2 INTRODUCTION

2.1 Preamble

Throughout the world there is increasing awareness of the immediate and long-term detrimental effects on the natural environment brought about by man's activities. With the growing recognition that all natural resources are finite there is now much greater acceptance of the principle of balancing the needs of man and nature and conserving resources - *i.e.* the principle of sustainability.

Therefore, where significant developments are proposed, it is essential that a systematic examination be carried out to assess the likely effects such developments may have on the environment. This is desirable so as, firstly, to ensure that the development is environmentally sustainable and, secondly, to maximize the positive aspects while, at the same time, mitigating any negative effects of the project on the environment.

The proposed upgrading of the Carrickmacross Wastewater Treatment Works is a necessary step in the development of the area and the provision of the infrastructure required to achieve growth on a sustainable basis.

2.2 Environmental Impact Assessment

The Environmental Impact Assessment is an established procedure for examining the impact of new developments, which because of their size or nature have the potential to have a significant impact on the environment.

2.3 Definition of Scope

This present Study has been prepared for Monaghan County Council in accordance with the provisions of the following documents, namely:

1) Statutory Instrument No. 349 of 1989 - European Communities (Environment Impact Assessment) Regulations 1989 and (Amendment) Regulations 1994 (SI No. 84 of 1994)
2) Statutory Instrument No. 101 of 1996 - Environment Impact Assessment Regulations (Amendments)
3) Statutory Instrument No. 351 of 1998 - Environment Impact Assessment Regulations (Amendments)
4) Statutory Instrument No. 93 of 1999 - Environment Impact Assessment Regulations (Amendments)
5) Statutory Instrument No. 450 of 2000 - Environment Impact Assessment Regulations (Amendments)

6) Statutory Instrument No. 600 of 2001 - The Planning and Development Regulations 2001

The provisions of the above regulations identify project types that must be subjected to an Environmental Impact Assessment prior to the granting of the necessary approval for the project to proceed to construction stage.

The particular provisions of the Regulations applicable to this study are those pertaining to development by or on behalf of Local Authorities. The subject of this proposal, an extension to a sewage treatment works with associated disposal facilities, falls within the scope of paragraphs 11 and 13 of Part II of the First Schedule of S.I. No. 93 of 1999 - i.e. an extension (>25%) to a wastewater treatment plant with a capacity greater than 10,000 PE

In summary, the study in the following sections of this document addresses the following issues:

1) The necessity for providing an increase in the capacity of the sewage treatment works at Carrickmacross;
2) The information required in an Environmental Impact Statement as specified in Article 25 of S.I. No. 349 of 1989;
3) Compliance of the scheme with the relevant Plans and Directives including:
   a) The Carrickmacross Town Development Plan (Carrickmacross Town Council, 1999);
   b) Draft Discussion Report (Messrs. Cunnane Stratton Reynolds for Monaghan County Council, 2003);
   c) SI 254 of 2001, concerning urban wastewater treatment.

This E.I.S. has been prepared by T.J.O'Connor and Associates in conjunction with DHV Water (BV) and input from specialist consultants where appropriate.

The specialist consultants who contributed to this E.I.S. were:

Acoustic Associates	Noise study
Envirocon Ltd	Odour study
Aquens Ltd UCD	Flora and fauna studies
Archaeological Services Unit UCC	Archaeological Study

3 DESCRIPTION OF THE PROPOSED WORKS

3.1 Preamble

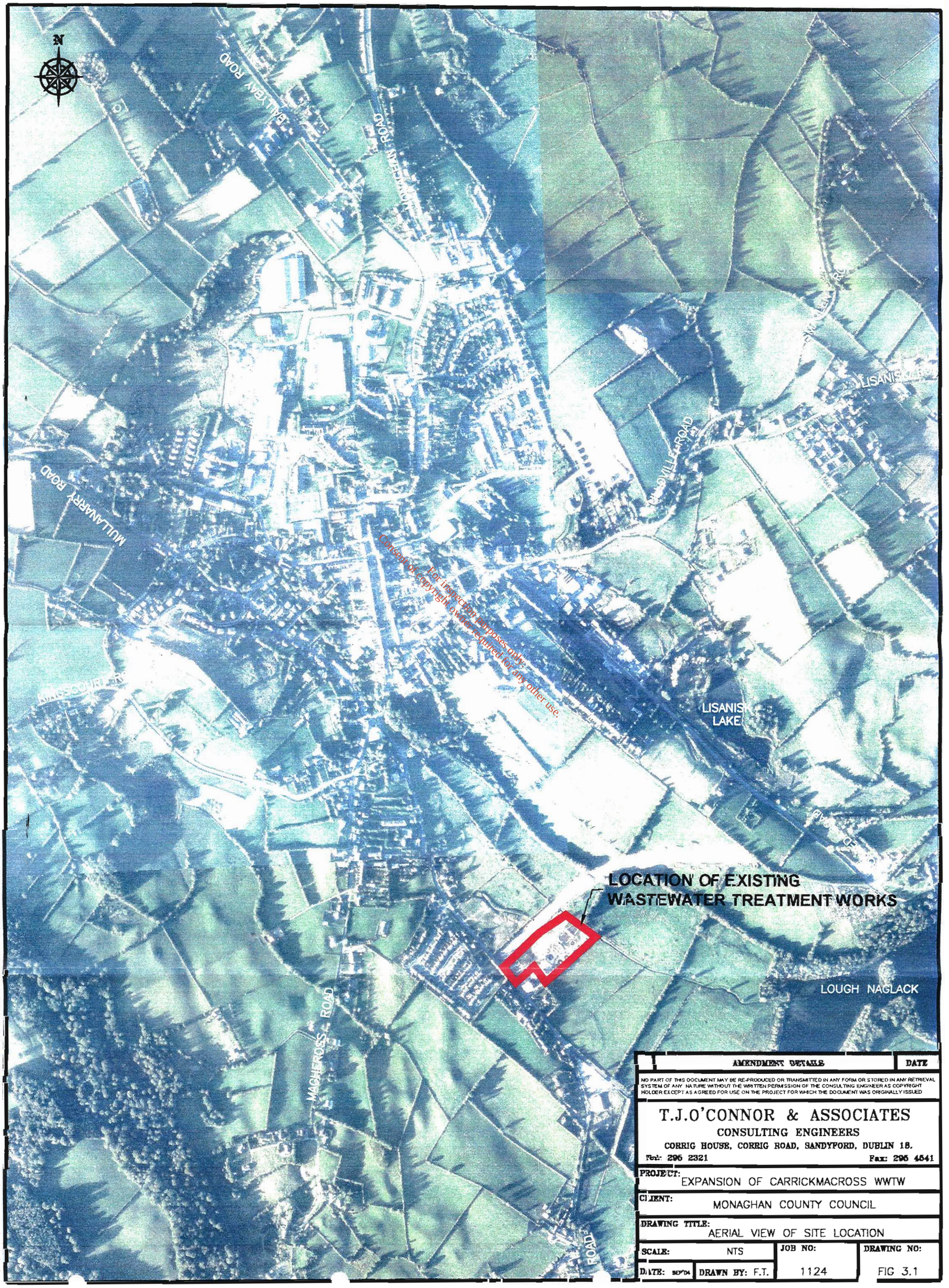
Carrickmacross is situated in County Monaghan on the banks of the River Proules and has been a thriving market town since the 18th century. After a severe decline in the post famine period, new industries came to Carrickmacross in the 1930's and 1960's. Of these Bose Ireland and Rye Valley Foods are now the major employers in the town. The urban district council for the town was established in 1899. Carrickmacross also hosts a number of primary and secondary schools.

Although Carrickmacross was not designated as a gateway or hub in the National Spatial Strategy, the government decentralisation programme proposes to relocate part of the Department of Social and Family Affairs to Carrickmacross. This combined with the present expansion in economic activity and the completion of the M1 motorway will result in substantial growth of the town in the coming years. Furthermore, the Carrickmacross bypass was recently finished and this has further reduced commuting times to north Dublin as well as taking N2 traffic out of the town centre. In other similar situations this has led to increased development of the town.

With the expansion of the town as described above, the flows arriving at the wastewater treatment works have increased markedly in recent years and the plant, though maintaining the effluent discharge standards, is operating well above its nominal design capacity.

Accordingly there is a need to increase the capacity of the treatment works to cater for the development of the town. The location of the existing works is shown in Figure 3.1.

A number of sites were considered as possible locations for the proposed wastewater treatment works, all of which are situated downstream from the existing site, either on the Proules River or the River Glyde. Each of these sites was assessed in detail as described later in this report; however, the site selected and the subject of this E.I.S. is the existing site of the WWTW at Ardee Road and adjacent lands as shown. The proposed site is ideally located, being separated from residential areas by the main road and the river, and yet reasonably close to both the source of the sewage (*i.e.* Carrickmacross town) and to the point of discharge of the treated effluent to the Proules river.



AMENDMENT DETAILS	DATE

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CONSULTING ENGINEERS
CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
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PROJECT:	EXPANSION OF CARRICKMACROSS WWTW
CLIENT:	MONAGHAN COUNTY COUNCIL
DRAWING TITLE:	AERIAL VIEW OF SITE LOCATION
SCALE: NTS	JOB NO: 1124
DATE: SEPT'04 DRAWN BY: F.T.	DRAWING NO: FIG 3.1

It is proposed to construct an extension to the existing treatment plant to provide treatment capacity for up to 30,000 PE in the first phase and a final capacity of 44,000 PE.

3.2 Carrickmacross Main Drainage Scheme

The sewerage system serving the town comprises a mixture of separate and fully combined drainage areas, with the town centre being mainly combined and the newer developments having separate foul and surface water systems. The main sewer conveying the discharges to the wastewater treatment works runs along the valley of the Proules River before heading east through the town centre where it connects with sewers serving the northern and eastern parts of the town. This sewer is 300mm diameter as it enters the wastewater treatment works but is 450mm for a length upstream of a combined sewer overflow on the Ardee Road. Topographical constraints dictate that there are a number of pumping stations on the system, both to the north and the south of the town.

The combined sewerage system is relieved at various points on the network by ten Combined Sewer Overflows (CSOs). These discharge to surface water sewers and culverts in storm conditions which in turn discharge to the Proules River or the headwaters of Lisanisk Lake in the north of the town. The overflows control the flow in the combined sewerage system and as a result there have been no known instances of serious flooding from the sewers in recent times. The final CSO on the system at the Ardee Road restricts the flow forward to the wastewater treatment works to around 48 l/s. This represents less than 3 multiples of the calculated dry weather flow and it is possible (but unproven) that discharges to the Proules could occur at the peak diurnal flowrate to the works in dry weather. This overflow is to be abandoned under separate proposals contained in a preliminary report for the Carrickmacross collection system.

Since June of 2001, the Proules River has been designated a ‘sensitive water’ for the purpose of the Urban Waste Water Treatment Directive (S.I. 254 of 2001) and nutrient removal at the wastewater treatment plant is now mandatory. Routine monitoring of the water quality of the Proules has been undertaken by the Environmental Protection Agency (EPA) and its predecessor over many years. In general terms this monitoring shows that the Proules is moderately polluted, particularly downstream of the town suggesting that the source of the pollution might include the overflows from the sewerage system.

The 1994 preliminary report recommended the complete abandonment of the overflows and various additional measures to upgrade the system to cater for the expected hydraulic loads. These measures mainly comprised upsizing of the main trunk sewer, the

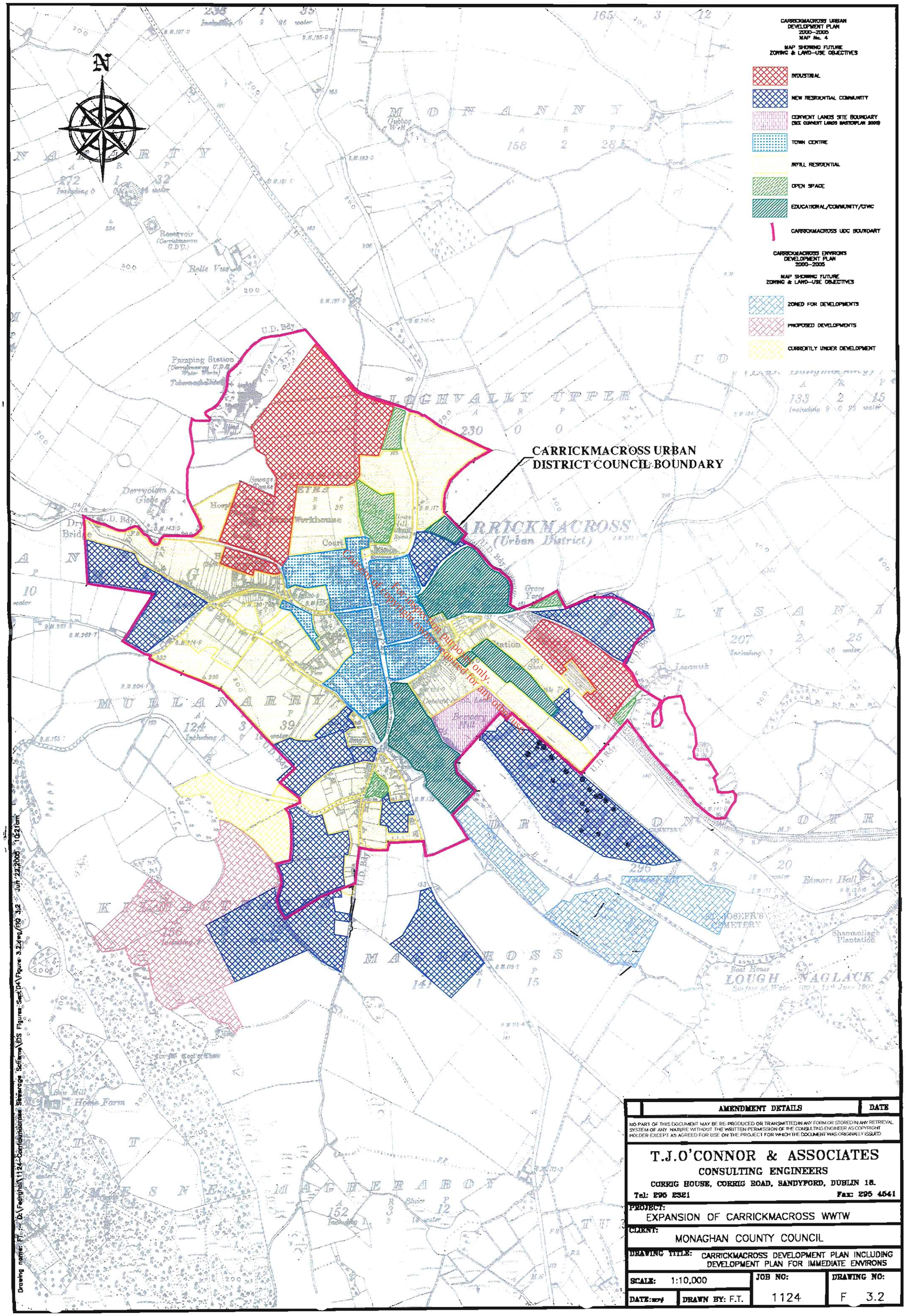
replacement of structurally damaged sewers identified from a CCTV survey, and upsizing of miscellaneous hydraulically deficient pipelines in various parts of the town. The basis of the hydraulic design of the remedial measures was a mathematical model of the existing system, which was amended to include proposed developments indicated by the planning officers and those designated in the local development plan. The output from the model of the existing system was checked against the results from a flow and rainfall survey (by others) in 2000. A comparison between the flows and depths predicted by the model in response to the recorded rainfall events and the flows and depths recorded in the actual sewers, showed that the model results were broadly representative and that the model would provide a reasonable but conservative basis for a detailed hydraulic design.

In addition to the increased flows in the combined system associated with the abandonment of the overflows, there is also expected to be significantly increased residential development both within and outside the town council boundary. The extent of the developments likely to take place has been assessed with reference to the Carrickmacross Development Plan of 1999 (see Figure 3.2), as well as planning applications submitted to both Carrickmacross Town Council and Monaghan County Council and more recently the implications of the draft discussion report prepared by Messrs. Cunnane Stratton Reynolds in 2003. With the abandonment of the overflows as recommended, and the connection of the new developments projected by the planning authorities, parts of the combined sewerage system are predicted to become severely overloaded, with flooding predicted from manholes at a number of points on the system for rainfall events with return periods of two years and less. Accordingly substantial upgrading measures will be required to accommodate the increased flows. The main trunk sewer in particular carries most of the flows generated in the town. It is currently relieved by 4 combined sewer overflows and their abandonment will significantly increase the flows to be carried.

A number of options were investigated to deal with these increased flows as listed below:

1. Increased separation of surface water from the combined system,
2. Upsizing the trunk sewer to provide increased hydraulic capacity,
3. Interception of branch sewers currently discharging to the trunk sewer and the provision of an alternative connection to the wastewater treatment works.

Option 1 was investigated and quickly emerged as being completely impractical. The older part of the town is the main source of surface water in the combined system and the works required would involve reconnecting a substantial number of individual house connections



AMENDMENT DETAILS	DATE

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PROJECT: EXPANSION OF CARRICKMACROSS WWTW

CLIENT: MONAGHAN COUNTY COUNCIL

DRAWING TITLE: CARRICKMACROSS DEVELOPMENT PLAN INCLUDING DEVELOPMENT PLAN FOR IMMEDIATE ENVIRONS

SCALE: 1:10,000	JOB NO:	DRAWING NO:
DATE:	DRAWN BY: F.T.	1124	F 3.2

to newly laid storm water sewers in a congested part of the town. It would not be possible to separate storm water from connections at the rear of properties in many instances.

Option 2, which was the preferred option in the 1994 preliminary report, involves completely relaying the main sewer from O'Neill Street/Farney Street to the wastewater treatment works. A number of options are considered for the upper section of this sewer given the route constraints imposed by new and infill developments since the preparation of the 1994 preliminary report.

Option 3 was investigated in detail and an alternative route to the wastewater treatment works via the Dundalk Road and the new bypass link road from the Ardee Road was considered. This route could convey flow to the wastewater treatment works under gravity. However deep excavations would be necessary along various sections of this sewer. Additionally it was found that this sewer could only intercept flows from a limited number of branch sewers and that the amount of flow that could thus be removed from the existing Proules trunk sewer would not be sufficient to allow this sewer to be retained. Accordingly work to the trunk sewer along the Proules River would still be necessary under this option albeit at a smaller diameter.

Option 2 above emerged as being the preferred means of accommodating the extra flows although the construction of the trunk sewer along the line proposed in the 1994 report at Main Street was found to be impossible. A number of means of conveying the flow onward to the wastewater treatment works were investigated to overcome the problems with the previously defined route at Main Street, namely tunnelling and pumping. The tunnelling option was investigated in detail but was found to be impractical for a number of reasons most particularly geotechnical considerations, overlying buildings and suitable locations for drive shafts and reception pits. As a result, the final proposal now includes for the construction of a sewage pumping station off Chapel Lane to pump flows along Main Street up to a new gravity sewer on Castle Street with a second pumping station sited on the Shercock Road which pumps along Mulanarry Street to a gravity sewer on Mulanarry Road. Both of these sewers link at the bridge and continue to the wastewater treatment works. It is proposed to rehabilitate the existing sewer along the Proules for approximately 450m of its length.

For the surface water system, works to the existing storm water culverts on Main Street, Castle Street, Shirley House Lane, Parnell Street, O'Neill Street and Farney Street are proposed. These works will see the old masonry culverts abandoned with new circular

sewers laid on the invert of the existing culverts. Other works to the surface water system will include upgrading works to increase the capacity of the main surface water sewer from lands off Chapel Lane traversing the town park and discharging to the Proules River close to the site of the towns' original treatment works.

3.3 Existing WWTW

The existing wastewater treatment plant serving Carrickmacross is located approximately one kilometre to the southeast of the town, adjacent to the Ardee Road. A layout of the existing treatment works is included in Figure 3.3.

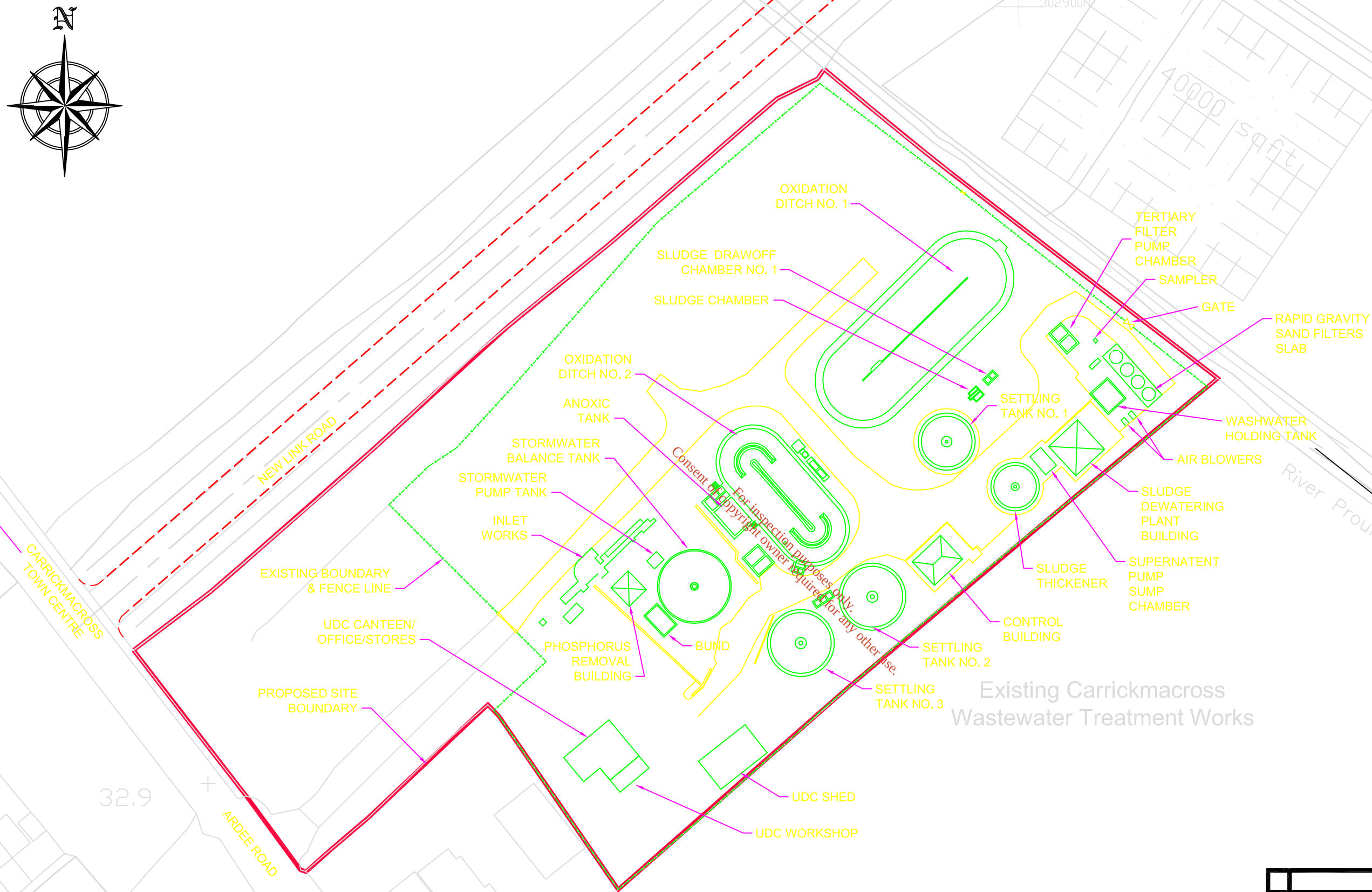
A treatment works has been located at this site since the early twentieth century. The development of the works to its existing form is described as follows:

- The original works consisted of six rectangular flat-bottomed settling tanks, four circular biological filters and two humus settling tanks.
- In the 1970s, this plant was decommissioned and replaced by an extended aeration plant consisting of preliminary treatment, an oxidation ditch, settlement tank and sludge drying beds.
- In the early 1990s, the plant was updated to provide operational flexibility and to minimise sludge handling and eliminate manual screening. Stormwater facilities, a sludge thickener and belt press with associated equipment and phosphorus removal equipment were constructed or installed. Furthermore, the inlet works, the oxidation ditch equipment and the plant controls were updated.

- As loadings continued to increase, a further upgrading of the works was completed in 1998. This work (referred to as Stage 3) included provision of an anoxic tank, a second oxidation ditch, 2 No. settling tanks and final effluent monitoring and sampling equipment.

- In 2004, a second sludge dewatering press and some additional aeration equipment was installed to provide a temporary solution to the plant overloading.

An examination of flows and BOD loads to the existing Carrickmacross plant suggests that the plant is treating flows in the region of 23,000 PE.



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	AMENDMENT DETAILS	DATE

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PROJECT: EXPANSION OF CARRICKMACROSS WWTW

CLIENT: MONAGHAN COUNTY COUNCIL

DRAWING TITLE: EXISTING SITE LAYOUT

SCALE:	JOB NO:	DRAWING NO:
1:1000	1124	FIG 3.3

DATE: SEP'04 DRAWN BY: F.T.

Photograph 3.1 – Stormwater Tank

3.3.1 Liquid Stream

Flows entering the treatment plant firstly undergo preliminary treatment where non-organic solids and floatable matter is screened out of the flow. The screenings are washed and compacted for disposal to landfill. Grit is removed from the flow in a subsequent treatment process.

A storm overflow facility is designed to allow flows up to a certain maximum (3 DWF) to pass forward for full treatment. The excess of influent is diverted to the stormwater holding tank. The overflow is via a side weir upstream of an actuated penstock controlled by the inlet flow measurement system. Storm water pumps return stormwater to the inlet works at times of low flow.

After preliminary treatment the flow gravitates to the secondary treatment stage, which comprises an anoxic tank, 2 No. oxidation ditches and 3 No. settling tanks.

Photograph 3.2 – Inlet Works

The main purpose of the anoxic tank is to promote the growth of bacteria with good settlement characteristics. It also acts as mixing chamber where the Re-circulated Activated Sludge (RAS) from the final settlement tanks is introduced to the flow from the preliminary treatment works. At the outlet from the anoxic tank, the flow (referred to as mixed liquor) is split between the two aeration tanks. The particular type of aeration tanks used at the Carrickmacross plant are often referred to as oxidation ditches in which plug flow conditions exist. These terms, aeration tanks/ oxidation ditch, are used interchangeably in subsequent descriptions.

In the oxidation ditches, biological processes convert the organic matter in the incoming wastewater into flocculent settleable biological and inorganic solids that can be removed in the sedimentation tanks. The process is based on provision of plug flow aeration conditions to provide extended aeration.

Photograph 3.3 – Oxidation Ditch No.1

The primary purpose of the secondary treatment stage is the combined removal of organic carbon and nutrients from the wastewater. For freshwater discharges, phosphorus is the key nutrient as it is the main cause of eutrophication in rivers and lakes.

Carbon removal is achieved by micro-organisms, which convert the colloidal and dissolved carbonaceous organic matter into various gases (e.g. CO_2) and into cell tissue.

Photograph 3.4 – Anoxic tank

In this plant, phosphorus is removed by a chemical process. Biological treatment, such as the conventional activated sludge process used at this plant, converts most phosphorus to the ortho-phosphate form. In this form the phosphorus can be removed by chemical precipitation using ferric sulphate, which is dosed into the wastewater stream at the inlet works.

Photograph 3.5 – Ferric Sulphate Storage Tanks

Mixed liquor from the aeration tanks/ oxidation ditches gravitates to the settling tanks. The function of the settling tanks is to separate the activated-sludge solids from the mixed liquor. In each tank the biological and inorganic solids settle to the floor of the tank, where they are scrapped to the central hopper. From here the sludge gravitates to sludge draw-off chambers. As the solids settle, the clarified supernatant overflows the outlet weir and gravitates to tertiary treatment.

Photograph 3.6 – Final Settling Tanks

From the settling tanks the clarified effluent gravitates to the tertiary treatment in the form of rapid gravity sand filtration. This is provided to achieve the required discharge standards of 10mg/l BOD and 10mg/l suspended solids.

Photograph 3.7 - Tertiary Sand Filters

Filtered effluent from the filters gravitates to the Outlet Flow Measurement and Sampling Chamber. From here the treated effluent discharges to the River Proules.

3.3.2 Sludge Stream

The source of sludge associated with the existing treatment process is the sludge generated by biological and chemical action in the aeration tanks. This sludge is directed from the settling tanks to a pumping station from where it is recycled to the oxidation ditches. In order to maintain the concentration of sludge within the specified limits, a proportion of the sludge is continuously 'wasted' after being drawn from the tanks and pumped to the sludge thickener.

Photograph 3.8 – Picket Fence Thickener

The existing Picket Fence Thickener (PFT) is a circular, hopper-bottomed type tank and is designed to increase the dry solids content of the sludge and reduce the volume of sludge to be dewatered. The tank operates in a similar manner to a conventional sedimentation tank. As the solids settle, the clarified supernatant overflows the outlet weir and gravitates to a pump sump chamber, from where it is pumped to oxidation ditch No.2.

The thickened sludge is pumped to the dewatering plant, which consists of sludge-feed pumps, polymer make-up and feed equipment, a sludge-conditioning tank (flocculator), a belt filter press, a sludge cake conveyor and a press washing facility. A second belt filter press was installed in 2004 to provide additional capacity and reduce the running hours of the existing press.

Photograph 3.9 - Belt Filter Press

Initially the sludge is pumped to the flocculator, where it is combined with the polymer. The polymer acts as a chemical conditioning agent, which results in the coagulation of the sludge solids and the release of the absorbed water. From the flocculator, the sludge passes to the Sludge Dewatering Press where it is pressed to around 20% dry solids

The dewatered sludge cake falls into a hopper at the end of the belt press and from there a screw conveyor transfers it to a trailer, for further treatment off site.

Photograph 3.10 – Screw conveyor discharging dewatered sludge to a tractor trailer

3.3.3 Odour Treatment

Odours from wastewater treatment works are due mainly to the presence of organic matter which decomposes under anaerobic conditions. This can result in the formation of hydrogen sulphide, organic sulphides, mercaptans and organic amines, which result in the characteristic odour associated with sewage. A previous odour and air quality study, found that a low level odour was present at the inlet works and the sludge dewatering building. Based on the findings of this study, the following odour control measures were implemented:

1. The relevant areas of the inlet works were covered. The air is extracted from this location and passed through a biofilter, where the air is scrubbed to remove malodours before being discharged to the atmosphere.

Photograph 3.11 – Inlet works with Odour Treatment

2. The second area of the works which has the potential to produce odours is the sludge treatment facility. The sludge dewatering equipment is housed in a building, but no odour removal equipment is provided.

3.4 Existing Flows and Loads

The existing flows and loads discharging to the WWTW at Carrickmacross have been estimated from a number of sources including census figures, metered water consumption readings, influent flow and Biochemical Oxygen Demand (BOD) measurement.

3.4.1 Historical Population Trends

The census data used in this section was taken from data collected by the Central Statistics Office over a period of 21 years, from 1981 to 2002.

Year	Carrickmacross Urban Population	Carrickmacross Rural Population	Carrickmacross Total Population
1981	1,768	2,169	3,937
1986	1,815	2,235	4,050
1991	1,678	2,295	3,973
1996	1,926	2,257	4,183
2002	1,964	2,540	4,504

Source: Census of Population 1981,1986, 1991, 1996 & 2002.

Table 3.1 - Population of Carrickmacross Urban, Rural and Total 1981 - 2002

Table 3.1 shows the population changes for Carrickmacross urban district, Carrickmacross rural area and the total population for Carrickmacross. Over the 21-year period considered the population increase amounts to approximately 14%. Between 1996 and 2002, according to the census the population increased by approximately 8%.

Year	Carrickmacross	% Change	Monaghan County	% Change
1981	3,937	-	51,192	-
1986	4,050	2.9	52,379	2.3
1991	3,973	-1.9	51,293	-2.1
1996	4,183	5.3	51,313	0.0004
2002	4,504	7.7	52,593	2.5

Source: Census of Population 1981,1986, 1991, 1996 & 2002.

Table 3.2 - Population Change in Carrickmacross and County Monaghan

3.4.2 Current Domestic Population

The most recent Carrickmacross Urban Development Plan provides much of the detail relating to housing stock and populations quoted below. The total number of dwellings discharging to the combined/foul drainage system in Carrickmacross was estimated at 1,482 in 2001. The occupancy rate for Carrickmacross is quoted to have been 2.73 in 2001. If this is applied to the estimate of the current housing stock, the resulting population of some 4,700 would tally reasonably with the 2002 census figures with an allowance for

increases in the housing stock since the census. At present, part of the Carrickmacross rural area is not serviced by the collection network. These unserviced areas include approximately 75 houses and so the actual total serviced population is estimated to be 4,500.

Based on the existing domestic population equivalent of 4,500, the resulting average daily flow to the plant is 810 m^3/d and the average daily BOD load is 270 kg/d.

3.4.3 Current Commercial Discharges

The town council holds comprehensive records of all commercial and industrial connections to the water supply and to the drainage system. These records were provided as part of a water conservation study undertaken by the council in 2000. The summary figure below represents the average daily consumption from 253 of the total of 260 such connections. The remaining seven discharge trade wastes under licence from Carrickmacross Town Council and are discussed separately in Section 3.4.6.

Based on the commercial discharges detailed above, the resulting average daily flow to the plant is 191 m^3/d and the average daily BOD load is 71 kg/d. These figures are estimated using the water usage rates and typical characteristics of commercial wastewater.

3.4.4 Current Institutional Discharges

There are six schools in Carrickmacross, three primary and three post-primary. The number of pupils in each school is listed in Table 3.3 below.

	No. of Pupils – 2002		
	Urban	**Rural**	**Total**
Secondary			
Patrician High School	150	276	426
St. Louis Secondary School	210	410	620
Vocational School	210	390	600
Primary			
St. Joseph's Primary School	190	51	241
St. Louis Primary School	270	65	335
Gael Scoil Rois	108	27	135
Total	**1138**	**1219**	**2357**

Table 3.3 - School Pupil Numbers

It is only necessary to consider discharges from pupils who do not reside within the Carrickmacross collection network area. This gives a total of 1,219 pupils, with a resulting daily effluent volume of 30.4 m^3/day and an organic loading of 9.12 kgBOD/day.

3.4.5 Current Industrial Discharges

There are seven licensed discharges to the collection system in Carrickmacross accounting for a total licensed discharge of around 720 m^3/day and 530 kgBOD/day. This is equivalent to 8,800 PE or almost 73% of the treatment plant design capacity. In addition, some of the industrial users exceed their licence limits.

The above figure is dominated by a single water user which deserves special mention. This is Rye Valley Foods, a major food processor in the town. The discharges to the collection system from this source has varied considerably over recent times with a particularly sharp increase recorded during the foot and mouth crisis of 2001 and a continuous increase since 2002.

In order to establish the scale of the hydraulic and biological discharges from Rye Valley Foods a series of flow/load surveys were undertaken during late 2003 and early 2004. The following table sets out the results of these findings:

	Survey Period No. 1 Sept / Oct 2003		**Survey Period No. 2 January 2004**	
	Average	Max	Average	Max
Rye Valley – hydraulic (m^3/day)	820	905	610	769
Rye Valley – biological (kgBOD/day)	851	956	570	1,260

Table 3.4 - Rye Valley Foods discharges

From the flow/load survey data obtained, it is clear that the hydraulic and biological loads from Rye Valley Foods can vary considerably. The average daily biological load varied between approximately 570 kgBOD/d and 850 kgBOD/d. The higher figure, which is equivalent to more than 14,000 PE, actually exceeds the total design capacity of the existing treatment works (729 kgBOD/d) and makes up almost 70% of the current load on the treatment works.

3.4.6 Infiltration

There are no records of continuous flow data available to examine the night-time flows on the combined/foul sewerage system and as a result there is no means of assessing infiltration to the system beyond the empirical formulae which express infiltration as a percentage of the other components of the dry weather flow. This percentage is commonly between 10% and 30%, though higher values are used in situations where there is evidence to suggest that a system is particularly infiltration prone. Infiltration flows are, in any case, rarely constant as they tend to fluctuate between winter and summer and between the occurrence of rainfall events.

For Carrickmacross some infiltration to the system was noted during the CCTV survey conducted as part of the 1994 Preliminary Report but infiltration was not generally noted as being a particularly severe problem. Accordingly it is proposed to take the average value from the above range of 20% which corresponds to a flowrate of approximately 400 m^3/day.

3.4.7 WWTW Records

Sampling and analysis of both the influent and the effluent from the WWTW at Carrickmacross are routinely undertaken for operational and compliance purposes. These analyses include parameters such as BOD, COD, ammonia and suspended solids. The flow of influent to the works is also recorded. By relating the flow records to the concentrations of pollutants in the influent, it is possible to estimate the total pollution load and thereby the Population Equivalent (PE) connected to the collection system. For the purposes of the Wastewater Treatment Regulations 1 PE is taken as 60g BOD.

The discharges to the works equate to a total PE of 23,000 and this figure has been adopted as the current load to the works.

The minimum load was 9,360 PE, while the maximum load of 43,000 PE was on the 11 June 2003. This maximum load was caused by a high flow (2,600 m^3/d) in combination with a particularly high BOD concentrations (990 mg/l).

3.4.8 Summary

The figures shown above, though derived from different sources show a reasonable level of consistency in terms of the flows and biological loads generated and the proportion of the domestic, non-domestic and infiltration elements of the total. Table 3.5 below provides

a summary of the figures that have been calculated as being the existing loads on the treatment works.

	Hydraulic Load (m^3/d)	Biological Load (kgBOD/d)	Total PE (based on BOD)
Domestic	810	270	4,500
Non-Domestic			
- Commercial	191	71	1,183
- Institutional	30	9	150
- Industrial	990	950	15,833
Infiltration	400	0	0
Total	**2,421**	**1,300**	**21,666**

Table 3.5 - Existing hydraulic and biological loads

3.5 Future Flows and Loads

3.5.1 Background

Carrickmacross Town Council and Monaghan County Council were consulted regarding proposed and potential developments both within and outside the town council boundary. It is clear from these consultations that there is considerable private sector interest in both residential and commercial development in Carrickmacross.

In order to coordinate decision making between the two councils and ensure that all development is consistent, Cunnane Stratton Reynolds were commissioned to prepare a Development Strategy for Carrickmacross. This strategy is intended to provide coordination of decision making and investment over a fifteen year horizon and will also set the development context for specific development plans for the town and the environs.

In 2001, the council adopted an urban development plan which designated (zoned) different areas of the town for particular types of development, within the boundary of the town. Under the plan, new residential development was to be permitted at six new sites around the town and also at existing residential areas with scope for infill.

In addition to the town development plan, the Monaghan County Development Plan covers the county administrative area including the environs of Carrickmacross. Outside the town boundary there has been considerable ribbon development along all of the approach roads to the town. It is a policy of the County Development Plan to discourage such

unserviced ribbon development. However, there have been a number of multiple unit developments outside the town boundary in recent years and new estates have been constructed off the Magheross Road, the Culloville/Rockdaniel Roads, the Castleblayney Road and others have been granted planning approval and are already under construction. Planning applications for some multiple unit developments have been refused in recent years because of concerns on the part of the County Council about the capacity of the existing collection system and the capacity of the wastewater treatment works and it is to be expected that these applications will be resubmitted following completion of the upgrading works proposed in this report.

It is believed that historical trends do not provide a realistic picture of the future population figures in the area under consideration for the following reasons:

- The present expansion in economic activity is increasing housing demand in population centres such as Carrickmacross.
- The completion of the M1 from Dublin to Dundalk has reduced commuting time to north Dublin to less than one hour.
- Work has recently finished on the Carrickmacross bypass, further reducing commuting times to Dublin and diverting N2 traffic from the town centre. In other similar situations this has led to an acceleration of population growth and investment.
- A significant factor inhibiting housing development in Carrickmacross has been the perceived inability of the existing treatment works to deal with any increase in the load and flow to the works.

3.5.2 Future Domestic Populations

The Draft Development Strategy Report prepared by Cunnane Stratton Reynolds was reviewed to determine the possible areas for residential development around the town of Carrickmacross. The strategy report proposes zoning extensive areas of land to the south of the town. In addition to these lands are areas adjacent to the Ballybay and Lisanisk roads which are already subject to a number of planning applications for large scale developments. It is estimated that all these areas, if zoned, would provide in excess of 290 hectares of residential development land. Assuming that these lands were to be developed at a rate of 20 housing units per hectare, with 2.7 persons per unit, then the 290 hectares would account for a population increase of 15,660. This would take the residential population of Carrickmacross to over 20,000.

3.5.3 Future Non-Domestic Loads

3.5.3.1 Future Commercial Loads

In an effort to estimate the future commercial loads it is assumed that the commercial loads would increase in proportion to the domestic flows, as per the existing ratio calculated at 1 PE commercial to 5 PE domestic. This ratio assumes that 20% of the existing commercial load results from domestic populations which reside outside the collection network area and so will not be subject to the same level of increase.

Taking the maximum growth scenario, with domestic populations increasing by 15,660 PE, the resulting commercial population equivalent increase would be 3,132 PE Assuming as previously that the BOD concentration of commercial wastewaters is comparable to domestic wastewater (300mg/l BOD) this would produce an additional daily commercial load of 188 kg of BOD or 564 m^3.

3.5.3.2 Future Institutional Loads

Since it is only necessary to consider discharges from pupils who do not reside within the Carrickmacross collection network area and since the populations in the rural areas surrounding Carrickmacross are not expected to increase due to the government's policy regarding one-off housing, etc. then it is assumed that there will be no significant increase in institutional loads.

3.5.3.3 Future Industrial Loads

In Section 3.4.6 it is estimated that Rye Valley Foods discharges upto 850 kgBOD/day, while the remaining non-domestic users with discharge licences are permitted to discharge up to 100 kgBOD/day. In accordance with discussions and agreements between Monaghan County Council and Rye Valley Foods a reserve of 950 kg BOD is proposed at the Carrickmacross plant.

With regard to the other industrial users it is proposed that the existing capacity be doubled to 200 kgBOD/day to provide spare capacity for expansion of the existing industries or the location of a new water-using industry within the collection network catchment.

3.5.4 Conclusions

Significant domestic and associated non-domestic development is to be expected in Carrickmacross over the coming years and a substantial increase in the capacity of the treatment works will be required to cater for the increased hydraulic and biological loads. Table 3.6 below provides an estimate of these increased loads and the capacity required to fulfil the planning objectives of the current development strategy.

	Hydraulic Load (m^3/d)	Biological Load (kgBOD/d)	Total PE (based on BOD) to 2027
Domestic	3,629	1,210	20,166
Non-Domestic			
- Commercial	777	259	4,317
- Institutional	30	9	150
- Industrial	1,200	1,150	19,167
Infiltration (10%)	560	0	0
Total	**6,196**	**2,628**	**43,800**

Table 3.6 - Proposed hydraulic and biological loads – max. growth scenario

The above estimate is based on the assumption that all of the land which is proposed to be zoned as residential will be fully developed within the 2027 design horizon. For this to happen the domestic population would have to increase at an average annual rate of some 15%. This is almost twice the total percentage increase which occurred between 1996 and 2002. If an assumed annual growth rate of 4.5% were applied then the domestic population would increase by almost 6,000 in the period to 2027.

Assuming a slightly reduced capacity for industrial discharges then a more modest increase in the total required capacity of the treatment works of 30,000 PE should be adequate.

It is not possible to forecast future population estimates over an extended period with any confidence as factors such as regional and national economic trends, fertility rates, life expectancy, etc. cannot be projected with certainty. However, the 30,000 PE and 44,000 PE projections above may be taken as representing alternative growth scenarios and as such place reasonable limits on the minimum requirements for wastewater treatment capacity for Carrickmacross. It is suggested therefore that the plant capacity could be

upgraded in phases with the first phase providing a capacity of 30,000 PE and a second phase taking the total to 44,000 PE, as and when the need arises.

3.6 Site for the Proposed Works

It is proposed to construct an extension to the existing works on adjacent lands at Ardee Road to take the capacity of the plant to 44,000 PE.

The reasons for retaining and expanding the existing site for the WWTW include :-

- There is already an existing WWTW present and use can be made of the existing assets present on the site;
- Wastewater treatment is already an established land use for the site;
- The collection system needs no modification to route the sewage flows to the current location;
- Factors mitigating against a move to an alternative site include the construction of lengthy rising main, costs and land acquisition. These are discussed in more detail in Section 4 of this report.

3.7 Effluent Discharge Standards

The proposed effluent discharge standard for the Carrickmacross WWTW has been established to take account of both statutory requirements under various regulations and of non-statutory water quality objectives for the Proules River. The statutory requirements include those under the Urban Wastewater Treatment Regulations, and the Phosphorus Regulations while non-statutory requirements include the assimilative capacity of the Proules River. The EPA has monitored the quality of the Proules River over many years and these results as well as the impact of the discharge from the WWTW under each of the above headings are discussed in Section 5 of this document. The following provides a summarised account of the import of the above and this is followed by a recommended effluent discharge standard.

Photograph 3.12 - Existing Outfall

3.7.1 The Urban Wastewater Treatment Regulations (UWWT)

These regulations have been in force in Ireland since 1994 and define minimum levels of treatment for wastewaters to be achieved by specified dates, depending on the population served and on the receiving water body. For Carrickmacross the requirements are stipulated in terms of maximum concentrations (95% of samples) of BOD (25mg/l), Suspended Solids (35mg/l), COD (125mg/l), and Total Phosphorus (2mg/l). The existing Carrickmacross plant is currently operating under the regulations and in general has consistently exceeded the requirements.

Significantly lower concentrations of certain parameters are proposed for the effluent in connection with other water quality objectives as described below.

3.7.2 The Phosphorus Regulations

These regulations (SI 258 of 1998) known as the Local Government (Water Quality Standards for Phosphorus) Regulations 1998, were brought into force to tackle a significant deterioration in water quality standards in Irish surface waters in the recent past and principally the problem of eutrophication. The regulations call for the maintenance or improvement of the standard of water quality in Irish rivers. The proposed increase in plant capacity would increase the phosphorus load to the Proules river, if the 2 mg/l standard as required under the UWWTD above were maintained.

Considering the above, it is proposed to specify a discharge limit which significantly reduces the daily phosphorus load from the treatment works, to the river and employing the 'Best Available Technology Not Entailing Excessive Cost' (BATNEC) principle. A design figure of 0.2 mg/l for total phosphorus concentration in the treated effluent would appear to be acceptable and achievable.

3.7.3 BOD Levels

As described above, the Urban Wastewater Treatment Regulations sets the discharge standards for BOD at 25 mg/l for plants with a population equivalent of more than 10,000. However, this would be a significantly poorer quality effluent than the current (self-imposed) discharge limit of 10 mg BOD/l. In order to determine the discharge standard appropriate to the receiving waters, it is necessary to consider the impact of the discharge, particularly in low flow conditions. To do this it is first necessary to establish the background BOD levels in the river upstream of the outfall and to estimate the low flow expressed as an exceedance probability (percentile).

The assimilative capacity of the river in respect of BOD, is usually taken as the ability of the river to accept a waste stream at a specified flow and strength, while maintaining a BOD level of the fully mixed waste/river water at no more than 4 mg/l. Because of the very low levels of dilution in the Proules River at the WWTW, a very high standard of treated effluent has been identified. Detailed calculations provided in section 5 of this EIS show that the required standard of effluent in respect of BOD is 4 mg/l.

3.7.4 Summary

Considering the Urban Waste Water Treatment Regulations, the various directives and associated regulations outlined above and the existing treated effluent discharge standards, Table 3.7 below summarises the proposed treated effluent standards of the upgraded treatment works.

Parameter	Concentration	Unit
BOD	4	mg/l
Suspended Solids	4	mg/l
Total Phosphorus	0.2	mg/l

Table 3.7 - Proposed Treated Effluent Discharge Standards

These proposed discharge standards combined with on-going reductions in agricultural discharges and the proposed decommissioning of the existing storm-overflows should

bring about substantial improvements in the quality of the Proules River in the coming years.

3.8 Proposed Treatment Process and Operation

Under the form of procurement proposed for the construction of the extension to the Carrickmacross works, the design will be open to tenders competing for a 'Design, Build and Operate' form of contract. Consequently the treatment processes, works layout and operational practices cannot be specified at this stage. Only those processes capable of meeting the effluent discharge standards and the other requirements identified in this E.I.S. will be accepted. For the purposes of this E.I.S. however, indicative designs have been prepared for the Carrickmacross works. It is anticipated that the successful design would have some or all of the following stages of treatment.

1) *Preliminary Treatment*

Preliminary Treatment of the incoming sewage will be carried out at a new inlet works, comprising screening of the sewage, to remove plastic and non-biodegradable matter, and grit removal. On removal, the screenings are washed and compacted for ease of disposal either to landfill. Grit is removed by a separate process and is washed during to ensure that any (malodorous) organic material is removed thereby leaving a clean material for disposal to landfill. The new inlet works will be housed in a building approximately 20m x 10m in plan and air extraction to a treatment unit will be provided for odour control. The maximum height of the inlet building is 15 metres.

The inlet works will be designed to cater for a maximum flow of 6 multiples of the ultimate domestic and non-domestic flows plus infiltration (6 DWF). The capacity of the treatment plant downstream of the preliminary works will be based on 3 DWF. This flow is usually referred to as the Full Flow to Treatment (FFT) and represents the hydraulic capacity of the treatment plant downstream of the preliminary treatment works. This flow is usually sufficient to cater for the usual daily (diurnal) variations in wastewater flows and would not generally be exceeded except in storm conditions. Under the phasing arrangement proposed, the capacity of the liquid stream downstream of the works will initially be based on 30,000 PE.

At the preliminary treatment works, flows in excess of the FFT will be spilled to a stormwater holding tank by a side weir overflow arrangement. There are various empirical rules used to assess the volume of stormwater storage required at WWTWs. The most common approach is to provide a volume equivalent to a flow of 3DWF for 2

hours. This equates to 1,452 m^3 at the ultimate (Phase II) load, which exceeds the capacity of the existing stormwater holding tank at some 450 m^3. A new stormwater holding tank with a capacity of around 1,000 m^3 will therefore be provided. When the influent flow is substantially decreased, the stored water will be pumped back to the the inlet works (downstream of the flow measurement) and subsequently undergo full treatment.

The preliminary treatment including the stormwater tanks will be designed and constructed for the final capacity of 44,000 PE, while the rest of the treatment plant will be extended and upgraded to cater for 30,000 PE.

2) *Secondary and Tertiary Treatment*

These stages comprise biological oxidation of the sewage by an activated sludge process followed by a solids separation stage. The proposals described are based on a common approach to biological oxidation however separate (alternative) methods of solids separation are proposed to illustrate the range of processes that could be offered.

The first stage of the process requires introducing a dense microbial population to the incoming wastewater under aerobic conditions in an aeration basin. Recirculated sludge from the final settlement tanks is mixed with wastewater from the preliminary treatment plant and the combined flow (referred to as mixed liquor) is split between the two oxidation ditches. Mixing would take place in an anaerobic selector tank, provided to promote the growth of bacteria with good settlement characteristics. In the oxidation ditches, compressed air from diffusers on the floor of the tank would rise through the mixed liquor causing oxygen to be dissolved and maintaining aerobic conditions. This oxygen is required by the aerobic micro-organisms for respiration but it also causes mixing and maintains the microbial flocs in suspension.

For the indicative designs, it is proposed to demolish the existing oxidation ditch No.1 and construct a new oxidation ditch with a volume of 2,300 m^3. Retention times in the oxidation ditches would be of the order of 12 hours. During this time the biological activity causes nutrients in the wastewater including dissolved and colloidal matter to be converted into harmless by products such as water, carbon dioxide and into new cellular material of the biomass.

Figure 3.4A is based on the mixed liquor from the aeration tanks being directed to a membrane reactor tank. This reactor would comprise a tank to hold the mixed liquor from the aeration tanks into which banks of small diameter hollow tube membrane cassettes are immersed in the tank. These tubes would collectively measure several kilometres and are connected to the suction side of pumps which maintain a negative pressure (sucking action) across the tubes. The tubes act in a similar manner to a filter or strainer with solids above a particular size being retained on the external surface of the tube. However the effective pore size at (typically) less than one thousandth of a millimetre (1 micron) is much smaller than conventional strainers or mechanical screens. The tubes are manufactured from specially designed plastics which permit water to pass through the tube (membrane). This water, referred to as permeate, is of a particularly high quality and is almost completely free of solid (particulate and colloidal) matter. The removal of solid matter has a consequential impact on BOD as these solids have an associated BOD load. To prevent the pores of the membrane from clogging-up (fouling), coarse bubble air diffusers on the floor of the reactor are used to create a scouring action on the surface of the tubes and remove solids. Additionally flow reversal with permeate being directed outward from inside the tubes causes any solids lodged to be blown out into the mixed liquor. The concentration of solids in the mixed liquor is maintained at a high level and regulated by continuous withdrawal of sludge. This sludge is subsequently recirculated to the influent to the aeration tank. However a surplus of sludge is always generated and this is 'wasted' by being pumped to the holding tanks (Picket Fence Thickeners) for disposal.

Figure 3.4B shows an alternative design to 3.4A above in which a final settlement stage is retained and a membrane reactor used as an effluent polishing stage. This process would be as described above except that the mixed liquor from the aeration tanks would be directed to one of three secondary clarifier tanks. The proposal would allow for the retention of two of the existing three clarifiers and the construction of a new larger clarifier to serve the new aeration basin as proposed above. The clarifiers allow the bacterial growths developed in the aeration tank to settle to the floor of the tanks. The tanks are fitted with scrapers that continuously rotate about the centre of the tank, directing clumps of the bacterial growths (sludge) to a central hopper from where it is conveyed to a pumping station. A proportion of the sludge is recirculated to the aeration tanks and the remainder pumped to the sludge storage tanks for dewatering and disposal. After the final settlement stage, the settled effluent would be directed to a reactor tank for filtration via similar hollow tube membranes as previously described. The effluent from the clarifiers would be drawn through the small diameter,

EXISTING HEDGEROW RETAINED

LANDSCAPED EMBANKMENT

INDICATIVE TREATMENT PLANT LAYOUT ALTERNATIVE 1 :

KEY

1. INLET WORKS
2. STORM TANKS
3. ADMINISTRATION BUILDING
4. BLOWER BUILDING
5. FERRIC STORAGE / DOSING
6. OXIDATION DITCH
7. INLET PUMP STATION
8. MEMBRANE BUILDING
9. CONTROL BUILDING
10. SLUDGE TREATMENT FACILITIES

	AMENDMENT DETAILS	DATE

T.J.O'CONNOR & ASSOCIATES
CONSULTING ENGINEERS
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PROJECT: EXPANSION OF CARRICKMACROSS WWTW

CLIENT: MONAGHAN COUNTY COUNCIL

DRAWING TITLE: INDICATIVE TREATMENT PLANT LAYOUT ALTERNATIVE NO. 1

SCALE: 1:500	JOB NO: 1124	DRAWING NO: FIG 3.4A
DATE: SEP'04	DRAWN BY: F.T.	

EXISTING HEDGEROW RETAINED

LANDSCAPED EMBANKMENT

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INDICATIVE TREATMENT PLANT LAYOUT ALTERNATIVE 2 :

KEY

1. INLET WORKS
2. STORM TANKS
3. ADMINISTRATION BUILDING
4. BLOWER BUILDING
5. FERRIC STORAGE / DOSING
6. OXIDATION DITCH
7. INLET PUMP STATION
6. MEMBRANE BUILDING
9. CONTROL BUILDING
10. SLUDGE TREATMENT FACILITIES
11. WEIGHBRIDGE
12. CLARIFIER TANK
13. PICKETFENCE THICKENERS

	AMENDMENT DETAILS	DATE

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CLIENT: MONAGHAN COUNTY COUNCIL

DRAWING TITLE: INDICATIVE TREATMENT PLANT LAYOUT ALTERNATIVE NO. 2

SCALE: 1:500		JOB NO:	DRAWING NO:
DATE: SEPT'04	DRAWN BY: F.T.	1124	FIG 3.4B

Drawing name: Fig 3.4B Mar 07 2006 4:48pm F:\PROJECTS\1124-Carrickmacross Sewerage Scheme\EIS Figures Sept'04\PROPOSED SITE LAYOUT - LO.dwg/FIG 3.4 B

hollow porous tubes which would be immersed in the settled effluent. A different (less expensive) type of membrane system could be used than proposed in Figure 3.4A to achieve the required standard of final effluent. The proposal would make greatest use of the existing tankage and would require a smaller reactor tank for the immersion of the membrane cassettes.

Phosphorous removal by dosing ferric salts upstream of the membrane plant is proposed in both of the indicative designs. This would causes the dissolved phosphorous to precipitate and to be filtered out by the membranes.

Either proposal would be capable of meeting the stringent final effluent discharge standards proposed.

3) *Sludge Treatment*

Excess sludge from the membrane reactors or the final settlement tanks will be removed to the Picket Fence Thickeners (PFT) to await de-watering. The indicative design provides for the retention of the existing PFT and the construction of a second for the storage and thickening of excess sludge. The PFT thickens the sludge by slow rotation of a metal frame (picket fence) causing drainage paths to be opened up and consolidation (thickening) of the solids present in the sludge. The thickened sludge is pumped from the PFT to the belt presses for de-watering.

4) *Buildings*

In addition to the existing buildings/superstructures, the following buildings may also be provided:

a) New preliminary treatment works building
b) Extension to the Administration Building;
c) Extension to the Dewatering Building;
d) Blower Building;
e) New administration Building;
f) Membrane reactor building
g) Weighbridge building
h) New picket fence thickener
i) New clarifier tank

The indicative layouts of the wastewater treatment works are presented in Figure 3.4A and 3.4B.

5) Safety and Security

Safety measures at the wastewater treatment works will provide for the requirements of those persons who will be working on the site itself and will limit access to the site by unauthorized personnel.

Handrails are provided to all units which are not roofed or otherwise protected, such as the aeration tanks; the final clarifiers; the picket fence thickener, together with safety chains to units as necessary. Cages shall be provided to the access ladders on elevated units. All access points that are greater than three metres in height should be accessed via stairs instead of ladders. All exposed ducts and channels shall have safety grid flooring. Warning and information signs will be provided, particularly where machinery with moving parts are located. Local emergency-stop buttons shall be provided on all machines. Life buoys will be placed at strategic locations around water units.

A perimeter security fence is provided with an intruder alarm system linked up to a centralised control station. Floodlighting will be installed, as described later in Section 6.5. These measures will help deter intruders from entering the works.

3.9 Effluents, Emissions and Residues

Sewage arising from both domestic and non-domestic sources will be treated at the wastewater treatment works at Carrickmacross. The initial and future design pollutant loads are set out in Tables 3.5 and 3.6.

3.9.1 Effluent Standard

The existing treatment works is designed to produce an effluent in accordance with the discharge limits as given in Table 3.8. This table also provides a record of the final effluent results for the period June to December 2003. This shows that there have been a limited number of exceedences of the treated effluent discharge standards.

Parameter	Discharge limits mg/l	Max mg/l	Min mg/l	Ave mg/l	No. of exceedances	% Exceedances
BOD	**10**	11.2	2.6	7	2	5.7
COD	125	41	3	23	0	0
SS	10	15	2	5.9	1	2.3
Total P	2 (ave)	0.8	0.1	0.4	0	0
NH4-N	-	3.7	0.0	0.4	-	-
NO3-N	-	72	1.1	16.7	-	-

Table 3.8 - Analysis of the treated effluent from existing works June – Dec 2003

As stated in Section 3.7 the proposed final effluent discharge standard for the Carrickmacross WWTW will take into account the statutory requirements of the Urban Wastewater Treatment Regulations and the Phosphorus Regulations. As a result discharge standards will be set at a higher level than would be required if the statutory requirements were considered in isolation. The resulting discharge standards are shown in Table 3.9 below.

Parameter	Concentration	Unit
BOD	4	mg/l
Suspended Solids	4	mg/l
Total Phosphorus	0.2	mg/l

Table 3.9 - Proposed Treated Effluent Discharge Standards

In accordance with the urban wastewater treatment regulations, the values for BOD and suspended solids are 95 percentile values while the value for phosphorous is a mean value.

3.9.2 Estimated Quantities of Expected Residues and Emissions

Efficient operation of a wastewater treatment works will significantly reduce, but will not completely eliminate, the various pollutants and a considerable volume of sludge would remain to be disposed of in a safe and environmentally acceptable manner.

The design discharge parameters for the proposed works have been derived from an analysis of the existing river water quality and consideration of the potential impact of the discharge from the proposed works. This is discussed in detail in Section 5 of this report. The expected discharges from the proposed works are as follows:

To waters via outfall pipe at the ultimate (44,000 PE) load.

- BOD load – 24.7 kg/d (0.9% of original);
- SS load – 24.7 kg/d (1.2% of original);
- Total Phosphorus load – 1.2 kg/d (2.5% of original);

To atmosphere:

- Odour – Air extraction and odour treatment units will be provided to ensure that the odour levels at the boundary of the site do not exceed 2 odour units on a 95 percentile basis.
- Noise – No greater than 35dB(A) outside nearest residence at night;

De-watered Sludge for further treatment

- c. 4,560 m^3/annum @ 20% DS;

Screenings and grit removal

- variable but small quantities (typically 1 to 2 domestic wheelie bins per week each).

The pollutant load of the effluent following treatment has been assessed in terms of the waste assimilative capacity of the river in Section 5 of this report. It was found that, if the specified final effluent parameters are achieved, the proposed works will lead to an improvement in the quality of the water in the river. It should be noted that this improvement may be masked by the ongoing agricultural practices in the upstream river catchment.

3.10 Construction

The main construction activities will be excavation and filling, reinforced concrete construction, pipe laying, building works, mechanical and electrical fit out and commissioning of the works. Furthermore, the existing inlet works, oxidation ditch No. 1 and clarifier No.1 will be demolished. The main impact on the local environment will be a short term increase in the levels of traffic, noise and dust.

There will be an increased volume of traffic on the access roads to the site. Given the proximity of the site to the Ardee Road and N2 link road and the urban nature of the area, the increased level of traffic will not represent a substantial increase on the existing level. The traffic can be managed to ensure that deliveries do not unduly affect the local

residents. The increased level of traffic will be for a limited period only and will reduce dramatically as the civil and building elements of the works draw to a close. A wheel washing facility will be in place to ensure that no material is dragged on to the local roads.

Any noise, which will arise during the construction of the works, will be mainly due to construction traffic and the operation of machinery and plant. Plant noise will be controlled in accordance with BS5228: 1984 or similar control criteria, which will be specified in the contract documents for the construction of the works. Noise limits will be set in the specification for the construction works in accordance with Department of the Environment Regulations S.I. No. 320 of 1988.

The use of water tankers to hose down the work areas may be necessary to keep dust levels down in dry, windy periods.

The impact of the traffic generated in the construction phase of the works is described and assessed at Section 9.3.

3.11 Conclusions

The existing treatment plant in Carrickmacross is severely overloaded and the current effluent discharge standards can only be maintained by the use of temporary Venturii aerators and a high level of supervision and operator intervention. With predicted growth in the domestic and non-domestic loads as provided for in the development plans for Carrickmacross and its environs, over-loading of the plant may be expected to worsen significantly in the short term. An increase in treatment capacity is therefore required to provide for the sustainable development of the town. As part of this EIS and as detailed in section 4 below, a number of alternative sites were considered before it was concluded that an expansion of the existing plant was the most appropriate means of providing the necessary increase in treatment capacity to 44,000PE. It is also recognised that the low levels of dilution available in the receiving waters at this location call for a very high standard of final effluent. The proposal and the subject of this EIS is the construction and operation of a plant to provide for the treatment of wastewaters arising in Carrickmacross to such a standard.

For the particular form of procurement (DBO) that will be used to tender works to expand the capacity of the plant, it is not possible to set out the precise layout of the plant that will be constructed. This is because the tenderers will be free to offer their own designs that will meet the requirements specified in the tender documents regarding plant performance,

and environmental impact. The typical designs described earlier in this section, is indicative only of the general layout of the plant that may ultimately be constructed. However the final design must comply with this EIS in terms of the effluent discharge standards, stormwater storage, odour and noise impacts, visual impacts etc. and only those tenders which meet these requirements can be considered for advancement to construction and operation.

4 ALTERNATIVES CONSIDERED

4.1 Treatment

The standard of effluent required for the new WWTW at Carrickmacross as outlined in the previous sections means that several stages of treatment will be necessary. Alternatives to the indicative design can be considered provided these are capable of meeting the final effluent discharge standards. Some of these alternative treatment methods are described below.

For the indicative design described in section 3, primary treatment has not been included in the liquid stream option outlined. However primary treatment could be included with other stages provided the final effluent discharge standards can be achieved. Although it is not incorporated in the existing WWTW, it might be considered an option on the basis that it would reduce the variation in loading to subsequent treatment stages currently experienced at Carrickmacross WWTW. The purpose of primary treatment is to reduce the solids and BOD load by settlement of some of the solid material in the incoming sewage. This provides a balanced flow to the main works.

Secondary and Tertiary Treatment – there are various forms of secondary treatment available all of which rely on bacterial action to remove suspended and dissolved matter from the wastewater. The main methods used would fall into two broad categories these being the activated sludge process and attached media systems. The activated sludge process involves aeration of a mixture of wastewater and a population of bacteria (sludge) which consume nutrients and dissolved oxygen in the wastewater. These processes include sequencing batch reactors in which the wastewater is batched and treated in a single tank, and conventional activated sludge followed by final settlement. There are many other variations of the activated sludge process involving varying levels of tankage which may offer advantages in particular situations (eg plug flow, deep shaft, stepped aeration, extended aeration, etc). Attached media processes include trickling filters, biologically active filters, and rotating biological contactors. Under the DBO contract proposed for the procurement of the works, tenderers for the Carrickmacross WWTW would be free to offer such processes.

Secondary treatment processes of the type described above cannot produce an effluent of the required quality and a tertiary treatment stage will be needed. The main alternative to

the membrane treatment proposed in the indicative design described would be soil/sand filtration with coagulation or via constructed wetlands. These methods can produce very high quality effluents but would not generally be considered as reliable as the membrane system proposed in the indicative design. Owing to limitations with respect to the size of the site, constructed wetlands could not be considered as this would typically require $1m^2$ per PE for effluent polishing.

4.2 Sludge Dewatering Processes

The County Monaghan Sludge Management Plan designated the WWTW at Monaghan Town as the hub centre for the treatment of wastewater sludges in the county. The plan also provides for the optional designation of a second hub centre at Carrickmacross. This option has since been rejected by the council and all wastewater treatment sludges arising in Carrickmacross are to be dewatered prior to onward transportation to Monaghan for treatment. Provision will be also be made for accepting and dewatering imported liquid sludges from a number of smaller wastewater treatment plants near Carrickmacross to minimise transportation costs to the hub centre in Monaghan.

The capacity of the existing picket fence thickener and belt presses (especially with the second belt press installed in early 2004) is sufficient to treat all waste activated sludge arising in phase 1. However, additional thickening capacity is required for phase 2. This can be done by the construction of an additional picket fence thickener or the installation of mechanical thickeners.

The indicative design provides for dewatering of sludges using the existing belt presses with an additional press proposed to provide the total capacity required under phase II. Any alternative to belt presses which is capable of producing a sludge cake of the required dry solids content could be considered. This would include centrifuges with or without pre-thickening using gravity belt thickeners. A proposal to use centrifuges and/or gravity belt thickeners would not have any associated impacts beyond those associated with the belt presses described in the indicative design. Air from the sludge dewatering building will be required to be extracted and treated regardless of the technology chosen.

4.3 Alternative Treatment Plant Locations

The existing site for the WWTW has a number of advantages over any proposal to relocate the plant elsewhere. These would include:-

- The existing plant has a considerable residual asset value which would be lost if the plant is relocated

- There is an established land use at the existing site.
- It is in reasonable proximity to the source of the wastewater at Carrickmacross
- No new land has to be acquired
- The cost of upgrading the existing plant is lower than any alternative

The disadvantages of locating the plant at the existing site include

- The available site area is limited although it has been shown through the indicative design that sufficient area exists for the development of the Phase 2 plant (44,000 PE) but that any further increase may necessitate the acquisition of additional lands;
- The available dilution in the Proules River at the existing outfall point is low – relocation downstream would provide some additional dilution.

The following sections examine the issues involved in relocating to an alternative site and compare the advantages and disadvantages of these alternatives with the proposed development at the existing site.

4.3.1 New WWTW on Alternative Site

A number of alternative locations have been considered for the WWTW. All are located downstream from the existing site, and are either on the Proules River or the River Glyde. The two alternative locations proposed for the purposes of this analysis are shown in Figure 4.1.

Alternative No. 1 involves constructing a new 44,000 PE plant on a green field site adjacent to the Proules River just downstream of Moynalty Lough. The main advantages of relocating to this site would include:

- It provides increased dilution for the final effluent from the plant;
- The final effluent outfall would be relocated to a point downstream of a lake which is used as a source of drinking water for the Killanny Group Water Supply Scheme;
- It would provide additional space for future expansion of the WWTW;

However, a number of disadvantages also arise.

- The wastewater from Carrickmacross would have to be conveyed to the site by means of a pumping station and a new rising main. The rising main at the ultimate 44,000 PE requirement would be at least 600mm diameter and run from the existing WWTW to the new site. Depending on the route chosen, this pipeline would be approximately 3km in length and entail extensive disruption of the area.

- New land and pipeline wayleaves would have to be acquired
- The development of a new WWTW at this site is likely to be viewed locally as disturbing the essentially rural character of the area.
- The increase in the level of dilution would not have a significant impact on the standard of final effluent required
- The cost of relocating the plant to this site would be considerably greater than upgrading the existing plant

In general terms it is suggested that relocating the plant to this site would have significant environmental impacts associated with the construction of pipelines and a new WWTW, on a greenfield site and that it does not offer any material environmental or monetary benefit.

Alternative No. 2 involves constructing a new wastewater treatment works on a green field site adjacent to the River Glyde at Aclint Bridge some 8 km from the site of the existing WWTW. This main advantage of locating the WWTW to this site is that it would provide additional dilution capacity and result in less stringent discharge standards. In addition to the increased level of dilution, the River Glyde is not designated as a sensitive water under the Urban Wastewater Treatment Regulations. However, very similar disadvantages would arise to those outlined above for Alternative 1 and any cost savings that might be achieved by constructing a treatment works to meet these less stringent discharge requirements would be more than offset by the additional costs associated with the construction of a total of 8km of 600mm rising main between the existing site and this alternative. In general it is suggested that the disruption and disturbance of an area with a rural character means that the proposal has no environmental benefit to offer over the proposed expansion of the plant at the existing site.

4.3.2 Alternative Outfall Locations

Instead of relocating the wastewater treatment works, the option of relocating the outfall to a point further downstream was also considered. In each instance this would require the construction of new pipelines to convey the treated effluent to the proposed outfall locations described below

Relocating the point of discharge of the treated effluent downstream of Lough Naglack would provide some additional dilution. However, the additional dilution is limited because of the comparatively small increase in the catchment area of the Proules to the new discharge point. The sensitive status of the Proules river would still require an onerous

EXISTING WASTEWATER
TREATMENT SITE LOCATION

ALTERNATIVE
SITE No. 1

ALTERNATIVE
SITE No. 2

AMENDMENT DETAILS	DATE

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PROJECT: EXPANSION OF CARICKMACROSS WWTW

CLIENT: MONAGHAN COUNTY COUNCIL

DRAWING TITLE: ALTERNATIVE TREATMENT SITE LOCATIONS

SCALE: NTS	JOB NO:	DRAWING NO:
DATE: Sept'04 DRAWN BY: F.T.	1124	4.1

Drawing Name: FT :- D:\Feargha\1124—Carrickmacross Sewerage Scheme\EIS Figures Sept'04\Figure 1.4_4.1.dwg/Fig 4.1 Jul 01,2005 11:34am

standard of treatment. Discharge to the Proules river further downstream would not therefore offer any significant benefit.

Relocating the final effluent outfall to the Glyde river would entail the construction of a pumping station and an 8km rising main as previously described in 4.3.1 above. Although the Glyde is not a sensitive water under the Urban Wastewater Treatment Regulations, the standard of effluent from the WWTW would have to be within the assimilative capacity of the river and would have to have regard to the phosphorous regulations. It is nonetheless expected that the final effluent discharge standard could be substantially relaxed as a result of the increased level of dilution available at this site and that a conventional activated sludge plant with a tertiary sand filtration stage could provide the required level of treatment. However the costs of constructing the rising main and pumping station would not be offset by any savings in the WWTW costs. As no significant environmental or monetary benefit would result from such a proposal it has been given no further consideration.

4.3.3 Conclusion

As described above none of the alternative proposals considered offer any significant environmental benefit over the proposed expansion of the plant at the existing site. Proposals involving the relocation of the WWTW itself could reasonably be judged as having higher environmental impacts as a result of the need to pump the wastewater and to construct and operate new plants in areas which are essentially rural in character. Relocating the final effluent outfall would also involve the construction of long rising mains and offer no significant environmental benefit. It is concluded that the expansion of the existing plant has the least environmental impact of all the alternatives considered and that such an expansion can be accommodated at this site without causing undue negative environmental impacts.

5 WATER

5.1 The River Proules

The existing treatment works discharges to the River Proules at the north-eastern boundary of the site. The river is a tributary of the Glyde River system which discharges to the sea at Dundalk Bay. The river rises approximately 3km upstream of Carrickmacross and flows through agricultural land and through the town before it enters Lough Naglack and thereafter Moynalty Lough. The river is generally between one and three metres in width, with a water depth of less than half a metre in normal conditions. Figure 5.1 shows the catchment of the River Proules.

This section of the EIS examines the available water quality data for the Proules River and sets out final effluent discharge standards appropriate to the background pollution levels and the available dilution. A separate assessment of the impact of the discharge on the aquatic flora and fauna is presented in chapter 8.

5.1.1 Receiving Environment

5.1.1.1 River Flows

As there are no hydrometric gauging stations on the River Proules, there is no long-term historical record of flows available for this study. All analyses have therefore been based on river catchment characteristics, as described below.

For the purposes of estimating the required effluent discharge standards, low flows in the river are of particular importance. These are used for calculations of dilution, fully mixed contaminant concentrations and when combined with background water quality measurements, they provide an accepted basis for determining appropriate effluent discharge standards. For the purposes of the current study, a software package developed by the European Small Hydropower Association (*Hydra*) for use throughout Ireland, has been used to estimate low flows on the River Proules. The package was developed by the Institute of Hydrology in the UK under an EU contract to provide the necessary hydrologic estimates for small scale hydropower projects in Ireland.

A widely accepted characterisation of low flows in rivers is the ninety-fifth percentile flow. This represents the value at which, statistically, flow in the river will be higher for 95% of the time. Table 5.1 below shows the output from the *Hydra* package, for the River Proules at the outfall from the existing treatment works.

Catchment Characteristics	
Total Area:	12.6 km^2
Rainfall (average annual):	939 mm
Potential Evaporation (average annual):	461 mm
Runoff (average annual):	528 mm
Flow Regime Results	
Mean flow estimate:	0.20 m^3/s
Q95 (% of mean):	11.0 %
Q95 (absolute):	0.022 m^3/s

Table 5.1 – River Proules catchment characteristics and flow regime results

5.1.1.2 EPA Water Quality Sampling and Measurement

EPA water quality sampling is routinely undertaken at 6 stations along the River Proules as shown in figure 5.2. Results from the analysis of water quality samples at these stations for the period 2001 to December 2004 are presented in Appendix E. The first two of these stations are upstream of the treatment works discharge location and they provide a good indication of background water quality in the river, above and below the town. The third station (u/s of Lough Naglack) is just downstream of the treatment works outfall, while the remaining two stations are located further downstream, before confluence with the Glyde River.

In terms of the impact of the existing WWTW discharge on the water quality on the Proules, the stations of most relevance would be the Ardee Road Bridge Station and the station immediately upstream of Lough Naglack as the outfall from the WWTW is between these stations. The results suggest that the WWTW would not appear to have a significant impact on water quality and that the deterioration in river water quality through the town is associated with other activities. These might include storm water overflows from the combined sewerage system and (perhaps) illegal connections to storm water sewers and/or private discharges directly to the river. The Carrickmacross Main Drainage scheme which is currently at planning stage will see the abandonment of all of the existing overflows and this should improve conditions in the river irrespective of the improved final effluent from the WWTW.

The EPA report of 2000 concluded that the Proules River was of satisfactory quality status upstream of the town and, although improved somewhat below this point since 1997, the river was again significantly polluted at the locations sampled between Lough Naglack and

Moynalty Lough. An extract from this report is included in Appendix E. The 2000 report confirms that the assertion above that the unsatisfactory conditions are associated with sources of pollution other than the WWTW.

5.1.1.3 Statutory Water Quality Objectives for the River Proules

There are a number of legislative requirements concerning the quality of effluent discharges from WWTWs which must be taken into account before deciding on appropriate standards for the Carrickmacross plant. Foremost among these legislative requirements are the Urban Wastewater Treatment Regulations (SI No. 254 of 2001), which place mandatory standards and dates for compliance on local authority WWTWs. The implications of the regulations as they affect Carrickmacross are discussed in 5.1.2 below. Other relevant legislation which needs to be considered in determining the effluent discharge standards include the Phosphorus Regulations (SI No. 258 of 1998).

5.1.2 Characteristics of the Proposal

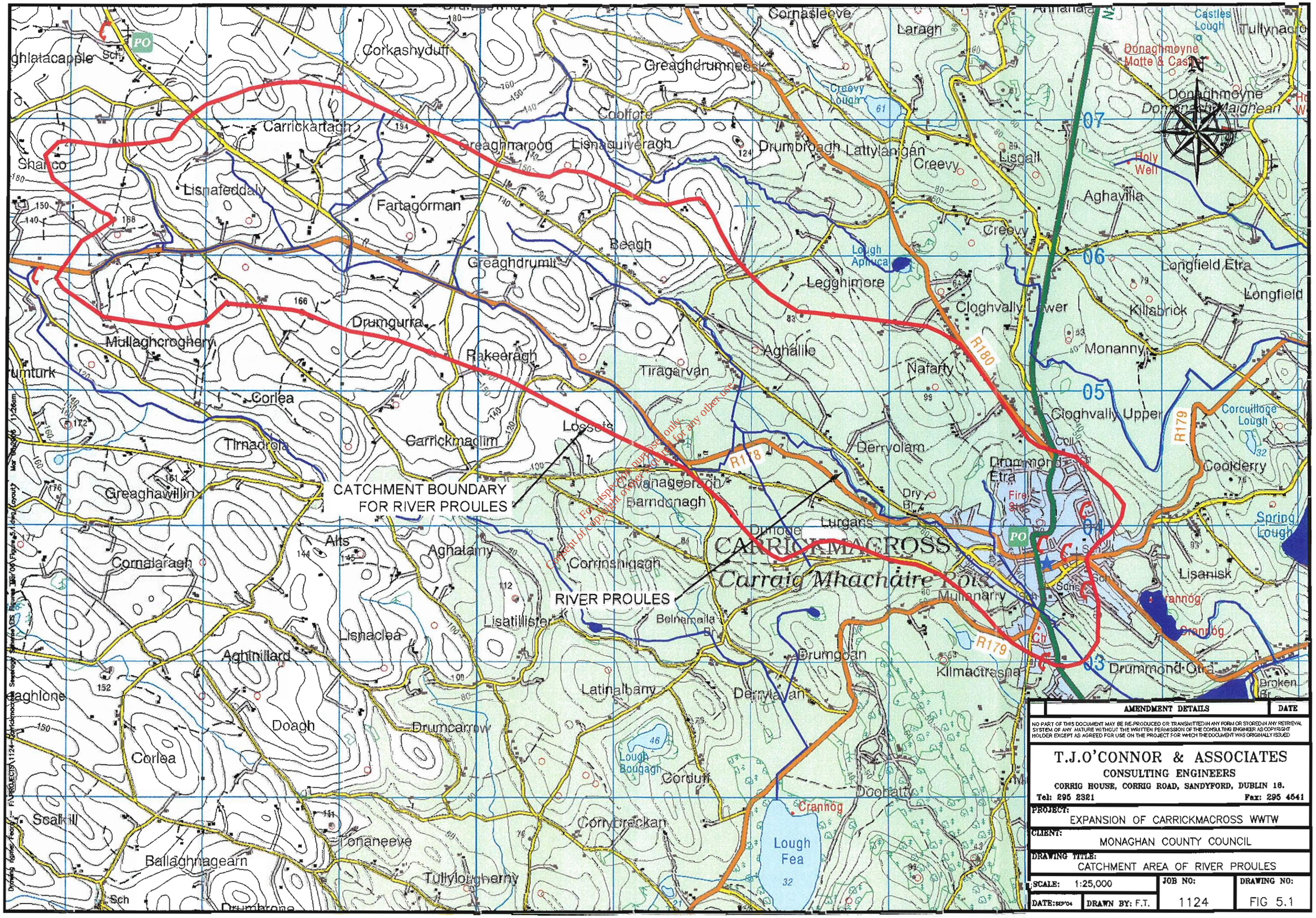
The discharge standards for the treated effluent from the upgraded Carrickmacross plant needs to take account of both statutory requirements under the various enactments referred to above and other non statutory objectives relating to the improvement of the water course. The following as discussed in the previous sections will therefore need to be considered in defining the standard to be achieved.

1) The Urban Waste Water Treatment Regulations
2) The Freshwater Fish Directive
3) Surface Water Directive
4) Dangerous Substances Directive

Each of the above is discussed separately below before a final standard consistent with the requirements of each is proposed.

5.1.2.1 Urban Waste Water Treatment Regulations

As detailed in the Urban Waste Water Treatment regulations, the effluent discharge standards for wastewater treatment plants with a population equivalent of greater than 10,000 are shown in Table 5.2 below.



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CLIENT: MONAGHAN COUNTY COUNCIL

DRAWING TITLE: CATCHMENT AREA OF RIVER PROULES

SCALE: 1:25,000	JOB NO: 1124	DRAWING NO: FIG 5.1
DATE: SEP'04	DRAWN BY: F.T.	

STATION 0100
DRY BRIDGE

STATION 0200
ARDEE ROAD BRIDGE

WWTP
OUTFALL

STATION 0300
JUST U/S LOUGH NAGLACK

STATION 0400
BROKEN BRIDGE

STATION 0500
BALLMACKNEY BRIDGE

STATION 0600
BRIDGE AT KILLANNY

CARRICKMACROSS
Carraig Mhachaire Rois

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PROJECT: EXPANSION OF CARRICKMACROSS WWTW

CLIENT: MONAGHAN COUNTY COUNCIL

DRAWING TITLE: STATION LOCATIONS ALONG RIVER PROULES

SCALE: 1:25,000	JOB NO: 1124	DRAWING NO: FIG 5.2
DATE: SEP'04	DRAWN BY: F.T.	

Parameter	Concentration	Minimum Reduction (%)
BOD	25 mg/l	70-90
SS	35 mg/l	75
COD	125 mg/l	90

Table 5.2 – UWWT Regulations effluent discharge standards for plants with a population equivalent of more than 10,000.

Furthermore, the River Proules has been designated a sensitive water and the directive additionally requires that discharges to sensitive waters for agglomerations (towns) above 10,000 PE incorporate nutrient reduction facilities. Table 5.3 lists the requirements for discharges from urban wastewater treatment plants to sensitive waters.

Parameter	Concentration	Minimum Reduction (%)
Total Phosphorus	2 mg/l	80
Total Nitrogen	15 mg/l	70-80

Table 5.3 – Additional UWWT Regulations effluent discharge standards for plants discharging to sensitive waters. Only Phosphorous applies in the case of Carrickmacross

For discharges from WWTWs to inland waters, including the Carrickmacross WWTW, only phosphorous reduction is generally applied. In addition to the standards outlined above, the UWWT Regulations also state that 'more stringent provisions than those specified shall be applied to discharges from a treatment plant where this is required to ensure that the receiving waters satisfy any other relevant Community Directives'. Relevant directives would include the 1978 directive on the quality of freshwaters needing protection or improvement in order to support fish life (78/659/EEC), the 1975 directive concerning the quality of surface water intended for the abstraction of drinking water (75/440/EEC) and the 1976 directive on pollution caused by dangerous substances discharged into the aquatic environment (76/464/EEC). Regulations have been made in connection with each of these directives.

5.1.2.2 Freshwater Fish Directive

This directive classifies fresh waters as either salmonid or cyprinid, the former being of such quality as to support game fish and the latter being of a lesser quality but satisfactory

for coarse fish. A range of Irish waters have been designated under the terms of the directive and in each case the waters have been classified as salmonid, requiring the higher quality standards. According to the 'Quality of Salmonid Waters' regulations (SI 293,1988) neither the River Proules, nor any water body into which it flows, have been designated a salmonid water, and so these regulations do not apply. To date there have been no corresponding regulations for cyprinid waters.

5.1.2.3 Surface Water Directive

This directive relates principally to the quality of surface water which is used as a source of water for human consumption – drinking water – with appropriate treatment following abstraction. The associated regulations (S.I. No. 294 of 1989) categorise surface waters from which water for public supply will be taken as A1, A2 or A3, depending on the (increasing) degree of treatment which will be applied, and they set out quality standards for a total of 39 parameters.

The Proules is not used directly for the abstraction of drinking water, but it flows into Moynalty Lough which is the source of the Killanny Group Water Supply Scheme. The EPA carries out regular analysis of water quality in Moynalty Lough. The results of this analysis indicate that in general the water complies with the standards of category A1. As the proposal described in this EIS provides for an improvement in the quality of final effluent discharged, it is expected that the treatment works discharges will not adversely effect the water quality of the lake, which should continue to comply with the limits of the A1 category.

5.1.2.4 Dangerous Substances Directive

This directive is very wide-ranging in scope. For the purpose of this report, only the Phosphorus Regulations (S.I. No. 258 of 1998) are relevant, as these give effect to requirements arising under the directive, concerning the setting of water quality objectives as part of overall pollution reduction programmes.

Phosphorus Levels

The Phosphorus Regulations set out clearly formulated targets for improving water quality by reducing phosphorus levels in rivers and lakes. As a starting point, they provide that the existing quality rating/status of a river or lake be maintained i.e. no dis-improvement in quality. In addition, the regulations provide for incremental improvements in water quality in rivers and lakes currently affected by pollution. The detailed requirements are reproduced in Table 5.4 below:

Existing Biological Quality (Q) Rating		Molybdate-Reactive Phosphorus Annual Median Concentration (mg/l)	Minimum Target Biological Quality (Q) Rating
5	Unpolluted	0.015	5
4-5		0.020	4-5
4		0.030	4
3-4	Slightly Polluted	0.030	4
3	Moderately Polluted	0.050	3-4
2-3		0.070	3
<2	Seriously Polluted	0.070	3

Table 5.4 - Quality Standards for Rivers

The benchmark for water quality rating/status, for the purpose of assessing compliance with the statutory obligation to maintain or improve water quality, will be that assigned by the EPA on the basis of monitoring carried out. The results of the latest EPA assessment, are included in "A Report on River Quality in County Monaghan - 2000". This assessment indicates a Q rating of 4-5, at the nearest monitoring station (0110) upstream of the treatment works and a corresponding Q rating of 2-3 at station (0300), just downstream of the works.

From the assessment, it is reasonable to conclude that the existing treatment works is contributing to the deterioration in water quality of the Proules. In order to comply with the Phosphorus Regulations, as stated, the upgraded treatment plant discharge should be such as to ensure a minimum Q rating of 3, in the river downstream of the outfall. However, this requirement is not feasible or realistic for the following two reasons:

1. Agricultural emissions, point discharges and storm overflows from the Carrickmacross collection system also contribute to the pollution of this stretch of the river.
2. Ignoring the other sources of pollution, the phosphorus concentration in the discharged effluent would have to be less than 0.05 mg/l, to achieve the required improvement in water quality. To achieve this figure would require the use of

reverse osmosis, nano-filtration or some other similar technology. Under the BATNEEC principle, such discharge limits would not be considered practicable.

Considering the above, it is proposed to comply with the principle of the phosphorus regulations, i.e. to improve water quality in the receiving body, by specifying discharge limits which shall significantly reduce the daily phosphorus load, from the treatment works, to the river. Employing the best available technology, which does not entail excessive cost, a design figure of 0.2 mg/l for total phosphorus concentration in the discharged effluent appears acceptable and achievable. Table 5.5 below indicates the current and proposed phosphorus loading to the river.

	Population Equivalent	DWF (m^3/d)	Total P conc. (mg/l)	Total P load (kg/d)
Existing plant	12,150	2,322	2.0	4.6
Phase 1	30,000	3,600	0.2	0.7
Phase 2	44,000	6,000	0.2	1.2

Table 5.5 - Phosphorus Loading to the River Proules

Analysis of the final effluent from the existing plant for the year 2001 indicates that the average daily total phosphorus load to the river was only 1.7 kg/d. This level reflects the efficiency of the existing phosphorous removal stages in the treatment plant which exceeds the statutory requirements. However, the standard proposed for both phases result in a significant reduction in the daily phosphorus load to the Proules.

BOD Levels

As set out above, the Urban Wastewater Treatment Regulations set the discharge standards for BOD at 25 mg/l for plants with a population equivalent of more than 10,000. However, as this is greater than the current discharge limit for BOD of 10 mg/l, it is proposed to comply with the principle of the regulations, i.e. to improve water quality in the receiving body, by specifying discharge limits which shall significantly reduce the daily BOD load, from the treatment works, to the river. In order to assess compliance with these regulations it is proposed to consider the BOD concentration of the river downstream of the outfall point. The concentration is calculated by applying the following mass balance formula, using the 95% river flow.

$$\text{BOD conc. of receiving water} = \frac{(Q \times C) + (q \times c)}{Q + q}$$

The following table sets out the figures for the existing situation and the proposed situation when the works is expanded to cater for a population equivalent of 44,000. The background BOD concentration for the river is taken from EPA results.

Symbol	Parameter	Unit	Existing	Proposed
Q	95% river flow	m^3/s	0.022	0.022
q	Effluent discharge flow	m^3/s	0.081	0.215
C	BOD conc. upstream of outfall	mg/l	1.7	1.7
c	BOD conc. of discharge	mg/l	10	4

Table 5.6 - BOD Calculation Data

As a result of discharges from the existing wastewater treatment work, the estimated BOD concentration in the river immediately downstream of the outfall point is 8.3 mg/l on a 95 percentile flow. This compares with the EPA results for this location which records an average BOD concentration at the same point of 1.5 m/l. The differences between the figures would be accounted for by the fact that flowrates were probably much higher than the 95 percentile flow on the days when samples were taken and the fact that BOD is not a conservative pollutant but tends to naturally reduce along the length of a stream.

If the proposed BOD concentration of the final effluent is set at 4 mg/l, then the BOD concentration in the river downstream of the outfall point shall be 4 mg/l at the ninety-fifth percentile flow. This is a worst-case situation when the level of available dilution is very low. When the mean flow occurs (c 200 l/s), the BOD concentration is expected to be around 2 mg/l. In either case, it is clear that by setting the discharge limit for BOD at 4 mg/l, the BOD concentration in the river downstream of the outfall point shall be brought down below the concentration resulting from the existing treatment plant discharge.

5.1.2.5 The Water Framework Directive

On the 22 December 2003, the Minister for the Environment, Heritage and Local Government made Regulations (S.I. No. 722 of 2003), which transpose the Water Framework Directive (2000/60/EC) in to national law. In summary the Regulations provide for –

- the protection of the status of all waters (i.e. no deterioration to be allowed) and the achievement of at least “good status” by 22 December 2015 for all waters

- the establishment of “river basin districts” (RBDs) as the administrative areas for implementation of the Directive (including international RBDs in relation to cross-border river basins)
- the co-ordination of actions by all relevant public authorities for water quality management in an RBD including cross-border RBDs
- the characterisation of each RBD
- the establishment of environmental objectives for each RBD
- the development of a programme of measures to achieve those objectives and subsequently its review / updating every six years
- the development and adoption in each RBD of a river basin management plan (RBMP) and subsequently its review / updating every six years.

The regulations assign responsibilities to the EPA, local authorities and other public authorities for implementation of the Water Framework Directive and lay down deadlines for the delivery of the main tasks required by the Directive.

For the Proules River the relevant River Basin District is the cross-border Neagh-Bann RBD. This district encompasses the catchment of the Glyde River in the republic as well as the river Bann and Lough Neagh in Northern Ireland. At present and in common with the other RBDs in Ireland, the Neagh-Bann RBD is understood to be in the process of characterizing the water bodies in its district via a comprehensive programme of water quality sampling and testing. After this characterization stage it is expected that the specific measures required to achieve good status would be identified. The final effluent discharge standards proposed take full account of all of the known requirements in terms of the flora and fauna and water usage downstream of the plant and are therefore consistent with the requirements of the WFD.

5.1.2.6 Proposed Final Effluent Parameters

Considering the Urban Waste Water Treatment Regulations, the various directives and associated regulations outlined above and the existing treated effluent discharge standards, Table 5.7 below summarises the proposed treated effluent standards of the upgraded treatment works.

Parameter	Concentration	Unit
BOD	4	mg/l
Suspended Solids	4	mg/l
Total Phosphorus	0.2	mg/l

Table 5.7 - Proposed Treated Effluent Discharge Standards

These proposed discharge standards combined with on-going reductions in agricultural discharges and the proposed decommissioning of the existing storm-overflows should help to achieve the required improvements in water quality.

5.1.3 Potential Impact of the Proposal

The potential impact of the proposal is an improvement to the quality of the water in the River Proules. The upgraded works will have a number of benefits for the river and the Carrickmacross area in general, particularly in conjunction with the ongoing river management programme.

- The standard of treatment of the wastewater will be substantially improved;
- The elimination of storm water overflows from the WWTW except during exceptionally adverse weather conditions;
- There will be a substantial improvement in the quality of the water in the river which will assist in the achievement of an improved Q rating for the river downstream of the works
- The amenity value of the river and downstream lakes for the local community will be enhanced;
- The upgraded works will satisfy all of Monaghan County Council's obligations under the UWWT Regulations and the Phosphorus Regulations.

It is clear that the potential impact of the proposed works on the river is wholly positive.

5.1.4 Mitigation Measures

No further mitigation measures will be required.

5.1.5 Predicted Impact of the Proposal

The predicted impact of the proposal is the same as the potential impact in that there will be an improvement to the quality of the water in the river. The upgraded works will have a number of benefits for the river and the Carrickmacross area in general, particularly in conjunction with an ongoing river management programme.

- The standard of treatment of the wastewater will be substantially improved;
- The elimination of storm water overflows from the WWTW except during exceptionally adverse weather conditions;

- There will be a substantial improvement in the quality of the water in the river which will assist in the achievement of an improved Q rating for the river downstream of the works
- The amenity value of the river and downstream lakes for the local community will be enhanced;
- The upgraded works will satisfy all of Monaghan County Council's obligations under the UWWT Regulations and the Phosphorus Regulations.

It is clear that the predicted impact of the proposed works on the river is positive.

5.1.6 Monitoring

Ongoing monitoring will be carried out in accordance with the requirements of the UWWT Regulations to ensure that the target final effluent parameters are achieved. The UWWT Regulations requires a minimum of 12 samples per year for a plant of this size. However, even more frequent daily monitoring during the proposed DBO contract will be required to demonstrate compliance with effluent discharge standards.

5.1.7 Reinstatement

Not applicable

5.2 Groundwater

5.2.1 Receiving Environment

Carrickmacross and the surrounding area (including the treatment works site) are located on a regionally important karst aquifer as shown in Figure 5.3. The protection of the aquifer from contamination by activities on the surface is therefore an important consideration. Under the Monaghan Groundwater Protection Plan, the aquifer is classified as extremely vulnerable and accordingly land spreading, and discharges to land in the area generally must be carefully controlled.

5.2.2 Characteristics of the Proposal

The treatment works will treat wastewater imported to the site through existing watertight pipelines. There will be no discharges of treated or untreated wastewater to the surrounding land.

5.2.3 Potential Impact of the Proposal

Proper construction and water-tightness of the pipes and water-retaining structures in the upgraded works will ensure no negative impact on the water quality of the river / groundwater. Spillages from chemical storage tanks could enter the groundwater system.

There will be a slightly reduced ground water recharge with run-off from some roads and paved areas directed to the river. Given the size of the area of the aquifer, there will be a

MAJOR AQUIFERS OF IRELAND

Armagh

Monaghan

Newry

Dundalk

Carrickmacross

Cavan

Map compiled by the Geological Survey of Ireland
& based on the European Communities
"Groundwater Resources of the Republic of Ireland"
Published in 1982

GSI

LEGEND

- Bedrock Aquifer
- Major Sand & Gravel Aquifer
- Minor / Complex Sand & Gravel Aquifer
- Sand & Gravel overlying Bedrock Aquifer
- Poor / Minor Aquifer (locally productive)

	AMENDMENT DETAILS	DATE

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PROJECT: EXPANSION OF CARRICKMACROSS WWTW

CLIENT: MONAGHAN COUNTY COUNCIL

DRAWING TITLE: GSI SURVEY – AQUIFER MAP

SCALE: NTS		JOB NO:	DRAWING NO:
DATE: SEP'04	DRAWN BY: F.T.	1124	FIG 5.3

negligible impact on the recharge of the aquifer.

5.2.4 Mitigation Measures

For process tanks good design to the appropriate water retaining standards will ensure that no egress of water or wastewater can take place. Commissioning tests using clean water will ensure that the tanks are water tight. Pipework including gravity and pressure pipes will be tested in accordance with the codes of practise to ensure that they are fully watertight. Bunds to all chemical storage tanks will be provided to ensure that any leaks or spillages of chemical are contained and do not enter the groundwater system.

5.2.5 Predicted Impact of the Proposal

The predicted impact will be insignificant.

5.2.6 Monitoring

The DBO contractor will be required to ensure that all chemical storage bunds are periodically relieved of any accumulated rainwater. Influent and final effluent flow monitoring will be provided to ensure that any significant leaks are quickly detected and repaired

5.2.7 Reinstatement

No specific measures are proposed.

5.3 Surface Water Abstraction

As previously stated, there is an abstraction for drinking water at Moynalty Lough which is downstream of the outfall from the WWTW. This abstraction is used to source raw water for a treatment plant supplying potable water to consumers on the Killanny Group Water Scheme. The treatment plant underwent a substantial upgrade in 2005 and now includes all the necessary processes required to produce drinking water in compliance with national drinking water regulations. The treatment process is understood to include coagulation, dissolved air flotation, rapid gravity filtration, pH correction and disinfection.

The lake currently meets the highest (A1) standard under the water abstraction regulations and the quality of the water supplied to consumers on the Killanny GWS has met the requirements of the drinking water regulations since the new plant came on stream in December 2005. Accordingly the existing effluent discharge standards do not adversely impact on the use of the lake for water supply purposes. With the proposed improvement in the quality of the final effluent proposed in this EIS and particularly membrane filtration of the final effluent, the quality of the raw water abstracted for the Killanny GWS may also be expected to improve and accordingly the proposal will have a beneficial impact.

6 AIR

6.1 Preamble

There are a number of aspects in relation to air quality, which must be considered when assessing the potential impacts of a sewage treatment works. These include the following:

- Noise;
- Odour;
- Aerosols;
- Light.

A noise and odour impact assessment was commissioned for the existing site at the Ardee Road in order to predict probable noise and odour levels during operation of the proposed plant. These were considered to be the two most important parameters that would affect adjoining areas.

6.2 Noise

6.2.1 Receiving Environment

The Ardee Road site is an established Wastewater Treatment Works. It is bounded to the South and to the North by agricultural land with no nearby housing. To the East the site is closely bounded by the Proules River. To the West is the Ardee Road, a filling station and some houses elevated above the Ardee Road and the WWTW site. A link-road to the new by-pass has been recently constructed to the north of the site. The proposed treatment works will be located on the site of the existing works.

The nearest residences, to the proposed Treatment Works, are (a) west of the existing WWTW at c.125 metres, and (b) North-east of the existing WWTW at c. 400 m.

Both groups of houses are on elevated ground. To the West there is significant noise screening from the existing treatment works due to intervening structures on the WWTW site. However the houses to the North-east have no significant screening from the WWTW plant.

The housing to the west of the proposed works extension have the highest ambient noise levels, due to traffic travelling on the nearby busy Ardee Road. The housing to the North-east has the lowest ambient noise levels as it is well removed from any busy road.

Noise can be a nuisance and excessive levels of noise can cause deafness to employees, stress and varying community responses. A sewage treatment works operates on a 24hr basis and, hence, it is a source of some noise at all times. At night, in particular, when background noise levels are low, noise can travel a long way, although the level diminishes with distance. Pumps, motors, compressors and aerators will all generate noise. The tolerance of noise levels can vary depending on noise source, duration, time of day and frequency.

Mr. Fred Walsh of Acoustic Associates has carried out measurements of source noise levels within the site boundary on 5th and 6th August 2004 and on 8th and 9th November 2004 with the new blowers in place. These readings are shown in full in the report contained in Appendix A and demonstrate the relatively steady nature of the noise levels at the existing works.

Measurements were made in accordance with International Standard ISO 1996 (1982, 1987) "Acoustics - Description and Measurement of Environmental Noise". This standard specifies that the average level L_{eq} is to be used for measurement and assessment of environmental noise. Basic acoustical data are equivalent continuous A-weighted sound pressure levels, denoted $L(A)_{eq}$., averaged over a given period.

The quieter areas adjacent to the proposed treatment works site have a noise climate characterised by the levels shown in Table 6.1. These are quiet urban in character. The noisier areas have some contributions from the activity at the filling station as well as from road traffic. The night-time has moderately low ambient noise levels.

Start Time	LAeq	LA1	LA10	LA50	LA90
334	46.1	48.7	47.5	46	44
335	45.7	48.3	47.1	46	44
336	47.2	50.4	48.7	47	46
337	48.1	52.9	50.8	47	45
338	45.5	48.6	47.0	45	44
339	45.4	47.9	46.6	45	44

LAeq : Average noise level for the period

LA90 : the level exceeded for 90% of the period (the "floor level")

LA50, LA10, and LA1 are the levels exceeded for 50%, 10% and 1% of the period

Table 6.1 - Noise Levels (dB) 200m North-east of the WWTW Site, 9th November 2004

6.2.2 Characteristics of the Proposal

The proposed Works sources likely to emit noise include:

(a) Blower Building (Enclosed)
(b) Preliminary Treatment Plant (removal of grit, rags and coarse solids-housed in a building)
(c) Sludge Dewatering Building (enclosed)
(d) Tertiary Filters
(e) Pumping Stations

The existing layout drawings are taken as indicative only as the proposal is to be a design and build contract which allows tenderers to put forward their own design for meeting the specified emission and discharge standards.

The proposed treatment works would operate 24 hours/day and 7 days per week.

The daytime activities will include transport of sludge in and out of the site, along with the continuously running plant items. An estimated average c.1 tanker/day, and c.10-12 cars, could enter and exit the site. The noise from these sources is unlikely to cause nuisance at any house. The recommended criterion for traffic at any residence is 55 $LAeq_{1hour}$.

At night only quiet (or enclosed) plant will be running, suitably attenuated to meet the given noise limit of 35 LAeq. This would not be expected to cause any complaints.

Site preparation and construction will take place over a number of months. This phase will generate some moderately high noise levels for short periods. Initially, it is expected that a bank or berm for noise containment will be constructed. There will be no construction work at night.

6.2.3 Potential Impact of the Proposal

A noise is liable to disturb people and provoke complaints when its level exceeds the pre-existing ambient level by a certain margin, or when the level attains a particular absolute value. People's reactions to noise may be influenced by a number of factors such as:

- **Noise level;**
- **Noise character;**
- **Habituation;**

- **Degree of control over the source;**
- **Personal sensitivity to noise;**
- **Attitude to the source;**
- **Activity engaged in;**
- **Time of day or night;**
- **Character of area;**
- **Visibility or otherwise of the noise source, and**
- **Seasonality of the operation.**

The night-time environment in the area of this site is assessed as quiet urban to roadside suburban or rural. Therefore, since the proposed works would operate continuously, a potential impact might arise if the noise emissions were to exceed 35 LAeq, and could adversely affect, at night, some local residence by causing sleep disturbance. However, if noise levels are maintained at or below this level at night, no adverse impact is likely to arise. It is unlikely that adverse daytime intrusion of works noise would occur.

The estimated traffic is c.1 tanker/day, and c.10-12 employee/visitor cars, entering and exiting the site. The noise from these sources is unlikely to cause a nuisance at any house. The recommended criterion for WWTW traffic at any residence is 55 $LAeq_{1hour}$.

At night there will be no traffic to or from the site. Only quiet (or enclosed) plant will be running, suitably attenuated to meet the given limit of 35 LAeq. This would not be expected to cause any complaints (noise-related).

The operations of the proposed WWTW are expected to be generally in the range up to 35 (at night), and up to 45 $LAeq_{1hour}$ (daytime) at any house.

External noise levels of 35 $LAeq_{15min}$ at night and 50 $LAeq_{1hour}$ by day are unlikely to disturb anybody. Therefore no interference with normal family or domestic activities is likely and, consequently, no noise-related complaints are considered likely.

6.2.4 Mitigation Measures

Adoption of noise limits of 50 $Laeq_{1hour}$ by day, and 35 $Laeq_{15minute}$ at night, at the nearest house and any house is the overriding control measure. Appropriate attenuation measures will be used to achieve these limits.

The existing Rotor in Oxidation Tank No.1 which is emitting excess noise, and a strong tonal component, will be serviced or replaced to eliminate this problem. Similarly, all plant will be monitored to detect and rectify, as soon as possible, any other excessively noisy plant which develops in the course of use. This facility could be part of the proposed supervisory control and data acquisition (SCADA) system.

The contractor, in his design, will be required to select plant that can be attenuated, to avoid any significant noise intrusion or disturbance at local residences. Plant will also be chosen to avoid significant low-frequency noise emission at night, which increases nuisance potential.

An earthen berm of suitable height is recommended along the Northern and Western site boundary in order to assist in containing noise emissions effectively.

The proposed blower house, and the inlet works building, will each have an acoustic insulation standard sufficient to achieve the overall recommended noise limits stated above.

Any new pumps may be of the submersible type and any new blowers may be sound insulated in such a manner that the overall noise limits mentioned above are achieved.

Noisier plant should be positioned to optimise screening by other plant.

Sound attenuation will be fitted to any fan or opening likely to emit excess noise. The internal walls of buildings will, if necessary, be fitted with sound-absorbing material to minimise any noise emissions. This could be of rockwool or glass-wool or equivalent sound absorbent. It would be protected mechanically by a suitable frame or fixtures and wire grille or netting.

Construction Phase

The temporary nature of construction activities accords the associated noise a higher level of acceptance by people than noise sources of a more permanent nature.

Construction plant and equipment for use on the proposed works should comply with Statutory Instrument No.632 of 2001 “European Communities (Noise Emission by Equipment for Use Outdoors) Regulations 2001”, and that silencers and engine covers be kept in good and effective working order.

The methodology of British Standard B.S.5228:1997 "Noise and vibration control on Construction and open sites" Part 1, is available for use, if need be, during the construction work if required to minimise emission of any noise to any residence. Construction work is not expected to occur at night.

A daytime limit of 65-70 $LAeq_{12hr}$ is often considered reasonable for construction work. This proposal is not expected to generate levels in excess of 70 $LAeq_{12hr}$, at any house, for any phase of the construction process. Furthermore construction work is only expected to take place during daytime hours.

6.2.5 Predicted Impact of the Proposal

The external noise level criteria considered appropriate are as follows :

Operations 0700-1900 hours : Daytime 50 $LAeq_{1hr}$; **Traffic** - 55 $LAeq_{1hour}$

1900-2200 hours : Evening 45 $LAeq_{1hour}$

2200-0700 hours : Night-time 35 $LAeq_{15mins}$ with no tones or impulses.

Note - Definition of day-night times is intended as a guide. These times can vary. Table 6.2 gives a guide to the likely community response to different noise levels.

dB(A) Excess Of Rating Sound	**Estimated Community Response**	
Level Over noise Criterion	**Category**	**Description**
0	None	No observed reaction
5	Little	Sporadic complaints
10	Medium	Widespread complaints
15	Strong	Threats of community action
20	Very Strong	Vigorous community action

Table 6.2 - Estimated Community Response to Noise (ISO-1996)

If the mitigation measures outlined in section 6.2.4 above are implemented to achieve the recommended noise limits, it is predicted that there will be no adverse impact on the local environment.

6.2.6 Monitoring

Monitoring of noise emissions will be undertaken at the nearest residence or any other location requested by the regulating authority, should any complaints relating to noise arise.

6.2.7 Reinstatement

No reinstatement will be required.

6.3 Odour

6.3.1 Receiving Environment

The wastewater treatment plant site at Carrickmacross is located approximately 1 km to the south east of the town centre with the site accessed from the N2 (Ardee Road). It is located on relatively flat land at about 32m O.D. within a shallow valley with the ground rising slightly to the north and south of the site. The lands to the NW and SE are generally undeveloped with trees/mature hedgerows or pasture land. There is a new road along the NW boundary that has been constructed to service lands zoned for industrial warehousing to the north of the site. There are no significant industrial emissions within the locality of the treatment plant. The nearest houses are located along the N2 within about 75-100m of the existing SW site boundary. There is a recently constructed housing development along the small ridge to the north of the site, with the nearest houses about 275m from the site boundary.

Overall, the air quality in the locality is good with levels of air pollutants in the area well below the National Air Quality Standards (NAQS) specified in (SI No 244 of 1987) and the Air Quality Standards Regulations 2002 (SI No 271 of 2002). Daily concentrations of sulphur dioxide would be less than 25% of the limit value of 125 µg/m^3 specified in the 2002 Regulations. Ambient concentrations of nitrogen dioxide would be less than 40% of the future NAQS annual limit of 40 µg/m^3, which is to be met by 2010. Corresponding hourly concentrations would also well below the current NAQS hourly limit value of 200 µg/m^3. Slightly elevated levels of nitrogen dioxide may be experienced near the south-eastern site boundary, due to exhaust emissions from traffic travelling along the N2. Carbon monoxide and benzene levels, which are important components of motor vehicle exhausts, would be very low in the area and typically less than 10% of the NAQS.

Dust and airborne particulates, in particular those referred to, as PM_{10} (particulate material with a mean aerodynamic diameter of less than 10 µm) would be below the National Air Quality Standards. The limit values specified in the Regulations 2002, which entered into force in January 2005, specify a daily value of 50 µg/m^3 (as a 90.4 percentile of daily average values) and an annual average value of 40 µg/m^3. Annual levels would be

typically in the region of 20-25 µg/m^3 close to the N2 roadside with vehicle exhaust emissions and roadside dust being the principal sources.

During the site visit undertaken in September 2004, no malodours could be detected near the site boundary of the wastewater treatment plant. The weather conditions were dry and sunny with light winds present during the site visit. In the past, complaints of odours have been reported by local residents. However, with the recent installation of a high efficiency odour control unit on the existing inlet works, no complaints have been reported within the past 12 months.

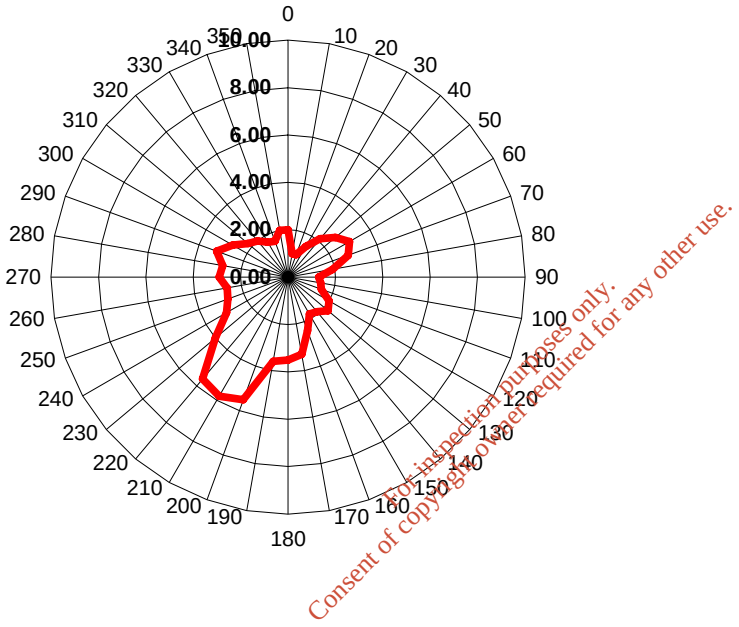

Figure 6.1 – Hourly Wind Direction Frequency

Observations from the meteorological station at Clones (40km to NW) will tend to be indicative of conditions experienced in the Carrickmacross area. The long-term wind direction and speed statistics are presented in Figure 6.1 for the period 1968-97 inclusive. It is evident that the prevailing winds are from a south westerly direction, with 28% of the hourly observations giving a direction of 200-250 degrees. Approximately 60% of winds are from the western sector with an incidence of calm 'slack' wind conditions of about 5%. The annual average wind speed at Clones is 4.4 m/s with less than 6% of the hourly observations recording wind speeds over 9 m/s. It is the lower wind speeds of typically, 1-2 m/s that cause the maximum ground level odour concentrations and wind speeds below 2m/s are reported for about 24% of the time. At higher wind speeds, the rapid rate of dilution of any odorous emissions from sources within the wastewater treatment plant will tend to be sufficient to prevent detection of odours from beyond a few metres from the

edge of the open tanks. It should be noted that these hours would not be consecutive and would tend to occur mainly during the summer period.

The greatest potential for odorous emissions is normally during the summer months when warm dry weather conditions can increase the rate of evaporation from exposed tank surfaces within the treatment plant. During the winter months with damp cool windy conditions prevailing, the potential for odours being detected more than a few metres from the side of the open tanks and odour exhaust vents would be substantially lower.

The long-term (30 year) annual mean air temperature for the Carrickmacross area is about 8.8 ^{o}C with a range in the maximum daily average of about 6.7 ^{o}C in January to 18.6 ^{o}C in July. The absolute maximum reported at Clones in recent years is 28-30 ^{o}C, which has been reported during the months of June-August. The potential for malodours to be generated will be greatest on warm sunny days, as this is normally associated with dry anti-cyclonic weather conditions which can result in low flow combined flow conditions into the treatment plant.

6.3.2 Characteristics of the Proposal

Fresh sewage arriving at a wastewater treatment plant via a properly constructed sewer system has a slight smell, normally described as musty in character. As long as a certain level of dissolved oxygen is maintained in the sewage anaerobic conditions will not take place. However, if the oxygen content of the sewage is used up then gases such as hydrogen sulphide, nitrogen and sulphur based organic compounds (mercaptans, ketones, amines, indoles and skatoles) are quickly produced and a general septic condition occurs with typical pungent odours being emitted. These conditions may arise where the incoming sewage becomes septic if it is pumped along long lengths of rising main and can result in strong malodours at the inlet works. These conditions do not occur at Carrickmacross and septicity in the incoming wastewater is not expected to be present.

The proposed expansion of the WWTW at Carrickmacross is designed to provide treatment capacity for a Biological Oxygen Demand (BOD) load of 44,000 PE (person equivalent), compared to the current design capacity of 12,150 PE and operating capacity approximately 20,000 PE. This will require a new inlet works, stormwater tank, additional tanks for secondary treatment and improved sludge treatment. The construction contract is design/build/operate (DBO). This means that the Contractor will carry out the design of the

plant. The DBO contract will contain performance specifications, including odour control. The Contractor will also be required to monitor odorous emissions to ensure compliance with emission limits during the normal routine operation of the plant.

In the indicative design (Figure 3.4) it is envisaged that in the upgraded treatment plant the following components will be included: -

- The present inlet works will be replaced by a new covered inlet works housing the inlet sump/flumes and preliminary treatment screening equipment.
- Additional stormwater holding tankage will be constructed.
- The existing No 1 oxidation ditch will be removed.
- A new aeration tank will be constructed.
- Sludge treatment will be carried out within an enclosed building
- A new membrane reactor within an enclosed building

The Envirocon assessment of odour potential due to air emissions was carried out by examining local climatic conditions, reviewing specialist literature to obtain baseline data and assessing this data using air dispersion modelling techniques. Odour control measures are proposed for the inlet works (which will be covered or housed), the sludge draw-off chambers and the sludge de-watering building.

The indicative design for the Carrickmacross works include an inlet works with screening and grit removal. Fine screening filters out material greater than 6mm from the liquid and washes and compresses them to lower moisture content. Biodegradable material will be washed out and returned with the wash water to the treatment stream, hence the screenings for disposal will be relatively dry and, therefore, less offensive with respect to odour production. These compacted screenings will be disposed of to landfill. The inlet works will be covered or housed and provided with odour control equipment, which could take the form of air scrubbing through peat filter bed or similar type of odour removal equipment.

The storm water tanks are unlikely to be a significant source of odour due to the infrequent nature of their use. Quick and efficient cleaning of the tanks after use will ensure that any odours generated would be short-term only.

Under normal operating conditions the aeration tanks should not be a significant source of

odour. The aeration plant will maintain aerobic conditions in the tanks.

Odours from secondary settlement tanks are not normally detectable beyond a few metres from the tank.

The sludge treatment system will be designed to prevent the escape of malodours to the atmosphere. The various sludge processes outlined earlier will be carried out within enclosed containers/covered buildings. There will be a separate odour treatment unit dedicated to the sludge stream. The exhaust air from the buildings and any covered odour source will be treated. Sludge will be stored within enclosed units or within covered tanks/silos.

Mr. Bailey's brief was to assess the adequacy of these measures and recommend further measures if required. It is accepted that odour cannot be totally eliminated within the site without enormous cost implications. The aim, therefore, is to prevent an odour nuisance, which could be detected beyond the site boundary.

High efficiency single or two stage odour control units will be installed to treat odorous air from the inlet works building and the sludge treatment plant. Each unit will have a very high removal efficiency rate, with odour reduction levels in excess of 95%. Acceptable methods of odour control include charcoal scrubbers, bio filtration and ozone scrubber systems.

6.3.3 Potential Impact of the Proposal

Short-term odour ground level concentrations downwind of the wastewater treatment plant were computed using the ADMS3 (Version 3.2, September 2004) advanced air quality dispersion model developed in the U.K. by CERC (Cambridge Environmental Research Consultants). This prediction model is used by Regulatory Authorities and the Environment Agency in the United Kingdom and has been approved by the Environmental Protection Agency for modelling studies supporting IPCL applications. It has been widely used in Ireland for evaluating the impact of odours from wastewater treatment plants.

Hourly climatological data from Clones meteorological station, for the years 1989 and 1990 were used to predict the 99.5 and 98 percentile hourly odour concentration values. These percentile calculations give the odour concentration at each receptor location that is predicted to be exceeded for 2% of the year or 175 hours in the case of the 98 percentile. The 99.5 percentile value is the concentration predicted to be exceeded for 0.5% of the

time, or 45 hours. The pattern of predicted odour concentration around the plant reflects the annual incidence of certain wind speeds and directions coupled with the different types of atmospheric stability close to the ground.

The wastewater treatment plant operates using an extended aeration process for secondary treatment and so there are no primary tanks, which are commonly found to be major potential sources of malodours. In addition, no primary sludge is produced and so the sludge that is recovered and de-watered is secondary sludge from the oxidation ditch process. Transfer and handling of primary sludge can be a cause of malodours at treatment plant and so this potential source is also not present at the Carrickmacross plant. On the other hand, the secondary sludge generated has a much lower organic content and due to the aerobic activity that takes place during aeration in the oxidation ditch has a lower odour potential. This results in lower emissions from de-watering the sludge in the sludge handling building and storage, compared to other treatment plants where primary sludge is de-watered.

The results of the odour impact modelling study based on the planned expansion of the existing wastewater treatment plant are presented as odour concentration contour plots in Figures 6.2 and 6.3. These plots show the pattern of the 99.5 percentile and 98 percentile odour concentrations in the locality of the plant and are based on the maximum value predicted at each receptor location over the two years that were modelled.

An odour concentration of 1 o.u./m^3 is defined as the level at which there is a 50% probability that, under laboratory conditions using a panel of qualified observers, an odour may be detected. At odour levels below 1 o.u./m^3, the concentration of the gaseous compound causing the odour in the air will be less than the detection level and so although the gas is still present in the air no odour may be detected. Sensitivity to an odour also depends on the location; for example, an odour from agricultural related activities is likely to be tolerated by the community longer in a rural setting than in an urban area.

The predicted 99.5 percentile odour concentrations that are predicted for the planned expansion are shown in Figure 6.2 and the pattern of odour levels indicates that the maximum level predicted to occur at the nearest houses to the SW boundary would be between 1-2 o.u./m^3. At the houses to the north of the site boundary, the predicted 99.5 percentile odour concentration is less than 1 o.u./m^3. In other words the odour prediction model predicts that odour levels will generally be below the odour detection level for 99.5

percent of the time at the nearest houses to the site. At the site boundary the predicted 99.5 percentile odour concentration is predicted to be 4-5 o.u./m^3.

The odour concentrations in the locality of the wastewater treatment plant that are predicted to be exceeded for 2% of the year, or 175 hours during the year, referred to as the 98 percentile, are shown in Figure 6.3. At the nearest houses to the south and north of the site, the predicted 98 percentile odour concentration is less than 1 o.u/m^3.
The odour levels are predicted to be less than 4 o.u./m^3 along all boundaries around the site.

An odour concentration of greater than 5 o.u./m^3 has been widely used as a criterion for determining possible nuisance complaints, typically as a predicted hourly average 98 percentile limit value. This predicted odour concentration has been adopted in the past as an acceptable approach in Ireland and the U.K. to demonstrate that no odour nuisance would occur beyond the site boundary of planned wastewater treatment plants.

Recent odour limits proposed by the EPA in a report (Odour Impacts and Odour Emissions Control Measures for Intensive Agriculture, EPA 2002) regarding odorous emissions from pig production units propose a more stringent condition in relation to a limit value around new pig production units of 3 o.u./m^3 as a 98 percentile of predicted hourly concentrations. A target value of 1.5 o.u./m^3 also as a 98 percentile has also been proposed to provide a general level of protection against odour nuisance for the general public. A predicted odour concentration of 1.5 o.u./m^3, expressed as a 98 percentile of hourly values, is recommended by the Environment Agency in the U.K. (IPPC H4 Horizontal Guidance for Odour Part 1, 2003) for sources with a potential for offensive odours, including wastewater treatment plants.

It is evident from the analysis of the modelled odour impact due to emissions from the proposed treatment plant that the potential for significant malodours to be detected beyond the boundary to the plant will be very low. No significant impact, likely to result in an odour nuisance in the locality of the nearest private properties is predicted as a result of the planned expansion to the wastewater treatment plant. It is considered that based on the foregoing that the predicted 98 percentile odour value should not exceed 4 o.u./m^3 at the site boundary and 1.5 o.u./m^3 at the nearest sensitive receptor to the boundary such as a house.

FIG 6.2: PREDICTED MAXIMUM 99.5 PERCENTILE OF SHORT–TERM ODOUR CONCENTRATIONS DUE TO EMISSIONS FROM PROPOSED EXPANSION OF WASTEWATER TREATMENT PLANT

INDICATIVE TREATMENT PLANT LAYOUT ALTERNATIVE 1 :

KEY

1. INLET WORKS
2. STORM TANKS
3. ADMINISTRATION BUILDING
4. BLOWER BUILDING
5. FERRIC STORAGE / DOSING
6. OXIDATION DITCH
7. SETTLING TANK
8. INLET PUMP STATION
9. TERTIARY FILTERS
10. CONTROL BUILDING
11. SLUDGE TREATMENT FACILITIES

	AMENDMENT DETAILS	DATE

T.J.O'CONNOR & ASSOCIATES
CONSULTING ENGINEERS
CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
Tel: 295 2321 Fax: 295 4541

PROJECT: EXPANSION OF CARRICKMACROSS WWTW

CLIENT: MONAGHAN COUNTY COUNCIL

DRAWING TITLE: PREDICTED MAXIMUM 99.5 PERCENTILE OF SHORT TERM ODOUR CONCENTRATIONS

SCALE: NTS	JOB NO: 1124	DRAWING NO: FIG 6.2
DATE: MAY'08	DRAWN BY: F.T.	

Drawing name: FT :- D:\Faughts\1124-Carrickmacross Sewerage Scheme\EIS Figures Sept'08\Figure 1.2_3.4_6.2_6.3.dwg/FIG 6.2 Jun 22,2005 9:40am

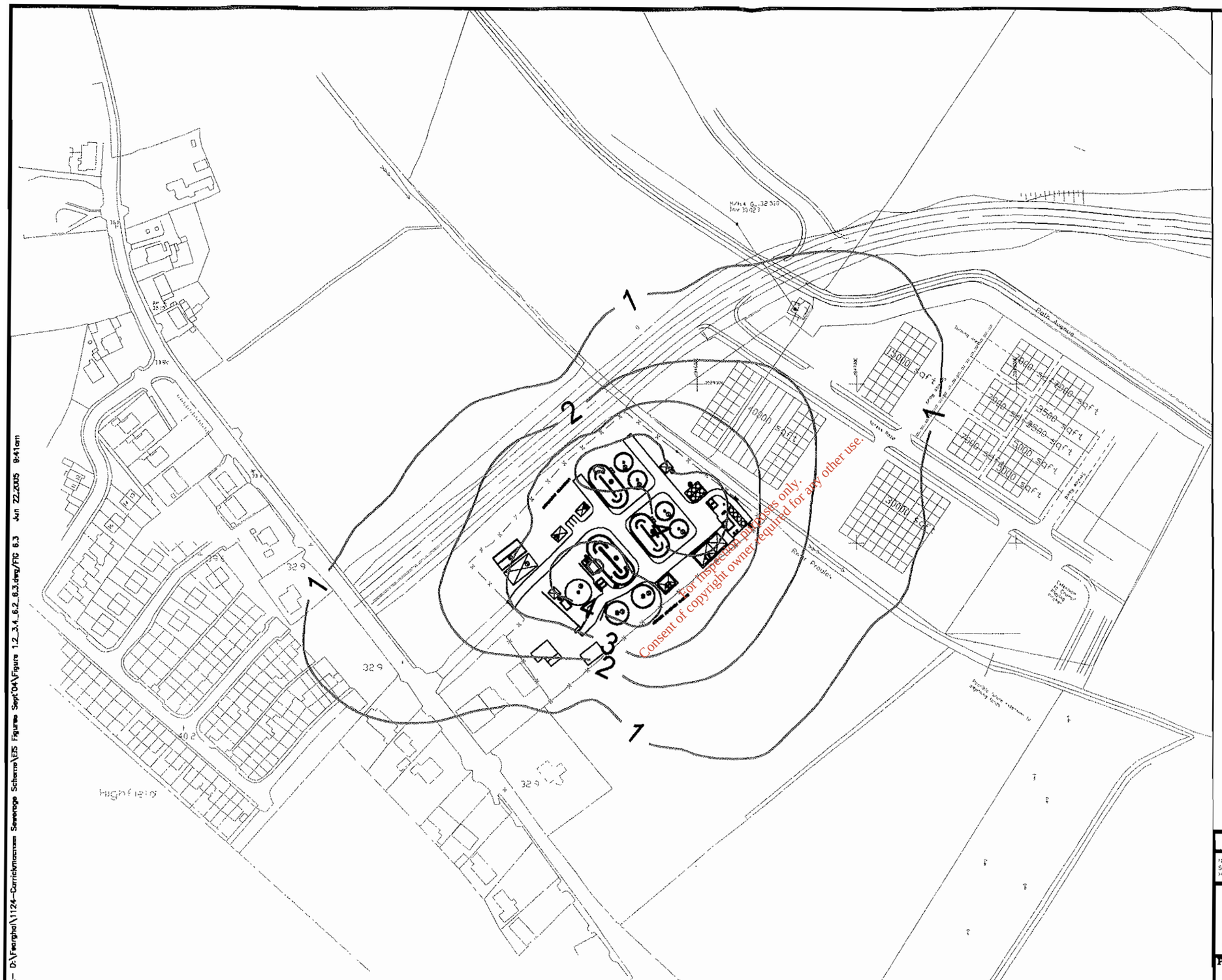

FIG 6.3: PREDICTED MAXIMUM 98 PERCENTILE OF SHORT-TERM ODOUR CONCENTRATIONS DUE TO EMISSIONS FROM PROPOSED EXPANSION OF WASTEWATER TREATMENT PLANT

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INDICATIVE TREATMENT PLANT LAYOUT ALTERNATIVE 1 :

KEY

1. INLET WORKS
2. STORM TANKS
3. ADMINISTRATION BUILDING
4. BLOWER BUILDING
5. FERRIC STORAGE / DOSING
6. OXIDATION DITCH
7. SETTLING TANK
8. INLET PUMP STATION
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	AMENDMENT DETAILS	DATE

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Tel: 295 2321 Fax: 295 4541

PROJECT:	EXPANSION OF CARRICKMACROSS WWTW
CLIENT:	MONAGHAN COUNTY COUNCIL
DRAWING TITLE:	PREDICTED MAXIMUM 98 PERCENTILE OF SHORT TERM ODOUR CONCENTRATIONS
SCALE: NTS	JOB NO: 1124
DATE: MAY'05 DRAWN BY: F.T.	DRAWING NO: FIG 6.3

Drawing name: FT :- D:\Fearghal\1124-Carrickmacross Sewerage Schems\EIS Figures Sept'04\Figure 1.2_3.4_6.2_6.3.dwg/FIG 6.3 Jun 22,2005 9:41am

6.3.4 Mitigation Measures

The following measures to control and reduce potential sources of malodours are proposed for the expansion programme of the wastewater treatment plant at Carrickmacross: -

- The inlet works channels and screening equipment will be covered or housed in a purpose designed building
- Screened coarse material and grit from the grit trap will be washed and transferred into covered skips located within the inlet works building.
- Diffused fine-bubble aeration or covered surface aerators and sub-surface mixers will be used in the aeration tanks to improve mixing and reduce the turbulence and hence the potential for generating malodours and aerosols from the tank liquor surface. In addition, the level of dissolved oxygen will be continuously monitored to prevent anaerobic conditions forming in the mixed liquor.
- Odorous emissions from the sludge dewatering building will be vented to atmosphere via a high efficiency odour treatment unit.
- The secondary sludge thickening tank will be covered and the headspace air in the tank ducted to the odour treatment unit.

The odour control units shall be designed to operate with removal efficiencies of over 95%. It is planned that one odour control unit will treat foul air from the inlet works, with a second unit for treating headspace air from the sludge treatment plant. These units may be stand-alone systems installed at ground level or emission vents located on the buildings. The location and design of the exhaust stacks to these units should ensure that adequate vertical release of emissions is achieved. The odour control systems to be installed should ensure that no malodours occur beyond the site boundary.

Under the form of procurement proposed, tenderers will be required to provide performance guarantees with respect to odours from their particular design. These will require the tenderers to guarantee that their designs will not generate odours of greater than 1.5 odour units at the nearest residence on a 98-percentile basis and to substantiate their proposal by odour modelling.

The predictive odour maps demonstrate that it is possible to mitigate the odour impact of the WWTW to within acceptable limits by incorporating the measures referred to earlier, including covering or housing of the inlet works in a building, covering of other odour

sources where required, and provision of separate odour treatment units dedicated to the sludge and liquid streams.

6.3.5 Predicted Impact of the Proposal

With the proposed extension of the WWTW as described in previous sections of this report, the levels are predicted to be within the range of 1-2 o.u./m^3 at the nearest dwelling. These results demonstrate that no adverse impact is predicted within the local community from the planned expansion of the wastewater treatment plant at Carrickmacross.

6.3.6 Monitoring

Under the form of procurement proposed for the treatment works the contractor appointed to operate the works will be required to ensure that detectable odours from the plant do not occur outside the works boundary based on the units discussed above. Failure on his part to control the odour from the plant to this level will result in liquidated damages being invoked so that the contractor will have a financial incentive to control the odours at the works. Routine monitoring of odour will be undertaken on a twice-yearly basis or more frequently in response to any complaint from the public relating to odours near the treatment works. There should be no odour nuisance under normal operating conditions within a well maintained plant.

6.3.7 Reinstatement

No reinstatement will be required.

6.4 Aerosol

6.4.1 Receiving Environment

The fine mist of droplets above an aerated liquid is referred to as an aerosol. Aerosols can be produced by a number of methods. The areas of concern at Carrickmacross are the potential use of surface aerators, the discharge pipe to the river and the use of effluent as wash water for cleaning within the works. Each of these situations have the potential to lead to the production of aerosols.

6.4.2 Characteristics of the Proposal

Aerosols are introduced into the air at aeration tanks in the activated sludge process due to the turbulent nature of the process, *i.e.* the injection of air into the liquid. They are produced in pressure cleaning by use of effluent as wash water and by the discharge of effluent to the river. Aerosols take the form of a fine mist of tiny droplets (smaller than 5µm). Aerosols produced in a WWTW will contain an element of bacteria. However,

because of the very small size of the fine mist droplets, they evaporate very quickly. Hence the micro-organisms will be subjected to rapid dehydration and generally do not survive. There are no known recorded cases of infection from aerosols derived from WWTWs.

6.4.3 Potential Impact of the Environment

Aerosols introduced into the air at the aeration tanks or through use of effluent as wash water should only present a potential public health hazard to anyone within 20m of these operations. Even then the risk is very small as there is little evidence that aerosols affect the plant operatives at existing treatment works. At distances greater than 20m the risk of contamination falls away rapidly. The risk is described as negligible beyond 20m by Dr. N. Gray of Trinity College Dublin in his publication “Biology of Wastewater Treatment” (Gray, 1989).

In the case of certain food processing and dairy industries only a zero risk of contamination is considered acceptable. It is normal practice for such industries to install purification systems on any air intakes and in sensitive production areas of their plants.

6.4.4 Mitigation Measures

Aerosols are really only of concern within the treatment works. Any proposal to use the effluent as site wash water should include ultraviolet treatment of the wash water at source or an alternative disinfection process. Operatives will also need to take precautions, such as the wearing of facemasks during certain operations such as the use of high pressure washing equipment, to prevent the inhalation of the aerosols.

The use of mechanical surface aerators will be permitted under the DBO contract under the provision of sufficient cover near the aerator to prevent aerosol production. If the aeration units employ diffusers for the transfer of oxygen, aerosol production and its inherent risks are dramatically reduced such that the aerosol production is negligible.

6.4.5 Predicted Impact of the Environment

The predicted impact of aerosols at the proposed treatment works is deemed to be minimal due to their rapid evaporation and consequently the inability of the micro-organisms to survive. Also, there is no known recorded evidence of a health hazard to those living near and being exposed to such aerosols.

6.4.6 Monitoring

Aerosol generation and distribution profile can be monitored by microbiological air sampling. Another important point for monitoring disposition of microbes from the plant

would be sampling leaves from the surrounding trees for faecal indicator bacteria such as *E. coli.* However such monitoring is not considered necessary at this stage but could be implemented by the Council at a later stage if deemed necessary.

6.4.7 Reinstatement

No reinstatement will be required.

6.5 Light

6.5.1 Receiving Environment

The site of the plant is off the Ardee Road on the outskirts of Carrickmacross. There are both commercial developments and residential developments in the immediate vicinity of the site. Street lighting is provided to the Ardee Road and to the N52 link road. Construction works for a new industrial estate on the opposite bank of the river has recently commenced and will include street lighting. The general character of the area is therefore urban with significant public light sources already in place.

6.5.2 Characteristics of the Proposal

The wastewater treatment works will be in operation for twenty four hours per day for 365 days per year but it will not be manned at all times. Lighting will be provided as a safety and security measure and will only be used as required.

It is proposed to provide lighting to illuminate all of the treatment units and access roads. This will consist of a combination of high masts and low level lighting where appropriate. The masts should be positioned so as to illuminate the individual treatment units and the roadways.

6.5.3 Potential Impact of the Proposal

The development of the treatment works site will increase the artificial light generated in this area. Excessive light levels can be a source of nuisance and could cause the treatment works to become a prominent feature in the landscape at night. This could have the potential to affect the surrounding residential and rural population.

6.5.4 Mitigation Measures

- The lighting fixtures should be directed inwards so as to minimize any over-spill of light at the boundaries.
- The design of the lighting and the selection of the types of lighting to be used will minimise the spillage of lighting outside the site boundary towards the local area.

- At night, the full lighting will only be in operation if the plant is manned or if the alarm system is activated. Screening of the works boundary with trees and shrubs as well as an embankment will also help shield the light spread outside the site.

6.5.5 Predicted Impact of the Proposal

The lighting at the treatment plant is not predicted to have any significant negative impact on the town of Carrickmacross as it will not be fully in use at night time or outside normal working hours and will be used only when the need arises. The external lights will generally only be in operation if lighting conditions demand during normal working hours, when the plant is manned or if the alarm system has been activated. Any negative impact will be minimised by mitigation in accordance with 6.5.4 above.

6.5.6 Monitoring

Monitoring will be required to ensure that there is no excessive or overuse of artificial site lighting.

6.5.7 Reinstatement

No reinstatement will be required.

6.6 Climate

Carrickmacross is located in the north of Ireland. The town is located in a drumlin area with elevations in the catchment varying between about 30 mAOD at the treatment works site, to over 75 mAOD at the upper extent of the existing wastewater catchment. The area has a humid, mesothermal climate that is typical of the country. There are no aspects of the WWTW project that will impact on the local climate. There are no climatic effects in the region that will require any special measures to be taken during the design, construction and operation of this project.

7 SOILS

7.1 Soil Type/Characteristics

7.1.1 Receiving Environment

Carrickmacross is located in a drumlin area with elevations in the catchment varying between about 30 mAOD at the treatment works site, to over 75 mAOD at the upper extent of the existing wastewater catchment.

The land adjacent to Carrickmacross is generally good quality agricultural land comprising predominantly dry granular soils typical of drumlin areas. The underlying geological formations are limestones of the Mullaghfin Formation. These are pale grey carboniferous limestones. The general soils map of Ireland (Teagasc 1980) suggests that Carrickmacross sits on or close to the boundary between two major soil groups as shown in Figure 7.1 below. Based on scaling of the map, the WWTW is thought to sit within the luvisol group.

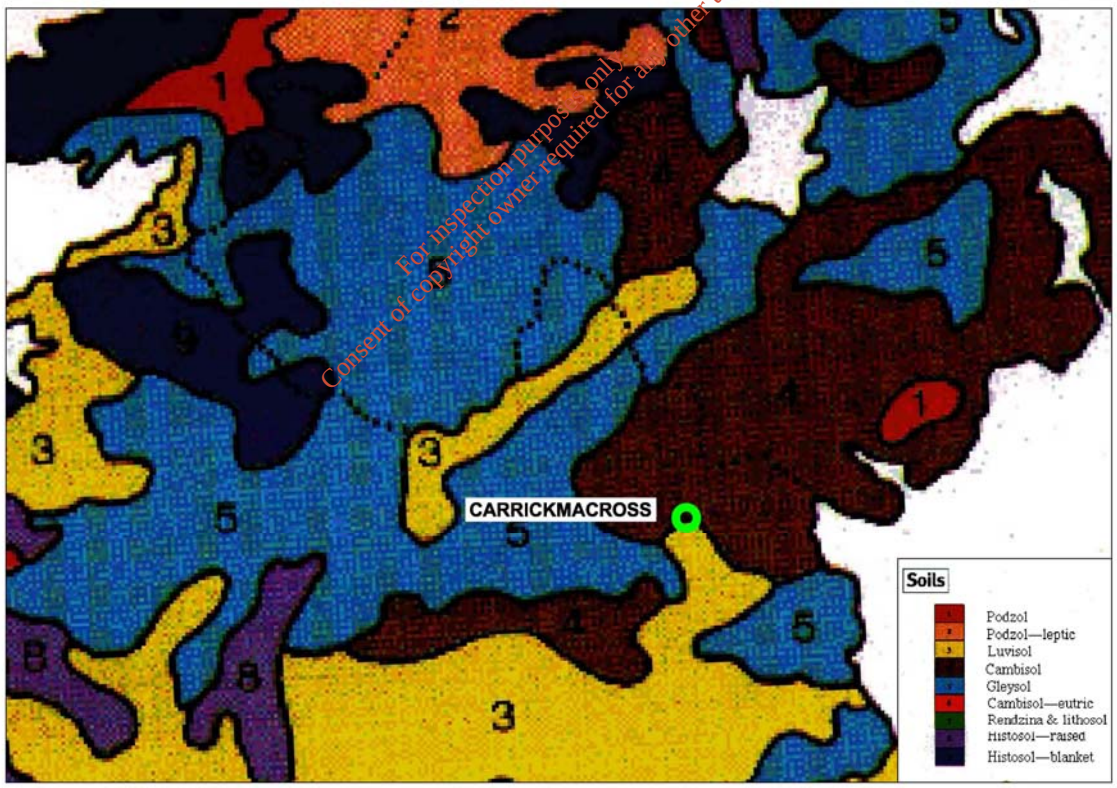


Figure 7.1 – General Soils Map of Ireland – Teagasc 1980

Investigations carried out for previous works at the WWTW indicate that the soils at the site consists of the following layers:

Overburden – A horizon of made ground is found across the site. This layer varies between 2m at the northeast site to 0.5m at the southwest of the site. To the north this made ground is underlain by soft to firm normally consolidated fluvial/lacustrine deposits comprising soft peat, soft marl, soft to firm silty clay and loose silty fine sands. This layer increases to the north and thins out to the southwest. Underlying these deposits, a brown silty sandy gravel with cobbles and boulders is encountered.

Limestone bedrock – This layer lies directly beneath the overburden.

The water table is at approximately 2-4 metres below the surface.

7.1.2 Characteristics of the Proposal

The main impact in respect of soils will be the construction of process tanks and foundations for new buildings. For the indicative design prepared for the E.I.S., several new tanks are shown. These new tanks are assumed to be based around top water levels coinciding (approximately) with existing ground levels to permit a gravity flow of the influent through the works from the preliminary treatment building. Under the proposed DBO contract, tenderers will be free to offer alternative designs including those entailing inter-stage pumping which may be proposed to avoid excavation below the water table. Where excavation below the water table is proposed, it is expected that the contractor will establish temporary sumps and pumping to lower the water table locally. Any tanks placed within or below the water table will be required to have an adequate factor of safety against flotation when empty. All surplus excavated material will be exported off site to licensed (non hazardous) landfill sites.

7.1.3 Potential Impact of the Proposal

The construction will have very little impact on the soils if the tanks are above ground level. If the tanks are buried then some dewatering will take place and certain tanks may need to be both anchored to prevent flotation and to be piled to prevent settlement due to the underlying soft peat layers. This excavation will be isolated in the areas of the tanks and the impact on the soils will be minimal.

7.1.4 Mitigation Measures

No mitigation measures are required.

7.1.5 Predicted Impact of the Proposal

The predicted impact of the proposal will be minimal.

7.1.6 Monitoring

No monitoring of the soil on site will be required.

7.1.7 Reinstatement

Reinstatement of the topsoil on the site will be carried out as part of the landscaping of the site.

7.2 Foundations

7.2.1 Receiving Environment

Piled foundations may be required to support certain units. Anchors may be required to hold down the tanks against flotation when empty.

7.2.2 Characteristics of the Proposal

The foundation works will be limited to normal excavation, piling and dewatering and, possibly, some ground anchors.

7.2.3 Potential Impact of the Proposal

The impact of the foundation works will be standard for similar type construction activities.

7.2.4 Mitigation Measures

No mitigation measures are required.

7.2.5 Predicted Impact of the Proposal

The impact of the foundation works will be standard for similar type construction activities.

7.2.6 Monitoring

No monitoring will be required.

7.2.7 Reinstatement

No reinstatement will be required.

8 ECOLOGICAL IMPACTS

A study of the ecology of the proposed treatment works site and of the River Proules downstream of the WWTW was carried out by Aquens Ltd, a UCD based company, in July and August 2004. A report summarizing the findings of this study and describing possible impacts of the proposed development on the ecology is reproduced in full in Appendix C. The flora and habitats of the WWTW site and the impact of the proposed wastewater treatment plant are described below in the form of a summary of the main findings from the Aquens report.

8.1 Land Based Habitats

8.1.1 Receiving Environment

The site of the proposed extension for the upgrading of the WWTW is adjacent to the existing plant. It is situated north of the plant and extends north-east to the boundary with the River Proules and north-west to the main N2 roadway. The new link road currently being developed runs along the northern boundary of the site separated by a perimeter of trees and a fence. A line of trees and fencing also separates the site from the river. The site of the proposed extension has a hard surface and is currently used as a storage area for vehicles and materials by the local authority.

A treeline is found along the northern and north-eastern boundary of the site. It is composed of planted (< 20 years old) cultivated varieties of Birch and Whitebeam, Leylandii and Portuguese Laurel. Birch is regenerating near this treeline. This habitat has low biodiversity value. It is of potential value as a nesting, roosting habitat for birds but could easily be improved by planting of native species of trees and shrubs.

Photograph 8.1 - The tree lined perimeter at the northern boundary of the proposed site of extension.

Fieldwork revealed the presence of a high diversity of flowering plants in the habitats associated with disturbed ground. A total of thirty-six species of flowering plants were identified. The most common species was Common couch grass which formed a mono-dominant sward near the boundary. Other species of some interest include the wetland plants Meadowsweet, Sharp-flowered Rush and Small Sweet-grass. Their presence may indicate the previous existence of a wetland on the site linked to the Proules River.

The site of the extension is of local interest for biodiversity due to the high diversity of flowering plants. This is likely to support good insect and butterfly diversity. The treeline has potential for improvement. None of the species found is rare or unusual. The species recorded are predominantly weedy species typical of disturbed areas.

While the site of the extension has a significantly higher diversity of plants than the river sites the plants are widely distributed species which can colonise a wide variety of habitats. These habitats are common locally and regionally.

On a regional level neither the habitats nor the species found at the site are rare. To repeat they are of local interest for biodiversity.

A bird survey was also carried out in August. Because this month is not the best month for a survey (not the breeding season) and because of the construction activities nearby, only a limited number of very common species and numbers were found.

Finally, during the Flora and Fauna Survey no mammals were observed and no evidence of mammalian activity was recorded. Only two species of butterflies were recorded.

8.1.2 Characteristics of the Proposal

The existing WWTW extension is confined to the existing site. Significant construction will be undertaken in this area disrupting the existing habitat. These construction works include stripping of topsoil, deep excavations, construction of concrete tanks, construction of temporary and permanent roads and fences and associated works. Construction of the treatment works buildings and landscaping and re-planting will be as described in earlier sections of this report.

8.1.3 Potential Impact of the Environment

Construction of the proposed works will result in the loss of all habitats at the site of the proposed extension works. This will not lead to the loss of any significant habitat or species of significant conservation importance. However, the excavation of parts on the proposed site for the extension will result in the removal of a nominal area of feeding and nesting habitats for birds, which could reduce the species diversity of birds within the site.

8.1.4 Mitigation Measures

A number of mitigation measures are required to ensure that there will be no long-term negative impact on the environment. The mitigation measures recommended in the Report on Flora and Fauna have been reproduced below as follows:

- By following the landscaping guidelines below, it will be possible for development to result in local and long-term biodiversity gains. The existing boundary area (with planted trees and shrubs) should be excluded from development and landscaped to improve its value to nature. Landscaping should involve:
  - The removal of all specimens of Leylandii and Laurel without disturbing adjacent tree species.
  - The establishment of native ash, oak and hawthorn in the resulting gaps, with hawthorn outside.
  - Where opportunities exist (at the corner of the site) these species should be planted in clumps.

- Management should actively manage vegetation growth around the trees by strimming until the scrub/woodland is established. Once established no further management will be required.
- The hedge around the two sides of the main compound should be retained as this is the main bird habitat of the site of the proposed extension. When the site is landscaped, broad-leaved trees and shrubs could be planted, especially berry producing species, to provide more habitat for birds.
- The grassy area along the perimeter at the river-side should be retained to keep the habitat for the butterflies.

Photograph 8.2 - The proposed retention of a 'buffer' strip at the north-east boundary of the proposed site.

8.1.5 Predicted Impact of the Proposal

The comprehensive measures proposed above to conserve or replace the existing habitats will form part of the design brief for the contractor for the design, construction and operation of the works. With such measures in place, the long-term impact of the proposal is negligible. Any other nominal existing habitats within the site which are disturbed by construction activities will be expected to regenerate elsewhere on or near the site so there will be no-long term adverse effects on the environment.

8.1.6 Monitoring

Monitoring of the regenerated hedgerows and vegetation areas should be performed to ensure that they are adequate and conducive to the return of the original wildlife.

8.1.7 Reinstatement

Planting of hedgerows with broad-leaved trees and shrubs, especially berry-producing species will maintain the bird density in the area and will enhance the visual aspect of the development and also improve its value as a site for wildlife.

8.2 Aquatic Habitats

8.2.1 Receiving Environment

A detailed description of the various flora and communities of species inhabiting the Proules River is given in the Aquens Report in Appendix C and is summarised briefly below.

Photograph 8.3 – View of river immediately downstream of the outfall pipe.

The survey of macro invertebrate communities in the Proules River did not find any exceptional species. The only Group A (sensitive) fauna were recorded upstream of the effluent discharge location. None of the flora species identified in the Aquens report is rare. They are native species and typical for a depositing lowland river.

There is some bird life along the river including mallards and kingfishers. Kingfishers are protected under Annex I of the EU Birds Directive (Directive 79/409 on the Conservation of Wild Birds) and are an amber listed species of conservation concern in Ireland (Newton et al., 1999).

Up to the early 1960's salmon were known to spawn in this river. In July 2004 the Eastern Regional Fisheries Board went about relocating fish stocks from a portion of the river, which is to be diverted to facilitate a new bridge on the northern interchange outside the town. A small stock of brown trout *Salmo trutta* L. currently exists in the river.

The Aquens report notes prolific plant growth in the channel of the Proules River and suggests that this is due to enrichment mainly from agricultural sources.

8.2.2 Characteristics of the Proposal

The treated effluent will be discharged through an outfall pipe directly into the River Proules. No construction work is planned for the banks of the river.

8.2.3 Potential Impact of the Proposal

The upgrading of the plant will have a positive effect on the quality of the River Proules. This will improve the quality of the water and enhance the area as a habitat for all types of flora and fauna. There will be no negative impact as long as the targeted final effluent standards are achieved. It will be important to monitor the discharge during construction and commissioning.

The river acts as a corridor for the movement of mammal species. It is probable that otter and/or mink might use the river as a corridor. Although the proposed works will not directly affect the physical nature of the river itself, the narrow grassy strip dividing the site from the river should be retained as a 'buffer strip' and wildlife corridor.

The presence of construction materials or the discharge of construction waste or silt (accidentally or otherwise) is a potential hazard during the construction period but offers no long-term impact.

If the proposed extension to the WWTW does not take place, then the quality of the final effluent will deteriorate as the region grows. This would have a substantial negative effect on the river.

8.2.4 Mitigation Measures

There should be a minimal requirement for mitigation measures as the discharge standards proposed may be expected to assist in the attainment of a substantial improvement in the water quality in the river. The measures recommended in the Aquens report are as follows.

- Impacts on the river and banks should be minimized wherever possible. A buffer strip, where it exists should be maintained along the river bank adjacent to the site,

this will act to protect the river against run-off from the site and act as a corridor for wildlife. Although buffer strips may be of any width, they must be at least 2m wide to be effective (SEPA 2000). The buffer strip should be clearly marked and fenced off during development to protect it from damage by heavy machinery, building debris etc.

- Silt arising from the plant during the development of the site should be contained.
- Effluent being discharged from the upgraded plant needs to adhere strictly to the standards set out in the aforementioned regulations so as to ensure the survival of the fish, in particular the stock of brown trout.
- The discharge should be monitored.

8.2.5 Predicted Impact of the Proposal

The measures proposed above will form part of the design brief for the contractor for the design, construction and operation of the works. With such measures in place, the longer-term impact of the proposal will be beneficial to the aquatic flora and fauna due to the improvement in water quality in the river. The level of agricultural runoff may limit the full benefits of this improvement. The existing riverbank should be maintained through the use of a buffer zone and no detrimental impact is predicted.

8.2.6 Monitoring

The quality of the River Proules is routinely monitored by the Environmental Protection Agency, with more than 12 samples at each of five stations on the river being analysed annually. Additional monitoring of the effluent quality from the WWTW will be undertaken as part of the DBO contract, as provided for under the Urban Wastewater Treatment Regulations.

8.2.7 Reinstatement

No reinstatement will be required.

9 SOCIO-ECONOMIC IMPACTS

9.1 Industrial and Residential Development

The 2002 census suggests that the population of Carrickmacross grew at a rate of approximately 1.3% per annum since 1996. Although this rate of growth is comparatively modest by recent Irish standards, a number of developments indicate that this rate may accelerate in the future. The completion of the M1 from Dublin to Dundalk and the Carrickmacross (N2) bypass has reduced commuting times to north Dublin to less than one hour. The improvement in the road infrastructure also makes Carrickmacross a more attractive location for new industry while the diversion of N2 traffic from the town centre may be expected to encourage commercial development. Furthermore, the government decentralisation programme proposes to relocate a section of the Department of Social and Family Affairs to Carrickmacross. Recent planning approvals granted by Carrickmacross Town Council and Monaghan County Council provide for the construction of more than 500 new houses. Planning approvals have also been granted for a number of multiple unit commercial developments.

The development plans of both Carrickmacross Town Council and of Monaghan County Council predict/provide for substantial growth in both residential and industrial development. The planned increase in the size of the plant from its current load of around 23,000 PE (including industrial) to 44,000 PE over a 20 year design horizon reflects the anticipated level of growth.

9.1.1 Potential Impact of the Proposal

The proposed extension of the treatment plant is designed to cater for the future needs of Carrickmacross town and its environs until the year 2027. The increased capacity of the plant will allow for the sustainable socio-economic development of the town and its environs over this period.

The region has good infrastructure in terms of transport with connections to the N2 and M1 and the newly constructed by-pass. These are essential for the sustainable development of the area, particularly with regard to industrial and commercial transport issues.

The existing plant is currently overloaded and will not be able to cope with any additional loads resulting from future growth. Sustainable growth as outlined above is dependant on the increased wastewater capacity that will result from the new extension.

In summary, a number of developments have recently taken place which facilitate a substantial and growth in the population of the Carrickmacross area. The proposed extension of the wastewater treatment plant is essential for this development to take place on a sustainable basis. It will enable increased populations in the local area, pprovide for further commercial and industrial investment and assist in the attainment of higher levels of employment and sustained prosperity for the region.

9.1.2 Mitigation Measures

There are no mitigation measures required with respect to the socio-economic impact of the new extension to the treatment works.

9.1.3 Predicted Impact of the Proposal

The upgrading of the wastewater treatment plant in Carrickmacross will enable the sustainable development of Carrickmacross town and its environs.

9.1.4 Monitoring

No monitoring will be required.

9.1.5 Reinstatement

No reinstatement will be required.

9.2 Power and Water Supply

9.2.1 Receiving Environment

The works is located on the edge of the town. There is a 3-phase high-tension overhead cable serving the existing works from across the river. At the WWTW a transformer is installed. An existing watermain serves the site.

9.2.2 Characteristics of the Proposal

Normally, high-tension electricity is only required where the maximum demand is greater than 500kW. Both the existing and proposed works will have a lower power requirement less than 500kW and for this reason a low-tension transformer station is installed to facilitate the electricity supply to the works. This transformer is located within the existing site and no new power lines are envisaged to be required. A stand-by generator is to be provided in case of power failure.

The existing water main will cater for the potable water requirements of the new site. Additional water for polymer make-up and washing may be obtained from the re-use of

final effluent. No new water mains will be required.

9.2.3 Potential Impact of the Proposal

As no new power lines or water mains will be required there will be no impact on the environment around the site.

9.2.4 Mitigation Measures

In the case of a power failure a standby generator will come into operation to provide electricity for the operation of the works and maintain the quality of the final effluent.

9.2.5 Predicted Impact of the Proposal

There will be no impact on the local environment.

9.2.6 Monitoring

No monitoring will be required.

9.2.7 Reinstatement

No reinstatement will be required.

9.3 Transport and Communications

9.3.1 Receiving Environment

The Carrickmacross WWTW is located adjacent to the Dublin or Ardee road. The entrance to the site has been improved during the previous upgrade of the WWTW in the nineties to increase the sight distance at the access point.

9.3.2 Characteristics of the Proposal

Construction and operation of the works will involve two distinct classes of vehicle and products. The main construction traffic will be associated with the delivery of construction materials to the site and the transport of machinery and plant items to and from the site. The latter traffic will mainly be confined to the start-up and finish of the project. The construction traffic will be the cause of some inconvenience in the short term and should be managed in order to minimize the disruption. It is anticipated that any material arising from the excavations will be reused as fill or landscaping.

During the operations phase, the dewatered sludge will be transported off site for treatment/reuse while the screenings and grit will sent to landfill. Table 9.1 details the materials and residues to be of imported to and exported from the WWTW during the operational phase of the plant as well as the associated truck movements.

There will be further traffic arising from staff and services such as the collection of rubbish. The level of annual heavy traffic movements anticipated by 2006 is shown in Table 9.1.

	Number of visits to and from the WWTW
Removal of dewatered sludge	**160**
Rubbish and screenings collection	**90**
Delivery of materials	**24**
Total	**274**

Table 9.1 - Total annual number of anticipated lorry movements for the new works

The total number of heavy transport movements to and from the site is calculated at approximately 548 per year, which will average 2 one-way trips per working day.

9.3.3 Potential Impact of the Proposal

During the construction phase there will be an increase in the level of traffic associated with the transport of material and construction personnel to the site. As is normal on construction projects the level of activity will vary, commencing slowly and building to a peak during the project before reducing toward the end. With the completion of the Carrickmacross bypass the temporary increase in traffic levels should have a very low impact on traffic levels in Carrickmacross generally. There will nevertheless be an increase in local traffic though this should only be significant on the access road to the site.

During the operation of the works the heavy transport entering the site will be approximately 2 one-way trips per working day. This level of traffic is considered to be in the context of the level of traffic currently experienced on the Ardee road now that the Carrickmacross bypass is opened, it is negligible. Given that the site is located adjacent to the Ardee road the effect of this traffic will be limited to the access road.

9.3.4 Mitigation Measures

A temporary wheel wash or washing facilities will be required to ensure that the lorries leaving the site during construction are clean and do not contaminate the local roads. Permanent wheel washing facilities will be installed for the permanent works.

Construction traffic will be scheduled to minimise disruption and will generally only operate during normal working hours on a five-day week.

9.3.5 Predicted Impact of the Proposal

The long-term impact of the proposal on the local traffic will be low.

All vehicles used to transport the generated sludge will be monitored to ensure that they are maintained in a clean and sanitary condition.

9.3.6 Monitoring

No monitoring will be required.

9.3.7 Reinstatement

No reinstatement will be required.

10 MATERIAL ASSETS

10.1 Assimilative Capacity of the River Proules

The existing river water quality has been assessed in Section 5 of this E.I.S. The assimilative capacity of the River Proules has been considered in conjunction with other regulations to establish an acceptable level of BOD within the river.

The calculations shown in Section 5 demonstrate that the chosen final effluent standard of 4 mg/l BOD is consistent with the dual targets of complying with the regulations and operating within the assimilative capacity of the river.

10.2 Land Ownership and Access

The proposed site is already owned by Monaghan County Council.

10.3 Development Potential and Expansion

The first phase of the treatment works at Carrickmacross will have the capacity, once commissioned, to treat wastewater arising from 30,000 persons equivalent (PE). However, the preliminary treatment and stormwater facilities will be designed for the final capacity of 44,000 PE. The layout of the treatment works will be planned to accommodate this future expansion.

10.4 Existing Structures

Most of the existing structures and buildings are expected to be incorporated into the new works. These include the existing oxidation ditch No.2, final clarifiers, the stormwater tank, administration building, sludge dewatering building, picket fence thickener and parts of the tertiary treatment facilities.

11 VISUAL IMPACT

11.1 Topography and Location

The treatment plant is located off the Ardee Road (previously the N2) on the southern outskirts of Carrickmacross. The north-western boundary of the wastewater treatment plant site is formed by a recently constructed link road, which connects the Ardee Road with the Dundalk Road and the N2 bypass. The Ardee Road itself is situated on the southwestern side of the WWTW. Both roads are a few metres higher than the ground level of the WWTW site. Due to the lack of any screening along the roads, the site is clearly visible from both roads.

The site is bounded by the River Proules on the north-eastern boundary. A bank of high trees and shrubs along this boundary as can be seen in photograph 8.2. The south-eastern boundary of the site is marked by smaller trees and shrubs and is adjacent to open fields.

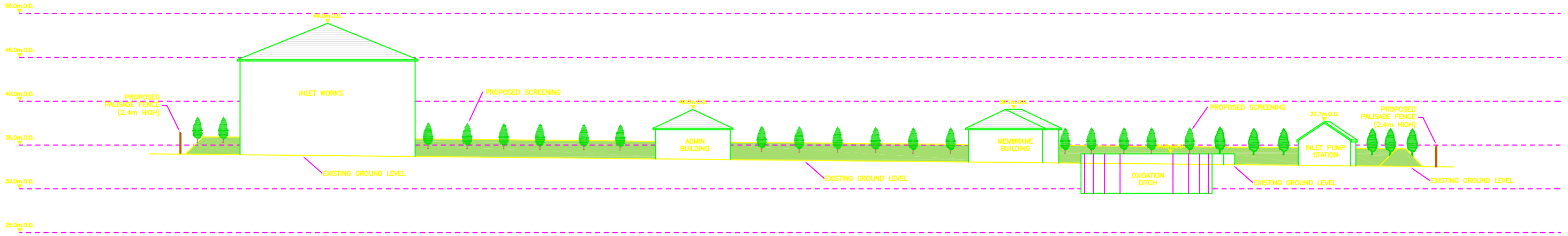
The general character of the area, particularly on the eastern side of the Ardee Road is mixed industrial/commercial. Planning approvals for further commercial and industrial development on the eastern side of the Ardee Road have been granted in recent years. This includes a new industrial estate on the opposite bank of the Proules River and a major commercial development as part of the 'Convent Lands' development.

11.2 Landscape and Buildings

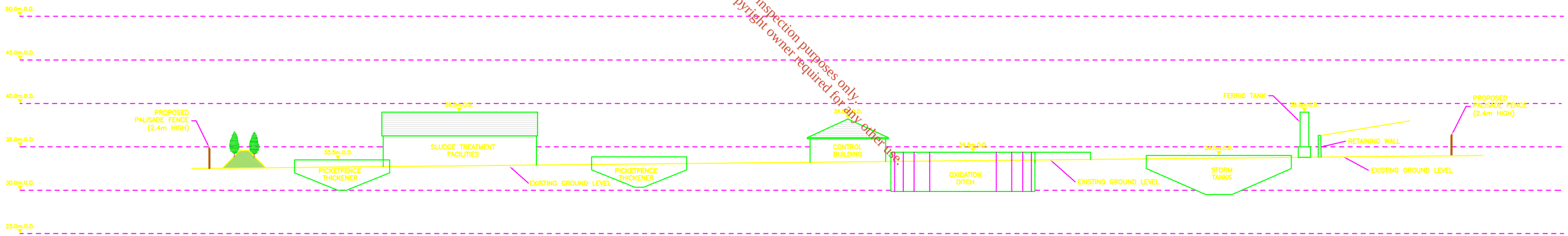
The layout of the site is dictated to a large extent by the functional requirements of the treatment works. However, earthworks, landscaping and appropriate architectural forms are proposed to soften the impact of the works. The buildings will have external finishes of a high quality. The overall shape of the new buildings will be similar to the existing buildings. It is anticipated that the most likely external finish will be a combination of high quality cladding and plastered blockwork. These finishes would generally be in character with the commercial and industrial character of the area.

Sections through the site illustrating the relative heights of the various building an process units are shown in Figure 11.1.

In the following figures, perspective views from different locations are presented without and with the proposed extension of the WWTW. The indicative views do not show the impact of proposed trees and shrubbery which may be expected to further soften the



SECTION A-A



SECTION B-B

NOTE: FOR SECTION LOCATIONS SEE FIGURE 3.4A

	AMENDMENT DETAILS	DATE

T.J.O'CONNOR & ASSOCIATES
CONSULTING ENGINEERS
CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
Tel: 295 2321 Fax: 295 4541

PROJECT: EXPANSION OF CARRICKMACROSS WWTW

CLIENT: MONAGHAN COUNTY COUNCIL

DRAWING TITLE: INDICATIVE SECTIONS THROUGH SITE

SCALE: 1:500	JOB NO: 1124	DRAWING NO: FIG 11.1
DATE: SEP'04	DRAWN BY: F.T.	

Drawing name: GJD :- \\Fearghal-newpc\1124-Carrickmacross Sewerage Scheme\EIS Figures Sept'04\PROPOSED SITE LAYOUT - LC.dwg/FIG 11.1 Dec 12,2007 6:23pm

impact of the larger buildings over the longer term, particularly the preliminary treatment works building.

Existing View from ***Indicative View of Proposed Extension***

Figure 11.1- Perspective View from the South

Existing View ***Indicative View of Proposed Extension***

Figure 11.2- Perspective View at junction of Ardee Road and the N2 link road

Existing View ***Indicative View with proposed extension completed***

Figure 11.3- Perspective View from N2 link road looking south east

Existing View ***Indicative View with proposed extension completed***

Figure 11.4- Perspective View from N2 link road looking east

11.3 Mitigation Measures

Landscaping will be required at the northwestern boundaries of the site to minimise any impact of the new buildings and tanks. Embankments will be provided along the full length of boundary as shown on Figure 11.2. These embankments will vary between 2 metres and six metres in width and will be between 1.5 metres and 2 metres in height. The embankments will be planted using the species listed in Table 11.1.

Some internal embankments and landscaping will be required to soften the impact of the proposed tanks and buildings on the vista. The final ground profile should be a rolling

landscape rising around the tanks and buildings to offer a landscaping shield in close proximity to the structures. In this way the structures will be shielded without interfering with the existing profile of the site.

Species to be included in planting	
Ash	Fraxinus Excelsior
Oak	Quercus Petraea
Hawthorn	Cretaegus monogyna
Wild rose	Rosa sp
Elder	Sambucus nigra
Blackthorn	Prunus spinosa

Table 11.1 - Species to be included in planting on landscaping embankments

11.4 Predicted Impact of the Proposal

The mitigation measures above will ensure that there will be a minimal impact on the environment at Carrickmacross. Given the topography of the site the impact of the embankment in combination with screening will reduce the visibility of the site from the Ardee Road. However the taller building will remain visible from surrounding residential and commercial developments.

11.5 Monitoring

No monitoring will be required.

11.6 Reinstatement

No reinstatement will be required.

12 CULTURAL HERITAGE

The archaeological and cultural heritage and their impact of the proposed extension to the WWTW were studied by the Archaeological Services Unit of University College Cork. Their report, included in Appendix D, forms the basis of this section of the E.I.S..

12.1 Receiving Environment

The existing wastewater treatment plant is located South-east of Carrickmacross town in the townland of Magheross, in the barony of Farney. The town of Carrickmacross is a district market town, located in the south of County Monaghan and has been termed the gateway to County Monaghan and to Ulster. Six known archaeological sites are recorded in the environs of the site.

The existing WWTW and the proposed area of the development was originally a boggy greenfield site. The existing treatment plant has since disturbed most of this ground. That which has not been built on has been landscaped, covered with concrete or stone gravel and used as a storage area.

12.2 Characteristics of the Proposal

The proposed development shall be contained within the existing treatment works site.

12.3 Potential Impact of the Proposal

The works proposed shall have no impact on the archaeology of the area. According to the Environmental Impact Statement produced for the most recent upgrade of the treatment works, "*The Curator of the County Museum has advised that the* (treatment works) *area is of no archaeological significance and that there are no entries in respect of this site or lands adjacent to the site in the Sites and Monuments Records*".

This is confirmed by the report from the Archaeological Services Unit of University College Cork. The proposed development does not incorporate any recorded archaeological sites, however, there are at least six known archaeological sites in the vicinity of the development (a church with graveyard, the site of a castle and an old bridge, all within the town, and three crannogs to the east and north-east of the site).

Finally, previous investigations related to the sewerage scheme were undertaken along the public roadway defining the western boundary of the proposed development site. Both a strip trench and a trial hole were excavated and nothing of archaeological significance was noted.

12.4 Mitigation Measures

No mitigation measures are proposed.

12.5 Predicted Impact of the Proposal

The proposed development will not have any impact on the archaeology of the area.

12.6 Monitoring

No monitoring will be required.

12.7 Reinstatement

No reinstatement will be required.

13 SUMMARY OF LONG TERM IMPACTS AND INTERACTIONS

13.1 Summary of Impacts

The previous eight sections have described the environmental impacts that are likely to arise as a result of the decision to upgrade the sewage treatment facilities at Carrickmacross. These impacts have been considered in detail in respect of the proposed site for the treatment works. The following provides a brief summary of the overall impact of the proposal.

The provision of a wastewater treatment works for Carrickmacross is a statutory requirement under Irish Law. The construction of the works at the existing site at the Ardee Road will enable the County Council to discharge their obligations in this respect. A brief summary of the impacts of the proposal is presented below.

- Significant reduction (>90%) in the polluting matter entering the river leading to
  - Enhanced water quality
  - Enhanced aesthetic appearance of the river encouraging recreational and tourist related activities on the river
  - A reduced public health risk
- The town will be provided with a facility which will significantly enhance its ability to attract and cater for industrial, residential and other developments in the town and its environs.
- The works will be designed to modern standards in respect of air treatment and no discernable odours are expected to be detectable beyond the works boundary during normal operation. Mitigation measures to reduce noise and light levels will ensure that the plant will not impact on the nearest residence or businesses in the locality.
- The landscaping and other measures proposed will minimise the visual impact of the works on the local environment.
- Any disruption of the natural habitat during the construction phase will be temporary in nature and any affected species are expected to become quickly re-established.
- Increased traffic to and from the completed works during the operational phase is limited. Given the proximity of the Ardee Road and the connection road to the bypass this will have a minimal impact on the surrounding roads network.

13.2 Inter-Actions

The statement has demonstrated that the wastewater treatment works will have a positive impact on the environment and will substantially enhance the attractiveness of the Carrickmacross area for tourism as well as commercial and industrial development. In these terms the interactions of the impacts of the proposal combine to produce an enhanced environment with positive benefits for the Carrickmacross area generally.

Some intensification of traffic in the area during the construction stage is unavoidable as is a short-term deterioration in the visual impact of the site. These impacts will, however, be confined to the construction period.

The mitigation measures identified for potentially negative impacts following construction such as odour and noise confine these impacts to within accepted limits. When considered together, there are no foreseeable circumstances in which the mitigated impacts can combine to produce a cumulative impact of any greater significance.

13.3 Recommendations

The upgrading of the sewage treatment works at Carrickmacross will improve the environment of the River Proules and enhance the amenity value of the river and downstream lakes to the town. It is an integral part of the infrastructure to enable growth in the region and is essential to the future development of the town. Failure to provide an adequate level of treatment will restrict growth in the town and in the county as a whole. Mitigation measures will be provided at the site at Ardee Road in order to minimise any potential negative impacts. It is therefore recommended that the proposed sewage treatment works be located there.

In summary, it is recommended that:

- Monaghan County Council proceed with their proposal to upgrade the wastewater treatment works as outlined in this document;
- This treatment works be sited at the existing site at Ardee Road;
- The associated mains/sewers be upgraded to convey wastewater to the works;
- The measures as outlined in this document be provided for the mitigation of any negative impacts on the environment resulting from this development.

APPENDIX A – REPORT ON POTENTIAL NOISE IMPACT

APPENDIX B – STUDY ON AIR QUALITY IMPACT

APPENDIX C – REPORT ON THE FLORA AND FAUNA

APPENDIX D – ARCHAEOLOGICAL STUDY

APPENDIX E – Water Quality Report on River Proules