8.0 GROUNDWATER

8.1 INTRODUCTION

This chapter of the EIS consists of an assessment of the potential impacts of the proposed development on the hydrogeological environment. Provided in this chapter is a description of the existing soils and geology environment and a statement of the likely significant hydrogeological impacts associated with both the construction and operational phases of the proposed development. Measures to mitigate the likely significant impacts of the proposed development are proposed, and residual impacts described.

8.2 METHODOLOGY

8.2.1 Baseline

The chapter has been prepared in accordance with the following guidelines:

- Environmental Protection Agency (EPA) Guidelines on the Information to be Contained in Environmental Impact Statements (2002);
- Environmental Protection Agency, (EPA) Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003);
- Institute of Geologists of Ireland (IGI) Geology in Environmental Impact Statements – A Guide (2002).

Consultation was carried out with the relevant bodies as detailed below.

- Geological Survey of Ireland (GSI);
- Department of Environment, Heritage & Local Government (DoEHLG);
- Environmental Protection Agency (EPA);
- Offaly County Council.

Consultation was also undertaken with other specialists in order to assess the impact of the interaction with other environmental factors. This included consultation with the soil and geology specialist in relation to contaminated ground and the potential risk to groundwater quality, and the hydrology specialist in relation to the groundwater and surface water interactions.

8.2.1.1 Study Area and Baseline Data Collection

A desk study was undertaken for the proposed development site and its surroundings (within a radius of approximately 5km). Information for the desk study was sourced primarily from GSI geological and hydrogeological datasets. Information on groundwater quality in the area was sourced from previous site investigation reports for the former ESB peat plant.

A site walkover was undertaken by WYG personnel in May 2008 and a well survey was undertaken within a 1km radius of the site to identify all third party wells within this vicinity. A pumping test was undertaken on the proposed abstraction well on the site of the proposed development in June 2009. A sample was also taken from the well for hydrochemical analysis.

The following is a list of the sources of information used for the hydrogeology assessment.

- GSI geology and hydrogeology datasets;
- Environmental Protection Agency (EPA) – National Groundwater Monitoring Programme;
- Offaly County Council – Water Services Section;
- ESB Exit Audit Reports: Phase 1 (July 2003) and Phase 2 (May 2005);
- URS Ireland Site Assessment (June 2005) and Exit Audit Summary Reports (June 2005 & April 2008) Letter Report (April 2008);
- Feedback from consultations with statutory consultees, interested organisations and affected third parties.

This information was used to describe and evaluate the hydrogeological environment at the proposed development site and in its vicinity and to identify and categorise the likely significant impacts of the proposed development on this environment.

8.2.2 Impact Assessment

The potential impacts of the proposed development on soils and geology were assessed as per the criteria for impact assessment provided in "*Guidelines on the Information to be Contained in Environmental Impact Statements*" (EPA 2002). The impacts are described by identifying three key aspects as follows:

- Beneficial, adverse or neutral – The impacts were assessed as being beneficial, adverse or neutral.

- Impact Magnitude – The magnitude of each impact was considered as being Negligible, Slight, Moderate or Significant in the case of negative impacts. The magnitude was considered as being minor, moderate or major in the case of beneficial impacts. The criteria for determining the magnitude of the impacts is summarised in Table 8.1 below.

Table 8.1 Criteria for Assessing Impact Magnitude

Impact Magnitude	Criteria
Significant Adverse	Results in loss of attribute
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute
Slight Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity
Minor Beneficial	Results in minor improvement of attribute quality
Moderate Beneficial	Results in moderate improvement of attribute quality
Major Beneficial	Results in major improvement of attribute quality

- Duration – The duration of each impact was considered to be either temporary, short-term, medium term, long-term or a permanent impact. Temporary impacts are considered to be those which are construction related and last less than one year. Short term impacts were seen as impacts lasting one to seven years. Medium-term impacts are impacts lasting seven to fifteen years. Long-term impacts are impacts lasting fifteen to sixty years and permanent impacts are impacts lasting over sixty years.

Where a significant impact is anticipated, mitigation measures are proposed to minimise the effect of the impact.

8.3 RECEIVING ENVIRONMENT

The following sections provide an overview of the regional hydrogeological environment. Further detail is provided for the proposed development site. Bedrock geology, subsoils and geological features of importance such as karst features and geological heritage areas are documented.

8.3.1 Aquifer Characterisation

The bedrock beneath the site comprises Dinantian Pure Unbedded Limestones (DPUL) of the Waulsortian Limestone Formation (WA). This formation comprises pale grey, sparry, fossilferous, (bryozoan) poly-mud micritic limestones, often massive knoll forms, with crinoidal or pale cherty shaly interbeds and frequently dolomitised. The limestone in this area is classified by the GSI as Locally Important (Ll) aquifer which is described as bedrock which is moderately productive in local zones only. A map of aquifer classification for the area is shown in Figure 8.1.

A pumping test was undertaken on the proposed abstraction borehole at the site (referred to in this report as PW1). Details of the results and analysis of the pumping test are provided in the Impact Assessment Section below. Analysis of the pumping test data indicates an aquifer transmissivity of 130m^2/d. The depth of the water bearing zone in the borehole was unknown as no borehole log was available. Therefore, an estimation of aquifer permeability was not possible.

8.3.2 WFD Groundwater Body Status

The groundwater body underlying the site is the Clara GWB which was delineated for the purposes of the EU Water Framework directive (WFD). The fundamental objective of the EU WFD aims at maintaining "high status" of waters where it exists; prevent any deterioration in the existing status of waters and achieving at least "good status" in relation to all waters by 2015. The current WFD status of the Clara GWB is Good (*Shannon IRBD 2008*).

8.3.3 Karstification

There are no karst features at the site of the proposed development. The nearest karst features are two springs at Kilcormac, approximately 6.2km and 6.9km respectively to the south. The next nearest spring is located 7.2km to the southwest of the proposed development site. No karst features were observed at the proposed development site or within a 1km radius of it during site visits in 2009.

8.3.4 Aquifer Vulnerability

The term 'vulnerability' is used to describe the ease with which groundwater may be contaminated by human activities (DELG et al., 1999). The vulnerability of groundwater depends on the time of travel of infiltrating water (and contaminants), the relative quantity of contaminants that can reach the groundwater and the contaminant attenuation capacity of the geological materials through which the water and contaminates infiltrate. These are more specifically determined at the site by the type and permeability of the subsoils, the thickness of the unsaturated zone through which the contaminant moves and the recharge type, whether point or diffuse.

The classification guidelines, as published by the GSI, are given in Table 8.2 below. It shows that the less permeable and thicker the overburden overlying an aquifer is, the lower the vulnerability of the aquifer to contamination.

Table 8.2 GSI Groundwater Vulnerability Guidelines

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) & Thickness			Unsaturated Zone	Karst Features
	High Permeability (sand/gravel)	Moderate permeability (e.g. sandy subsoil)	Low permeability (e.g. clayey subsoil, clay, peat)	(sand/gravel aquifers only)	(<30m radius)
Extreme (E)	0 – 3.0m	0 – 3.0m	0 – 3.0m	0 – 3.0m	-
High (H)	>3.0m	3.0 – 10.0m	3.0 – 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0 – 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

Notes: (1) N/A = not applicable
(2) Precise permeability values cannot be given at present
(3) Release point of contaminants is assumed to be 1-2m below ground surface.

The GSI database indices groundwater vulnerability at the proposed development site is High (H). Site specific information for depth to bedrock and subsoil type was obtained from data from site investigations undertaken at the site of the former ESB plant in 1997 and 2004. Subsoils at the site comprise glacial deposits ranging in thickness from 4.0m to 7.4m, with an average thickness of 5.3m. The glacial deposits consist of moderately permeable till overlying moderately to highly permeable gravels. A thin layer of black sandy clay, which may represent peat ash, was encountered in boreholes to the central and east areas of the proposed development site. The groundwater vulnerability at the proposed development site is revised to range from High (H) to Moderate (M), based on subsoil permeability and thickness recorded during site investigations.

A map of groundwater vulnerability for the area is shown in Figure 8.2.

8.3.5 Groundwater Flow

No field data was available to determine groundwater flow direction or gradient across the site. In the absence of site specific data it is assumed that groundwater flow direction will be coincident with topography and be to the east/northeast towards the Silver River. Assumed groundwater flow direction is shown in Figure 8.3.

8.3.6 Hydrogeological Conceptual Model

The Waulsortian Limestone formation is the principal water bearing unit and is more than several hundred metres thick in this area. The limestone bedrock is overlain in places by gravel deposits which are in turn overlain by a confining clay layer. The gravels may provide additional aquifer storage; however, they are not large enough to be considered an aquifer. Permeability in the bedrock tends to decrease rapidly with depth (GSI, 2003). Most flow occurs in the upper 15m, in the zone that comprises a weathered layer and a connected fracture zone below this. Deeper flows may occur along faults or significant fractures, or occasionally bedding-parallel dissolution planes. The limestones have little primary or intergranular porosity with permeability dependent on fracturing and fissuring.

Groundwater levels recorded from the on-site wells and third party wells in the area indicate shallow groundwater (<5.0m below ground level (bgl)). It is likely that groundwater conditions are slightly confined where significant clays overly the gravel & bedrock layers.

Due to the shallow groundwater flow in the aquifer, groundwater and surface waters are closely linked. The streams and rivers crossing the aquifer in the area are generally gaining (*GSI 2003*).

8.3.7 Groundwater Resources

There is an existing well at the site of the proposed development which was previously used for abstraction during operation of the peat plant. It is proposed to use this well for process water purposes for the proposed gas fired plant. The well is greater than 50m deep. However, no borehole log indicting lithology or borehole construction was available.

A survey of all third party wells within 1km radius of the proposed development site was undertaken by WYG on 8th and 9th June 2009. Information on wells such as depth, diameter usage was obtained where available from the landowner. A summary of this information is provided in Table 8.3 below and the locations of the wells are presented in Figure 8.3. Several well owners reported elevated iron levels in groundwater in the area.

Table 8.3 Details of Well Survey

BH ID	Easting	Northing	Site Owner	Well /Mains	Use	Depth (m)	Diameter (m)	Well Type Bored /Dug	Water Level (mbgl)*	Comments
DW1	213596	219195	Laides	Well	Domestic & Agricultural		-	Unknown	Measurement not possible	Not at home
DW2	213565	219125	Byrnes	Well	Domestic & Agricultural		-	Unknown	Measurement not possible	Not at home
DW3	213624	219132	James Roche	Well	Domestic	15.4	-	Bored	Measurement not possible	-
DW4	210579	219060	Valerie James	Well	Domestic		-	Bored	2.93	-
DW5	213476	219031	Pat Barret	Well	Domestic	20.0	-	Bored	Measurement not possible	-
DW6	213473	218978	Joe Peavoy	Well	Domestic	11.8	-	Bored	1.77	-
DW7	213478	218949	Patricia Kershaw	Well		5.4	0.75	Dug	Measurement not possible	-
DW8	213429	218977	-	Well			-	Bored	Measurement not possible	Not at home
DW9	213280	218853	Guinan	Well	Domestic & Agricultural		-	Bored	Measurement not possible	-
DW10	213246	218922	Francis Gilligan	Well	Agricultural only		-	Dug	Measurement not possible	-
DW11	213318	218920	Gilligans	Well	Domestic	23.4	-	Bored	1.742	-
DW12	213593	218759	Pat Gilligan	Well	Domestic	4.5	1.00	Dug	Measurement not possible	-
DW13	213546	218837	School	Well	School Supply	-	-	Unknown	Measurement not possible	-
DW14	213732	218739	Michael Guinan	Well	Agricultural only	34.5	-	Bored	1.32	-
DW15	213847	218757	Michael Guinan	Well	Domestic	12.1	-		Measurement not possible	-
DW16	213883	218604	Thomas Camon	Well	Domestic & Agricultural (supplies 3 properties)	61.0	-	Dug	Measurement not possible	-
DW17	214529	216906	Martina & Enda Egan	Well	Domestic	49.0	-		Measurement not possible	-
DW20	214323	221249	Lally	Well	Domestic & Agricultural	-	-	Bored	Measurement not possible	-
DW23	213717	221335	Sean McGovern	Well	Domestic & Agricultural	-	1.00	Dug	Measurement not possible	High iron - not in use most of time

*mbgl – metres below ground level

The GSI groundwater database indicates a number of source protection areas for public water supplies (PWS) and group water schemes (GWS) in the region. The Kilcormac PWS and Ballyboy GWS are located approximately 7km to the south-east. The Holmshill and Agall spring Source Protection Areas are located approximately 13km to the east of the site, while the Tully source is located approximately 15km to the south-east. None of the source protection areas for these supplies incorporate the site area.

8.3.8 Groundwater quality

Groundwater in the area has a calcium-bicarbonate signature and is very hard (typically ranging between 380–450 mg/l as $CaCO_3$), with high electrical conductivities (650–800 µS/cm), alkalinity (250-370 mg/l as $CaCO_3$) and pH is generally neutral (GSI, 2003).

Groundwater sampling was undertaken across the site of the former peat plant during site investigations undertaken by the ESB as part of exit audits in 2004. (A contamination assessment was undertaken as part of this EIS, the details of which are provided in Chapter 7 – Soils & Geology). All groundwater samples taken as part of previous investigations were from lands outside the boundary of the proposed development site as no boreholes were situated on the proposed site development area. Given the proximity of the sampling locations to the proposed development site it is assumed that the results are indicative of groundwater quality at the proposed development site.

The results were compared with the EPA Interim Guideline Values for Groundwater (IGVs) (EPA 2003) and EU Drinking Water Regulations (S.I. No. 278 of 2007). The results indicate a neutral pH between 7.33 and 7.72. All parameter results except ammoniacal nitrogen, nitrite, manganese, arsenic, nickel and hydrocarbons were below the relevant IGVs and drinking water limits.

The concentration of ammoniacal nitrogen exceeded the IGV and drinking water limit in all samples taken with a mean concentration of 2.5mg/l and a maximum concentration of 5.1mg/l in a borehole on the former ash field site approximately 450m south east of the proposed development site. The widespread distribution of elevated ammoniacal nitrogen suggests that it is likely to be related to former activities at the station. The source may be leaching of nitrogen compounds from the peat deposits near the station (ESB, 2005). The source could also be slurry and fertilisers from agricultural activities in the area.

Manganese concentrations were found to exceed the IGV and Drinking Water limits in samples taken from boreholes approximately 200m south of the site and in a borehole approximately 40m east of the site. This could be naturally occurring or a result of the former station activities. Elevated manganese is often found under anaerobic conditions in limestone aquifers.

Slightly elevated arsenic levels and elevated nickel levels were found in boreholes approximately 100m to the south of the proposed development site at the former station dump.

Hydrocarbons were detected in one borehole close to the site of the former station dump.

A sample was taken from the proposed supply well at the site on 12th June 2009. Unstable parameters (temperature, pH, electrical conductivity and dissolved oxygen) were measured in the field. The sample was analysed for a set of indicator parameters.

The results were compared with Interim Guideline Values for Groundwater (IGVs) and the parameters as specified in the Drinking Water Regulations (S.I. No. 278 of 2007). While it is not proposed to use the borehole as a drinking water supply, the drinking water limits were used for indicative purposes. All parameter results except for Total Ammonia and Manganese were below the relevant IGV and Drinking Water limits. Ammonia concentrations exceeded both the IGV and Drinking Water limit and could be a result of past activities at the site or from agricultural activities in the wider area. Manganese concentrations exceeded the IGV and the Drinking Water limit. These levels could also be a result of past activities at the site or due to a result of agricultural impact.

The water quality results from the pumping test are summarised in Table 8.4 below. Certificates of this analysis and previous analyses from the on-site monitoring wells are included in Appendix 8.1 and Appendix 8.2 respectively.

Table 8.4 Hydrochemical Results for On-Site Borehole

Parameter	Units	Limit of Detection	Sample Results 12/06/09	IGV	SI No. 273 of 2007
pH	pH units	<0.01	7.46	≥6.5 and ≤9.5	≥6.5 and ≤9.5
Electrical Conductivity at 25 °C	µS/cm	<100	652	1000	2500
Sulphate	mg/l	<0.05	98.96	200	250
Chloride	mg/l	<0.3	20.9	30	250
Nitrate as NO3	mg/l	<0.2	0.4	25	50
Nitrite as NO2	mg/l	<0.02	0.03	0.1	0.5
Orthophosphate as PO4	mg/l	<0.06	<0.06	0.03	-
Total Ammonia as NH_4	mg/l	<0.2	2.9	0.15	0.3
Total Dissolved Solids	mg/l	<35	390	1000	-
Total Alkalinity as $CaCO_3$	mg/l	<1	232	NAC	-
Total Organic Carbon	mg/l	<2	3	NAC	NAC
Total Hardness	mg/l	<1	276	-	-
Calcium#	mg/l	<0.03	81.88	200	-
Magnesium#	mg/l	<0.02	17.09	50	-
Potassium#	mg/l	<0.04	3.6	5	-
Sodium	mg/l	<0.15	24.96	150	200
Iron#	µg/l	<20	<20	200	200
Manganese#	µg/l	<2	260	50	50
Extractable Petroleum Hydrocarbons (C_8-C_{40})	µg/l	<10	<10	10	-
Mineral Oil	µg/l	<10	<10	10	-

*NAC – no abnormal change
- Dissolved

8.4 IMPACT ASSESSMENT

The impacts of the proposed development on the hydrogeological environment were assessed as per the methodology described above. Potential impacts from the proposed development on the hydrogeological environment that were considered in this assessment are mainly the following: potential impact on third party wells in the area and flows in the Silver River from the proposed groundwater abstraction, impacts on groundwater quality from accidental spillages and leaks of chemicals/fuel and disturbance of contaminated ground during construction. These potential impacts are discussed below.

8.4.1 Construction Phase

8.4.1.1 Contaminated Soils

The disturbance of contaminated soil during construction has the potential to impact on groundwater quality where contaminants are leached to the water table. A contamination assessment was undertaken for the proposed development site as part of this EIS. This is reported on in Chapter 7 - Soil & Geology. The extent of contamination of soils was assessed to be low level. The contamination comprises principally hydrocarbon, low-level metal and phenol contamination in limited areas of the site. The underlying clay subsoils will reduce migration of any contaminants to groundwater.

The 2008 Summary Environmental Exit Audit Report (URS 2008) states no evidence of chemical contamination in soil that would limit redevelopment of the subject area for commercial or industrial use. Based on the limited area of deposits, low level requirement for excavation and low level nature of the contamination, it is anticipated that there will be a **negligible** impact to groundwater quality from disturbance of soils during construction.

Any domestic wells identified are located upgradient of the proposed development and any potential groundwater contamination during construction will therefore not migrate towards these wells.

8.4.1.2 Accidental Spillages and Leaks

There is a potential impact on groundwater quality from accidental spillages or leaks from vehicles or chemical materials used on site during the construction phase. Possible pollutants include fuels, lubricants and hydraulic fluids from equipment used in construction, uncured concretes and grouts and waste from toilet and wash facilities on site. With mitigation measures described below this impact is considered to be **negligible.**

8.4.1.3 Process Wastewater

During plant commissioning larger quantities of effluent will be produced related to plant cleaning procedures (e.g. condensate resulting from pre-operational steam blowing of steam piping). This has the potential to impact on groundwater quality if not treated and disposed of appropriately. If not classified as hazardous liquid waste, these effluents will be diverted to the process wastewater treatment plant. With mitigation measures described below this impact is considered to be **Negligible.**

8.4.1.4 Surface Water Drainage

Surface water which accumulates on site during construction has the potential to impact on groundwater quality if not contained, treated or discharged appropriately. The impact associated with this is considered to be **Negligible.**

Table 8.5 Summary of Impacts during Construction Phase

Magnitude of Impact	Criteria	Residual Impact
Significant Adverse	Results in loss of attribute	None
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	None
Slight Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Temporary impacts on groundwater quality as a result of accidental spills/leaks of fuel/chemicals to groundwater during construction
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	There will be a temporary negligible impact on groundwater quality as a result of disturbing localised areas of contaminated soils during construction. There will be a temporary negligible impact on groundwater quality due to any accidental spills or leakages during construction There will be a temporary negligible impact on groundwater quality as a result of disposal of process wastewater during construction There will be a temporary negligible impact on groundwater quality from potentially contaminated surface water
Minor Beneficial	Results in minor improvement of attribute quality	None
Moderate Beneficial	Results in moderate improvement of attribute quality	None
Major Beneficial	Results in major improvement of attribute quality	None

8.4.2 Operational Phase

8.4.2.1 Groundwater Abstraction

It is proposed to use an existing borehole on the site of the proposed development for use as cooling water in the proposed plant. Supply for domestic purposes only will be obtained from the Leabeg-Leamore Group Scheme which is supplied by the Agall Spring, Holmshill and Tully sources.

The proposed on-site abstraction well is referred to as PW1 for the purposes of this report. The location of this well is shown in Figure 8.3. The average daily water requirement will be 96m^3. The abstracted groundwater will be demineralised on site to achieve high purity.

The well was previously used for abstraction by the ESB during operation of the peat plant. Abstraction volumes were believed to be four times greater than that required by the proposed development.

A pumping test was undertaken on the proposed abstraction well in order to establish if the well could deliver the volume of water required and to assess the impact, if any, of the pumping well on surface water flows in the nearby Silver River and local domestic wells.

It is proposed to discharge treated process waste water from the proposed plant to the Silver River. The capacity of the Silver River to assimilate the waste is based on flows in the River. This is considered in detail in Chapter 9 – Hydrology. However the potential impact of the groundwater abstraction on the River low flows and consequently its assimilative capacity are considered here.

A 72-hour pumping test on the PW1 commenced on 9th June 2009. The static groundwater level (prior to commencement of the test) in the well was 1.01m below ground level (bgl). The well was pumped at approximately 100m^3/d for the first 60minutes. The water level in the well was 1.22m bgl after 60 minutes, equating to a drawdown of 0.21m. The pumping rate was increased to approximately 245m^3/d for the next 60 minutes. The water level after this period was 1.74m bgl, equating to a drawdown of 0.73m. The pumping rate was further increased to 500m^3/day. After 60 minutes at this pumping rate the water level was 2.01m, with a drawdown of 1.00m. These initial steps were completed to gauge the overall productivity of the well.

The pumping rate was then reduced to approximately 100m^3/d for the remainder of the test period which was used to represent the operational abstraction from the well. Water levels had stabilised by the end of the test period. The final water level in the well after 72 hours was 1.70m, giving a total drawdown of 0.69m. A graph of time versus drawdown for the first 300 minutes of the test is shown in Figure 8.4. A graph of the entire pumping test is shown in Figure 8.5. Pumping test data is included in Appendix 8.3.

The pump was switched off after 72 hours and the recovering water levels were monitored for 24 hours. Water levels recovered to within 0.07m of static water levels after 24 hours. A graph of time versus residual drawdown for the recovery period is shown in Figure 8.6 and recovery test data is included in Appendix 8.4.

Observation well measurements were taken from an existing site investigation borehole to the east of the proposed development site. The observation well is referred to as OBW1 for the purposes of this report. The observation well is located approximately 40m to the east of the eastern site boundary and located between the pumping well and Silver River (see Figure 8.3). The static water level in OBW1 prior to commencement of the pumping test was 3.01m bgl. The water level in OBW1 fluctuated between 3.01m bgl and 3.06m bgl. A graph of the water levels in the observation well for the duration of the test period are shown in Figure 8.7. The fluctuations in water level in OWB1 are closely related to the Silver River water level measured during the same period. There is no indication of an impact on the water table at OBW1 as a result of the pumping test.

Assessment of the pumping test data indicates the well can sustain the proposed abstraction rate of 96m^3/day. Analysis of the recovery test data indicates a transmissivity of 130m^2/d. The observation well data shows minimal impact on water levels during the pumping test. However, it is not possible to determine if the impact was naturally occurring or a result of the pumping well. It does confirm that the cone of drawdown from the pumping well had not extended significantly to the observation well, and is therefore unlikely to impact on the Silver River which is further east from the pumping well that the observation well.

The dry weather flow (DWF) and 95%ile flow for Millbrook gauging station (approximately 1.5km upstream the Silver River at the proposed development site) is 250l/s (216,000m^3/d) and is 500l/s (432,000m^3/d) respectively. These figures are used for the dry weather flows for the Silver River at the proposed development site. These figures are, therefore, conservative for the Silver River at the proposed development site. The proposed abstraction rate for the on-site borehole is 96m^3/d. This equates to 0.04% and 0.02% of the DWF and 95%ile flow respectively.

In addition process water will be discharge to the Silver River at a down stream location. Therefore any minor impacts on flow in the river will be very localised.

It is anticipated that the impact of the groundwater abstraction on the flow in the River Silver will be **negligible.**

8.4.2.2 Third Party Groundwater Resources

The observation well data indicates that a significant cone of drawdown had not developed to the east of the abstraction well during the pumping test. The nearest third party well is located 450m upgradient of the site. The impact of the proposed abstraction on water levels in neighbouring wells is predicted to be to be **negligible.**

8.4.2.3 Fuel and Chemical Storage

A number of chemicals will be stored on the site during regular operation including chemicals for water treatment and boiler dosing. An assortment of lubricants, oils and greases will also required storage on site.

In addition diesel will be stored on site to be used as a back up fuel in the event of interruption to the natural gas supply in order comply with the Commission for Energy Regulation (CER) Regulations. Five days running capacity (approximately 5,000m^3) of diesel will be stored on the site.

As a result of the above materials the site will be classified as lower tier COMAH in accordance with European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2006 (S.I. No. 74 of 2006).

There is potential for contamination of groundwater in the event of an accidental spillage or leak of any of the above materials. However, with the mitigation measures outlined below, the impact is considered to be **Slight Negative.**

8.4.2.4 Process Wastewater

Process wastewater consists of wastewater from the demineralisation plant and wastewater generated from boiler blow-down. Typical normal wastewater volumes generated is approximately 96m^3 per day. Process effluents from the plant will be routed via the on-site process wastewater treatment plant to effluent drainage system. Treated process wastewater will then be discharged via the wastewater collection system to the Silver River via the discharge point located in the north eastern corner of the site.

Chemical feed area drainage consists of spillage, tank overflows, maintenance operations and area wash-downs. This wastewater will be contained and collected in a bund area and the drainage manually emptied by means of a mobile drainage pump. General plant drainage consists of effluents produced by sample drains, equipment drains, equipment leakage, area wash-downs, etc. This effluent will be collected in a system of floor drains and sumps and routed to the condensate pit which represents the lowest drainage point in the plant. From there it is delivered to the wastewater treatment plant via a water/oil separator. This wastewater will be treated and discharged to the Silver River. There will be no direct discharge of process wastewater to ground. Mitigation measures are incorporated in the design for accidental leaks. Therefore, the impact is considered to be **Slight Negative.**

8.4.2.5 Surface Water Drainage

The surface water drainage system will collect all run-off from roofed and paved areas of the proposed development site and be discharged to the Silver River via the stream in the north eastern corner of the site. Large external areas/compounds at the site will be surfaced with stone to allow rainwater to percolate to the underlying soils. Where these coincide with areas of historical hydrocarbon contamination there is a potential for leaching of hydrocarbons to groundwater. However percolation of surface water in this area is ongoing under natural conditions and no additional impact is predicted as a result of the development, therefore, the impact is considered to be **Negligible.**

8.4.2.6 Domestic Wastewater

Domestic water, which comprises wastewater other than process waste water and surface water, will be treated in a proprietary treatment system prior to discharge. It is planned that the treated wastewater will be discharged to the Silver River via the drainage ditch located along the northern boundary of the site. However, the option of percolating to ground may also be considered at detailed design stage following completion of a site suitability assessment, including percolation testing, which will be undertaken to determine the suitability of the site.

If the site is suitable for percolation further treatment will be afforded by the filtration of the wastewater through the soils. The resulting impact on groundwater quality of treated wastewater discharging through suitable soils in a well constructed and maintain on-site septic system is considered to be **negligible.**

8.5 MITIGATION MEASURES

8.5.1 Construction Phase

8.5.1.1 Accidental Spillages and Leaks

An environmental management plan will be implemented during construction which will minimise the potential for and impact of any accidental spills/ contamination. Measures will include the following:

Chemicals and other construction materials will be safely stored to ensure the risk of oil or chemical contamination of soil is minimised.

Appropriate measures will be put in place to minimise the risk of soil contamination from re-fuelling of vehicles, e.g., re-fuelling to be undertaken in designated areas with drained hard standing, and spill kits in place.

Good housekeeping (daily site clean-ups, use of disposal bins, etc.) on the project site, and the proper use, storage and disposal of many substances used on construction sites, such as lubricants, fuels and oils and their containers can prevent soil contamination.

A contingency plan for pollution emergencies will also be developed by the appointed contractor prior to work and regularly updated, which would identify the actions to be taken in the event of a pollution incident. The CIRIA document (CIRIA 2001) recommends that a contingency plan for pollution emergencies should address the following:

- Containment measures;
- Emergency discharge routes;
- List of appropriate equipment and clean-up materials;
- Maintenance schedule for equipment;
- Details of trained staff, location, and provision for 24-hour cover;
- Details of staff responsibilities;
- Notification procedures to inform the relevant environmental protection authority;
- Audit and review schedule;
- Telephone numbers of statutory water undertakers and local water company;
- List of specialist pollution clean-up companies and their telephone numbers.

8.5.1.2 Process Wastewater

Any effluent waste not classified as hazardous liquid waste produced during plant commissioning will be diverted to the process wastewater treatment plant.

8.5.1.3 Surface Water Drainage

During the construction phase, all surface water will be contained on site with the use of berms and will be settled prior to discharge. Water with suspended solids will be completely enclosed within the site. There will be settlement lagoons located at the lowest elevations within the site. Oil separators will be installed to treat waters originating from all areas where there is a risk of hydrocarbon pollutants.

8.5.2 Operational Phase

8.5.2.1 Fuel and Chemical Storage

A back up supply of diesel (5,200m^3) is required at the site in the event of an interruption of the gas supply. All appropriate measures will be taken to minimise the risk of accidental spillages or leaks. The fuel will be stored in a cylindrical steel tank within a 110% capacity bund to comply with bunding requirements. The bund will be constructed in accordance with CIRIA Report 163 "*Construction of Bunds for Oil Storage Tanks*" and BS8007:1987 "*Code of Practice for Design of Concrete Structures for Retaining Aqueous Liquids*". The diesel oil will be limited to 0.1% sulphur as per the requirements of EU Directive 1999/32/EC (relating to a reduction in the sulphur content of certain liquid fuels)

The site will be classified as lower tier COMAH in accordance with European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2006 (S.I. No. 74 of 2006). In accordance with legislative requirements, a major accident hazard (MAH) report was prepared for the proposed development. This report details risk and consequence assessments for the site in accordance with the Health and Safety Authority (HSA) guidance document entitled 'Setting the Specified Area – The Approach of the HSA'.

8.5.2.2 Surface Water Drainage

Surface water from roofed and paved areas will be routed via an oil/water interceptor before being finally discharged through an attenuation tank (controlled discharge) to the Silver River via the stream in the north eastern corner of the site. In order to ensure that uncontaminated surface drains are not mixing with possibly oil contaminated surface drains, such 'oil risk areas' will discharge into a separate system. Small areas that have the potential for causing oil contamination of surface drain water will be separated from the overall surface water drainage. This comparably low volume of surface water with potential for oil contamination will be collected separately and routed through a water/oil separator and delivered to the plant's effluent sump. Any surface water indirectly discharging to ground will therefore be uncontaminated.

8.5.2.3 Domestic Waste Water

Domestic wastewater will be treated in an on site proprietary treatment system to suitable standards prior to discharge. Treated domestic wastewater will only be discharged to groundwater if percolation tests indicate the site is suitable for such.

8.6 RESIDUAL IMPACTS

There will be no likely significant hydrogeological impacts as a result of the proposed development.

There will be a temporary slight adverse impact on groundwater quality as a result of accidental spills/leaks of fuel/chemicals to groundwater during construction.

There will be a temporary negligible impact on groundwater quality as a result of disturbing localised areas of contaminated soils during construction.

There will be a negligible localised impact on flow in the Silver River as a result of the proposed groundwater abstraction.

There will be negligible impact on groundwater quality from potential accidental discharge of treated wastewater to ground.

Table 8.6 Summary of Residual Impacts on Groundwater

Magnitude of Impact	Criteria	Residual Impact
Significant Adverse	Results in loss of attribute	None
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	None
Slight Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Temporary impacts on groundwater quality as a result of accidental spills/leaks of fuel/chemicals to groundwater during construction
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Impact on flow in the Silver River as a result of the proposed groundwater abstraction There will be a temporary negligible impact on groundwater quality as a result of disturbing localised areas of contaminated soils during construction.
Minor Beneficial	Results in minor improvement of attribute quality	None
Moderate Beneficial	Results in moderate improvement of attribute quality	None
Major Beneficial	Results in major improvement of attribute quality	None

8.7 REFERENCES

- Environmental Protection Agency, 2002. *Guidelines on the Information to be contained in Environmental Impact Statements.*
- Environmental Protection Agency, 2003. *Advice Notes on Current Practice in the Preparation of Environmental Impact Statements.*
- Environmental Protection Agency (EPA), 2003. *Towards Setting Guideline Values for the Protection of Groundwater in Ireland – Interim Report.*
- ESB International, July 2003. *Ferbane Generating Station – Environmental Exit Audit Phase 1 Report.*
- ESB International, May 2005. *Environmental Ground Investigation - Former Ferbane Generating Station Co. Offaly.*

- Geological Survey of Ireland (GSI), 2003. *Clara GWB – Summary of Initial Characterisation.*
- Geological Survey of Ireland (GSI), 2005. *Geology of Galway – Offaly Sheet No. 45. (1:100,000 scale maps).*
- Shannon International River Basin District Project, December 2008. *"Draft River Basin Management Plan for the Shannon International River Basin District".*
- URS Ireland, June 2005. *Environmental Exit Audit Summary Report – Ferbane Generating Station, Co. Offaly.*
- URS Ireland, June 2005. *Environmental Site Assessment of Station Dump Area – Former ESB Generating Station, Ferbane, Co. Offaly.*
- URS Ireland, April 2008. Letter Report – *ESB Ferbane Site Inspection*.
- URS Ireland, April 2008. *Summary Environmental Exit Audit Report – Northern Portion of Former ESB Generating Station, Ferbane, Co. Offaly.*
- Environmental Protection Agency Ireland (EPA) website - www.epa.ie
- Geological Survey of Ireland (GSI) website – www.gsi.ie