharge that is causing the impact. The Leannan River rated Q4 at LN4 (upstream) and Q4 at LN3, 2km downstream of the Lurgy River confluence.

4.3 BULLABA RIVER AND GLASHAGH (UPPER) RIVER

The Bullaba River flows into Lough Gartan and was sampled to ascertain potential inputs to Lough Gartan, considering that the Leannan River rates Q4 at the outlet from the lake.

Peat harvesting activity and some agriculture are evident from aerial photographs of the Bullaba sub-catchment in the upper Leannan catchment. The Bullaba merited a rating of Q4, however there were a number of negative indicators at the site, including bank erosion due to stock access, a significant peaty silt plume and reasonably high FGA coverage (40%). The Glaskealan River (with peat harvesting and forestry in the sub-catchment) also flows into Lough Gartan and rated Q3-4 (slight pollution) at the most downstream site (GK1) on the main channel. There were a number of negative water quality indicators within the Glaskealan at GK1 including heavy siltation and high FGA coverage values (see separate report). The Leannan River rated Q4 below the outflow from the lake, which indicates that the lake itself may be very slightly enriched.

Water quality in the Glashagh (Upper) showed a sharp decline during EPA monitoring in 2004 with perhaps a slight improvement evident during 2007 monitoring. In 2008, a serious pollution incident occurred whereby a large volume of limestone slurry was released from a quarry (grid reference approx. C07160 14640) into a small stream that confluences with the Glashagh (Upper). The decision was taken to survey an accessible point on the Glashagh (Upper) as close as possible to it's confluence with the Leannan River (SAC) to determine the extent of damage and/or recovery since the event.

Plate 2 Habitat at Glashagh (Upper) – site LN11, 1km upstream of the Leannan confluence

The current survey (approx. 1 km upstream of Leannan confluence) indicates that, in spite of the incident, there is a continuing steady improvement in water quality occurring at this site (see

monitoring table in section 3.12) – with the stream meriting a Q4 rating ('Fair' water quality) during this survey. A number of 'sensitive' species were collected in the benthos, including Heptagenid mayflies and Groups A and B Plecopteran spp. (*Chloroperla torrentium* and Leuctridae spp., respectively). In terms of physical habitat - sampling in the stony substrates of the riffle generated a significant silt plume which took a long time to settle (indicative of very fine sediment). In slow glides and pools just downstream, sediments were very fine, with a moderate amount of submerged and emergent macrophyte (even in the mid-channel) including *Sparganium erectum*, *Callitriche* sp. and *Potomogeton* sp. (see Plate 2). It could be said that the presence of *Sparganium erectum* growing mid-channel in a small riffle-glide sequenced stream such as this, is unusual and can perhaps be attributed to the deposition of very fine, soft sediments following the pollution incident. This remains speculation in the absence of a detailed site description prior to the event, however, *Sparganium erectum* is more usually associated (mid-channel) in heavily silted, sluggish rivers and at the silted margins of otherwise stony river and lake habitats.

5 REFERENCES

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APPENDIX 1

HABITAT ASSESSMENT AT SAMPLING SITES

APPENDIX 2

PHOTOGRAPHS

APPENDIX 3 MACROINVERTEBRATE LIST incl. Q-VALUE, BMWP & ASPT

Taxa	EPA	BMWP	SITE										
	Quality	Score											
	Category		LN1	LN 2	LN 3	LN4	LN5	LN6	LN7	LN8	LN9	LN10	LN11
MAY FLIES (Ephemeroptera)													
Heptageniidae:	A	10	*	*	*	*		*	*	*	*	*	*
Heptagenia sp.			20	35	32	15			16	5			3
Ecdyonurus sp.								1		1	7	16	
Rhithrogena sp.								26	10			3	
Ephemerella ignita	C	10	50	70	100+	80	75	58	25	60	100+	90	46
Baetis rhodani	C	4	45	100+	50	100+	100+	200+	100+	30	16	100+	50
Caenis sp.	C	7	7	5			5	5					
STONE FLIES (Plecoptera)													
Isoperla sp. (indet)	A	10							5	2			
Chloroperla torrentium	A	10											3
Leuctra sp.	B	10	80	12	33	100+	13	70	95	55	40	25	100+
CADDIS FLIES (Trichoptera)													
Sericostoma personatum	B	10	2										
Lepidostoma hirtum	B	10	1	9		3							
Athripsodes sp.	B	10								2	15		
Rhyacophila dorsalis	C	7	23	15	3	16		17	11	12	10	19	12
Hydropsychidae:	C	5	*	*				*	*	*	*	*	*
Hydropsyche sp.			60	90				1	4	100+	50	2	12
Cheumatopsyche lepida				5							46		
Glossosoma sp.	B	~						1					
Polycentropidae:	C	7								*	*		
Polycentropus flavomaculatus										1			
Holocentropus sp.											100+		
Tinodes waeneri	C	7					1						

Appendix (Continued)

Taxa	EPA Quality Category	BMWP Score	SITE										
			LN1	**LN 2**	**LN 3**	**LN4**	**LN5**	**LN6**	**LN7**	**LN8**	**LN9**	**LN10**	**LN11**
Philopotimidae:	C	8	*							*	*		
Philopotamus montanus			5										
Chimarra marginata											1		
Wormaldia subnigra			2							10			
Limnephilidae:	C	7			*		*	*	*				*
Limnephilid indet.							1	6					5
Potomophylax sp.					3				2				
Halesus radiatus								1	3				
Hydroptilidae indet.	C	6						1					1
TRUE FLIES (Diptera)													
Chironomidae	C	2	100+	30	100+	100+	500+	100+	50	6		100+	100+
Chironomus sp.	E	2						2					
Simuliidae	C	5	2	17	14	100+	300+	100+	14	50	25	35	
Empididae	~	~					22	4	6			5	2
Tipulidae	C	5	1										
BEETLES (Coleoptera)													
Hydraena gracilis	C	5	3			5		5	3			5	
Oreodytes sanmarkii	C	5					1						
Helophorus brevipalpis	C	5						1				1	
Gyrinid indet.	C	5								1			
Elmidae	C	5	90	45	100+	50	23	6	38	13	2	20	45
WATERBUGS (Hemiptera)													
Aphelocheirus aestivalis	B	10		14									
F/W SHRIMPS (Crustacea)													
Gammarus sp.	C	6	100+	35	200+	80	52	30	16	11	15	65	

Appendix (Continued)

Taxa	EPA	BMWP	SITE										
	Quality	Score											
	Category		LN1	LN 2	LN 3	LN4	LN5	LN6	LN7	LN8	LN9	LN10	LN11
Asellus sp.	D	3	8										
SNAILS (Mollusca)													
Ancyclus fluviatilis	C	6		8	12	8	2	2		16	14	11	13
Sphaeriidae	D	3	2	38							18		
Potomapyrgus sp.	C	3	12	2	100+	38	6				3	100+	
Lymnaea peregra	D	3									4		
WORMS (Annelida)													
Oligochaetae	E	1	30	100+	15	60	100+	5	40	22	8	50	75
LEECHES (Hirudinea)													
Trocheta sp.	D	3									1		
Glossophonia complanata	D	3				1					1		
FLATWORMS (Tricladia)													
Polycelis sp.	D	5	1										
EPA Q Value			**Q4**	**Q4**	**Q4**	**Q4**	**Q3**	**Q4**	**Q4**	**Q4**	**Q4**	**Q4**	**Q4**
Total BMWP Score			115	104	76	87	85	103	87	111	109	84	83
ASPT			6.1	6.1	5.8	5.8	5.7	5.7	6.2	6.5	5.7	5.6	6.4

APPENDIX 4

Ecological Quality Objectives for Freshwater Pearl Mussel Sites (DEHLG, 2008)

Element	Objective	Notes
Macroinvertebrates	EQR ≥0.90	High status
Filamentous algae (Macroalgae)	Trace or Present (≤4%)	Any filamentous algae should be wispy and ephemeral and never form mats
Phytobenthos (Microalgae)	EQR ≥0.93	High status
Macrophytes - rooted higher plants	Trace or Present (≤4%)	Rooted macrophytes should be absent or rare within the mussel habitat.
Siltation	No artificially elevated levels of siltation	No plumes of silt when substratum is disturbed

Habitats Directive Article 6 Assessment for

Waste Water Discharge License

Kilmacrennan

	Text No	Attachment No	Description	Date	Check By
	KMC/LA/F1(ii)	Attachment F.1	Habitats Directive Article 6 Assessment	02/12/09	Donal Casey

Executive Summary

Article 6 assessments are required under the Habitats Directive (92/43/EEC), and are required where a plan or project may give rise to significant effects upon a Natura 2000 site. Natura 2000 sites are those identified as sites of Community importance designated under the Habitats Directive (Special Areas of Conservation, here after referred to as SACs) or the Birds Directive (Special Protection Areas, here after referred to as SPAs). In the case of the present assessment, Ramsar sites are also included by way of best practice. It is important to note that the phrase '*Appropriate Assessment*' is sometimes used more loosely to refer to the whole process set out under Articles 6(3) and 6(4) of the Habitats Directive (Dodd *et al*., 2008), and therefore note that for the present assessment the term '*Article 6 assessment*' will be used, not '*Appropriate Assessment*' (which refers to Stage 2 in the sequence under Article 6 assessment).

Guidance on Strategic Environmental Assessment (SEA) produced by the EPA (EPA, 2008) provides a useful definition of Article 6 assessments (referred to as appropriate assessment in that document) (EPA, 2008): "*An assessment based on best scientific knowledge, of the potential impacts of the plan on the conservation objectives of any Natura 2000 site (including Natura 2000 sites not situated in the area encompassed by the draft plan or scheme) and the development, where necessary, of mitigation or avoidance measures to preclude negative effects"*. Importantly, an Article 6 assessment has a narrow focus i.e. the maintenance of the integrity of the site and assessing the significance of the effects on designated interest features and the conservation objectives of the site. It is a protection led assessment and is carried out using the precautionary principle.

The assessment of the present proposal for licensing the Waste Water Discharge at Kilmacrennan concluded the following:

The screening process has been undertaken to identify the qualifying interests on the Leannan river SAC Natura 2000 site and potential impacts arising from the Kilmacrennan Wastewater treatment plant.

The process has shown that there are likely to be significant negative effects on three of the species listed as qualifying interests on the Natura 2000 site arising from the Kilmacrennan Wastewater Treatment Plant. It is unlikely that there will be 'in combination' negative effects from any other additional plans or developments in the catchment.. The current operation of the plant in question is desirable in order to mitigate the impact of what would otherwise be untreated waste water generated by the Kilmacrennan agglomeration. Further mitigation measures will be required to improve and subsequently maintain the site in order to bring it to favourable conservation status for the species involved. These mitigation measures involve the upgrade of the treatment plant. The consequences of not operating the plant would have a far more significant negative effect on this Natura 2000 site hence its continued operation is essential.

Introduction

Article 6 is one of the most important articles of the Habitats Directive in determining the relationship between conservation and site use. Article 6(3) requires that "*Any plan or project not directly connected with or necessary to the conservation of a site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives.*" The purpose of this report is to describe how that Article 6 assessment was carried out, and also to detail the results and conclusions from the assessment.

Waste Water Discharge (Authorisation) Regulations

Local Authorities are required to carry out an Appropriate Assessment as per article 6 of the Habitats Directive (92/43/EEC (2000)) in relation to waste water authorisations pursuant to the Waste Water Discharge (Authorisation) Regulations, 2007 (S.I. No. 684 of 2007).

The specific objectives of the WWDA Regulations are contained within the regulations.

Kilmacrennan Waste Water Treatment Plant

Kilmacrennan Waste Water Treatment Plant was constructed in the late 1970's. It was upgraded around 1988 with the introduction of Secondary Treatment through 2 Roating Biological Contactors and Secondary Sedimentation by means of a horizontal flow humus tank. The outlet is to the River Lurgy.It is a combined flow waste water network. The core network dates from the late 1960's. A Map showing location of the plant (Attachment B.2) is copied below.

The main elements of the WWTP are:

- inlet works. This allows for screening of material, removal of grit. Inlet sampling takes place at this location.
- storm overflow channel. This discharges to a junction manhole where it combines with the outlet from the humus tank.
- Primary settlement tank. Twin chamber Imhoff Tank .
- Two Rotating Biological Contactors.
- Secondary sedimentation tank . Consists of a Horizontal flow humus tank.
- Outlet. This discharges from the humus tank to a junction manhole where it joins the storm overflow outlet. The outlet then discharges to the River Lurgy via a 12" ductile Iron pipe. Effluent sampling takes place at this location.

Sludge removal. Sludge is drawn off from the Imhoff tank to the sludge sump. It is dewatered by a mobile dewatering unit and sent to the Sludge Hub in Donegal Town for treatment.

Article 6 assessment

The Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora better known as "The Habitats Directive" provides the framework for legal protection for habitats and species of European importance. Articles 3 to 9 provide the legislative means to protect habitats and species of Community interest through the establishment and conservation of an EU-wide network. The Habitats Directive and the Birds Directive and sites designated under them form this network of European protected sites that are better known as the Natura 2000 network. This consists of;

Special Areas of Conservation (SACs) for flora, fauna and habitats of Community interest under the EU Habitats Directive;

Special Protection Areas (SPAs) for rare, vulnerable or migratory birds under the EU Birds Directive;

Sites that are being considered for designation as one of the above are referred to as cSAC (candidate) or pSPA (proposed).

Ramsar sites are wetlands of global importance, listed under the Convention on Wetlands of International Importance. Ramsar sites are contained within Natura 2000 sites and for that reason, and in line with best practice, Ramsar sites, if present would have been included in this assessment.

Article 6 sets out provisions which govern the conservation and management of Natura 2000 sites. Article 6(3) and 6(4) of the Habitats Directive set out the decision-making tests for plans and projects likely to affect Natura 2000 sites. Article 6(3) establishes the requirement for Appropriate Assessment:

"Any plan or project not directly connected with or necessary to the management of the [Natura 2000] site but likely to have a significant effect thereon, either individually or in combination with other plans and projects, shall be subjected to appropriate assessment of its implications for the site in view of the site's conservation objectives. In light of the conclusions of the assessment of the implication for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public"

This assessment is underpinned by the precautionary principle, especially in the assessment of potential impacts and their resolution. If it is not possible to rule out a risk of harm on the evidence available then it is assumed a risk may exist and it needs to be dealt with in the appropriate assessment process.

Stages of the Article 6 assessment

The stages of an Article 6 assessment are outlined in the European Commission Methodological Guidance on the provision of Article 6(3) and 6(4) of the 'Habitats' Directive 92/43/EEC (EC 2001) and the European Commission Guidance 'Managing Natura 2000 Sites'. These are set out below in line with EPA guidance on Appropriate Assessment for Waste Water Discharge Licensing.

Stage 1 - Screening

Step 1: Management of the site. In the case of all waste water discharges the project is not connected with, or necessary to the management of a Natura 2000 site

Step 2: Description of the Project (in this case the Ardara WWTP) and identification of European sites that may be affected (including 'in combination' effects)

Step 3: Characteristics of the site identifying areas where the project may impact on European sites.

Step 4: Assessment of Significance. Assessment of the likelihood of significant effects of the project on European sites, including individual and cumulative impacts. Exclusion of site where it can be objectively concluded that there will be no significant effects and hence no requirement to proceed to further stages.

Stage 2 - Appropriate Assessment (AA)

Step 1: Information collation of likely effects of project and impacts on European site.

Step 2: Description of the Natura 2000 sites, including qualifying interests.

Step 3: Identification of the conservation objectives for of these sites and potential significant impacts likely to occur from the proposal

Step 4: Identification and assessment of mitigation measures against any likely adverse effects of the Project.

Stage 3 - Assessment of alternative solutions

Step 1: Identification of alternative solutions

Step 2: Assessment of alternative solutions

Stage 4 – Imperative Reasons of Overriding Public Interest

Confirm that there are a) imperative reasons of overriding public interest and b) human health or safety considerations or important environmental benefits. If this is so then compensation measures are required for any remaining adverse effect.

Results of Kilmacrennan WWTP Assessment

Stage 1 –Screening

Step 1: Management of the Site.

The project is a WWTP and therefore is not directly connected with or necessary for the management of the European sites involved.

Step 2: Description of Project and European Sites

Description of the Project

A full description of the project is provided in Sections A and C of the WWD application and in addition the project is briefly outlined above for convenience.

European Natura 2000 Sites

The Kilmacrennan WWTP discharges into Lower reaches of the River Lurgy catchment which is a tributary of the River Leannan and hence is an integral par of the Leannan River SAC (IE0021276). A brief description of the site follows.

Other Discharges to Recieving Waters

There are no other discharge into the receiving waters of the River Lurgy which have the potential to have a significant effect on the Natura 2000 site. The water quality of the River Lurgy as it enters the Leannan River is regarded as 'good or higher' hence other downstream discharges to the Leannon River itself are not considered in this assesment. See further report

Step 3: Potential Impacts

The qualifying interests of the Leannan River SAC have been identified and tabulated below (Table 1.0) along with an assessment of water dependence (Curtis et al 2006. North South Shared Aquatic Resource (NS Share) Register of Protected Areas – Report on the

ecological requirements of water dependent habitats and species designated under the Habitats Directive NS Share T5 (2)-2.1). The water dependent qualifying interests could potentially be impacted by the WWTP discharge are the Atlantic Salmon – S*almo salar,* the Freshwater Pearl Mussel-*Margaritifera margaritifera* (Species no 1029) and the Otter-*Lutra lutra*

Cumulative, Direct, Indirect, Short& Long Term Effects

There are no other point discharges into the receiving waters of the R Lurgy that might potentially have cumulative direct indirect short or long term effects on the European sites. Nutrient discharges from Agriculture in the catchment are a potential source of eutrophication and as such are subject to the Good Agricultural Practice Regulations. These regulations (both current and any future amendments) have been agreed as the appropriate Measure for Agriculture under the Water Framework Directive Programme of Measures and will be incorporated into the River Basin District management Plans. Monitoring up stream of the discharge from the Kilmacrennan Waste water plant indicates water quality is 'Good' hence there is no evidence to suggest that agricultural practice in the area is a making significant impact on the Natura 2000 site. Freshwater Pearl Mussel catchments will be subject to the proposed Sub-Basin Management Plans for this species and a copy of the draft Freshwater Pearl Mussel Sub-Basin Management Plan for the Leannan River catchment is attached (Appendix ZZ). A plan to protect and restore the otter population to early 1980s levels nationally has been published by NPWS. This includes references to mitigating the effect of wastewater discharges.

Step 4.0 Likely Significance of Impacts

Atlantic Salmon

All salmon spawn naturally in freshwater. Spawning typically occurs in the headwater and tributary streams of rivers, though it can happen anywhere in a river if the substrate is suitable. The migration to suitable habitat may commence up to a year before spawning takes place in autumn-winter, salmon ceasing to feed, directing all their energy instead to

reproduction. Fertilised eggs hatch in spring normally during March-April developing into free swimming fry within 3-6 weeks. They then quickly develop into parr and feed on aquatic insects and grow for one to three years in their natal stream. They then pass through a process known as smolting which includes internal changes in the salt-regulating mechanisms of the body. The smolts become silvery and change from swimming against the current to moving with it. These adaptations prepare the smolt for its journey to the oceans and the next phase of its life cycle. After one to three years at sea feeding on fish the now mature salmon returns to its natal stream to spawn and thereby complete the life cycle of the species.

During their life cycle salmon are subject to a wide range of pressures. These includes water quality issues in rivers as a result of point and diffuse source pollution. Disease and parasitic sea lice can impact on their numbers as well as unsustainable fishing practices and other anthropogenic activities which impact on water quality and habitat.

Although the waste water treatment plant at Kilmacrenan has removed a number of previously uncontrolled discharges to the local riverine system there is evidence from monitoring that water quality is being adversely affected by the discharge compared to upstream of the plant. Recent surveys relating to the Freshwater Pearl Mussel plans refer to a smell of sewage in the river over one kilometre downstream. While this was at a period of low flow it cannot be concluded that the discharge is not adversely impacting on salmon using the river as a suitable habitat. Taking into account the Precautionary Principle the discharge is therefore likely to be a contributory factor to the paucity of numbers of salmon in the Lurgy river system. Therefore it can be considered to be impacting on the overall Leannon system Natura 2000 site in relation to this species being at favourable conservation status.

Freshwater Pearl Mussel

The freshwater Pearl mussel Margaritifera sp., is a bivalve mollusc belonging to the family Unionidae. In Ireland, Margaritifera is a scheduled species under the 1976 Wildlife Act (Statutory Instrument No. 112, 1990) and consequently is statutorily protected. Margaritifera is also listed in the Habitats Directive and, as such, Member States are required to establish the necessary conservation measures corresponding to the ecological requirements of the species and its habitat. Margaritifera margaritifera is listed on the most recent International

Union for Conservation of Nature and Natural Resources (IUCN) Red Data List as "Endangered" (IUCN, 1996).Margaritifera durrovensis is listed as “critically endangered”. Margaritifera’s reproductive strategy involves the annual production by individual females of up to 28 million parasitic larvae called glochidia that attach themselves to the soft gill tissues of trout and salmon during late summer. Several months later, and further upstream, the glochidia drop off the host fish and settle into the stream substrate as juvenile mussels. Margaritifera is extremely sensitive to pollution and under the DEHLG funded NS2 project in which Donegal county Council is project promoter specific Sub-Basin management plans are being developed to protect this species and to ensure its sustainability in Irish waters. A copy of the draft Leannon River sub basin plan is attached. Eutrophication and siltation pressures are considered the main threats to the conservation status of the species’ populations in Irish rivers. The juvenile stages (from 0 to 5 years) are the most sensitive. This species has not been found in any numbers in the Lurgy river and a potential reason for this is the lack of salmon numbers in the catchment which reduces the possibility of the glochidia finding a suitable host. This then is likely to have a negative impact on the ability of the species to flourish and achieve favourable conservation status. Other potential reasons for this species decline over time include illegal harvesting by individuals in a quest for pearls, which has been known to happen in the Leannon system.

Otter:

The ecology of otters has been the subject of a project under the LIFE Nature programme of the European Commission, published by Life in UK Rivers. The study shows that otters require huge territories. Quantities of prey dictate numbers of otters and any factor that impacts on fish stock numbers can have significant impact. A little eutrophication favours the species. The food taken by otters has been the subject of a number of studies, and the main prey of the otter includes fish, frogs, crayfish and eels. Chemical vulnerability relates to prey (principally fish) and the possibility of PCB contamination. The reduction of fish numbers in the Lurgy system, as reported by the Northern Regional and Central Fishery Boards will reduce the prey levels for this species and this together with less than good water

quality downstream of the discharge must be considered as potentially impacting on the otter population in the area

Stage 2 Appropriate Assessment

Step 1 Information

All relevant information on the project is contained in the Application form of which this document is an appendix. The Natura 2000 site involved is the R Leannan SAC and a description of the site is given in the Site Synopsis produced by NPWS which is attached in Appndix 1 togeteher with the qualifying interests as published by the NPWS. The impact on the receiving waters of the R Lurgy (which is within Leannan SAC) is to reduce water quality to less than good status which is likely to impair fish life notably that of the Atlantic Salmon. This consequently has a potential impact on the favourable status of two other qualifying interests of the SAC, the Freshwater Pearl Mussel and the Otter who have a dependence on the Atlantic Salmon. There are therefore potentially direct, indirect, short and long term and cumulative effects as a result of the project involved. Mitigation measures have been identified and are referred to in detail in the Application Form and in Step 4 below.

Step 2/3 Impact prediction and Conservation objectives

The qualifying interests have been identified which require to be brought to favourable conservation status. Their current status is discussed below

Atlantic Salmon

Surveys of salmon numbers have been carried out by the Northern Regional Fisheries Board and the Central Fisheries Board in the Leannan system including the River Lurgy. The conclusions drawn from these surveys are:

The electro fishing survey undertaken in 2009 show the site downstream of the discharge produced the lowest number of juvenile salmonids in the entire Lurgy system. In relation to

the Atlantic Salmon the number of salmon produced in Lurgy catchment falls below what would be expected for the habitat of the area involved by at least 50%.

Redd count data gathered from the 1960s to 2009 show a decline in the R Lurgy from 47 in the early 60's to 1 in the last survey which would be regarded as a significant decline in production of Atlantic Salmon in this river system. Overall Redd counts in the Leannan system does not show a similar level of decline indeed the counts have remained consistent over the period.

Freshwater Pearl mussel

This species has been the subject of ongoing studies in Natura 200- areas where is has been designated as a qualifying interest such as the River Leannon system. A copy of this study is attached and provides the most up to date information available ion this species and its current conservation status. The study points to water quality issues below the discharge and make specific reference to the smell of sewage over 1 kilometre down stream of the discharge. The Lurgy river although part of the Leannan system has not got a recognised population of Freshwater Peal Mussels. It cannot be ruled out that the low Atlantic Salmon population has been a contributory factor to this situation.

The Otter.

The principle prey of the Otter is known to be fish with salmonoids eels and sticklebacks comprising the bulk of this prey group. In the case of sticklebacks these may be secondary prey as they form a major prey group of salmonids. It must therefore be regarded that activity impacting on the fish population particularly salmonoids has to be regarded as potentially impacting on the otter population. although otters prey on other non fish species such as frogs and mammals etc when fish numbers are reduced. The 2004/5 survey of otters carried out and published by NPWS indicates a general decline in otter numbers although the report concludes that no significant relationship surprisingly was detected with pollution or human disturbance. The Leannan SAC was not surveyed during that survey hence specific data on the particular area in question is not available.

Step 4 mitigating measures.

Proposals to upgrade the WWTP are given in the main application form (See appendix G) and are copied below for convenience.

STAGE 3 Alternative

There are no feasible alternative solutions to mitigating the impact of this discharge other than upgrading of the Kilmacrenan Wastewater Treatment works to the appropriate standard required to ensure water quality is brought up to 'good' status.

Stage 4 IROPI

This wastewater treatment plant is an essential piece of infrastructure to provide treatment of municipal sewage from the Kilmacrenan agglomeration. This is not only to protect water quality but also to protect Public Health within the agglomeration.

Other Policies, Plans or Projects

There are no current proposals for further developments that would create discharges into receiving waters.

Conclusion

The screening process has been undertaken to identify the qualifying interests on the receiving waters within Natura 2000 site and potential impacts arising from the Kilmacrenan Wastewater treatment plant. . Three of the water dependant species have been identified has

being impacted by the facility and mitigating measures to deal with these impacts have been identified.

TABLE 1.0. The qualifying interests of the West of Ardara/Maas SAC are listed in the table below along with an assessment of their water dependence and any potential significant effects of the Ardara WWTP.

Code	Qualifying Interest	Water Dependency	Potential Significant Effect
3110	Lowland Oligotrophic lakes	Surface Water Dependant lake ecosystem	No impact of wastewater discharge
1355	Otter (*Lutra lutra*)	Surface Water Dependent: Rivers and Lakes. Mild eutrophication favours otters. Chemical vulnerability relates to prey (principally fish) and possibility of PCB contamination. Any factor that impacts on fish stock numbers	Potential impact of waste water discharge
1029	Fresh Water Pearl Mussel (*Margratifera margratifera*)	Surface water dependant requires high quality freshwater environment vulnerable to eutrophication and siltation	No impact of wastewater discharge not present in R Lurgy
1106	Atlantic Salmon (*Salmo salar*)	Surface water dependant. Freshwater dependant and marine water dependant during stages of life cycle	Potential impact of waste water discharge
1833	Slender Naiad (*Najas flexilis)*	Freshwater species of aquatic plant	Present in L Akibbon no impact of wastewater discharge

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www.wetlands.org

www.birdlife.org

www.antaisce.org

				(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
Kilmacrennan - downstream	072507570	27/11/2007	7.54	7.36	11	0.548	0.33	0.009	0.104	0.296
Kilmacrennan - downstream	082501068	14/01/2008	7.32	1.86	0.75	0.069	0.33	0.019	0.015	0.036
Kilmacrennan - downstream	082502168	25/03/2008	7.43	2.6	2	0.44	0.385	0.009	0.087	0.174
Kilmacrennan - downstream	082503337	27/05/2008	7.29	3.88	7.5	1.279	0.21	0.012	0.27	0.357
Kilmacrennan - downstream	082504594	18/07/2008	7.62	17.16	16.8	1.62	0.22	0.022	0.394	0.593
Kilmacrennan - downstream	082506262	06/10/2008	7.4	0.62	2.25	0.196	0.23	0.03	0.04	0.077
Kilmacrennan - downstream	082506788	30/10/2008	7.44	1.12	1.25	0.005	0.21	0.008	0	0.034
Kilmacrennan - downstream	082507258	24/11/2008	7.79	1.21	3.5	0.181	0.15	0.028	0.036	0.053
Kilmacrennan - downstream	092501347	29/01/2009	7.44	0.98	0.5	0.015	0.434	0.006	0	0.031
Kilmacrennan - downstream	092504015	24/07/2009	7.51	2.61	1	0.214	0.239	0.013	0.023	0.042
Kilmacrennan - downstream	092504910	22/09/2009	7.8	2.11	4.5					

Upstream										
Kilmacrennan - upstream	072507567	27/11/2007	7.35	0.81	5	0	0.301	0.013	0	0.036
Kilmacrennan - upstream	082501065	14/01/2008	7.01	1.36	0.5	0.011	0.32	0.016	0.007	0.03
Kilmacrennan - upstream	082502165	25/03/2008	7.01	1.37		0.047	0.295	0.008	0.003	0.017
Kilmacrennan - upstream	082503334	27/05/2008	7.68	1.33	0	0.006	0.29	0.007	0.019	0.025
Kilmacrennan - upstream	082504591	18/07/2008	7.77	1.39	2.6	0.021	0.23	0.016	0.55	0.076
Kilmacrennan - upstream	082506259	06/10/2008	7.36	0.36	1.25	0.032	0.36	0.009	0	0.009
Kilmacrennan - upstream	082506785	30/10/2008	7.49	0.96	2	0.006	0.24	0.008	0.004	0.014
Kilmacrennan - upstream	082507255	24/11/2008	7.54	0.56	2.25	0.007	0.16	0.026	0.003	0.053
Kilmacrennan - upstream	092501344	29/01/2009	7.35	0.7	1	0.126	0.476	0.008	0.007	0.012
Kilmacrennan - upstream	092504012	24/07/2009	7.5	1.22	0.5	0.002	0.243	0.019	0.004	0.036
Kilmacrennan - upstream	092504007	22/09/2009	7.74	1.68	8.25					

Text No	Attachment No	Description	Date	Check By
KMC/LA/F1(i)	AttachmentF.1	Upstream and Downstream Sample Monitoring	27/10/09	Donal Casey

Location	Lab.Ref	Date	pH	BOD	C.O.D.	S.S.	NH3 (as N)	NO3(as N)	NO2 (as N)	Ortho P	Total P
				(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
Kilmacrennan - outlet	072507569	27/11/2007	7.47	98.1	287	136	15.21	0.16	0.02	1.5	2.63
Kilmacrennan - outlet	082501067	14/01/2008	7.16	24.88	165	44	7.3	0.38	0.03	0.86	1.83
Kilmacrennan - outlet	082502167	25/03/2008	7.37	61.4	240	60	15.58	0.16	<0.01	2.25	3.29
Kilmacrennan - outlet	082503336	27/05/2008	7.02	225.2	613	60	40.4	<0.05	<0.01	5.36	7.9
Kilmacrennan - outlet	082504593	18/07/2008	7.45	104.8	404	113	27.88	<0.05	<0.01	3.14	4.97
Kilmacrennan - outlet	082506261	06/10/2008	7.19	85.1	324	80	19.7	0.13	0.04	2.84	3.45
Kilmacrennan - outlet	082506787	30/10/2008	7.15	43.1	133	40	4.97	0.52	<0.01	0.82	1.47
Kilmacrennan - outlet	082507257	24/11/2008	7.67	12.26	86	18	7.58	<0.05	0.03	0.64	1.22
Kilmacrennan - outlet	092501346	29/01/2009	7.21	18.4	92	5.5	9.13	0.36	0.1	0.85	1.35
Kilmacrennan - outlet	092504014	24/07/2009	6.95	69.6		38					2.67
Kilmacrennan - outlet	92504909	22/09/2009	7.28	162.4	384	180					0.11

Text No	Attachment No	Description	Date	Check By
KMC/LA/E4(i)	Attachment E.4	Outlet Monitoring results 2008 - 2009	27/10/09	Donal Casey

Code	Name	Location	EPA River Code	River Basin District	Hydrometric Area	Catchment Area	Q Value 2001	Q Value 2004
39L020100	Goldrum bridge	DL	39L02	NW IRBD	39	Lurgy	3	4
39L020300	Bridge u/s Leannan River	DL	39L02	NWIRBD	39	Lurgy	4	3
39L020500	Ballydone Bridge(u/s Lough Fern)	DL	39L02	NW IRBD	39	Leanman	3-4	4

Text No	Attachment No	Description	Date	Check By
KMC/LA/E3(i)	Attachment E.3	EPA summary results of Sampling 2003	27/10/09	Donal Casey

1 Purpose

The progress of a sample or batch of samples through the laboratory system is recorded by the use of the DCC Register of Samples.

2 Procedure

Samples are normally collected on site by a member of DCC.

Where possible, samples are placed on a bench in the main laboratory and are immediately assigned a DCC Lab Reference number, normally the next number in the series. A test sheet must also be completed, recording,

- The lab ref no.
- The date & time of sampling
- The exact location
- The name of the Sampler
- Any results of tests carried out in the field

This sheet will then be used to record the results of all analysis carried out on the sample and is signed off by the person responsible for that area of testing when completed. The sheets are colour coded & filed as follows;

- Sewerage – yellow pages
- Landfill – green pages
- Drinking water – blue pages
- Factories/trade effluent – pink pages
- Rivers – salmon pages
- Lakes – white pages
- Miscellaneous – ivory pages

The sheet is given a page number when filed in the appropriate section to ensure that all pages are accounted for. Each sheet lists only the analysis required for that type of sample. In some cases, a label, listing the specific analysis required, is applied to the bottle to enable progress to be tracked readily. The member of staff who collected the sample(s) must assume responsibility for storing the sample and for ensuring that the member of staff performing the analysis is aware of the sample location.

3 Procedural History

New SOP – no revisions to date.

Compiled by: Joe Ferry Date: 4/2/05
Authorized by: Donal Casey Date: 4/2/05

Text No	Attachment No	Description	Date	Check By
KMC/LA/E2(iii)	Attachment E.2	Reception & Handling of Samples – GENSOP 3.04	27/10/09	Donal Casey

1 PRINCIPLE OF METHOD AND SAMPLE TYPE

Two types of sample can be taken, grab samples or composite samples.

(1) Grab sample:

A sample collected at a particular time and place can represent only the composition of the source at that time and place. This involves manual sampling and minimal equipment but may be unduly costly and time-consuming for routine or large-scale sampling programs. As the name implies 'Grab samples' are simple scoops of the wastewater being sampled and are appropriate where conditions are constant or well mixed and slow to change. This type of sample can be used for instance for Balance Tank sampling or measuring sludge solids in the aeration basin (MLSS). Care should always be taken that a grab sample is representative of the whole, and should be taken from well-mixed areas on all occasions.

(2) Composite Samples:

Composite samples are either amalgamated or made up of smaller sub samples, and can be prepared in two ways. Automatic samplers can eliminate human errors in manual sampling, reduce labour costs, provide the means for more frequent sampling, and are used increasingly.

The simplest form is time-related composites, which are made up of sub samples of equal volume taken at specific time intervals e.g. sub samples every hour composited to make a single daily sample. A ***composite sample*** representing a 24hr period is considered standard for most determinations. Under other circumstances, however, a composite representing a longer time period, or a shorter time period may be preferable. The other form is ***flow proportional*** sampling, which requires a purpose-designed sampler. These units take samples of wastewater proportional to the flow and are usually linked to an automatic flow meter. This latter form of sampling is extremely accurate and can be used to establish the total wastewater load. Because of its accuracy, flow proportional composite sampling is preferable.

2 EQUIPMENT

- Sample bottles: One litre or 2 ½ litre new PVC bottles to be used for all samples taken except samples taken for bacteriological, oil based or solvent analysis.
- Sampling hand-pump with extension tube – to be used for depth sampling at low flow. Otherwise a sampling beaker (250ml, 500ml or 1000ml) with screw-in extension rods to be used for depth sampling with sufficient flow.

- Manhole lifters
- Markers to be used to mark Identification on sample bottles

Disposable gloves

3 PROCEDURE

I. Qualified authorised Local Authority personnel must take all samples. Sampling must be carried out taking due care to avoid personal risk or injury arising from the nature of the sample itself or the location of the sample point.

II. Sample bottles/containers must be clearly labelled and identified. The time/date must be recorded together will all relevant details of location and sampling conditions that may be present at time of sampling , e.g. weather conditions.

III. Sample bottles must be securely sealed following sampling and stored securely for safe transport to the laboratory in cooler boxes where necessary (see relevant test SOP).

IV. Samples will be analysed within 24 hours of sample collection, as a general rule; however, there may be specific requirements for particular tests. The relevant SOP should be referred to in all cases.

4 INTERFERENCES

I. Heavy rainfall dilutes effluent discharging from treatment plants that are not housed. Flow into sewage treatment plants increases greatly when there is heavy rainfall, particularly in towns where the surface water flows to the sewers rather than to the streams/rivers.

II. Care should be taken to avoid gross solids and to avoid disturbing sediment or materials adhering to surfaces of pipes, chambers, channels or watercourses.

5 REFERENCES

- Environmental research unit – Parameters of water quality.
- Standard Methods for the Examination of Water and Wastewater, 19th Edition 1995.

Compiled By: ***Margaret O'Neill*** ***Date: 5th March 2004.***

Authorized by: ***Hugh Kerr*** ***Date: 5th March 2004.***

1. **Introduction**

The aim of the calibration system is to endure that all measuring and test equipment whose accuracy influences the quality of test results shall be calibrated at regular defined intervals. This document lists the equipment which requires calibration by external contractors

2 **Schedule**

Item No.	Description	Make	Model	Serial No	Supplier	Calibration carried out by	Calibration Interval	Date of Calibration	Current location
LY002	Incubator	FTD	250	23696-LDA		AGB	Annual	February	Micro Lab
LY005	Balance	Mettler	PE1600	C96731 FNR47495		AGB	Annual	February	Lab
LY006	Balance	Mettler	AE260	SNR H56169		AGB	Annual	February	Lab
LY007	Hach Spectrophotometer	Hach	DR2010	971000005762	Celtic Eng	Celtic Eng	Annual	June	Lab
LY008	Hach Spectrophotometer	Hach	DR3000	283	Celtic Eng	Celtic Eng	Annual	June	Lab
LY011	COD Reactor	Hach	16500-01	165001	Celtic Eng	Celtic Eng	Annual	June	Lab
LY012	COD Reactor	Hach	456	010700008857	Celtic Eng	Celtic Eng	Annual	June	Lab
LY013	Hach Spectrophotometer	Hach	DR2000	950200033476	Celtic Eng	Celtic Eng	Annual	June	Lab
LY014	Convection Oven	Sanyo	MOV-212F	98100593		AGB	Annual	February	Lab
LY015	Combustible gas Indicator	MSA	40	F11509		CSL	6 months	May/Oct	Lab
LY020	Landfill Gas Analyzer	Geotechnical	GA 94	P006670		CSL	6 months	April	Field
LY024	Autoclave	LTE	Series 100	50806/1		Davidson & Hardy	Annual	January	Lab
LY025	Incubator	Sanyo	EN055	01-0115		AGB	Annual	February	Micro Lab
LY026	Incubator	Heraeus	B6030-(I)	51006829		AGB	Annual	February	Micro Lab
LY027	Incubator	Heraeus	B6030	51006830		AGB	Annual	February	Micro Lab

COMPILED BY : Joe Ferry DATE: 4th January 2005
AUTHORISED BY: Hugh Kerr DATE: 4th January 2005

Text No	Attachment No	Description	Date	Check By
KMC/LA/E2(i)	Attachment E.2	Equipment Calibration Procedures – GENSOP10.02	27/10/09	Donal Casey

Donegal County Council
Laboratory Quality Manual

	Text No	Attachment No	Description	Date	Check By
	KMC/LA/C1(viii)	Attachment B.12	Quality Manual	27/10/09	Donal Casey

QUALITY MANUAL

Donegal County Council Laboratory

Magheranan

Letterkenny

Issued by: **Joe Ferry**

Executive Scientist

SECTION 1: CONTROL, REVIEW AND MAINTENANCE OF MANUAL

1.1 The Quality Manager, (Executive Scientist), is responsible for the upkeep of the manual. It shall be renewed as required and reviewed at annual intervals.

1.2 When the manual is completely revised, the new version shall be numbered consecutively to the previous version and the new issue shall supersede any previous issue.

New or altered text shall be identified by shading the appropriate paragraph, as in this example.

1.3 INAB shall be notified immediately of any revisions to the manual, changes in staff or scope of activities that could affect the Laboratory's compliance with INAB regulations.

1.4 Copies of the manual may be inspected at the DCC Laboratory premises at the discretion of the Executive Scientist or Senior Executive Chemist. The Laboratory shall hold an INAB copy on behalf of INAB. This shall be made available to INAB upon request.

1.5 Controlled copies of manual:

No. 1 *Master copy*

No. 2 *Laboratory copy*

No. 3 *INAB copy*

SECTION 2: QUALITY POLICY

2.1 Quality Policy Statement

The management of Donegal County Council, (DCC), Laboratory are committed to good professional practice in order to ensure quality is achieved in all aspects of work, complying specifically with all INAB requirements, for those tests where INAB accreditation has been sought, and, so in far as is practicable, for all other tests carried out by the laboratory.

The Quality Assurance criteria applied shall be in accordance with the International Standard ISO/IEC 17025:2000

This policy will be implemented by the Senior Executive Chemist of DCC Laboratory, (who also assumes the role of Deputy Technical Manager).

The Analytical work carried out shall be in accordance with INAB criteria.

Where appropriate, tests shall be traceable to National Standards, with stated uncertainties of measurement and certified by an approved signatory.

All analytical staff shall be aware of the content of the quality manual and shall appreciate the necessity to comply with its policies and procedures.

Signed …… Donal Casey (Senior Executive Chemist)

Date: …….

2.2 Accreditation and Approval Bodies

DCC Laboratory is currently working towards accreditation for Nutrient Analysis.

2.3 Aims and Form of Quality System

2.3.1 The Quality Manual

This is the key document used to ensure that all procedures are conducted in the appropriate manner to achieve the required standard. The Quality Manual has been prepared in accordance with the International Standard ISO/IEC 17025:2000. The Quality Manual and associated documentation (regulations, standard operating procedures, test methods, manuals etc), identify the scope of operation, organisation, facilities and equipment, analysis procedures and document control that apply within DCC Laboratory. All such documentation is controlled as described in section 3.5.7. All staff must adhere to the Quality System, defined in the Quality Manual.

2.3.2 The Quality Manager

The Quality Manager is responsible for:

- the efficient operation of the quality system.
- the implementation of specific policy and procedures.
- the authorisation, compilation, distribution, maintenance and revision of the Quality Manual and associated documentation. (***On no account should any document be altered unless authorised by the Quality Manager or Deputy Quality Manager).***

2.3.3 The Technical Manager

The Technical Manager is responsible for the overall control of the quality policy, system and associated staff. On the occasion of extended absence of the Technical Manager, a Deputy Technical Manager shall assume the Technical Manager's duties as described above and in 3.3.1.

2.3.4 Departures from Authorised Procedures

Except where specified by the customer, all analysis must be undertaken using proper documented procedures. Any departure from these procedures must be authorised by the Quality Manager or Technical Manager and recorded as a non-conformance. If, for any reason, there have been unauthorised departures from documented procedures that may affect the quality of testing, then the work must be halted immediately and the reason for the departure investigated with action taken to correct the situation before resuming. Where there is cause to suspect the validity of completed work that has already been reported to a member of the public, they must be notified, the work returned for authentication, if necessary retested, and a new analysis report issued, as detailed in the standard operating procedure file.

SECTION 3 ORGANISATION

3.1 History

The Donegal County Council Laboratory was formed about 25 years ago to provide the essential analytical techniques to service the work of the council, primarily in water/sewage treatment. As concern over the environment has increased over the last twenty years, the laboratory has widened its scope to service the monitoring needs for the surrounding land, rivers, lakes, beaches, and to a lesser extent, air, in the region. It now has the authority to issue and revoke pollution licences to those factories in the region, which release potentially harmful substances into the environment and is responsible for ensuring these companies stay within the restrictions imposed by the licence.

3.2 Organisation and Job Titles of Key Staff

A chart showing the basic organisation of the Lab and identifying the staff responsible for the provision of the INAB accredited service(s) can be obtained on request from any of the Executive Technicians.

3.3 Staff Responsibilities

3.3.1 Technical Manager/Chief Technician (Hugh Kerr)

The Technical Manager reports to the Executive Scientist & Senior Executive Chemist of DCC Laboratory and is responsible for the implementation and overall control of the sampling and analysis system and associated staff, while ensuring that all relevant INAB requirements are met.

Objectives

1. To ensure the integrity of the Laboratory, equipment and operation.

2. To ensure that sampling and analyses are carried out in accordance with standard operating procedures, in line with INAB requirements.

3. To assume full responsibility for all matters relating to Drinking Water

Duties and Responsibilities

1. To liase closely with all of the Technicians and report regularly to the Executive Scientist & Senior Executive Chemist of DCC Laboratory.

2. To manage and control all Laboratory personnel.

3. To ensure contractual commitments are met.

4. To interview, appoint and audit analytical personnel, as required.

5. To assist the Quality Manager with the revision of analytical procedures as and when required, to comply with changing standards.

6. To ensure correct processing of results.

7. To investigate and deal with client complaints in accordance with the appropriate standard operating procedure.

8. To act as one of the signatories recognised by INAB to sign the Laboratory's analysis reports and to take technical responsibility for their content. (Section 3.6)

Deputy Technical Manager

On the occasion of the extended absence of the Technical Manager, the Deputy Technical Manager shall take responsibility for the Technical Manager's duties as described in 3.3.1.

3.3.2 Laboratory Manager

Responsible to the Executive Scientist.

Duties and Responsibilities

1. Administration and operation of the Lab.
2. Assessing the forward needs of the Lab in respect of equipment, space, apparatus and its integration within the Lab.
3. Ensuring that absolute confidentiality is maintained at all times.
4. Supervision of all the laboratory technical staff.
5. Allocation of responsibilities to ensure effective performance.
6. Allocation of workload within the unit.
7. Collation of results from completed analyses and preparation of reports for submission to clients.
8. To investigate and deal with client complaints in accordance with the appropriate standard operating procedure.

Deputy Laboratory Manager
On the occasion of the extended absence of the Laboratory Manager, the Deputy Laboratory Manager shall take responsibility for the Laboratory Manager's duties as described in 3.3.2.

3.3.2 Quality Manager

Responsible to the Senior Executive Chemist

Duties and Responsibilities

1. To introduce and maintain documentation and to standardise procedures in accordance with the requirements of INAB.
2. To ensure that quality standards are maintained.
3. To plan quality audits carried out in accordance the Laboratory's Audit Programme *(as detailed in the appropriate Controlled Document)* and to liase closely with the Technical Manager on the carrying out of such audits.

4. To investigate and deal with client complaints in accordance with the appropriate standard operating procedure.

5. To carry out performance appraisals and arrange training necessary to maintain standards

Deputy Quality Manager

On the occasion of the extended absence of the Quality Manager, the Deputy Quality Manager shall take responsibility for the Quality Manager's duties as described in 3.3.3.

Assistant Quality Manager

DCC Laboratory will appoint an assistant Quality Manager who will visit the laboratory on occasions to provide assistance, advice and guidance to the management in the design and execution of the Quality System. The person appointed has substantial experience in design and adaptation of Laboratory Quality Systems and in Laboratory accreditation requirements. He will also carry out external audits as required by DCC Laboratory.

3.3.4 Nutrient Analyst

The Nutrient Analyst is responsible to the Technical Manager.

Duties and Responsibilities

1. The safe handling of all relevant analytical equipment.

2. Ensuring that all relevant equipment is "in calibration".

3. Carrying out all analysis and calibrations in accordance with the relevant SOP(s).

4. Ensuring that all routine maintenance is carried out, as necessary, e.g. replacing consumables.

5. Ensuring that all non-routine maintenance is carried out quickly and efficiently, in the event of a breakdown.

6. Ensuring that the Technical Manager is informed of any situations that deviate from the standard procedure and could have a direct bearing on the quality of the service provided by the Laboratory.

7. Liaison with suppliers, manufacturers, etc.

8. Ensuring that there is an acceptable turnaround time between sample submission and reporting results.

9. Ensuring that all documents are updated and available for consultation by authorised personnel.

10. Ensuring that other authorised operators have adequate up to date training.

11. Ensuring that Health and Safety Regulations are adhered to at all times.

Deputy Nutrient Analyst

On occasion of extended absence of the Nutrient Analyst, the Deputy Nutrient Analyst shall assume the Nutrient Analyst's duties as described in 3.3.4.

3.4 Training

The determination of the competence of those carrying out testing is the responsibility of the Technical Manager. The Training Manager is responsible for identifying additional training needs and ensuring that the training records are adequate and maintained up-to-date.

The Laboratory's policy is to ensure that existing and new staff have and maintain the relevant technical skills, professional qualifications and professional expertise.

Staff qualification and training records will be held and maintained by the Training Manager.

3.4.1 Staff Entry Requirements

All DCC Laboratory technical staffs are graded according to qualifications, experience, and demonstrated competence. Entry requirements depend on the level of ability considered necessary to carry out the specific job being offered.

3.4.2 Trained Staff

Since much of the work carried out in the Laboratory is specialised, in-house training is paramount.

All documented procedures carried out in the Laboratory have been assigned to one or more members of staff. These are to be detailed in a document entitled *Authorised Operators and Training Records for All Standard Operating Procedures*.

These procedures cannot be carried out by anyone other than those authorised to do so in this document, which is cross-referenced with the current training record for each named member of staff.

3.4.3 Untrained Staff

Staff undergoing training must be assigned to a supervisor who will oversee their work until an acceptable level of competence has been consistently demonstrated. This must include the successful use of reference materials and chemical standards where applicable. The person is allowed to carry out the work unsupervised only when the Training Manager and Technical Manager have given written authorisation for them to do so by transferring their name to the 'Trained Staff' list for the appropriate procedure reference(s) on the document described above. ('*Authorised Operators and Training Records for All Standard Operating Procedures*').

3.4.4 Students on work experience schemes

Students on work experience schemes are permitted to undertake some basic analyses of samples, under the supervision of a fully trained technician. All students must have attained a minimum of 2 years 3rd level experience in an appropriate field *(either Environmental Engineering/Chemistry).*

3.4.5 Setting of Staff Training Goals

It is the policy of DCC Laboratory to ensure that all staff appointed by the Laboratory receives adequate training to enable them to fulfil their full potential for the benefit of both DCC Laboratory and the member of staff concerned.

To this end, the annual staff training programme will be developed which sets staff training goals with respect to education, training and skills.

3.5 Administrative Procedures

3.5.1 Dealing with Enquiries

The Senior Executive Chemist, Executive Scientist, the Chief Technician and the Executive Technicians handle general enquiries from the general public and specific complaints about pollution from the Public. This enables technical or commercial queries to be discussed and agreed quickly. On occasions, when none of these are available, DCC Laboratory personnel will follow procedure: *'Dealing With New Clients'* and *'Dealing with Public Complaints'*. This ensures that all information relating to the enquiry/complaint is documented and arrangements are made for contact to be made at a later stage.

A member of the public may wish to consult directly with the member of the technical staff who is carrying out the work or vice-versa. This can only be done by arrangement with DCC Laboratory Management.

3.5.2 Sample Collection

The Technician undertaking the analysis normally collects the samples on site. On receipt in the laboratory, their details are entered into the Sample Register (as detailed in the appropriate standard operating procedure). Each sample is given a numerical identity code, specific to that sample.

Where possible, the samples are analysed immediately by the appropriate technician. If this is not possible, they are placed in short term storage. Those samples to be analysed for nutrients are stored in the freezer or refrigerator. Any samples required for pending Court cases are kept in a locked refrigerator. Only the Analyst concerned has keys to this.

3.5.3 Contract Policy

3.5.3.1 Form of Contract

Two forms of contract are identified:

i. A formal contract entered into only at the specific request of an external client. The format of such a contract will be as specified by the client. It is DCC Laboratory policy not to require such a formal contract unless the client specifically requests this. A record of all such contracts will be kept in a Contract Log.

ii. Information recorded in the Sample Log. This will generally be in the form of oral and/or written instruction in relation to the analysis of a sample or set of samples, transcripted to the log or referenced in the log and held in the clients file. Generally, the client leaves it at the discretion of DCC Laboratory, as to which analysis will be performed on the samples.

3.5.3.2 Contract Review

If a client requests a change in a formal contract, or the Laboratory deems it necessary to perform analysis not already detailed in the formal contract, a contract review must be performed. The Senior Executive Chemist or Chief Technician must carry out this review.

In case of a formal contract, any actions taken following the contract review are noted in the contract log.

Changes to the contract are designated as 'major' or 'minor'.
A minor change is one that does not significantly change the nature of the original instruction e.g. an increase or decrease in the number of samples or the additional or removal of a related type of analysis.
A major change is one that significantly changes the original instruction, e.g. a cancellation of all or part of the work, the additional of unrelated tests or a change in timescales.

3.5.3.3 Contract Modification

A formal contract may only be modified after consultation with the client and with the client's written instruction. Only the Senior Executive Chemist or Chief Technician may authorise the modification of a formal contract. The original contract must be clearly marked "Contract Changed/Cancelled" as relevant and the details must be recorded in the Contract Log.

3.5.4 *Security of Confidential Information*

It is the policy of the Laboratory to ensure confidentiality of information by restricting the release of information both through technological communications and the physical security of the Laboratory. Any information relating to a client or sample may be released to the Public by applying to the main Council office in Lifford through the Freedom of Information Act.

Entry to computer systems in which confidential information is stored must be restricted by the use of a password.

Security keys that cannot be copied without written authorisation lock the Laboratory and offices. All existing keys have been assigned to DCC Laboratory staff.

Only those who hold a permanent position on the staff, hold keys to the premises.

3.5.5 *Sub-contracting of Analysis*

It will be the Unit's policy that, where possible, tests for which it will eventually hold INAB accreditation are carried out by the Laboratory.
If the occasion should arise where this is not possible, (because of prolonged instrument failure for example) it may be appropriate to sub-contract to another Laboratory holding INAB accreditation for that particular test. In such a case, the subsequent report must clearly indicate that the work was subcontracted.

The Quality Manager shall maintain a record of all sub-contracted work and a register of all sub-contractors used.

The Laboratory accepts responsibility for the quality of sub-contracted work unless the client has specified which sub-contractor is to be used.

3.5.6 *Purchasing of Equipment, Materials and Services*

It is the Lab's policy to purchase equipment, material and services from reputable suppliers. Purchasing procedures are governed by the Council's guidelines.

In the case of INAB accredited tests, the certification/accreditation status of all suppliers of equipment / materials and services will be recorded and monitored at least annually as part of the internal auditing programme.

The Laboratory generally uses chemicals, reagents, glassware etc. that are either supplied or recommended by the manufacturer of the equipment with which they will be used. Where this is not the case, all supplies must be checked for their compliance with the specifications stated in the associated

Standard Operating Procedures. Preference must be given to suppliers with documented evidence of accreditation by a recognised certification body. Where no independent assurance is available, purchases shall not be used until inspected or otherwise verified to comply with required specification.

The Laboratory can make no purchases without authorisation from the Senior Executive Chemist. All supplies received are checked, and their suitability documented before being added to stock. (See Standard Operating Procedure *'Control of Stock Levels of Consumables in the Laboratory')*. *(To be compiled)*

These records will be kept in 'Equipment Files' at the appropriate analysis workstation. They are specific to each piece of equipment used and are maintained by the Analyst and checked by the Quality Manager.

3.5.7 Document Control and Document Review

The Quality Manual and associated documentation (regulations, standard operating procedures, test methods, manuals etc) which identify the scope of operation, organisation, facilities and equipment, analysis procedures and document control that apply within DCC Laboratory, are controlled as follows:

All internally generated documentation must include the following minimum information:

- designated procedure and revision number
- date of compilation
- approved signatories
- page number and title
- statement and purpose
- description of steps involved
- procedure history

No controlled document may be issued until it has been approved and reviewed by the Senior Executive Chemist.

The existence of all copies of controlled documents will be recorded and monitored. Every copy will be assigned to a named member of staff who has accepted responsibility for its use. All obsolete copies of controlled documents must be destroyed with the exception of the master copy, which is marked 'obsolete' and maintained for reference purposes only. Uncontrolled copies of documents may be issued with authorisation by the Technical Manager. Such issues are recorded and marked accordingly. This procedure is to be detailed in SOP reference; 'Compiling and Controlling Standard Operating Procedures and Other Documentation'.

No person is allowed to alter any controlled document unless authorised by the Quality Manager or Deputy Quality Manager. However all staff are encouraged to suggest corrections or improvements to the Quality system.

Standard operating procedures will be put in place for the purpose: 'Requesting a New SOP; 'Revising an Existing SOP; 'Revising the Quality Manual'.

It is the policy of DCC LABORATORY that the Document Review process will ensure that each Controlled Document is reviewed not less than once a year, so that any changes in Laboratory Policy or Practise, the ISO/IEC Standard, or appropriate legislation are fully reflected in the Controlled Documents. It is the responsibility of the Quality Manager to ensure that such Reviews are incorporated into Laboratory Quality System. A Document Review programme is currently included in the agenda for Quality Review Meetings.

3.6 Analysis Reports

Analysis reports are used for issuing results to all clients. Analysis reports are compiled as detailed in the SOP entitled *Compiling Analysis Reports*, unless requested in a different format by the client.

Such results must be reported with the utmost accuracy, clarity and objectivity, in such a manner as to minimise the possibility of misuse or misunderstanding.

Reports are issued as hard copy or by electronic data transfer. When reported by electronic data transfer, they are deemed as draft results only and must be followed by an authenticated hard copy.

Every effort must be made to ensure client confidentiality. The company's aim is to report results in the manner prescribed by the client. Electronic data transfer and telephone must be used only when prior notice has been given to the client and only by staff authorised to do so, as detailed in the SOP entitled *'Telephoning and Faxing Results to Clients.'*

Where a party other than the Laboratory has carried out sampling an appropriate disclaimer must be included.

Unless the client has specified otherwise, each analysis report will contain the following minimum information:

1. Name and address of Laboratory.
2. Name, company and full address of client
3. Unique identification number with page numbers
4. Title

5. DCC Laboratory reference and Client reference

6. Sample description

7. Any date written on the sample or accompanying documentation.

8. The date when the sample(s) arrived at the DCC Laboratory

9. The member of the Laboratory personnel who received the sample(s)

10. The analysis performed on the sample(s)

11. The date the analysis was completed

12. Reference to the test method used. Any deviations, additions or exclusions from the standard operating procedure must be recorded

13. The signature of the person(s) responsible for compiling the analysis report and the signature of the person(s) responsible for approving the analysis report must be included.

14. Any other available information helpful to or requested by the client. Where results arise from sub-contracted analysis this shall be clearly indicated on the analysis report.

Any revisions of an analysis report after issue must be made only as a further document that includes the statement "Certificate of Analysis - Supplementary".

The Laboratory will notify clients promptly in writing if there is any cause to doubt the validity of any reported results. A standard procedure must be followed when an error has been identified, as detailed in the SOP: '*Dealing with Reported Erroneous Results.'*

The end of an analysis report is marked by the inclusion of signatures. Approved signatories who take technical and legal responsibilities for the report provide these. They are the Senior Executive Chemist, Executive Scientist, Chief Technician, and Executive Technicians. Where another technician has carried out the work, they may sign the report but it must be countersigned by one of the above.

3.7 Conditions for the Use of INAB Accreditation Mark

The INAB Accreditation Mark will be displayed on analysis reports containing only test results for which the Laboratory is accredited.

3.7.1 *Use of INAB Accreditation Mark on Publicity Material*

The INAB Accreditation Mark will be displayed in publicity material that refers to accredited services. This will clearly indicate what activities are accredited.

It is clearly understood that the INAB Accreditation Mark or any reference to INAB accreditation does not imply that INAB accepts responsibility for the accuracy of an analysis result or any opinion or interpretation derived there from.

3.7.2 *Disclaimer for Non-accredited Results*

Where the INAB Accreditation Mark is displayed on analysis reports, which contain both accredited test results and results which are outside the scope of the Laboratory's accreditation, the following disclaimer will be clearly stated.
"Tests marked "Not INAB accredited" are not included in the INAB Accreditation Schedule of this Laboratory".

Where non-accredited test results are reported they shall be marked "Not INAB Accredited".

When a test report contains opinions, interpretations or other material relating to investigational activities, the following disclaimer shall be stated:
"Opinions and interpretations expressed herein are outside the scope of INAB Accreditation".

When information relating to sampling is included in a test report, the following disclaimer shall be stated:
"Information relating to sampling expressed herein is outside the scope of INAB Accreditation".

3.8 Handling of Complaints and Anomalies

The Laboratory strives to minimise the possibility of error and ensure client satisfaction. When a complaint is received, it must be dealt with thoroughly and efficiently in accordance with the standard operating procedure.

Receiving and Processing Client Complaints.

It is the responsibility of the Chief Executive Chemist to ensure that complaints are resolved fully to the satisfaction of all concerned and that every effort is made to ensure that the incident cannot be repeated.

A record must be maintained of all complaints and of subsequent action taken by the Quality Manager. This may include carrying out a specific audit on the affected area, depending on the nature of the complaint as indicated below:

Minor complaint (A specific audit is not necessary.) An isolated incident such as typographical error or a misunderstanding affecting only one sample or group of samples.

Major complaint (A specific audit is required.) Repeated minor complaint or one affecting more than one sample or group of samples. An incident that raises doubt concerning the Laboratory's compliance with its policies or procedures, or with the requirements of the International Standard ISO/IEC 17025:2000. If an error has been identified in reported test results, the Laboratory must immediately carry out Standard Operating Procedure, '*Dealing With Reported Erroneous Results'*. *(To be compiled).* This includes alerting the affected client(s) immediately by telephone and as soon as practicable in writing. Other action to be taken is described in Standard Operating Procedure, '*Quality Audit.'(To be compiled).* Every effort must be made to prevent further error or minimise delays if an operation has been suspended.

3.9 Influence and Inducement

It is the Unit's policy not to accept any influence or inducement in respect of the reporting of results. Any member of staff becoming aware of or suspecting such pressure from a client must advise the Quality Manager immediately. Where the Quality Manager is satisfied that a client is seeking to exert any such influence or inducement, they must advise the Senior Executive Chemist, who will advise the client of the Unit's policy and ask the client to desist. Any repetition will lead to the immediate withdrawal of services from that client. Should a member of staff fail to report any such approach from a client or be suspected of complying with such an approach, disciplinary procedures will be invoked.

SECTION 4: LABORATORY ACCOMMODATION, EQUIPMENT AND RECORDS

4.1 Laboratory Accommodation

The Lab is committed to the provision of an environment and accommodation that are suitable for conducting chemical analysis whilst ensuring safe working conditions for staff.

There are no activities currently being carried out in the Laboratory requiring specialised environmental conditions that cannot be met through the use of local exhaust ventilation systems. The performance of these facilities will be monitored annually.

Any deviations from the above should be reported to the Laboratory Manager.

4.2 Equipment used for Analysis

The Laboratory uses suitable equipment that is capable of achieving the accuracy required in compliance with the specification relevant to the analysis concerned.

An inventory number will be issued to each item of equipment after it has been fully checked for compliance with safety regulations, at the time of receipt. This inventory number, which is attached to the equipment, uniquely identifies it and can be used to trace its safety compliance history. Safety compliance records are held in the individual equipment files.

All equipment must be checked prior to use to ensure that it is capable of achieving the accuracy required and that it complies with standard specifications relevant to the tests concerned. The criteria for these checks are based on the agreed specifications as to be detailed in the associated Standard Operating Procedures.

Only authorised staff can use Accredited equipment.

An Equipment Record must be completed for each item received. This must contain the following information:

1. name of the item of equipment
2. name of the manufacturer and any model or type identification
3. any serial number allocated by the manufacturer
4. inventory number
5. date when received
6. condition when received
7. date when placed in service
8. current location

An 'Equipment File' must be prepared. See Standard Operating Procedure *'Equipment Files', GENSOP8.01.* This must contain:
-the Equipment Record
-a list of authorised users including a named primary person responsible and a secondary person responsible
-reference code and location of applicable Standard Operating Procedures
-title and location of relevant operating and maintenance manuals
-records of routine maintenance
- details of any breakdown/failure
-calibration records
-list of all consumables required for the operation of the equipment including location, storage conditions, minimum stock level, reordering information.
-details of suppliers of consumables and services including their accreditation status.

Each Equipment File is stored in a location convenient to the equipment itself. It is the responsibility of the operators of the equipment to ensure that once a file has been prepared, it is kept complete, up-to-date, and available on request. It must be checked at regular intervals as part of the Laboratory's Quality Audit programme and can be consulted at any time by any authorised personnel.

Equipment must be maintained regularly to ensure proper functioning. Where applicable the equipment manufacturers' instructions are available to authorised staff.

Where relevant, equipment that is in constant use is checked between regular re-calibrations. Where an instrument is operating outside the documented specifications or its performance is questioned as a result of damage, mishandling or interference of any kind, operation of the instrument must be suspended. It must be clearly labelled to this effect and a statement provided to advise users of possible delays. The instrument cannot be returned to service until it has been repaired if necessary and its performance checked in accordance with the documented re-calibration and re-validation criteria.

For equipment requiring calibration, each record must include calibration reports, certificates and other relevant documents. Wherever practicable, all equipment requiring recalibration must be labelled so that the status of calibration and recalibration dates is obvious.

Records must include details of any equipment that may be out of service for a period and subsequently require re-calibration and re-commissioning for future use.

Where computers or other electronic equipment is used for the collection and processing of data, such equipment must be satisfactorily maintained.

Any non-commercial software being utilised must be fully documented and validated before use.

4.3 Control and Traceability

The Laboratory adheres to the mandatory requirements for the calibration control of all measuring instruments. It is the responsibility of the primary operator of each piece of equipment to check that it is 'in calibration' and that calibration records are maintained. This will be checked as part of the Laboratory's Quality Audit Programme.

The Laboratory obtains all primary standards and calibrations for INAB accredited tests from bodies that possess INAB accreditation, with the required facilities to ensure traceability to national standards and accepts the reported associated uncertainties.

Reference standard materials are reserved for calibration purposes only and cannot be accessed by any person unauthorised to do so. They must be stored in the Laboratory in accordance with the conditions and shelf life recommended by the suppliers.

The Technician using it calibrates the balances on a regular basis using reference weights. An external accredited body also calibrates the balances annually.

All analysis equipment, whether new, modified or reconditioned, must be calibrated and checked for conformance to the relevant specifications.

The frequency of calibration is regulated by any mandatory requirement, the type of equipment, calibration history and the amount of usage to which the equipment is subjected.

All analysis equipment must be labelled clearly to indicate required calibration dates.

4.4 Records

The Lab will maintain a systematic and documented record of all information of practical relevance to all work carried out in the Laboratory. This records system is operated so as to facilitate identification of the sources of error.
All records relating to an analysis / calibration or related process must be prepared in accordance with standard operating procedures. Records will consist of a combination of the following:

Logbooks/ Maintenance records: These are designed and issued as a standardised method for recording specific information in relation to a standard procedure. Each book / record should have a title, reference code and issue number and the pages are numbered sequentially in each.

Computer printouts: The original printouts must be stored after processing for future reference. These show all work carried out including preparations, calibrations etc. The identity code of the operator is included in the information provided on the printout.

A copy of issued results must be kept in the manner described in the appropriate Standard Operating Procedure.

All information must be entered in permanent ink and any corrections must be made clearly beside the original entry, which should be crossed out without making it illegible. The member of staff making it must sign the correction. Major errors must be brought to the attention of management.

All records must be retained so that work can be reviewed and, if necessary repeated at a later stage. This includes workbooks, printouts ('raw data'), as well as copies of reported material. All information should be stored for a minimum of six years. All records are protected from loss, damage or misuse in accordance with the general security/ confidentiality policy of the Laboratory; see section 3.5.4 of this document.

4.5 Analysis Report Distribution

Original - To the client, if external

Copy - Laboratory Manager/Customer File

Copies of analysis reports will be maintained for a minimum of six years.

Records can only be destroyed with the permission of the Senior Executive Chemist.

SECTION 5: QUALITY CONTROL SYSTEM

5.1 Quality Control Policy

All of the Laboratory's activities must be carried out according to the relevant Standard Operating Procedures in a manner that ensures the quality of the data produced, following the general protocols set out in this manual. In so far as is practical, all activities must be audited on a regular basis to ensure that this policy is being followed. In any case, all activities relating to an accredited procedure must be audited following the protocols set out below.

5.2 Authorised Auditors

The Quality Manager shall plan and organise audits and the Quality Manager or a competent auditor, designated, must carry out audits.

5.3 Audit Procedure and Preventative Action

Audits must be carried out in accordance with Standard Operating Procedure '*Quality Audit*'. This has been prepared specifically to cover the activities of this Laboratory and includes all aspects of the quality system. A basic audit plan has also been prepared for each area to be audited. It is the responsibility of the Quality Manager to add to this or modify it to highlight key areas to be reviewed. These will be based on problems or potential problems, which have been identified through complaints (see section 3.8), audits in other areas and Quality Review findings etc.

Auditors are instructed to adopt a pre-emptive approach in their work and all staff are encouraged to look for, and report any potential problems or opportunities to improve the quality system. This is facilitated by the use of the procedure; entitled: '*Revision of, or preparing a new Standard Operating Procedure"*

This will be incorporated into the Laboratory's policy on " Preventative Action" *(to be written)* which aims to prevent any future quality failures or mitigate the effects of any such failures by using the knowledge and intelligence obtained through auditing, or through the investigation of quality failures, anomalies, or client complaints.

It will be the policy of the DCC Laboratory to document any such "Preventative Action" taken and to retain records of such "Preventative Action" in a "Preventative Action" binder. Its existence is made known to all staff, who are encouraged to refer to the documents contained therein. All relevant documents, including any modifications to procedures or analytical methods are to be included with the filed and completed " Preventive Action forms.

5.4 Frequency of Audits ***Does not yet apply – subject to change***

All designated activities and responsibilities must be audited at least once a year. In addition, two vertical audits must be conducted in the first and second halves of each year in association with an external auditor from another INAB accredited Laboratory. An Audit Programme has been prepared to provide a visual indication of the current audit status in all areas of the Quality System.

The Quality Manager is responsible for ensuring that audits are carried out within the time scale specified, either in the audit programme or Quality Review Meeting. They may authorise an audit to be carried out at any time in any area of the Laboratory.

5.5 Audit Findings ***Does not yet apply***

The Quality Manager is responsible for verifying and reviewing audits. Where an audit reveals non-compliance with the Laboratory's policy or procedure, corrective action must be taken within an appropriate time scale. This time scale must be agreed by both the Quality Manager and the person responsible for carrying it out at the time of the audit. The Quality Manager must verify monitoring and completion of corrective action. A record of Quality Audits and findings together with any non-compliance raised and the corrective action taken are kept on file for the required mandatory time period and for inspection by INAB as and when required.

5.6 Quality Review ***Does not yet apply***

The quality system operated by the Laboratory must be reviewed when required or at least once a year, so that compliance with on-going requirements of INAB is maintained. The review will follow an agenda as detailed in appendix 12. This takes account of the findings of internal audits and external assessments, the results of Measurement Audits or Inter-Laboratory comparisons, complaints from clients or other relevant factors.

Review findings must be recorded including any action required. All staff will be expected to attend the annual Quality Review Meeting with the exception of the Director of the Laboratory.

Quality meetings are held at least monthly. The quorum for the monthly meetings will consist of three of the following: Technical Manager, Quality Manager, Deputy Quality Manager, Laboratory Manager and Training Manager A number of clients carry out audits of the Laboratory, the results of which are incorporated into the Quality Review.

5.7 Other Quality Checks

The Laboratory makes use of standard reference materials and sub-reference materials as to be detailed in the SOPs relating to specific analytical methods.

SECTION 6: ANALYSIS SYSTEM

6.1 Standard Traceability

It is recognised that INAB requirements for the Laboratory's analysis programme apply not only to the analysis that the Laboratory offers as a service for which it holds accreditation but also to all subsidiary analysis, such as environmental conditions that could affect the accuracy or validity of such analysis or tests.

The Laboratory's procedures in relation to analysis or tests for reference standards meet the requirements of the International Standard ISO/IEC 17025:2000.

Reference standards are only used for calibration purposes.

The Laboratory's system of calibration and analysis is designed and operated so as to ensure that calibrations and analysis are traceable to National Standards or through evidence of correlation of calibration by regular use of reference materials.

The Laboratory offers an analysis service and holds reference standards and other items of analytical equipment required to cover the range of analysis performed. The analytical equipment and reference standards will be calibrated at intervals. *To be implemented*

Official calibration certificates obtained from INAB accredited laboratories will be retained in the equipment file for each item of equipment.

6.2 Analysis Procedures

Due to the specialised nature of the work undertaken, the Laboratory must prepare 'in-house' standard procedures. The format of these procedures will be specified in the standard operating procedure for compiling and controlling documentation. This will state that all standard operating procedures must include the following minimum information:

- designated procedure and revision number
- date of compilation
- approved signatories
- page number and title
- statement and purpose
- description of steps involved
- procedure history

Procedures will be compiled and reviewed by experienced staff after consultation with technical experts and appropriate internationally recognised

standards, where relevant e.g. International Standards, USEPA Methods, Manufacturers Technical Specifications, etc.

Standard Operating Procedures will be prepared for most of the activities carried out in the Laboratory and for **all** those upon which any accredited work is dependent. These procedures are to be maintained and controlled by the Quality Manager. Instruction must be given in sufficient detail and clarity to ensure proper implementation and consistency of application from one occasion to another. A Standard Operating Procedure cannot be circulated for use until it has been approved by an authorised signatory i.e. the Senior Executive Chemist of the Laboratory, as to be defined in the appropriate Standard Operating Procedure.

All Standard Operating Procedures should be controlled by applying a coloured stamp to every page. This will also states the copy number and date of issue. Staff are not allowed to hold any copies other than those stamped with their unique identity number.

The Laboratory uses current methods and procedures that are recognised as standard.

In addition to methods and procedures for analysis and related activities, the Laboratory has access to, and maintains on record any further information necessary for the proper performance of the analysis.

The integrity of analysis is protected at all times. All data are filed in a secure system of storage. Data processing by computer will be performed only under secure access password control and is hard copied and filed.*(To be implemented)*

The Laboratory will only commence work on behalf of a client after the analysis to be performed has been agreed on by the Senior Executive Chemist, Chief Technician or Senior Executive Technicians and the client.

The analyst carrying out Nutrient analysis must adhere to the procedure as to be specified in the Nutrient Analysis Standard Operating Procedure and in compliance with the relevant Standards/ Specifications.

6.3 Uncertainty in Measurement

It is the Unit's policy not to provide an estimate of the uncertainty associated with any measurement unless specifically requested to do so by a client.

In that case, an uncertainty budget must be established for each sample. This is usually taken to be two standard deviations about the mean.

In the case of Nutrient Analysis, the various associated potential sources of errors are:

a. the uncertainty caused by weighing out the test material
b. random variation in the repeatability of results when analysing a reference material of known composition
c. random variation in the repeatability of the results of the samples analysed.

6.4 Availability

Analysis will be carried out to the latest issue of any given specification unless requested otherwise by the client.

All Standard Operating Procedures and any other relevant information is made available to all associated staff.

Arrangements for analysis to non-standard methods can be negotiated. The reports issued will clearly state the area of deviation or special method of analysis used.

6.5 Responsibility

The Senior Executive Chemist and the Chief Technician are responsible for the authorisation of analysis procedures.

All procedures must be endorsed with Date of Compilation/Revision Number. Obsolete copies must be withdrawn and destroyed.

SECTION 7: SAMPLE HANDLING STORAGE AND DISPOSAL

All test samples received into the Laboratory must be handled in accordance with the Standard Operating Procedure (*see section 3.5.3*). If the sample is from a known source and/or has documentation indicating it is safe and non-hazardous, it can be opened at the laboratory bench. If the source of a package is unknown and/or no documentation is available or it is known to be hazardous, the package is opened in a fume cupboard and the samples are checked for leakage or any other form of damage. A separate procedure is followed for damaged samples, see *'Handling Samples Damaged in Transit'*. This involves assessing the integrity and quantity of the remaining sample and consultation with the client.

There are no test items curently accepted by the Laboratory that require specialised storage or handling conditions that cannot be met through the use of local exhaust ventilation systems (fumehoods), refrigerators etc. The performance of all fumehoods is monitored regularly and all other facilities are monitored when their performance could effect the result of any test being carried out.

Having been accepted for analysis, all samples are logged into the DCC Laboratory Sample Register, and each sample received is uniquely identified. Every sample in the batch is individually marked with an individual Lab Reference number which is;

- quoted on all documentation, analysis records, reports, and disposal records relating to it.
- Quoted on all correspondence with other bodies that have reason to deal with the analysis or processing of the sample,
- Quoted on all portions of samples.

Currently, due to constraint of space, samples are not retained after analysis. It is hoped that the new premises will have adequate facilities to enable samples to be kept for a minimum of two months after sampling. The conditions of storage and transportation where required are as directed by the client or, in the absence of such directions, as recommended by DCC Laboratory management.

Test samples are currently disposed of safely through the existing sewage treatment plant at the facility, as will be detailed in the appropriate Standard Operating Procedure.

SECTION 8: SECURITY OF LABORATORY PREMISES

The Central Laboratory is located on the top floor of a new 3-storey building, comprising the laboratory areas and office space. Access to the building can only be achieved through a main door, dedicated to the Laboratory, which is protected by a keypad during working hours and locked outside normal working hours. Visitors to the Lab must report to the Reception area, via the intercom, and entry to the building may be granted by pressing a door switch in Reception. Security cameras monitor the front door and sides of the building, and all visitors may be seen on screens in Reception. On entering into Reception visitors must pass through a second door protected by a keypad in order to enter into the main laboratory and office areas.

Only established members of staff hold keys, for which they are responsible. Loss or misplacement of a key must be promptly reported to the Senior Executive Chemist. A list of all current key holders is posted in the reception area of the Laboratory.

Visitors can enter either the Laboratory or office areas by invitation only and are accompanied at all times by a member of staff.

Responsibility for DCC Central Laboratory site security lies with the Senior Executive Chemist. All key holders are responsible for ensuring that the Laboratory is never left unlocked and unattended.

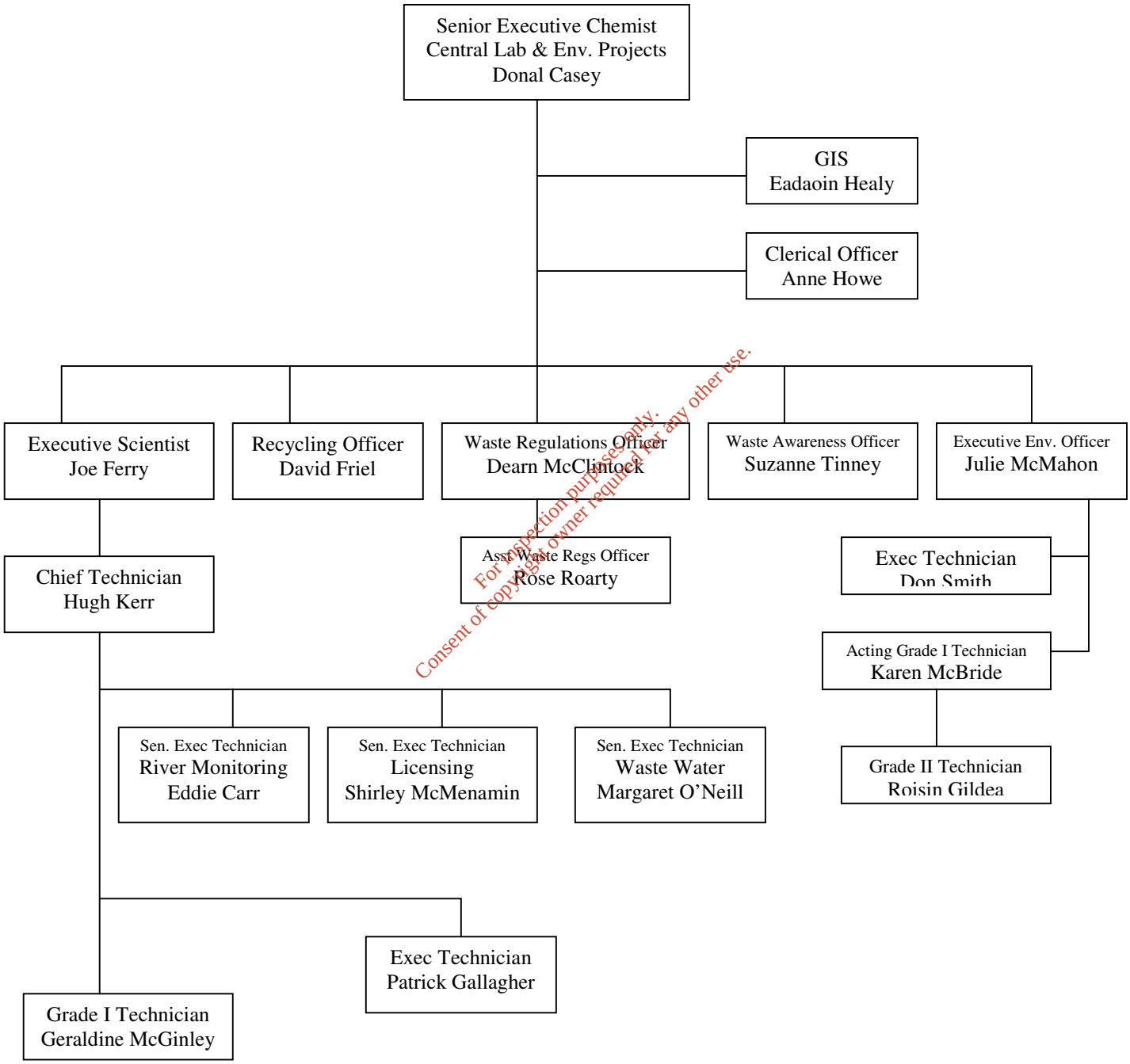
Appendix I

Quality System Organisational Structure

Position	Designated Staff member	Deputy
Quality Manager	Executive Scientist	Sen. Executive Technician
Technical Manager	Chief Technician	
Training Manager	Senior Executive Technician	

Position	Designated Staff member	Deputy
Quality Manager	Joe Ferry	Shirley McMenamin
Technical Manager	Hugh Kerr	Geraldine McGinley
Training Manager	Margaret O'Neill	Patrick Gallagher

Appendix II – Water & Environmental Services Organisation Chart



EPA Environmental Intercalibration Programme

Register of Quality Approved Laboratories Submitting Data to the EPA (2008 Data)

	Text No	Attachment No	Description	Date	Check By
	KMC/LA/C1(vii)	Attachment C.1	EPA Register of Quality Approved Laboratories (2008)	27/10/09	Donal Casey

REGISTER of QUALITY APPROVED LABORATORIES SUBMITTING DATA to EPA (2008 Data)

This register has been compiled in compliance with Section 66 of the EPA Act 1992.

Explanatory Note

Section 66 of the Environmental Protection Agency Act 1992 provides for the establishment of an intercalibration programme for the purpose of assessing analytical performance and ensuring the validity and comparability of environmental data for laboratories which submit data to the Agency. It also provides for the establishment of a register of quality approved laboratories which would normally be expected to send data to the Agency. This register lists, on a parameter by parameter basis, the laboratories which performed satisfactorily in the EPA intercalibration programme for the previous year. The register is updated annually. The objective criteria for inclusion in the register are listed below.

Criteria for compliance

4 satisfactory returns from 5 or 3 satisfactory returns in consecutive rounds or current laboratory accreditation Criteria for pH require 3 returns within 0.20 pH units of reference concentration and 1 return within 0.30 units.

Note to above

Only laboratories which provide data to the Agency, either directly or indirectly, are eligible to participate in the intercalibration programme. Some laboratories do not routinely carry out all of the tests listed on the register or may not have returned sufficient intercalibration data during 2008 to allow an assessment based on the above criteria for a particular parameter. It should not be inferred therefore, that the absence of a laboratory from the listing under a particular parameter necessarily implies unsatisfactory performance for that parameter. The parameters along with the laboratories which are deemed to have complied according to the above criteria are set out in the attached schedule:

REGISTER SCHEDULE

ALKALINITY
Alcontrol
Amberley Quality & Environmental Services Ltd
Aughinish Alumina Ltd
BHP Laboratories Ltd.
Bodycote Consultus Ltd
Bord na Mona
Bristol-Myers Squibb
Central Fisheries Board
Coillte
Cork City Council
Cork County Council (Mallow)
Cork County Council (Water)
Donegal County Council
Dublin City Council (Ballyboden)
Dublin City Council (Ballymore Eustace)
Dublin City Council (Central Laboratory)
Dublin City Council (Roundwood)
Dublin County Council (Leixlip)
Ensen (formerly Nutrisolv)
Envirolab
Enva
EPA (Castlebar)
EPA (Cork)
EPA (Monaghan)
EPA (Richview)
EPA Kilkenny
Euro Environmental Services
FBA Laboratories
Galway City Council
Hensey Glan Uisce
Independent Analytical Supplies
Kerry County Council
Limerick County Council
Lough Derg/Ree Laboratory
Mercury Analytical
Microchem Laboratories
Microlabs
North Tipperary County Council (Nenagh RWSS)
Oldcastle Laboratories
Public Analyst Cork
Public Analyst Dublin
Q-Lab Ltd
Roscommon County Council
SERBD
Southern Scientific Services
T.E. Laboratories Ltd.
Three Rivers Project Boyne
Tipperary SR County Council
TMS Environment
Treatment Systems Ltd
Water Technology
Waterford County Council
Western Regional Fisheries Board
Wicklow County Council

ALUMINIUM
Alcontrol
Amberley Quality & Environmental Services Ltd
Biolabs
Bord na Mona
Cavan County Council
Clare County Council (Doolough)
Coillte
Complete Laboratory Solutions
Cork City Council
Cork County Council (Mallow)
Cork County Council (Water)
Donegal County Council
Dublin City Council (Ballyboden)
Dublin City Council (Ballymore Eustace)
Dublin City Council (Central Laboratory)
Dublin County Council (Leixlip)
EPA (Richview)
EPA Kilkenny
Euro Environmental Services
FBA Laboratories
Galway City Council
Independent Analytical Supplies
Kerry County Council
Laois County Council
Leitrim County Council.
Limerick City Council
Mayo County Council (Ballinrobe)
Microchem Laboratories
Microlabs
Sligo County Council
Southern Scientific Services
T.E. Laboratories Ltd.
TMS Environment
Waterford County Council
Wicklow County Council

AMMONIA
AIBP Cahir
Alcontrol
Amberley Quality & Environmental Services Ltd
Aqualab
BHP Laboratories Ltd.
Biolabs
Bodycote Consultus Ltd
Bord na Mona
Cavan County Council
Central Fisheries Board
Clare County Council
Coillte
Complete Laboratory Solutions
Cork City Council
Cork County Council (Environment)
Cork County Council (Mallow)
Cork County Council (Water)
Dairygold
Dawn Pork
Donegal County Council
Dublin City Council (Central Laboratory)
Ensen (formerly Nutrisolv)
Envirolab
Environmental Efficiency
EPA (Castlebar)
EPA (Cork)
EPA (Monaghan)
EPA (Richview)
EPA Kilkenny
Euro Environmental Services
FBA Laboratories
Galway County Council
Hensey Glan Uisce
Independent Analytical Supplies
Jones Environmental
Kerry County Council
Kerry Ingredients Charleville
Kildare County Council Osberstown
Kilkenny County Council
Kilkenny County Council, Sion Rd
Limerick City Council
Limerick County Council
Longford County Council
Longford Town Council
Lough Derg/Ree Laboratory
Mayo County Council (Swinford)
Mayo County Council Ballyhaunis
Meath County Council (Navan)
Microchem Laboratories
Microlabs
Monaghan County Council (Ballybay)
Neptune Laboratory Services
North Tipperary County Council (Nenagh RWSS)
Offaly County Council
Oldcastle Laboratories
Public Analyst Cork
Public Analyst Dublin
Public Analyst Galway
Q-Lab Ltd
Roche Ireland
Roscommon County Council
SERBD
Sligo County Council
Southern Scientific Services
T.E. Laboratories Ltd.
Teagasc
Three Rivers Project Boyne
Tipperary SR County Council
Treatment Systems Ltd
Trinity College
Water Laboratories
Water Technology
Waterford County Council
Western Regional Fisheries Board
Wicklow County Council

BOD
Alcontrol
Aqualab
Aughinish Alumina Ltd
BHP Laboratories Ltd.
Bodycote Consultus Ltd
Bord na Mona
Carrickmacross STP
Central Fisheries Board
Clare County Council
Clare County Council (Doolough)
Complete Laboratory Solutions
Cork City Council
Cork County Council (Environment)
Cork County Council (Mallow)
Cork County Council (Water)
Dairygold
Donegal County Council
Dublin City Council (Central Laboratory)
Emerald Environmental Services
Ennis Town Council
Ensen (formerly Nutrisolv)
Enterprise Environmental
Envirolab
Environmental Laboratory Services
Enva
EPA (Castlebar)
EPA (Cork)
EPA (Monaghan)
EPA (Richview)
EPA Kilkenny
Euro Environmental Services
Galway County Council
Galway County Council (Tuam)
Greystones WWTW
Glanbia Ballyraggett
Guinness
Hensey Glan Uisce
Independent Analytical Supplies
Independent Laboratory Ltd
Jones Environmental

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Kerry Ingredients Charleville
Kildare County Council Osberstown
Kilkenny County Council
Laois County Council
Leitrim County Council.
Longford County Council
Longford Town Council
Lough Derg/Ree Laboratory
Mayo County Council (Ballinrobe)
Mayo County Council (Swinford)
Mayo County Council Ballyhaunis
Mayo County Council Westport
Meath County Council (Navan)
Mercury Analytical
Microchem Laboratories
Microlabs
Mutton Island S.T.W
North Tipperary County Council, Roscrea STP
Offaly County Council
Q-Lab Ltd
Roche Ireland
Roscommon County Council
Sixmilebridge STP
Skerries WWTW
Sligo County Council
Southern Scientific Services
T.E. Laboratories Ltd.
Teagasc
Three Rivers Project Boyne
Tipperary Town WWTW
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Waterford County Council
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BHP Laboratories Ltd.
Bodycote Consultus Ltd
Bord na Mona
Coillte
Complete Laboratory Solutions
Cork City Council
Cork County Council (Environment)
Cork County Council (Water)
Donegal County Council
Dublin City Council (Central Laboratory)
EPA (Richview)
EPA Kilkenny
Euro Environmental Services
FBA Laboratories
Independent Analytical Supplies
Independent Laboratory Ltd
Kerry County Council
Microchem Laboratories
Public Analyst Dublin
Southern Scientific Services
T.E. Laboratories Ltd.
TMS Environment

CALCIUM
Alcontrol
BHP Laboratories Ltd.
Bodycote Consultus Ltd
Bord na Mona
Coillte
Complete Laboratory Solutions
Cork County Council (Mallow)
Cork County Council (Water)
Donegal County Council
Dublin City Council (Central Laboratory)
Envirolab
Environmental Laboratory Services
EPA (Cork)
EPA (Richview)
EPA Kilkenny
Euro Environmental Services
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Kerry County Council
Microchem Laboratories
Microlabs
Oldcastle Laboratories
Public Analyst Dublin
Roscommon County Council
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T.E. Laboratories Ltd.
Teagasc
TMS Environment
Water Laboratories
Water Technology
Waterford County Council

CHLORIDE
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Astellas Ltd.
Aughinish Alumina Ltd
Bodycote Consultus Ltd
Bord na Mona
Bristol-Myers Squibb
Clare County Council
Coillte
Complete Laboratory Solutions
Cork City Council
Cork County Council (Environment)
Cork County Council (Mallow)
Cork County Council (Water)
Donegal County Council
Dublin City Council (Central Laboratory)
Ensen (formerly Nutrisolv)
Envirolab
EPA (Castlebar)
EPA (Cork)
EPA (Monaghan)
EPA (Richview)
EPA Kilkenny
Euro Environmental Services
FBA Laboratories
Galway City Council

Glanbia Ballyraggett
Independent Analytical Supplies
Independent Laboratory Ltd
Kerry County Council
Kilkenny County Council
Laois County Council
Limerick County Council
Longford County Council
Lough Derg/Ree Laboratory
Mercury Analytical
Microchem Laboratories
Microlabs
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Public Analyst Cork
Public Analyst Dublin
Q-Lab Ltd
Roscommon County Council
SERBD
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Three Rivers Project Boyne
TMS Environment
Treatment Systems Ltd
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Coillte
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Cork City Council
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EPA (Richview)
EPA Kilkenny
Euro Environmental Services
FBA Laboratories
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Kerry County Council
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Southern Scientific Services
T.E. Laboratories Ltd.
TMS Environment

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Aqualab
Arigna Fuels Ltd.
Arran Chemicals
Astellas Ltd.
Athy Town Council
Aughinish Alumina Ltd
BHP Laboratories Ltd.
Biolabs
Bodycote Consultus Ltd
Bord na Mona
Bristol-Myers Squibb
Bulmers
Carrickmacross STP
Cavan County Council
Central Fisheries Board
City Analysts
Clare County Council
Clare County Council (Doolough)
Complete Laboratory Solutions
Corden PharmaChem
Cork City Council
Cork County Council (Environment)
Cork County Council (Mallow)
Dairygold
Dawn Pork
Donegal County Council
Dublin City Council (Central Laboratory)
Emerald Environmental Services
Ennis Town Council
Ensen (formerly Nutrisolv)
Enterprise Environmental
Envirolab
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Environmental Laboratory Services
Enva
EPA (Castlebar)
EPA (Cork)
EPA (Monaghan)
EPA (Richview)
EPA Kilkenny
Euro Environmental Services
FBA Laboratories
Galway County Council
Galway County Council (Tuam)
Glanbia Ballyraggett
Glanbia Foods, Carrick-on-Suir
Glanbia Ingredients
Greystones WWTW
Guinness
Hensey Glan Uisce
Independent Analytical Supplies
Independent Laboratory Ltd
Jones Environmental
Kerry County Council
Kerry Ingredients Charleville
Kildare County Council Leixlip
Kildare County Council Osberstown
Kilkenny County Council
Kilkenny County Council, Sion Rd
Laois County Council
Leitrim County Council.
Limerick City Council

Limerick County Council
Longford County Council
Longford Town Council
Lough Derg/Ree Laboratory
Mayo County Council (Ballinrobe)
Mayo County Council (Swinford)
Mayo County Council Ballyhaunis
Mayo County Council Westport
Meath County Council (Navan)
Mercury Analytical
Microchem Laboratories
Microlabs
Millipore Ireland B.V.
Monaghan County Council (Ballybay)
Mutton Island S.T.W
North Tipperary County Council (Nenagh RWSS)
North Tipperary County Council, Roscrea STP
Offaly County Council
Oldcastle Laboratories
Public Analyst Dublin
Q-Lab Ltd
Roche Ireland
Roscommon County Council
Sixmilebridge STP
Skerries WWTW
Sligo County Council
Southern Scientific Services
T.E. Laboratories Ltd.
Tipperary SR County Council
Tipperary Town WWTW
TMS Environment
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Waterford County Council
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Wexford WWTW
Wicklow County Council
Wyeth Nutritionals Askeaton

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Arran Chemicals
Aughinish Alumina Ltd
Bodycote Consultus Ltd
Bord na Mona
Bristol-Myers Squibb
Cavan County Council
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Coillte
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Dublin City Council (Ballyboden)
Dublin City Council (Ballymore Eustace)
Dublin City Council (Central Laboratory)
Dublin City Council (Roundwood)
Dublin County Council (Leixlip)
Ensen (formerly Nutrisolv)
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EPA Kilkenny
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Dublin City Council (Roundwood)
Dublin County Council (Leixlip)
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EPA (Richview)
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Limerick County Council
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Public Analyst Dublin
Public Analyst Galway
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EPA (Richview)
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Microlabs
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NICKEL
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EPA (Richview)
EPA Kilkenny
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Coillte
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Donegal County Council
Dublin City Council (Central Laboratory)

Emerald Environmental Services
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EPA (Monaghan)
EPA (Richview)
EPA Kilkenny
Euro Environmental Services
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Glanbia Ballyraggett
Greystones WWTW
Guinness
Hensey Glan Uisce
Independent Analytical Supplies
Independent Laboratory Ltd
Jones Environmental
Kerry County Council
Kildare County Council Osberstown
Kilkenny County Council
Laois County Council
Limerick City Council
Limerick County Council
Longford County Council
Longford Town Council
Lough Derg/Ree Laboratory
Meath County Council (Navan)
Microlabs
Monaghan County Council (Ballybay)
Monaghan County Council (Monaghan)
North Tipperary County Council (Nenagh RWSS)
North Tipperary County Council, Roscrea STP
Public Analyst Cork
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SERBD
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Wicklow County Council
Wyeth Nutritionals Askeaton

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Clare County Council
Clare County Council (Doolough)
Coillte
Corden PharmaChem
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Cork County Council (Environment)
Cork County Council (Mallow)
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Donegal County Council
Dublin City Council (Ballyboden)
Dublin City Council (Ballymore Eustace)
Dublin City Council (Central Laboratory)
Dublin City Council (Roundwood)
Dublin County Council (Leixlip)
Ensen (formerly Nutrisolv)
Enterprise Environmental
Envirolab
Environmental Laboratory Services
Enva
EPA (Castlebar)
EPA (Cork)
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EPA (Richview)
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Laois County Council
Leitrim County Council (Moneyduff)
Leitrim County Council.
Limerick City Council
Limerick County Council
Longford County Council
Lough Derg/Ree Laboratory
Mayo County Council (Ballinrobe)
Mayo County Council Ballyhaunis
Mercury Analytical
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Microlabs
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North Tipperary County Council (Nenagh RWSS)
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Hensey Glan Uisce
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Limerick City Council
Limerick County Council
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SUSPENDED SOLIDS
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Aqualab
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Arran Chemicals
Astellas Ltd.
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Biolabs
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Cork County Council (Environment)
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Dairygold
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Emerald Environmental Services
Ennis Town Council
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Guinness
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Limerick City Council
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Monaghan County Council (Monaghan)
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TOT_HARDNS
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T.E. Laboratories Ltd.
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Tipperary SR County Council
TMS Environment
Treatment Systems Ltd
Water Laboratories
Water Technology
Waterford County Council

Wicklow County Council

ZINC
Alcontrol
BHP Laboratories Ltd.
Bodycote Consultus Ltd
Bord na Mona
Coillte
Complete Laboratory Solutions
Cork City Council
Cork County Council (Environment)
Cork County Council (Mallow)
Cork County Council (Water)
Dublin City Council (Central Laboratory)
Envirolab
EPA (Richview)
EPA Kilkenny
Euro Environmental Services
FBA Laboratories
Independent Analytical Supplies
Independent Laboratory Ltd
Kerry County Council
Microchem Laboratories
Public Analyst Cork
Public Analyst Dublin
Southern Scientific Services
T.E. Laboratories Ltd.
Teagasc
TMS Environment

1 Purpose

1.1 The purpose of this document is to describe the procedure for entering & retrieving information, including sample type, location, purpose and analytical results, from the ***LabInfo*** Laboratory Information Management System, (LIMS).

2 General Information

LabInfo is a database supplied by the LGCSB and is used by many Local Authorities across the country. It is therefore, a LIMS tailored to meet the needs of the Laboratory Service in that it has been set up to store data under the relevant headings, such as Rivers, lakes, Wastewater Treatment, Drinking Water, Licenced discharges and complaints of various types. It contains a number of report formats which are suitable for downloading into Microsoft Excel and may then be forwarded to the EPA.

3. Procedure – start-up

Shortcut to LabInfo.exe.lnk

Click on the icon on your desktop

Select from 3 options;

Option	Function
Enquiry/Data Entry	Enter new samples, interrogate data, print data etc
Database Utilities	Not required by Lab
Configuration	Set up users, new sample purposes etc

4. Procedure – Configuration

Click on ***Configuration*** and select from the following Tabs

Tab	Function
Report Details	Once set up, doesn't need to be changed. Appears on reports
User	List of users, click on "Add New" to insert new user
Monitored Entity	Select entity type from DW, Water Bodies, Discharges or Operational. Click "Add New", as required
Station	Eg – Lake or River
Parameter Info	List of parameters, click "Add New" as required
Sample Purpose	Eg- Bathing Water- Blue Flag tests, "Add New" as reqd
Field Sheets	Not used
Audit	Tracks changes made in the system
Work List	Gives Drinking water sampling frequency

5. Procedure – Enquiry/Data Entry

Select entity type from ***DW, Water Bodies, Discharges or Operational*** or all of these. Using the button on the bottom left hand corner, ***Enquiry Mode***, select from the following options;

Enquiry Mode	Function
Enquiry	Allows retrieval of data for selected entity type
New Sample	Enter details for a new sample using predefined Sample Purpose & Station, (ie these must be entered first)
Result Entry	Enter results for any of all parameters for a single sample or as many samples as desired
Batch Entry	Enter results for a selected parameter for a list of samples
Certification	Certify/Approve results for a set of samples, eg- DW
Field Sheets	Set up
Auto Analysers	For the importing of results from Lachat csv or Excel files
Investigations	For DW incidents

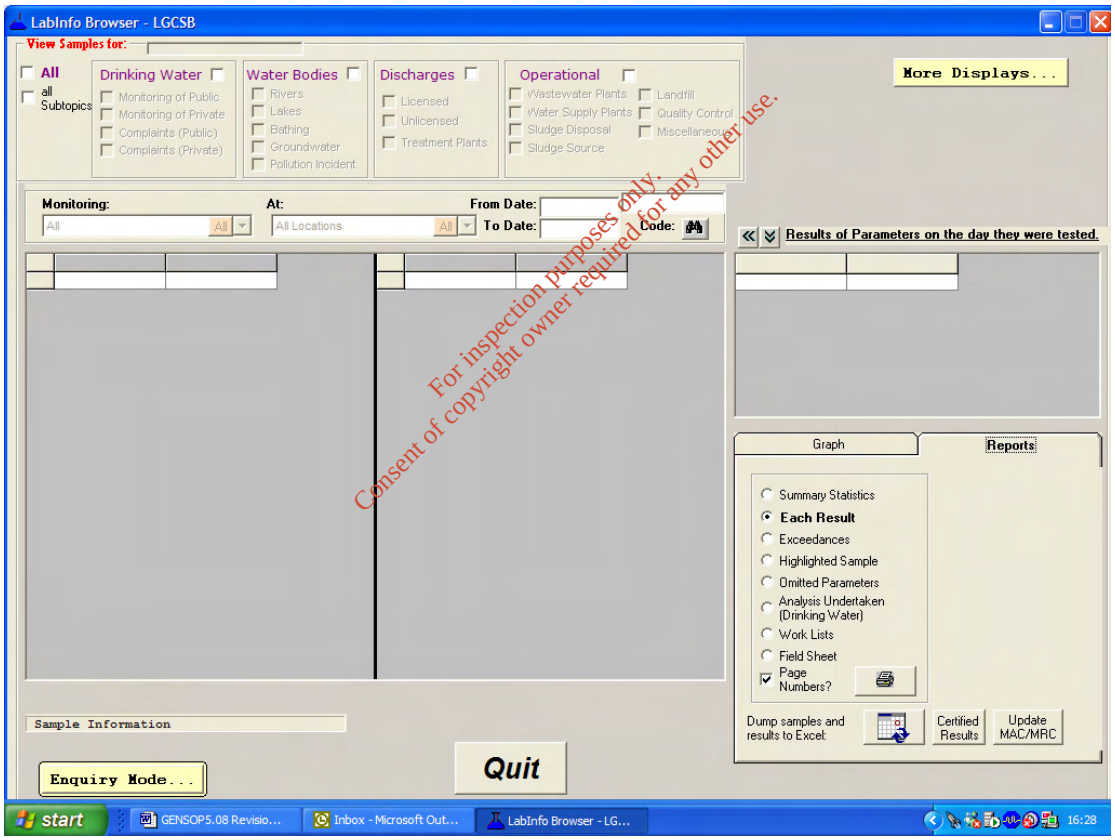
In the ***Enquiry Mode***, click on ***More Displays,*** in the top right hand corner of the screen, to reveal the following options;

- Samples For: All Purposes or select from "Audit Monitoring Public" etc
- Exceedances For: All Parameters or select from a list of Paramaters
- Samples of Status: Awaiting Results, With Results, With Results Certified, With ResultsUncertified, Exceedances Only or All

In the bottom right hand corner of the screen, select from

Graph	by Entity or by Station
Reports –Summary Statistics	Report with list of sample no's, min, median & max

Each Result	Cert with single results page for each sample
Highlighted sample	Cert with single results page for selected sample
Omitted Parameter	List of mandatory parameters omitted from analysis
Analysis Undertaken (DW)	Requests Start Date & End date
Work Lists	Generally not used
Field Sheet	Generally not used
Page Numbers	Generally not used
Printer icon	To print certs with results, single or Statistics
Dump to Excel	To dump selected results into Excel
Certified Results	To dump certified results into Excel
Update MAC/MRC	Generally not used



6. Procedural History

New SOP – no revisions to date.

Compiled by: Joe Ferry Date: 6/2/07

Authorized by: Donal Casey Date: 6/2/07

12.1 PRINCIPLE OF METHOD.

The Lachat QC 8000 Flow injection Analyzer is used in the analysis of Low levels of Ammonia, orthophosphate, nitrate and nitrite. The analyzer has 4 channels for the simultaneous analysis of these parameters. A small volume of the sample is injected into each of the channels of the analyzer, which have a unique set up based on different chemical reactions, which give rise to a colour change, whose magnitude is dependant on the concentration of the parameter in the sample under analysis. By measuring the level of color change associated with each of the calibration standards, which contain known quantities of the parameters, the instrument is able to determine calibration graphs for each parameter. These calibration graphs are then used to determine the levels in unknown samples.

Ammonia

The sample containing ammonia is injected into a carrier stream by means of an injection valve, and is mixed with a continuously flowing stream of alkaline solution. The ammonia is separated from the matrix in a diffusion cell over a hydrophobic semi-permiable membrane and taken up by a flowing recipient stream containing a pH indicator. The resulting pH shift causes a colour change, which is measured at 590 nm in the flow photometer.

Nitrite

The nitrite is determined by diazotization with sulfanilamide under acidic conditions to form a diazonium ion, which is coupled with N-(1-naphthyl)ethylenediamine dihydrochloride. The resulting pink dye absorbs at 520 nm.

Nitrate.

Nitrate is quantitatively reduced to nitrite by passage of the sample through a copperized cadmium column. The nitrite (made up of reduced nitrate plus original nitrite) is then determined by diazotization with sulfanilamide under acidic conditions to form a diazonium ion, which is coupled with N-(1-naphthyl)ethylenediamine dihydrochloride. The resulting pink dye absorbs at 520 nm. Nitrate concentrations are obtained by subtracting nitrite values, which have been determined from the nitrite + nitrate values.

Orthophosphate
The orthophosphate ion (PO_4^{3}-) reacts with ammonium molybdate and antimony potassium tartrate under acidic conditions to form a complex. This complex is reduced with ascorbic acid to form a blue complex, which absorbs light at 880 nm. The absorbance is proportional to the amount of orthophosphate in the sample.

12.2 SCOPE

This method is used for the analysis of surface waters and drinking waters and, simultaneously, analyses for Ammonia, orthophosphate, nitrite and nitrate. The range of calibration standards is as follows.

Ammonia	1 mg/l as N – 0.1 mg/l
Orthophosphate	0.5 mg/l as P - 0.01 mg/l
Nitrite	0.1 mg/l as N – 0.01 mg/l
Nitrate.	2 mg/l as N – 0.1 mg/l

12.3 SAMPLE COLLECTION, PRESERVATION & STORAGE.

Samples should be collected in plastic or glass bottles. The volume collected should be sufficient to insure a representative sample, allow for replicate analysis and to minimise waste disposal.

Samples to be analysed within 24 hours should be stored overnight in a fridge. Samples to be stored for a longer period of time should be stored in a freezer at -18 ^{o}C.

12.4 INTERFERENCES.

Ammonia
If the sample is strongly acidic the required pH shift in the chemifold may not occur. If the sample pH is below 3, it should be adjusted to between 3 and 5.

Nitrate
Turbidity can interfere therefore it is necessary to pass the sample through a 0.45 micron filter before analysis.
High concentrations of iron, copper & other metals can create a positive error.

Nitrite
Sample Turbidity may interfere. Remove turbidity by filtration with a 0.45 um filter prior to analysis.

12.5 EQUIPMENT

- Balance–analytical, capable of accurately weighing to the nearest 0.0001g
- Flow injection analysis equipment designed to deliver and react sample and reagents in the required orders and ratios.
- Sampler
- Multi-channel proportional pump.
- Chemistry manifold, (*chemifold*)
- Sample processing Module
- Data System.

12.6 REAGENTS

Reagent make-up is documented in ChemSOP9.02.

12.7 PROCEDURE

FIA Analyser Set up

Filters.

Ammonia Manifold	- 590
Orthophosphate manifold	-880
Nitrate manifold	- 520
Nitrite/Nitrate manifold	- 520

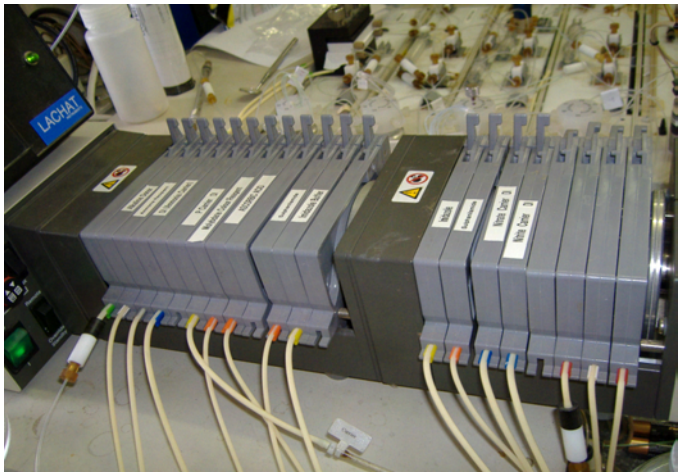
Sample Loops

Ammonia Manifold	- 50 cm
Orthophosphate manifold	-.028 " * .058.
Nitrate manifold	- 150 cm
Nitrite/Nitrate manifold	- 150 cm

12.8 SAMPLE ANALYSIS.

i. Turn on instrument.
ii. Turn on computer.
iii. Turn on pump.
iv. Pump de-ionised water through the manifolds for 10 min.
v. Degas reagents by applying vacuum for 15 minutes.

vi. Place all reagent lines into the reagent bottles and allow 5 minutes for flow through manifold.



vii. Click on the **Omnion Fia** icon.

viii. Click **Ok** to initialise the instrument.

ix. Input user identity & password.

x. The Omnion FIA data system screen then appears.

xi. Click on **Flow injection analyser** to run the instrument.

xii. The most recent tray to have been worked on will then appear on the screen.

xiii. Click on **Tray** and **Temp** to bring up a blank template tray for running a tray of low level samples. The calibration standards have already been inputted into the tray. It is necessary to position the working standards into the calibration standards rack on the auto-sampler. Working standard A is placed in position 1, working standard B is placed into position 2 and so on.

xiv. Input the sample reference numbers of the samples to be tested into the tray with the associated location of the filtered sample in a test tube in the relevant auto-sampler position. The sample is filtered using a 0.45 µm syringe filter.
xv. To save the tray press -**File – Save Tray**.
xvi. To run the samples click on the yellow **run** icon in the centre of the tool bar.
xvii. Select the method for analysis of low level nutrients, method –**1234.**
xviii. Select **Tray** – named as previously saved.
xix. Then select a filename for the results data file, YYMMDDletter, (A,B,C etc).
xx. Click **Run** to begin the analysis.
xxi. The calibration will be run and if successful the instrument will proceed with the analysis of the samples. The calibration graph will be platted and an **r** value worked out for the graph. If this r value is less than 0.999 the calibration is deemed to be unsuccessful and will need to be repeated.
xxii. The auto-analyser will then work its way through the sequence of samples as detailed in the Tray.
xxiii. ***Shut down***.

- Place the reagent pump lines into deionised water
- pump the system through for 10 minutes.
- Remove the tubes from the water and allow air to be pumped through
- Turn off the pump and release the tighteners.

12.10 QUALITY CONTROL STANDARDS

A QC check mixed standard is made up as standard C. This check standard should be analysed to check the accuracy of the calibration graph. The analysis should be repeated 21 times to determine within batch standard deviation.

12.9 REPORTING OF RESULTS.

When the analyser has completed the analysis of the tray of samples a hard copy is printed by clicking on the Custom icon and printing the result sheet. This sheet should be retained in the hard copy results file. An electronic file of the sample run is retained in the computer.

- Ammonia to be expressed as NH_3-N mg/l.
- Orthophosphate to be expressed as PO_4^{3-} mg/l.
- Nitrite to be expressed as NO_2-N mg/l.
- Nitrate is expressed as NO_3-N mg/l.

The result for Nitrate is determined by subtracting the result for the Nitrite channel from the result of the Nitrite/Nitrate channel.

Transfer of results to Excel File

When analysis is complete, click on

- **File**
- **Export Data**, (Save Export Data As)
- Save file as type – select **Text(*.csv)** & click **OK**.

The file or files may then be copied onto a floppy disk and moved or e-mailed to a networked PC.

- Click on the file and open as a csv file in Excel.
- Copy data & paste into the Lachat Excel file under the data already present.
- Adjust data, as required, taking out dilution notes and putting into the comments column, format to 3 decimal places, drag down formula for calculating nitrate from the nitrate/nitrite figure.
- Re-sort data by Lab reference.

Transfer of results to LabInfo from Excel File

- Ensure that all samples to be transferred are logged into LabInfo, (so that the Lab reference number correlates with the data from the Lachat)
- Open Excel file & add columns to get into the correct format.

12.11 REFERENCES.

- Instruction Manual for Lechat QC 800 Flow injection Analyser.
- Lechat Quickchem Method 10-107-06-1-A Determination of Ammonia by Flow injection Analysis.
- Lechat Quickchem Method 10-115-01-1-A Determination of Orthophosphate in waters by Flow injection Analysis colorimety.
- Lechat Quickchem Method 31-107-05-1-A Determination of Nitrite by Flow injection Analysis.
- Lechat Quickchem Method 31-107-04-1-C Determination of Nitrate + Nitrite by Flow injection Analysis colorimetry.

Compiled by: Joe Ferry Date: 3/12/2004

Approved by: Patrick Gallagher Date: 3/12/2004

Suspended Solids

1 PRINCIPLE OF METHOD AND SCOPE

Suspended solids are determined by filtering a well-mixed sample through a 0.45 μm weighed glass fibre filter. The residue retained on the filter is dried to a constant weight at 103-105 °C. This method is applicable to the examination of drinking water, surface water and wastewater.

2 SAMPLE STORAGE AND PRESERVATION

Analyse within 24 hours of sample collection.

3 INTERFERENCES

Exclude large floating particles or submerged agglomerates of non-homogenous materials from the sample, if their inclusion is not desired in the final result.
Excessive residue may form a water entrapping crust. It is therefore often necessary to limit the sample size to prevent this from occurring.

4 EQUIPMENT AND REAGENTS

- Drying oven, for operation at 103-105 °C
- Desiccator, provided with a desiccant containing a colour indicator of moisture concentration.
- Membrane filtration apparatus and vacuum pump.
- Glass fibre disc 1 µm
- Analytical balance capable of weighing to 0.0001g
- Distilled water
- Graduated cylinders
- Forceps

Text No	Attachment No	Description	Date	Check By
KMC/LA/C1(iv)	Attachment C.1	SOP – S.S ChemSOP 6.01	27/10/09	Donal Casey

5 PROCEDURE

5.1 The glass fibre disc

i. Switch on the vacuum pump.
ii. Write the laboratory reference number on the disc.
iii. Using forceps insert the glass fibre disc onto the funnel of the membrane filtration apparatus.
iv. Wash the glass fibre disc with approximately 50 mls of distilled water.
v. Turn the valve to the open position. Suction is continued until all traces of water are gone.
vi. The filter paper is then removed from the filtration apparatus using forceps and placed onto aluminium foil or tray.
vii. The filter is then dried in an oven at 105°C for 1 hour. Store in a desiccator until needed.
viii. Remove disc from the dessicator.

5.2 Sample analysis

i. Weigh the disc (W1) using analytical balance, record weight and lab reference number in the suspended solids register.
ii. Switch on the vacuum pump.
iii. Using forceps insert the weighed glass fibre disc onto the funnel of the membrane filtration apparatus.
iv. Ensure cork is tight on sample bottle and invert 4-6 times to mix well.
v. Pour a suitable volume of a well-mixed sample into a graduated cylinder. Record volume in the suspended solids register.
vi. Turn the vacuum pump valve to the open position. Suction is continued until all traces of water are gone.
vii. Turn off the vacuum pump valve.
viii. The filter paper is then removed from the filtration apparatus using forceps and placed onto aluminium foil or tray.
ix. The filter is placed in the oven at 103 -105°C for 1 hour.
x. Filters are removed from the oven and placed in the dessicator for at least 1 hour to cool.
xi. Filters are then weighed (W2) again using analytical balance and weight is recorded in suspended solids register and result is calculated.

6 REPORTING OF RESULTS

6.1 Calculation of results

1	2	3	4	5	6	7	8
Date	**Lab ref**	**Location**	**Weight 1 g (W1)**	**Weight 2 g (W2)**	**W2-W1 X 1000 mg Note: multiply by 1000 to convert to mg**	**Mls used**	**Suspended Solids mg/l Note: 1. Divide 1000 by mls used to give conversion factor to litres 2. multiply column 6 by conversion factor**

6.2 Report results

Record the results in the suspended solids register to the nearest mg/l.

7 REFERENCES

- Standard Methods for the Examination of Water and Wastewater, 19th Edition1995 pg 2-54

Compiled by: Shirley McMenamin Date: 20th December 2004

Authorized by: Joe Ferry Date: 20th December 2004

Chemical Oxygen Demand, COD

1 PRINCIPLE OF METHOD

The Chemical Oxygen Demand (COD) test is used widely to estimate the amount of organic matter in water and wastewater. It is a measurement of the oxygen equivalent of the materials present in the wastewater that are subject to oxidation by a strong chemical oxidant, in this case dichromate.

In the reactor digestion method test, the COD procedure is greatly simplified. Small volumes of the water samples are pipetted into vials containing the pre-measured reagents, including catalysts and chloride compensator. The vials are incubated until digestion is complete and cooled; then the COD determination is made with the spectrophotometer.

2 SCOPE

2.1 Range: Three ranges are available - 0-150 mg/l, 0-1500 mg/l and 0-15000 mg/l. Please note that there are different determination procedures according to the range selected. The range should be selected based on the expected COD level of the sample.

2.2 Type of Water: This method is applicable for water, wastewater and seawater.

3 SAMPLE STORAGE AND PRESERVATION

Analyse within 24 hours of sampling.

4 INTERFERENCES

Ensure the glass cells are free from any marks or water droplets. Wipe outside of glass cell with absorbent tissue paper prior to placing in cell holder of spectrophotometer (this is to remove any water droplets on the exterior, which may cause interference with the reading). Caution should be taken when placing the COD vials into the heating mantle

Text No	Attachment No	Description	Date	Check By
KMC/LA/C1(iii)	Attachment C.1	SOP – C.O.D. ChemSOP 7.01	27/10/09	Donal Casey

5 EQUIPMENT

Dry- bath block heater, 150°C +/- 1 °C
Hach DR/3000
Transpipette
Pipette tips

6 REAGENTS

COD vials
Deionised Water

The vials should be covered or preferably placed behind a shield while heating (fume cupboard).

Health and Safety act advises to WEAR SAFETY GLASSES OR GOGGLES.

7 PROCEDURE

7.1 Digestion of samples.

1.Turn on the COD reactor block and preheat to 150 ^{o}C.
2.Remove the cap from a COD digestion reagent vial and add 2 mls of de-ionised water to the vial to prepare the blank.
3.Add 2 mls of the sample to be tested to a new COD digestion vial. This is the prepared sample.
4.Invert the vials several times to mix and then place in the preheated COD reactor block.
5. The vials should remain in the heated block for two hours after this time the block should be turned off and the vials allowed to cool.
6. Remove the vials from the block and invert several times to mix before placing in a rack to allow to cool.
7. Once cool the samples can be tested using the Colorimetric Determinaton procedures as detailed below.

7.2 Colorimetric Determination Procedure for COD vial range 0-150 mg/l.

i. Switch the DR/ 3000 on and leave for 15 minutes.

ii. To begin the stored program initiate the program mode by making the following key strokes:

Press: **4** **5** **Stored Program**

The STORED PROGRAM light will come on and a wavelength setting of 420.0 for colour testing will appear in the display. The SET WAVELENGTH and ZERO prompting lights will flash.

Turn the wavelength selector dial, located on the upper right corner of the instrument, to a setting of 420.

Press: **Clear**

The SET WAVELENGTH prompting light will turn off and the display will read 0. The ZERO prompting light will continue to flash until the instrument is zeroed in Step iv.

iii. Place the COD Vial adapter in the cell holder of the spectrophotometer with the groove in the adapter facing the front of the instrument. Wipe the vial containing the reagent blank clean with a wet towel followed by a dry one. Insert the vial in the COD holder and cover with the light shield.

iv. The reagent vial blank is used to set the zero concentration point. Zero the instrument as follows:

Press: **Zero** **Conc**

The ZERO, CONCENTRATION and AUTO UPDATE lights will come on and a concentration value of O will appear in the display.

v. Wipe the vial containing the test sample with an absorbant tissue paper Insert the sample vial in the COD holder and cover with the light shield and read the mg/l COD from the display. Record this value for the sample tested.

7.7.3 Colorimetric Determination Procedure for COD vial ranges 0-1500 mg/l and 0-15000 mg/l.

i. To begin the stored program for, initiate the program mode by making the following key strokes:

Press: **4** **6** **Stored Program**

ii. The STORED PROGRAM light will come on and a wavelength setting of 620.0 for colour testing will appear in the display. The SET WAVELENGTH and ZERO prompting lights will flash.

iii. Turn the wavelength selector dial, located on the upper right corner of the instrument, to a setting of 620.

Press: **Clear**

iv. The SET WAVELENGTH prompting light will turn off and the display will read 0. The ZERO prompting light will continue to flash until the instrument is zeroed in Step iv.

iii. The reagent blank is used to set the zero concentration point. Zero the instrument as follows:

Press: **Zero** **Conc**

The ZERO, CONCENTRATION and AUTO UPDATE lights will come on and a concentration value of O will appear in the display.

vi. Wipe the vial containing the test sample with an absorbant tissue paper Insert the vial in the COD holder and cover with the light shield and read the mg/l COD from the display.

If a pure green colour is obtained in the reacted sample, all the dichromate has been reduced to the chromic state. It will be necessary to repeat the digestion with a diluted sample. For the best accuracy, dilute and repeat those determinations that approach 140-150 mg/l for low range and 1400- 1500 mg/l COD for the high range.

7.8 REPORTING OF RESULTS

The results should be reported as mg/l Chemical Oxygen Demand .

7.9 REFERENCES

Hach DR/3000 Procedure .

Standard Methods for the Examination of Water and Wastewater, 19th Edition 1995

Compiled by:	**Margaret O'Neill**	**Date:**	**17th December 2004**
Authorized by:	**Joe Ferry**	**Date:**	**17th December 2004**

2.1 INTRODUCTION, SCOPE AND PRINCIPLE OF METHOD

The $B.O.D._5$ test is defined as " the mass of dissolved oxygen required by a specific volume of liquid for the process of biochemical oxidation, under prescribed conditions, over 5 days at 20^o C in the dark" (DoE, 1983). The result is expressed as milligrams of oxygen per litre of sample.

Biochemical Oxygen Demand ($B.O.D._5$) is a standard quality test for the presence of natural or introduced organic matter, including pollutants, in waters and effluents. B.O.D. is a test in which standardised laboratory procedures are used to determine the oxygen requirements of bacteria and other micro-organisms which, in the presence of oxygen, cause the biodegradation of organic matter (carbonaceous oxygen demand). The test will also measure the oxygen used to oxidise inorganic material such as sulphides and ferrous iron where these are present. It may also measure the oxygen used to oxidise reduced forms of nitrogen, unless an inhibitor reduces their oxidation.

A 250 to 300ml sample of water or waste water (diluted, as appropriate) is incubated at 20^o C in the dark for 5 days. Sufficient micro-organisms and nutrients must be present in the sample or diluted sample to allow for the biodegradation of the organic matter present; hence for some samples, the dilution water will need to be seeded with micro-organisms. The dissolved oxygen in the sample is measured at the beginning and end of the test period. The reduction in D.O. during the incubation period yields a measure of the B.O.D. Dissolved oxygen must be present throughout the test with a recommended minimum of 2mg/l Oxygen remaining after 5 days, samples with a BOD greater than 7mg/l must be diluted using dilution water.

2.1.1 Type of Application: This method is applicable for determining B.O.D. in clean and polluted surface waters, and in municipal, agricultural and industrial effluents.

2.2 SAMPLE STORAGE AND PRESERVATION

Analyse within 24 hours of sampling. Samples may be preserved for up to 48 hours by cooling to 2-4 ^{o} C. in the dark, (refrigerated).

2.3 EQUIPMENT

a) Glass BOD bottles 250 – 300 ml and stoppers
b) B.O.D. stopper P.V.C. covers or tin foil or *parafilm*.
c) Calibrated dissolved 0xygen meter and probe with stirrer.
d) Incubator set to 20^{o} C $\pm$ 1 ^{o}C.
e) 1000ml graduated cylinder and other assorted glassware.
f) Air pumps with air stones attached to the polyethylene tubing.
g) 25 litre or 50 litre P.V.C. graduated container with tap for dilution water
h) Thermometer
i) Auto pipette 0 to 5 mls or disposable syringes 0-1 ml, 0-5 ml & 0-10 ml.
j) Disposable gloves.
k) One Large Black Bin Bag.

2.4 REAGENTS

a) Phosphate Buffer solution – purchased from an Approved Vendor, (E.g-Reagecon, product no. WTR5005)
b) Magnesium Sulphate solution 0.09M – purchased from an Approved Vendor (E.g.- Reagecon product no. MS0091).
c) Calcium Chloride solution 0.01M – purchased from an Approved Vendor (E.g.- Reagecon, product no. CA20011)
d) Ferric Chloride Solution 0.001M – purchased from an Approved Vendor, (E.g-Reagecon, product no. F00011)
e) Dilution Water – Mains water is distilled into a PVC container no. 1. The distilled water is drawn from PVC Container no. 1 to PVC graduated container no. 2. Nutrients are added to the distilled water in no. 2. The container (no. 2) is then agitated, using the airpump, by immersing the ends of the PVC tubing, with the airstones attached, into the distilled water and agitate for 15mins. When required, add nitrification inhibitor (see 2.4.f) and/or seed material (see 2.4.h) after adding the nutrients and then proceed to agitate for 15 mins. The container of dilution water is usually made up 24 hours before it is required, the container covered with a black plastic bag and left on the lab. bench overnight. On occasion, the dilution water is used one hour after being made up.
f) Nitrification Inhibitor, purchased from an Approved Vendor (E.g.-Hach product purchased from Celtic Engineering – Formula 2533, Cat. No. 2533-34) – Use 0.16g per 300ml sample, 5.3g per 10 litres dilution water, 8g per 15 litres dilution water, or 10.6 g per 20 litres dilution water.
g) Glucose Glutamic Acid Solution – This may be produced by two methods.

(1) Vials: This is purchased from an Approved Vendor (E.g.- a Hach product, ex Celtic Engineering, Cat. No. 14865-10). The vial is broken and the contents added to dilution water (see procedure section below)

(2) The solution may be prepared directly from Glucose (BDH Analar) and Glutamic acid (Merck for biochemistry) powder. These materials must be dried prior to use by placing a suitable quantity of both materials into beakers and drying at 103° C for one hour. The beakers and their contents are then allowed to cool in the desiccators. Add 150mg of each to a 1 litre volumetric flask and make up to the mark with deionised water. Place magnetic stirrer into volumetric flask. Place flask onto magnetic stirring plate. Stir well for one hour.

h) Seed material – either from the outlet of an activated sludge sewage treatment plant or polyseed capsules. Empty one polyseed capsule into 500mls of dilution water. Aerate solution for 30mins or stir with magnetic stirrer. For best results, the Polyseed should be used within 6 hours of re-hydration. When using the outlet of an activated sludge treatment plant, add either 0.2ml of the outlet sample to 800ml of dilution water in the graduated cylinder or 1.25 ml of the outlet sample to 5 litres of dilution water.

i) Sodium Thiosulphite granules

j) Alkali and Acid solutions 1N for neutralisation of waste samples when required. H_2SO_4 1N - add slowly, while stirring, 28mls conc. Sulphuric acid to distilled water in a volumetric flask and dilute to 1 Litre. NaOH 1N – Dissolve 40g NaOH in distilled water and dilute to 1 litre in a volumetric flask. Alternatively the 1N acid and alkali solutions may be purchased.

2.5 PROCEDURE

2.5.1 Pre-treatment

a) pH Adjustment – if the pH of the sample is outside the range 6.5-8.5, neutralize to pH 6.5-7.5 with a solution of H_2SO_4 or NaOH of such strength that the quantity of reagent used does not dilute the sample by more than 0.5%.

b) Removal of Residual Chlorine – Residual chlorine may dissipate by standing the sample in the light for one to two hours. If the residual chlorine does not dissipate on standing, add about 5-6 granules of Sodium Thiosulphate to the B.O.D. bottle containing the sample. Dilution water used for testing chlorinated/de-chlorinated samples must be seeded, or the samples must be seeded directly into the BOD bottle.

c) Saline samples – Add about 5-6 granules of Sodium Thiosulfate to each B.O.D. bottle, record salinity and, when possible, adjust D.O. meter for the salinity.

d) Removal of Algae – Remove algae by filtration or centrifugation. Report the results as BOD (filtered) or BOD (centrifuged).
e) Samples saturated with Dissolved Oxygen – Samples containing more than 9 mg/l D.O. at 20° C may be reduced to saturation by vigorous shaking/agitation in a partially filled corked sample bottle.

2.5.2 Calibration

a) Turn on Dissolved Oxygen Meter (YSI).
b) Wait 15 minutes.
c) Press Calibrate
d) Press D.O. Cal.
e) Press up or down as necessary to achieve 100%
f) Press enter
g) Press Mode – calibration is now complete.

2.5.3 Test Procedure

a) Check that samples are at 20° C ± 1° C
b) Check that the pH is within required range.
c) Place BOD bottles in a row on the bench in front of the DO Meter
d) Mark each sample identification log number on each bottle; also mark dilution on each BOD bottle.
e) Fill two BOD bottles with dilution water from each batch and call Blank 1 & Blank 2. When batches of dilution water are seeded, blanks are put on of each batch.
f) Mark one BOD bottle A/C. Pour dilution water into a 1000ml graduated cylinder to 990mls. Break **acid check** vial and pour into cylinder.
g) Place gloved hand, (clean disposable plastic glove), on top of cylinder and gently rock the cylinder from side to side about six times until mixing occurs without allowing air entrapment. The sample is then poured into a B.O.D. bottle.
h) or, use pipettor/ syringe and put 10mls of glucose glutamic **acid** standard (as made up in volumetric flask – see 2.4.g) into cylinder.
i) When samples do not require dilution, pour sample into BOD bottle gently without allowing air bubbles to form. Samples with an expected BOD of <7 do not require dilution.
j) For dilution purposes, the BOD's of effluents are estimated at 0.7 times the C.O.D. demand and dilutions are prepared accordingly. C.O.D. results are not often available when doing large numbers of B.O.D's, so through experience the analyst learns what dilutions to give the various effluents. The relevant

amount of dilution water is poured into a 1000ml graduated cylinder, the required amount of sample is added using a pipettor or syringe, e.g., when doing a 1/100 dilution pour the dilution water into the graduated cylinder to 990 mls, then using a pipettor or syringe add 10mls of the sample. Place gloved (clean disposable plastic glove) hand on top of cylinder and gently rock the cylinder from side to side about six times until mixing occurs without allowing air entrapment. The sample is then poured into a B.O.D. bottle.

k) Ensure the D.O. meter is calibrated as per 2.6.1. The D.O. probe is placed into each B.O.D. bottle and the D.O. is recorded.
l) The B.O.D. bottles are placed in the incubator, which is set to 20^{o} C.
m) After 5 days, the B.O.D. bottles are removed from the incubator.
n) The D.O. meter is calibrated and the D.O. level of each sample, in each bottle, is measured.

2.6 REPORTING OF RESULTS

a) The D.O. reading on day 1 minus the D.O. reading on day 5 gives the B.O.D. in mg/l
b) For diluted samples, the difference in the D.O. readings, minus the blank, multiplied by the dilution factor gives the B.O.D. in mg/l. Where samples had been seeded, subtract the seeded blank value before multiplying by the dilution factor.

2.7 PRECISION

As this test is a biological test, there are many parameters, which are outside the analyst's control. The glucose/glutamic acid standard should give a result of 198mg/l B.O.D. $\pm$ 30.5. The results of this test are plotted on a Control Chart in the Lab.

2.8 TROUBLESHOOTING

In the event that DO readings are lower than expected, or results for blanks differ significantly from the initial readings, it is imperative to check the physical condition of the membrane cap and to change the tip if there is any concern about its reliability. The stirrer paddle must be removed prior to unscrewing the old membrane cap. The probe tip should then be rinsed with deionised water to remove any contaminants. The new membrane cap is half filled with electrolyte solution, (KCl – purchased), prior to screwing on to the probe, (moderately tight), and a small amount of electrolyte should overflow. This excess is rinsed off with DI water and the paddle re-fitted. Ensure that the membrane is not wrinkled or torn and does not contain air bubbles >1/8". The average replacement interval is 1-2 weeks, depending on use.
A complete troubleshooting guide may be found in the Probe Instruction Manual.

2.9 REFERENCES

Standard Methods for the examination of water and wastewater, 19th edition 1995.
YSI 5905/5010 BOD Probe Instruction Manual
YSI

Compiled by:	Shirley McMenamin	Date:	5th July 2005
Authorized by:	Joe Ferry	Date:	5th July 2005

Measurement of pH

1 PRINCIPLE OF METHOD

pH is a measure of acidity and is defined by equation (1)

$$pH = -\log a_{H^+} \quad (1)$$

where a_{H^+} = activity of H^+ ion

Combination glass electrode: The glass membrane is in equilibrium with H^+

$$Si\text{-}O\text{-}Na + H^+ \; - \; Si\text{-}O\text{-}H + Na^+ \quad (2)$$

On each surface and Na^+ ions transport charge across the membrane so that one side still senses the other side. The response to changes in pH is nearly Nerstian and can be described by equation (3).

$$E = E^o + 0.059\log([H^+] + K[Na^+]) \quad (3)$$

Where: E = observed potential
E^o = potential dependent on the electrode system used
K = selectivity coefficient for H^+ over Na^+

1.2 SCOPE

Working Range: pH = 2-12

1.3 SAMPLE STORAGE & PRESERVATION

Analyze within 24 hours of collection (preferably as soon as possible after sampling).

1.4 INTERFERENCES

- The glass electrode is relatively free from interferences from colour, turbidity, colloidal matter, oxidants, reductants or high salinity except for a sodium error at pH > 10 (in this case use special electrodes).
- pH measurement is affected by temperature, mechanical effects that are issued by changes in the properties of the electrodes and chemical effects caused by equilibrium changes.
- Always report temperature with pH measurements.

1.5 EQUIPMENT

WTW pH 320, 330 or 340 meter and Sentix 41 probe with range 0-14 pH scale and temperature sensor.

1.6 REAGENTS

- Pre-prepared certified standard solutions of Technical Buffers 7.00 and 4.01
- 3 molar solution of Potassium Chloride, KCl

1.7 INSTRUMENT CALIBRATION (WTW 320, 330 and 340)

i. Remove the rubber protective seal covering the electrode.
ii. Bring the buffers to 20-25°C (room temperature).
iii. Switch on meter. Ensure TP is present at bottom RHS of screen to indicate temperature sensor is connected.
iv. Press **Cal** button until CTI appears on screen (AutoCal TEC at bottom of screen).
v. Rinse electrode in distilled water and gently pat dry.
vi. Immerse electrode in pH 7.00 and allow to stabilise.
vii. Press **Run/Enter**. **AR** will flash on screen and the mV reading for pH 7.00 appears and should be within 0 ± 30 mV. Record value.
viii. **CT2** will then appear.
ix. Rinse electrode in distilled water and gently pat dry.
x. Immerse in pH 4.01 buffer and allow to stabilise.
xi. Press **Run/Enter**. AR will flash on screen and the mV reading for pH 4.01 appears and should be within 170 ± 30 mV. Record value.
xii. Meter will then give slope value (S), which must be within range of minus 57-60mV. Record slope value.
xiii. Press **pH/mV** button to convert to pH units. Record value for pH 4.01 buffer.
xiv. Rinse electrode in distilled water and gently pat dry.

xv. Immerse in pH 7.00 buffer, allow to stabilise and record pH reading for same.

1.8 INSTRUMENT CALIBRATION (WTW 340i)

Calibration for WTW 340i is the same as that outlined in section 1.7. with the following amendments:

- (vii) is amended in that the mV reading for pH 7.00 does not appear and therefore is not recorded. pH 7.00 remains on the screen until CT2 appears.
- (xi) is amended in that the mV reading for pH 4.01 does not appear and therefore is not recorded. pH 4.01 remains on the screen until CT2 appears.
- (xiii) is amended in that the **M** button is pressed to convert to pH units – this button has the same function of changing the measuring mode as **pH/mV** button.

1.9 SAMPLE ANALYSIS

- Analyse for pH as soon as possible after sampling ensuring that pH probe with a temperature sensor.
- Remove electrode from buffer, rinse, blot dry and immerse in sample.
- Stir sample to ensure homogeneity - stir gently to avoid entrainment of carbon dioxide.

1.10 REPORTING OF RESULTS

Report the pH values to the nearest 0.1 pH unit for samples only

1.11 QUALITY CONTROL STANDARD

Run Q.C. standards with each batch of samples analysed. Measure the pH of the Q.C. standard buffers pH 7.00 and 4.01 (reference temperature 25°C) as outlined in section 1.7. (xiii) and (xv).

1.12 STORAGE OF pH PROBE

The pH probe may be stored in pH 7.00 buffer during the day between use but the protective cap should be half-filled with 3M KCl solution and placed on the electrode overnight or for long periods when not in use. The KCl solution should be replaced regularly.

1.12 REFERENCES

- Sentix Electrode Operating Instructions
- Instruction Manuals for WTW pH 320, 330 and 340 portable pH meter
- Standard Methods, 19th Edition, Section 4500-H+, Page 4-65

2.1.1 Procedural History

(Revision 1 compiled to include details for new WTW 340i meters

Compiled by:	Geraldine McGinley	Date: 26th January 2005
Authorized by:	Joe Ferry	Date: 26th January 2005

Donegal

Water Services Investment Programme 2007 - 2009

Schemes at Construction	W/S	Est. Cost
Ballyshannon Sewerage Scheme	S	6,300,000
Donegal Bay Wastewater Treatment Plant - Group A (DBO Contract - incorporating part of Donegal, Ballyshannon and Rossnowlagh)	S	30,200,000
Letterkenny Sewerage Scheme (G)	S	29,210,000
Letterkenny Water Supply Scheme (G)	W	4,000,000
Rossnowlagh Sewerage Scheme	S	5,000,000
		74,710,000
Schemes to start 2007		
Desertegney Water Supply Scheme Stage 1 (Contract 3)	W	1,100,000
		1,100,000
Schemes to start 2008		
Ballyshannon Water Supply Scheme	W	20,000,000
Burtonport Sewerage Scheme	S	3,700,000
Convoy Sewerage Scheme	S	1,150,000
Donegal Bay Wastewater Treatment Plant - Group B (DBO Contract for Bundoran, Glencolmcille & Killybegs)	S	30,400,000
Dungloe Sewerage Scheme	S	4,500,000
Falcarragh Sewerage Scheme	S	3,600,000
Glenties Sewerage Scheme	S	3,100,000
Gweedore Sewerage Scheme	S	26,000,000
Killybegs Water Supply Scheme (Sludge Handling)	W	[illegible]
Lough Mourne/Letterkenny Water Supply Scheme (G)	W	[illegible]
		[illegible],330,000
Schemes to start 2009		
Fanad Water Supply Scheme Stage 2	W	9,800,000
Gortahork/Falcarragh Water Supply Scheme	W	3,400,000
Inishowen Sludge Management	S	1,100,000
Killybegs Sewerage Scheme (Network)	S	8,500,000
Laghey Sewerage Scheme	S	806,000
Moville/Greencastle Sewerage Scheme	S	9,300,000
Rathmullan Sewerage Scheme	S	3,400,000
		36,306,000

Serviced Land Initiative	W/S	Est. Cost
Bridgend Sewerage Scheme (G)	S	648,000
Brookfield (Donegal Town) Sewerage Scheme	S	1,350,000
Church Rd Watermains Improvement Scheme	W	515,000
Kilmacrennan Wastewater Treatment Plant (Upgrade)	S	104,000
St Johnston Wastewater Treatment Plant	S	323,000
		2,940,000
Rural Towns & Villages Initiative		
Ardara Sewerage Scheme	S	8,400,000
Lagan Water Supply Scheme Phase 3	W	654,000
Malin Town Sewerage Scheme	S	2,560,000
		11,614,000
Schemes to Advance through Planning		
Ballybofey/Stranorlar Sewerage Scheme	S	4,200,000
Buncrana Sewerage Scheme	S	4,900,000
Carrigart Sewerage Scheme	S	1,400,000
Castlefin Sewerage Scheme	S	1,700,000
Cranford Regional Water Supply Scheme	W	5,300,000
Dunfanaghy/Portnablagh Sewerage Scheme	S	1,700,000
Dunkineeley Sewerage Scheme	S	2,000,000
Frosses/Arrdcharles/ Inver Water Supply Schemes	S	3,600,000
Inishowen Regional Water Supply Scheme	W	19,000,000
Kilcar Sewerage Scheme	S	1,700,000
Lettermacaward Regional Water Supply Scheme	W	4,400,000
Lifford Sewerage Scheme	S	1,800,000
Milford Sewerage Scheme	S	2,000,000
Ramelton Sewerage Scheme	S	950,000
Rosses Regional Water Supply Scheme	W	3,400,000
		58,050,000
Water Conservation Allocation		**25,253,000**
Asset Management Study		**120,000**
North South SHARE (WFD) Project[1]		**7,500,000**
Programme Total		**352,923,000**

[1] This project is being led by Donegal County Council on behalf of the other authorities in the SHARE Project

(G) Refers to a Gateway as designated in the National Spatial Strategy

Text No	Attachment No	Description	Date	Check By
KMC/LA/B10(i)	Attachment B.10	Copy of Approved Funding	28/10/09	Donal Casey

Comhairle Chontae Dhún na nGall
Donegal County Council Laboratory
Tel: 074 9122787, 9122404, 9122423 Fax 074 91 61304, 9122423
www.donegal.ie

Kilmacrenan Waste Water Treatment Plant
Licence Application
Text Schedule
October 2008

Text number	Attachment Number	Title
KMC/LA/B8(i)	B.8	Site Notice
KMC/LA/B10(i)	B.10	Copy of Approved Funding
KMC/LA/C1(i)	C.1	SOP – P.H.
KMC/LA/C1(ii)	C.1	SOP – B.O.D.
KMC/LA/C1(iii)	C.1	SOP – C.O.D.
KMC/LA/C1(iv)	C.1	SOP – S.S.
KMC/LA/C1(v)	C.1	SOP – NH3, NO2, NO3, etc
KMC/LA/C1(vi)	C.1	SOP – Laboratory Information System
KMC/LA/C1(vii)	C.1	EPA Environmental Intercalibration Programme - Register of Quality Approved Laboratories Submitting Data to the EPA (2008 Data)
KMC/LA/C1(viii)	C.1	Quality Manual
KMC/LA/E2(i)	E.2	Equipment Calibration Schedule
KMC/LA/E2(ii)	E.2	SOP -Waste Water Sampling Methods
KMC/LA/E2(iii)	E.2	SOP – Reception and Handling of Samples

KMC/LA/E3(i)	E.3	EPA summary results of sampling 2001-2006
KMC/LA/E4(i)	E.4	Donegal County Council Outlet Monitoring Results 2007-08
KMC/LA/F1(i)	F.1	Upstream and Downstream Sample Monitoring
KMC/LA/F1(ii)	F.1	Habitats Directive Article 6 Assessment
KMC/LA/F1(iii)	F.1	Report on Biological Monitoring of Surface Water Quality in the Leannan Catchment
KMC/LA/G1	G.1	Preliminary report on the redevelopment of Kilmacrenan WWTP