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A1 Map 4	Proposed Site Layout
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Laboratory Test Report
Cork County Council
Waste Water Laboratory
Inniscarra, Co. Cork

February 19,2009

Industry Name Cloughduv Wastewater Plant
Address Cloughduv,
C. Cork

Industry Code No. 392
Report Ref No. T19-02-09-005.
Issued to D. Barnett.
WSIP
CCC

Licence No. Type S

	Volume	ph	B.O.D.	C.O.D.	S.Solids	TP-P			Code		Comments
Licence Limit	m3 99999	11.99 3.99	mg/l 25	mg/l 125	mg/l 35	mg/l 99					
Date											
10/07/08			* 145	* 326	* 269	10.58			GS626	G	Sampled from preclarifier ta
24/09/08			* 75	* 126	* 102				GS995	G	
09/10/08			* 54	* 206	* 89				GS1029	G	
18/12/08			* 66	* 133	* 61				GS1403	G	
15/01/09		7.4	* 39	66	* 63	7.5			GT059	G	TN-N=30.9mg/l,OPO4-P=5.
% Compl.	***	100	0	20	0	100	***	***			
Average	****.**	7.40	75.80	171.40	116.80	9.04	****.**	****.**			

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The samples are received at the Laboratory on the day of sampling. The above test methods are based on Standard Methods for the examination of Water and Waste Water, 21st Edition 2005, APHA, AWWA, WEF.
C = Composite Sample, G = Grab Sample.
The compliance value may be varied on items marked with an * by the application of uncertainty of measurement values on reverse Page
Chemical Procedure Numbers(CP No.) for INAB accredited tests are as follows:
CP NO. 1 = B.O.D. CP NO. 3 = S.S. CP NO.20 = TP-P
CP NO. 5 = pH CP NO. 6 = C.O.D. ~~CP NO. 7 = Cl~~ VH CP NO.22=Ammonia(KONELAB)
CP NO.23 = OPO4-P(KONELAB) CP NO.24 = Chloride (KONELAB) CP NO.25=Sulphate(KONELAB)
This report relates only to the samples listed above. This report shall not be reproduced except in full and only with with the approval of the testing laboratory. Cork County Council is not accredited by INAB for tests marked with $.
Kg loadings based on flows as supplied by the company. ~ indicates results that have been edited.

Reported by: V. Hannon Date: 19/2/09

Ms. V. Hannon Technical Manager ☑
Deputy Technical Manager ☐

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Wastewater Laboratory Cork County Council- Test Report Addendum

a. Sample date reported in column 1 on this report is the date of collection of the sample from the industry name and address as outlined at the top of the report.
b. Cork County Council wastewater laboratory are not accredited for sample collection.
c. Data reported in (d) below is defined in section 5.10.3 (c) in wastewater laboratory quality manual.
d. Table of Uncertainty Of Measurement – Estimate Of Values For Accredited Tests

Chemical Procedure No.	range	Test Name	Estimated Uncertainty	Units
CP No. 1	1 - 8 mg/l	Biochemical Oxygen Demand (BOD)	± 0.30	mg/l
CP No. 1	9 –70 mg/l	Biochemical Oxygen Demand (BOD)	± 3.2	mg/l
CP No. 1	71 - 700 mg/l	Biochemical Oxygen Demand (BOD)	± 40	mg/l
CP No. 3	35 mg/l	Suspended Solids (SS)	± 6.4	mg/l
CP No. 3	200 - 400mg/l	Suspended Solids (SS)	± 41.6	mg/l
CP No. 3	700 – 1000mg/l	Suspended Solids (SS)	± 80.0	mg/l
CP No. 5	2 - 12	pH	± 0.12	pH Units
CP No. 6	< 6 mg/l	Chemical Oxygen Demand (COD LR)	± 5.6	mg/l
CP No. 6	15 – 75 mg/l	Chemical Oxygen Demand (COD LR)	± 10.6	mg/l
CP No. 6	100 –135 mg/l	Chemical Oxygen Demand (COD LR)	± 17.4	mg/l
CP No. 6	120 – 1500mg/l	Chemical Oxygen Demand (COD) High Range	± 26.8	mg/l
CP No. 20	0.2 – 2.5 mg/l	Total Phosphorus (TP-P)	± 0.22	mg/l
CP No. 22	0.1 – 0.9 mg/l	Ammonia (Konelab)	± 0.04	mg/l
CP No. 22	1.0 – 2.0 mg/l	Ammonia (Konelab)	± 0.10	mg/l
CP No. 22	2 – 10 mg/l	Ammonia (Konelab)	± 0.32	mg/l
CP No. 22	11 – 19 mg/l	Ammonia (Konelab)	± 0.72	mg/l
CP No. 22	20 – 25 mg/l	Ammonia (Konelab)	± 1.56	mg/l
CP No. 23	0.05 – 1.00 mg/l	Orthophosphate as P (Konelab)	± 0.04	mg/l
CP No. 24	25.00 – 99.00 mg/l	Chloride (Konelab)	± 3.04	mg/l
CP No. 24	100.00 – 200.00 mg/l	Chloride (Konelab)	± 11.16	mg/l
CP No. 25	30.00 – 199.00 mg/l	Sulphate (Konelab)	± 3.42	mg/l
CP No. 25	200.00 – 250.00 mg/l	Sulphate (Konelab)	± 8.70	mg/l

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January 2009

The raw data used to evaluate the above estimations is stored in the Wastewater Laboratory, Cork County Council.

The method followed is located in the Uncertainty of Measurement file and in the Eurachem Guidelines for Quantifying Uncertainty in Analytical Measurement.

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Dixon . Brosnan
environmental consultants

project title	River Bride Assessment
client	Cork County Council
client ref.	–
project ref.	–
report ref.	–
revision	0-issue to client
date	26th January 2006
approved by	Carl Dixon
certified only where signed	

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EXECUTIVE SUMMARY

Dixon.Brosnan were commissioned by Cork County Council to carry out an environmental assessment of the Bride River to determine the impacts of existing and future wastewater discharges with particular emphasis on Kilumney and Crookstown. The assessment included the examination of the most suitable means of disposal of treated wastewater and the treatment standard required. The impacts of the proposed development were examined with respect to the existing environment.

The Bride is an important salmonid river and although not formally designated it is of considerable ecological value.

The unit flow rate within the catchment is low and there appears to be differences between flows in the upper and lower catchment. This may be related to differences in the underlying geology.

Q values suggest there is a sharp decline in water quality at Bride Bridge however the cause of this decline could not be ascertained within the confines of this survey. However based on the available information discharges to the Bride River from Aherla and Farran may have a detrimental impact on the ecology of the river.

Based on the available data from the EPA, Cork County Council and Dixon.Brosnan surveys the background concentrations for a range of parameters have been estimated. Based on this data the impact at various locations along the river was examined.

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CONTENTS

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1. INTRODUCTION

Dixon.Brosnan were commissioned by Cork County Council to carry out an environmental assessment for the provision of sewage treatment for settlements along the Bride River, Co. Cork. The assessment included the examination of the treatment options available and the most suitable means of disposal of treated wastewater. The impacts of the various options were examined with respect to the existing environment.

The proposed development is below the threshold above which an Environmental Impact Assessment is required under the European Communities (Environmental Impact Assessment) Regulations, 1989 (S.I. No. 349 of 1989), and accordingly this report does not purport to be an Environmental Impact Statement. However, the Environmental Protection Agency document *Advice notes on current practice in the preparation of Environmental Impact Statements* (1995) was consulted during the preparation of the report.

This report is presented in four parts as follows:

Part 1: Existing environment
Part 2: Legislation & standards
Part 3: Treatment & disposal options
Part 4: Impacts & recommendations.

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2. CATCHMENT OVERVIEW

2.1 RIVER BRIDE

The River Bride rises close to Cappeen in west Cork and flows for approximately 20 miles before discharging to the Lee upstream of Inniscarra Bridge. The upper reaches flow over sandstone/mudstone whereas the middle to lower reaches flow over limestone. This band of limestone, which is part of the Little Island formation, runs from Crookstown in the west to Youghal Bay in the east. The section of the Bride downstream of Crookstown flows over this band of limestone, which includes karst limestone and limestone gravels. The underlying limestone geology supports a number of quarries between Crookstown and Ovens.

Upstream of Crookstown the landscape is characterised by low hills with some planted conifers. The farmland is generally of moderate quality with some sections of wetter and marginal ground. In the upper reaches from Cappeen to Crookstown farms and dwellings are widely scattered and a number of houses are located close to the main channel of the Bride

The quality of the surrounding farmland is considerably higher in the middle and lower reaches. From Crookstown onwards the land is flat to the south of the river with low hills to the north. Much of the land in the lower reaches is intensively farmed and receives landspread waste and chemical fertiliser. Although most of the surrounding land is under grass there are large sections of tillage. Crops include sugar beet, cereals and maize and potatoes are grown around Grange Crossroads. There are a number of dairy farms in the vicinity of Crookstown and there are pig rearing units around Cloughduv and Kilmurry. Along certain stretches of the river, dwellings and farms are located away from the main channel. Examples include the section of river immediately downstream of Crookstown, a larger section from Coolmucky Bridge to Kilcrea Bridge and a smaller section upstream of Kilumney.

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The riparian zone is varied with native woodland evident on sections of river upstream of Crookstown, at Ryecourt and at Ovens. Some sections of the river close to Kilumney have been invaded by laurel. Laurel is an invasive species, which casts a heavy shade and may reduce plant growth within the river.

The Bride is joined by a number of tributaries along its length, most of which are relatively short. In the lower and middle reaches the tributaries flowing in a northerly direction drain flat agricultural land while the tributaries flowing southwards drain low-lying hills on the opposite side of the N22.

A number of settlements occur along the River Bride. In the upper catchment Cappeen is the largest settlement occurring immediately adjacent to the river. In the lower to middle reaches a number of villages occur including

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Crookstown, Farnanes, Kilumney and Ovens, which are close to the main channel, and Kilmurry, Cloughduv, Aherla and Farran which are situated some distance back from the main channel.

2.2 BROUEN RIVER

Cloughduv is served by a treatment plant, which discharges to a tributary of the Bride referred to as the 'Brouen River' (Discovery Map 86). The Brouen rises north of Crookstown and is adjoined by blocks of conifers in its upper reaches. For 2km north of Crookstown the stream runs close to a road (R590) and the riparian zone is dominated by native woodland. In these upper reaches the gradient is relatively steep and the stream is characterised by a hard, rocky substrate and turbulent flows. These conditions are suitable for salmonid spawning.

South of Crookstown the streams swings abruptly eastwards and travels in almost a straight line for approximately 1.7km to a point west of Cloughduv village. Once the stream crosses under the R585 road the characteristics of the stream change. Due to the low gradient the stream is deeper, slow flowing with no dense riparian woodland. For much of this section the stream runs adjacent to spoil heaps associated with Castlemore quarry.

An overview of the Bride and Brouen catchments including sampling locations is show in Fig 1-8.

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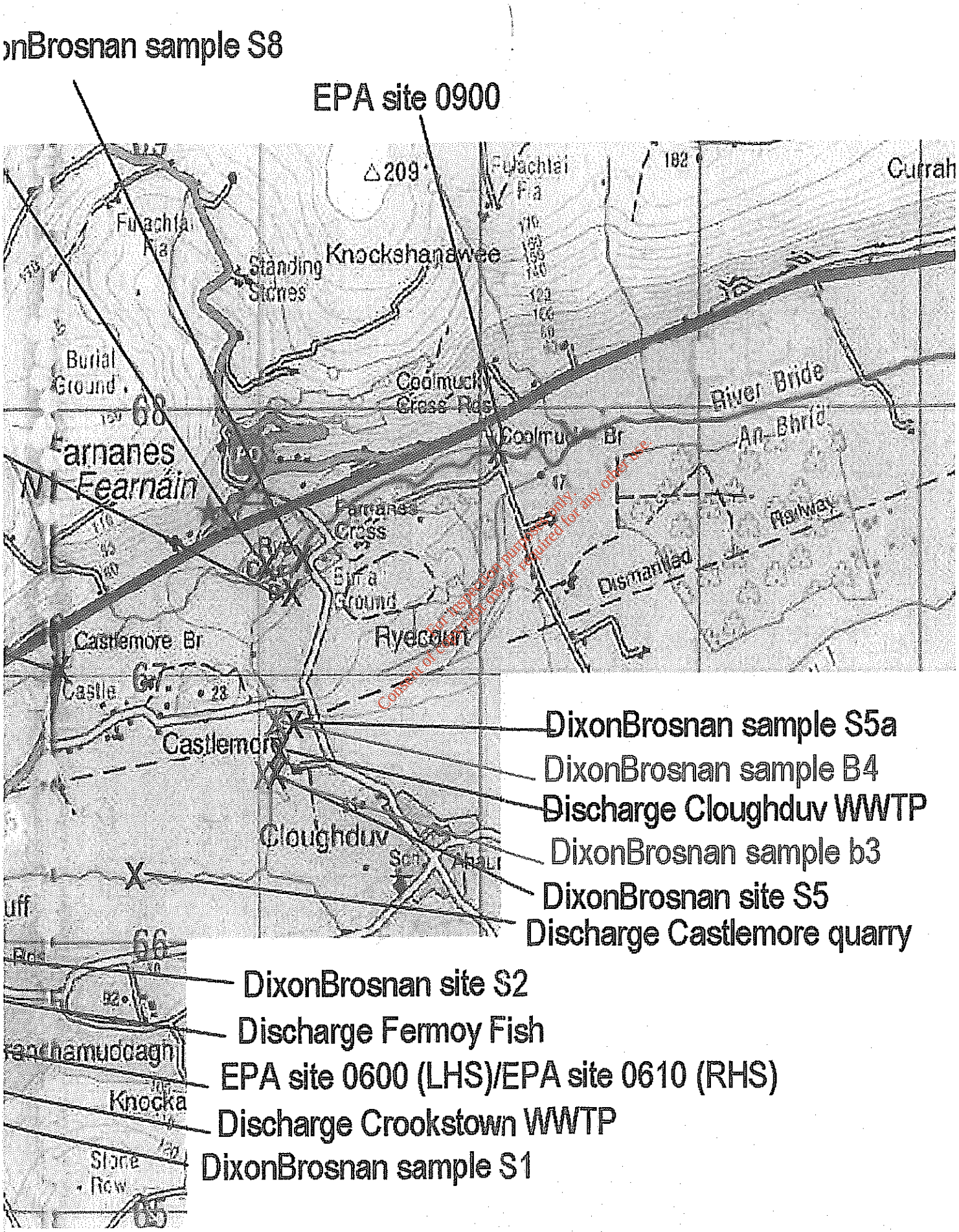

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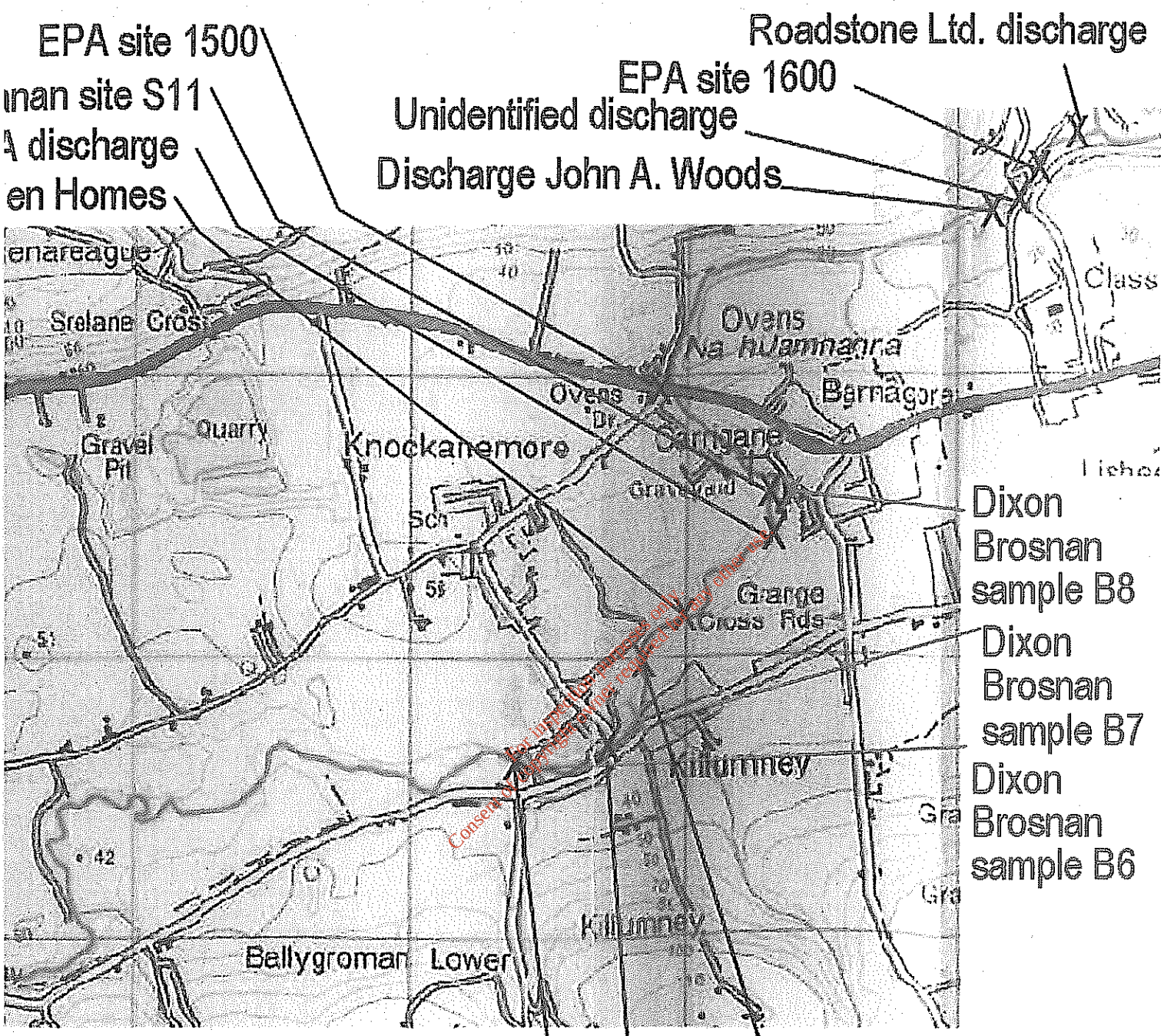

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3. ABSTRACTIONS & DISCHARGES

3.1 ABSTRACTIONS

None of the settlements situated along the Bride abstract water from the river. In the upper and middle catchment water is generally abstracted from groundwater sources. Kilmurry, Crookstown, Cloughduv, Aherla and Farnanes all abstract water from bored wells. In the lower reaches (Ovens, Kilumney) water is supplied from Inniscarra and these settlements are therefore net contributors to the flow in the Bride.

Kilmurry

There is a small treatment plant at Kilmurry treating wastewater from the Council estate which discharges to a percolation area and the remainder of the village is treated by septic tanks. There has been no new large-scale development at Kilmurray and there are no applications for such development at present.

Crookstown

The Bellmount housing estate in Crookstown is served by a septic tank which discharges to the River Bride. Problems have been experienced with this discharge in the past. It is assumed that the remainder of the village is served by individual septic tanks. The future population of Crookstown is estimated at 1140 p.e.

Cloughduv

The treatment plant at Cloughduv discharges to the Brouen stream approximately 400m north of Cloughduv and at the location of the discharge the watercourse is characterised by heavy shade and silty conditions.

Aherla

At present it is believed that the majority of the older dwellings in Aherla are served by septic tanks. A new treatment plant and percolation area serves the new development to the north of the village. Vulnerability mapping is used to identify the likelihood of contamination reaching an aquifer as a result of contamination at or near the surface. This depends upon the type and thickness of soils and upon the presence of karst or other highly permeable features. Information received from the Geological Survey of Ireland (GSI) indicates that the percolation area is located in an area of high vulnerability. However there are areas of extreme vulnerability and karst features in the vicinity of Aherla. The Geological Survey of Ireland (GSI) have produced a South Cork aquifer classification scheme. Under this scheme the underlying aquifer is classified as regionally important karst aquifer with good development potential. A small tributary of the Bride runs through the village of Aherla. This stream is small with insufficient flow to assimilate wastewater from the village.

Farran and Farnanes

There is no treatment plant at either of these settlements, which are served by individual septic tanks.

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Kilumney

There are a number of treatment systems in operation in Kilumney. Wastewater from the Beverly Housing Estate is treated via a septic tank, which does not discharge directly into the Bride River. A treatment plant is located within Kilumney village and discharges to the Bride approximately 300 m downstream of the village. It is probable that not all of the houses within the village discharge via this treatment plant and it is likely that some sewage/grey water is discharging directly into the river from houses backing onto the river. A large residential development at Grange Manor will be treated at a new treatment plant and discharged to the Bride downstream of Kilumney village. EMC has its own treatment plant and discharges to the Bride downstream of Kilumney. There is also a small discharge from a second company on the same industrial estate (Guy Company Ltd).

Ovens

Wastewater from Ovens is treated by an existing septic tank. It is intended that the wastewater will be treated via a centralised treatment plant in Kilumney in the future.

3.2 DISCHARGE LICENSES

Discharge licenses are granted by local authorities for commercial discharges and a register of these licenses is maintained by Cork County Council. A review of the discharge licenses granted by Cork County Council shows that seven licences have been granted and five of these are currently operational. The details of these licences are given in Appendix 1.

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A review of the discharge licences indicates that the following premises discharge to the River Bride.

- Of the discharges included on the register, two are no longer active (Kilumney Creamery and John A. Wood Garryhesta).

- EMC do not have a discharge licence, although this company treats wastewater in its own treatment plant and discharges to the Bride downstream of Kilumney. Based on information received from the company the peak discharge is approximately 4m³/hr. Located on the same IDA industrial estate, Guy Company Ltd. also discharge into the Bride via the same discharge point. Further information on discharges from this location is currently being sought by Cork County Council.

- Corlon Trading Ltd. (now operating as Fermoy Fish Ltd.) are expected to stop discharging to the River Bride although a discharge from this facility was noted during a site visit. Further information on the discharge at this location is currently being sought by Cork County Council.

- The John A. Wood quarry at Classes Lake discharges into the Bride via a lagoon system.

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- Ruden Homes have a discharge licence for a development with a population equivalent of 1,238 in Kilumney (Grange Manor). This development is under construction and there is no discharge from this location at present.

- Roof water from Roadstone Provinces Ltd. is diverted into the Bride downstream of Classis Bridge; however this discharge is not expected to have a significant impact.

Two further discharges were noted which are not listed on the Cork County Council database.

- Castlemore Quarries discharge into the Brouen River between Crookstown and Cloughduv. The discharge consists of pumped groundwater. The exact quantity and quality of this discharge is unknown although on the day of the site inspection the discharge appeared clear with no evidence of high solid levels.
- The second discharge was noted immediately upstream of Classis Bridge where siltation and occasionally strong odours were noted. The source of this discharge is not known.

A summary of discharges to the Bride is given in Tab le 3.1

	Included on Cork County Council Register	
A	Kilumney Creamery	Not active.
B	John A. Wood Garryhesta	Not active
C	EMC	Active.
D	Guy Co. Ltd.	Active.
E	John A. Wood quarry (Classes Lake)	Active.
F	Roadstone Provinces Ltd	Active
G	Fermoy Fish Ltd (formerly Corlon Trading Ltd.)	Active
	Not included on Cork County Council Register	
H	Discharge from Castlemore Quarry	Active
I	Upstream of Classis Bridge	Active

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4. FLOW DATA

4.1 RIVER BRIDE

The Environmental Protection Agency document *Hydrological Data – A listing of water level recorders and summary statistics at selected gauging stations* (1997) notes the existence of a hydrometric station on the River Bride at Ovens (Code 19016). This hydrometric station (Grid Reference W550700 155000) is located at Ovens Bridge and the catchment area upstream of this station is 123km^2. The 95-percentile flow at this hydrometric station is 0.070 m^3/s.

Based on a catchment of 123km^2 the unit flow per km^2 is calculated at 0.00057 m^3/s, which equates to 0.57litres/ km^2. This figure is low and may be attributable to areas of limestone gravel which occur in the lower reaches of the river. The EPA's *Hydrological Data* notes the following in respect of this monitoring location "Stable control. Fair rating" and confirmed that calibration measurements of flow have been taken under low flow conditions.

It has been noted (M. Murphy *pers. comm.*) that on occasions, within certain sections of the Bride River close to Kilumney, there may be no surface flow visible during drought conditions. This may occur when low flows correspond with deep gravels through which the water flows beneath the surface or when water is diverted via karst features. Although some flow will remain within the channel (as indicated by flow readings at Ovens Bridge) the absence of a surface flow may have ecological implications.

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Two additional staff gauges were noted within the Bride catchment and were located as follows:

1. On the Brouen Tributary at the bridge east of Crookstown (Farranduff).
2. On the main channel of the Bride at Castlemore Bridge approximately 1.6km downstream of Crookstown village.

It was determined that both staff gauges were put in place by K.T. Cullen Consulting Engineers working on behalf of Castlemore Quarries. Some limited flow data may be available from these locations. However this information was not available for the purposes of this report.

The Bride is approximately 30km in length, and considerable variation occurs in the underlying geology, topography and land-use. Therefore there may be variations in the unit flows in the upper and lower catchment, and extrapolation from the data obtained at Ovens may be inaccurate when calculating flows in the upper catchment. To clarify this situation direct flow measurements were taken at Crookstown in the upper catchment and at the staff gauge in Ovens in the lower catchment. Flow readings were taken by measuring the cross sectional area combined with velocity readings taken across the stream width. Velocity readings were taken in accordance with standard methods using an OTT Sensa flow monitor.

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Flow values were recorded on the 9th September 2004. It was noted that due to recent rainfall flows were considerably higher than the dry weather or 95 percentile flows. Immediately upstream of Crookstown the measured flow was 0.4347m³/s. The measured flow at Ovens Bridge was 0.8565m³/s. The area draining through the monitoring point at Crookstown is approximately 47.5 km² compared to an area of 123km² draining through the monitoring point at Ovens. This corresponds to a unit flow of 0.0092m³/s/km² at Crookstown and a unit flow of 0.0070 m³/s/km² at Ovens. Thus the unit flow at Crookstown is 31.4% higher than at Ovens.

Although based on limited data it appears that the flow rate through the upper catchment is proportionally higher than that in the lower catchment. This corresponds with a significant change from an upper catchment characterised by hills, some non-native forestry and an underlying geology of sandstone/mudstone to a lower catchment characterised by flat land, an underlying geology of limestone and more intensive agriculture including tillage.

It is noted that the recorded unit flow of 0.000570m³/s/km² recorded at Ovens Bridge is very low in comparison with other rivers in the area. The 95% flow and unit flows for a range of rivers to the north, west and south of the Bride are shown in Table 4.1.

Table 4.1. 95% flow and unit flows for a range of rivers

Station name	River	Catchment Area (km²)	95 percentile (m³/s)	Unit flow m3/s/km²
BALLEA	OWENBOY	106	0.17	0.0016
LEEMOUNT U/S	LEE	927.2	2.97 *	0.003
LEEMOUNT D/S	LEE	1137	3.26 *	0.0029
INNISCARRA	LEE	792	2.9 *	0.0037
HEALY'S BR.	SHOURNAGH	207	0.29	0.0014
OVENS	BRIDE(LEE)	123	0.07	Catchment under consideration
BAWNNAFINNY	BLARNEY	89	0.08	0.0008
TOWER	SHOURNAGH	160	0.27	0.0017
CARRIGAPHOOCA	FOHERISH	74.5	0.12	0.0016
KILL	LANEY	84.3	0.27	0.0032
DRIPSEY	DRIPSEY	88	0.28	0.0032
UMMERA	SULLANE	309.5	0.82	0.0026
MACROOM	SULLANE	210	0.34	0.0016
INCHIGEELAGH	LEE	115	0.08	0.006
STATION ROAD	MARTIN	60.4	0.04	0.00067
BANDON	BANDON	406	0.78	0.002
CURRANURE	BANDON	431	0.8	0.0019
BELGOOLY	STICK	37	0.08	0.0022
DOWNDANIEL BR.	BRINNY	86.1	0.13	0.0015
			Total flow m3/km²	**0.04157**
			Mean value m3/km²	**0.0023**

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It is noted that in contrast to the above-mentioned rivers a high proportion of the Bride flows over limestone including limestone gravels and karst limestone features. It is probable therefore that the low flows recorded at the Bride are related to underlying geology. However the Bride catchment above Crookstown is dominated by sandstone/mudstone rather than limestone and thus it would be expected that the flow regime in the upper reaches would be more similar to that occurring in neighbouring catchments with similar geologies rather than the lower limestone reaches of the Bride.

Based in the figures shown above in Table 4.1 the mean unit flow for a range of rivers in the region is 0.0023 m3/km² which equates to 2.3 litres km². Although the use of this mean figure may not be suitable a conservative value of 1litre/ km² is considered appropriate as an estimate of the unit 95% flow upstream of the Crookstown. It is noted however that additional flow monitoring is required at Crookstown to provide a more accurate estimate of flow values at this location.

4.2 RIVER BROUEN

As noted in Table 3.1(H) there is a discharge from Castlemore quarry. The pumps work continuously to remove a constant influx of water from groundwater however the volume of water pumped is unknown at present. Castlemore quarries is located between the Brouen and Bride Rivers with an underlying limestone geology. It is probable therefore that the water, which is being pumped from Castlemore quarries, would naturally drain into either the Brouen or Bride Rivers. It is possible however that water that would naturally drain to the Bride is now diverted to the Brouen River thus causing a slight reduction in flows within the Bride and a slight increase in flows in the Brouen. However it is not possible to quantify this effect without long-term monitoring and therefore for the purposes of this report the probable extra dilution available in the Brouen River is not factored into calculations.

4.8 Based on extrapolation from the flow readings at Ovens and/ catchment information the 95% flows at various locations is given in Table 4.1.

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Table 4.2 Flows at discharge locations

	Catchment km^2	95% flow m^3/s	Flow rate $m^3/s/km^2$	Comments
Kilmurray (Bride tributary)	4.98	0.00498	0.001	Flow reading indicates that unit flow is higher at Crookstown compared to the unit flow rate at Ovens Bridge. Based on the figures available from other catchments in the area a unit 95% flow rate of 1 lit/s/km2 is considered appropriate
Kilmurray (Bride)	45.75	0.0458	0.001	Flow reading indicates that unit flow is higher at Crookstown compared to the unit flow rate at Ovens Bridge. Based on the figures available from other catchments in the area a unit 95% flow rate of 1 lit/km2 is considered appropriate
Crookstown (Bride)	47.50	0.0475	0.001	Flow reading indicates that unit flow is higher at Crookstown compared to the unit flow rate at Ovens Bridge. Based on the figures available from other catchments in the area a unit 95% flow rate of 1 lit/km2 is considered appropriate
Cloughduv (Brouen)	16.25	0.009	0.00057	Groundwater from Castlemore quarries is discharged to the Brouen River. Cannot be quantified at present and is therefore excluded from calculations.
Farnanes (Bride)	78.75	0.045	0.00057	
Aherla (Bride Bridge)	93.25	0.053	0.00057	
Farran (Bride)	97.25	0.055	0.00057	
Kilumney (Bride)	121.25	0.069	0.00057	
Ovens(Ovens Bridge)	123	0.070	0.00057*	

*hydrometric station

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4.9 It is noted that orthophosphate levels are often the limiting factor and that the Phosphorus Regulations are based on the *median* levels of orthophosphate i.e. a median orthophosphate level 0.03mg/l is indicative of satisfactory water quality. However when calculating the downstream concentration the 95% flow rate is used. The 95% flow is the flow which is equalled or exceeded at least 95% of the time (on average all but 18 days per year), and this measurement is generally used when assessing the impact of wastewater discharges. The 95% flow rate is generally considered indicative of low flows and therefore to a degree represents extreme conditions. In contrast the median orthophosphate value is indicative of average values i.e. over the complete range of flows. Thus there is a large safety margin when using the 95% flow rate, which occurs for only short periods of the year.

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To allow additional comparisons to be made further information was requested from the hydrometric office of the EPA. Processing of information for the period from 1984 to 2004 allows for an estimate of the 80-percentile flow rate at Ovens Bridge. It is noted that this period does not include drought years in 1975 and 1976.

The 95-percentile flow for this period is 0.21m3/s, which is higher than the long-term 95% flow value of 0.07m3/s utilised for calculations in this report. The approximate 80-percentile flow rate for the same period is estimated at 0.63m3/s. Thus the 80-percentile flow is three times higher than the 95-percentile flow. Although these figures are presented for comparison purposes only they do indicate that the use of the 95-percentile flow provides a large safety margin. Due to the presence of limestone gravels beneath the lower reaches of the Bride catchment it appears that flows drop dramatically during periods of very low rainfall. However with the exception of these extreme events the assimilative capacity of the river is considerably higher than the 95 percentile calculations suggest.

5. HABITAT DESIGNATIONS & FISHERIES

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No formal designation applies to the Bride and its immediate environs. Thus the Bride River does not form part of any Natural Heritage Area, Special Protection Area, Special Area of Conservation, Statutory Nature Reserve or National Park. Although there are a number of designated areas adjoining the main channel of the Lee River none of these habitats will be affected by the proposed treatment discharging to the Bride River. However sea Lamprey *(Petromyzon marinus)* has been recorded from the main channel of the Lee and is known to spawn in the Bride. Ammocoete larvae *(juvenile lamprey)* have been found in the Bride and it is likely that all 3-lamprey species Sea, River *(Lampetra fluviatilis)* and Brook Lamprey *(Lampetra planeri)* occur in this river. All three species are listed in Annex II of the Habitats Directive. Two other Annex II species occur within the Bride namely salmon (*Salmo salar*) and otter (*Lutra lutra*).

On the basis of its salmon population and spawning grounds the Bride is included in a 'shadow list' of proposed Special Areas of Conservation submitted to the European Commission (DGXI Natura, 2000) under a group NGO initiative sponsored by The Heritage Council for Ireland. However this is not a formal designation. (*Constraints Study Report for the N22 Ballyvourney – Macroom - Ballincollig Road Project*)

The Bride River is a productive brown trout fishery particularly in its lower reaches where it flows over limestone and is considered the most important spawning/nursery tributary of the Lee. A high proportion of the river has retained a relatively natural flow pattern and this, combined with an underlying limestone geology, creates good habitat for brown trout. The average size is 0.5lb; however larger fish are taken on occasion (O Reilly, 1998). The Bride is not noted as a sea trout river although it may contain an occasional fish. As the Bride River meets the Lee downstream of Inniscarra dam, the Bride is of particular importance as a spawning river for salmon. The river gets a big run of salmon which generally arrive after the fishing season has ended (O Reilly, 1998). The South Western

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Regional Fisheries Board have not noted any severe problems relating to the Bride River with the exception of serious pollution at Crookstown related to the existing sewage discharge (M. McPartland *pers. comm.*)

The Brouen into which the WWTP from Cloughduv discharges is one of largest tributaries of the Bride and contains a population of brown trout. The upper sections of the river (from its source to Crookstown) are characterised by steep gradients and fast-flowing waters with clean gravels. These stretches of the stream are suitable for salmonid spawning. Although brown trout were noted downstream of the discharge point from Cloughduv, no spawning gravels are available for salmonids in the lower reaches of this watercourse.

The European Communities (Quality of Salmonid Waters) Regulations of 1988 (S.I. No. 293 of 1988) implementing the Freshwater Fish Directive (78/659/EEC) designates a number of rivers and the parameters that are to be monitored on such rivers. The Bride is not designated under this directive. However the River Lee into which the Bride flows is so designated. The Lee rises near Gouganebarra and flows eastwards through Cork City before discharging into Cork Harbour. It is approximately 90km in length and with its tributaries it drains an area of 774 km². Although the construction of two dams has prevented salmon from accessing the upper reaches, the lower 8km of the Lee is fished for salmon and is considered an important fishery. The salmon population below Inniscarra dam is supplemented with stocked fish. Brown trout and coarse fish are also common within the catchment.

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6. WATER QUALITY MANAGEMENT PLAN

The Local Government (Water Pollution) Act, 1977, provides for one or more local authorities to take co-ordinated action on a river catchment basis by the preparation and implementation of river catchment management plans. Cork County Council has not formally adopted any plan for the catchment under investigation.

The above management function has now been superseded by EU Directive 2000/60/EC, establishing a framework for Community action in the field of water policy. Under the Water Framework Directive local authorities are obliged to prepare river basin management plans. A management programme is currently under preparation for the Cork area.

Cork County Council does prepare reports related to the implementation of the Phosphorus Regulations. The most recent report is currently being prepared and the section of the draft version of this report relating to the Bride is reproduced in Appendix 2

A review of the information presented in the Implementation Report indicates that there are ongoing difficulties associated with discharges from the treatment plant at Crookstown. The deterioration in Q value at Classis Bridge is also identified as an area of concern and the need to amalgamate the discharges from different systems at Kilumney is also recognised.

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7. WATER QUALITY DATA – CORK COUNTY COUNCIL

7.1 WATER QUALITY DATA 2000-2004

Recent water quality data for the Bride River was received from Cork County Council and is detailed in Table 2.1. The only site monitored on a regular basis in the period 2003-2004 was at Classis Bridge. Ovens Bridge was monitored on one occasion only during this period. Results form this sampling period are given in Table 7.1

Table 7.1. Water quality Data for the Bride River 2003-2004.

Location	Date	Temp °C	D.O mg/l	D.O %	Nitrite NO_2 mg/l	Molybdate Reactive Phosphorous (P) mg/l	Ammonium NH_4 mg/l	Nitrate NO_3 mg/l
Classis Bridge	15-Jan-03	8	11		0.081	0.052	0.09	20.7
Classis Bridge	19-Feb-03				0.027	0.019	< 0.026	24.92
Classis Bridge	20-Feb-03				0.029	0.018	< 0.026	23.49
Classis Bridge	17-Apr-03				0.028	0.021	< 0.026	15.4
Classis Bridge	22-May-03	12.6	11.2	106	0.038	0.015	< 0.026	22.61
Classis Bridge	26-Jun-03	17.5	9.8	102	0.023	0.02	< 0.026	
Classis Bridge	24-Jul-03	15.9	9.4	95	0.051	0.037	< 0.026	18
Classis Bridge	21-Aug-03	18.5	10.2	109.5	0.044	0.019	< 0.026	15.5
Classis Bridge	16-Oct-03	12.7	9.4	88	0.081	0.027	0.054	17.46
Classis Bridge	13-Nov-03				0.048	0.053	0.05	20.44
Classis Bridge	04-Dec-03				0.033	0.028	0.041	20.57
Classis Bridge	25-Feb-04	7.1	12	99	0.029	0.022	< 0.026	27.54
Classis Bridge	18-Mar-04	8.9	11.2	97	0.028	0.027	0.056	25.41
Classis Bridge	14-Apr-04	11.7			0.069	0.055	0.133	15.64
Classis Bridge	20-May-04	14.8	10.7	106	0.089	0.01	0.059	
Classis Bridge Mean Values*		12.77	10.54	100.31	0.0465	0.028	0.0322	20.59
Ovens Bridge	26-Jun-03				0.043	0.02	< 0.026	

* It is noted that the Phosphorus Regulations use the median value. However to allow comparison with Dixon.Brosnan chemical samples the mean value is used for the purposes of this report.

Source: Cork County Council (D. Sheehan *pers. comm.*)

Ammonium levels recorded were satisfactory, being lower than the maximum allowable concentration of 0.82mg/l N specified in the Freshwater Fish Directive for total ammonium. The recorded levels are also lower than the 1mg/l (for 95% of samples) specified under the Salmonid Regulations, although it should be noted that the Bride is not designated under these regulations.

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The Freshwater Fish Directive does not specify a limit for nitrate, and thus reference may be made instead to the Surface Water Regulations in which a maximum limit of 11.3mg/l N (50mg/l NO_3) is noted. No breaches of this limit were recorded in the available data.

Under the Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations, 1998 (S.I. No. 258 of 1998) Q values of 4 or higher are taken to represent satisfactory water quality where eutrophication is unlikely to be a problem. A Q value of 4 corresponds to an orthophosphate value of 0.03mg/l. As detailed in Table 7.1 this level was breached on four occasions at Classis Bridge.

It is noted that EPA Q values at Classis Bridge indicate that some deterioration in water quality has occurred at this location. Two discharges occur immediately upstream of Classis Bridge namely from a quarry (John A. Wood Table 3.1–E) and from an unknown source (Table 3.1–I). Results from this location do give an accurate estimate of background water quality in the overall catchment. It is also noted that despite values that were elevated on occasions the mean orthophosphate level of 0.028 mg/l is marginally lower than the value of 0.03 mg/l P which is considered indicative of satisfactory water quality under Phosphorous Regulations. It is noted however that a site with Q value of 4 and/or median orthophosphate value of 0.03mg/l may not be in compliance with the Phosphorus Regulations. This arises because the target value for a given site under the Phosphorus Regulations is based on the baseline data measured in 1997.

7.2 WATER QUALITY DATA 1998-2000-Appendix 3

Cork County Council data for the period from 1998-2000 is given in Appendix 3. Sampling was carried out at 3 sites (1300 Kilcrea Bridge, 1400 bridge at Kilumney and 1600 Bridge upstream of River Lee confluence). Results for pH, temperature, dissolved oxygen, BOD, total ammonia, un-ionised ammonia and oxidised nitrogen are all indicative of satisfactory water quality. However the median phosphate levels at 1300 and 1400 were high at 0.04 and 0.05mg/l respectively. These values are higher than the 0.03mg/l, which is taken to be representative of satisfactory water quality under the Phosphorous Regulations. Further downstream at site 1600 the measured orthophosphate value of 0.03mg/l is indicative of satisfactory water quality.

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7.3 WATER QUALITY DATA 1995-1997-Appendix 3

A review of the water quality data for the period 1995-1997 indicates that the elevated orthophosphate values at 1300 (0.05mg/l) and 1400 (0.05mg/l) are similar to those obtained in the period 1998-2000. The detected level of orthophosphate at Crookstown was low with a detected median value of 0.02mg/l. The remaining results at all three locations are indicative of satisfactory water quality.

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The Environmental Protection Agency carries out a biological assessment of most river channels in the country on a regular basis. The assessments are used to derive Q-values – which are indicators of the biological quality of the water. These values are of particular importance as they give an indication of long-term water quality. The EPA Q-value scheme is summarised in Table 8.1.

Table 8.1. EPA Biotic Index Scheme.

Q-VALUE	WATER QUALITY	POLLUTION	CONDITION (likelihood of interference with uses)
5	Good	Unpolluted	Satisfactory
4	Fair	Unpolluted	Satisfactory
3	Doubtful	Moderately polluted	Unsatisfactory
2	Poor	Seriously polluted	Unsatisfactory
1	Bad	Seriously polluted	Unsatisfactory

Source: EPA

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The intermediate ratings Q1-2, 2-3, 3-4 and 4-5 are also used to denote transitional conditions, while ratings within parenthesis indicate borderline values. Great importance is attached to the EPA biotic indices and consequently it is this data that is generally used to form the basis of water quality management plans for river catchments.

8.1 RIVER BRIDE

Hydrometric area no. 19, which includes the Bride River, was most recently surveyed by the EPA in 2003. Monitoring locations are shown in Figs. 1 and 2. Survey results from the EPA biological monitoring programme for the years 1990 to 2003 are listed in Table 8.2.

Table 8.2. Q values recorded at sampling stations on the Bride (1990-2003).

NO.	LOCATION	1990	1994	1997	1999	2003
0400	Hornhill Bridge	4	4	4	4	4
0600	Br at Crookstown LHS	4-5	4	4	4	4-5
0610	Br at Crookstown RHS	-	3	2	3	2
0900	Br S of Knocknagoul	5	4-5	4	4-5	4-5
1300	Kilcrea Bridge	4	4	4	4	4
1400	Br at Killumney	4	4	4-5	4-5	4
1500	Ovens Bridge	4	-	-	-	-
1600	Br u/s River Lee confl	4	4	3-4	4	3-4

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In *Interim Report on Biological survey of River Quality 1997 and 1999* (EPA Publications) the following assessments of the River Bride are given:

1997: "Continuing mostly satisfactory but in lower reaches (1600) now markedly eutrophic and further deterioration recorded at Crookstown (0610) where seriously polluted, apparently by sewage; a two metre wide band of slime growth was observed over a distance of some 120 m along the right hand side of the river at the point."

1999: "Satisfactory except for the right-hand side of the river at Crookstown (0610), where moderate pollution due to a sewage discharge was recorded, this location was seriously polluted in the previous survey of 1997. An improvement to satisfactory conditions was recorded at final location (1600) which has been slightly polluted in previous survey".

The EPA have stated that the low Q values at site 0610 Br at Crookstown RHS is due to a sewage discharge and the reduction at 1600 u/s of River Lee confluence is due to siltation. (J. Lucy *pers. comm.*)

As detailed above the majority of sites on the river are in a satisfactory condition with the exception of two sites. At the right hand side of the river at Crookstown (0610) the deterioration in water quality is related to a discharge from the existing treatment plant serving Bellmount Housing Estate.

The reduced water quality at site 1600 Br u/s River Lee (Classis Bridge) confluence is possibly due to overflow from the lagoon associated with a quarry at this location (John A. Woods Table 3.1-E). There is also a second discharge on the right hand side of the river, which has a strong odour on occasions (source unknown Table 3.1-I).

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Water quality on the remainder of the Bride was consistently satisfactory at the remaining locations during the sampling period 1990-2003. It is noted however that the Q value of 4 obtained at 1400 Br. at Kilumney indicates that this site is not in compliance with the Phosphorus Regulations as a baseline Q value of 4-5 was obtained in 1997.

8.2 RIVER LEE

The main channel of the River Lee is designated a salmonid river under the European Community's (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293 of 1988) implementing the Fish Directive (78/659/EEC). In compliance with these regulations the local authority is required to analyse water samples from the rivers' functional area in relation to a number of parameters. The majority of these parameters are to be sampled monthly. Where salmonid waters do not comply with the specified standards and are being affected by human input, the local authority shall adopt an action programme. This consists of appropriate measures to reduce pollution and to ensure that EU standards are complied with.

A review of EPA water quality data for the period 1995-1997 and 1998-2000 shows that although breaches of the specified limits have occurred, water quality in the River Lee is generally satisfactory. According to the available

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data (Appendix 4), the majority of the breaches of the limits were for nitrite levels. It should be noted however that the levels set for nitrite i.e. 0.05mg/l NO_2 are considered stringent (McGarrigle M. L. *et al*, 2002). BOD and dissolved oxygen levels exceeded the limits in a small percentage of samples. Breaches of dissolved oxygen limits occurred at only one site (0600) in the period 1998-2000 compared to breaches at eight sites in the 1995-1997 period. Dissolved copper is toxic to fish and can cause fish kills. Its toxicity varies with hardness and its presence in water is often due to attacks on copper piping, galvanic corrosion of tanks and rarely to algicides. Copper is not particularly toxic to humans. Two samples breached the limits for copper in the period 1995-1997 according to EPA data and this may have constituted a risk to fish.

Q-values on the River Lee are satisfactory on all but one site, Iniscarra Bridge (0600). Q values on this site have been consistently low since 1990 and remained at Q3 in 2003. The eutrophication of this section of the Lee River may be linked to the presence of the dam upstream.

9. SITE SURVEYS

A number of surveys were undertaken along the Bride River: catchment assessment, chemical survey and biological survey. The results of the catchment assessment have been described in Section 2. The remaining surveys are discussed below.

9.1 CHEMICAL SURVEY

In order to determine the current water quality of the Bride River, water samples were taken at nine locations. Monitoring locations are shown in Fig. 2. The sampling locations, and results of analyses are presented in Tables 9.1 and 9.2 respectively.

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Table 9.1. Sampling locations.

REF.	LOCATION	REASON FOR SELECTION
X1	Tributary Kilmurry	To ascertain existing water quality in the tributary of the Bride closest to Kilmurry
B1	Bride River – 100m upstream of Crookstown	To ascertain current water quality in the Bride River u/s of the Crookstown discharge
B2	Bride River – 20m downstream of discharge from Crookstown discharge	To ascertain current water quality in the Bride River d/s of the discharge from the Crookstown WWTP
B3	Brouen – u/s of discharge point from Cloughduv WWTP	To ascertain existing water quality in the Brouen u/s of discharge from the WWTP
B4	Brouen – d/s of discharge from Cloughduv WWTP	To ascertain existing water quality in the Broeun d/of the discharge from the WWTP.
B5	Bride River – immediately u/s of Bride Bridge	To ascertain existing water quality in the Bride d/s of Aherla
B6	Bride River – u/s of WWTP in Kilumney	To ascertain existing water quality in the Bride u/s of all discharges in Kilumney
B7	Bride River – d/s of the Bridge in Kilumney and u/s of the discharge from the WWTP	To ascertain existing water quality in the Bride within Kilumney village
B8	Bride River – d/s of EMC discharge	To ascertain existing water quality in the Bride downstream of all existing discharges in Kilumney

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Table 9.2. Water quality- Bride and Brouen Rivers

PARAMETER	X1	B1	B2	B3	B4	B5	B6	B7	B8	Limits
pH	7.88	8.09	7.70	8.07	8.01	7.60	8.16	8.12	8.4	6.0-9.0[1]
BOD (mg/l)	<4	<2	3	2	<2	<2	<2	<2	<2	5[2] 7[3]
Suspended solids (mg/l)	<5	<10	<10	<10	15	<10	<10	<10	<10	50[2]
Nitrate (NO_3) (mg/l)	23.89	11.0	11.4	19.7	19.2	-	14.5	14.8	3	-
Nitrite (NO_2) (mg/l)	<0.01	0.11	0.20	0.06	0.10	-	0.11	0.09	<0.01	-
Total oxidised nitrogen (mg/l N)	-	-	-	-	-	-	-	-	3	-
Ammoniacal nitrogen as N (mg/l)	<0.1	<0.2	7	<0.2	<0.2	<0.2	<0.2	<0.2	0.1	0.82[1]
Total Nitrogen (mg/l)	5	5	5	6	5	5	6	5	-	-
Orthophosphate (o-PO_4-P) (mg/l)	0.02	0.03	0.10	0.03	0.03	0.016	<0.01	<0.01	0.03	0.03 (Q4)[7] 0.02 (Q4-5)[7]
Conductivity µs/cm	254	233	241	466	233	290	357	358	320	1000[4]

Analysis: Alcontrol Laboratories Ltd & Consultus Ltd.

NOTES

[1]Freshwater Fish Directive – salmonid waters

[2]Surface Water Directive – A1 waters

[3]Surface Water Directive – A3 waters

[4]Surface Water Directive – A1-A3 waters

[5]Freshwater Fish Directive – cyprinid waters

[6]No limits specified in Surface Water or Freshwater Fish Directives

[7] Phosphorous Regulations

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X1-Kilmurray

The chemical sample from Kilmurray indicates that for most of the parameters surveyed levels are within accepted limits. In particular orthophosphate levels are low. However levels of nitrate were elevated.

B1 & B2 - Crookstown

The discharge from Crookstown WWTP appears to be having a discernible impact on water quality and this impact is reflected in the chemical results. Values for most parameters were higher at the downstream site (B2). The most obvious difference is the increase in ammoniacal nitrogen from 0.2mg/l at B1 to 7mg/l at B2. This value of 7mg/l is significantly higher than the limit of 0.82mg/l specified under the Freshwater Fish Directive. Orthophosphate values were also elevated downstream of the discharge point at 0.1mg/l. The value of 0.1mg/l exceeds the value of 0.03mg/l which is indicative of satisfactory water quality under the Phosphorous Regulations. BOD was also slightly elevated although values at both locations were lower than the relevant limits. The pH value detected upstream of Crookstown village was quite high at 8.09. However the value downstream was considerable lower at 7.70.

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B3 & B4 - Cloughduv

The discharge point at Cloughduv is situated downstream of a cattle crossing point on the Brouen. Although no discharge was visible the location of the discharge point is characterised by a dense bed of watercress. This is probably due to increased nutrients derived from the WWTP discharge. The Brouen differs considerably from the main channel of the Bride River and is characterised by slow-flowing water and a soft substratum. The section of watercourse downstream of the discharge is heavily shaded.

No significant differences were discernible between the detected levels upstream (B3) and downstream (B4) of the WWTP discharge. It is noted that one sample does not provide a conclusive portrait of water quality over the long-term and that in this instance the absence of a well-defined discharge point makes an accurate assessment of water quality problematical. High shade may also be suppressing the diversity of invertebrates thus affecting Q values. It is also noted that the samples were taken close to a cattle crossing point and farm, which may be having a localised impact on the river. Based on Q a value of 3 and orthophosphate levels of 0.02mg/l the background orthophosphate level is conservatively estimated at 0.04mg/l.

B5 - Aherla

At Aherla the houses are served by individual septic tanks. A treatment plant and percolation area serves the new housing estate. To determine if a discharge to the Bride is a viable option a chemical sample was taken from the Bride at a location downstream of Aherla at Bride Bridge (B5). Results from Bride Bridge indicate are not indicative of a deterioration in water quality.

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B6-B8 Kilumney

Due to the proximity of dwellings to the river within the village of Kilumney there is a possibility that the section of river within the village will be affected by septic tank and/or grey water discharges. Therefore a sample (B6) was taken from a site immediately upstream of the village. Results from this location are indicative of satisfactory water quality and no breaches of relevant limits were noted.

A second sample (B7) was taken downstream of the Bridge in Kilumney but upstream of the discharge from the WWTP. This sample was taken to ascertain if the houses backing onto the river upstream of the WWTP are having an impact on water quality. No significant differences were noted between B6 (upstream) and B7 (downstream) and no breaches of the relevant limits were noted. The orthophosphate value of <0.010mg/l detected at both sites is indicative of satisfactory water quality. Levels of BOD and ammoniacal nitrogen were low at both sites.

A third chemical sample (B8) was taken downstream of Kilumney, downstream of the discharge from Kilumney WWTP and the discharge from the IDA industrial estate (EMC and Guy Ltd.). The orthophosphate value equalled the value of 0.03 mg/l (indicative of satisfactory water quality) at this location and there were no other indications of a deterioration in water quality.

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9.2 BIOLOGICAL SURVEY

Biological monitoring was carried out at a number of locations on the Bride and Broeun watercourses and, on the basis of the diversity and density of macro-invertebrates found at each site Q values were assigned. The objective of this survey was (1) to determine background water quality upstream of the specific discharges at each location, (2) to determine the effect of the existing discharges and (3) to cover areas not included in the standard EPA monitoring programme.

Samples were taken at 11 locations and the locations and results obtained are presented in Table 9.3. Monitoring locations are shown in Figs. 1,2 and 3. A species list is presented in Appendix 5.

Table 9.3. Q-values.

SITE	LOCATION	Q-VALUE
Y1 *(Corresponds to chemical sample X1)*	Tributary of the Bride at Aghnaveloge Br.	Q4-5
S1 *(Corresponds to chemical sample B1)*	100m upstream of Crookstown	Q4-5
S2	70m downstream of the discharge from the fish processing plant at Crookstown	Q4
S3	At Castlemore Bridge 1000m downstream of Crookstown	Q4-5
S4	Brouen 700 m downstream of Crookstown	Q4
S5 *(Corresponds to chemical sample B3)*	Brouen 20m upstream of the discharge from Cloughduv WWTP	Q3
S5a *(Corresponds to chemical sample B4)*	Brouen 200m downstream of the discharge from Cloughduv WWTP	Q3
S6	Brouen immediately upstream of the confluence with the Bride River	Q3-4
S7	Bride immediately upstream of its confluence with the Brouen	Q4-5
S8	Bride immediately downstream of its confluence with the Brouen	Q4-5
S9 *(Corresponds to chemical sample B5)*	Bride at Bride Bridge	Q3
S10	Bride upstream 150m of upstream of Kilumney	Q4-5
S11 *(Corresponds to chemical sample B8)*	Bride downstream of all discharges from Kilumney	Q4

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Kilmurray

A Q value of 4-5 was assigned to site Y1 which is located on a tributary of the Bride. Diversity was relatively high with a number of pollution sensitive species noted.

Crookstown

A Q value of 4-5 was assigned to S1 upstream of Crookstown. Sensitive species including the stonefly species *Perla* sp. and *Isoperla* sp. were numerous. Overall diversity was reasonably high. S2 was taken downstream of the

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discharge coming from the small industrial estate in Crookstown; it is believed this discharge comes from a fish processing unit and some staining and siltation was noted at the discharge point. Notwithstanding this discharge water quality at S2 approximately 90m downstream of this point at was found to be satisfactory (Q4). A third survey carried out at Castlemore Bridge (S3) downstream of Crookstown and water quality was found to be satisfactory at this location (Q4-5).

Cloughduv

Four samples were taken on the Brouen Tributary and three of these samples were indicative of unsatisfactory water quality. The exception was a sample taken 700m downstream of Crookstown (S4) to which a Q value of 4 was assigned.

For the remaining sites sampling was problematical due to deep, slow flowing water with high silt levels and heavy shade. Localised agricultural impacts were also noted. The sampling point upstream of the discharge (S5) is located immediately downstream of a cattle crossing point. This may be impacting on water quality, which was found to be unsatisfactory (Q3).

A second sample (S5a) was taken at a bridge 200m downstream of the discharge point, which was characterised by high silt levels. Water quality was again found to be unsatisfactory (Q3).

The final site on this tributary was located immediately upstream of the confluence with the Bride (S6). Although a small number of sensitive species were noted at this location, which may be indicative of some improvement in water quality, a Q3-4 was assigned to this site.

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To determine if the discharge from the Brouen was having a detectable impact on the Bride, samples were taken on the Bride upstream (S7) and downstream (S8) of the confluence with the Brouen. Water quality was found to be satisfactory (Q4-5) at both locations and no significant difference was noted between the two sites.

Subsequent to the survey by Dixon.Brosnan a further inspection was carried out by personnel from Cork County Council and the report relating to that inspection is included in Appendix 6. The report notes that the farmyard located upstream of the WWTP discharge point constitutes a low risk and slurry storage and management are of a high standard. It was also noted that the crossing point does not appear to be impacting on water quality and that the stream appeared quite clean.

Based on the available data it is difficult to accurately determine the cause of the low Q values obtained on the Brouen tributary. These values may be related to the physical characteristics of the stream (high shade levels, sluggish flows, soft substrate) or increased nutrients and/or silt from agricultural or quarry sources. Further monitoring is therefore recommended.

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Aherla

S9 is located immediately upstream of Bride bridge and was chosen to represent a possible discharge point for wastewater from Aherla. The site is located upstream of the confluence with a stream which runs through Aherla village. However the site is located downstream of the confluence of the Bride and four tributaries namely two small streams draining the low hills to the north and two larger streams draining flat farmland to the south. A serious deterioration in water quality was noted at this location, which was assigned a Q value of 3. The diversity and density of macroinvertebrates noted at this site, which included high numbers of Simulid fly larvae and *Asellus* sp., is indicative of a significant impact at this location. Although a number of small of tributaries drain into the Bride upstream of this site, the lower reaches of these streams are heavily silted and shaded and it was not possible to obtain accurate Q values. A concrete pipe was also noted approximately 100 m upstream of Bride Bridge. However there was no discharge coming from the pipe during the site visit.

Subsequent to the survey by Dixon.Brosnan a further inspection was carried out by personnel from Cork County Council and the report relating to that inspection is included in Appendix 6. The report notes that a number of drains flow into the Bride upstream of Bride Bridge and noted some silt on the southern side of the stream. It is possible that the low Q value obtained at this location is due to localised impacts from silt and it is recommended that further monitoring be carried out at this location.

Kilumney

Two sites were sampled at Kilumney. S10 is located approximately 150m upstream of Kilumney village and was assigned a Q value of 4-5 which is indicative of satisfactory water quality. A second sample (S11) was taken downstream of all discharges in Kilumney. This sample was taken to ascertain if the existing discharges are having an impact on water quality. Water quality was also found to be satisfactory at this location (Q4) although the Q value was lower than the value of Q4-5 assigned upstream of Kilumney.

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9.3 NOISE & ODOUR

The noise environment is dominated by traffic (local and through-flow). Occasional noise emissions will arise from domestic sources (e.g. children), agriculture (e.g. tractors) and natural noise (e.g. wind, birds). The local air environment is rural in character, with no sources of industrial atmospheric emissions present in the immediate locality. There is some limited industrial activity at Crookstown, Kilumney, Ovens and Aherla however noise levels from industrial activity is not significant. Overall the most intrusive feature is the noise level arising from passing traffic.

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10. INTERPRETATION – EXISTING ENVIRONMENT

This section provides a summary and analysis of information documented in Part 1 (Sections 2 to 9) regarding the existing environment.

10.1 GEOLOGY

The geology of the Bride River is characterised by sandstone in the upper reaches and by limestone in the lower to middle reaches.

10.2 ECOLOGY AND FISHERIES

The Bride is an important fishery in its own right and is also valuable as a spawning/nursery river for the Lee into which it discharges. Although the Bride River has not received any formal designations the Lee River into which the Bride discharges is designated under the European Community's (Quality of Salmonid Waters) Regulations, 1988.

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10.3 WATER CHEMISTRY

A review of the available water chemistry data from Cork County Council indicates that orthophosphate is the parameter, which is of most concern. None of the recorded results for the remaining parameters breach the relevant limits.

10.4 EPA Q VALUES

With the exception of the monitoring locations downstream of the septic tank discharge in Crookstown and at Classis Bridge water quality on the remainder of the Bride remained consistently satisfactory at the remaining locations during the sampling period 1990-2003. It is noted however that the Q value of 4 obtained at 1400 Br. at Kilumney indicates that this site is not in compliance as a baseline Q value of 4-5 was obtained in 1997.

10.5 FLOW DATA

Although accurate flow data is available for the lower reaches of the river because of the variation in underlying geology there may be differences in unit flow rates in the upper and lower catchment. It has been observed that surface flow has not been visible on occasions within the Bride and this is a cause for concern when assessing impacts on the river. A discharge from Castlemore quarries may be increasing the flow within the Brouen. However any increases in flow at Crookstown and in the Brouen cannot be accurately quantified at present.

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10.6 DISCHAGE LOCATIONS

Kilmurray

The orthophosphate level of 0.02mg/l corresponds in this instance with the Q value of 4-5, which was assigned to the same location. (Y1). However nitrate levels were elevated at this location.

Crookstown

Water quality at Crookstown is affected by a discharge from the existing WWTP and a Q value of 2 was assigned to Crookstown RHS in 2003. Biological monitoring upstream of Crookstown (Dixon.Brosnan 2004) detected a Q value of 4-5 and the EPA assigned to Q value of 4 to a site at Hornhill Bridge upstream of Crookstown and a value of 4-5 at Crookstown LHS in 2003. It is noted that although a Q4 was assigned to Hornhill Bridge this site is located a considerable distance upstream of Crookstown and that therefore the Q4-5 assigned to Crookstown LHS is probably a better indicator of water quality upstream of the discharge from the WWTP.

Q values are generally indicative of long-term water quality and where available are often of more value than a one–off chemical samples. A Q value of 4-5 is indicative of an orthophosphate level of 0.02mg/l and this value determined by a one off chemical sample taken by Dixon.Brosnan in 2004.

In addition to the discharge from the WWTP a discharge was also noted further downstream. It is believed that this discharge comes from a fish processing facility (Table 3.1-G). A Q value of 4 was assigned to a site downstream of this discharge and the discharge from the WWTP, which indicates that the river is recovering from the effects of these discharges. Further downstream a Q value of 4-5 was assigned to a site at Castlemore Bridge, which indicates that the river has completely recovered from the discharges in Crookstown at that point. The impact from the discharges in Crookstown therefore appears to be localised. It is noted that the gradient is sufficiently steep to maintain riffles with turbulent flows which provide high re-oxygenation potential in this section of the river.

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Cloughduv discharging to the Brouen

The lower reaches of the Brouen, into which the WWTP from Cloughduv discharges is characterised by overgrown banks providing heavy shade and deep silt. These conditions limit the availability of biological monitoring points. A cattle-crossing point immediately upstream of the discharge from the WWTP may also be having a localised impact on water quality. No significant differences were noted between samples taken from upstream and downstream of the discharge. Q values at all three sites (one upstream and two downstream of the discharge) are indicative of unsatisfactory water quality. Based on the available evidence, an orthophosphate level of 0.0 4mg/l is considered an accurate estimate of the background orthophosphate concentration. Q values of 4-5 were assigned to sites on the Bride immediately upstream and downstream of the confluence with the Brouen River, which suggests that any deterioration in water quality on the Brouen is not impacting on water quality in the Bride.

Farnanes/Cloughduv discharging to the Bride

Farnanes is located on the opposite site of the N22 and is close to the section of river between Castlemore Bridge (Dixon.Brosnan biological monitoring site S3) which as assigned a Q value of 4-5 and the EPA biological

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monitoring location 0900 Bridge south of Knocknagoul which as assigned a Q value of 4-5 in 2003. Based on the Q values obtained at the closest upstream location (S3) the median orthophosphate level is estimated at 0.02mg/l

Aherla

The EPA sampling point 0900 Br south of Knocknagoul was assigned a Q value of 4-5 in 2003. However biological monitoring at Bride Bridge (Dixon.Brosnan S9) approximately 4km downstream of 0900 found a significant decline in water quality and a Q value of 3 was assigned at this location. Orthophosphate levels were low at 0.016 mg/l.

The village of Aherla is located approximately 1.2km from the monitoring point. The stream which runs through the village discharges downstream of Bride Bridge. Wastewater from Aherla is treated via individual septic tanks and a treatment plant/percolation area, which treats wastewater from a new development. Given the distance of this percolation area from Bride Bridge and it is considered unlikely that the decline in water chemistry is due to wastewater treatment at Aherla.

Three streams discharge into the Bride in the stretch of river 2km upstream of Bride Bridge. In their lower reaches these streams are heavily shaded with soft substrates and could not be effectively sampled; however it is possible that one or more of these streams are impacting on water quality. A further site inspections was carried out in this section of river by Cork County Council personnel and the this report (which shows the location of the these small streams) is included in Appendix 2.

Further monitoring will be required to determine if the impact at this location is due to a recent pollution incident or is due to a chronic problem. For the purposes of this report the background orthophosphate level is estimated at 0.04 mg/l.

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Farran

Farran is located on the opposite site of the N22 close to Kilcrea Bridge. Since 1990 the EPA have consistently assigned a Q value of 4 to site 1300 Kilcrea Bridge. This is an improvement on the value of Q3 assigned by Dixon.Brosnan further upstream at Bride Bridge but lower than the value of Q4-5 assigned to 0900 Bridge south of Knocknagoul. This indicates a pattern where water quality declines between site 0900 (Q4-5) and site S9 (Q3) and improves between S9 (Q3) and 1300 (Q4). A review of Cork County Council data shows that orthophosphate values have been elevated in the past with values of 0.05mg/l and 0.04mg/l recorded in the periods 1995-1997 and 1998-2000 respectively. It is also noted that this section of river runs through flat ground and in a relatively straight line and reoxygenation potential may be limited. Based on a conservative estimate the background orthophosphate is estimated at 0.035mg/l.

Kilumney

Biological and chemical monitoring was undertaken upstream of Kilumney to assess water quality in the absence of any impact from discharges within the village. A Q value of 4-5 was assigned to the site upstream of the village (Dixon.Brosnan biological monitoring site –S10) and the orthophosphate level was recorded as <0.01 mg/l (Dixon.Brosnan chemical monitoring site – B6). The EPA monitoring point is located at the Bridge in Kilumney

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village which is downstream of a number of dwellings which back directly onto the river but upstream of the discharge from the WWTP. Some grey water/ sewage may be reaching the river from these dwellings. A Q value of 4 was assigned by the EPA to this site in 2003 (compared to a target value of 4-5 under the Phosphorus Regulations) and elevated orthophosphate values have been detected in the past (1995 to 1997-0.04mg/l, 1998 to 2000-0.05mg/l). However a second chemical sample taken downstream of Kilumney Bridge by Dixon.Brosnan (B7) did not detect any discernable impact, which could be ascribed to these dwellings. A third chemical sample was taken by Dixon.Brosnan downstream of the discharge from the IDA industrial estate and from the WWTP. No significant impact on water chemistry was detected at this site and orthophosphate levels were satisfactory at 0.03mg/l. A Q value of 4 was also assigned to this site. Based on the available information an orthophosphate level of 0.02mg/l orthophosphate is considered appropriate. It is also noted that there is sufficient gradient downstream of Kilumney to maintain a sequence of pools and turbulent riffles which provide a high re-oxygenation potential.

Ovens Bridge to Classis Bridge

Only limited data is available for Ovens Bridge and due to temporary roadworks at this location accurate samples could not be obtained. In 1990 a Q value of 4 was assigned at Ovens Bridge (1500), which is indicative of satisfactory water quality. Cork County Council took one chemical sample in June 2003, which detected an orthophosphate level of 0.02mg/l, corresponding to a Q value of 4-5. A conservative estimate of 0.03mg/l is considered appropriate.

Classis Bridge, which is located 400 m upstream of the confluence with the Lee River, was monitored extensively by Cork County Council in 2003-2004. None of the results are indicative of deterioration in water quality and the mean orthophosphate level of 0.028mg/l corresponds to a Q value of 4. In contrast the EPA Q value of 3-4 measured in 2003 is indicative of unsatisfactory water quality. Two discharges are located upstream and in close proximity to Classis Bridge, namely a discharge from the John A. Wood quarry (Table 3.1-E) and an unidentified discharge close to the bridge (Table 3.1-I). Silt arises from both discharges and the EPA note that the decline in water quality at this location is due to siltation. Based on the available data the background orthophosphate level is estimated at 0.03mg/l; however no additional discharges are planned for this location

An estimate of the background concentrations of the most relevant chemical parameters at each location is given in Table 10.1

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Table 10.1 Background concentrations

	Catchment km2	95% flow m3/s	Ortho Phosphate Mg/l	BOD Mg/l	SS Mg/l	Nitrate Mg/l NO3
Kilmurray (tributary)	4.98	0.003	0.02	<4	5	23.89**
Kilmurray (Bride)+++	45.75	0.026	0.02	1.3*	10**	11 **
Crookstown (Bride)	47.5	0.027	0.02	1.3*	10**	11 **
Cloughduv (Brouen)	16.25	0.009	0.04	2**	10**	19.7**
Famanes (Bride)	78.75	0.045	0.02	2**	10**	11**
Aherla (Bride Bridge)	93.25	0.053	0.04	2**	10**	11 **
Farran (Bride)	97.25	0.055	0.035	1.3***	10**	11 (estimated from nearest upstream location)
Kilumney (Bride)	121.25	0.069	0.02	1.3***	10**	14.5**
Ovens (Ovens Bridge)	123	0.070	0.028	-	-	20.59****

*Cork County Council 1995-1997 **Dixon.Brosnan survey 2004 *** Cork County Council 1998-2000 **** Cork County Council 2003-2004

+++ An option for Kilmurray is to discharge to the Bride upstream of Crookstown. Due to the proximity of this site to Crookstown the background chemical values for Crookstown are used.

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11. SURFACE WATER DIRECTIVE

Council Directive 75/440/EEC of 16 June 1975, concerning the quality of surface water intended for the abstraction of drinking water in the Member States, was incorporated into Irish law by the European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989 (S.I. No. 294 of 1989). The Regulations set out quality standards for a total of 39 parameters for waters, which are to be treated for distribution, with the standards varying with the degree of treatment provided. The regulations divide surface waters, from which water for public supply will be taken, into three categories; these categories are based on the degree of treatment, which will be applied, and they set out quality standards for a total of 39 parameters. The degree of treatment for the three categories A1, A2 and A3 are as follows:

A1- Simple physical treatment and disinfection e.g. rapid filtration and disinfection

A2- Normal physical treatment, chemical treatment and disinfection e.g. prechlorination, coagulation, flocculation, decantation, filtration, disinfection (final chlorination).

A3- Intensive physical and chemical treatment, extended treatment and disinfection e.g. chlorination to break-up point, coagulation, flocculation, decantation, filtration, adsorption, (activated carbon), disinfection (ozone, final chlorination).

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As the degree of treatment is based on the quality of water to be abstracted there are obvious financial implications should the water quality deteriorate to such a degree that it moves into an A2 or A3 classification. None of the settlements situated within the middle or lower Bride catchment abstract water from the Bride River and the provisions of the Surface Water Directive are therefore not directly relevant.

12. BATHING WATER DIRECTIVE

Council Directive 76/160/EEC of 8 December 1975, concerning the quality of bathing water and the follow-up National Quality of Bathing Waters Regulations (the most recent being S.I. No. 177 of 1998) lay down quality requirements for inland and coastal waters as designated bathing areas. The quality standards refer chiefly to microbiological parameters, with provision for monitoring of other parameters where it is suspected that conditions have deteriorated. Microbiological limit values specified in the Directive and in the Quality of Bathing Waters Regulations, 1992 (S.I. No. 155 of 1992) are listed in Table 8.1

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Table 12.1. Bathing Waters limits (per 100ml).

LEGISLATION	TOTAL COLIFORMS	FAECAL COLIFORMS	FAECAL STREPTOCOCCI
Directive 76/160/EEC	500[1] 10,000[2]	100[1] 2,000[2]	100[3]
S.I. No. 155 of 1992	5,000[1] 10,000[2]	1,000[1] 2,000[2]	300[2,4]

[1]Compliance by 80% of samples

[2]Compliance by 95% of samples

[3]To be measured where present or where deterioration suspected

[4]Compliance by 90% of samples

There are no designated bathing areas in the stretch of water under examination and hence Directive 76/160/EEC and its Regulations, do not directly apply. It is noted however that some localised recreational use of the river may occur upstream of the discharge from Kilumney WWTP within the village and in the Lee downstream of the confluence with the Bride.

13. FRESHWATER FISH DIRECTIVE/SALMONID REGULATIONS

Council Directive 78/659/EEC of 18 July 1978, on the quality of fresh waters needing protection, in order to support fish life, was given Irish effect by the European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293 of 1988). The Regulations specify a separate range of standards for salmonid and cyprinid fish in waters designated as needing protection or improvement for their support.

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The Bride River has not been designated as a salmonid river under the European Communities (Quality of Salmonid Waters) Regulations, 1988s. Under these regulations monthly monitoring for a range of specified parameters is required and limits are specified for a range of parameters. The Freshwater Fish Directive and Quality of Salmonid Waters Regulations carry some weight; due to their strict limits and the consequent suitability of a watercourse for other uses should it meet these limits. The most significant wastewater parameters are examined in Table 13.1 with respect to the Salmonid Regulations

The Lee River, into which the water from the Bride will ultimately discharge, is designated under this Directive. It is important therefore that the flow from the Bride River does not have a negative impact on water quality in the Lee River. Table 13.1. Freshwater Fish Directive limits.

PARAMETER	SALMONID WATERS
BOD	5 mg/l
Suspended solids	25mg/l
Non-ionised Ammonia – NH_3	0.02 mg/l
Total ammonium –NH_4	1 mg/l
Nitrite	0.05 mg/l
pH	6-9
Dissolved Oxygen	50% / >9 mg/l

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14. URBAN WASTE WATER TREATMENT DIRECTIVE

The Environmental Protection Agency Act, 1992 (Urban Wastewater Treatment) Regulations, 1994 (S.I. No. 419 of 1994) were issued to give effect to EU Council Directive 91/271/EEC concerning urban wastewater treatment. The Regulations specify that wastewater arising from populations of less than 2,000 shall, by the end of 2005, be subject to appropriate treatment prior to discharge. Appropriate treatment is defined as:

> *...any process and/or disposal system which after discharge allows the receiving waters to meet the relevant quality objectives and the relevant provisions of the Directive and of other Community Directives.*

This requirement applies to freshwater and estuarine discharges. It also applies to coastal discharges from agglomerations of less than 10,000.

Wastewater quality limits specified in the Second Schedule of the Regulations note that the final concentrations of BOD and suspended solids shall not exceed 25mg/l and 35mg/l respectively. These limits apply however, only to treated discharges from populations over 2,000 (10,000 where the discharge is coastal); the relevant discharge standards to be applied are to be determined from '...other relevant Community Directives'. Other directives of immediate relevance are Directives 75/440/EEC, 76/160/EEC, 78/659/EEC and 79/923/EEC, all of which have been discussed above.

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The Urban Wastewater Directive notes in Annex IIA that a water body (freshwater, estuarine or coastal) must be identified as a sensitive area if certain criteria are met and to where treated waste from agglomerations of greater than 10,000 p.e. will discharge. The Bride River has not been designated as a sensitive area. The designation process is directed at agglomerations significantly larger than that under consideration here.

The Directive specifies a number of obligations regarding the design of wastewater treatment plants as follows:

(a) Such plants shall be designed, constructed, operated and maintained to ensure sufficient performance under all normal local climatic conditions.

(b) When designing the plants, seasonal variations of the load shall be taken into account.

(c) Waste water treatment plants shall be designed or modified so that representative samples of the incoming wastewater and of treated effluent can be obtained before discharge to receiving waters.

(d) The points of discharge of urban wastewater shall be chosen, as far as possible, so as to minimize the effects on receiving waters.

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It is recommended that items (a), (b) and (c) are taken into account at the design and installation stage of the treatment plant. Item (d) is addressed in this report.

15. PHOSPHORUS REGULATIONS

The Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations, 1998 (S.I. No. 258 of 1998) were introduced to counter eutrophication observed throughout Irish watercourses and also to comply with Council Directive 76/464/EEC, on pollution caused by certain dangerous substances, discharged into the aquatic environment.

The Regulations oblige local authorities to maintain or improve the water quality at any part of a river, by 2007, by reference to the biotic index (Q-value) or to the concentration of molybdate-reactive phosphate (largely orthophosphate). The target values specified are set out in the third schedule of the Regulations and are reproduced in Table 10.1.

Table 15.1 Phosphorus Regulations target values

	EITHER TO BE APPLIED	
EXISTING Q-VALUE	TARGET Q-VALUE	TARGET MRP (ug/l)
5	5	15
4-5	4-5	20
4	**4**	**30**
3-4	4	30
3	3-4	50
2-3	3-4	50
≤2	3	70

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The target values specified in the Regulations were adopted on the basis of the empirical relationship between the biotic indices and orthophosphate concentrations in Irish waters as monitored extensively by the EPA. Some concern has been expressed that this simplistic approach does not apply equally throughout Irish watercourses, with consequent complications in the assessment of existing and proposed discharges. These and other difficulties may be addressed in the incorporation of the EU Water Framework Directive into Irish law.

In practical terms Q values of 4 or more are taken to represent satisfactory water quality, where eutrophication is unlikely to be a problem. Because annual median phosphate (P) values in such waters rarely exceed 30µg P/l, this concentration has been adopted as the target value to be achieved by 2007. The empirical relationship between phosphate and eutrophication suggests that once annual Median Reactive Phosphate (MRP) values exceed 30µg

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P/l, there is a strong statistical likelihood that the stretch of river in question will have a significant eutrophication problem.

It is also noted that although on average a Q value of 4 correlates with an orthophosphate level of 0.03mg/l this does not hold true for all situations. In addition elevated orthophosphate levels affect watercourses by causing eutrophication, which in turn causes depletion of oxygen levels. However all rivers are dynamic and variable systems and high phosphate levels are not always correlated with low oxygen levels. For example the presence of turbulent water, waterfalls or weirs may prevent significant deoxygenation of water. In addition shade levels will also affect plant and algal growth. Orthophosphate values may show considerable fluctuation over time and the use of a limited number of samples can therefore provide a misleading picture of water quality at a given location.

Because of the points noted above Q values are often better indicators of long-term water quality in a watercourse. Q values also provide a better indication of the real impact of water quality on the ecology of the watercourse. Invertebrates are valuable as indicator species and information on the diversity and density of invertebrates can provide an accurate of the suitability of the monitoring location for species such as fish.

The Phosphorus Regulations are directly applicable to the proposed discharge; however information on orthophosphate levels in the watercourse is limited and may not provide accurate information on long-term trends within the watercourse. Given the consistency of the Q values over a longer time period, these values are considered more relevant as a basis for determining background orthophosphate levels.

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16. NITRATES DIRECTIVE

Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources obliges member states to identify Nitrate Vulnerable Zones within which restricted agricultural practices will apply. Zone designation is undertaken by reference to a number of criteria listed in Annex I of the Directive including excessive nitrate concentrations in surface or ground waters and high trophic status. With respect to surface waters, the Directive notes that sensitive waters shall be identified where nitrate levels exceed the maximum concentration specified in the Surface Water Directive i.e. 11.3mg/l N. It is noted that a figure of 11.3mg/l (as N) is very high and allowing levels of nitrate to rise to this level is not recommended. In this context a guideline value equal to 50% of the mandatory value of ll.3mg/l N is considered an appropriate target value. This equates to 5.65mg/l N or 25mg/l NO3.

Under Ireland's implementation of the Nitrates Directive the whole country has been designated as a Nitrate Vulnerable Zone and limited to 170kg/hectare/annum application limit of animal manure or fertiliser. However a derogation is being sought for a 250kg/ha/annum limit.

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17. ROYAL COMMISSION STANDARDS

The standards noted in the Eight Report of the Royal Commission on Sewage Disposal (1912) have played an important part in water quality management since their publication. The standards are summarised in Table 11.1.

Table 17.1. Royal Commission standards, 1912.

DILUTION	STANDARD (mg/l)		TREATMENT REQUIRED
	BOD	SUSPENDED SOLIDS	
8-150	20	30	Primary & secondary
150-300	-	60	Chemical precipitation
300-500	-	150	Plain sedimentation
>500	-	-	No treatment

The normal standard fixed was 20mg/l BOD and 30mg/l suspended solids. The Commission did not include a quality standard for receiving waters in their recommendations, but noted that river waters with a BOD of 4mg/l will be ordinarily free from signs of pollution. In accordance with the Commission's report, most river authorities have traditionally sought a minimum dilution of 1:8 in the discharge of treated wastewater to a watercourse, regardless of treatment efficiency. It is noted however that the Royal Commission Report dates to 1912 when a treatment standard of less than 20/30 was difficult to obtain. In recent times however it has become feasible to reduce treatment standards below this level and therefore a 1:8 dilution is of limited value

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The Commission standards formed the basis for Memorandum No. 1 (1978) issued by the Irish Department of the Environment Technical Committee on Effluent and Water Quality Standards. The majority of quality standards specified in the memorandum have since been superseded by more recent legislation and standards such as those described above.

18. NOISE & ODOUR

There are no national noise limits in place in Ireland. Most developments are usually restricted by way of noise conditions in relevant planning permissions or Environmental Protection Agency licences. In the granting of permission to developments, the authorities will often refer to the EPA document *Integrated Pollution Control Licensing – Guidance note for noise in relation to scheduled activities* (1995) which notes that the noise level at a sensitive location should be kept below an L_{Ar} value of 55dB during the hours 0800-2200, and below 45dB outside of these hours, the L_{Ar} being equal to the L_{Aeq} (the average noise level) plus a penalty applied where the noise is

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tonal or impulsive. The guidance note states in particular that audible tones and impulsive noise at sensitive locations should be avoided at night, irrespective of the noise level.

The EPA guidance note defines a noise sensitive location as:

> *Any dwelling house, hotel or hostel, health building, educational establishment, places of worship or entertainment, or any other facility or area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.*

It follows that any local residence or establishment, internally and externally, in the vicinity of the WWTP site is a noise sensitive location within the terms of the guidance note.

While the EPA document was prepared as a guidance note for activities specified only in the First Schedule to the EPA Act (1992) and subsequently in follow-up Orders, the absence of other Irish guides or standards lends the document some significance and consequently the document now carries some weight outside of the industrial sectors regulated by the EPA.

There are no odour limits specified in Irish legislation, and only the Air Pollution Act, 1987 makes any reference to odour nuisance. In the absence of any limits, the EPA in their document *Wastewater Treatment Manuals: Treatment Systems for Small Communities, Business, Leisure Centres and Hotels* (1999) have recommended minimum buffer zones to be applied around WWTPs over certain threshold p.e. values. The zones have been selected to reduce both odour and noise impacts. The document notes that for systems designed to treat greater than 161 p.e. a buffer zone of 50m should allowed i.e. the WWTP should not be located nearer than 50m to existing development. It is further noted that at least 30m of this distance should be in the possession of the WWTP operator.

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19. INTERPRETATION – LEGISLATION & STANDARDS

This section provides a summary and analysis of information documented in Part 2 (Sections 12 to 18) regarding legislation and standards pertinent to the proposed developments and the aquatic environment.

It is not intended that water will be abstracted from the Bride in the future and accordingly, the Surface Water Directive is not directly relevant to the proposal. The whole country is designated as a Nitrate Vulnerable Zone; therefore the Nitrates Directive is applicable.

The 1912 Royal Commission report notes that a wastewater discharge to a watercourse should comply with a 20mg/l BOD and 30mg/l suspended solids standard, and a minimum dilution of 8. This standard is generally the minimum allowed in the disposal of treated wastewater, and has been endorsed by the Irish Department of the

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Environment Technical Committee on Effluent and Water Quality Standards. However due to advances in wastewater treatment efficiency its relevance is limited.

The Bride River has not been designated as sensitive areas in the context of the Urban Wastewater Treatment Directive. With reference to the proposal under consideration, the Directive notes that the proposed discharge shall be subject to appropriate treatment prior to discharge, where appropriate treatment is described as that which will allow compliance with other relevant Directives. The most pertinent of these is the Freshwater Fish Directive. The Urban Wastewater Directive specifies that the point of discharge of the treated wastewater shall be chosen so as to minimize the effects on receiving waters.

There are no designated bathing areas in the Bride River and while due regard should be given to the amenity value of the area; the provisions of the Bathing Water Directive do not directly apply.

The Phosphorus Regulations oblige local authorities to maintain or improve the water quality at any part of a river, by 2007, by reference to the biotic index (Q-value) at EPA monitoring sites. The proposed development will be assessed in respect of the limits specified under these regulations.

In summary, the articles of legislation of greatest significance with respect to the proposed discharge are the Freshwater Fish Directive, Nitrates Directive and Phosphorus Regulations. Compliance with limits specified in these articles will generally ensure compliance with provisions of other relevant legislation. The limits of relevance will be discussed in Part 4.

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20. PROPOSED DEVELOPMENT

Cork County Council proposes to install new wastewater treatment plants in Crookstown and Kilumney to effectively deal with the current waste loadings and to facilitate future development. It is proposed that all existing discharges at these locations will be assimilated into new treatment plants. New treatment plants or upgrades of existing systems may also be required for smaller settlements i.e. Kilmurry, Cloughduv, Farran, Farnanes and Aherla.

It is noted that the relationship between water quality and the ecological health of a watercourse is complex and that the impact of a specific discharge cannot be predicted with a high degree of certainty. It is also noted that the use of formulas does not provide conclusive answers and such calculations are often based on limited data. It is necessary therefore to continually review water quality data to ascertain what changes are occurring within the watercourse.

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The EPA document *Wastewater Treatment Manuals: Treatment Systems for Small Communities, Business, Leisure Centres and Hotels* (1999) notes that recent research suggests that *per capita* wastewater flow averages 180l/day, and the document recommends this figure be used. Accordingly this *per capita* wastewater flow is now accepted as the standard flow to be used in the design of wastewater treatment systems and is used as standard throughout this report.

As there is minimal industrial wastewater discharging to the Bride, wastewater is assumed to be domestic in nature. The characteristics of such wastewater streams have been documented by the EPA (1999) and are summarised in Table 20.1. No unusual variations in the wastewater discharge are expected.

Table 20.1 Domestic inflow wastewater characteristics from EPA study.

PARAMETER	MEAN
SS	163mg/l
BOD	168mg/l
COD	389mg/l
o-PO4-P	7.1mg/l
Total N	40.6mg/l
NH3-N	31.5mg/l
NO3-N	0.25mg/l
NO2-N	0.04mg/l

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pH	7.5
Total coliforms	$1x10^8$ CFU per 100ml
Faecal coliforms	$4x10^7$ CFU per 100ml

In addition to the new wastewater treatment system, new collection systems may be required so that all discharges are effectively managed. It is recommended that surface water be discharged directly to the nearest watercourse. It is advisable that an assessment be carried out of all dwellings and pubs/restaurants etc. to ensure that grey water entry to the surface water system is limited.

21. DISCHARGE OPTIONS

At Kilmurry the closest watercourse is a small tributary of the Bride. Approximately 2.5km downstream of Kilmurry this tributary joins the main channel of the Bride. At Crookstown the only practical option is a discharge to the Bride River. Although there are small streams close to Farran and Farnanes these streams have insufficient flow during dry periods to assimilate wastewater discharges. Wastewater from Cloughduv is currently treated by a WWTP, which discharges to the Brouen; however a discharge to the Bride River is an option for the future. Wastewater from a new development at Aherla is treated by a WWTP and discharged to a percolation area. The small stream which passes through Aherla has insufficient flow to assimilate wastewater and a discharge to the Bride may be required should the population of the village increase significantly in the future. As noted earlier in this report there are a number of discharges in or close to Kilumney and, following consolidation of these, a single discharge could be discharged either to the Bride or if necessary to the Lee.

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PART 4: IMPACTS & RECOMMENDATIONS

22. IMPACTS

The impacts of the proposed discharges to the Bride River are assessed under a number of headings: waste assimilative capacity and BOD, suspended solids, nitrogen, phosphorus, pathogens, and ecology and fisheries.

Mass balance equations may be used to determine the concentration of a parameter in a watercourse downstream of its discharge. A typical equation is as follows:

$$T = (FC + fc) / (F + f) \qquad \text{Formula 22.1}$$

where T = downstream pollutant concentration
F = upstream river flow
C = background pollutant concentration
f = effluent flow
c = effluent pollutant concentration

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23. DILUTION

The Royal Commission recommended a minimum dilution of 1:8 for a treatment standard of 20/30mg/l. Based on the 95th percentile flow rates at the proposed discharge points, Table 23.1 presents the maximum population equivalent which will meet the recommended 1:8 dilution. It is noted however that the Royal Commission Report dates to 1912 when a treatment standard of less than 20/30 was difficult to obtain. In recent times it has become feasible to reduce treatment standards below this level and therefore a 1:8 dilution is of limited value. Nonetheless, for comparison purposes the maximum population equivalents which will meet the 1:8 dilution are given in Table 23.1.

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Table 23.1. Dilutions.

LOCATION	RIVER FLOW m³/s	DILUTION REQUIRED	PER CAPITA FLOW l/day	P.E.
Kilmurray (tributary)	0.005	8	180	300
Kilmurray (Bride)	0.046	8	180	2760
Crookstown (Bride)	0.048	8	180	2880
Cloughduv (Brouen)	0.009	8	180	540
Cloughduv (Bride)	0.045	8	180	2700
Farnanes (Bride)	0.045	8	180	2700
Aherla (Bride Bridge)	0.053	8	180	3180
Farran (Bride)	0.055	8	180	3300
Kilumney (Bride)	0.069	8	180	4140

24. WASTE ASSIMILATIVE CAPACITY & BOD

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The waste assimilative capacity (WAC) of a watercourse is the mass of BOD, which the watercourse can healthily absorb in one day. The WAC is a function of the existing BOD in the watercourse, the maximum permissible BOD and the minimum flow rate. The WAC may be determined as follows:

$$WAC = (Cmax - Cback) \times F95 \times \text{Conversion factor} \qquad \textit{Formula 24.1}$$

where WAC = waste assimilative capacity
Cmax = maximum permissible BOD
Cback = background upstream BOD
F95 = 95th percentile flow

A number of different and sometimes contradictory limits have been applied to BOD and assimilative capacity. The Eight Report of the Royal Commission on Sewage Disposal (1912) did not include a quality standard for receiving waters in their recommendations, but noted that river waters with a BOD of 4mg/l will be ordinarily free from signs of pollution. Using the mass balance equation, and based on a BOD limit of 4mg/l the waste assimilative capacity of the Bride and Broeun Rivers at the relevant locations are detailed in Table 24.1.

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Table 24.1 Waste Assimilative Capacity 4mg/l maximum (river concentration).

LOCATION	BACKGROUND BOD mg/l	MAX BOD mg/l	WAC kg BOD/day
Kilmurray (Bride)	1.3	4.00	10.73
Crookstown (Bride)	1.3	4.00	11.20
Cloughduv (Brouen)	2	4.00	1.56
Famanes (Bride)	2	4.00	7.78
Aherla (Bride Bridge)	2	4.00	9.16
Farran (Bride)	1.3	4.00	12.83
Kilumney (Bride)	1.3	4.00	16.10

Memorandum No. 1 (1978) notes that a discharge to a watercourse should not increase the BOD within the watercourse by more than 1mg/l. However this does not take into account the background concentration of BOD within the river. Based on a maximum BOD rise of 1mg/l the waste assimilative capacity of the Bride and Broeun Rivers at the relevant locations are detailed in Table 24.2.

Table 24.2 Waste Assimilative Capacity - maximum 1mg/l increase (river concentration).

LOCATION	BACKGROUND BOD mg/l	MAX BOD mg/l	WAC kg BOD/day
Kilmurray (Bride)	1.3	2.3	3.97
Crookstown (Bride)	1.3	2.30	4.15
Cloughduv (Brouen)	2	3.00	0.78
Famanes (Bride)	2	3.00	3.89
Aherla (Bride Bridge)	2	3.00	4.58
Farran (Bride)	1.3	2.30	4.75
Kilumney (Bride)	1.3	2.30	5.96

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Under the European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293 of 1988) the maximum BOD concentration in salmonid freshwaters should not exceed 5mg/l. This standard should be conformed to by 95% of samples over a period of 12 months. Although the Bride is not designated as salmonid water under these regulations the limits specified provide a good measure of suitable water quality. Based on a BOD limit of 5mg/l the waste assimilative capacity of the Bride and Brouen Rivers at the relevant locations are detailed in Table 24.3.

It is noted that a BOD figure for a receiving river is only indicative of the maximum extent to which the oxygen level in that watercourse could be theoretically depleted by the organic matter present. In reality, factors such as low

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temperatures, aeration at turbulent riffles and other variables may prevent significant deoxygenating from occurring.

Table 24.3 Waste Assimilative Capacity - maximum 5mg/l i (river concentration).

LOCATION	BACKGROUND BOD mg/l	MAX BOD mg/l	WAC kg BOD/day
Kilmurray (Bride)	1.3	5.00	14.71
Crookstown (Bride)	1.3	5.00	15.34
Cloughduv (Brouen)	2	5.00	2.33
Farnanes (Bride)	2	5.00	11.66
Aherla (Bride Bridge)	2	5.00	13.74
Farran (Bride)	1.3	5.00	17.58
Kilumney (Bride)	1.3	5.00	22.06

25. SUSPENDED SOLIDS

Of the various standards and articles of legislation discussed in Part 2, the strictest suspended solids limits are specified in the Freshwater Fish Directive, which notes that a guide limit of 25mg/l of suspended solids is desirable in fresh waters. The same maximum concentration is specified by the Salmonid Waters Regulations. The application of this limit will ensure compliance with those specified in the Urban Waste Water Directive and in Memorandum No. 1. The value for suspended solids was determined from samples taken by Dixon.Brosnan.

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Table 25.1. Suspended solids concentration downstream of mixing zone.

LOCATION	p.e.	PER CAPITA FLOW l/day	EFFLUENT CONC mg/l	RIVER FLOW m^3/s	BACKGROUND CONC mg/l	DOWNSTREAM CONC mg/l
Kilmurray (tributary)	8000*	180	30.000	0.005	5	16.538
Kilmurray (Bride)	8000*	180	30.000	0.046	10	12.660
Crookstown (Bride)	8000*	180	30.000	0.027	10	15.155
Cloughduv (Brouen)	8000*	180	30.000	0.009	10	22.987
Cloughduv (Bride)	8000*	180	30.000	0.045	10	15.405
Farnanes (Bride)	8000*	180	30.000	0.045	10	15.405
Aherla (Bride Bridge)	8000*	180	30.000	0.053	10	14.785
Farran (Bride)	8000	180	30.000	0.055	10	14.651
Kilumney (Bride)	80000	180	30.000	0.069	10	13.891

- An 8,000 p.e is used for illustrative purposes. At 8,000 p.e. other parameters will be limiting.

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26. NITROGEN

NOTE: ALL CONCENTRATIONS BELOW IN MG/L AS N03 UNLESS OTHERWISE SPECIFIED.

Elemental nitrogen may be present in a number of forms in a wastewater discharge. Ammonia and nitrates are of most significance, with the relative proportions of their take-up by plants and algae varying with their ratio, the local conditions and the species involved. The nitrite form is an intermediate stage in the conversion of these two parameters.

Of greatest importance is that the proposed discharge does not elevate nitrate levels in the receiving watercourse significantly and does not affect the status of the aquatic environment with respect to the 11.3mg/l N (50mg/l NO3) limit specified in the Nitrates Directive and the Surface Water Directive. It is noted that a figure of 11.3mg/l (as N) is a maximum value and allowing levels of nitrate to rise close to this level is not recommended. In this context a guide value equal to 50% of the mandatory value of 11.3mg/l N is considered an appropriate target value. This equates to 5.65mg/l N or 25mg/l NO3.

Nitrogen present as nitrate will rarely impact directly on fish life and thus there are no limits specified in the Freshwater Fish Directive or Salmonid Regulations. Nitrite limits are specified under Quality of Salmonid Waters Regulations. Of more significance are levels of ammonia, particularly the un-ionised form. The European Inland Fisheries Advisory Commission (1970) have reported that an un-ionised concentration of 0.02mg/l NH_3 will present a long-term sub-lethal dose for salmonid and cyprinid fish. This level of 0.02mg/l is specified under the Salmonid Regulations and the same regulations have specified maximum 'total ammonium' concentrations of 1mg/l N.

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Most modern packaged treatment units produce a nitrified effluent, with the major portion of nitrogen converted from ammonia to nitrates as a result of nitrification processes incorporated in the design. Due to the conversion dynamics within secondary stage treatment units, it is difficult to specify separate concentrations of ammonia and nitrates to be met in the treated effluent. The application of a total nitrogen limit – consisting of ammonia, nitrates and intermediate stages – provides a more common sense approach, and limits below are specified accordingly.

Without the installation of a specific nitrogen-removal process, secondary stage treatment units will not significantly reduce nitrogen levels but merely convert the various forms present to oxidised nitrate, with consequent reductions in ammonia concentrations. The modular design of packaged systems allows further nitrification to be introduced following commissioning. It is not expected that the chosen method of treatment will result in problematic levels of ammonia. Nonetheless, it is recommended that the 1mg/l limit noted above be applied as a guide quality standard downstream of the mixing zone. Based on a nitrate target value of 5.65 mg/l N, a mandatory value of 11.3 mg/l and effluent concentration of 40.6 mg/l total N the waste assimilative capacity of the Bride and Brouen Rivers at the relevant locations are detailed in Table 26.1.

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Table 26.1. Nitrate concentrations downstream of mixing zones.

LOCATION	p.e.	PER CAPITA FLOW l/day	EFFLUENT CONC mg/l	RIVER FLOW m³/s	BACKGROUND CONC N mg/l	DOWNSTREAM CONC mg/l N
Kilmurry (tributary)	15	180	40.6	0.005	5.4	5.62
Kilmurry (tributary)	290	180	40.6	0.005	5.4	11.161
Kilmurry (bride)	2040	180	40.6	0.026	2.410	5.65
Kilmurry (bride)	6400	180	40.6	0.026	2.410	11.21
Crookstown (Bride)	6500	180	40.6	0.048	2.410	11.097
Crookstown (Bride)	1900	180	40.6	0.048	2.410	5.4366
Cloughduv (Brouen)	990	180	40.6	0.009	4.310	11.076
Cloughduv (Brouen)	165	180	40.6	0.009	4.310	5.645
Cloughduv (Bride)	6300	180	40.6	0.045	2.410	11.034
Cloughduv (Bride)	2000	180	40.6	0.045	2.410	5.646
Famanes (Bride)	6300	180	40.6	0.045	2.410	11.034
Famanes (Bride)	2000	180	40.6	0.045	2.410	5.646
Aherla (Bride Bridge)	7400	180	40.6	0.053	2.410	11.016
Aherla (Bride Bridge)	2350	180	40.6	0.053	2.410	5.639
Farran (Bride)	7700	180	40.6	0.055	2.410	11.034
Farran (Bride)	2440	180	40.6	0.055	2.410	5.641
Kilumney (Bride)	8900	180	40.6	0.069	3.170	11.098
Kilumney (Bride)	2350	180	40.6	0.069	3.170	5.65

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27. PHOSPHORUS

Within the aquatic environment phosphorus will be present in a number of forms, both organic and inorganic, and within solution or bound in solids. All forms present are referred to as total phosphorus. A significant fraction of total phosphorus is available for biological metabolism and is termed orthophosphate. The analytical procedure used in the determination of orthophosphate is the molybdate-reactive method, which is used to derive the concentration of molybdate-reactive phosphate (MRP) in a sample. Although the MRP may slightly overestimate the level of orthophosphate present, the two expressions have become synonymous.

The target values specified in the Phosphorus Regulations were adopted on the basis of the empirical relationship between the biotic indices and orthophosphate concentrations in Irish waters as monitored extensively by the EPA. In practical terms Q values of 4 or more are taken to represent satisfactory water quality, where eutrophication is unlikely to be a problem. Because annual median phosphate (P) values in such waters rarely exceed 30µg P/l, this concentration can be considered indicative of satisfactory water quality. It is noted however that a site with Q value of 4 and/or median orthophosphate value of 0.03mg/l may not be in compliance with the

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Phosphorus Regulations. This arises because the target value for a given site under the Phosphorus Regulations is based on the baseline data measured in 1997.

The downstream orthophosphate concentrations arising from various orthophosphate loadings in the proposed wastewater discharge have been calculated and are presented in Table 27.1

Table 27.1 Orthophosphate levels downstream of discharge.

LOCATION	p.e.	PER CAPITA FLOW l/day	EFFLUENT CONC mg/l P (orthophosphate)	RIVER FLOW m^3/s	BACKGROUND CONC O-P mg/l	DOWNSTREAM CONC mg/l
Kilmurry (tributary)	100	180	1.0*	0.005	0.02	0.06****
Kilmurry (tributary)	130	180	0.8**	0.005	0.02	0.06****
Kilmurry (tributary)	220	180	0.5***	0.005	0.02	0.06****
Kilmurry (bride)	950	180	1.0*	0.046	0.02	0.06****
Kilmurry (bride)	1200	180	0.8**	0.046	0.02	0.06****
Kilmurry (bride)	2000	180	0.5***	0.046	0.02	0.06****
Crookstown (Bride)	970	180	1.0*	0.048	0.02	0.06****
Crookstown (Bride)	1230	180	0.8**	0.048	0.02	0.06****
Crookstown (Bride)	2120	180	0.5***	0.048	0.02	0.06****
Cloughduv (Brouen)	90	180	1.0*	0.009	0.04	0.06****
Cloughduv (Brouen)	115	180	0.8**	0.009	0.04	0.06****
Cloughduv (Brouen)	200	180	0.5**	0.009	0.04	0.06****
Farnanes and/or Chloughduv (Bride)	920	180	1**	0.045	0.02	0.06****
Farnanes and/or Chloughduv(Bride)	1180	180	0.80**	0.045	0.02	0.06****
Farnanes and/or Chloughduv(Bride)	1950	180	0.5***	0.045	0.02	0.06****
Aherla (Bride Bridge)	550	180	1**	0.053	0.040	0.06****
Aherla (Bride Bridge)	680	180	0.80**	0.053	0.040	0.06****
Aherla (Bride Bridge)	1150	180	0.5***	0.053	0.040	0.06****
Farran (Bride)	700	180	1*	0.055	0.035	0.06****
Farran (Bride)	900	180	0.8**	0.055	0.035	0.06****
Farran (Bride)	1500	180	0.5***	0.053	0.035	0.06****
Kilumney (Bride)	1400	180	1*	0.069	0.020	0.06****
Kilumney (Bride)	1800	180	0.8**	0.069	0.02	0.06****
Kilumney (Bride)	3000	180	0.5***	0.053	0.02	0.06****

* 1mg/l is achievable with added chemical treatment

** 0.8 mg/l may be difficult to achieve consistently with added chemical treatment

*** 0.5 mg/l may be extremely difficult to achieve on a consistent basis

**** 0.03mg/l is considered indicative of satisfactory water quality. 0.06 mg/l is used for comparative purposes.

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28. PATHOGENS

Table 28.1 indicates that domestic wastewater will contain on average 100 million and 40 million colony-forming units of total and faecal coliforms respectively per 100ml. These organisms, while not overtly pathogenic in themselves, are used as indicators of pathogenic activity. Due to growth and decay dynamics within bacterial populations, normal mass balance calculations cannot be applied in the assessment of bacteriological impacts. Significant variations in local environmental conditions and wastewater microbiological characteristics do not facilitate the generation of discharge-specific models.

All treatment processes applied to wastewater will provide some degree of coliform reduction, usually via the filtration of suspended solids in the wastewater stream. Gray (1999) reports that conventional treatment will remove up to 90% of bacterial pathogens, with tertiary treatment increasing this to 98%. Further reduction to 99.99% may be achieved using disinfection. He also notes that dilution and the effects of natural biotic and abiotic factors in surface waters will reduce the density of pathogens further.

Given the difficulties associated with the modelling of microbiological impacts of a discharge, the varying treatment abilities of treatment plants, and the absence of coliform quality objectives applicable to treated discharges, no specific coliforms standards are recommended.

Although there are no designated bathing sites downstream within the Bride river there is some localised recreational use of the Bride (Kilumney) and Lee (downstream of the confluence of the two rivers). As a precaution therefore it is recommended that the design of the WWTP be such that the post-installation of disinfection equipment is facilitated.

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29. TREATMENT FACTORS

29.1 DISCHARGE LIMITS

Based on the background concentrations of various parameters, estimated flows and the relevant limits the maximum populations equivalents at different for different treatment standards are detailed below.

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29.1 Limits and population equivalents Kilmurray (discharging to the Bride)

Parameter	Background Concentration	Limit	Maximum P.E Meeting these limits: BOD 20 mg/l SS 30 mg/l Ortho. P 1 mg/l Total N 40.6mg/l	Maximum P.E meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 1 mg/l Total N 40.6 mg/l	Maximum P.E Meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 0.8 mg/l Total N 40.6mg/l	Maximum P.E Meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 0.5 mg/l Total N 40.6mg/l	Comments
BOD	1.3	5mg/l [1]	4086	8172	8172	8172	
BOD	1.3	4 mg/l [2]	2980	5961	5961	5961	
BOD	1.3	Increase by 1mg/l [2]	1102	2205	2205	2205	
Dilution	N/a	1: 8 at 20/30 [2]	2880	N/A	N/A	N/A	
Orthophosphate	0.02	0.03 mg/l [3]	230	230	300	490	
Orthophosphate	0.02	0.05 mg/l [3]	700	700	890	1450	0.05 mg/l exceeds target value
Suspended solids	10	25 mg/l [1]	>8000	>8000	>8000	>8000	
Nitrate as N	2.41	11.3 mg/l [4]	6650	6650	6650	6650	
Nitrate as N	2.41	5.65[5]	2040	2040	2040	2040	

[1]Salmonid Regulations [2]Royal Commission Standards [3] Phosphorous Regulations [4]Nitrate Directive [5] Guide value (50% mandatory value)

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Table 29.2 Limits and population equivalents Crookstown

Parameter	Background Concentration	Limit	Maximum P.E Meeting these limits: BOD 20 mg/l SS 30 mg/l Total P 1 mg/l Total N 40.6mg/l	Maximum P.E meeting these limits; BOD 10 mg/l SS 10 mg/l Total P 1 mg/l Total N 40.6 mg/l	Maximum P.E Meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 0.8 mg/l Total N 40.6mg/l	Maximum P.E Meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 0.5 mg/l Total N 40.6mg/l	Comments
BOD	1.3	5mg/l [1]	4261	8522	8522	8522	8522
BOD	1.3	4 mg/l [2]	3111	6222	6222	6222	6222
BOD	1.3	Increase by 1mg/l [2]	1152	2305	2305	2305	2305
Dilution	N/a	1: 8 at 20/30 [2]	2880	N/A	N/A	N/A	
Dilution	N/a	1: 8 at 20/30 [2]	1620	N/A	N/A	N/A	
Orthophosphate	0.02	0.03 mg/l [3]	245	245	300	500	
Orthophosphate	0.02	0.05 mg/l [3]	740	740	920	1550	0.05 mg/l exceeds target value
Suspended solids	10	25 mg/l [1]	>8000	>8000	>8000	>8000	
Nitrate as N	2.41	11.3 mg/l [4]	6700	6700	6700	6700	
Nitrate as N	2.41	5.65[5]	1900	1900	1900	1900	

[1]Salmonid Regulations [2]Royal Commission Standards [3] Phosphorous Regulations [4] Nitrate Directive [5] Guide value (50% mandatory value)

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29.3 Limits and population equivalents (Cloughduv Discharging to the Brouen)

Parameter	Background Concentration mg/l	Limit	Maximum P.E meeting these limits: BOD 20 mg/l SS 30 mg/l Ortho P 1 mg/l P Total N 40.6mg/l	Maximum P.E meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 1 mg/l P Total N 40.6 mg/l	Maximum P.E meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 0.8 mg/l P Total N 40.6mg/l	Maximum P.E meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 0.5 mg/l P Total N 40.6mg/l
BOD	2	5mg/l [1]	647	1294	1294	1294
BOD	2	4 mg/l [2]	433	866	866	866
BOD	2	Increase by 1mg/l [2]	217	433	433	433
Dilution	N/a	1: 8 at 20/30 [2]	540	N/A	N/A	N/a
Orthophosphate	0.04	0.03 mg/l [3]	Background exceeds limit	Background exceeds limit	Background exceeds limit	Background exceeds limit
Orthophosphate	0.04	0.05 mg/l	45	45	55	95
Suspended solids	10	25 mg/l [1]	>8000	>8000	>8000	>8000
Nitrate as N	4.31	11.3 mg/l [4]	990	990	990	990
Nitrate as N	4.31	5.65[5]	165	165	165	165

[1]Salmonid Regulations [2]Royal Commission Standards [3] Phosphorous Regulations [4] Nitrate Directive [5] Guide value (50% mandatory value)

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Table 29.4 Limits and population equivalents (Cloughduv and/ Famanes Discharging to the Bride)

Parameter	Background Concentration Mg/l	Limit	Maximum P.E meeting these limits: BOD 20 mg/l SS 30 mg/l Ortho P 1 mg/l Total N 40.6mg/l	Maximum P.E meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 1 mg/l Total N 40.6 mg/l	Maximum P.E meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 0.8 mg/l Total N 40.6mg/l	Maximum P.E meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 0.5 mg/l Total N 40.6mg/l
BOD	2	5mg/l [1]	3238	6477	6477	6477
BOD	2	4 mg/l [2]	2161	4322	4322	4322
BOD	2	Increase by 1mg/l [2]	1080	2161	2161	2161
Dilution	N/a	1: 8 at 20/30 [2]	540	N/A	N/A	N/A
Orthophosphate	0.02	0.03 mg/l [3]	230	230	290	480
Orthophosphate	0.02	0.05 mg/l	690	690	870	1420
Suspended solids	10	25 mg/l [1]	>8000	>8000	>8000	>8000
Nitrate as N	2.41	11.3 mg/l [4]	6300	6300	6300	6300
Nitrate as N	2.41	5.65[5]	2000	2000	2000	2000

[1]Salmonid Regulations [2]Royal Commission Standards [3] Phosphorous Regulations [4] Nitrate Directive [5] Guide value (50% mandatory value)

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Table 29.5 Limits and population equivalents (Aherla)

Parameter	Background Concentration Mg/l	Limit	Maximum P.E meeting these limits: BOD 20 mg/l SS 30 mg/l Ortho P 1 mg/l Total N 40.6mg/l	Maximum P.E meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 1 mg/l Total N 40.6 mg/l	Maximum P.E meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 0.8 mg/l Total N 40.6 mg/l	Maximum P.E meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 0.5 mg/l Total N 40.6 mg/l
BOD	2	5mg/l [1]	3816	7633	7633	7633
BOD	2	4 mg/l [2]	2544	5088	5088	5088
BOD	2	Increase by 1mg/l [2]	1271	2544	2544	2544
Dilution	N/a	1: 8 at 20/30 [2]	3180	N/a	N/a	N/a
Orthophosphate	0.04	0.03 mg/l [3]	Background exceeds limit	Background exceeds limit	Background exceeds limit	Background exceeds limit
Orthophosphate	0.04	0.05 mg/l	280	280	350	580
Suspended solids	10	25 mg/l [1]	>8000	>8000	>8000	>8000
Nitrate as N	2.41	11.3 mg/l [4]	7400	7400	7400	7400
Nitrate as N	2.41	5.65[5]	2350	2350	2350	2350

[1]Salmonid Regulations [2]Royal Commission Standards [3] Phosphorous Regulations [4] Nitrate Directive [5] Guide value (50% mandatory value)

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Table 29.5 Limits and population equivalents (Farran)

Location	Background Concentration	Limit	Maximum P.E meeting these limits: BOD 20 mg/l SS 30 mg/l Ortho P 1 mg/l Total N 40.6mg/l	Maximum P.E Meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 1 mg/l Total N 40.6 mg/l	Maximum P.E meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 0.8 mg/l Total N 40.6mg/l	Maximum P.E meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 0.5 mg/l Total N 40.6mg/l	
BOD	1.3	5mg/l [1]	4883	9766	9766		
BOD	1.3	4 mg/l [2]	3563	7127	7127		
BOD	1.3	Increase by 1mg/l [2]	1319	2638	2638		
Dilution	N/a	1: 8 at 20/30 [2]	3330	N/a	N/a		
Orthophosphate	0.035	0.03 mg/l [3]	Background exceeds limit	Background exceeds limit	Background exceeds limit	Background exceeds limit	
Orthophosphate	0.035	0.05	430	430	540	860	0.05 mg/l exceeds target value
Suspended solids	10	25 mg/l [1]	>8000	>8000	>8000	>8000	
Nitrate as N	2.41	11.3 mg/l [4]	7700	7700	7700	7700	
Nitrate as N	2.41	5.65[5]	2440	2440	2440	2440	

[1]Salmonid Regulations [2]Royal Commission Standards [3] Phosphorous Regulations [4] Nitrate Directive [5] Guide value (50% mandatory value)

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Table 29.6 Limits and population equivalents (Kilumney)

Parameter	Background Concentration	Limit	Maximum P.E meeting these limits: BOD 20 mg/l SS 30 mg/l Ortho P 1 mg/l Total N 40.6mg/l	Maximum P.E meeting these limits: BOD 10 mg/l SS 30 mg/l Ortho P 1 mg/l Total N 40.6 mg/l	Maximum P.E meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 0.8 mg/l Total N 40.6mg/l	Maximum P.E meeting these limits: BOD 10 mg/l SS 10 mg/l Ortho P 0.5 mg/l Total N 40.6mg/l	
BOD	1.3	5mg/l [1]	6127	12255	12255	12255	
BOD	1.3	4 mg/l [2]	4472	8944	8944	8944	
BOD	1.3	Increase by 1mg/l [2]	1655	3311	3311	3311	
Dilution	N/a	1: 8 at 20/30 [2]	4140	N/a	N/a	N/a	
Orthophosphate	0.02	0.03 mg/l [3]	350	350	450	690	
Orthophosphate	0.02	0.05 mg/l	1060	1060	1340	2240	0.05 mg/l exceeds target value
Suspended solids	10	25 mg/l [1]	>10000	>10000	>10000	>10000	
Nitrate as N	3.17	11.1 mg/l [4]	8900	8900	8900	8900	
Nitrate as N	3.17	5.65[5]	2350	2350	2350	2350	

[1]Salmonid Regulations [2]Royal Commission Standards [3] Phosphorous Regulations [4] Nitrate Directive [5] Guide value (50% mandatory value)

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Kilmurry

The high nitrate value measured on the tributary of the Bride close to Kilmurry combined with the flow rates makes any discharge problematical. As the high nitrate value was derived from one sample taken by Dixon.Brosnan further monitoring on this watercourse is recommended. In addition given the large distance between this tributary and the flow monitoring station at Ovens bridge the flow value provides an estimate only. It is recommended that flows be recalculated based on new longer-term flow data from Crookstown.

The second option is to discharge to the main channel of the Bride downstream of its confluence with this tributary where additional flow is provided. Based on the background water chemistry downstream of this location at Crookstown orthophosphate would be the limiting factor. The most conservative option (1mg/l P in the discharge, a limit of 0.03 mg/l in the watercourse) would allow for a discharge from 230 people. If a less conservative approach is taken (0.5mg/l P (orthophosphate) in the final discharge, a limit of 0.05mg/l downstream) approximately 1450 people could discharge to river. It is also noted that (a) this discharge would be very close to the discharge at Crookstown (b) the calculations are based on the 95% flow, which represents low flow conditions.

Kilmurry is a small settlement and a discharge from 400 p.e may represent a reasonable approach. It is noted however that it cannot be stated with any degree of certainty that this discharge will not have a negative impact on the watercourse. At 400 p.e nitrogen removal would not be required and a BOD concentration of 20mg/l is unlikely to have a significant impact. However given the importance of this watercourse for salmonid species a target value (not an absolute limit) of 10mg/l BOD is recommended.

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Crookstown

Based on Q values and water chemistry data, an orthophosphate value of 0.02mg/l was estimated as the background value upstream of Crookstown. Results also suggest that despite a current discharge from the existing WWTP and an ongoing discharge from a fish-processing unit, the Q values recover quickly. In these circumstances it is not considered likely that an increase of orthophosphate levels to 0.03mg/l will have a significant impact on water quality and downstream Q values. Based on a 1 mg/l orthophosphate concentration in the effluent discharge a maximum population of 245 p.e. could discharge into the river without raising orthophosphate levels above 0.3mg/l. It treatment standard is raised to 0.8mg/l a population equivalent of 300 p.e could discharge and this figures increases to 500 p.e. if the treatment standard is raised to 0.5mg/l. It is noted that a treatment standard of 1mg/l can be achieved using phosphate dosing however concentrations of 0.8mg/l and in particular 0.5mg/l orthophosphate in the final effluent may be technically difficult to achieve on a consistent basis.

Notwithstanding the discharges affecting the Bride at present (Crookstown WWTP and fish processing plant) water quality improves relatively quickly. This is probably due to the strong reoxygenation potential of this section of the river. Elevated orthophosphate levels do not always directly correlate with the ecological health of a watercourse, which is best indicated by Q values. For example despite elevated orthophosphate values at both Kilcrea Bridge and Kilumney (values range from 0.04mg/l to 0.05mg/l) in the period from 1995 to 2000, Q values over that period indicated that water quality was satisfactory (values range from Q4 to Q4-5). It is possible

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therefore that an increase in background orthophosphate levels to a level of 0.05mg/l may not impact significantly on the ecological health of the river as indicated by Q values.

As noted in the calculations detailed above orthophosphate is considered the limiting factor. The most conservative option (1mg/l P in the discharge, a limit of 0.03 mg/l downstream) would allow for a discharge from 230 people. This obviously creates severe difficulties as the population of the village already exceeds this amount. If a less conservative approach is taken (0.5mg/l P (orthophosphate) in the final discharge, a limit of 0.05mg/l downstream) approximately 1550 people could discharge to river. It is also noted that (a) the existing discharge is having a extremely negative impact on the river and that (b) the calculations are based on the 95% flow which represents low flow conditions. In these circumstances a discharge from 1100 p.e with a target value of 0.5mg/l P in the discharge may represent a reasonable approach. It is noted however that it cannot be stated with any degree of certainty that this discharge will not have a negative impact on the watercourse.

A number of different limits can be applied in respect of BOD and dilution. Of the limits specified, the 1:8 dilution is based on a 20/30 mg/l limit in the discharge and this limit has to some degree been made redundant by better treatment efficiencies. Similarly a maximum rise of 1mg/l in BOD does not take into account the background BOD concentration in the river. Of more relevance is the 4mg/l derived from the Royal Commission and the 5mg/l specified by the Salmonid Regulations. A waste assimilative capacity based on the 5mg/l specified by the salmonid regulations would probably not significantly impact on water quality, however it leaves little additional capacity to assimilate waste which might arise from other sources. An overall limit of 4mg/l is therefore considered more appropriate.

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Based on a maximum p.e. of 1100 a BOD concentration of 20mg/l in the final discharge would not increases BOD levels in the river above 4mg/l and would not increase background levels by more than 1 mg/l. However given the importance of this watercourse for salmonid species a target value of 10mg/l BOD is recommended. A suspended solids concentration of 30mg/l is unlikely to have a significant impact on water quality./l. No impact on water quality is likely to occur from a nitrogen concentration of 40.6mg/l as the guide value of 5.65 mg/l Nitrate as N would allow a discharge from a population equivalent of 1900 and at this p.e. orthophosphate is limiting.

It is recommended that a flow monitoring station be put in place at Crookstown to obtain a more accurate measure of flow at this location.

Cloughduv (Discharging to the Brouen)

The discharge from Cloughduv currently discharges into the Brouen, which is a tributary of the Bride River. The Q values obtained on the river both upstream and downstream of the discharge point were indicative of unsatisfactory water quality although it is noted that obtaining suitable monitoring points on the river is problematic. There is no water chemistry data available from Cork County Council and for the samples taken by Dixon.Brosnan the levels of orthophosphate in the Brouen were satisfactory. A comparison between the Q values and orthophosphate values indicates that the Q values were lower than expected. Although Q values are generally better long-term indicators of orthophosphate levels in this instance obtaining accurate Q values is problematical

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due to the nature of the stream. It is recommended therefore that additional water chemistry monitoring be carried out at this location. As a large volume of water is currently being discharged from a quarry to the Brouen River further monitoring of flows would also be of value. In the mean time, an increase in population equivalent discharging through the current system is not recommended.

Farnanes/Cloughduv (Discharging to the Bride)

As an alternative to the current discharge the wastewater from the Cloughduv WWTP could be piped to the Bride. Water chemistry data and Q values at the nearest upstream site indicate that water quality is satisfactory. The settlement of Farnanes is close to this section of the Bride and could conceivably discharge to the Bride at the same location. The calculations below are therefore relevant for a discharge from Cloughduv and/or Farnanes.

Based on Q values and water chemistry data an orthophosphate value of 0.02mg/l was estimated as the background value at the section of the Bride into which Cloughduv/Farnanes could discharge. Flows were extrapolated from the 95% flow at Ovens Bridge. Based on this data and an orthophosphate concentration in the final discharge of 0.8 mg/l a maximum of 290 p.e. could discharge to the Bride without increasing the orthophosphate value above 0.03mg/l. Based on the same flow data and an orthophosphate concentration in the final discharge of 0.5mg/l, a maximum p.e. of 480 could discharge to the Bride without increasing the orthophosphate value above 0.03 mg/l.

The most conservative option (1mg/l P in the discharge, a limit of 0.03 mg/l downstream) would allow for a discharge from 230 p.e. If a less conservative approach is taken (0.5 mg/l P (orthophosphate) in the final discharge, a limit of 0.05mg/l downstream) approximately 1420 p.e. could discharge to river. In these circumstances a discharge from 700 p.e with a target value of 0.5 mg/l P in the discharge may represent a reasonable approach. It is noted however that it cannot be stated with any degree of certainty that this discharge will not have a negative impact on the watercourse.

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Based on a maximum p.e. of 700 a BOD concentration of 20mg/l in the final discharge would not increases BOD levels in the river above 4mg/l. Given the importance of this watercourse for salmonid species a target value of 10mg/l BOD is recommended. A suspended solids concentration of 30mg/l is unlikely to have a significant impact on water quality./l. No impact on water quality is likely to occur from a nitrogen concentration of 40.6mg/l as the guide value of 5.65 mg/l Nitrate as N would allow a discharge from a population equivalent of 2000 and at this p.e. orthophosphate is limiting.

Aherla

Based on Q values it would appear that water quality at Bride Bridge is unsatisfactory. However measured orthophosphate levels were satisfactory. It is also noted that, although there are turbulent shallow areas beneath the bridge, the gradient is low and the potential for re-oxygenation is low in the stretch of river downstream of Bride Bridge. Further work would be required to determine the cause of this deterioration in water quality at this location.

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Based on a background orthophosphate level of 0.04 mg/l this parameter is the limiting factor at this location. It is not recommended that the discharge from Aherla be directed to the Bride River at present. It could not be ascertained within the confines of this study whether the significant drop in the Q value at Bride Bridge is due to a one-off incident or due to long-term chronic problems. The cause of this drop in water quality would need to be determined prior to any discharge to the Bride from Aherla.

Farran

Results indicate water quality is generally satisfactory and, although a chemical sample was not taken at Kilcrea Bridge, the EPA assigned a Q value of 4 in 2003. Chemical data from Cork County Council for the period 1998-2000 found that levels of most parameters were satisfactory with the exception of orthophosphate, which was detected at 0.04mg/l. The Q value at this location (Q4 from 1990 to 2003) does not correspond in this instance with the recorded orthophosphate levels (1998-2000 0.04mg/l, 1995-1997 0.05mg/l). It is also noted that the re-oxygenation potential in this section of the river is moderate with relatively deep water and slow flows in certain sections. It is recommended therefore that a conservative view be taken and an orthophosphate level of 0.035 be applied for the purposes of calculations. Orthophosphate is the limiting factor at this location.

Based on an orthophosphate concentration in the final discharge of 0.8mg/l a population equivalent of 540 would increase the orthophosphate level from 0.035 to 0.05mg/l. Based on the same flow data and an orthophosphate concentration in the final discharge of 0.5mg/l, a maximum p.e. of 860 could discharge to the Bride without increasing the orthophosphate value above 0.05 mg/l. Due to elevated orthophosphate levels in the past a conservative approach is considered preferable namely 450 p.e. with a target value of 0.8mg/l orthophosphate in the final discharge. However it cannot be stated with any degree of certainty that this discharge will not have a negative impact on the watercourse.

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At 450 p.e a BOD concentration of 20mg/l is unlikely to have a significant impact however given the importance of this watercourse for salmonid species a target value of 10mg/l BOD is recommended. A suspended solids concentration of 30mg/l is unlikely to have a significant impact on water quality. No impact on water quality is likely to occur from a nitrogen concentration of 40.6mg/l as the guide value of 5.65 mg/l Nitrate as N would allow a discharge from a population equivalent of 2440 and at this p.e. orthophosphate is limiting. If the current system of waste treatment is satisfactory it may be preferable not to discharge from Farran to the Bride.

Kilumney

An EPA Q value of 4 was detected at Kilumney in 2003. However the monitoring location is in the middle of the village and as such may be affected by existing discharges from houses backing onto the river. Cork County Council sample the same location and found elevated orthophosphate concentrations of 0.04mg/l in 1998-2000 and 0.05mg/l in 1995-2000. Despite this elevated orthophosphate level, Q values of 4-5 were assigned by the EPA to the site at Kilumney in 1997 and 1999. It would appear therefore that the increased phosphorous levels at this location are not having as severe an impact on the ecology of the river as might be expected perhaps due to the high re-oxygenation potential within this section of the river.

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Dixon.Brosnan carried out biological and chemical monitoring at a site upstream of Kilumney to determine water quality in the absence of any discharge from Kilumney. Results indicate that water quality is satisfactory at this location with an orthophosphate level of 0.02mg/l and a Q value of 4-5. As orthophosphate is the limiting factor and, based on orthophosphate concentrations in the final discharge of 0.8mg/l and an orthophosphate limit in the river of 0.03mg/l, the maximum population equivalent is calculated at 450 p.e. Based on a discharge concentration of 0.5 mg/l orthophosphate a discharge from 690 p.e would increase the background levels to 0.03mg/l.

As noted in the calculations detailed above orthophosphate is considered the limiting factor. The most conservative option (1mg/l P in the discharge, a limit of 0.03 mg/l downstream) would allow for a discharge from a p.e of 350. However the river already receives a discharge from a population figure in excess of this amount. If a less conservative approach is taken (0.5mg/l P (orthophosphate) in the final discharge, a limit of 0.05mg/l downstream) approximately 2240 people could discharge to river. This is obviously higher than the target value of 0.03mg/l however it is noted that Q values of satisfactory water quality have been obtained at this site despite elevated orthophosphate levels. In these circumstances a discharge from 1800 p.e with a target value of 0.5mg/l P in the discharge may represent a reasonable approach. It is noted however that it cannot be stated with a high degree of certainty that this discharge will not have a negative impact on the watercourse. At 1800 p.e a BOD concentration of 20mg/l is unlikely to have a significant impact however given the importance of this watercourse for salmonid species a target value of 10mg/l BOD is recommended. A suspended solids concentration of 30mg/l is unlikely to have a significant impact on water quality. No impact on water quality is likely to occur from a nitrogen concentration of 40.6mg/l as the guide value of 5.65 mg/l Nitrate as N would allow a discharge from a population equivalent of 2350 and at this p.e. orthophosphate is limiting.

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It is noted that a number of treatment systems discharge to the Bride at or close to Kilumney. Although good quality data on flow rates and chemical values in the relevant discharges is not available estimates are detailed below:

EMC/Guy: A conservative estimate of the discharge figure for 2004 is 4m3/hr which equates to a p.e of 533 p.e. Based on a discharge concentration of 20/30mgl (BOD/suspended solids) it is expected that the orthophosphate concentration will be approximately 2mg/l. It is estimated therefore that 191.88g/day orthophosphate reaches the river from this source.

County council treatment plant: although the plant was designed for a population equivalent of 700 p.e it is estimated that it receives a discharge from 500p.e. at present. The expected treatment standard is 2mg/l. It is estimated therefore that 180 g/day orthophosphate reaches the river from this source.

Grange manor: The discharge from Grange Manor is approximately 1,200 p.e. with a treatment standard of 0.5 mg/l orthophosphate. Therefore it is expected that approximately 108 g/day orthophosphate reaches the river from this source.

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Septic Tank: The septic tank at the Beverly estate is emptied on an ongoing basis by Cork County Council however there are number of septic tanks within a relatively short distance of the river. Although it cannot be quantified at present it is expected that some nutrients reach the river from these sources.

Based on the above a conservative estimate of the amount of orthophosphate reaching the Bride at present is 479.88 g/day, which equates to a discharge from 5332 p.e. at a discharge concentration of 0.5mg/l orthophosphate.

A more reasonable approach in these circumstances may be a discharge from a population equivalent of 3,500 with a discharge concentration of 0.5mg/l orthophosphate. At 3,780 p.e a BOD concentration of 10mg/l BOD is recommended. In addition nitrogen removal will be required.

29.2 TREATMENT STANDARDS CUMULATIVE EFFECTS

Although at present the main concerns are the discharges from Crookstown and Kilumney this report also considers possible discharges from smaller settlements. It is noted that there may be a cumulative effect if a number of new treatment systems discharge to the Bride. Although there would appear to be sufficient distance between the discharges from Crookstown, Cloughduv/Farnanes and Kilumney, discharges from Aherla and Farran could have a slight impact on water quality at Kilumney given the deterioration in water quality noted at Bride Bridge.

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The consolidation of a number of small discharges into one larger discharge may initially cause a localised increase in orthophosphate values. However this should be balanced against some of the advantages provided by consolidating wastewater discharges. For example a large modern treatment plant with suitable backup systems is less likely to suffer a serious failure, which would cause high levels of damage to the watercourse. In addition concentrating resources on one large WWTP management may be more efficient at maintaining a high quality discharge and managing problems more effectively.

30. RECOMMENDED TREATMENT STANDARDS

30.1 The following recommendations are based on the available data and it could not be ascertained with a high degree of certainty that these discharges will not impact on water quality. Conversely it is possible that discharges from significantly higher population equivalents than those detailed below will not have significant impacts on water quality. Thus the recommendations detailed below should be considered as estimates only.

It was noted in section 4.9 that orthophosphate levels are often the limiting factor and that the Phosphorus Regulations are based on the *median* levels of orthophosphate. However when calculating the downstream concentration the 95% flow rate is used.. The 95% flow rate is generally considered indicative of low flows and

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therefore to a degree represents extreme conditions. In contrast the median orthophosphate value is indicative of average values i.e. over the complete range of flows. Thus there is a large safety margin when using the 95% flow rate, which occurs for only short periods of the year. A Technical Working Party Group is currently addressing this issue in respect of the Water Framework Directive. Recommended treatment standards are detailed overleaf in Table 30.1.

Table 30.1 Recommended treatment standards

Discharge	Limited Factor	Recommended Treatment	Other comments
Kilmurry discharging to a tributary	Nitrate	Further tests for nitrate and flow readings (extrapolated from Crookstown) are required.	
Kilmurry discharging to the Bride	Orthophosphate	Most conservative estimate 135 p.e Least conservative estimate 1050 p.e Moderate risk approach 400 p.e	
Crookstown	Orthophosphate	Most conservative estimate 140 p.e Least conservative estimate 1100 p.e Moderate risk approach 950 p.	Further flow monitoring required. On going assessment of the impacts of increased discharges is recommended
Cloughduv discharging to the Brouen	Orthophosphate	Further chemical monitoring required Additional assessment of flows required	
Cloughduv/Famanes discharging to the Bride	Orthophosphate	Most conservative estimate 230 p.e Least conservative estimate 1420 p.e Moderate risk approach 700 p.	
Aherla	Orthophosphate	Further biological and/or chemical monitoring required	
Farran	Orthophosphate	Due to elevated orthophosphate levels in the Bride in this area in the past a conservative approach of 450p.e is recommended	
Kilumney	Orthophosphate	**(1) From Calculations** Most conservative estimate 350 p.e Least conservative estimate 2240 p.e **(2)Existing discharges** Conservative estimate of existing discharge 5,332 p.e. **(3)Moderate risk approach 3,780 p.e**	Nitrogen removal required at 3,780 p.e. A discharge from 3,780 p.e. will increase background BOD by more than 1mg/l

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31. OTHER CONDSIDERATIONS

Although at present the main concerns are the discharges from Crookstown and Kilumney this report also considers possible discharges from smaller settlements. It is noted that there may be a cumulative effect if a number of new treatment systems discharge to the Bride. Although there would appear to be sufficient distance between the discharges from Crookstown, Cloughduv/Farnanes and Kilumney, discharges from Aherla and Farran could have a slight impact on water quality at Kilumney given the deterioration in water quality noted at Bride Bridge.

The consolidation of a number of small discharges into one larger discharge may initially cause a localised increase in orthophosphate values. However this should be balanced against some of the advantages provided by consolidating wastewater discharges. For example a large modern treatment plant with suitable backup systems is less likely to suffer a serious failure, which would cause high levels of damage to the watercourse. In addition concentrating resources on one large WWTP management may be more efficient at maintaining a high quality discharge and managing problems more effectively..

It is noted that given the pattern of settlement along the Bride, discharges to this river may be the only practical option for some of the villages along its route. It may be of value therefore to focus on other inputs of nutrients such as orthophosphate which can be avoided. Measure could include buffer zones for agricultural land, dual flush toilets and the use of non-phosphate detergents.

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As nitrification processes may interfere with the wastewater pH, it is recommended that the effluent discharge be monitored to ensure the pH does not fall outside the range 6-9 where such processes are employed.

It is recommended that any existing discharges be removed following commissioning of upgraded plants. It is advisable that an assessment be carried out of all premises to ensure that grey water entry to the surface water system is limited.

It is recommended that a suitable grease trap/interceptor be stipulated in planning permissions granted to any commercial developments intending to discharge to the Bride which will include cooking facilities.

In the final selection of a treatment unit, it is recommended that the following criteria be applied by the supplier at the design stage:

(a) WWTPs should be designed, constructed, operated and maintained to ensure sufficient performance under all normal local climatic conditions.

(b) Seasonal variations of the load should be taken into account.

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(c) Provision should be made for possible future retrofitting of additional nitrogen removal and disinfection processes in the WWTP selected.

(d) Sampling points should be provided on the influent and effluent lines to the selected WWTP unit.

The EPA's noise guidance note states that the noise level at a sensitive location should not exceed 55dB during daytime hours and 45dB at night-time. As the proposed WWTPs will be operative during both periods, it is recommended that the 45dB limit be applied. In order to meet this limit, and also to prevent odour nuisance, it is recommended that a buffer zone of at least 50m is allowed between the site of the proposed WWTP and the nearest existing development, of which 30m or more should lie within the WWTP site boundary.

Modern treatment plants if correctly maintained should not cause excessive odours and similarly noise pollution is unlikely to be a significant issue. However it is important that both noise and odour are assessed on an ongoing basis. The treatment plants to be used should allow retrospective fitting of absorption systems should odour become a problem in the future.

Secure fences will be necessary for the perimeter of WWTP sites to prevent unauthorised access.

It is advisable that a maintenance contract is agreed with the supplier of the treatment units selected.

It is recommended that any proposed upgrade to new or existing WWTPs or any increase in loadings to the plant is accompanied by a reassessment of waste assimilative capacities in the local catchment.

It was noted that flows within the Bride may drop to a level where no surface flow is visible. It important that the maximum storage capacity is available to provide for periods of drought. Consideration should be given to acquiring sufficient ground to provide tertiary treatment should problems arise in the future. In particular the provision of a constructed wetland may be an appropriate treatment system. Such systems are particularly effective at removing suspended solids and would provide a margin of safety if serious problems arose within the WWTP. A wetland can remove heavier solids from the inflow and solids in wetland discharges are often derived from algal and plant material, which is less likely to negatively impact on river biota. Furthermore evaporation from the wetland will reduce the final effluent volume. The EPA guidelines (*Treatment systems for small communities, business, leisure centres and hotels*, EPA 1999) give a requirement of 1m²/p.e. for tertiary treatment.

Consideration should be given to flow proportional discharges and flow proportional use of the chemicals required for phosphate removal.

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32. REFERENCES

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Licencee	Licence No.	River discharged to	Activities	Max Discharge	BOD	SS	Phosphates	Nitrates	Detergent	Oils fats & grease	pH	Ammonia
C.P. T Ireland(now operating under EMC2)	W. P. (W) 21/81	Bride at Barnagore, Ovens	Sewage effluent	No discharge licence								
Corlon Trading Ltd Now operating as Fermoy Fish Ltd	W. P. (W) 2/99	Bride	Refrigerated truck-roe extract-evisceration, defining and filleting-packing in boxes-freezing. Normal operlion is from mid October to end April	50	25	35	3				6-8.5	0.5
Guy Company Ltd	W. P. (W) 6/95	Bride	Printing Company-Processes (a) film processor (b) lithopositive developer (C) washing of dampers	12	15	15					6-9	
John A Wood Ltd	W. P. (W) 20/78	Bride at Garryhesta	Gravel washing	Bride at Garryhesta	Gravel washing	Details of any accidental discharge from the pit & discharge from emergency overflow pipe.						
John A Wood Ltd Classes Pit.	W. P. (W) 24/78	Bride at Classes	Effluent arising from gravel dredging		No degradation in 02 level							
Kilumney CreameryDefunct	W. P. (W) 64/78	Bride at Knockanemore Td.	Milk intake. Peak intake should not exceed 1,000 gallons per day								6.0 - 8.5	
Roadstone Provinces LtdRoof water to bride	W. P. (W) 8/00	River Lee and adjacent pond			10mg/l	15mg/l	0.5 mg/l	15mg/l	1mg/l	1mg/l	6.0 - 8.5	
Ruden Homes Ltd	W. P. (W) n8/03	River Bride	Treated effluent from a residential development									

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The Bride containing 7 EPA monitoring points discharges to the river Lee (19L03) upstream of site 0600, which is downstream of Inniscarra reservoir. Improvements in 1999 at two sites (site 0610 [Q2] 100m downstream of Crookstown septic tank & site 1600 [Q3-4], Br. upstream Lee confluence) disimproved again in 2003. Site 0610 is one of five Q2 sites reported by the EPA for 2001-2003 in County Cork. Crookstown septic plant is overloaded at present and is scheduled for upgrade to a package plant under the 2007-2012 Needs Assessment Programme. Provision of a new municipal wastewater treatment plant, storm separation and extension of the collection system is identified. Service Land Initiative Funding has been applied for to the Department of Environment. Limited farm surveys are proposed in 2004-2006 in the catchment area upstream of this site to eliminate any agricultural discharges, staff resources and mileage allocation allowing.

Site1600, Br. upstream Lee confluence, recorded a Q3-4 in 2003. At least two quarries, one batching plant, ongoing road and housing construction works since 2001 and the discharge from Kilumney MWWTP (PE 150) primarily influence the water quality at this site. There is a proposal in the 2007-2012 Needs Assessment Programme to consolidate four existing wastewater treatment plants within the Kilumney/Ovens area and provide nutrient reduction. Assisting this process is the appointment of Consulting Engineers by South Cork Rural Water Services Division to carry out an Environmental Assessment of Wastewater Discharges to the Bride catchment. Follow up agricultural surveys will also be carried out upstream of this site in 2004-2006 in the catchment area upstream of this site to eliminate any agricultural discharges, staff resources and mileage allocation allowing. The South Western Fisheries Board has also carried out an intensive farm inspection programme in the River Bride catchment and Cork County Council are assisting where required in follow up actions and regulatory proceedings.

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Site 0610 has been identified as a site where there may be difficulties in achieving the standard by 2007 as per Article 3(9). This site is potentially located in the mixing zone of the discharge from Crookstown septic tank, approximately 100m upstream and this may increase the difficulty in improving its water quality status. It is expected that the future infrastructural upgrade of Crookstown septic tank and farm surveys will assist this Q2 to reach its interim standard of Q3. All sites will be reviewed in 2008 when the updated EPA monitoring data is available in order to finalise the list of sites ot be submitted to the EPA for consideration under Article 3(9).

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River Bride results of Chemical Analyses 1998 to 2000:
Data Set: 1 19B04 Cork County Council

Station No.	pH				Conductivity µS cm^{-1}				Temperature oC			
	No.	Min	Med	Max	*No.*	Min	Med	Max	*No.*	Min	Med	Max
1300	6	7.6	7.8	8.3	-	-	-	-	5	7.0	10.0	17.5
1400	4	7.6	7.8	8.1	-	-	-	-	5	7.0	13.0	18.0
1600	6	7.9	8.1	8.3	-	-	-	-	6	7.0	11.5	17.0

Station No.	Dissolved Oxygen % Saturation				Dissolved Oxygen mg $O_2$1^{-1}				B.O.D mg $O_2$1^{-1}			
	No.	Min	Med	Max	*No.*	Min	Med	Max	*No.*	Min	Med	Max
1300	-	-	-	-	-	-	-	-	5	1.0	1.3	3.3
1400	-	-	-	-	-	-	-	-	4	1.1	1.2	2.5
1600	4	96	101	101	4	9.5	10.6	11.6	5	0.9	1.0	3.0

Station No.	Chloride mg Cl 1^{-1}				Total Ammonia mg N 1^{-1}				Un-Ionised Ammonia mg NH_3 1^{-1}			
	No.	Min	Med	Max	*No.*	Min	Med	Max	*No.*	Min	Med	Max
1300	-	-	-	-	8	0.02	0.04	0.09	5	<0.001	0.001	0.002
1400	-	-	-	-	7	0.02	0.04	0.09	4	<0.001	0.001	0.002
1600	-	-	-	-	9	0.02	0.03	0.08	5	0.001	0.001	0.004

Station No.	Oxidised Nitrogen mg N 1^{-1}				Ortho-Phosphate mg P 1^{-1}				Colour Hazen			
	No.	Min	Med	Max	*No.*	Min	Med	Max	*No.*	Min	Med	Max
1300	5	2.4	4.1	5.2	8	0.01	**0.04**	0.07	-	-	-	-
1400	4	2.6	4.6	5.2	7	0.01	**0.05**	0.09	-	-	-	-
1600	5	3.1	4.9	**6.1**	9	0.01	0.03	0.06	-	-	-	-

NOTES
[1]Freshwater Fish Directive – salmonid waters
[2]Surface Water Directive – A1 waters
[3]Surface Water Directive – A3 waters
[4]Surface Water Directive – A1-A3 waters
[5]Freshwater Fish Directive – cyprinid waters
[6]No limits specified in Surface Water or Freshwater Fish Directives
[7] Phosphate regulations

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River Bride results of Chemical Analyses 1995 to 1997:

Station No: 1300 **Location:** Kilcrea Bridge **Date From:** 1995 **To:** 1997

A value displayed in **BOLD** indicates the value falls outside either an upper or lower threshold and highlights stations where there may be water quality problems.

Parameter	Parameter Units	Minimum	Median	Maximum	No of Samples	Source	Source Type
B.O.D	mg/l O^2	**0.5**	**1.4**	4.0	36	Cork County Council	LA
Colour	Hazen	**5**	**20**	100	30	Cork County Council	LA
Conductivity	µS/cm	174	232	298	31	Cork County Council	LA
Dissolved Oxygen	mg/l O^2	8.5	**11.1**	**13.6**	34	Cork County Council	LA
Dissolved Oxygen	% Saturation	77	100	120	34	Cork County Council	LA
Ortho-Phosphate	mg/l P	**0.01**	**0.05**	**0.22**	36	Cork County Council	LA
Oxidised Nitrogen	mg/l N	**2.5**	**3.6**	**17.9**	36	Cork County Council	LA
pH	pH	7.4	7.7	8.2	36	Cork County Council	LA
Temperature	°C	**6.0**	**10.8**	**16.0**	36	Cork County Council	LA
Total Ammonia	mg/l N	**0.01**	**0.02**	**0.20**	36	Cork County Council	LA
Un-Ionised Ammonia	mg/l NH^3	**0.000**	**0.000**	**0.002**	36	Cork County Council	LA

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Station No: 1400 **Location:** Br at Killumney **Date From:** 1995 **To:** 1997

A value displayed in **BOLD** indicates the value falls outside either an upper or lower threshold and highlights stations where there may be water quality problems.

Parameter	Parameter Units	Minimum	Median	Maximum	No of Samples	Source	Source Type
B.O.D	mg/l O^2	**0.4**	**1.3**	4.2	36	Cork County Council	LA
Colour	Hazen	**5**	**18**	100	30	Cork County Council	LA
Conductivity	µS/cm	186	265	359	31	Cork County Council	LA
Dissolved Oxygen	mg/l O^2	8.7	**11.3**	**14.3**	34	Cork County Council	LA
Dissolved Oxygen	% Saturation	82	99	**141**	34	Cork County Council	LA
Ortho-Phosphate	mg/l P	**0.01**	**0.04**	**0.16**	36	Cork County Council	LA
Oxidised Nitrogen	mg/l N	**2.5**	**3.7**	**5.3**	36	Cork County Council	LA
pH	pH	7.4	7.7	8.4	36	Cork County Council	LA
Temperature	°C	**6.0**	**10.5**	**16.5**	36	Cork County Council	LA
Total Ammonia	mg/l N	**0.01**	**0.02**	**0.14**	36	Cork County Council	LA
Un-Ionised Ammonia	mg/l NH^3	**0.000**	**0.000**	**0.002**	36	Cork County Council	LA

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Station No: 0600 **Location:** Br at Crookstown LHS **Date From:** 1995 **To:** 1997

A value displayed in **BOLD** indicates the value falls outside either an upper or lower threshold and highlights stations where there may be water quality problems.

Parameter	Parameter Units	Minimum	Median	Maximum	No of Samples	Source	Source Type
B.O.D	mg/l O^2	**0.3**	**1.3**	3.4	36	Cork County Council	LA
Colour	Hazen	**5**	**30**	**150**	30	Cork County Council	LA
Conductivity	µS/cm	106	125	195	31	Cork County Council	LA
Dissolved Oxygen	mg/l O^2	**9.1**	**11.7**	**14.4**	35	Cork County Council	LA
Dissolved Oxygen	% Saturation	78	104	123	35	Cork County Council	LA
Ortho-Phosphate	mg/l P	**0.00**	**0.02**	**0.17**	36	Cork County Council	LA
Oxidised Nitrogen	mg/l N	**1.1**	**2.1**	**3.0**	36	Cork County Council	LA
pH	pH	7.2	7.5	8.6	36	Cork County Council	LA
Temperature	°C	**6.0**	**10.0**	**16.0**	36	Cork County Council	LA
Total Ammonia	mg/l N	**0.01**	**0.02**	**0.34**	36	Cork County Council	LA
Un-Ionised Ammonia	mg/l NH^3	**0.000**	**0.000**	**0.027**	36	Cork County Council	LA

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Station No: 1600 **Location:** Br u/s River Lee confl **Date From:** 1995 **To:** 1997

A value displayed in **BOLD** indicates the value falls outside either an upper or lower threshold and highlights stations where there may be water quality problems.

Parameter	Parameter Units	Minimum	Median	Maximum	No of Samples	Source	Source Type
B.O.D	mg/l O^2	**0.7**	**1.3**	3.9	37	Cork County Council	LA
Colour	Hazen	**5**	**20**	100	32	Cork County Council	LA
Conductivity	µS/cm	205	285	383	33	Cork County Council	LA
Dissolved Oxygen	mg/l O^2	8.7	**10.9**	**13.5**	36	Cork County Council	LA
Dissolved Oxygen	% Saturation	79	97	121	36	Cork County Council	LA
Ortho-Phosphate	mg/l P	**0.01**	**0.05**	**0.16**	38	Cork County Council	LA
Oxidised Nitrogen	mg/l N	**2.8**	**4.7**	**6.3**	38	Cork County Council	LA
pH	pH	7.4	7.8	8.4	38	Cork County Council	LA
Temperature	°C	**6.0**	**11.3**	**19.0**	38	Cork County Council	LA
Total Ammonia	mg/l N	**0.01**	**0.02**	**0.50**	38	Cork County Council	LA
Un-Ionised Ammonia	mg/l NH^3	**0.000**	**0.000**	**0.008**	38	Cork County Council	LA

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Table A. River Lee stations with parameter values exceeding limits set by the Quality of Salmonid Waters Regulations from samples taken from 1998-2000.

RIVER	STATION	*PARAMETER*	NO. SAMPLES	NO. EXCEEDING LIMIT (LIMIT DO < 6MG/L)	NO. EXCEEDING LIMIT (LIMIT DO < 9 MG/L)
Lee	0600	Dissolved Oxygen	35	1	3
Lee	0100	Nitrite	30	1	
Lee	0180	Nitrite	30	1	
Lee	0200	Nitrite	2	1	
Lee	0360	Nitrite	33	6	
Lee	0400	Nitrite	33	7	
Lee	0500	Nitrite	28	11	
Lee	0600	Nitrite	33	15	
Lee	0700	Nitrite	33	20	
Lee	0800	Nitrite	33	23	

Table B. River Lee stations with parameter values exceeding limits set by the Quality of Salmonid Waters Regulations from samples taken from 1995-1997.

RIVER	STATION	*PARAMETER*	NO. SAMPLES	NO. EXCEEDING LIMIT (LIMIT DO < 6 MG/L)	NO. EXCEEDING LIMIT (LIMIT DO < 9 MG/L)
Lee	0100	Dissolved Oxygen	34	0	3
Lee	0180	Dissolved Oxygen	35	0	4
Lee	0360	Dissolved Oxygen	35	0	7
Lee	0400	Dissolved Oxygen	34	1	6
Lee	0500	Dissolved Oxygen	25	1	4
Lee	0600	Dissolved Oxygen	33	0	8
Lee	0700	Dissolved Oxygen	35	0	5
Lee	0800	Dissolved Oxygen	35	0	8
Lee	0500	BOD	34	3	
Lee	0500	Copper	1	1	
Lee	0800	Copper	5	3	
Lee	0300	Nitrite	34	4	
Lee	0360	Nitrite	34	11	
Lee	0400	Nitrite	33	8	
Lee	0500	Nitrite	24	12	
Lee	0600	Nitrite	32	20	
Lee	0700	Nitrite	34	25	
Lee	0800	Nitrite	34	28	

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Table C. Q values recorded at sampling stations of the River Lee (1971-1999)

NO.	LOCATION	1971	1976	1981	1986	1990	1994	1997	1999	2002
0010	Just u/s Gouganebarra Lake	-	-	-	-	-	4-5	4-5	4	4
0040	Ford (Br) S of Gortafludig	-	-	-	-	-	4-5	4-5	4	4-5
0100	Inchinossig Bridge	5	5	4-5	4-5	4-5	4-5	4-5	4-5	4-5
0200	Br at Castlemasters (Foot-bridge)	5	5	5	4-5	4-5	4	4-5	4	4
0300	Dromcarra Bridge	5	5	5	4-5	5	4-5	4-5	4	4
0600	Iniscarra Bridge	4-5	4-5	4	4	3-4	3	3	3	3
0700	Leemount – Carrigrohane	5	5	4	4	4	4	4	4	4

In *Interim Report on Biological survey of River Quality 1997* and *2000* (EPA Publications) the following assessments of the River Lee are given:

1997; "The river Lee was in a generally satisfactory condition over most of its course in 1997, but as in the previous two surveys, the river exhibited the symptoms of extreme eutrophication downstream of Iniscarra Reservoir (0600)".

1999; "Water quality mostly "fair" but continuing highly eutrophic at Iniscarra bridge (0600)".

2002: No significant change. Satisfactory apart from Inishcarra Bridge (0600) where again highly eutrophic. The protected pearl mussel has apparently become scarce in the river in the past two decades.

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Leutra sp.	Velidae
Amphinemura sp.	Limniphilidae
Protonemura sp	Polycentropus sp.
Chloroperla sp.	Rhyacophila sp.
Perla sp.	Hydropsyche sp.
Isoperla grammatica	Philopotomous sp.
Baetis sp.	Gammerus sp.
Ecdynorus sp.	Asellus sp.
Rhrithrogena sp.	Ancylidae
Caenis sp.	Tipulidae
Gammarus sp.	Tabanidae
Seristocomatidae	Simulidae
Goeridae	Chironomidae
Elminthidae	Chironomous sp.
Gyrinidae	Oligochaeta
Dytiscidae	Tubificidae

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Status Report for 228 Lee Waterbody

WaterBody Category:	subbasin
WaterBody Name:	228 Lee
WaterBody Code:	IE_SW_19_1709
Overall Status Result:	Good
Test Date:	12/1/2008 12:00:00 AM

TIP	STATUS DESCRIPTION	RESULT
SubCat	**Supporting Elements**	
MOR	Hydromorphology	n/a
PAS	Specific Relevant Pollutants	n/a
PC	General Physico-Chemical	Pass
SubCat	**Biological Elements**	
Q	Macroinvertebrates (Q-Value)	Good
DI	Phytobenthos (Diatoms)	n/a
FI	Fish	n/a
SubCat	**Chemical Status**	
SPO	Chemical Status	n/a
SubCat	**Overall Ecological Status**	
O	Overall Ecological Status	Good

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Cloughduv

Census 2006	349
Projection 2015	439
Upstream Q station	Coolmucky Bridge
Q2004-2007	4-5
Downstream Q station	Kilcrea Bridge
Q2004-2007	4
Waterbody code	SW_19_1709 (See map for extents)
Protected area within	yes
Category	salmonid
Ecological Status	Good
WFD Objective	Protect
Point source Risk	yes
Risk type	insuff future assim Cap 2015 (based on old location)

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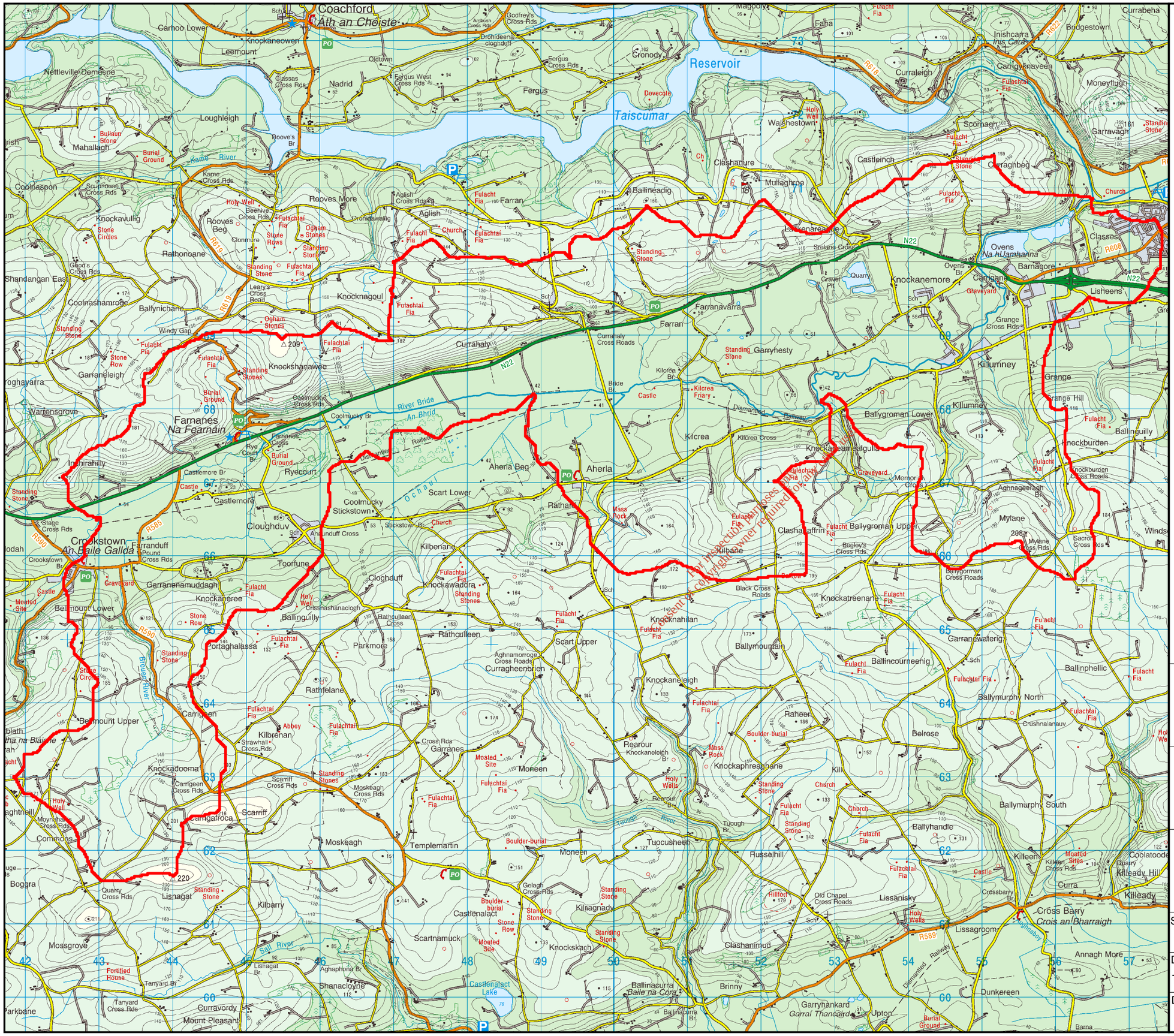

NOTES

1. Dimensions are not be be scaled from drawing.
2. The drawings is to be read in conjunction with the WWDL Application.
3. This drawing is to be read in conjunction with all other application drawings

LEGEND

Water Body Catchment Boundary

N. O'KEEFFE, B.E.
COUNTY ENGINEER,
CORK COUNTY COUNCIL,
COUNTY HALL,
CORK.

JobTitle:

Cloughduv Wastewater Discharge Licence Application

Drawing Title:

Extent of Water Body Attachment F1 - Map 13

Scale:	Surveyed by:	Drawn by:
1:50,000	MMEPO	TOH
Designed by:	**Checked by:**	**Date:**
TOH	DOS	February 2009
Drawing No.:		**Rev:**
F1 - Map 13		--

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Parameter									Temperatu	Dissolved (	pH	BOD	Nitrite	Molybdate	Ammonium	Nitrate	Hardness	Alkalinity
										O2		O2	NO2	P	NH4	NO3	CaCO3	CaCO3
Max.									--	15	Varies	Varies	0.05	Varies	Varies	Varies	--	--
Target									--	--	--	--	--	--	--	--	--	--
Min.									--	5	Varies	--	--	--	--	--	--	--
Project		Location	Location R	Location E	Location N	Sample Te	Sample Re	Sample Date	Sample Tir	Comments	Degrees C	mg/l	pH units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Bride South		Br u/s R Le	19B041600	156253	70712	WFD Oper	2008/0935	14-May-08	10:30		14.9	10.8	8.1	0.9	0.025	***0.036***	0.048	20.2	135	110
Bride South		Br u/s R Le	19B041600	156253	70712	WFD Oper	2008/1407	09-Jul-08	10:15		14.2	9.9	8	0.8	0.04	***0.037***	< 0.026	20.1	106	86
Bride South		Br u/s R Le	19B041600	156253	70712	WFD Oper	2008/2572	08-Oct-08	10:05		12.1	11.2	8	0.4	0.038	***0.034***	0.037	16.5	120	100
										Sample Coun	4	4	4	4	3	3	3	3	4	4
										Maximum	14.9	12.2	8.2	0.9	0.04	0.037	0.048	20.2	142	110
										Minimum	7.2	9.9	8	0.4	0.025	0.034	< 0.026	16.5	106	86
										Mean	12.1	11	8.07	0.65	0.034	0.036	0.033	18.9	126	102
										Median	13.2	11	8.05	0.65	0.038	0.036	0.037	20.1	128	105
										Std. Deviatior	3.48	0.954	0.096	0.238	0.008	0.002	0.018	2.11	16.1	11.4
Bride South		Br. at Crookstown		142635.3	65930.7	WFD Oper	2008/0361	05-Mar-08	09:40		6.5	12.3	8	0.1					84	58
Bride South		Br. at Crookstown		142635.3	65930.7	WFD Oper	2008/0933	14-May-08	10:00		12.4	10.8	7.9	0.9	< 0.013	0.015	0.066	15	82	66
Bride South		Br. at Crookstown		142635.3	65930.7	WFD Oper	2008/1405	09-Jul-08	09:30		13.4	10.3	7.9	0.8	***0.059***	***0.046***	0.056	14.4	81	58
Bride South		Br. at Crookstown		142635.3	65930.7	WFD Oper	2008/2570	08-Oct-08	09:20		10.7	12.6	7.8	0.2	0.031	***0.033***	0.053	12.9	79	62
										Sample Coun	4	4	4	4	3	3	3	3	4	4
										Maximum	13.4	12.6	8	0.9	0.059	0.046	0.066	15	84	66
										Minimum	6.5	10.3	7.8	0.1	< 0.013	0.015	0.053	12.9	79	58
										Mean	10.8	11.5	7.9	0.5	0.032	0.031	0.058	14.1	81.5	61
										Median	11.6	11.6	7.9	0.5	0.031	0.033	0.056	14.4	81.5	60
										Std. Deviatior	3.04	1.12	0.082	0.408	0.026	0.016	0.007	1.08	2.08	3.83
Bride South		Coolmucke	19B040900	146046	67832	WFD Oper	2008/0362	05-Mar-08	10:00		7	11.9	7.9	0.3					124	96
Bride South		Coolmucke	19B040900	146046	67832	WFD Oper	2008/0934	14-May-08	10:15		13.1	10.1	7.8	0.7	< 0.013	0.014	< 0.026	17.7	125	104
Bride South		Coolmucke	19B040900	146046	67832	WFD Oper	2008/1406	09-Jul-08	09:40		13.5	10.2	7.8	0.9	0.05	***0.046***	0.036	15.7	93	76
Bride South		Coolmucke	19B040900	146046	67832	WFD Oper	2008/2571	08-Oct-08	09:40		11.2	9.8	7.8	0.6	0.024	***0.032***	0.03	14.1	105	90
										Sample Coun	4	4	4	4	3	3	3	3	4	4
										Maximum	13.5	11.9	7.9	0.9	0.05	0.046	0.036	17.7	125	104
										Minimum	7	9.8	7.8	0.3	< 0.013	0.014	< 0.026	14.1	93	76
										Mean	11.2	10.5	7.82	0.625	0.027	0.031	0.026	15.8	112	91.5
										Median	12.1	10.1	7.8	0.65	0.024	0.032	0.03	15.7	114	93
										Std. Deviatior	2.97	0.949	0.05	0.25	0.022	0.016	0.012	1.8	15.5	11.8

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Appearanc	Chloride	Dissolved (	Colour	Conductivit	Mg	Ca
	Cl		Hz		Mg	Ca
--	--	150	Varies	--	--	--
--	--	--	--	--	--	--
--	--	50	--	--	--	--
Descriptive	mg/l	% O2	Hazen	µS/cm	mg/l	mg/l
	19.7	106		304		
clear		97		247		
foamy	17.5	101	54	273		
-	2	4	2	4	1	1
-	19.7	106	54	304	6.5	46
-	17.5	97	24	247	6.5	46
-	18.6	101	39	280	6.5	46
-	18.6	100	39	285	6.5	46
-	1.56	3.87	21.2	25.8	0	0
clear		99	18	201	5	25
	19	101		206		
clear		100		191		
clear	16.8	114	48	190		
-	2	4	2	4	1	1
-	19	114	48	206	5	25
-	16.8	99	18	190	5	25
-	17.9	104	33	197	5	25
-	17.9	100	33	196	5	25
-	1.56	7.07	21.2	7.79	0	0
clear		96	13	269	6.7	39
	18.8	96		283		
clear		101		223		
foamy	17	89	40	241		
-	2	4	2	4	1	1
-	18.8	101	40	283	6.7	39
-	17	89	13	223	6.7	39
-	17.9	95.5	26.5	254	6.7	39
-	17.9	96	26.5	255	6.7	39
-	1.27	4.93	19.1	27.1	0	0

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Cork County

Water Services Investment Programme 2007 - 2009

Schemes at Construction	W/S	Est. Cost
Cork North		
Mitchelstown Sewerage Scheme (Nutrient Removal)	S	221,000
Cork South		
Ballyvourney/ Ballymakeery Sewerage Scheme	S	3,049,000
Cobh/ Midleton/ Carrigtwohill Water Supply Scheme	W	10,135,000
Cork Lower Harbour Sewerage Scheme (Crosshaven SS) (G)	S	4,850,000
Cork Water Strategy Study (G)	W	941,000
Kinsale Sewerage Scheme	S	20,000,000
Midleton Sewerage Scheme (Infiltration Reduction) (G)	S	2,078,000
		41,274,000

Schemes to start 2007	W/S	Est. Cost
Cork North		
North Cork Grouped DBO Wastewater Treatment Plant (Buttevant, Doneraile & Kilbrin)	S	5,150,000
Cork West		
Skibbereen Sewerage Scheme	S	20,000,000
		25,150,000

Schemes to start 2008	W/S	Est. Cost
Cork North		
Mallow/ Ballyviniter Regional Water Supply Scheme (H)	W	8,662,000
Mallow Sewerage Scheme (H)	S	5,408,000
Cork South		
Ballincollig Sewerage Scheme (Nutrient Removal) (G)	S	948,000
Ballingeary Sewerage Scheme	S	1,296,000
Bandon Sewerage Scheme Stage 2	S	14,729,000
City Environs (CASP) Strategic Study (G)	S	153,000
Cloghroe Sewerage Scheme (Upgrade)	S	683,000
Coachford Water Supply Scheme	W	1,318,000
Garrettstown Sewerage Scheme	S	2,153,000
Inniscarra Water Treatment Plant Extension Phase 1	W	2,678,000
Little Island Sewerage Scheme (G)	S	2,200,000
Cork West		
Bantry Sewerage Scheme	S	7,148,000
Dunmanway Sewerage Scheme	S	2,153,000
Leap/ Baltimore Water Supply Scheme	W	6,365,000
Schull Water Supply Scheme	W	5,253,000
		61,137,000

Schemes to start 2009	W/S	Est. Cost
Cork North		
Banteer/Dromahane Regional Water Supply Scheme	W	1,576,000
Conna Regional Water Supply Scheme Extension	W	2,627,000
Cork NE Water Supply Scheme	W	4,326,000
Cork NW Regional Water Supply Scheme	W	6,046,000
Millstreet Wastewater Treatment Plant (Upgrade)	S	1,628,000

Schemes to start 2009 contd.	W/S	Est. Cost
Cork South		
Ballincollig Sewerage Scheme (Upgrade) (G)	S	22,248,000
Cork Lower Harbour Sewerage Scheme (excl. Crosshaven SS)	S	73,542,000
Shannagarry/ Garryvoe/ Ballycotton Sewerage Scheme	S	3,780,000
Youghal Sewerage Scheme	S	14,420,000
Cork West		
Ballydehob Sewerage Scheme	S	683,000
Bantry Water Supply Scheme	W	14,935,000
Clonakilty Sewerage Scheme (Plant Capacity Increase)	S	3,677,000
Courtmacsherry/ Timoleague Sewerage Scheme	S	2,472,000
Dunmanway Regional Water Supply Scheme Stage 1	W	12,669,000
		164,629,000

Serviced Land Initiative	W/S	Est. Cost
Cork North		
Ballyclough Water Supply Scheme	W	139,000
Ballyhooley Improvement Scheme	W/S	139,000
Broghill-Rathgoggin Sewerage Scheme	S	406,000
Bweeng Water Supply Scheme	W	115,000
Churchtown Sewerage Scheme (incl. Water)	W/S	543,000
Clondulane Sewage Treatment Plant	S	417,000
Freemount Sewerage Scheme	S	150,000
Pike Road Sewerage Scheme (incl. Water)	W/S	2,080,000
Rathcormac Sewerage Scheme (incl. Water)	W/S	555,000
Spa Glen Sewerage Scheme	S	736,000
Uplands Fermoy Sewerage Scheme (incl. Water)	W/S	1,174,000
Watergrasshill Water Supply Scheme (incl. Sewerage) (G)	W/S	4,151,000
Cork South		
Ballincollig Sewerage Scheme (Barry's Rd Foul and Storm Drainage) (G)	S	1,164,000
Belgooley, Water Supply Scheme (incl. Sewerage)	W/S	2,913,000
Blarney Water Supply Scheme (Ext. to Station Rd) (G)	W	416,000
Carrigtwohill Sewerage Scheme (Treatment and Storm Drain) (G)	S	7,632,000
Castlematyr Wastewater Treatment Plant Extension	S	1,200,000
Crookstown Sewerage Scheme (incl. Water)	W/S	1,200,000
Dripsey Water Supply Scheme (incl. Sewerage)	W/S	1,112,000
Glounthane Sewerage Scheme (G)	S	1,576,000
Innishannon Sewerage Scheme	S	277,000
Innishannon Wastewater Treatment Plant	S	694,000
Kerrypike Sewerage Scheme	S	832,000
Kerrypike Water Supply Scheme	W	416,000
Killeagh Wastewater Treatment Plant Extension	S	1,200,000
Killeagh Water Supply Scheme (includes Sewerage)	W/S	485,000
Killeens Sewerage Scheme	S	420,000
Kilnagleary Sewerage Scheme	S	694,000
Midleton Wastewater Treatment Plant Extension	S	4,050,000

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Cork County contd.

Water Services Investment Programme 2007 - 2009

Serviced Land Initiative contd.	W/S	Est. Cost
Cork South contd.		
Mogeely, Castlemartyr & Ladysbridge Water Supply Scheme	W	2,566,000
North Cobh Sewerage Scheme (G)	S	3,193,000
Riverstick Water Supply Scheme (incl. Sewerage)	W/S	525,000
Rochestown Water Supply Scheme	W	2,700,000
Saleen Sewerage Scheme	S	1,051,000
Youghal Water Supply Scheme	W	2,300,000
Cork West		
Castletownshend Sewerage Scheme	S	1,576,000
		50,797,000
Rural Towns & Villages Initiative		
Cork North		
Buttevant Sewerage Scheme (Collection System)	S	2,446,000
Doneraile Sewerage Scheme (Collection System)	S	1,738,000
Cork South		
Innishannon (Ballinadee/ Ballinspittle/ Garrettstown) Water Supply Scheme	W	6,726,000
Cork West		
Ballylicky Sewerage Scheme	S	2,153,000
Baltimore Sewerage Scheme	S	3,162,000
Castletownbere Sewerage Scheme	S	5,202,000
Schull Sewerage Scheme	S	3,523,000
		24,950,000
Schemes to Advance through Planning		
Cork North		
Mitchelstown North Galtees Water Supply Scheme	W	3,152,000
Mitchelstown Sewerage Scheme	S	3,000,000
Newmarket Sewerage Scheme	S	3,152,000

Schemes to Advance through Planning cond.	W/S	Est. Cost
Cork South		
Carrigtwohill Sewerage Scheme (G)	S	20,000,000
Cork Sludge Management (G)	S	14,420,000
Cork Water Supply Scheme (Storage - Mount Emla, Ballincollig & Chetwind) (G)	W	8,500,000
Inniscarra Water Treatment Plant (Sludge Treatment)(G)	W	5,356,000
Macroom Sewerage Scheme	S	5,150,000
Minane Bridge Water Supply Scheme	W	1,421,000
Cork West		
Bantry Regional Water Supply Scheme (Distribution)	W	9,455,000
Cape Clear Water Supply Scheme	W	1,679,000
Castletownbere Regional Water Supply Scheme	W	8,405,000
Glengarriff Sewerage Scheme	S	2,500,000
Roscarberry/Owenahincha Sewerage Scheme	S	1,576,000
Skibbereen Regional Water Supply Scheme Stage 4	W	7,880,000
		95,646,000
Water Conservation Allocation		**12,206,000**
Asset Management Study		**300,000**
South Western River Basin District (WFD) Project[1]		**9,400,000**
Programme Total		**485,489,000**

[1] This project is being led by Cork County Council on behalf of other authorities in the River Basin District

(H) Refers to a Hub as designated in the National Spatial Strategy

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

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Laboratory Test Report
Cork County Council
Waste Water Laboratory
Inniscarra, Co. Cork

February 19,2009

Industry Name Cloughduv Wastewater Plant
Address Cloughduv,
C. Cork

Industry Code No. 392
Report Ref No. T19-02-09-005.
Issued to D. Barnett.
WSIP
CCC

Licence No. Type S

	Volume	ph	B.O.D.	C.O.D.	S.Solids	TP-P			Code		Comments
Licence Limit	m3 99999	11.99 3.99	mg/l 25	mg/l 125	mg/l 35	mg/l 99					
Date											
10/07/08			* 145	* 326	* 269	10.58			GS626	G	Sampled from preclarifier ta
24/09/08			* 75	* 126	* 102				GS995	G	
09/10/08			* 54	* 206	* 89				GS1029	G	
18/12/08			* 66	* 133	* 61				GS1403	G	
15/01/09		7.4	* 39	66	* 63	7.5			GT059	G	TN-N=30.9mg/l,OPO4-P=5.
% Compl.	***	100	0	20	0	100	***	***			
Average	****.**	7.40	75.80	171.40	116.80	9.04	****.**	****.**			

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The samples are received at the Laboratory on the day of sampling. The above test methods are based on Standard Methods for the examination of Water and Waste Water, 21st Edition 2005, APHA, AWWA, WEF.
C = Composite Sample, G = Grab Sample.
The compliance value may be varied on items marked with an * by the application of uncertainty of measurement values on reverse Page
Chemical Procedure Numbers(CP No.) for INAB accredited tests are as follows:
CP NO. 1 = B.O.D. CP NO. 3 = S.S. CP NO.20 = TP-P
CP NO. 5 = pH CP NO. 6 = C.O.D. ~~CP NO. 7 = Cl~~ VH CP NO.22=Ammonia(KONELAB)
CP NO.23 = OPO4-P(KONELAB) CP NO.24 = Chloride (KONELAB) CP NO.25=Sulphate(KONELAB)
This report relates only to the samples listed above. This report shall not be reproduced except in full and only with with the approval of the testing laboratory. Cork County Council is not accredited by INAB for tests marked with $.
Kg loadings based on flows as supplied by the company. ~ indicates results that have been edited.

Reported by: V. Hannon Date: 19/2/09

Ms. V. Hannon Technical Manager ☑
Deputy Technical Manager ☐

CTR 001 Issue No 6 ~~November 2007~~ VH October 2008

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Wastewater Laboratory Cork County Council- Test Report Addendum

a. Sample date reported in column 1 on this report is the date of collection of the sample from the industry name and address as outlined at the top of the report.
b. Cork County Council wastewater laboratory are not accredited for sample collection.
c. Data reported in (d) below is defined in section 5.10.3 (c) in wastewater laboratory quality manual.
d. Table of Uncertainty Of Measurement – Estimate Of Values For Accredited Tests

Chemical Procedure No.	range	Test Name	Estimated Uncertainty	Units
CP No. 1	1 - 8 mg/l	Biochemical Oxygen Demand (BOD)	± 0.30	mg/l
CP No. 1	9 –70 mg/l	Biochemical Oxygen Demand (BOD)	± 3.2	mg/l
CP No. 1	71 - 700 mg/l	Biochemical Oxygen Demand (BOD)	± 40	mg/l
CP No. 3	35 mg/l	Suspended Solids (SS)	± 6.4	mg/l
CP No. 3	200 - 400mg/l	Suspended Solids (SS)	± 41.6	mg/l
CP No. 3	700 – 1000mg/l	Suspended Solids (SS)	± 80.0	mg/l
CP No. 5	2 - 12	pH	± 0.12	pH Units
CP No. 6	< 6 mg/l	Chemical Oxygen Demand (COD LR)	± 5.6	mg/l
CP No. 6	15 – 75 mg/l	Chemical Oxygen Demand (COD LR)	± 10.6	mg/l
CP No. 6	100 –135 mg/l	Chemical Oxygen Demand (COD LR)	± 17.4	mg/l
CP No. 6	120 – 1500mg/l	Chemical Oxygen Demand (COD) High Range	± 26.8	mg/l
CP No. 20	0.2 – 2.5 mg/l	Total Phosphorus (TP-P)	± 0.22	mg/l
CP No. 22	0.1 – 0.9 mg/l	Ammonia (Konelab)	± 0.04	mg/l
CP No. 22	1.0 – 2.0 mg/l	Ammonia (Konelab)	± 0.10	mg/l
CP No. 22	2 – 10 mg/l	Ammonia (Konelab)	± 0.32	mg/l
CP No. 22	11 – 19 mg/l	Ammonia (Konelab)	± 0.72	mg/l
CP No. 22	20 – 25 mg/l	Ammonia (Konelab)	± 1.56	mg/l
CP No. 23	0.05 – 1.00 mg/l	Orthophosphate as P (Konelab)	± 0.04	mg/l
CP No. 24	25.00 – 99.00 mg/l	Chloride (Konelab)	± 3.04	mg/l
CP No. 24	100.00 – 200.00 mg/l	Chloride (Konelab)	± 11.16	mg/l
CP No. 25	30.00 – 199.00 mg/l	Sulphate (Konelab)	± 3.42	mg/l
CP No. 25	200.00 – 250.00 mg/l	Sulphate (Konelab)	± 8.70	mg/l

January 2009

The raw data used to evaluate the above estimations is stored in the Wastewater Laboratory, Cork County Council.

The method followed is located in the Uncertainty of Measurement file and in the Eurachem Guidelines for Quantifying Uncertainty in Analytical Measurement.

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28th November 2007

Mr. Noel O'Keeffe
Senior Engineer,
Cork County Council,
County Hall,
Co. Cork.

RE: Approval of Serviced Land Initiative Schemes in Cork

A Chara,

I am directed by Mr. John Gormley T.D., Minister for the Environment, Heritage and Local Government, to convey approval to ten Serviced Land Initiative schemes applied for by Cork County Council. Attached is a schedule with the approved schemes and the approved funding for each.

The schemes in question are Cloughduv Water and Sewerage, Crookstown Water and Sewerage, Dunkettle, Glenville and Kinsale Water Supply Schemes and Bandon, Coachford and Crossbarry Sewerage Schemes. This approval is subject to the Council submitting quarterly reports giving the up to date position on each scheme as required under all Serviced Land Initiative schemes.

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Mise le meas

Anthony O'Grady,
Water Services Section,
Environment Infrastructure and Services Division.

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Schemes	*Description of Works*	Scheme Costs €000	No. Housing Units
Water Supply			
Cloghduv*	New borehole source, reservoir and associated mains	1,650	456
Crookstown*	New borehole source, reservoir and associated mains	1,263	532
Dunkettle	Upgrading of mains	255	1,830
Glenville	New borehole source, reservoir, pumping station and associated mains	849	350
Kinsale	Upgrading / extension of existing supply network, reservoir, pumping station	2,225	1,950
Wastewater Schemes			
Bandon	New pumping station, associated sewers and pumps	3,113	1,196
Cloghduv*	New wastewater treatment plant, pumping station and sewers	1,480	
Coachford	New wastewater treatment plant and associated works	1,447	336
Crookstown*	New wastewater treatment plant and associated works	2,400	
Crossbarry	New wastewater treatment plant, sewers and pumping station	1,707	360
	Totals	**€ 16,389**	**7,010**

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* The Cloghduv and Crookstown Water and Sewerage Schemes will develop the same lands.

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