SECTION G1: Compliance with Council Directives

Table G1-1: Table of Attachments

*Cork County Council Test Reports cannot be copied to OCR format.

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

July 10,2008

Industry Name: Charleville Sewage Works
Address: Charleville, Co. Cork

Industry Code No. 304
Report Ref No. S10-07-08-164.
Issued to F.S. Room
See under Service with.

Licence No. Type S

	Volume m3	pH	B.O.D. mg/l	C.O.D. mg/l	Sus Solids mg/l	TP-P mg/l	Code	Comments
Licence Limit	999999	3.99	25	125	35	99		
Date								
21/02/07	8656	7.6	7.5	25	8	0.69	GR165	G TN-NS=21.4mg/l
08/03/07		7.9	7.1	24	19	0.69	GR204	C TN-NS=8.2mg/L
03/05/07	4574	8.0	4.7	25	5	2.2	GR356	C TN-NS=10.6mg/L THM=<1
13/09/07	3483	7.8	1.94	<21	3	1.75	GR853	G SO4=<30mg/l TN-NS=5.2mg
27/09/07	3645	7.7	2.76	23	5	1.14	GR932	G OPO4=0.98mg/l NH3=0.4mg
03/10/07	4795	7.6	7.65	<21	15	1.31	GR944	G OPO4=0.89mg/l NH3=1.3mg
14/02/08	10480	8.3	4.28	26	9	1.2	GR102	C NH3-N=0.1mg/l O-PO4=0.8
10/04/08			3.7	24	6	1.64	GS328	C TN-NS=11mg/l OPO4-P=1.4
% Compl.	100	100	100	100	100	96%	0	***
Average	5938.83	7.84	4.95	16.58	8.75	1.38	22.70	****.**

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 CP NO.22=Ammonia(KONELAB)
CP NO.23 = OPO4-P(KONELAB) CP NO.24 = Chloride (KONELAB) CP NO.25=Sulphate(KONSLAB)
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 S.
Kg loadings based on flows as supplied by the company. ~ indicates results that have been edited.

Reported by: V. Hannon Date: 10/7/08

Ms. V. Hanton Technical Manager
Deputy Technical Manager

CTR 001 Issue No 5 November 2007

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 - 3 mg/l	Biochemical Oxygen Demand (BOD)	± 0.38	mg/l
CP No. 1	9 - 70 mg/l	Biochemical Oxygen Demand (BOD)	± 5.2	mg/l
CP No. 1	91 - 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)	± 43.6	mg/l
CP No. 3	700 - 1000mg/l	Suspended Solids (SS)	± 80.6	mg/l
CP No. 5	2 - 12	pH	± 0.12	pH Units
CP No. 4	< 6 mg/l	Chemical Oxygen Demand (COD LR)	± 5.6	mg/l
CP No. 4	15 - 75 mg/l	Chemical Oxygen Demand (COD LR)	± 10.6	mg/l
CP No. 6	100 - 150 mg/l	Chemical Oxygen Demand (COD LR)	± 17.4	mg/l
CP No. 6	120 - 1500mg/l	Chemical Oxygen Demand (COD) High Range	± 26.5	mg/l
CP No. 7	5.0 - 1.25 mg/l	Chloride (Cl)	± 0.85	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)	± 0.64	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 - 35 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)	± 3.42	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)	± 8.76	mg/l

November 2007

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.

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

Page 1 of 1
July 10,2008

Industry Name: Charleville Sewage Works
Address: Charleville, Co. Cork

Industry Code No. 304
Report Ref No. 510-07-08-168
Issued to F. Cronin
SE Water Services [illegible]

Licence No. Type $

Licence Limit	Volume m3	pH	B.O.D. mg/l	C.O.D. mg/l	Sus Solids mg/l	TP-P mg/l			Code		Comments
	999999	11.99 / 3.99	25	125	35	99					
Date											
21/02/07	8656	7.6	7.5	25	8	0.69			GR165	G	TN-N5=21.4mg/l
08/03/07		7.9	7.1	24	19	0.69			GR204	C	TN-N5=8.7mg/l.
03/05/07	4574	8.0	4.7	25	5	2.2			GR356	C	TN-N5=10.0mg/l, THM<0
13/09/07	3483	7.8	3.94	<21	3	1.75			GR853	G	SO4=<30mg/l TN-N5=5.2m(
27/09/07	3645	7.7	2.76	23	5	1.54			GR902	G	OPO4=0.98mg/l NH3=0.4mg
03/10/07	4795	7.6	7.66	<21	15	1.31			GR944	G	OPO4=0.89mg/l NH3=1.1mg
% Compl.	100	100	100	100	100	100	***	***			
Average	5030.60	7.77	5.28	16.17	9.17	[illegible]	****.**	****.**			

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.
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Ms. V. Hannon Technical Manager
Deputy Technical Manager

CTR 001 Issue No 5 November 2007

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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)	± 30.6	mg/l
CP No. 6	100 -135 mg/l	Chemical Oxygen Demand (COD LR)	± 37.4	mg/l
CP No. 6	120 – 1500mg/l	Chemical Oxygen Demand (COD) High Range	± 26.8	mg/l
CP No. 7	5.0 – 125 mg/l	Chloride (Cl)	± 0.89	mg/l
CP No. 29	0.2 – 7.5 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	3 – 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)	± 3.84	mg/l
CP No. 24	100.00 – 300.00 mg/l	Chloride (Konelab)	± 11.16	mg/l
CP No. 25	30.00 – 150.00 mg/l	Sulphate (Konelab)	± 7.42	mg/l
CP No. 25	200.00 – 250.00 mg/l	Sulphate (Konelab)	± 8.70	mg/l

November 2007

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.

Table F1-9: River Allow Water Quality (Upstream of Charleville WWTP)

Sample Date	21/02/2007	03/05/2007	13/09/2007	14/02/2008	10/04/2008
Sample	river	river	river	River	River
Flow M^3/Day	*	*	*	*	*
pH	8	*	8.4	8.5	*
Temperature °C	*	*	*	*	*
Cond 20°C	*	*	*	*	*
SS mg/L	<2.5	3	6	3	*
NH_3 mg/L	<0.1	<0.1	<0.1	0.1	*
BOD mg/L	<1	<1	1.68	1.31	*
COD mg/L	*	*	*	*	*
TN mg/L	1.7	7.65	8.9	*	*
Nitrite mg/L	*	*	*	*	*
Nitrate mg/L	*	*	*	*	*
TP mg/L	<0.2	0.21	1	<0.2	*
O-PO4-P mg/L	*	*	0.33	0.09	0.08
SO4 mg/L	*	*	<30	<30	*
Chromium mg/L	*	*	*	<0.02	*
Copper mg/L	*	*	*	<0.02	*
Cyanide µg/L	*	*	*	*	*
Fluoride	*	*	*	*	*
Lead mg/L	*	*	*	0.051	*
Nickel mg/L	*	*	*	<0.02	*
Zinc mg/L	*	*	*	<0.02	*
Boron mg/L	*	*	*	<0.02	*
Cadmium mg/L	*	*	*	<0.02	*
Mercury µg/L	*	*	*	*	*
Selenium µg/L	*	*	*	*	*
Barium mg/L	*	*	*	0.045	*

Table F1-10: River Allow Water Quality (Downstream of Charleville WWTP)

Sample Date	21/02/2007	08/03/2007	03/05/2007	13/09/2007	14/02/2008
Sample	river	river	river	river	River
Flow M^3/Day	*	*	*	*	*
pH	7.8	7.9	*	8	8.3
Temperature °C	*	*	*	*	*
Cond 20°C	*	*	*	*	*
SS mg/L	*	6	*	*	9
NH_3 mg/L	*	0.1	1.2	4.1	<0.1
BOD mg/L	7.7	2.4	2.5	7.33	5.05
COD mg/L	*	<21	*	*	*
TN mg/L	17.5	5.8	8.6	10.5	*
Nitrite mg/L	*	*	*	*	*
Nitrate mg/L	*	*	*	*	*
TP mg/L	0.43	0.3	1.24	1.94	0.66
O-PO4-P mg/L	*	*	*	*	0.6
SO4 mg/L	*	*	*	<30	<30
Chromium mg/L	*	*	*	*	<0.02
Copper mg/L	*	*	*	*	<0.02
Cyanide µg/L	*	*	*	*	*
Fluoride	*	*	*	*	*
Lead mg/L	*	*	*	*	0.056
Nickel mg/L	*	*	*	*	<0.02
Zinc mg/L	*	*	*	*	<0.02
Boron mg/L	*	*	*	*	<0.02
Cadmium mg/L	*	*	*	*	<0.02
Mercury µg/L	*	*	*	*	*
Selenium µg/L	*	*	*	*	*
Barium mg/L	*	*	*	*	0.08

SITE SYNOPSIS

SITE NAME : LOWER RIVER SHANNON

SITE CODE : 002165

This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the sub-catchment of the Feale include the Galey, Smearlagh, Golagh, Allaugheun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Deel River, the Bilboa, Glashacloonaraveela, Gortanageragh and Cahernahallia.

The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the EU Habitats Directive. The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the EU Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter.

The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary.

Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (*Zostera* spp.) and patches of green

algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a *Macoma-Scrobicularia-Nereis* community.

In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and Club-rushes (*Scirpus maritimus, S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triquetrus*), two scarce species are found in some of these creeks (e.g. Ballinacourra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*).

Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Saltmarsh Rush (*Juncus gerardi*), Long-bracted Sedge (*Carex extensa*), Lesser Sea-spurrey (*Spergularia marina*) and Sea Arrowgrass (*Triglochin maritima*). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the compass of Common Saltmarsh-grass (*Puccinellia maritima*) and Hard-grass (*Parapholis strigosa*).

Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a National Inventory of Lagoons are Shannon Airport Lagoon and Cloonconeen Pool. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa, Cerastoderma glaucum, Lekanesphaera hookeri, Palaemonetes varians, Sigara stagnalis* and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon (2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of Stonewort (*Chara canescens* and *Chara cf. connivens*).

Most of the site west of Kilcredaun Point/Kilconly Point is bounded by high rocky sea cliffs. The cliffs in the outer part of the site are sparsely vegetated with lichens, Red Fescue, Sea Beet (*Beta vulgaris*), Sea Campion (*Silene maritima*), Thrift and Plantains (*Plantago* spp.). A rare endemic Sea Lavender (*Limonium recurvum* subsp.

pseudotranswallianum) occurs on cliffs near Loop Head. Cliff-top vegetation usually consists of either grassland or maritime heath. The boulder clay cliffs further up the estuary tend to be more densely vegetated, with swards of Red Fescue and species such as Kidney Vetch (*Anthyllis vulneraria*) and Bird's-foot Trefoil (*Lotus corniculatus*).

The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the pcSAC.

The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae.

Other coastal habitats that occur within the site include the following:

- stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (*Fucus* spp., *Ascophyllum nodosum* and kelps).
- shingle beaches - the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (*Matricaria maritima*), Sea Campion and Curled Dock (*Rumex crispus*).
- Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head.
- sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (*Ammophila arenaria*).

Flowing into the estuaries are a number of tidal rivers.

Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Semi-natural habitats, such as wet grassland, wet woodland and marsh occur by the rivers, however, improved grassland is most common. One grassland type of particular

conservation significance, *Molinia* meadows, occurs in several parts of the site and the examples at Worldsend on the River Shannon are especially noteworthy. Here are found areas of wet meadow dominated by rushes and sedges and supporting a diverse and species-rich vegetation, including such uncommon species as Blue-eyed Grass (*Sisyrinchium bermudiana*) and Pale Sedge (*Carex pallescens*).

Floating river vegetation characterised by species of Water-crowfoot (*Ranunculus* spp.), Pondweeds (*Potamogeton* spp.) and the moss *Fontinalis antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to county Limerick.

Alluvial woodland occurs on the banks of the Shannon and on islands in the vicinity of the University of Limerick. The woodland is up to 50m wide on the banks and somewhat wider on the largest island. The most prominent woodland type is gallery woodland where White Willow (*Salix alba*) dominates the tree layer with occasional Alder (*Alnus glutinosa*). The shrub layer consists of various willow species with sally (*Salix cinerea* ssp. *oleifolia*) and what appear to be hybrids of *S. alba* x *S. viminalis*. The herbaceous layer consists of tall perennial herbs. A fringe of Bulrush (*Typha* sp.) occurs on the riverside of the woodland. On slightly higher ground above the wet woodland and on the raised embankment remnants of mixed oak-ash-alder woodland occur. These are poorly developed and contain numerous exotic species but locally there are signs that it is invading open grassland. Alder is the principal tree species with occasional Oak (*Quercus robur*), Elm (*Ulmus glabra, U. procera*), Hazel (*Corylus avellana*), Hawthorn (*Crataegus monogyna*) and the shrubs Guelder-rose (*Viburnum opulus*) and willows. The ground flora is species-rich.

Woodland is infrequent within the site, however Cahirmon Wood contains a strip of old Oak woodland. Sessile Oak (*Quercus petraea*) forms the canopy, with an understorey of Hazel and Holly (*Ilex aquifolium*). Great Wood-rush (*Luzula sylvatica*) dominates the ground flora. Less common species present include Great Horsetail (*Equisetum telmateia*) and Pendulous Sedge (*Carex pendula*).

In the low hills to the south of the Slievefelim mountains, the Cabernahallia River cuts a valley through the Upper Silurian rocks. For approximately 2km south of Cappagh Bridge at Knockanavar, the valley sides are wooded. The woodland consists of Birch (*Betula* spp.), Hazel, Oak, Rowan (*Sorbus aucuparia*), some Ash (*Fraxinus excelsior*) and Willow (*Salix* spp.). Most of the valley is not grazed by stock, and as a result the trees are regenerating well. The ground flora feature prominent Greater wood-rush and Bilberry (*Vaccinium myrtillus*) with a typical range of woodland herbs. Where there is more light available, Bracken (*Pteridium aquilinum*) features.

The valley sides of the Bilboa and Gortnageragh Rivers, on higher ground north east of Cappamore, support patches of semi-natural broadleaf woodland dominated by Ash, Hazel, Oak and Birch. There is a good scrub layer with Hawthorn, Willow, Holly and Blackthorn (*Prunus spinosa*) common. The herb layer in these woodlands is often open with a typically rich mixture of woodland herbs and ferns. Moss species diversity is high. The woodlands are ungrazed. The hazel is actively coppiced in places.

There is a small area of actively regenerating cut away raised bog at Ballyrotheen. It is situated approx. 5km north west of Cappamore Co. Limerick. The bog contains some wet areas with good moss (*Sphagnum*) cover. Species of particular interest include the Cranberry (*Vaccinium oxycoccos*) and the White Sedge (*Carex curta*) along with two other regionally rare mosses including *S. fimbriatum*. The site is being invaded by Birch (*Betula pubescens*) scrub woodland. Both commercial forestry and the spread of rhododendron has greatly reduced the overall value of the site.

A number of plant species that are Irish Red Data Book species occur within the site - several are protected under the Flora (Protection) Order, 1999:

- Triangular Club-rush (*Scirpus triquetrus*) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary.
- Opposite-leaved Pondweed (*Groenlandia densa*) - this protected pondweed is found in the Shannon where it passes through Limerick City.
- Meadow Barley (*Hordeum secalinum*) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill.
- Hairy Violet (*Viola hirta*) - this protected violet occurs in the Askeaton/Foynes area.
- Golden Dock (*Rumex maritimus*) - noted as occurring in the River Fergus Estuary.
- Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon.
- Convergent Stonewort (*Chara connivens*) - presence in Shannon Airport Lagoon to be confirmed.

Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose (246; 1995/96), Golden Plover (11,067; 1996/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in 1993/94.

Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (250; 1995/96), Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504; 1995/96), Redshank (3228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank.

A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987)

There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site.

Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite Shad (*Alosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey.

Two additional fish of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon.

Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River.

There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through over-grazing and poaching. Much of the land adjacent to the rivers and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale.

In the past, Cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds.

Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats.

Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the

E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.

This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country. Most of the estuarine part of the site has been designated a Special Protection Area (SPA), under the E.U. Birds Directive, primarily to protect the large numbers of migratory birds present in winter.

17.05.2005

SECTION G2: Compliance with Water Quality Standards for Phosphorous Regulations (S.I. 258 of 1998)

Table G2-1: Table of Attachments

*Cork County Council Test Reports cannot be copied to OCR format.

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

Page 1 of 1
July 10,2008

Industry Name: Charleville Sewage Works
Address: Charleville, Co. Cork

Industry Code No. 204
Report Ref No. 510-07-08-167.
Issued to F. C. Rodin
See water services Mtc.

Licence No. Type S

	Volume m3	pH	B.O.D. mg/l	C.O.D. mg/l	Sus Solids mg/l	TP-P mg/l			Code		Comments
Licence Limit	999999	11.99 3.99	25	125	35	99					
Date											
21/02/07	8656	7.6	3.5	25	8	0.69			GR163	G	TN-NS=21.4mg/l
08/03/07		7.9	7.1	24	19	0.69			GR204	C	TN-NS=8.7mg/L
03/05/07	4574	8.0	4.7	25	5	2.2			GR356	C	TN-NS=10.6mg/L THM=<1
13/09/07	3453	7.8	1.94	<21	3	1.75			GR853	G	SO4=<30mg/l TN-NS=6.2mg
27/09/07	3645	7.7	2.76	23	5	1.14			GR932	G	OPO4=0.98mg/l NH3=0.4mg
03/10/07	4795	7.6	7.65	<21	15	1.31			GR944	G	OPO4=0.89mg/l NH3=1.3mg
14/02/08	10480	8.3	4.28	26	9	[illegible]	* 22.7		GR102	C	NH3-N=0.1mg/l O-PO4=0.8
10/04/08			3.7	24	6	1.64			GS328	C	TN-NS=1.6mg/l OPO4-P=1.4
% Compl.	100	100	100	100	100	100	0	***			
Average	5938.83	7.84	4.95	16.38	8.75	1.53	22.70	****.**			

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 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 the approval of the testing laboratory. Cork County Council is not accredited by INAB for tests marked with S.
Kg loadings based on flows as supplied by the company. ~ indicates results that have been edited.

Reported by: V. Hannon Date: 10/7/08

Ms. V. Hannon Technical Manager
Deputy Technical Manager

CTR 001 Issue No 5 November 2007

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)	± 5.2	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)	± 43.6	mg/l
CP No. 3	700 – 1000mg/l	Suspended Solids (SS)	± 80.8	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	± 26.5	mg/l
CP No. 7	5.0 – 125 mg/l	Chloride (Cl-)	± 0.85	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 – 35 mg/l	Ammonia (Konelab)	± 1.36	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)	± 3.62	mg/l
CP No. 24	100.00 – 200.00 mg/l	Chloride (Konelab)	± 11.16	mg/l
CP No. 25	30.00 – 99.00 mg/l	Sulphate (Konelab)	± 3.42	mg/l
CP No. 25	200.00 - 250.00 mg/l	Sulphate (Konelab)	± 8.70	mg/l

November 2007

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.

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

Page 1 of 1
July 10,2008

Industry Name	Charleville Sewage Works
Address	Charleville, Co. Cork
Industry Code No.	304
Report Ref No.	S10-07-08-108
Issued to	F. Cronin SE Water Services

Licence No. Type S

	Volume m3	pH	B.O.D. mg/l	C.O.D. mg/l	Sus Solids mg/l	TP-P mg/l			Code		Comments
Licence Limit	999999	11.99 / 3.99	25	125	35	99					
Date											
21/02/07	8656	7.6	7.5	25	8	0.69			GR165	G	TN-NS=21.4mg/l
08/03/07		7.9	7.1	24	19	0.69			GR204	C	TN-NS=8.7mg/l.
03/05/07	4574	8.0	4.7	25	5	2.2			GR556	C	TN-NS=10.8mg/l, THM<5
13/09/07	3483	7.8	1.94	<21	3	1.75			GR853	G	SO4<30mg/l TN-NS=5.2mg/l
27/09/07	3645	7.7	2.76	23	5	1.34			GR902	G	OPO4=0.98mg/l NH3=0.4mg/l
03/10/07	4795	7.6	7.66	<21	15	1.31			GR944	G	OPO4=0.88mg/l NH3=1.4mg/l
% Compl.	100	100	100	100	100	100	***	***			
Average	5030.60	7.77	5.28	16.17	9.17	1.39	****.**	****.**			

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
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CP NO.23 = OPO4-P(KONELAB) CP NO.24 = Chloride(KONELAB) CP NO.25=Sulphate(KONELAB)

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Kg loadings based on flows as supplied by the company. ~ indicates results that have been edited.

Reported by: V. Hanson Date: 10/7/08

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

CTR 001 Issue No 5 November 2007

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.
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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)	± 30.6	mg/l
CP No. 6	100 -135 mg/l	Chemical Oxygen Demand (COD LR)	± 37.4	mg/l
CP No. 6	120 – 1500mg/l	Chemical Oxygen Demand (COD) High Range	± 26.8	mg/l
CP No. 7	5.0 – 125 mg/l	Chloride (Cl)	± 0.89	mg/l
CP No. 29	0.2 – 7.5 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	3 – 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)	± 3.64	mg/l
CP No. 24	100.00 – 300.00 mg/l	Chloride (Konelab)	± 11.16	mg/l
CP No. 25	30.00 – 150.00 mg/l	Sulphate (Konelab)	± 7.42	mg/l
CP No. 25	200.00 – 250.00 mg/l	Sulphate (Konelab)	± 8.70	mg/l

November 2007

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.

Table F1-8: Charleville Assimilative Capacity Assessment

P.E.	Parameter	Receiving waters Background concentration	Upstream		WWTP		Downstream Water Quality		Receiving Water Quality Limiting Value	Q- Rating
			Upstream River Flow See Note 1 below		Discharge Flow	Effluent Discharge Standard	Flow	Expected Water Quality	(see note 1 below)	
		mg/l	*l/s*	*m3/d*	*m3/d*	*mg/l*	*m3/d*	*mg/l*	*mg/l*	
21/02/2007	BOD	1.7	11.00	950.40	8656	7.50	9606.40	6.93	2.7	Q3
	SS	3	11.00	950.40	8656	8.00	9606.40	7.51	25	
	Phosphorus	0.105	960.00	82944.00	8656	-	91600.00	-	0.07	
03/05/2007	BOD	1.7	11.00	950.40	4574	4.70	5524.40	4.18	2.7	Q3
	SS	3	11.00	950.40	4574	5.00	5524.40	4.66	25	
	Phosphorus	0.105	960.00	82944.00	4574	-	87518.00	-	0.07	
13/09/2007	BOD	1.7	11.00	950.40	3483	1.94	4433.40	1.89	2.7	Q3
	SS	3	11.00	950.40	3483	3.00	4433.40	3.00	25	
	Phosphorus	0.105	960.00	82944.00	3483	1.44	86427.00	0.16	0.07	
27/09/2007	BOD	1.7	11.00	950.40	3645	2.76	4595.40	2.54	2.7	Q3
	SS	3	11.00	950.40	3645	5.00	4595.40	4.59	25	
	Phosphorus	0.105	960.00	82944.00	3645	0.98	86589.00	0.14	0.07	
03/10/2007	BOD	1.7	11.00	950.40	4795	7.66	5745.40	6.67	2.7	Q3
	SS	3	11.00	950.40	4795	15.00	5745.40	13.01	25	
	Phosphorus	0.105	960.00	82944.00	4795	0.89	87739.00	0.15	0.07	
14/02/2008	BOD	1.7	11.00	950.40	10488	4.28	11438.40	4.07	2.7	Q3
	SS	3	11.00	950.40	10488	9.00	11438.40	8.50	25	
	Phosphorus	0.105	960.00	82944.00	10488	0.86	93432.00	0.19	0.07	
17/07/2008	Atrazine	0.000005	2.50	216.00	3600	0.00001	3816.00	0.00001	0.001	Q3
	Dichloromethane	0.0005	2.50	216.00	3600	0.00050	3816.00	0.00050	0.01	
	Simazine	0.000005	2.50	216.00	3600	0.00001	3816.00	0.00001	0.001	
	Toluene	0.0005	2.50	216.00	3600	0.00050	3816.00	0.00050	0.01	
	Xylenes	0.0005	2.50	216.00	3600	0.00050	3816.00	0.00050	0.01	
	Arsenic	0.002	2.50	216.00	3600	0.00100	3816.00	0.00106	0.025	
	Copper	0.01	2.50	216.00	3600	0.01000	3816.00	0.01000	0.03	
	Cyanide	0.0025	2.50	216.00	3600	0.00250	3816.00	0.00250	0.01	
	Lead	0.01	2.50	216.00	3600	0.01000	3816.00	0.01000	0.01	
	Nickel	0.01	2.50	216.00	3600	0.01000	3816.00	0.01000	0.05	
	Zinc	0.01	2.50	216.00	3600	0.01000	3816.00	0.01000	0.1	

Note 1: Median Flow is used to calculate assimilative capacity for Orthophosphate, DWF is used for dangerous substances and 95%-ile flow is used for all other substances.

BOD limiting value is based on the BOD background + 1mg/l as recommended by Royal Commission in it's report on Water Quality Guidelines.

SS limiting value is 25mg/l which is based on the Freshwater Fish Directive in the absence of alternative guidance.

Phosphorus standard for a Q3 rated river is 0.07mg/l.

Limiting Values for dangerous substances from Dangerous Substances Act 2001 (based on Charleville Stream CaCO3 content >100mg/l)