APPENDIX 5

Three Mile Water Monitoring Results

2.5 SURFACE WATER

2.5.1 Drainage Network

The Ballynagran site is drained in a southerly direction by three small streams that merge to form the Three Mile Water river. The river flows east and south to where it discharges into the Irish Sea south of Ardmore Point, approximately 6km southwest of the site (Figure 2.5.1). The ridge to the north and west of the site forms a catchment divide. The land to the northwest of this divide drains to the Vartry river which discharges to the sea 3km to the north of Wicklow Town.

Site drainage is shown on Figure 2.5.2. Two streams at the western end of the site and one to the east flow through the site in a southerly direction. Other drains on site are generally 1 to 2 metres deep and are seasonal. The eastern stream is known as the Long Ford stream. For ease of reference in this report the central stream is referred to as the Ballynagran stream and the westernmost stream called the Kilcandra stream after the townlands through which they pass.

2.5.2 Surface Water Quality

2.5.2.1 Biological Quality

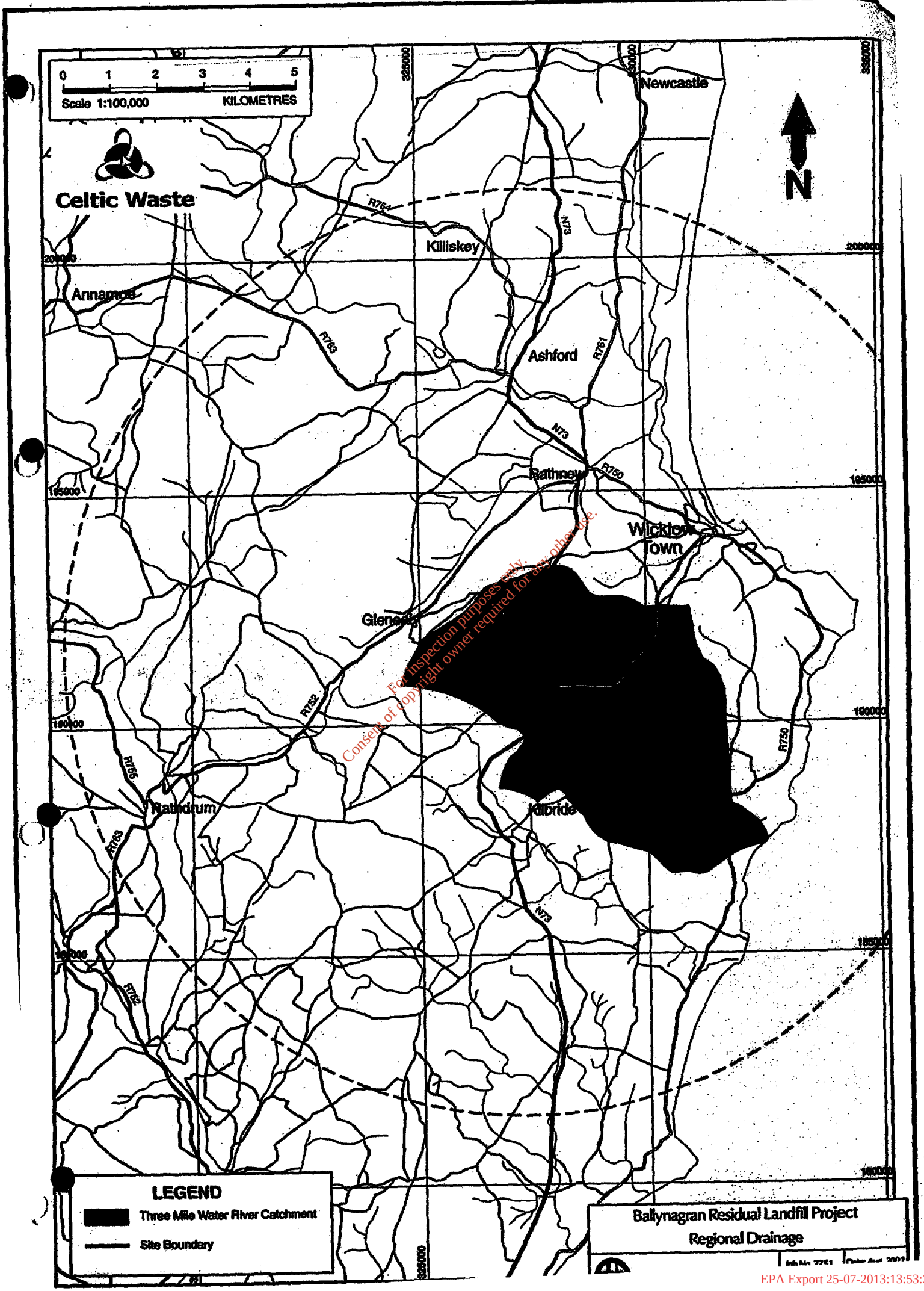
The EPA Water Quality Report for the period 1995-1997 indicated that the upper section of the Three Mile Water (station 0200 at N11 - SW6 on Fig. 2.5.3), was moderately polluted and the lower section (station 0500 bridge near Maherabeg) unpolluted in biological terms. In both 1990 and 1994 the upper section was found to be slightly polluted, whereas the lower section on each occasion was moderately polluted. The assessment of the river in the EPA report stated :

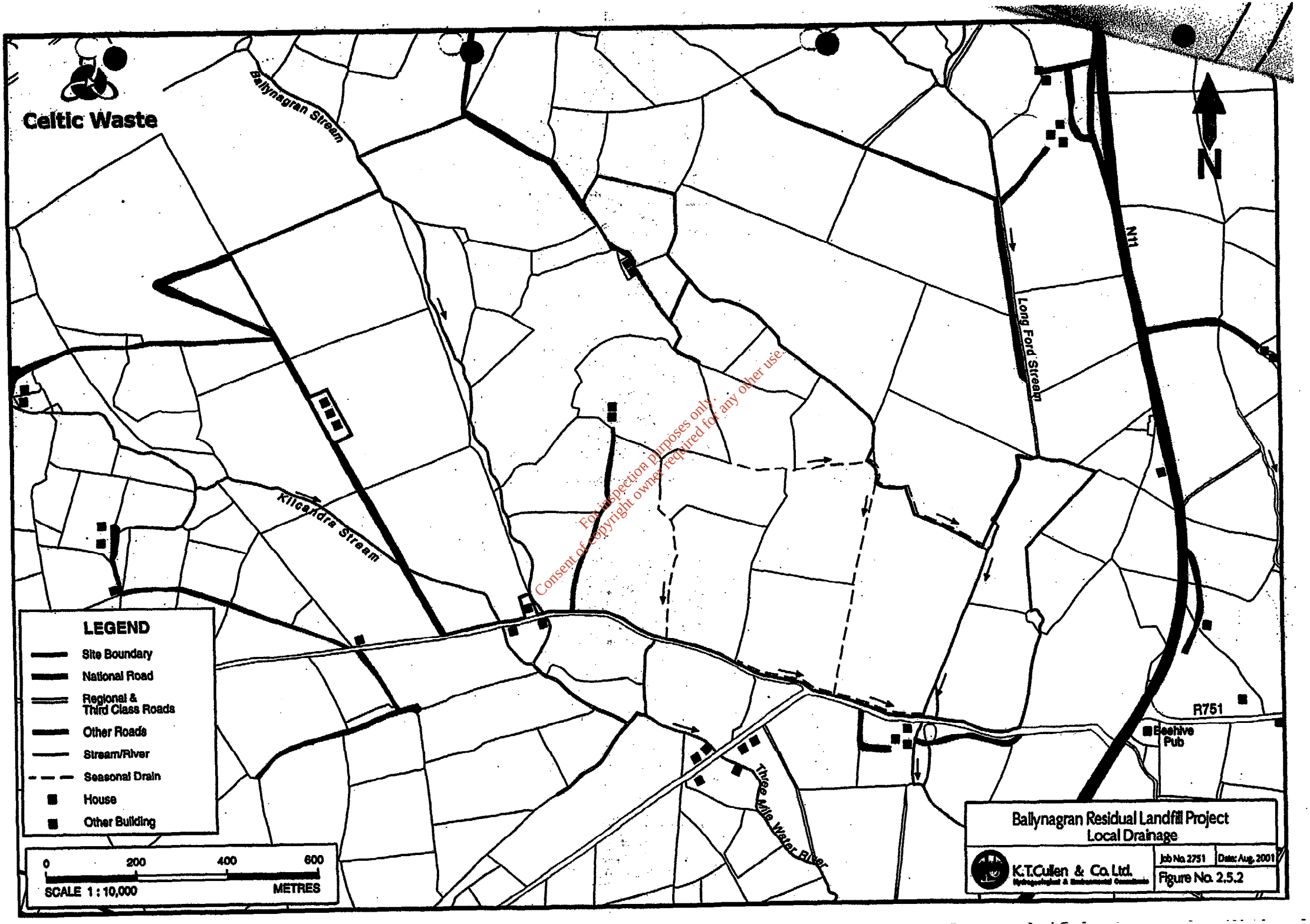
"The Three Mile Water was distinctly polluted by suspected agriculture related activities in its upper reaches (0200) but a marked improvement was recorded at the lowermost station (0500) where conditions were assessed as satisfactory in mid-June 1997."

A biological survey of the Three Mile Water and its tributaries in the vicinity of the site was carried out as part of this EIS and recorded moderately polluted to unpolluted waters. The details and results of this survey are discussed in Section 2.7.6.

2.5.2.2 Chemical Quality

Samples from seven stations on the Three Mile Water and its tributaries (Figure 2.5.3) were collected on 11th June 2001 and forwarded to Enterprise Ireland, Glasnevin, Dublin, for laboratory analysis. The results are presented in Table 2.5.1.





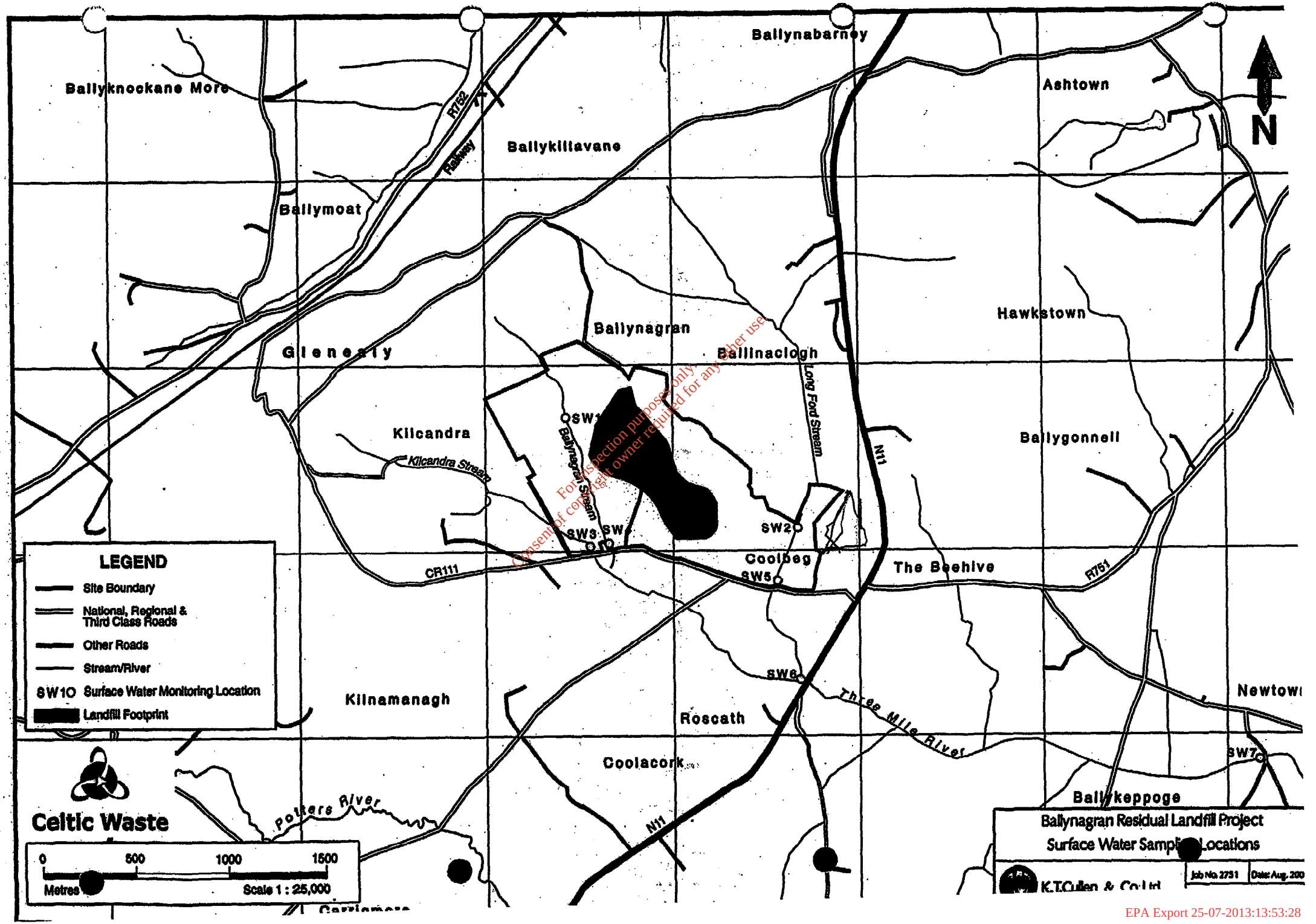


Table 2.5.1 - Surface Water Quality - Ballynagran, 11/6/01.

Parameter	Units	Three Mile Water River						
		SW1	SW2	SW3	SW4	SW5	SW6	SW7
pH	pH Units	7.2	7.2	7.5	7.6	7.5	8.1	8.2
Conductivity	µS/cm @ 20oC	185	265	185	195	270	230	340
Total Hardness as CaCO3	mg/l	69	109	69	83	112	97	159
Total Alkalinity as CaCO3	mg/l	36	68	38	55	64	64	125
Bicarbonate as CaCO3	mg/l	33	41	31	28	58	33	34
Calcium as Ca	mg/l	16	31	16	22	32	26	50
Magnesium as Mg	mg/l	7.1	7.6	7.2	6.9	7.8	7.7	8.3
Sodium as Na	mg/l	11	13	11	11	13	13	13
Potassium as K	mg/l	1.8	3.1	1.7	1.3	3.5	1.8	1.9
Iron as Fe	mg/l	0.03	0.13	0.07	0.08	0.18	0.07	0.08
Manganese as Mn	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper as Cu	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminium as Al	mg/l	<0.05	0.07	<0.05	0.06	0.15	<0.05	<0.05
Nitrate as NO3	mg/l	42	36	26	20	39	25	26
Nitrite as NO2	mg/l	0.12	<0.01	0.02	<0.01	<0.01	0.16	<0.01
Chloride as Cl	mg/l	24	34	25	23	34	30	30
Sulphate as SO4	mg/l	7	9.9	11	7.8	10	9.6	15
Total Ammonia as NH4	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Non-Purg. Org. Carbon as C	mg/l	2.3	2	2	3.1	2.1	2	1.6
Suspended Solids	mg/l	<10	22	<10	<10	14	16	<10
Arsenic	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Tin	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus	mg/l	<0.05	0.12	<0.05	<0.05	0.14	<0.05	<0.05
Zinc	mg/l	<0.01	<0.01	<0.01	<0.5	<0.01	0.04	<0.01
Cadmium	mg/l	<0.005	<0.005	<0.005	<0.01	<0.005	<0.005	<0.005
Lead	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cobalt	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	mg/l	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01
Boron	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Strontium	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.14
Barium	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

The relative proportions of major ions found in the surface waters at the site are similar to those found in the groundwater samples taken from the bedrock aquifer (Table 2.6.3 in Section 2.6). This suggests that each of the streams at the site is receiving groundwater discharges. The Long Ford stream (SW2 and SW5) is more mineralised than the two westernmost streams with higher levels of the major ions and subsequently higher conductivity and hardness. SW7 on the Three Mile Water at Newtown, approximately 3km downstream of the site, showed increased levels of major ions, suggesting that the influence of groundwater discharges on the river increases downstream.

The water quality was generally good in all samples and the level of each parameter complied with the A1 maximum admissible concentrations (MAC) for Irish surface waters (S.I. No. 294 of 1989). However, the two samples on the Long Ford stream (SW2 and SW5) found evidence of slight contamination in the form of elevated nitrate, chloride and potassium. These parameters are often elevated in surface waters in rural environments due to agricultural or domestic sources such as fertilisers, farmyard effluents or domestic effluents from septic tanks.

2.5.2.3 Historical Water Quality

The Three Mile Water, upstream of the N11 bridge, experienced serious pollution instances in the mid to late 1980s (MCOS 1996). Wicklow Co. Council conducted successful prosecutions in relation to these incidents. Monitoring by Wicklow County Council of the water quality in the river in the 1990s showed better results. A summary of results from 1994 to 2001 are presented in Table 2.5.2 below and the full data-set is included in Appendix 2.5.1. While there have been indications of minor contamination in the form of elevated BOD and ammonia the water quality has been good on most sampling occasions.

Table 2.5.2 Summary of Water Quality in the Three Mile Water from 1994 to 2001

Parameter	Unit	Minimum	Average	Maximum
Biochemical Oxygen Demand (BOD)	mg/l	0.6	2.14	6.1
Ammonia	mg/l as N	0.0	0.11	1.72
Nitrate	mg/l as N	2.1	4.62	6.58
Phosphate	mg/l PO4	0.04	0.23	1.201
pH	pH unit	6.75	7.32	7.88
Dissolved Oxygen (DO)	%	82	99	135

2.5.3 Surface Water Flows

The Three Mile Water river has a catchment area of approximately 28.5 km^2. Annual average rainfall for the catchment is approximately 1000mm (893mm in Wicklow Town and 1119mm in Glenealy 1961-1990). Effective rainfall in the catchment, after losses to evapotranspiration, is expected to be approximately 500 mm/annum. The total water available to the catchment including surface water run-off and groundwater recharge is therefore in the region of 0.45 m^3/sec.

Flow measurements carried out by M.C. O'Sullivan in the Winter of 1994/1995 found flows of 0.11 to 0.07 m3/sec on the Three Mile Water in the vicinity of the site and 0.08 to 0.03 m3/sec along the Ballynagran Stream. These measurements are only 'snapshots' of the streams and may not be representative of winter flows in the area.

There are no EPA long term river gauging stations on the Three Mile Water.