Energy for generations

Derrybrien Wind Farm Project

Gort Windfarms Ltd.

Remedial Environmental Impact Assessment Report
Chapter 8 - Aquatic Ecology & Fisheries Appendices

Document No.: QS-000280-01-R460-001-000

Date: July 2020

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Appendix 8-1 Significance Terminology - Table 3.3 of the Guidelines (EPA, 2017)

Quality of Effects It is important to inform the non-specialist reader whether an effect is positive, negative or neutral	**Positive Effects** A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).
	Neutral Effects No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
	Negative/adverse Effects A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).
Describing the Significance of Effects "Significance' is a concept that can have different meanings for different topics – in the absence of specific definitions for different topics the following definitions may be useful (also see *Determining Significance* below.).	**Imperceptible** An effect capable of measurement but without significant consequences.
	Not significant An effect which causes noticeable[2] changes in the character of the environment but without significant consequences.
	Slight Effects An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
	Moderate Effects An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
	Significant Effects An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
	Very Significant An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
	Profound Effects An effect which obliterates sensitive characteristics
Describing the Extent and Context of Effects Context can affect the perception of significance. It is important to establish if the effect is unique or, perhaps, commonly or increasingly experienced.	**Extent** Describe the size of the area, the number of sites, and the proportion of a population affected by an effect.
	Context Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?)

Describing the Probability of Effects Descriptions of effects should establish how likely it is that the predicted effects will occur – so that the CA can take a view of the balance of risk over advantage when making a decision.	**Likely Effects** The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented.
	Unlikely Effects The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.
Describing the Duration and Frequency of Effects 'Duration' is a concept that can have different meanings for different topics – in the absence of specific definitions for different topics the following definitions may be useful.	**Momentary Effects** Effects lasting from seconds to minutes
	Brief Effects Effects lasting less than a day
	Temporary Effects Effects lasting less than a year
	Short-term Effects Effects lasting one to seven years.
	Medium-term Effects Effects lasting seven to fifteen years.
	Long-term Effects Effects lasting fifteen to sixty years.
	Permanent Effects Effects lasting over sixty years
	Reversible Effects Effects that can be undone, for example through remediation or restoration
	Frequency of Effects Describe how often the effect will occur. (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)

Appendix 8-2 Macroinvertebrate Tables (2011-2020)

2011	Category	B1	B2	B4	B5	O1	O2	O3	O4	OG1	O6	O9
MAY FLIES (Ephemeroptera)												
Heptageniidae:	A	*	*		*	*	*	*		*	*	*
Rhithrogena semicolorata		3			47					26	100+	100+
Ecdyonurus sp.			22		15	2	2	9		27	46	2
Heptagania sp.										2		3
Baetis rhodani	C	45	28		19	77	70	42	100+	15	80	30
STONE FLIES (Plecoptera)												
Perla bipunctata	A											7
Chloroperla sp.	A									1	1	
Isoperla sp.	A	2	6	2		2	1	3	2		2	
Nemouridae:	A	*	*	*	*		*	*	*	*	*	
Amphinemoura sp.				1								
Protonemoura spp.		17	26	82	73		14	48	44	76	100+	
Leuctra spp.	B		38	17	1	34	2	1	2		28	
CADDIS FLIES (Trichoptera)												
Silo pallipes	B	62	16	19	16	1	1	12	44	11	1	14
Rhyacophilidae	C	11	2	5	4		3	2	2	2	3	1
Hydropsychidae	C		2		1				2	3	9	5
Glossosomatidae:	C	*								*	*	*
Agapetus sp.										3	2	3
Glossosoma sp.		3										64
Plectronemia conspersa	C		4	12		3	1	1	1	2	5	
Philopotomus montana	C										1	
Limnephilidae:	C	*		*	*	*	*	*		*	*	
Potomophylax spp.					1					9	1	
Limnephilid indet.		2		2	2	5	8	3		2	4	
TRUE FLIES (Diptera)												
Dicranota sp.			20	6	2	5	3	7	1	5	12	3
Chironomidae	C	10		1	6	9	21	3	7		25	
Simuliidae	C	40	14		15	23	29	30	22	8	62	
Tipulidae	C	2	3			3	1					
BEETLES (Coleoptera)												
Hydraenidae	C		2							1	2	
Agabus guttatus	C			1								
Elmidae	C	6	37	62	26		3	46		22	41	22
F/W SHRIMPS (Crustacea)												
Gammarus sp.	C	46	11		30		1			21		
SNAILS (Mollusca)												
Ancyclus fluviatilis	C				3					15	15	
Sphaeriidae	D	1	2	1								
WORMS (Annelida)												
Oligochaetae	E	17	37	2		22	24	2	8	3	14	2
LEECHES (Hirudinea)												
Trocheta spp.										1	3	
FLATWORMS (Tricladia)												
Indet.	D					1						

	2014						2018						
	O4	O5	O6	O7	O9	O11	B4	B3	O9A	O2	O3	O4	O7
MAY FLIES (Ephemeroptera)													
Ephemera danica													F
Heptageniidae:													
Rhithrogena semicolorata				F		+		C					C
Ecdyonurus sp.		+	C	F			F/C	N/D	C/N	F	F/C	+	N
Heptagania sp.				+	D	F							
Seratella ignita		C	C	C	C	C							
Siphonlurus sp.													
Baetis rhodani	E	E	D	C	N	C	+	C	C/N	N	D	C/N	F/C
STONE FLIES (Plecoptera)													
Perla bipunctata					C								
Chloroperla sp.					F								
Isoperla sp.						+	F/C	F	+			F/C	F
Nemouridae:													
Amphinemoura sp.		F				+							
Protonemoura spp.				F			C	F	F/C	F	F	+	F
Brachyptera risi													
Nemoura sp.													
Leuctra spp.	F	C	C	F		F	F	+		+			
CADDIS FLIES (Trichoptera)													
Goeridae				+			F/C		F	F/C			+
Sericostoma personatum						+							
Leptoceridae													+
Rhyacophilidae	C	C	F	F	C	F	F/C	F/C	F		F		
Hydropsychidae				C		F/C		F/C	F		F	F	C
Glossosomatidae:													
Agapetus sp.				+									
Glossosoma sp.					F								
Polycentropidae	F	F					+						
Philopomatidae								+					
Limnephilidae:													
Potomophylax spp.													
Limnephilid indet.										F			
TRUE FLIES (Diptera)													
Dicranota sp.			F	F		F							
Chironomidae	C			F	C	F						F	
Simuliidae	D	C	F	F	F	F/C	F	F	C/N	C		C/N	
Tipulidae									+	+			+
BEETLES (Coleoptera)													
Scirtidae													
Hydraenidae						F			F/C	F			
Haliplidae			F										
Elmidae	C	N		N		C	C/N	F/C	C	F	F	F	C
Water Mites													
F/W SHRIMPS (Crustacea)					C								
Asellus						+/F							
Gammarus sp.				C		C		F	+	F/C			F
SNAILS (Mollusca)					F								
Ancyclus fluviatilis								F	+	+			F
Lymneae peregra													
Sphaeriidae				+									
Hirudinae (Leeches)													
Trchochaeta													
WORMS (Annelida)													
Oligochaetae			F	+		F		+	+	+	F	F	+

+ = Present (one or two individuals), F = Few (5%), C = Common (6-20%), N = Numerous (21-50%), D = Dominant (51-75%) E = Excessive (>75%)

2019	O1	O2	O3	O3A	O4	O4A	O5	O5A	O6A	O7A	O7B	O8A	O9A1
MAY FLIES (Ephemeroptera)													
Ephemera danica													
Heptageniidae:													
Rhithrogena semicolorata													
Ecdyonurus sp.			C/N	C	+		N	N/D	C/N	N	C/N		
Heptagania sp.										+	+		
Seratella ignita							+		F	F	F/C		
Siphonlurus					+								
Baetis	N	D	C/N	F/C	N	+	N	C/N	N	C	C	F	C
STONE FLIES (Plecoptera)													
Perla bipunctata													
Chloroperla sp.													
Isoperla sp.				+				+	+				
Nemouridae:						N							
Amphinemoura sp.													
Protonemoura spp.		C	C/N	F	F		C/N	+				F	
Brachyptera risi													
Nemoura sp.													
Leuctra spp.	C	+	F	C	C	F/C	F	F	C/F	C	F/C	N	C/N
CADDIS FLIES (Trichoptera)													
Goeridae				+	+/F					+		+	
Sericostoma personatum											F		+
Leptoceridae											F/C		
Rhyacophilidae	+			C	F		F	F/C	F	F/C	+/F	+	F
Hydropsychidae									F	F	+/F		
Glossosomatidae:									+	F/C	F		
Agapetus sp.													
Glossosoma sp.													
Polycentropidae				F	F	F/C	+	+	+			C	F
Philopomatidae													
Limnephilidae:										+			
Potomophylax spp.													
Limnephilid indet.						+	+					+	+/F
TRUE FLIES (Diptera)													
Dicranota sp.		+			+			F/C	F	F		+	
Chironomidae						+			+/F	F	+		
Simuliidae	C/N	F	C/N	F	C/N	C	C/N	C/N	F	F		C/N	+/F
Tipulidae													
BEETLES (Coleoptera)													
Scirtidae				+	+		+	F/C				+	
Hydraenidae													
Haliplidae													
Elmidae		F	C/N	F/C	C		C/N	F	+/F	C	C/N	+	F
Water Mites							F		+	+	F/C		
F/W SHRIMPS (Crustacea)													
Asellus													
Gammarus sp.		+								+	C	+/F	C
SNAILS (Mollusca)													
Ancyclus fluviatilis											+		+
Lymneae peregra											+		
Sphaeriidae													
Hirudinae (Leeches)													
Trchochaeta											+		
WORMS (Annelida)													
Oligochaetae	+	+	+				+			F	F		

+ = Present (one or two individuals), F = Few (5%), C = Common (6-20%), N = Numerous (21-50%), D = Dominant (51-75%) E = Excessive (>75%)

Appendix 8-3 Macroinvertebrate Sampling Site Descriptions and Photos

13/10/11 (Water levels in falling flood)				
Site	**Depth (cm)**	**Substrate**	**Velocity**	**Notes**
O1	-	Cobbles and large stones on gravel	swift/turbulent	much iron scum (with black organic layer under scum)
O2	10-20	Boulder on loose sand, heavily embedded, little loose material	swift/turbulent	heavy moss and liverwort cover
O3	-	Boulder and cobble on coarse sand	swift/turbulent	water coloured. Moss and liverwort present
O4	10	cobble and coarse sand	swift/turbulent	clear, coloured. Some algal scum
O6	10-20	boulders, small cobble & pebble	diverse turbulent swift & slacker areas	moss on small boulders
O9	10-18	small cobble and pebble	riffle (mod/swift)	no plant cover
B1	15	small cobble & pebble - loose	riffle (mod/swift)	no plant cover, evidence of localised cattle access
B2	10-12	small cobble & pebble & coarse sand - loose	riffle (mod/swift & swift)	much moss and liverwort
B4	-	embedded boulder & cobble, little pockets of gravel only (& coarse sand)	riffle/glide swift/turbulent	heavy moss cover on boulders
B5	-	embedded boulder & cobble, little pockets of gravel only	swift/turbulent	moss covered boulders
D1	-	Boulders on coarse sand and fine gravel	swift/turbulent	moss and liverwort cover.

Plate 1A-1F October 13th 2011: A=O1, B=O2, C=O3, D=O4, E = O6, F=O9

Plate 1G-1K October 13th 2011: G=B1, H=B2, I=B4, J=B5, K=D1

30/7/14 (low to very low flow – conditions quite stressed, some sites low suitability for kick sampling due to reduced velocity and depth) e.g. could not take a sample at O3

30/7/14					
Site	**Width**	**Depth (cm)**	**Substrate**	**Velocity**	**Notes**
O4	1.5-1.8	2.5-7	cobble, pebble & sand (glide/shallow riffle)	mod/turbulent	some peaty iron flocks present, some moss & liverwort cover1-5%
O5	3.3	5-7	small cobble & pebble with fine gravel	mod/swift, riffle/cascade	FGA on stones (~5%, liverwort on boulders (~10%)
O6	4.2	7-15	cobble & pebble	mod/swift/turbulent, riffle/cascade	clear, coloured, no peat silt
O8	7-8	7-12	small cobble & pebble	mod/swift, riffle/riffle-run	*Myriophyllum* in slack flow u/s, FGA & BG marginally (<5%) moss & liverwort on boulders
O10	4-6	15-20	cobble, pebble, coarse sand	mod/swift turbulent (weir/cascade)	
O11	wide	~10	small cobble, large pebble, coarse sand	mod/swift turbulent, riffle	*Ranunculus* common, liverwort on boulders, FGA-trace

FGA = filamentous green algae, BG = blue-green algae

Plate 2A-2F July 30th 2014: A=O4, B=O5, C=O6, D=O8, E=O10, F=O11

10/10/18 Moderate - low flow summer, peat silt in evidence			
Site	**Substrate**	**Velocity**	**Notes**
O2	embedded small boulder & lge cobble, with gravel and sand	moderate	all substrate covered in a n intact layer of peat silt (~1-3mm)overlain in places by a fine tracery of algal filaments.
O3	bedrock and embedder cobbles with pockets coarse sand and gravel	mod/turbulent	liverwort with a heavy coating of peat silt/scum (less than at O2)
O4	small and medium cobble & lge. gravel with pockets of fine gravel and coarse sand	mod/swift in riffle/cascade, mod in shallow pool/glide	scattered liverwort and moss on larger substrate elements. Peat scum recorded on cobbles but not noted in photos
O7	cobble & gravel	mod/swift (rifle, riffle/glide)	Fontinalis squamosa, liverwort and FGA present, loose peat silt coating in marginal areas
O9A	cobble & gravel, with coarse sand	mod-mod/swift, riffle & shallow glide	
B3	boulder & cobble dominated with pockets of gravel & coarse sand	mod/swift turbulent, short glide/runs	good moss and heavy liverwort cover, some peat silt in moss
B4	boulders and cobbles with small pockets of gravel and coarse sand	mod/swift turbulent	heavy cover of F. squamosa and liverworts on larger substrate elements. Water clear, silt free and very coloured

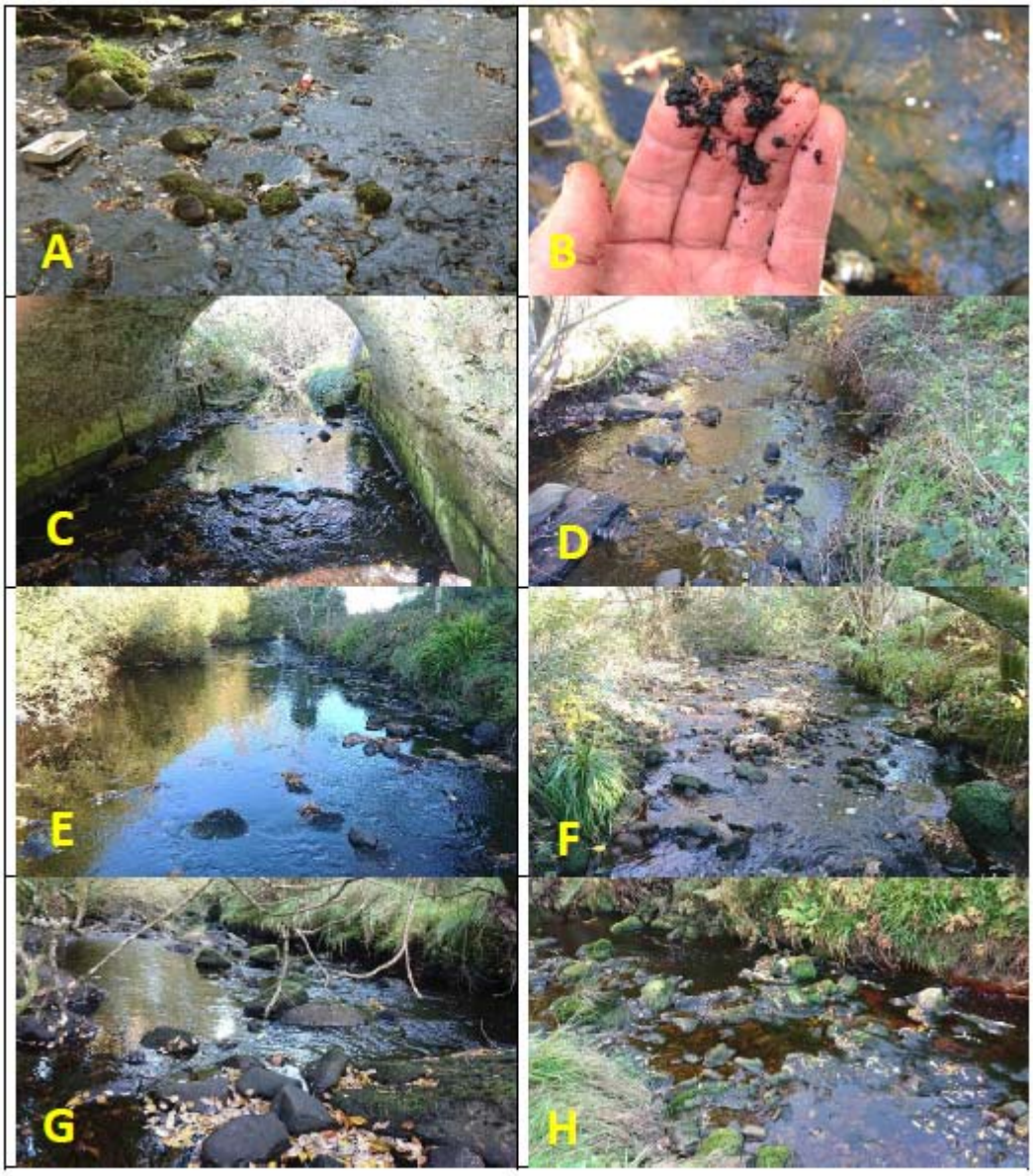

Plate 3A-3H October 10th 2018:A=O2, B=O2 (peat coating), C=O3, D=O4, E=O7, F=O9A, G=B3, H=B4

Macroinvertebrate sampling sites descriptions 2019 (1/8/19, 15/8/19, 15/9/19, 22/12/19)

1/8/19					
Site	**Width**	**Depth (cm)**	**Substrate**	**Velocity**	**Notes**
O6A	3	10-15	cobble (dom.) & pebble	mod/swift turbulent, riffle	very occ. *F. antipyretica* and liverwort on lge. cobbles
O7A	4.5-5	8-18	cobble (dom.) & pebble	mod/swift turbulent, riffle/run	shaded side of channel with much *F. squamosa* and liverwort, elsewhere plant-free
O7B	3	5-10	small cobble & lge. gravel (dom.)	mod/swift turbulent, shallow short riffle	plant free in kick-sample area
B4B	0.7-1.2	5-10	small cobble & gravel	mod/swift	clear and coloured, heavy liverwort cover on cobble
B4C	0.8	5-10	pockets of clear granitic sand and gravel between embedded, liverwort covered cobbles	moderate?/riffle	very difficult to obtain a sample due to shallow flow and embedded cobble substrate
15/8/19					
O1	1.5-1.7		small boulders and embedded cobble & large gravel	mod/swift turbulent	iron bacterial & peaty biofilm with some FGA on all substrate
O3A	1.5	10-15	cobble & v large pebble	swift/turbulent and laminar riffle/run & glide	mainly plant-free
O4	1.3-1.5	5-15	cobble & lge. pebble	mod/swift, riffle & shallow glide	*F. fontinalis* & *F. squamosa* and liverwort on lge. cobble
O4A	0.5-0.7	10-15	cobble & lge. Pebble (embedded)	mod-mod/swift	pronounced biofilm, peaty deposit & iron scum, liverwort present
O8A	1.7	5-20	med & small cobble, with gravel and clean coarse sand	mod-mod/swift	scattered liverwort
O9A1	3	10-15	med & small cobble and lge. pebble	swift/turbulent	much liverwort cover, no biofilm

Site	Width	Depth (cm)	Substrate	Velocity	Notes
O9A2	2	10-15	med & small cobble and lge. pebble	swift/torrential	Liverwort & moss, fine algal scum
O9B	1.5	5-15	embedded cobble with pockets of coarse pebble	swift/torrential	some moss & liverwort
B1B	0.4-1.2	13-17	boulders and lge. embedded cobble & pebble with pockets of sand	stepped pools/cascades	heavy liverwort cover in places
B2A	0.4-1	6-8	angular pebble & sand/fine gravel between embedded cobble	mod/swift	scattered liverwort on cobble, no biofilm
D1A			scattered boulders, lge. And medium cobbles and lge. Pebble & gravel	mod/swift turbulent	
15/9/19					
O2	2.4-3	10-17	cobble and boulders very embedded with tiny pockets of gravel	mod/swift turbulent	heavy peaty organic iron scum on cobble with very fine tracery of algal filaments, with scattered silted moss and liverwort on boulder and cobble
O3	1.2-1.8	10-20	dominated by embedded cobble with a small amount of embedded gravel	mod/swift turbulent (?)	liverwort on large cobble mainly at waterline
O5	2.2-2.8	6-7	mix of large cobble (60%) lge. Pebble (30%) and scattered small boulder (10%)	mod/swift turbulent	*F. squamosa* and liverwort on scattered lge. cobble/boulder, at or below the waterline. Very coloured.

Site	Width	Depth (cm)	Substrate	Velocity	Notes
O5A	3	5-12	pebble 60%, cobble 40%	mod/swift turbulent	Scattered liverwort cover on larger substrate, trace of FGA.,. Coloured.
B2	1.9-2.4	8-12	pebble (60%) small cobble (40%)	mod-mod/swift turbulent, 100% riffle	*Vaucheria*, *F. squamosa* and liverwort fairly common.
B3	4.5-5	12-20	cobble & boulder dominant, tiny pockets of pebble	mod-swift turbulent/torrential	very coloured; good cover of liverwort on and below waterline.
B3A	4-5	12-20	massive boulders, cascade with tiny pockets of pebble	mod/swift turbulent	heavy moss and liverwort cover; difficult to kick-sample
B4	3-3.6	5-12	cobble 50%, pebble 40%, boulder 10%	mod/swift turbulent	good cover of F. squamosa and liverwort on lge. Cobble and boulders, fine FGA cover on shallow cobble
22/12/19					
OHL 1	1-2?		cobble 60%, coarse sand 40%	mod-mod/swift run	heavy liverwort cover in places
OHL 2	1-1.5	18-25	gravel 70%, small cobble 30%	mod/swift, glide/riffle-run	largely plant-free
12/1/20					
O4B	1	8-12	cobble 40%, gravel 60%	swift (100% riffle)	plant-free instream

Plate 4A-4F **August 1st 2019: A=O6A, B=O7A, C=O7B, D=B4B, E=B4B, F=B4C**

Plate 5A-5F **August 15th 2019: A=O1, B=O3A, C=O4, D=O4A, E=O8A, F=O9A1**

Plate 5G-5K **August 15th 2019 contd: G=O9A2, H=O9B, I=B1B, J=B2A, K=D1A**

Plate 6A-6F **September 15th 2019: A=O2, B=O3, C=O5, D=O5A, E=B2, F=B3**

Plate 6G-6L **September 15th 2019: G=B3A, H=B4, December 22nd 2019: I=OHL1, J=OHL2, January 12th 2020 K = O4B (u/s Barrage 1), L = O4B close-up**

Appendix 8-4 Lough Cutra Sediment Photos (2019)

CU 1 – subsample for drying for granulometry

CU1 – portion of field sample

CU2 – sample in the field (note hard agglomeration of clay and coarser material beneath water on the right with an organic matrix on the left.

CU2 – portion of mineral residue after washing (1mm sieve)

CU2 – organic content (removed from granulometry sample – not sieved)

CU 3 – subsample for drying for granulometry

CU 3 – washed residue (1mm sieve)

CU5 – subsample for drying for granulometry

CU 6 sample in the field

CU 6 subsample for drying for granulometry

CU 8 sample in the field

CU 9 subsample for drying for granulometry

CU 10 sample in the field

CU 10 subsample for drying for granulometry

CU 10 residue after washing trough a sieve (1mm sieve)

CU 11 in the field

CU 11 Subsample for drying for granulometry

CU 11 washed organic residue (1mm sieve)

Appendix 8-5 Electrofishing Results (2011, 2014, 2019)

Numbers and Length of Fish in Centimeters (2011 Surveys September 26th & 27th)

O1	O2	O3	O4	O5A		O6		
No Fish	No Fish	1 eel (22cm)	No Fish	Trout		Trout		
				Pass 1	Pass 2	Pass 1	Pass 2	Pass 3
				9.8	0	10	22.7	0

O9

Trout		Loach		Lamprey	Eel
Pass 1	Pass 2	Pass 1	Pass 2	Pass 2	Pass 2
16.9	0	6.5	6.5	11	20
16.5		11.2	4.9	11	
		6.2	5.7		
		6.3	6.8		
		7.2	5.9		
		7.1	6.2		
		8.4	8.2		
		6.9	7.3		
		6.6	7.1		
		5.9	7		
		7.2	6		
		6.5			
		7			
		6			
		7			

D1

Trout				Minnow
Pass 1	Pass 2	Pass 3	Pass 4	Pass 1
16.4	8.1	7.5	13.6	4.4
6.5	7.6	7.4	7.6	
9.2	6.4	9	6.8	
8.3	14.2	8.2		
8	7.3			
6.7	7.7			

B1

Trout		
Pass 1	Pass 2	Pass 3
6.4	8	0
8		

B2

Trout		
Pass 1	Pass 2	Pass 3
19.5	13.9	16.2
7.1	8.2	6.9
12.7		
7.4		
6.6		
7.3		

B4

Trout		
Pass 1	Pass 2	Pass 3
17.3	16.9	0
17	6.7	
13.8		
6.9		

B5

Trout		
Pass 1	Pass 2	Pass 3
17.2	15.8	12.3
16.6	17.3	12.7
16.6	12	
12	11.8	
15.9	13.7	
	7.3	

2011 (Electrofishing Sites – Physical Characteristics & Photos)

Site	L(m)	W(m)	A(m^2)	AD cm (max)	Substrate	Habitat Obs.
B1	35	1.42	50	21 (40)	gravel 40%, cobble 30%, silty/peaty gravel 20%, peat 10%	80% shallow glide, 20% riffle/run. v. coloured
B2	35	1.5	53	20 (47)	cobble 60%, gravel 20%, boulder 20% ,	pool 50%, riffle 30%, glide 20%, much liverwort, v coloured
B4	35	3.43	120	19 (65)	boulder 40%, cobble 40%, gravel 15%, sand 5% - high moss cover	~equally divided between cascade, riffle, riffle/run, glide/run, glide and pool , high moss cover - very coloured
B5	30-40	7.25	254-326	23 (45)	cobble 40%, gravel 35%, boulder 20%, sand 5%	riffle/run 80%, glide 20%- heavy moss cover
D1	30-40	3.6	108-144	21 (25)	mainly riffle and riffle run	
O1	~30	1.1	~33	11 (30)	swift flow over bedrock and cobble.	iron scum on moss and algae.
O2	30-40	3.4	102-137	14 (30)	boulder 50%, cobble 35%, fine gravel/sand 15%	shallow run 60%, riffle 20%, cascade 10%, glide 10%
O3	30	2.4	72	19 (50)	boulder 50%, cobble 10%, rock 15%, sand & gravel 25%	
O4	41	2.2	90	14 (25)		riffle 70%, pool 30%
O5A	30	2	99	12 (20)	boulder 15%, large cobble 45%, gravel 40%	riffle/cascade 100%
O6	45	24.4	178	21 (45)	boulder 25%, cobble 35%, gravel 30%, sand 10%	glide 55%, pool 20%, cascade 15%, riffle 10%
O9	44	15	660	25 (45)	boulder 10%, cobble 30%, gravel 40%, sand 10%	

L=length, W=width, A = area, AD = average depth

Plate 7A-7H Sept 26th/27th 2011: A&B=O1, C=O2, D=O3, E=O4, F=O5A, G=O6, H=O9

Plate 7I-7N Sept 26th/27th 2011: I=B1, J=B2, K=B4, L=B4 u/s Br., M=B5, N=D1

Numbers and Length of Fish in Centimeters (2014 Surveys July 17th)

O5

No fish

O4

No Fish

O6

Trout		
Pass 1	Pass 2	Pass 3
13.3	14	
18.4	14.4	
12		
17		
15		
12.9		
14.6		

O8

Trout			Stone Loach		
Pass 1	Pass 2	Pass 3	Pass 1	Pass 2	Pass 3
16.2	15	17	6.5	7.6	6.3
14.1	11.5	13	7	8	6
6.7	8	7.5	5	6.6	6.7
6.6	11.6	12	8	7.3	7
6.5	12.7	12	6.9	7.4	8
6.5	12.5	7.4	7.2	6	7.2
7	6.6	7.1	6.8	5	7
16	7	7.1	6	7	6
12	11.5	7.5	7.8	7.1	6.2
12.8	13	7.7	7	7	
	6.6	12.1	5.7	6	
	12.4		7	7.3	
	6.1		8.2	6.5	
Lamprey			7	8	
Pass 1	Pass 2	Pass 3	6.9	6.5	
8		4	6.5	7.1	
		9	7.3	6.8	
			7.2	7.2	
			7.1	7.6	
			2.4	7.1	
			6	6.5	
			5.5	5	

Numbers and Length of Fish in Centimeters (2014 Surveys July 17th)

O10

Trout				Stone Loach		
Pass 1	Pass 1	Pass 2	Pass 3	Pass 1	Pass 2	Pass 3
12	13.6	20.4	12	7.5	8.5	6
14.1	6.4	11.9	6.5	8	7.6	12.6
12.8	11	6.8	12.1	8	7	6.9
13.5	10	10.4	12.5	5	7.5	7.3
12.6	7	16.3	6.9	6	8	7.8
16	6.5	12	7.5	6.9		6.5
15	6.4	12.6		6		7.5
15	6	16.7		6		8
13.6		6.5		6		
11		7.3		7		
12.6		6.6		7.3		
14		7.4		7.2		
14.1		7.1		7.4		
14.2						
12.5				Eel		
7				Pass 1	Pass 2	Pass 3
12.6						30
7.6						
7						
7.2						
11.8						
12.6						
6.4						
6.6						
12.5						

O11

Trout				Stone Loach	Lamprey
PASS 1	PASS 1	PASS 1	PASS 1	PASS 1	PASS 1
4.7	6	6.7	13.9	11.5	11
5	6	6.8	14	5.5	
5.1	6	6.9	14	5	
5.2	6	6.9	14.3		
5.2	6.1	7	14.6		
5.3	6.2	7	15		
5.4	6.2	7	15.4		
5.4	6.2	7	16.5		
5.4	6.3	7	17.6		
5.5	6.4	7	17.7		
5.5	6.4	7	18.4		
5.6	6.4	7	18.5		
5.7	6.4	7	18.6		
5.7	6.4	7.1	18.6		
5.8	6.5	7.5	19		
5.8	6.5	7.8	19.3		
5.8	6.5	8	22.3		
5.8	6.5	8	23		
5.8	6.5	8	25.8		
5.8	6.6	11			
5.8	6.6	11.5			
5.8	6.6	11.8			
5.9	6.6	12			
5.9	6.7	13.1			
6	6.7	13.5			

2014 (Electrofishing Sites – Physical Characteristics & Photos)

Site	L (m)	W (m)	A (m^2)	D	Substrate	Habitat Obs.
O4	30-40	1.3-1.8	40-70	pool 15-20, riffle 3-7		glide/pool 60% riffle/run 40%
O5	49	1-2	50-100			bedrock pools and short rock chutes, small cobble cascades
O6	64	3.16	202	pools 20-50	Boulder/cobble/bedrock dominant, gravel scarce	
O9	39	8.7	338	riffle 11-12		riffle, riffle/run 100%
O10	32	6.1	195	run 18-20, glide/run 30-40	u/s br. cobble boulder dominated, d/s br. cobble & gravel dom.	good moss and macrophyte (Myriophyllum) cover
O11	53	9.7	514	riffle 5, pool 35-80, pool/glide 40		very diverse mix of habitats

L=length, W=width, A = area, D = depth

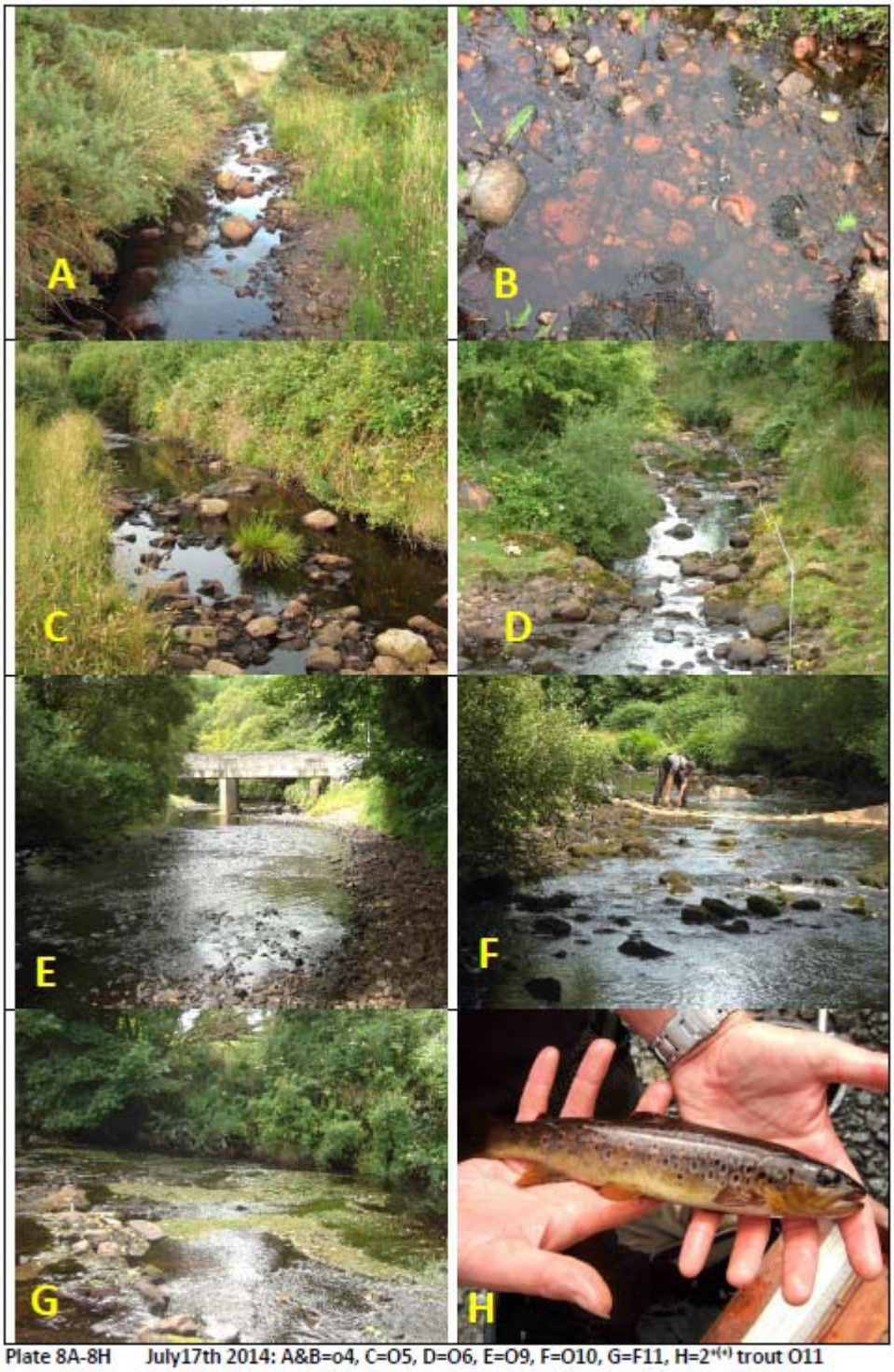

Plate 8A-8H July17th 2014: A&B=o4, C=O5, D=O6, E=O9, F=O10, G=F11, H=2$^{+(+)}$ trout O11

Numbers and Length of Fish in Centimeters (2019 Surveys September 21st & 22nd)

O2	O3				O5	O5A	O6
Trout	Trout		Stone Loach		No Fish	Trout	Trout
Pass 1	Pass 1	Pass 2	Pass 1	Pass 2		Pass 1	Pass 1
16	10.6	8.5	8	0		~25	16
14.1	10						9.5
8							

O6A

Trout			Stone Loach		
Pass 1	Pass 2	Pass 3	Pass 1	Pass 2	Pass 3
12.5	13.5	17	10	6.6	7
8.8	14.2	12	7.5	11	10
9.6	9.2		6.2	6.1	7.7
8.4	10.2		7	8	8
7.7	7.6		7.4	7.1	6.6
			10.5	7.8	6.8
			7.8	5.6	6.2
			7.5	7	
			7.4	6.2	
			6.4	6.5	
			7.2		
			8		
			6.5		
			7		
			7.4		
			7.5		
			6.5		
			8.2		
			8.5		
			7.6		
			7.1		
			6.6		
			6.9		

O6A

Stickleback			Lamprey		
Pass 1	Pass 2	Pass 3	Pass 1	Pass 2	Pass 3
4.1				14	
4.8					

Numbers and Length of Fish in Centimeters (2019 Surveys September 21st & 22nd)

O7A

Trout			Stoneloach		
Pass 1	Pass 2	Pass 3	Pass 1	Pass 2	Pass 3
22.5	23.2	14	6	7.8	9.7
19.1	14	8	9.5	9.4	8.6
20	15.6	8	7	9.6	6.6
15	14.5	8.1	8	7.7	7.1
17.5	16.3		10.5	8	6.5
17.6	14.1		8.1	7	7
14.4	13		8	7.6	6.8
14.1	9.7		6.4	6.8	7.2
9	9.4		7.6	7.6	7.4
8	9.8		6.7	7	6.2
9.4	8.4		6.5	8.5	5.6
8.3	8		10.5	7.7	
8.4	7.7		7.1	7.5	
7.8	7		8.1	6.1	
7.7			6.4	6.3	
8			8.7		
8.5			7.6		
8.5			8		
9.2			8		
8.6			9		
7.5			7.3		
7.8			7.5		
7.6			6.6		
8.5			7.8		
8.2					

O7B

Trout			Stone Loach			Lamprey		
Pass 1	Pass 2	Pass 3	Pass 1	Pass 2	Pass 3	Pass 1	Pass 2	Pass 3
19.5	14.8	17	7.9	7.2	7.2			10.5
19	12	17.1	6	7	10.2			9
19	13.7	8	6.5	6.1	5.1			
14	13	7.7	9.6	7.1	8.4			
14.6	7.7	7.8	10.5					
13.7	8.9	8.3	9.4					
12.8	8.9		7.2					
13	8.1		10.6					
11.7	7.6		7.8					
13	7.2		8					
13.6	7.3		8					
6.7	7.5		8.1					
8	7.5							
6.6	7.1							
7.9	7.7							
7.8								
7.7								
7								

Numbers and Length of Fish in Centimeters (2019 Surveys September 21st & 22nd)

O7C

Trout			Stone Loach			Stickleback		
Pass 1	Pass 2	Pass 3	Pass 1	Pass 2	Pass 3	Pass 1	Pass 2	Pass 3
18.8	13.5	20.2	9	5.3	6.2			3.6
17.7	12.1	15.7	5.6	5.8	6.9			
15.7	14.8	12.9		8.8	6.4			
12.8	13.6	12.6		6.5	7.1			
11.8	16	8.8		6.8	8.3			
12.6	12.5	10.7			6.4			
14.5	12.6	8.7			7.5			
12.5	12.2	7.7						
13.8	9	8.2						
7.7	16.7	7.4						
8	7.1							
8.5								
7.8								

B2

Trout		
Pass 1	Pass 2	Pass 3
12.5	8.8	8.4
13.2	8.8	8.6
9.3	7.4	8.3
8		
9.9		
8.2		
7.6		
7.4		
7.3		
9		
7.6		
8.2		

B4

Trout	
Pass 1	Pass 2
19	17
19.8	14
15.9	
17.5	
13.5	
14	
11.1	

2019 (Electrofishing Sites – Physical Characteristics & Photos)

2019	L(m)	W(m)	A(m^2)	D (cm)	Substrate	Habitat Obs.
O2	38	2.5	95	pool 20-40	embedded lge. cobble & boulder 90%, lge. pebble 10%	riffle/run 50%, glide/run 50%, iron bacterial scum on substrate
O3	30	2	60	pool 40-50	cobble 70%, pebble 30%	riffle/run 60%, pool/glide 40%
O5	37	2.8	103.6	glide/run 10-20, glide/pool 30	lge. cobble, scattered boulder 60%, bedrock 25%, grave l& coarse sand 15%	glide/run 100%, very coloured
O5A	40	1.5	60	stepped riffle/cascade 25, pool 60+	Embedded boulder and cobble 75% gravel 25% occasional bedrock	stepped pool/cascades sequence of boulders and cobbles
O6	47	2-3m			cobble/boulder 90%, pebble 10%	riffle/run/cascade 80%, pool & glide/pool 20%
O6A	38	2.4		pool/glide 25-40	cobble 70%, pebble 30%	riffle/run 65% pool/glide 35%
O7A	32.5	6.8	221	pool, 40-60	cobble 70%, pebble 30%	riffle 20%, pool 25%, glide/run 55%
O7B	33	4		riffle 10-20, pool/glide 40-50	coarse pebble and scattered cobble and boulder	riffle 25%, pool/glide 75%, very coloured
O7C	25	4.7	120	riffle 10-15, pool/glide 40-60	cobble 70%, gravel 30%	glide/pool 65%, riffle 35%, very coloured
B4	50	2.8	140	pool under the bridge 30-50	cobble & boulders	cobble/boulder cascade, run dominated, glide/pool under bridge, very coloured
B2	45	2.3	103.5	riffle 10-15, pool/glide 20-30	pebble 60%, small cobble 40%	40% riffle, 60% shallow glide

L=length, W=width, A = area, D = depth

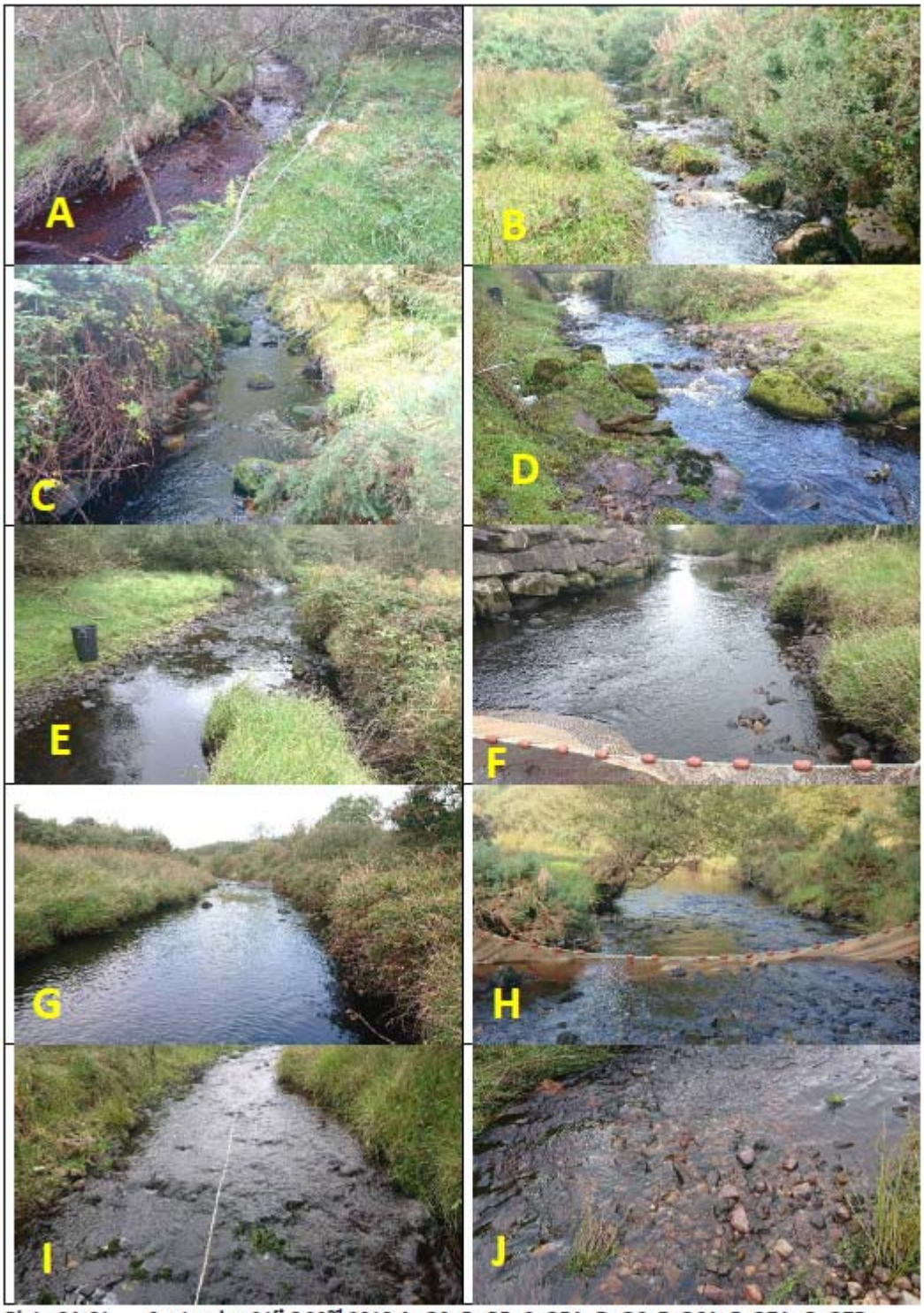

Plate 9A-9J September21st &22nd 2019:A=O2, B=O5, C=O5A, D=O6, E=O6A, F=O7A, G=O7B, H=O7C, I&J=B2

Plate 9K-9P September21st &22nd 2019: K&L=B4, M=0+ trout B2, N=1+ trout O6, O=2+ trout O7C, P=2+(+) trout O5A.

Appendix 8-6 Galway County Council Historic Water Monitoring Data

Galway County Council Historic Monitoring Data (Data from Galway County Council)

Water Analysis Results from Galway County Council from Water Samples Taken between October 2003 and January 2004 in the Owendalulleegh/Beagh/Cannahowna Rivers and Gort Water Supply

Location	Date	Day	Colour	Turbidity	pH	Suspended Solids mg/l
Black Road						
	18/10/03	Saturday				700
	23/10/03	Thursday				76
	01/11/03	Saturday				690
	12/11/03	Wednesday	over range	334	5.35	354
	14/11/03	Friday	over range	285	4.36	
	18/11/03	Tuesday	over range	107	5.78	
	25/11/03	Tuesday	over range	91.3	6.75	116
	12/12/03	Friday	over range	63.8	5.68	
	09/01/04	Friday	over range	126.3	6.2	
	22/01/04	Thursday	349	25	7.82	
Flaggy Bridge						
	18/10/03	Saturday				0
	23/10/03	Thursday				200
	01/11/03	Saturday				1410
	12/11/03	Wednesday	over range	142	6.06	140
	14/11/03	Friday	over range	315	5.2	
	18/11/03	Tuesday	over range	102.4	6.66	
	25/11/03	Tuesday	over range	128.6	6.49	120

Location	Date	Day	Colour	Turbidity	pH	Suspended Solids mg/l
	12/12/03	Friday	over range	65.2	6.74	
	09/01/04	Friday	513	43	6.1	
	22/01/04	Thursday	322	20.16	7.44	
Tooraglassa						
	01/11/03	Saturday				230
	12/11/03	Wednesday	283	19.22	6.66	16
	14/11/03	Friday	over range	44.4	6.72	
	18/11/03	Tuesday	356	24.9	7.01	
	25/11/03	Tuesday	453	27.6	6.58	20
	12/12/03	Friday	383	29.8	7.13	
	09/01/04	Friday	282	15.14	6.1	
Inchamore bridge						
	30/10/03	Thursday				184
	01/11/03	Saturday				33
Derrywee bridge						
	18/10/03	Saturday				0
	23/10/03	Thursday				0
	31/10/03	Friday				172
Dereen bridge						
	18/10/03	Saturday				0
	23/10/03	Thursday				0
	24/10/03	Friday				24
Killafeen Bridge						
	18/10/03	Saturday				0
	23/10/03	Thursday				0
	01/11/03	Saturday				44
	03/11/03	Monday	over range	51.8	6.95	54
	06/11/03	Thursday	202	8.11	7.2	

Location	Date	Day	Colour	Turbidity	pH	Suspended Solids mg/l
	12/11/03	Wednesday	311	21.9	7.03	21
	14/11/03	Friday	497	48.4	7.21	
	18/11/03	Tuesday	252	17.73	7.18	
	25/11/03	Tuesday	106	3.05	6.78	1
	12/12/03	Friday	378	28.5	7.26	
	09/01/04	Friday	313	25	6.4	
	22/01/04	Thursday	83	3.28	7.31	
Cahills Bridge						
	03/11/03	Monday	517	34	7.24	27
	04/11/03	Tuesday	522	34.5	7.02	11
	05/11/03	Wednesday	over range	45.2	6.91	32
	06/11/03	Thursday	over range	40.8	7.12	
	07/11/03	Friday	over range	36.4	7.11	
	10/11/03	Monday	476	31.8	7.25	
	12/11/03	Wednesday	376	24.1	7.21	
	14/11/03	Friday	339	20.08	7.28	
	18/11/03	Tuesday	238	11.49	7.25	
	25/11/03	Tuesday	134	7.09	6.82	2
	12/12/03	Friday	168	4.49	7.21	
	09/01/04	Friday	171	4.33	6.72	
	22/01/04	Thursday	151	6.03	7.31	
Water Intake Gort						
	03/11/03	Monday	73	3.28	7.39	18
	04/11/03	Tuesday	377	23.1	6.85	13
	05/11/03	Wednesday	385	21.9	7.7	18
	06/11/03	Thursday	454	28.8	7.64	
	07/11/03	Friday	440	26.3	7.46	

Location	Date	Day	Colour	Turbidity	pH	Suspended Solids mg/l
	10/11/03	Monday	370	23.8	7.06	
	12/11/03	Wednesday	366	22.8	7.18	
	14/11/03	Friday	332	18.96	7.23	
	18/11/03	Tuesday	218	10.49	7.16	
	25/11/03	Tuesday	125	6.12	6.86	3
	12/12/03	Friday	142	4.08	7.34	
	09/01/04	Friday	170	4.32	6.97	
	22/01/04	Thursday	155	5.79	7.19	
Hydrant at Community Centre						
	03/11/03	Monday	17	3.43	6.85	1
	04/11/03	Tuesday	16	0.87	6.71	0
	05/11/03	Wednesday	27	2.6	6.7	0
	06/11/03	Thursday	37	3.38	6.85	
	07/11/03	Friday	47	2.5	6.82	
	10/11/03	Monday	30	1.68	6.83	
	12/11/03	Wednesday	57	2.97	6.95	
	14/11/03	Friday	58	3.08	7.07	
	18/11/03	Tuesday	56	2.8	6.83	
	25/11/03	Tuesday	25	1.31	6.96	
	12/12/03	Friday	33	1.74	7.34	
Gort Bridge						
	05/11/03	Wednesday	355	21.9	7.03	15
	06/11/03	Thursday	410	27.4	7.01	
Kiltartan Rising						
	05/11/03	Wednesday	204	9.39	6.96	5
	06/11/03	Thursday	202	8.37	7.02	
	07/11/03	Friday	213	10.34	7.01	
	10/11/03	Monday	210	10.18	7.07	
	09/01/04	Friday	177	5.4	7.23	

Location	Date	Day	Colour	Turbidity	pH	Suspended Solids mg/l
Coole River						
	05/11/03	Wednesday	174	6.87	6.83	3
	06/11/03	Thursday	203	9.14	7.04	
	07/11/03	Friday	191	6.37	7.07	
	10/11/03	Monday	191	9.36	7.18	
Kinvara Raw						
	06/11/03	Thursday	82	2.6	6.89	
	07/11/03	Friday	83	2.35	6.9	
	10/11/03	Monday	58	1.84	7.03	
	25/11/03	Tuesday	29	2.08	6.9	
Kinvara Treated						
	06/11/03	Thursday	59	2.97	6.89	
	07/11/03	Friday	66	2.88	6.95	
	10/11/03	Monday	54	1.61	7.07	
	25/11/03	Tuesday	22	1.69	6.9	

Appendix 8-7 – A3 Figures

See Vol 2 Section 3 for A3 figures