6 Water Quality

6.1 Introduction

This chapter of the EIS addresses the hydrology, water quality of rivers in close proximity to the proposed development and the proposed location for the discharge of effluent arising from the power plant. Impacts related to the construction and operational phases of the proposed development are assessed and mitigation measures proposed to reduce significant environmental impacts on the receiving environment. This chapter is divided into the following sub-sections:

6.1 Introduction

6.2 Methodology

- *General*
- *River Water Quality and Hydrometric Assessment*
- *Impact Assessment of Proposed Development*
- *Consultation*

6.3 Existing Environment

- *Surface Water Quality*

6.4 Water Quality Impacts

- *Construction Phase Impacts*
- *Operational Phase Impacts*

6.5 Water Quality Mitigation Measures

- *Construction Phase Mitigation*
- *Operational Phase Mitigation*

6.6 Residual Impacts

6.2 Methodology

6.2.1 General

A desk-based assessment of surface water quality in the vicinity of the proposed development site was conducted. Groundwater resources are discussed separately in Chapter 7 *Soils, Geology and Hydrogeology*. There are two rivers in relatively close proximity to the proposed development site. The first of these is the Mongagh River which is located *c.* 0.7 km north of the site, and the second is the Yellow River located *c.* 1.4 km to the south of the site. See Figure 6.1 *Watercourses in proximity to the proposed Development Site.* The required information on water quality and hydrology in both the Yellow River and the Mongagh River was obtained from the following sources:

- Environmental Protection Agency
- Offaly County Council
- Westmeath County Council
- Eastern Regional Fisheries Board

Additional information was generated from a review of the following documents:

- Environmental Impact Statement: The Proposed Extraction of Sand and Gravel at Derryarkin and Drumman, Co. Offaly and Co. Westmeath, Bord na Mona Environmental Ltd. (2001).
- Parameters of Water Quality, Interpretation and Standards, EPA (2001).

6.2.2 River Water Quality and Hydrometric Assessment

Water quality of rivers in Ireland is assessed using biological and physio-chemical data. Physio-chemical monitoring measures the causes of pollution and the quantity of pollutants while biological monitoring measures the effects of pollution on the ecological status of the water body. Another important element of the assessment of water quality is the assessment of flow in rivers. The level of flow in a river, in combination with the existing water quality, determine the ability of a river to accept discharges without having a negative impact on the river.

(i) Biological Assessment

The biological assessment used by the EPA is known as the Q-Rating system. The Q-Rating system refers to a biological rating system for freshwaters where the presence and quantity of suitable resident organisms, primarily readily visible invertebrates, are surveyed. Different species show different levels of tolerance and sensitivity to pollution. As such, the presence or absence of specific organisms in the water indicates the level of pollution in the watercourse.

The Q-Rating system measures the effects of pollution by condensing biological information into a readily understandable form by means of a 5-point biotic index (Q-Values), an arbitrary system in which biodiversity and water qualities are related, as described in Table 6.1 *Q-Rating System and Water Quality.*

Table 6.1: Q-Rating System and Water Quality

Biotic Index (Q-Value)	Water Quality
5 (diversity high)	Good
4 (diversity slightly reduced)	Fair
3 (diversity significantly reduced)	Doubtful
2 (diversity low)	Poor
1 (diversity very low)	Bad

Intermediate values are used to describe conditions where appropriate. These relate to the Q-Value scale and indicate the degree of pollution as shown in Table 6.2 *Q-Rating and Pollution.*

Table 6.2: Q- Rating and Pollution

Quality Ratings	Category of River Water Quality
Q5, Q4-5, Q4	Unpolluted
Q3-4	Slightly polluted
Q3, Q2-3	Moderately polluted
Q2, Q1-2, Q1	Seriously polluted

(ii) Physio-chemical data

The physio-chemical assessment of water quality is based on an assessment of a number of water quality parameters with five primary parameters considered. These are Biological Oxygen Demand (BOD), Dissolved Oxygen (DO), Ammonia, Nitrate and Phosphorous.

The BOD test indicates the level of organic matter in the water and the amount of dissolved oxygen present. The greater the rate of loss of dissolved oxygen, the greater the amount of organic matter present. The BOD test therefore provides a good indication of the level of contamination of the water with biodegradable material.

Dissolved Oxygen (DO) is a measure of the oxygen in water which is readily available for fish and other aquatic organisms. The depletion of dissolved oxygen in water can be detrimental to aquatic life and occurs in response to the addition of excessive levels of nutrients arising from anthropogenic or natural sources. The addition of elevated levels of nutrients result in the excessive growth of macrophytes or algae which utilise the limited oxygen supply in the water and so depriving other aquatic species of oxygen.

Ammonia is a toxic substance generally present in small concentrations in natural waters as a result of microbiological activity. In general, concentrations greater than 0.1 mg/l are indicative of sewage or industrial pollution. Free, non-ionised ammonia is the most harmful form of ammonia to aquatic life.

Phosphorous is widely used in agricultural fertilisers and detergents. Significant phosphorous concentrations can lead to eutrophication. Ortho-phosphate is generally considered to be the most readily available form for algal growth.

(iii) Hydrometric Assessment

Ireland is divided into 40 hydrometric areas, each of which consists of a single river catchment or a number of smaller ones. The National Hydrometric Programme was established to collect information on the levels, flows and volumes of water in rivers, lakes and groundwater within each hydrometric area. Records of water levels and corresponding rates of flows in rivers, lakes and groundwater are termed hydrometric data. The EPA, the Office of Public Works (OPW), the Electricity Supply Board (ESB) and the Local Authorities have an extensive network of water level recorders on rivers and lakes throughout Ireland and hydrometric data is measured at various points, known as hydrometric stations, along these watercourses.

Data from hydrometric stations combined with physico-chemical data, from EPA monitoring, was used in conjunction with indicative process waste water loading figures to determine potential discharge points for waste waters from the proposed development.

6.2.3 Impact Assessment of the Proposed Development

An assessment was undertaken in order to determine the potential impact of the proposed development on the surface-water receiving environment. A full description of the proposed development is included in Chapter 3 of this EIS, *Description of the Development*. This section describes the specific issues of the proposed development in relation to surface water quality and quantity. These issues are surface water run-off, foul water and process wastewater discharges.

(i) Surface Water Runoff

Surface water runoff will be generated from all surfaces within the facility which are exposed to rainwater, or to which water is applied in order to clean. This includes all hardstanding surfaces, roofs and other impermeable surfaces. In general surface water runoff results in clean water which is not contaminated. However, there is potential for surface runoff water to come in contact with contaminated material on the site, particularly in areas used for the storage or handling of contaminants. All such areas are contained within bunds to control and contain runoff water.

Distillate oil will be stored in 3 x 5,000 m^3 capacity tanks within a concrete bund with a total capacity which equates to 110% of a single tank. Processes in the water treatment plant will utilise acid and alkali, both of which will be delivered by road tanker and stored on site in bunded storage tanks within a covered enclosure. A range of specialist chemical treatment options are available for boiler feedwater. These include the use of passivation chemicals for pH control and the use of oxygen scavengers. These chemicals will be stored on site in bunded designated areas in the Boiler Dosing Building.

The majority of hardstanding will include gravity fed drainage channels, directing runoff water to a below ground concrete attenuation tank. Certain hardstanding areas, such as the transformer and distillate storage bund, will require surface water to be pumped from these bunded areas. This surface water will be pumped through free-flowing channels and an oil/water interceptor to the attenuation tank, thus mitigating against accidental release of spillages to the attenuation tank. All other surface water runoff arising from hardstanding areas and roofs will be directed through a hydrocarbon interceptor and silt trap prior to discharge to the attenuation tank. Refer to Figure 6.2a *Site Drainage Plan.*and Figure 6.2b *Site Drainage Plan.*

As stated above all chemical storage areas will be covered and bunded to control potential losses of contaminants. These bunded areas will require surface water to be manually pumped to the process water tank for treatment where required. However as these areas are covered there will be minimal surface water generation from these areas.

It is not intended to contain and treat water arising from grassed areas or areas of hard-core where there is no risk of contamination of runoff water. Within these areas all water will be allowed to percolate as normal.

Any surface water collected within the attenuation tank will be discharged via a pipeline and open drain to a discharge point on the Mongagh River as described in Section 6.4.2 (ii).

(ii) Process Wastewater

The process wastewater to be discharged from the site comprises primarily of effluent from the water treatment plant and from boiler blow-down.

Wastewater from the water treatment plant comprises more concentrated saline water containing the salts removed from the raw water or neutralised backwash of the resins. The volumes of effluent will depend on whether a Reverse Osmosis / EDI (Electrodeionisation) or a resin based demineralisation plant is employed at the site.

Boiler blow-down comprises water which has been circulating in the water/steam cycle. In order to remove the build up of salts from the HRSG drum, which remain in the drum once the water has evaporated off, it is necessary to continually “blow-down” 1% of the total circulating water, which is discharged to the process wastewater discharge pit. While blow-down water may have a high enough saline content to require removal from the HRSG drum, it should be noted that the saline content is generally much lower than that of the initial raw water supply.

All process wastewater arising from the facility will be collected in the Process Waste Water Discharge Tank prior to discharge. The discharge tank is a below ground concrete structure separated into a number of chambers. The process drains will discharge into the inlet chamber. The wastewater will then be pumped from this chamber into two aeration chambers where air is bubbled up through the process wastewater in order to reduce the temperature. The wastewater then overflows from these chambers into a small treatment chamber where an agitator mixes the wastewater and pH is measured. The wastewater is dosed automatically, if required, to regulate the pH within a range of 6 - 9. The wastewater then overflows from this chamber into the final main discharge chamber from where it is either pumped back to the aeration chambers, if it exceeds the Emission Limit Values (ELVs) for the parameters detailed below, or pumped to the discharge point.

Dissolved oxygen, pH, conductivity and temperature will be continuously monitored in the main discharge chamber. The automated system will only discharge if these parameters are within limits set under the facility’s IPPC licence limits. If any of the parameters fail to comply with the ELVs the system will automatically switch back to recirculation mode and the wastewater will be returned back to the aeration chambers. Discharge volumes will be measured using a flow-meter installed in the discharge pipe. In addition, the process water discharge pit will be fitted with an automatic sampler which will sample water discharges, on a continuous basis, over a given period as directed by the EPA under the IPPC license for the facility. An on-site laboratory will also be provided to facilitate monitoring of specific parameters on site.

The average quantity of process wastewater to be discharged from the proposed power plant development is estimated at c. 250 m^3/day. This value is estimated using a projected operating profile for the CCGT unit estimated at 6,000 hours per annum, equivalent to an average of 16.5 hours per day, fired on natural gas and 500 hours per annum for the OCGT unit, which equates to less than 1.5 hrs per day, on distillate fuel.

An alternative scenario was developed to determine the maximum potential process water effluent arising from the operation of the power plant. This scenario is based on effluent from the demineralised water production plant operating at maximum capacity, and blow-down from the CCGT unit operating 24 hours per day. The operation of the CCGT unit will be optimised to minimise boiler blow-down. The maximum process waste water discharge estimated for this scenario is 360 m^3/day..

It is proposed to discharge process wastewater to a discharge point on the Yellow River as discussed in Section 6.4.2 (ii).

(iii) Foul Wastewater

It is proposed that all foul water, consisting of sewage and domestic type waste water, emanating from the site during the operational phase will be treated in a proprietary secondary treatment system prior to discharge. It is considered that the treated wastewater will be discharged to the Yellow river. However the option of percolating to ground will also be considered at detailed design stage on foot of a site suitability assessment, including percolation testing, which will be undertaken to determine the suitability of the topsoil and subsoil layers for this purpose. As described in Section 6.4.2, it is anticipated that up to 2,100 litres / day of treated foul water will be discharged with an anticipated 20 mg/l BOD and 30 mg/l SS (suspended solids).

During the construction phase temporary fully contained chemical portaloo toilets will be installed. All foul water will be removed from the site to an appropriately licensed facility.

6.2.4 Consultation

Consultations were conducted with the Eastern Regional Fisheries Board, Offaly County Council and Westmeath County Council regarding the selection of an appropriate discharge point for waste waters.

6.3 Existing Environment

The proposed development site lies within the Boyne River catchment. There are two tributaries of the Boyne in close proximity to the site. These are the Yellow River which is *c.* 1.4 km south of the proposed development, and the Mongagh River, which is located 0.7 km to the north.

6.3.1 Surface Water Quality

(i) Mongagh River

The Mongagh River (EPA code: 07/C/04) is a tributary of the Yellow River, which ultimately flows into the River Boyne (OS Catchment No: 159). It rises to the east of Tyrrellspass, Co. Westmeath, flowing in an easterly direction before joining with the Yellow River and entering the River Boyne (See Figure 6.1 *Watercourses in Proximity to the Proposed Development*).

The Mongagh River (07/C/04) is located approximately *c.* 0.7 km to the north of the proposed development site and forms the boundary between County Offaly and County Westmeath. The Mongagh River flows from west to east with its source approximately 3 km upstream of its nearest point to the proposed development site. The Rochfortbridge Stream, also known as the Derry River, flows from north to south and converges with the Mongagh River approximately 1 km east of the R400 in Drumman Bog. The Mongagh flows through Drumman Bog and then converges with the Milltown River and further downstream, south east of Baltinoran Bridge, becomes known as the Castlejordan River. The Castlejordan River joins with the Yellow River approx. 1 km south of Castlejordan Village.

Biological assessments of the Mongagh and Castlejordan Rivers were conducted by the EPA in 2003. The monitoring location along the Mongagh River is at Baltinoran Bridge (07/Y/02/0100), where a Q value of 3 was assigned in 2003. There has been a deterioration in water quality at this monitoring station since the previous monitoring event in 2000 (Q4) The monitoring point for the Castlejordan River is located in the village of Castlejordan and a Q value of 3 was assigned in 2003. There are no EPA monitoring points for the Mongagh River upstream of the Derrygreenagh site.

Table 6.3: EPA Biological Quality Ratings (Q Values) for the Castlejordan River 1976 to 2003

Station no.	Station location	1976	1981	1985	1990	1994	1997	2000	2003
0060	SE Rahinine	-	-	-	3-4	2-3	2-3	3	-
0100	Baltinoran Br	-	4-5	3-4	4	3-4	3-4	4	3
0190	Castlejordan Br	-	-	-	4	3-4	3-4	4	3
0200	0.5 km d/s Castlejordan	4-5	4	3-4	-	-	-	-	-

The Mongagh River was found to be moderately polluted. The maintenance of the channel and the absence of habitat diversity due to ongoing substrate removal and channelization have significantly reduced the ecological and fisheries value of the river in the vicinity of the sampling location. The macroinvertebrate habitat at the site was found to be poor and this section of the Mongagh River was deemed 'Class C Moderately Polluted' (Q3). The Biological Monitoring Working Party (BMWP) score corresponded to a rating of 'Moderately Impacted' and habitat rating was deemed 'Poor' for salmonid and lamprey species. Functional Group analysis was conducted on the results of the invertebrate survey and the results indicated that this section of the Mongagh River is distinctly autotrophic and a severely impacted ecosystem. The Mongagh River is evaluated as a Class E watercourse 'Low Value, Locally Important'.

(ii) Yellow River

The Yellow River (EPA code: 07/Y/02) is a tributary of the River Boyne (OS Catchment No: 159) and rises to the north of Daingean, Co. Offaly; flowing in an easterly direction for approximately 22 km before entering the River Boyne (See Figure 6.1 *Watercourses in Proximity to the Proposed Development*).

Biological sampling of the Yellow River has conducted by the EPA, as well as the Environmental Research Unit (ERU) and An Foras Forbartha prior to the establishment of the EPA, since 1976. This monitoring has indicated that the water quality at the closest monitoring location to the proposed development site, (Garr Bridge: Site Code 07Y020100), has experienced some degradation during this period, with the majority of monitoring events recording "slight pollution" at the monitoring location. However monitoring undertaken at the location in 1985 and 1994 showed temporary improvements in the water quality with the monitoring location recording an "unpolluted status".

Further downstream at Clongall Bridge (Site Code 07Y020300) water quality has been consistently good, with a water quality status of "unpolluted" recorded for all monitoring events. Upstream of Garr Bridge, (Site code 07Y020060), near Derryarkin the water quality has been classified as "unpolluted" since monitoring began in 1994, with the exception of 2003, where there was a significant deterioration in water quality, as the location was classified as "moderately polluted".

Table 6.4: EPA Biological Quality Ratings (Q Values) for the Yellow River 1976 to 2003

Station no.	Station location	1976	1981	1985	1990	1994	1997	2000	2003
0060	Near Derryarkin	-	-	-	-	4	4	4	3
0100	Garr Bridge	-	3-4	4	3-4	4	3-4	3	3-4
0300	Clongall Bridge	4-5	4-5	4	4	4	4	4	4

The EPA has noted that intensive agriculture could be responsible for the decrease in quality in the upper reaches (0060) of the Yellow River. The Derryarkin station (0060) is located c. 2 km upstream of the sampling point selected for the current study. The Garr Bridge sampling station (0100) is located east of the sampling point, c. 3 km downstream, while the Clongall Bridge sampling station is c. 10 km downstream of the current sampling location. At the time of the biological survey in 2003, the lower river (0300) had been recently dredged and as a result algal crops had not been re-established but macroinvertebrate populations had recovered sufficiently to indicate the likelihood of satisfactory water quality there.

6.4 Water Quality Impacts

6.4.1 Construction Phase Impacts

(i) Surface Water Runoff

There is potential for impact on local surface water quality during the initial site clearance and civil works phases of this project in particular. However the potential impact on water quality is significantly reduced due to the fact that the nearest water body is the Mongagh River, which is *c.* 700 m to the north of the site. However the peat harvesting areas next to the site are characterised by the presence of large drainage channels designed to drain the peatlands. As such, there is potential for these drainage channels to act as a transport route for contaminants arising from the site during the construction phase.

The main potential impact on the receiving waters during the site clearance and construction phases relate to the release of sediment and other contaminants to the Mongagh River and the Yellow River via drainage channels as detailed below:

- Potential contaminants associated with any civil engineering works include those associated with materials to be used during the construction process. Such materials include cement, which can run-off to receiving waters. Potential contamination of sediments and benthic organisms from the accidental release of organic polymers or heavy metals associated with cementing and/or grouting materials from the construction works. This material is toxic to benthic organisms in sufficient quantities and, in the event of an accidental release, could potentially contaminate the riverbed sediments adjacent to the development, inhibiting recolonisation of the area after construction. Liquid cement also has potential to cause fish kills due to its highly alkaline and corrosive nature.

- Chemical contamination could also occur from accidental spillages, such as oil and other chemicals, through poor operational management, the non-removal of spillages, and poor storage, handling and transfer. However, if suitable precautions are taken and best practice for the storage, handling and disposal of such materials is followed, impacts should be minimal.

- Potential exists for the release of suspended solids to receiving drainage channels, particularly during the site clearance phase. Escape of inert solids to waterways as a result of exposed ground, stockpiles of soil, plant and wheel-washing may give rise to water pollution, such as high suspended solids levels, high turbidity, high colour and reduced water transparency. A very high concentration of solid waste can clog fish gills, which would cause asphyxiation. Discoloration of water due to solids escapement can seriously reduce the success of angling in the affected stretches, as salmon and trout cannot see the lures. See Section 5.3.1 (ii) *Aquatic Ecology* for details of the fishery stock recorded in the Yellow river.

There is a potentially significant, short-term, negative impact from the site clearance and construction of the proposed power plant development, which can be avoided with the implementation of appropriate mitigation measures as described in Section 6.5.1 *Construction Phase Mitigation.* The predicted effects of the construction phase on surface water quality in the locality are expected to be negligible or at most slight and short term.

(ii) Foul Wastewater

During the construction phase temporary fully contained chemical portaloo toilets will be installed. All foul water will be removed from the site to an appropriately licensed facility.

6.4.2 Operational Phase Impacts

Potential operational phase impacts on water quality associated with the proposed development relate to:

- Surface water run-off.
- Process wastewater discharge.
- Foul water discharge.

(i) Surface Water Run-off

A *Sustainable Urban Drainage System (SUDs)* approach has been taken in order to assess the potential run-off from the development. Using the “Win Des” drainage design program, it is estimated that the main 17.5ha pre-development site (if assumed as a greenfield site) would generate 213.5 litres/second of storm water in a 1 in 100 year storm event. The smaller 5.3ha western site (site of proposed Eirgrid Substation) is estimated to generate 65.2l/s for the same storm event.

Only 10.6ha of the main development site is expected to drain to the proposed surface water system. The other 6.8ha will be undeveloped permeable surfacing, such as grass and will be allowed to drain naturally –into the local drainage ditches and eventually into the Mongagh. Similarly with the western site, it is estimated that 3.2ha will drain into the proposed surface water drainage system.

Of the 10.6 ha that will enter the proposed main site surface water system, it has been calculated that 6.04 ha can be considered impermeable. This figure represents 34.7% of the total proposed site area. A storage system will be constructed to protect both the site and the river from flooding, which will be in the form of an attenuation tank. The proposed discharge arising from the tank will be attenuated to a maximum flow rate of no more than 70.4 l/s, which is equivalent to Q_{BAR} which is the mean annual flood flow for the pre-development site. Limiting the discharge rate to this figure equates to an attenuation storage requirement of 2,540m^3 on site to prevent flooding during a 1 in 100 year storm.

Similarly for the proposed western site, it is estimated that 1.1ha (or 21%) of the area draining into the surface water system will be from hardstanding areas. Again, volumes to be balanced have been calculated for a 1 in 100 year storm while limiting the discharge to the site Q_{bar} rate of 21.5l/s. For a more detailed breakdown of how these figures have been calculated, refer to the flood risk assessment in Appendix 4A *Flood Risk Assessment*.

All surface water will be directed from the hardstanding areas (and roves) on the main site through discrete channels to a below ground 2,600 m^3 concrete attenuation tank via a hydrocarbon interceptor and silt trap. This system will ensure that surface water run-off generated from the site is separated from any hydrocarbon contaminants or grit that it may come into contact with on site. The western site will have a similar system and the volume to be balanced for a 1 in 100 year storm has been calculated as 388m^3. This quantity of water will be attenuated in an attenuation tank with capacity to contain 400m^3 prior to the discharge via a hydrocarbon interceptor and silt trap to a field drain in the cut-over bog area adjacent to the site.

All chemicals for use on site will be stored in fully bunded and covered from which surface runoff and washing water will be directed to the process water discharge tank. Areas where there will be no risk of contaminants entering groundwater will remain porous where possible. Surface water feed to the attenuation tank will be via a silt trap and hydrocarbon interceptor.

Discharge from the attenuation tank on the main site will occur to either a new discharge pipe or a field drain adjacent to the site. This field drain is the location of the current site drainage discharge point and flows towards the Mongagh River, to which it discharges *c.* 700m north of the site. Ideally the discharge would be direct to this field drain but there is a possibility that this could cause scouring and sediment entrainment which may have an effect on watercourses downstream.

At detailed design stage the discharge point will be designed to ensure that there is no scouring of the field drain channel arising from the discharge of runoff water from the site. Alternatively, a discharge pipeline direct to the Mongagh could completely eliminate the possibility of sediment entrainment.

Considering the measures outlined above, the impact of surface water on the receiving environment is expected to be neutral.

(ii) Process Wastewater

An assessment was undertaken to ascertain the most suitable location for the discharge of process wastewater arising from the proposed facility. There are two rivers in close proximity to the proposed development site as detailed in Section 6.3 *Existing Environment*. These are the Yellow River which is located *c.* 1.4 km south of the site and the Mongagh River which is located c. 0.7 km north of the site. An analysis of both of these rivers, as possible discharge locations, indicated that the Yellow River was the more suitable location, based on the following:

- Results of an ecological water quality assessment on both rivers, which is detailed in Chapter 5 *Flora and Fauna* and Section 6.3.1 of this chapter, identified that the water quality of the Mongagh River with a Q value of Q3 was of lower quality than the Yellow River which had a better ecological status with a Q value of Q3-4.

- In addition to this available flow data for both rivers indicated that the Yellow River had a more significant flow rate and as a consequence a more significant assimilative capacity. The Yellow River, at hydrometric station 07108, located just upstream of Garr Bridge, had a 95%ile flow rate of 0.247 m^3/s. This compared with the Mongagh River at hydrometric station 07028, located just north of the proposed development site, which had a 95%ile flow rate of 0.05 m^3/s.

- Consultation was undertaken with the Eastern Regional Fisheries Board (ERFB) and it was ascertained from this consultation that both rivers are considered important in terms of their salmonid status. However they had a preference for locating the discharge point on the Yellow River, rather than the Mongagh River due to its potential, further downstream, as a habitat for Salmon (*Salmo salmar*).

Based on the reasons listed above, it was determined that the Yellow River is more suitable for the location of a discharge point from the proposed development. See Figure 6.3 *Proposed Process Water Discharge Location and Proposed Municipal WwTP Discharge Location*. However, it was essential to undertake a detailed assimilative capacity assessment of the Yellow River in order to determine if the river had sufficient assimilative capacity for the proposed wastewater discharge. Assimilative capacity is the amount of contaminant load that can be discharged to a water body without exceeding water quality standards appropriate to that water body.

The assimilative capacity of the Yellow River was determined based on 95%ile flow at the EPA hydrometric station (07108), located just downstream of Garr Bridge, and water quality data recorded at the EPA water quality monitoring station at Garr Bridge (07/Y020100).

Offaly County Council has submitted plans to the Department of Environment, Heritage and Local Government to locate a municipal Wastewater Treatment Plant (WwTP) on the Yellow River in proximity to Garr Bridge. The proposed WwTP would have a population equivalent (PE) of 2000, and a design flow of 500 m^3/day. In order to account for the estimated future loading predicted to arise from this WwTP, an assimilative capacity calculation was undertaken to determine what the background water quality in the river would be on receipt of the wastewater load. The results of this assimilative capacity are presented in Table 6.5 *Assimilative Capacity arising from the Proposed Municipal WwTP*. Total Dissolved Solids (TDS) was not considered in this assimilative capacity calculation as there was no information available in regard to the TDS concentrations in the proposed WwTP effluent. TDS is not generally considered as a significant discharge arising from a WwTP.

The assimilative capacity calculations for the proposed municipal WwTP allowed for the determination of the likely background water quality parameter levels in the Yellow River, once the municipal WwTP plant was in operation. These predicted water quality parameter concentrations were then used as the "background water quality" levels when considering the impact of the process wastewater arising from the proposed power plant development.

Predicted maximum loading characteristics for process water discharge parameters from the proposed power plant development were based on MMP's previous experience with similar power plants in Ireland, where available. This data was limited to Ammonia (as N), Total Phosphorous (as P), Suspended Solids and Total Dissolved Solids. As information on potential maximum BOD levels was unavailable maximum Integrated Pollution Prevention and Control (IPPC) licence limits for similar plants were used.

Due to the potential variability in the running profile of the proposed power plant, the proposed process wastewater discharge will vary. In order to fully assess the potential impact on the Yellow river arising from the process wastewater discharge, an assimilative capacity calculation was undertaken considering the highest potential discharge rate of 360m^3/day. The assimilative capacity figures are presented in Table 6.6: *Assimilative Capacity Based on a Discharge of 360 m^3/day, (Maximum Discharge Volume during Normal Operations)* and have already taken account of the wastewater loading predicted to arise as a result of the proposed municipal WwTP.

Table 6.5: Assimilative Capacity arising from the proposed Municipal WwTP

Parameters	**BOD mg/l**	**Ammonia mg/l (as N)**	**Ortho-phosphate mg/l (as P) (median)**	***Suspended Solids (mg/l)***	***Total Dissolved Solids (mg/l)***
Garr Bridge (Mean; 2005 to 2007)	3.26	0.37	0.09	*8.9*	*442*[1]
Predicted Water Quality allowing for WwTP Loading	*3.41*	*0.42*	*0.091*	*8.93*	*442*[2]

[1] Based on the conversion of background measured Conductivity using the following conversion: (Total Dissolved Solids mg/l = Conductivity µS/cm x 0.67)
[2] No data was available in terms of the TDS loading arising from the WwTP, however it is assumed to be negligible.

Table 6.6: Assimilative Capacity Based on a Discharge of 360m³/day,

Parameter	Background Concentration in Yellow River	Concentration of Process Wastewater Discharge	Incremental Addition to Yellow River	Concentration in Yellow River on Receipt of Discharge	Water Quality Limits (mg/l)
BOD (mg/l)	3.41	20[1]	0.28	3.69	5
Total Ammonia (mg/l)	0.42	1.5	0.02	0.44	1
O-Phosphate (mg/l)	0.0917	0.1 (Total Phosphorous)	0.0001	0.0918	0.03
Suspended Solids (mg/l)	8.93	30	0.34	9.27	25
Total Dissolved Solids (mg/l)	442[2]	5,000	76	518	670[3]

[1] Based on maximum IPPC threshold for a similar CCGT Power Plant (Tynagh, Co. Galway).
[2] Based on the conversion of background measured Conductivity using the following conversion: (Total Dissolved Solids mg/l = Conductivity µS/cm x 0.67)
[3]Based on the limit value for conductivity in Surface Waters of 1,000µS/cm as per the *European Communities (Quality of Surface Water Intended For The Abstraction of Drinking Water) Regulations, 1989 (S.I. 294/1989)* (Total Dissolved Solids mg/l = Conductivity µS/cm x 0.67)

The assimilative capacity for BOD (3.69 mg/l) is within the limit of 5mg/l set in *European Communities (Quality of Salmonid Waters) Regulations 1988 (S.I. 293/1988)*. The predicted concentration in the Yellow River, after receiving the discharged process water, increases by 0.28 mg/l.

As demonstrated in Table 6.6: *Assimilative Capacity Based on a Discharge of 360 m³/day,* the resultant Ammonia concentration in the Yellow River is 0.44 mg/l, which is well within the permitted level set by the *European Communities (Quality of Salmonid Waters) Regulations 1988 (S.I. 293/1988),* of 1 mg/l of Total Ammonia. This concentration of Ammonia equates to 0.017 mg/l non-ionised Ammonia, at a pH of 8 and a temperature of 20°C, which is also within the limits set by the *European Communities (Quality of Salmonid Waters) Regulations 1988 (S.I. 293/1988).)* of 0.02 mg/l.

Assuming a conservative approach, where Total Phosphorous is assumed to equate to Ortho-phosphate, a very slight increase in background Ortho-phosphate concentration was predicted, resulting from the addition of effluent. It is important to note that the background levels of phosphorus in the river are currently elevated, reflecting other sources of phosphorus within the catchment area. Under the *Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations 1998 (S.I. of 1998),* an aim was set to attain a phosphorus concentration of 0.03 mg/l or better. This was based on the fact that the Q value for the EPA monitoring site at Garr Bridge: Site Code 07Y020100, was Q3-4 in the period 1995-1997. This level clearly has not been attained due to other sources of phosphorus arising within the catchment. However, it is considered that the slight increase in phosphorus concentration resulting from the proposed development will have a negligible impact on the water quality in the river.

The predicted water quality in the Yellow River on receipt of process water from the proposed development for Suspended Solids (9.27 mg/l) is also within the limit of 25 mg/l set in *European Communities (Quality of Salmonid Waters) Regulations 1988 (S.I. 293/1988)*. The predicted concentration in the Yellow River, on receiving the discharge process water, increases by 0.34 mg/l. The predicted increase in concentration is well within the environmental quality standard specified in the *Salmonid Waters Regulations 1998*.

There is no recommended limit value for Total Dissolved Solids, however the limit value for conductivity in Surface Waters is 1,000 µS/cm as per the *European Communities (Quality of Surface Water Intended For The Abstraction of Drinking Water) Regulations, 1989 (S.I. 294/1989)* . It is possible to convert this Conductivity value to Total Dissolved Solids, using the following equations:

Total Dissolved Solids mg/l = Conductivity µS/cm. x 0.67

The conductivity limit value as per the above mentioned regulations equates to approximately 670 mg/l Total Dissolved Solids. The predicted Total Dissolved Solids concentration in the receiving waters following the discharge from the proposed development will be 518 mg/l, which is significantly below the limit set in the *European Communities (Quality of Surface Water Intended For The Abstraction of Drinking Water) Regulations, 1989 (S.I. 294/1989)*. as converted from Conductivity.

Based on the anticipated limits likely to be set by the EPA under the IPPC licensing regime, in addition to the proposed wastewater treatment and control systems, the impact of discharge of process waste water from the proposed development on the Yellow River is expected to be insignificant. Consequently the impact on the River Boyne and River Blackwater SAC (*c.* 27 km downstream) is similarly considered to be insignificant.

(iii) Foul Wastewater

It is proposed that all foul water, consisting of sewage and domestic type waste water, emanating from the site during the operational phase will be treated in a proprietary secondary treatment system prior to discharge. It is considered that the treated wastewater will be discharged to the Yellow river. However the option of percolating to ground will also be considered at detailed design stage on foot of a site suitability assessment, including percolation testing, which will be undertaken to determine the suitability of the topsoil and subsoil layers for this purpose. It is anticipated that up to 2,100 litres /day of treated foul water will be discharged with an anticipated 20 mg/l BOD and 30 mg/l SS (suspended solids).

It is proposed that the proprietary secondary treatment system will be designed to serve a population of 70 persons, during the operational phase.

According to the *Wastewater Treatment Manual, Treatment Systems for Small Communities, Business, Leisure Centres and Hotels, (EPA, 1999),* the recommended wastewater loading rate for an industrial facility without a canteen is:

- Flow rate of 30 litres/day per person; and
- BOD level of 20 g/day per person.

An estimated 70 persons would thus equate to:

- Flow rate of 2,100 litres/day; and
- BOD level of 1,400 g/day, equating to 0.67 g BOD / litre.

The specification of the treatment system will be better than those required by *BS6297: Code of Practice for Design and Installation of Small Sewage Treatment Works*, guaranteeing treatment of the treated wastewater to a 20:30 BOD:SS standard. This standard is that available from a Bord Na Mona Puraflo system with secondary treatment. In order to assess the impact of the foul water discharge to the receiving water assimilative capacity calculations have been undertaken to assess the impact of discharging 2,100 litres/day of treated foul water to the Yellow River.

However the option of percolating to ground will also be considered at detailed design stage on foot of a site suitability assessment, including percolation testing, which will be undertaken to determine the suitability of the topsoil and subsoil layers for this purpose.

These calculations have demonstrated an insignificant impact on background levels arising from the potential discharge of foul wastewater to the Yellow River, should this be required as outlined in Table 6.7 *Foul Water Discharge to the Yellow River*. The Background Concentrations in the Yellow River used for this assimilative capacity are based on the process wastewater from the proposed development and wastewater discharge from proposed municipal WwTP also being discharged to the river. The resultant concentrations within the river are well within prescribed limits as per the *European Communities (Quality of Salmonid Waters) Regulations 1988 (S.I. 293/1988).*

Table 6.7: Foul Water Discharge to the Yellow River

Parameter	Background Concentration in Yellow River[1]	Concentration of Treated Foul Wastewater Discharge	Concentration in Yellow River on Receipt of Discharge	Incremental Addition to Yellow River	Max. Limits (*Quality of Salmonid Waters Regulations)*
BOD mg/l	3.689	20	3.691	0.002	5
SS mg/l	9.2728	30	9.2768	0.0004	25

[1] Background Concentrations in Yellow River used for this assimilative capacity are based on the process water from the proposed development and wastewater discharge from proposed municipal wastewater treatment plant

The impact of the discharge of foul water on the Yellow River is expected to be insignificant.

6.5 Water Quality Mitigation Measures

6.5.1 Construction Phase Mitigation

Although the risk of contamination of water resources is low, due to the limited surface water resources in the immediate area of the proposed development, it is considered appropriate that best practices be implemented to contain any potential losses from the proposed development site. There is a risk from the construction of the proposed discharge pipeline, due to the significant length of the pipeline, where it interfaces with associated drainage channels through the peatland areas.

A technically competent Contractor will be employed by Bord Na Móna Energy to manage on-site construction activities. The Contractor will be required to develop a Construction and Environmental Management Plan (CEMP). This will include a Water Management Plan incorporating a comprehensive and integrated strategy for erosion and sediment control. The plan will be reviewed regularly and modified as necessary. Regular inspections will take place to ensure measures are effective. The following conditions will be included:

- Unnecessary clearing and grading will be avoided;
- Clearing adjacent to drainage channels will be minimised. Silt control measures will be installed along the perimeter of excavation areas adjacent to drainage channels and at locations along the proposed discharge pipeline route, where there is potential to impact on drains or on the Yellow River itself;
- Construction activities will be phased to minimise soil exposure. Large areas of grading will be avoided in order to minimise erosion potential;
- Soils will be stabilised as soon as is practicable;
- To prevent chemical pollution, all liquid fuels and chemicals stored on site during the construction phase will be stored in suitable containers within bunds in a designated area away from the main construction site activities. These designated areas will be located at an appropriate distance from drainage channels and onsite boreholes. All containers and bunds will be capable of storing the chemicals contained within. Bunds will be integrity tested during the construction phase to ensure functionality;
- On-site refuelling will be carried out in designated bunded areas only;
- Spill kits are to be maintained near working areas. All spills / leaks are to be cleaned up immediately. An emergency response plan will be put in place detailing the measures to be undertaken should pollution be identified, as detailed in the CEMP;
- Equipment will be regularly maintained and leaks repaired as soon as is practicable. If the equipment cannot be repaired it will be removed from the site. Accidental spillages will be contained and cleaned up immediately;
- Contained chemical portaloo toilets will be used on site during the construction phase. All sewage will be removed from the site to an authorised treatment plant; and

- Construction of the discharge pipe placement will be carried out in accordance with the ERFB guidance document "*Protection of Fisheries Habitat during Construction and Development Works at River Sites*". The ERFB will also be consulted regarding discharge pipe placement to avoid disruption to the river during the most sensitive stages of salmonid or lamprey development.

6.5.2 Operational Phase Mitigation

Operational Phase Mitigation measures relate to surface water run-off, discharge of process wastewater and of foul water.

- Emission Limit Values (ELVs) for process wastewater discharge will be determined by the EPA under the IPPC licensing regime.

- A water quality monitoring programme will be developed for process wastewater and surface water run-off. Monitoring of the receiving water body upstream and downstream of the wastewater discharge point will be undertaken on a periodic basis to determine the impact of the discharge on the receiving water. The parameters, thresholds and frequency of the monitoring programmes required will be detailed in the IPPC licence for the proposed development.

- All bunds and chemical containers will comply with the appropriate standards. All bunds will be leak tested prior to commencement of operations and at a frequency thereafter to comply with the relevant conditions of the IPPC licence.

- The discharge water pipeline will be inspected periodically, to comply with IPPC licence conditions.

6.6 Residual Impacts

It is anticipated that the overall residual impact will be minimal, as the location of the site for the proposed power plant development is not in close proximity to any significant water body, and the water discharged to the Yellow River will be fully treated prior to discharge

The implementation of mitigation measures as detailed above will ensure that there is a minimal impact on water resources in the area from this proposed development.