KERRY COUNTY COUNCIL

COMHAIRLE CONTAE CHIARRAÍ

NORTH KERRY WWTP DISCHARGES

NATURA IMPACT STATEMENT

FEBRUARY 2011

RYAN HANLEY
CONSULTING ENGINEERS
Sherwood House, Sherwood Avenue, Taylor's Hill, Galway
Suite D4, The Cubes Offices, Beacon South Quarter, Sandyford Dublin 18

Quality Control

CLIENT	Kerry County Council
PROJECT NO	2181
PROJECT TITLE	NORTH KERRY WWTP DISCHARGES
REPORT TITLE	NATURA IMPACT STATEMENT

Rev.	Status	Author(s)	Reviewed By	Approved By	Issue Date
1	ISSUE	GH	MJ	MJ	04.03.2011

TABLE OF CONTENTS

1 Introduction

1.1 Background

Ryan Hanley Consulting Engineers have been contracted by Kerry County Council to carry out an assessment of the potential ecological impacts of twelve wastewater treatment plant discharges in North Kerry and prepare a Natura Impact Statement (NIS). This NIS will subsequently be used to inform the Appropriate Assessment carried out by the Council. The discharges are associated with the following agglomerations:

- Listowel
- Ballybunion
- Tarbert
- Lixnaw
- Ballylongford
- Ballyduff
- Moyvane
- Kilflynn
- Brosna
- Causeway
- Knocknagoshel
- Duagh

Applications for Waste Water Discharge Licences or Certificates for the above agglomerations have been submitted to the EPA by Kerry County Council in accordance with the Waste Water Discharge (Authorisation) Regulations 2007 (SI 864 of 2007). Section F of the waste water discharge licence application requires an assessment of the impacts of discharges on the existing environment.

Where such discharges occur within the catchment of a Natura 2000 site, EPA guidelines state that 'Initial Screening' be carried out in accordance with Appendix 1 of the Circular L8/08 entitled "Water Services Investment and Rural Water Programmes – Protection of Natural Heritage and National Monuments" issued by the Department of the Environment, Heritage and Local Government (DoEHLG) in 2008. Should the outcome of this screening process indicate that negative effects to any

Natura site cannot be ruled out, a full 'Appropriate Assessment' is to be carried out. Further details on the various stages of Appropriate Assessment are included in Section 1.2.

The purpose of this report is to determine the ecological effects, if any, of the existing WWTPs (listed below in Table 1.1) to further assess if any of the predicted impacts have the potential to have significant negative impacts on the qualifying interests or on the conservation objectives of the respective Natura 2000 sites.

Table 1.1 – Agglomerations and receiving sites

Agglomeration	Receiving River	Natura 2000 Site
Listowel		Lower River Shannon cSAC
Ballybunion		Lower River Shannon cSAC
Tarbert		Lower River Shannon cSAC
Lixnaw		Lower River Shannon cSAC
Ballylongford		Lower River Shannon cSAC
Ballyduff		Lower River Shannon cSAC
Moyvane		Lower River Shannon cSAC
Kilflynn		Lower River Shannon cSAC
Brosna		Lower River Shannon cSAC
Causeway		Lower River Shannon cSAC
Knocknagoshel		Lower River Shannon cSAC
Duagh		Lower River Shannon cSAC

1.2 Appropriate Assessment – Legislative Context

The EU Habitats Directive (*Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna*) contains a list of rare habitats and species (Annex I and II respectively); the conservation of these is considered to be of European and International importance. Similarly, the EU Birds Directive (*Council Directive 79/409/EC on the conservation of wild birds*) aims to protect specific bird species considered to be at risk. Member states have the responsibility to designate geographic sites according to their conservation value for the aforementioned habitats and species, namely Special Areas of Conservation and Special Protection Areas, which together form a network referred to as *Natura 2000*; see Section 1.2.

Paragraph 3 of Article 6 of the Habitats Directive state that:

6(3) *Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.*

Where such an assessment finds that all potential impacts cannot be successfully avoided or mitigated against, then Paragraph 4 of Article 6 is applied:

6(4) *If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.*

Where the site concerned hosts a priority natural habitat type and/or a priority species, the only considerations which may be raised are those relating to human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest.

The statutory agency responsible for Natura 2000 sites is the National Parks and Wildlife Service of the Department of Environment, Heritage and Local Government. The European Court of Justice has recently (December 13 2007) issued a judgment in a legal case against Ireland that found that Ireland has failed in its statutory duty to confer adequate protection on designated areas. Following on from this the Circular Letter 1/08 & NPWS 1/08 on Appropriate Assessment of Land Use Plans (from the Department of the Environment, Heritage and Local Government) states that all plans and projects will be subject to critical assessment to ensure that they comply with all relevant legislation.

AA is a focused and detailed impact assessment of the implications of the plan or project, alone and in combination with other plans and projects, on the integrity of a Natura 2000 site in view of its conservation objectives. The terms of AA have been worked out in judgments of the European Court of Justice. The case law has established that assessments should be undertaken on the basis of the best scientific evidence and methods. Accordingly, if the consent authority so requires, data and information on the project and on the site and an analysis of potential effects on the site must be obtained and presented in a ***Natura Impact Statement*** (NIS) which must be presented by the applicant.

Ecological specialists are generally engaged by applicants to undertake the surveys, research and analysis, with input from other experts (e.g. hydrologists or engineers) as necessary to prepare the NIS. In general, larger projects will entail a greater amount of scientific scrutiny. It is the responsibility of the applicant to have the NIS prepared for submission to the consent authority. Having satisfied itself that the Statement is complete and objective, the competent authority carries out the AA on the basis of the NIS and any other appropriate sources of information. In the case of Waste Water Discharge Licensing, the Environmental Protection Agency is considered to be the competent authority.

There are 4 stages in an Appropriate Assessment as outlined in the European Commission Guidance document (2001). The following is a brief summary of these steps.

Stage 1 - Screening: This stage examines the likely effects of a project either alone or in combination with other projects upon a Natura 2000 Site and considers whether it can be objectively concluded that these effects will not be significant

Stage 2 - Appropriate Assessment: In this stage, the impact of the project on the integrity of the Natura 2000 site is considered with respect to the conservation objectives of the site and to its structure and function. The Appropriate Assessment is informed by the Natura Impact Statement.

Stage 3 - Assessment of Alternative Solutions: Should the Appropriate Assessment determine that adverse impacts are likely upon a Natura 2000 site, this stage

examines alternative ways of implementing the project that, where possible, avoid these adverse impacts.

Stage 4 - Assessment where no alternative solutions exist and where adverse impacts remain: Where imperative reasons of overriding public interest (IROPI) exist, an assessment to consider whether compensatory measures will or will not effectively offset the damage to the Natura site will be necessary.

1.3 Natura 2000 sites

There are two designations which from part of the Natura 2000 network of sites that require specific ecological protection in Ireland:

Special Areas of Conservation (SACs)

These are sites that have been identified to be of conservation importance in a European context, based on the habitats and species, both plant and animal; that they support. The Directive has a number of Annexes. Habitats listed on Annex I are those habitat types of community interest whose conservation requires the designation of Special Areas of Conservation. Some of these are known as priority habitats for which there is a particular obligation for protection. Animal and plant species of community interest whose conservation requires the designation of Special Areas of Conservation are listed on Annex II of the Directive.

All SACs are also proposed Natural Heritage Areas. There is a list of Notifiable Actions which apply to each annexed habitat and species. These are activities for which consent must be sought from the Minister of Environment, Heritage and Local Government within SACs. SACs are protected under the Habitats Directive of 1992 (EU Directive 92/43/EEC) and the Natural Habitats Regulations of 1997 (S.I.94/97).

Special Protection Areas (SPAs)

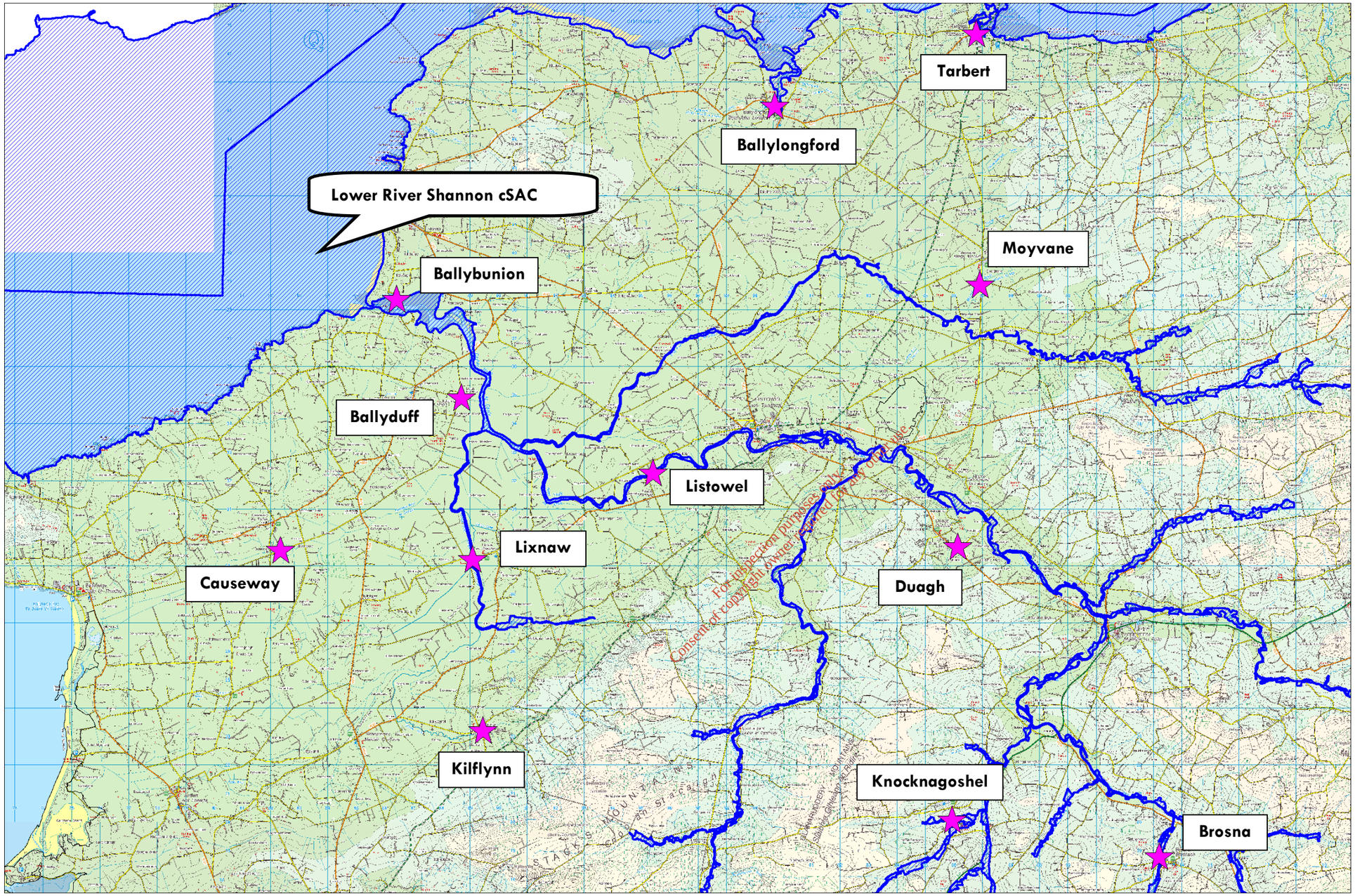
These are sites of European importance that have been identified as being of conservation importance on account of the bird species and populations they support. The Directive directs all member states to take measures to protect all wild birds and to preserve a sufficient diversity of habitats for all species naturally occurring within

their territories, so as to maintain populations. Species whose status is a cause for concern are specifically identified for special conservation measures in Annex I of the Directive, and SPAs have been designated based on either the presence of these species or the presence of significant numbers of wintering waterfowl.

All SPAs are also proposed Natural Heritage Areas. SPAs are protected under the Birds Directive of 1979 (EU Directive 79/409/EEC) and the Natural Habitats Regulations of 1997 (S.I.94/97).

1.4 Scheme locations

The geographic location of the agglomerations and any designated sites in the vicinity are shown in Figure 1.1. While numerous other Natura 2000 sites are located within the region, this report only considers potential impacts which relate to the Lower River Shannon cSAC.



RYAN HANLEY

RYAN HANLEY CONSULTING ENGINEERS
Sherwood House, Sherwood Avenue, Taylor's Hill, GALWAY
Tel: 091 587116 / Fax: 091 587110
Email: info@ryanhanley.ie

Figure 1.1 – Geographic location of treatment plants and receiving designated site

2 Methodology

2.1 Desk study

A desk study was carried out to collate the available information on the ecological environment. Water quality data from sampling points upstream and downstream of the respective discharges was gleaned from the Environmental Protection Agency website (www.epa.ie). The National Parks and Wildlife Service (NPWS) website (www.designatednaturesareas.ie) was also queried in relation to areas and records of rare and protected species within the discharge receiving waters. Further information was collated from the Water Framework Directive website (www.wfdireland.ie). The licence application forms already submitted by Kerry County Council were consulted, as were the 2008 County Kerry Waste Water and Sludge Strategy Technical Assessments. Water sampling data supplied by Kerry County Council was queried in relation to various water quality standards, where available for the respective discharges. Other environmental reports submitted in relation to plans or projects in the region were also reviewed.

2.2 Consultation

The Shannon regional division of Inland Fisheries Ireland was consulted in relation to the potential for disturbance to aquatic habitats and fisheries within the receiving waters and was also asked to comment on any existing issues in relation to the existing discharges. No reply has been received to date. The National Parks and Wildlife Service (NPWS) were consulted through the Development Applications Unit (DAU); no response has been received to date. Informal phone consultation was also carried out with regional NPWS staff who subsequently referred the consultant to the NPWS site synopses.

2.3 Field surveys

Site visits to the locations of the respective discharges were made by the Ryan Hanley Senior Ecologist on January 19th 2011 to document local conditions and potential impacts, if any.

3 Assessment

The assessment of impacts associated with the respective discharges has been prepared in accordance with the following documents:

- Note on Appropriate Assessments for the purposes of the Waste Water Discharge (Authorisation) Regulations, 2007 (S.I. No. 684 of 2007). Environmental Protection Agency. Wexford. 2009.
- Circular L8/08 Water Services Investment and Rural Water Programmes – Protection of Natural Heritage and National Monuments. 2 September 2008.
- Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government. Dublin. 2009 (Revised March 2010)
- Assessment of Plans and Projects significantly affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, European Commission 2001
- Managing Natura 2000 Sites: The Provisions of Article 6 of the 'Habitats Directive' 92/43/EEC, European Commission, 2000

For ease of reference and subsequent separation if necessary, screening and assessments for the respective discharges are contained in Appendices 1 through 12. The NPWS site synopsis for the Lower River Shannon cSAC is contained in Appendix 13.

4 Conclusions

4.1 Listowel

The Listowel WWTP is not considered at present to be significantly contributing to such enrichment as the plant is currently underloaded and produces a good quality effluent that is compliant with the UWWT regulations. The effluent is also compliant with the requirements of the Salmonid Waters Regulations.

There is some concern regarding the influence of storm water overflows in the collection network. Peak loading may release untreated sewage to the river.

It is of note that salmon populations remain in good condition in the river, and the Feale remains open for angling for both spring salmon and grilse. This may be used as an indicator of the overall good ecological status of the river.

The Feale is a sizeable waterbody downstream of Listowel town and is expected to have a high assimilative capacity. The discharge from the Listowel WWTP is not expected to negatively impact the overall integrity of the Lower River Shannon cSAC, both within the Feale channel and downstream where it enters the Shannon estuary.

4.2 Ballybunnion

The Ballybunnion WWTP discharges a high quality effluent to the extensive western extent of the Cashen estuary, an area of predicted high assimilative capacity with low nutrient pressures. The screening exercise therefore finds that any impacts will be indistinguishable context of the Lower River Shannon cSAC. In conclusion, no further assessment is required.

4.3 Ballyduff

While the Ballyduff Imhoff tank is currently overloaded and discharging to a small canal with low assimilative capacity, the final receiving waterbody (Cashen estuary) is an area of predicted high assimilative capacity with low nutrient pressures. Plans to increase the capacity of the system are described in the County Kerry Wastewater and Sludge Strategy Technical Assessment report.

The screening exercise finds that there may be a local ecological impact within the canal channel, but this is not within the cSAC boundary. However, any impacts will be indistinguishable context of the Lower River Shannon cSAC as the Cashen estuary has a sizeable assimilative capacity. In conclusion, no further assessment is required.

4.4 Causeway

While the Causeway Imhoff tank is currently overloaded and discharging to a minor stream with low assimilative capacity, the final receiving waterbody (Cashen estuary) is an area of predicted high assimilative capacity with low nutrient pressures. Plans to increase the capacity of the Causeway system are described in the County Kerry Wastewater and Sludge Strategy Technical Assessment report.

The screening exercise finds that there may be a local ecological impact within the stream and Crompaun River, but these are not within the cSAC boundary. There is also a 7km geographical separation of the discharge from the cSAC. Any local impacts in the stream and Crompaun River are not being transmitted to the Lower River Shannon cSAC as the Cashen estuary has a sizeable assimilative capacity. In conclusion, no further assessment is required.

4.5 Lixnaw

The Lixnaw treatment system is currently overloaded and discharges an effluent that is non-compliant with the UWWT regulations. Only the main channel of the River Feale is subject to the restrictions contained in the Salmonid Waters Regulations. The Lixnaw River/River Brick is of Moderate Status for dissolved oxygen and ecological factors. The Lixnaw plant discharges to a point in the canal of slow flow with little natural oxygenation of the water column. Biological recovery from increased BOD loading is likely to be slow in nature in this type of estuarine habitat. Dilution factors in the canal, while high are not considered sufficient to deal with the current loading of the discharge.

Migrating salmon pass through the Cashen estuary and Lixnaw Canal in order to spawn higher up in the Brick River. Salmon stocks in the catchment are currently considered to be in good condition and are a good indicator that moderate ecological conditions in the canal are not contributing to negative impacts to this species. Lampreys are generally considered to have similar water quality requirements to salmonids. Freshwater pearl mussels do not occur in the Lixnaw canal. Bottlenose

dolphin records are from the main Shannon channel. Both species are not expected to be impacted.

However, it is likely that overall catchment pressure on dissolved oxygen levels in the Lixnaw Canal/River Brick are contributing to a loss in overall ecological diversity within the canal. The surrounding land is topographically very flat and flows are slow to moderate. It reasonable to predict that direct BOD loading and possible nutrient enrichment of the Lixnaw canal is exacerbating this pressure on dissolved oxygen levels. This may be having an overall significant effect on the integrity of the Lower River Shannon cSAC within the Lixnaw/Brick sub-catchment. It is noted that impacts are not expected to be carried through the main Cashen estuary, which has a significantly larger assimilative capacity.

The assessment therefore concludes that the possibility of significant impacts to the conservation objectives of the Lixnaw Canal, part of the Lower River Shannon cSAC, cannot be discounted at this stage.

4.6 Kilflynn

The Kilflynn septic tank is currently overloaded and discharging to the moderate flow Shanow River. Nutrient levels are however quite low in the sampled effluent and are not considered to be contributing to any enrichment of the river. BOD loading may be causing minor deoxygenation of the river in the vicinity of the discharge, but this is not considered likely to be having a significant effect on the qualifying interests of the Natura 2000 site. Any such deoxygenation will be very limited in extent and will not be transferred to inside the cSAC boundary 9km downstream.

The screening exercise therefore finds that any negative localised impacts will not be transferred to the qualifying habitats or species of the Lower River Shannon cSAC. In conclusion, no further assessment is required.

4.7 Tarbert

The Tarbert septic tanks are currently operating beyond their design capacity and generate a low quality effluent with notably high levels of phosphorus, nitrogen and organic solids. The discharge from these tanks may be leading to localised eutrophication of the Tarbert estuary, which is designated habitat of both the cSAC and SPA. This may be negatively impacting the

integrity of the site by altering the trophic status of the area which can lead to changes in macroinvertebrate communities and bird species diversity.

The assessment therefore concludes that the possibility of significant impacts to the conservation objectives of the Tarbert estuary, part of the Lower River Shannon cSAC and River Fergus/River Shannon SPA cannot be discounted at this stage.

4.8 Ballylongford

The effluent from Ballylongford receives no treatment and sampling has indicated notably high levels of phosphorus, nitrogen and organic solids. The discharge from these tanks may be leading to localised eutrophication of Ballylongford Creek, which is designated habitat of both the cSAC and SPA. This may be negatively impacting the integrity of the site by altering the trophic status of the area which can lead to changes in macroinvertebrate communities and bird species diversity. Significant BOD loading which also is likely to result around the discharge will exacerbate this problem, as only certain low-oxygen tolerant species will be able to thrive in such an environment.

The assessment therefore concludes that the possibility of significant impacts to the conservation objective of Ballylongford Creek, part of the Lower River Shannon cSAC and River Fergus/River Shannon SPA cannot be discounted at this stage.

4.9 Moyvane

The Galey River maintains good ecological status immediately downstream of the Moyvane River and despite poor results for ecological status, the Galey remains open for salmon angling, suggesting that this species is not being adversely impacted.

However, despite this, it is likely that the Moyvane discharge, though minor in nature, is acting in conjunction with other diffuse pressures (predominantly agriculture) in the catchment to reduce overall water quality further downstream in the catchment through nutrient enrichment.

The assessment therefore concludes that the possibility of significant impacts to the Galey River, part of the Lower River Shannon cSAC cannot be discounted at this stage.

4.10 Duagh

The Duagh treatment plant is slightly overloaded. However, the River Glasha is currently in good ecological condition, with no evidence of any negative impacts from the Duagh discharge. The receiving River Feale is also in good ecological condition downstream of the Glasha confluence.

The screening exercise therefore concludes that no significant impacts to the Lower River Shannon cSAC are envisaged and therefore no further assessment is required.

4.11 Knocknagoshel

The Knocknagoshel treatment plant is currently overloaded. However, the Owveg River is currently in good ecological condition, with no evidence of any negative impacts from the Knocknagoshel discharge observed in the unnamed stream or in the Owveg itself. The receiving River Feale is also in good ecological condition downstream of the Glasha confluence. The only two qualifying interests for the cSAC found in this eastern extent of the Natura 2000 site (salmon and otter) are present in good numbers in the sub-catchment and are not predicted to be being impacted in any way by the present effluent. There are also preliminary plans to upgrade the Knocknagoshel agglomeration to compliant standards; this is to be carried as and when funding becomes available.

The screening exercise concludes that no significant impacts to the Lower River Shannon cSAC are envisaged and therefore no further assessment is required.

4.12 Brosna

The Brosna treatment plant is currently overloaded. However, the Clydgah River is currently considered to be in satisfactory ecological condition with good conditions prevailing 1.5km downstream of the discharge. Eutrophication does not appear to be a problem, and the nature of the river indicates that it possesses a relatively large assimilative capacity for BOD loading; biological recovery appears to be rapid.

The receiving River Feale is also in good ecological condition downstream of the Clydagh confluence. The only two qualifying interests for the cSAC found in this eastern extent of the Natura 2000 site (salmon and otter) are present in good numbers in the sub-catchment and are not predicted to be being impacted in any way by the present effluent. No salmonid spawning

gravels were observed along the stretch of the Clydagh downstream of the plant and therefore no impacts to salmon spawning or juvenile fish are expected. There are also preliminary plans to upgrade the Brosna agglomeration to compliant standards; this is to be carried as and when funding becomes available.

The screening exercise concludes that no significant impacts to the Lower River Shannon cSAC are envisaged and therefore no further assessment is required.

Appendix I – Listowel Screening & Assessment

Project	
Location	Discharge associated with agglomeration of Listowel Town, County Kerry.
Distance from designated site	0km: Outfall discharges directly to River Feale inside the cSAC boundary.
Brief description	Listowel is situated on the N69 National Secondary Route, approximately 30 km northeast of Tralee and 60 km from Limerick City. It is the third largest urban centre in Co. Kerry with a population of 4,338 persons. The principal milk processing/food factory of the Kerry Group is located in the town and is a major employer. However, this enterprise has its own private wastewater treatment plant and independent discharge to the River Feale. The wastewater treatment plant has been operational since 1987. It is located at Gortnaminsha on the right-hand bank of the River Feale, just south of the Greenville/Finuge Road. It was designed for a BOD loading of 750kg in a DWF of 2,840 m3/day, which is equivalent to 12,500PE. An inspection of the plant performance records in September, 2008 revealed that the plant is consistently producing a good quality effluent with no recorded evidence of any exceeding of the design discharge standards (i.e., 20mg/l / 30mg/l BOD/SS). Phosphorus and nitrate reduction do not currently from part of the treatment process; these phases have been recommended as part of any future upgrades to the plant. Both the Listowel town and Kerry foods WWTPs are operating satisfactorily. There is however, insufficient capacity in the town sewer collection network, and several storm overflows in the town collection network are known to occasionally discharge untreated effluent to the river.
Is the plan directly connected with or necessary to the Natura 2000 site management for nature conservation?	No.
Natura 2000 site	
Name	Lower River Shannon
Designation	Candidate Special Area of Conservation
Basis	EU Habitats Directive
Description	*From the NPWS Site Synopsis*: This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of

Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the subcatchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia.

The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter.

The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary.

Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (*Zostera* spp.) and patches of green algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a *Macoma-Scrobicularia-Nereis* community.

In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and Club-rushes (*Scirpus maritimus, S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triquetrus*), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*).

Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Saltmarsh Rush (*Juncus gerardi*), Long-bracted Sedge (*Carex extensa*), Lesser Seaspurrey (*Spergularia marina*) and Sea Arrowgrass (*Triglochin maritima*). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the compass of Common Saltmarsh-grass (*Puccinellia maritima*) and Hard-grass

	(*Parapholis strigosa*). Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a National Inventory of Lagoons are Shannon Airport Lagoon and Cloonconeen Pool. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa, Cerastoderma glaucum, Lekanesphaera hookeri, Palaemonetes varians, Sigara stagnalis* and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon (2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of Stonewort (*Chara canescens* and *Chara cf. connivens*). The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the cSAC. The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae. Other coastal habitats that occur within the site include the following: • Stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (*Fucus* spp., *Ascophyllum nodosum* and kelps). • Shingle beaches - the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (*Matricaria maritima*), Sea Campion and Curled Dock (*Rumex crispus*). • Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head. • Sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (*Ammophila arenaria*). Flowing into the estuaries are a number of tidal rivers. Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Floating river vegetation characterised by species of Water-crowfoot (*Ranunculus* spp.), Pondweeds

	(*Potamogeton* spp.) and the moss *Fontinalius antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to county Limerick. There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site. Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey. Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River. This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country.
Area	72138ha
Condition	There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through overgrazing and poaching. Much of the land adjacent to the rivers and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale. In the past, Cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds. Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats. Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating

	(including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.
Conservation interests	**SAC Qualifying Interests – Habitats** • Estuaries • Mudflats and sandflats not covered by seawater at low tide • Coastal lagoons • Vegetated sea cliffs of the Atlantic and Baltic coasts • Salicornia and other annuals colonizing mud and sand • Atlantic salt meadows (Glauco-Puccinellietalia maritimae) • Mediterranean salt meadows (Juncetalia maritimi) • Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation • Sandbanks which are slightly covered by sea water all the time • Large shallow inlets and bays • Reefs • Perennial vegetation of stony banks • Spartina swards (Spartinion maritimae) • Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae) • Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) **SAC Qualifying Interests – Species** • River lamprey • Brook lamprey • Sea lamprey • Atlantic salmon • Bottlenose dolphin • European otter • Freshwater pearl mussel *Water-dependent habitats and species are underlined **Additional features/species of conservation interest** A number of plant species that are Irish Red Data Book species occur within the site - several are protected under the Flora (Protection) Order, 1999: • Triangular Club-rush (*Scirpus triquetrus*) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary. • Opposite-leaved Pondweed (*Groenlandia densa*) - this protected pondweed is found in the Shannon where it passes through Limerick City. • Meadow Barley (*Hordeum secalinum*) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill. • Hairy Violet (*Viola hirta*) - this protected violet occurs in the Askeaton/Foynes area. • Golden Dock (*Rumex maritimus*) - noted as occurring in the River Fergus Estuary. • Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon. • Convergent Stonewort (*Chara connivens*) - presence in Shannon Airport Lagoon to be confirmed. Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose

	(246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in 1993/94. Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96), Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504;1995/96), Redshank (3228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank. A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987). Two additional fish of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon. Freshwater pearl mussels are also known from the Upper River Feale; a population was encountered during surveys for the N21 upgrade. No detailed survey of pearl mussels in the Lower Feale has taken place to date. The Feale is a designated salmonid river, and is also listed as a sensitive river by the UWWT regulations. The Feale, Galey and Brick rivers were all open rivers for salmon angling in 2010, indicating a harvestable surplus for the species.

Stage 1 - Screening	
Describe the individual elements of the plan (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 sites.	The Listowel agglomeration receives primary and secondary treatment at the WWTP site, before discharging to the River Feale. The effluent then disperses in the water column. The most recent EPA water quality sampling data from 2007 indicates that the Feale undergoes a minor decrease in water quality between Listowel town and the sampling point downstream of the WWTP (from Q=4 to Q=3-4). This is more likely to be attributable to the influence of storm water overflows in the town environs than to the effluent of the treatment plant. The plant also lies in close proximity to the Kerry Group plant in Listowel. This plant has its own dedicated WWTP and also produces a good quality effluent. Minor increase in chloride and sulphate concentrations from the Kerry discharge are not predicted to act in conjunction with the Listowel WWTP discharge. Agricultural run-off from fields in the vicinity of Listowel may be

	contributing to phosphorus levels in the river. There is a water supply intake 3km downstream of Listowel in and approximately 500m upstream of the WWTP. This has the potential to decrease the assimilative capacity of the River Feale, especially during periods of drought. The outfall effluent contains material and solutes which may have a slight eutrophying effect within the River Feale, but these are likely to exist in significantly lower concentrations than if no treatment were to be applied. No response was received from Inland Fisheries Ireland during the consultation period. The Water Framework Directive assigns 'Good' status to the entire main Feale channel. Listowel WWTP is however listed as a source 'At Risk' for the WMU, owing to insufficient capacity of the sewer collection network. Listowel WWTP lies downstream of Duagh and Abbeyfeale WWTPs, the effluent of which also passes through the Feale system. Significant dilution of these discharges will have occurred before the River Feale reaches Listowel, and any cumulative effects are considered unlikely. An improvement in water quality downstream of Abbeyfeale was also noted during recent EPA water quality sampling events.
Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of: Size and scale; Land-take; Distance from Natura 2000 site or key features of the site; Resource requirements; Emissions; Excavation requirements; Transportation requirements; Duration of construction, operation etc.; Others.	All potential impacts relate to the effluent of the WWTP entering the cSAC; no impacts will result from land-take, resource usage, excavation, construction or transportation. Disposal of effluent to river systems can lead to altered nutrient balance (eutrophication), increase in particulate matter, potential threat of toxicity, reduction in biological status and loss of habitat / species. Nutrient enrichment has the effect of increasing phytoplankton growth which in turn increases the biological oxygen demand, resulting in decreasing oxygen levels in the site. This would impact negatively on all aquatic life in the River Feale. Any increases in toxic substances resulting from contamination events during the operation phase could have direct negative impacts on all of the aquatic species for which the Lower River Shannon cSAC has been designated, in particular salmon, lamprey and freshwater pearl mussel. Any impacts which could negatively affect salmonid populations in the river could have indirect effects on lamprey and pearl mussel populations all of which are dependent on salmonids in the parasitic phases of their life cycles. Otter may be affected by decreases in fish populations which form a key dietary resource. Abstraction of water from river systems can potentially result in a reduced flow regime with associated drying of channels / reduced habitats and a reduction assimilative capacity in receiving waters where discharges occur. There is an abstraction 500m upstream of the Listowel WWTP discharge. Other plans and projects in the vicinity which may act in combination with the discharge include: • Continued operation of Kerry Group on-site WWTP removing significant levels of potentially enriching material • Implementation of Nitrates Directive: Reduction in eutrophying run-off to Feale Catchment and Shannon Estuary • Shannon River Basin District Plan: Overall improvement in river water quality within catchment • Listowel Town Development Plan: Sustainable development of area

	with awareness of conservation interests of River Feale • Over the past few years the local angling club the "North Kerry Anglers Association" has invested in the region of £100,000 on in-stream development works. Such works contribute to improving the state of the Feale for salmon. • N69 Listowel Bypass: To be constructed north of the town, with a new bridge over the Feale. This will reduce traffic volume in Listowel town and may contribute to reduction in levels of petrochemical run-off from the roads in the town entering the storm collection network. Overall, these are likely to have a beneficial cumulative effect on the Natura 2000 site.
Describe any likely changes to the site arising as a result of: Reduction of habitat area; Disturbance of key species; Habitat or species fragmentation; Reduction in species density; Changes in key indicators of conservation value; Climate change.	There will be no loss of our reduction in Annex I habitats as a result of the operation of the existing WWTP. Accelerated algae and plant growth within river water columns leads to shifts in diurnal oxygen concentrations. This in turn leads to loss of biological indicator macroinvertebrate species. These species form the bases of salmonid feeding patterns, and their loss may lead to alterations in river ecology as other less sensitive invertebrate species begin to dominate. Salmonid spawning grounds may be significantly impacted by the increased growth of plants on the river substrate. Such growth will also impede the movement of lamprey and juvenile fish, and also reduce the recruitment success of freshwater pearl mussel. It is estimated that climate change will result in more extended but less frequent wet and dry periods and warmer water temperatures, as rainfall patterns in Ireland are changing. This could result in precipitation increases of over 10% in the winter months, and decreases of approximately 25% in the summer, and annual temperature increases. However, there is insufficient information to predict the effects on the site as these will be more closely related to localised rainfall events.
Describe any likely impacts on the Natura site as a whole in terms of: Interference with the key relationships that define the structure of the site; Interference with key relationships that define the function of the site.	Potential nutrient enrichment of receiving waters due to the discharge resultant from the operation of the existing WWTP has the capacity to adversely affect water quality. It may also potentially negatively impact on populations of the protected aquatic species for which the site has been designated. However, more significant negative impacts are likely to result to the Natura site in the event of the decommissioning of the WWTP and the subsequent release of untreated sewage to the River Feale.
Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale of magnitude of impacts is not known.	Potential impacts noted above are considered to be generally minor in nature, while impacts are likely to be higher in the absence of the existing treatment process. However, given the fact that the WWTP discharges effluent directly to the SAC, the screening exercise concludes that further assessment should be carried out in Stage 2 below. This assessment considers the potential impacts of the discharge with specific reference to the species and/or habitats which may be impacted.

Stage 2 - Project Assessment	
Describe the elements of the project	Waste water treatment plants can contribute significant nutrient and organic

that are likely to give rise to significant effects on the site	loads to rivers. There is potential that the discharge from the Listowel WWTP is in combination with other activities within the Feale catchment leading to increased levels of nutrients within the system.
Set out the conservation objectives of the site	European and national legislation places a collective obligation on Ireland and its citizens to maintain at favourable conservation status areas designated as candidate Special Areas of Conservation. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites. According to the EU Habitats Directive, favourable conservation status of a habitat is achieved when its natural range, and area it covers within that range, is stable or increasing, and the ecological factors that are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable as defined below. The favourable conservation status of a species is achieved when population data on the species concerned indicate that it is maintaining itself, and the natural range of the species is neither being reduced or likely to be reduced for the foreseeable future, and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis. The generic conservation objectives of the Lower River Shannon cSAC are: **1.** To maintain the Annex I habitats for which the cSAC has been selected at favourable conservation status: Estuaries; Mudflats and sandflats not covered by seawater at low tide; Coastal lagoons; Vegetated sea cliffs of the Atlantic and Baltic coasts; Salicornia and other annuals colonizing mud and sand; Atlantic salt meadows (Glauco-Puccinellietalia maritimae); Mediterranean salt meadows (Juncetalia maritimi); Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation; Sandbanks which are slightly covered by sea water all the time Large shallow inlets and bays; Reefs; Perennial vegetation of stony banks Spartina swards (Spartinion maritimae); Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae); Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) **2.** To maintain the Annex II species for which the cSAC has been selected at favourable conservation status: *Lampetra fluviatilis; Lampetra planeri; Petromyzon marinus; Salmo salar; Tursiops truncates; Lutra lutra Margaritifera margaritifera* **3.** To maintain the extent, species richness and biodiversity of the entire site. **4.** To establish effective liaison and co-operation with landowners, legal users and relevant authorities. It should be noted that only a sub-sample of these qualifying interests are water-dependent, as identified in the screening process.
Describe how the project will affect key species and key habitats	Nutrient enrichment has the effect of increasing phytoplankton growth which in turn increases the biological oxygen demand, resulting in decreasing oxygen levels in the site. Species which could be directly affected by this are Atlantic salmon and the three lamprey species. Extent and location of freshwater pearl mussel populations downstream of Listowel are unknown. The Feale is not a listed freshwater pearl mussel site and has no WFD sub-basin plan associated with it. Otter may be indirectly affected by changes in fish stocks, but are also able to adjust their foraging behaviour to accommodate temporary changes in diet resources.

	Bottlenose dolphin are unlikely to be affected as they occur in the expansive Shannon estuary which is in excellent ecological condition and not susceptible to pressures from land-based WWTPs. Any increases in toxic substances resulting from contamination events during the operation phase could have negative impacts on all of the aquatic species for which the Lower River Shannon cSAC has been designated, in particular Atlantic salmon. Any impacts which could negatively affect salmonid populations in the river could have knock on effects on lamprey and otter populations all of which are dependent on salmonids. Pollution events are preventable through judicious plant management.
Describe how the integrity of the site (determined by structure and function and conservation objectives) is likely to be affected by the project or plan (e.g. loss of habitat, disturbance, disruption, chemical changes, hydrological changes etc).	The key ecological relationships that define the structure and function of the River Feale as part of the Lower River Shannon cSAC are likely to be impacted by potential nutrient enrichment of the main channel and key tributaries. The Listowel WWTP is not considered at present to be significantly contributing to such enrichment as the plant is currently underloaded and produces a good quality effluent that is compliant with the UWWT regulations. The effluent is also compliant with the requirements of the Salmonid Waters Regulations. There is some concern regarding the influence of storm water overflows in the collection network. Peak loading may release untreated sewage to the river. It is of note that salmon populations remain in good condition in the river, and the Feale remains open for angling for both spring salmon and grilse. This may be used as an indicator of the overall good ecological status of the river. The Feale is a sizeable waterbody downstream of Listowel town and is expected to have a high assimilative capacity. The discharge from the Listowel WWTP is not expected to negatively impact the overall integrity of the Lower River Shannon cSAC, both within the Feale channel and downstream where it enters the Shannon estuary.
Describe mitigation measures that are to be introduced to avoid, reduce or remedy the adverse effects on the integrity of the site	The current Listowel WWTP is conservatively designed and there no current plans to upgrade the plant. It is proposed to instate monitoring of flows/sampling in relation to the storm overflows. A network model of the collection system should be constructed to assess its performance and identify problem areas. This will facilitate the focused upgrading of the collection network where necessary.

Appendix 2 – Ballybunnion Screening

Project	
Location	Discharge associated with agglomeration of Ballybunnion village, County Kerry.
Distance from designated site	0km: Outfall discharges directly to Feale Estuary inside the cSAC boundary.
Brief description	Ballybunnion is a seaside town located on the north Kerry coastline at the mouth of the Shannon Estuary, approximately 16km north west of Listowel and 28km Tralee. Ballybunnion is better known as a tourist resort and golfing destination and has a large seasonal influx of visitors. As a result many commercial premises in the town close during the winter months. The wastewater treatment plant has been operational 1993. It is located in the Ballyeagh area, approximately 600m north of the Cashen Estuary and 2 km south of the town centre. The plant was designed for a BOD loading of 450 kg in a flow of 2,736 m3/d. Based on a per capita contribution of 55g BOD/head/d, the design rating of the plant was 8,180pe. Using the modern accepted standard of 60g/head/d would indicate a treatment capacity of 7,500pe. The final effluent results for the entire year were consistently satisfactory with average BOD, COD, and SS concentrations of 2mg/l, 16mg/l, and 7mg/l respectively and maximum BOD, COD, and SS concentrations of 7mg/l, 29mg/l, and 29mg/l respectively. It is reported that stormwater overflows regularly occur because the majority of the town collection system is combined and up to 10.5 times DWF can be pumped to the inlet works with only 3 DWF going forward for full treatment. A degree of untreated sewage therefore enters the bay during such events.
Is the plan directly connected with or necessary to the Natura 2000 site management for nature conservation?	No.
Natura 2000 site	
Name	Lower River Shannon
Designation	Candidate Special Area of Conservation
Basis	EU Habitats Directive
Description	*From the NPWS Site Synopsis*: This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the subcatchment of the Feale include the

	Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia. The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter. The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary. Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (*Zostera* spp.) and patches of green algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a *Macoma-Scrobicularia-Nereis* community. In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and Club-rushes (*Scirpus maritimus, S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triquetrus*), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*). Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Saltmarsh Rush (*Juncus gerardi*), Long-bracted Sedge (*Carex extensa*), Lesser Seaspurrey (*Spergularia marina*) and Sea Arrowgrass (*Triglochin maritima*). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the compass of Common Saltmarsh-grass (*Puccinellia maritima*) and Hard-grass (*Parapholis strigosa*). Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a

	National Inventory of Lagoons are Shannon Airport Lagoon and Cloonconeen Pool. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa, Cerastoderma glaucum, Lekanesphaera hookeri, Palaemonetes varians, Sigara stagnalis* and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon (2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of Stonewort (*Chara canescens* and *Chara cf. connivens*). The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the cSAC. The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae. Other coastal habitats that occur within the site include the following: • Stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (*Fucus* spp., *Ascophyllum nodosum* and kelps). • Shingle beaches - the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (*Matricaria maritima*), Sea Campion and Curled Dock (*Rumex crispus*). • Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head. • Sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (*Ammophila arenaria*). Flowing into the estuaries are a number of tidal rivers. Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Floating river vegetation characterised by species of Water-crowfoot (*Ranunculus* spp.), Pondweeds (*Potamogeton* spp.) and the moss *Fontinalius antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from

	in-stream boulders on the Bilboa, new to county Limerick. There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site. Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey. Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River. This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country.
Area	7213.8ha
Condition	There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through overgrazing and poaching. Much of the land adjacent to the rivers and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale. In the past, Cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds. Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats. Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in

	fishing gear and collisions with fast moving craft.
Conservation interests	**SAC Qualifying Interests – Habitats** • Estuaries • Mudflats and sandflats not covered by seawater at low tide • Coastal lagoons • Vegetated sea cliffs of the Atlantic and Baltic coasts • Salicornia and other annuals colonizing mud and sand • Atlantic salt meadows (Glauco-Puccinellietalia maritimae) • Mediterranean salt meadows (Juncetalia maritimi) • Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation • Sandbanks which are slightly covered by sea water all the time • Large shallow inlets and bays • Reefs • Perennial vegetation of stony banks • Spartina swards (Spartinion maritimae) • Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae) • Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) **SAC Qualifying Interests – Species** • River lamprey • Brook lamprey • Sea lamprey • Atlantic salmon • Bottlenose dolphin • European otter • Freshwater pearl mussel * Water-dependent habitats and species are underlined **Additional features/species of conservation interest** A number of plant species that are Irish Red Data Book species occur within the site - several are protected under the Flora (Protection) Order, 1999: • Triangular Club-rush (*Scirpus triquetrus*) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary. • Opposite-leaved Pondweed (*Groenlandia densa*) - this protected pondweed is found in the Shannon where it passes through Limerick City. • Meadow Barley (*Hordeum secalinum*) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill. • Hairy Violet (*Viola hirta*) - this protected violet occurs in the Askeaton/Foynes area. • Golden Dock (*Rumex maritimus*) - noted as occurring in the River Fergus Estuary. • Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon. • Convergent Stonewort (*Chara connivens*) - presence in Shannon Airport Lagoon to be confirmed. Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose (246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in

	1993/94. Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96), Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504;1995/96), Redshank (3228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank. A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987). Two additional fish of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon. Freshwater pearl mussels are also known from the Upper River Feale; a population was encountered during surveys for the N21 upgrade. No detailed survey of pearl mussels in the Lower Feale has taken place to date. The Feale is a designated salmonid river, and is also listed as a sensitive river by the UWWT regulations. The Feale, Galey and Brick rivers were all open rivers for salmon angling in 2010, indicating a harvestable surplus for the species.

Stage 1 - Screening	
Describe the individual elements of the plan (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 sites.	The Ballybunnion agglomeration receives primary and secondary treatment at the WWTP site, before discharging to the River Cashen Estuary (the most westerly stretch of the River Feale). The effluent then disperses in the tidal water column. As the plant discharges to the estuarine environment, no EPA sampling data is available in relation to this waterbody. The outfall effluent contains material and solutes which may have a slight eutrophying effect within the River Cashen estuary, but these are likely to exist in significantly lower concentrations than if no treatment were to be applied. No response was received from Inland Fisheries Ireland during the consultation period. The Water Framework Directive assigns 'Moderate' status to the Cashen estuary, due to moderate results for BOD loading in the site. Otherwise the estuary achieves good to high status for the other key classification variables, including Dissolved Oxygen and Reactive Phosphorus. Ballybunnion WWTP is not specifically referenced as 'At Risk' for the site.

	Ballybunnion WWTP lies downstream of Listowel; the effluent from the WWTPs here also passes through the Feale system. Significant dilution of these discharges will have occurred before the River Cashen/Feale reaches Ballybunnion, and any cumulative effects are considered unlikely. The Cashen estuary is an extensive site with a high assimilative capacity for nutrients.
Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of: Size and scale; Land-take; Distance from Natura 2000 site or key features of the site; Resource requirements; Emissions; Excavation requirements; Transportation requirements; Duration of construction, operation etc.; Others.	All potential impacts relate to the effluent of the WWTP entering the cSAC; no impacts will result from land-take, resource usage, excavation, construction or transportation. Disposal of effluent to river systems can lead to altered nutrient balance (eutrophication), increase in particulate matter, potential threat of toxicity, reduction in biological status and loss of habitat / species. Shifts in trophic status of estuarine systems due to nutrient changes may have consequent impacts upon marine/estuarine littoral invertebrate colony structure. This in turn may impact on feeding patterns and demography of bird species which depend upon such food chains. Nutrient enrichment has the effect of increasing phytoplankton growth which in turn increases the biological oxygen demand, resulting in decreasing oxygen levels in the site. This would impact negatively on all aquatic life in the bay. The Cashen estuary is classed as 'Moderate' under the WFD for BOD. Prolonged wet weather may lead to increased BOD loading around the outfall; the estuary is very extensive at this location however, and such influence is considered to be very limited in duration and spatial extent; it is not considered significant in this case. Any increases in toxic substances resulting from contamination events during the operation phase could have negative direct impacts on all of the aquatic species for which the Lower River Shannon cSAC has been designated, in particular Atlantic salmon and Sea lamprey. The Ballybunnion outfall occurs at the extensive western extent of the Cashen estuary, within 1km of the ocean. The Ballybunnion WWTP is a relatively modern installation and no such events are predicted. Any impacts which could negatively affect salmonid populations in the river could have knock on effects on lamprey and otter populations all of which are dependent on salmonids. Other plans and projects in the vicinity which may act in combination with the discharge include: • Continued operation of Listowel WWTP and Kerry Group on-site WWTP removing significant levels of potentially enriching material upstream of Ballybunnion • Implementation of Nitrates Directive: Reduction in eutrophying run-off to Feale Catchment and Shannon Estuary • Shannon River Basin District Plan: Overall improvement in river water quality within catchment • Ballybunnion Local Area Plan: Sustainable development of area with awareness of conservation interests of River Feale Overall, these are likely to have a beneficial cumulative effect on the Natura 2000 site.
Describe any likely changes to the site arising as a result of: Reduction of habitat area;	In the estuarine habitats, enrichment can potentially lead to increased phytoplankton concentrations which form the trophic base of the estuarine/marine food web. This may result in more extreme diurnal

Disturbance of key species; Habitat or species fragmentation; Reduction in species density; Changes in key indicators of conservation value; Climate change.	variation in dissolved oxygen, which may negatively impact upon the numbers of estuarine macroinvertebrates. Conversely, the overall increase in planktonic concentrations may lead to an increase in macroinvertebrates, though at the cost of a loss of diversity. Change in either direction will have impacts upon lamprey, salmon and otter in the catchment. Opportunistic macroalgae may also colonise estuarine habitats where eutrophication has occurred. The Ballybunnion effluent contains acceptably low levels of phosphorus and nitrogen and is not expected to lead to any such enrichment. Changes in the invertebrate communities of the Cashen estuary resulting from losses associated with temporary decreases in dissolved oxygen may have consequences for the structure and function of the estuary and mudflat habitats found therein. Any such effects will be highly localised and will not affect the overall integrity of the site. Migrating salmon pass through the Cashen estuary in order to spawn higher up in the Feale catchment. Salmon stocks in the catchment are currently considered to be in good condition and are a good indicator that the Cashen estuary continues to provide an unpolluted migration corridor. It is estimated that climate change will result in more extended but less frequent wet and dry periods and warmer water temperatures, as rainfall patterns in Ireland are changing. This could result in precipitation increases of over 10% in the winter months, and decreases of approximately 25% in the summer, and annual temperature increases. However, there is insufficient information to predict the effects on the site as these will be more closely related to localised rainfall events.
Describe any likely impacts on the Natura site as a whole in terms of: Interference with the key relationships that define the structure of the site; Interference with key relationships that define the function of the site.	Potential nutrient enrichment of receiving waters due to the discharge resultant from the operation of the existing WWTP has the capacity to adversely affect water quality. It may also potentially negatively impact on populations of the protected aquatic species for which the site has been designated. However, more significant negative impacts are likely to result to the Natura site in the event of the decommissioning of the WWTP and the subsequent release of untreated sewage to the Cashen Estuary.
Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale of magnitude of impacts is not known.	As the Ballybunnion WWTP discharges a high quality effluent to the extensive western extent of the Cashen estuary, an area of predicted high assimilative capacity with low nutrient pressures, the screening exercise finds that any impacts will be indistinguishable context of the Lower River Shannon cSAC. In conclusion, no further assessment is required.

Appendix 3 – Ballyduff Screening

Project	
Location	Discharge associated with agglomeration of Ballyduff village, County Kerry.
Distance from designated site	0km: Outfall discharges to disused tidal canal, 700m west of the cSAC boundary.
Brief description	Ballyduff is a village in north Kerry, located on the R551 approximately 15km west of Listowel The village provides a wide range of services to the rural hinterland, including a number of shops, two hardware stores, a health centre, a bookmaker, a fast-food takeaway, a post office, a number of public houses, a Garda station, a church, a funeral home, a primary school, a playschool/crèche, a GAA club, and a community centre. Wastewater flows by gravity to an Imhoff tank located to the on the east village. The tank provides primary treatment, before discharging treated effluent to a short section of disused canal that runs towards Ballyduff from the Cashen River. Kerry County Council report that design capacity of the Imhoff tank is 300pe, and that the tank is currently overloaded. A site visit to the location of the discharge at low tide indicated that the receiving canal has a very low assimilative capacity and was notably stagnant with discoloured water predominating. The tidal mud in the disused canal was predicted to be eutrophic.
Is the plan directly connected with or necessary to the Natura 2000 site management for nature conservation?	No.
Natura 2000 site	
Name	Lower River Shannon
Designation	Candidate Special Area of Conservation
Basis	EU Habitats Directive
Description	*From the NPWS Site Synopsis*: This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the subcatchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia. The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive.

	The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter. The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary. Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (*Zostera* spp.) and patches of green algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a *Macoma-Scrobicularia-Nereis* community. In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and Club-rushes (*Scirpus maritimus, S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triquetrus*), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*). Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Saltmarsh Rush (*Juncus gerardi*), Long-bracted Sedge (*Carex extensa*), Lesser Seaspurrey (*Spergularia marina*) and Sea Arrowgrass (*Triglochin maritima*). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the compass of Common Saltmarsh-grass (*Puccinellia maritima*) and Hard-grass (*Parapholis strigosa*). Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a National Inventory of Lagoons are Shannon Airport Lagoon and Cloonconeen Pool. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon

	includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa, Cerastoderma glaucum, Lekanesphaera hookeri, Palaemonetes varians, Sigara stagnalis* and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon (2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of Stonewort (*Chara canescens* and *Chara cf. connivens*). The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the cSAC. The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae. Other coastal habitats that occur within the site include the following: • Stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (*Fucus* spp., *Ascophyllum nodosum* and kelps). • Shingle beaches - the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (*Matricaria maritima*), Sea Campion and Curled Dock (*Rumex crispus*). • Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head. • Sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (*Ammophila arenaria*). Flowing into the estuaries are a number of tidal rivers. Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Floating river vegetation characterised by species of Water-crowfoot (*Ranunculus* spp.), Pondweeds (*Potamogeton* spp.) and the moss *Fontinalius antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to county Limerick. There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site.

	Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey. Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River. This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country.
Area	72138ha
Condition	There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through overgrazing and poaching. Much of the land adjacent to the river and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale. In the past, Cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds. Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats. Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.
Conservation interests	**SAC Qualifying Interests – Habitats** • Estuaries • Mudflats and sandflats not covered by seawater at low tide • Coastal lagoons

- Vegetated sea cliffs of the Atlantic and Baltic coasts
- Salicornia and other annuals colonizing mud and sand
- Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
- Mediterranean salt meadows (Juncetalia maritimi)
- Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
- Sandbanks which are slightly covered by sea water all the time
- Large shallow inlets and bays
- Reefs
- Perennial vegetation of stony banks
- Spartina swards (Spartinion maritimae)
- Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae)
- Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)

SAC Qualifying Interests – Species

- River lamprey
- Brook lamprey
- Sea lamprey
- Atlantic salmon
- Bottlenose dolphin
- European otter
- Freshwater pearl mussel

* Water-dependent habitats and species are underlined

Additional features/species of conservation interest

A number of plant species that are Irish Red Data Book species occur within the site, several are protected under the Flora (Protection) Order, 1999:
• Triangular Club-rush (*Scirpus triquetrus*) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary.
• Opposite-leaved Pondweed (*Groenlandia densa*) - this protected pondweed is found in the Shannon where it passes through Limerick City.
• Meadow Barley (*Hordeum secalinum*) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill.
• Hairy Violet (*Viola hirta*) - this protected violet occurs in the Askeaton/Foynes area.
• Golden Dock (*Rumex maritimus*) - noted as occurring in the River Fergus Estuary.
• Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon.
• Convergent Stonewort (*Chara connivens*) - presence in Shannon Airport Lagoon to be confirmed.

Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose (246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in 1993/94.

Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96),

	Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504;1995/96), Redshank (3228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank. A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987). Two additional fish of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon. Freshwater pearl mussels are also known from the Upper River Feale; a population was encountered during surveys for the N21 upgrade. No detailed survey of pearl mussels in the Lower Feale has taken place to date. The Feale is a designated salmonid river, and is also listed as a sensitive river by the UWWT regulations. The Feale, Galey and Brick rivers were all open rivers for salmon angling in 2010, indicating a harvestable surplus for the species.

Stage 1 - Screening	
Describe the individual elements of the plan (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 sites.	The Ballyduff agglomeration receives primary treatment only at an Imhoff tank, before discharging to disused tidal canal which flows to the River Cashen Estuary (the most westerly stretch of the River Feale). The effluent then disperses in the tidal water column. The plant is currently overloaded, as the design capacity of the tank is 300PE, while Ballyduff has a population of at least 560. As the plant discharges to the estuarine environment, no EPA sampling data is available in relation to this waterbody. Sampling data provided by Kerry county council indicates that the discharge is non-compliant with the requirements of the UWWT regulations for sensitive rivers. However, it is notable that Nicholas O'Dwyer Ltd carried out an assessment of the assimilative capacity of the Cashen River as part of a 2007 Preliminary Report, based on flow data available from the EPA and recorded water quality data. The assessment determined that the Cashen River has a very large assimilative capacity, with a dilution factor in excess of 600. The current elevated levels for BOD, SS and P recorded in the Ballyduff data would be immediately diluted upon reaching the flow of the Cashen River. The outfall effluent contains material and solutes which may have a very localised eutrophying effect within the River Cashen estuary, but these are likely to exist in lower concentrations than if no treatment were to be applied. No response was received from Inland Fisheries Ireland during the consultation period.

	The Water Framework Directive assigns 'Moderate' status to the Cashen estuary, due to moderate results for BOD loading in the site. Otherwise the estuary achieves good to high status for the other key classification variables, including Dissolved Oxygen and Reactive Phosphorus. Ballyduff WWTP is listed 'At Risk' for the site, but is assigned Level 2 Priority pending further assessments relating to need for plant upgrade. Ballyduff WWTP lies downstream of Listowel; the effluent from the WWTPs here also passes through the Feale system. Significant dilution of these discharges will have occurred before the River Cashen/Feale reaches Ballyduff, and any cumulative effects are considered unlikely. The Cashen estuary is an extensive site with a high assimilative capacity for nutrients.
Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of: Size and scale; Land-take; Distance from Natura 2000 site or key features of the site; Resource requirements; Emissions; Excavation requirements; Transportation requirements; Duration of construction, operation etc.; Others.	All potential impacts relate to the effluent of the WWTP entering the cSAC; no impacts will result from land-take, resource usage, excavation, construction or transportation. Disposal of effluent to river systems can lead to altered nutrient balance (eutrophication), increase in particulate matter, potential threat of toxicity, reduction in biological status and loss of habitat / species. Shifts in trophic status of estuarine systems due to nutrient changes may have consequent impacts upon marine/estuarine littoral invertebrate colony structure. This in turn may impact on feeding patterns and demography of bird species which depend upon such food chains. Nutrient enrichment has the effect of increasing phytoplankton growth which in turn increases the biological oxygen demand, resulting in decreasing oxygen levels in the site. This would impact negatively on all aquatic life in the bay. The Cashen estuary is classed as 'Moderate' under the WFD for BOD. Prolonged wet weather may lead to increased BOD loading around the outfall; the estuary is very extensive at this location however, and such influence is considered to be very limited in duration and spatial extent; it is not considered significant in this case. Any increases in toxic substances resulting from contamination events during the operation phase could have negative direct impacts on all of the aquatic species for which the Lower River Shannon cSAC has been designated, in particular Atlantic salmon and Sea lamprey. The Ballyduff Imhoff tank releases a relatively low volume of effluent via a canal channel to the deep channel of the Cashen; this channel has been identified as having a very large dilution factor and assimilative capacity. Eutrophication and deoxygenation of the tidal substrate within the disused canal is likely to be occurring at present. However, it is not predicted that this is occurring in the main receiving Cashen waterbody. Other plans and projects in the vicinity which may act in combination with the discharge include: • Continued operation of Listowel WWTP and Kerry Group on-site WWTP removing significant levels of potentially enriching material upstream of Ballyduff • Implementation of Nitrates Directive: Reduction in eutrophying run-off to Feale Catchment and Shannon Estuary • Shannon River Basin District Plan: Overall improvement in river water quality within catchment • North Kerry Settlements Local Area Plan: Sustainable development of area with awareness of conservation interests of River Feale

	Overall, these are likely to have a beneficial cumulative effect on the Natura 2000 site.
Describe any likely changes to the site arising as a result of: Reduction of habitat area; Disturbance of key species; Habitat or species fragmentation; Reduction in species density; Changes in key indicators of conservation value; Climate change.	In the estuarine habitats, enrichment can potentially lead to increased phytoplankton concentrations which form the trophic base of the estuarine/marine food web. This may result in more extreme diurnal variation in dissolved oxygen, which may negatively impact upon the numbers of estuarine macroinvertebrates. Conversely, the overall increase in planktonic concentrations may lead to an increase in macroinvertebrates, though at the cost of a loss of diversity. Change in either direction will have impacts upon lamprey, salmon and otter in the catchment. Opportunistic macroalgae may also colonise estuarine habitats where eutrophication has occurred. The Ballyduff effluent contains somewhat elevated levels of phosphorus, but this is not expected to lead to any such enrichment of the Cashen River due to the small scale nature of the discharge and large assimilative capacity of the Cashen. Changes in the invertebrate communities of the Cashen estuary resulting from losses associated with temporary decreases in dissolved oxygen may have consequences for the structure and function of the estuary and mudflat habitats found therein. Any such effects will be localised to the disused canal and will not affect the overall integrity of the site. Migrating salmon pass through the Cashen estuary in order to spawn higher up in the Feale catchment. Salmon stocks in the catchment are currently considered to be in good condition and are a good indicator that the Cashen estuary continues to provide an unpolluted migration corridor. It is estimated that climate change will result in more extended but less frequent wet and dry periods and warmer water temperatures, as rainfall patterns in Ireland are changing. This could result in precipitation increases of over 10% in the winter months, and decreases of approximately 25% in the summer, and annual temperature increases. However, there is insufficient information to predict the effects on the site as these will be more closely related to localised rainfall events.
Describe any likely impacts on the Natura site as a whole in terms of: Interference with the key relationships that define the structure of the site; Interference with key relationships that define the function of the site.	Potential nutrient enrichment of receiving waters due to the discharge resultant from the operation of the existing WWTP has the capacity to adversely affect water quality. It may also potentially negatively impact on populations of the protected aquatic species for which the site has been designated. However, more significant negative impacts are likely to result to the Natura site in the event of the decommissioning of the WWTP and the subsequent release of untreated sewage to the Cashen Estuary.
Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale of magnitude of impacts is not known.	While the Ballyduff Imhoff tank is currently overloaded and discharging to a small canal with low assimilative capacity, the final receiving waterbody (Cashen estuary) is an area of predicted high assimilative capacity with low nutrient pressures. Plans to increase the capacity of the system are described in the County Kerry Wastewater and Sludge Strategy Technical Assessment report. The screening exercise finds that there may be a local ecological impact within the canal channel, but this is not within the cSAC boundary. However, any impacts will be indistinguishable context of the Lower River Shannon cSAC as the Cashen estuary has a sizeable assimilative capacity. In conclusion, no further assessment is required.

Appendix 4 – Causeway Screening

Project	
Location	Discharge associated with agglomeration of Causeway village, County Kerry.
Distance from designated site	7km: Outfall discharges to tributary of Crompaun River, which flows north east to the Lixnaw Canal.
Brief description	Causeway is a village in north Kerry, located on the R551, approximately 7.5km east of Ballyheigue, and approximately 10km north of Ardfert. The original collection system in the village is a combined system constructed in 1954, with some minor additions completed subsequent. Wastewater flows by gravity to an Imhoff tank and percolating filters located to the south of the village. The plant provides secondary treatment, before discharging treated effluent through a 170m long, 225mm diameter outfall to the local watercourse, a tributary of the Crompaun River. Kerry County Council report that design capacity of the plant is 250PE, and that it is currently overloaded. The current population of Causeway is estimated at 281.
Is the plan directly connected with or necessary to the Natura 2000 site management for nature conservation?	No.
Natura 2000 site	
Name	Lower River Shannon
Designation	Candidate Special Area of Conservation
Basis	EU Habitats Directive
Description	*From the NPWS Site Synopsis*: This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the subcatchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia. The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the

following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter.

The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary.

Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (*Zostera* spp.) and patches of green algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a *Macoma-Scrobicularia-Nereis* community.

In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and Club-rushes (*Scirpus maritimus, S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triquetrus*), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*).

Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Saltmarsh Rush (*Juncus gerardi*), Long-bracted Sedge (*Carex extensa*), Lesser Seaspurrey (*Spergularia marina*) and Sea Arrowgrass (*Triglochin maritima*). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the compass of Common Saltmarsh-grass (*Puccinellia maritima*) and Hard-grass (*Parapholis strigosa*). Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a National Inventory of Lagoons are Shannon Airport Lagoon and Cloonconeen Pool. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa, Cerastoderma glaucum, Lekanesphaera hookeri, Palaemonetes varians, Sigara stagnalis* and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon

	(2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of Stonewort (*Chara canescens* and *Chara cf. connivens*). The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the cSAC. The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae. Other coastal habitats that occur within the site include the following: • Stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (*Fucus* spp., *Ascophyllum nodosum* and kelps). • Shingle beaches – the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (*Matricaria maritima*), Sea Campion and Curled Dock (*Rumex crispus*). • Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head. • Sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (*Ammophila arenaria*). Flowing into the estuaries are a number of tidal rivers. Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Floating river vegetation characterised by species of Water-crowfoot (*Ranunculus* spp.), Pondweeds (*Potamogeton* spp.) and the moss *Fontinalius antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to county Limerick. There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site. Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys

	and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey. Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River. This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country.
Area	72138ha
Condition	There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through overgrazing and poaching. Much of the land adjacent to the rivers and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale. In the past, Cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds. Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats. Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.
Conservation interests	**SAC Qualifying Interests – Habitats** • Estuaries • Mudflats and sandflats not covered by seawater at low tide • Coastal lagoons • Vegetated sea cliffs of the Atlantic and Baltic coasts • Salicornia and other annuals colonizing mud and sand • Atlantic salt meadows (Glauco-Puccinellietalia maritimae) • Mediterranean salt meadows (Juncetalia maritimi)

- Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
- Sandbanks which are slightly covered by sea water all the time
- Large shallow inlets and bays
- Reefs
- Perennial vegetation of stony banks
- Spartina swards (Spartinion maritimae)
- Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae)
- Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)

SAC Qualifying Interests – Species

- River lamprey
- Brook lamprey
- Sea lamprey
- Atlantic salmon
- Bottlenose dolphin
- European otter
- Freshwater pearl mussel

* Water-dependent habitats and species are underlined

Additional features/species of conservation interest

A number of plant species that are Irish Red Data Book species occur within the site - several are protected under the Flora (Protection) Order, 1999:
• Triangular Club-rush (*Scirpus triquetrus*) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary.
• Opposite-leaved Pondweed (*Groenlandia densa*) - this protected pondweed is found in the Shannon where it passes through Limerick City.
• Meadow Barley (*Hordeum secalinum*) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill.
• Hairy Violet (*Viola hirta*) - this protected violet occurs in the Askeaton/Foynes area.
• Golden Dock (*Rumex maritimus*) - noted as occurring in the River Fergus Estuary.
• Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon.
• Convergent Stonewort (*Chara connivens*) - presence in Shannon Airport Lagoon to be confirmed.

Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose (246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in 1993/94.

Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96), Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504;1995/96), Redshank (3228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are

	also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank. A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987). Two additional fish of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon. Freshwater pearl mussels are also known from the Upper River Feale; a population was encountered during surveys for the N21 upgrade. No detailed survey of pearl mussels in the Lower Feale has taken place to date. The Feale is a designated salmonid river, and is also listed as a sensitive river by the UWWT regulations. The Feale, Galey and Brick rivers were all open rivers for salmon angling in 2010, indicating a harvestable surplus for the species.

Stage 1 - Screening	
Describe the individual elements of the plan (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 sites.	The Causeway agglomeration receives primary treatment only at an Imhoff tank, before discharging to a stream tributary of the Crompaun River which flows to the River Cashen Estuary (the most westerly stretch of the River Feale). The plant is currently overloaded, as the design capacity of the plant is 250PE, and the current population of Causeway is estimated at 281. The Crompaun River is not sampled for water quality by the EPA. It is assigned a 'Moderate' status by the WFD classification system, which is based entirely on a 'Moderate' score for ecological status. The Crompaun River is not contained within the cSAC. No sampling data on the river or effluent is available from Kerry County Council. The outfall effluent contains material and solutes which may have a localised eutrophying effect within the Crompaun River, but these are likely to exist in lower concentrations than if no treatment were to be applied. No response was received from Inland Fisheries Ireland during the consultation period. The Crompaun is a tributary of the Cashen River estuary. The Water Framework Directive assigns 'Moderate' status to the Cashen estuary, due to moderate results for BOD loading in the site. Otherwise the estuary achieves good to high status for the other key classification variables, including Dissolved Oxygen and Reactive Phosphorus. Causeway WWTP is listed 'At Risk' for the site, but is assigned Level 3 Priority pending further assessments relating to need for plant upgrade. The Crompaun River confluence with the Cashen estuary lies downstream

	of Listowel; the effluent from the WWTPs here also passes through the Feale system. Significant dilution of these discharges will have occurred before the River Cashen/Feale reaches the Crompaun confluence, and any cumulative effects are considered unlikely. The Cashen estuary is an extensive site with a high assimilative capacity for nutrients.
Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of: Size and scale; Land-take; Distance from Natura 2000 site or key features of the site; Resource requirements; Emissions; Excavation requirements; Transportation requirements; Duration of construction, operation etc.; Others.	All potential impacts relate to the effluent of the WWTP entering the cSAC; no impacts will result from land-take, resource usage, excavation, construction or transportation. Disposal of effluent to river systems can lead to altered nutrient balance (eutrophication), increase in particulate matter, potential threat of toxicity, reduction in biological status and loss of habitat / species. Shifts in trophic status of estuarine systems due to nutrient changes may have consequent impacts upon marine/estuarine littoral invertebrate colony structure. This in turn may impact on feeding patterns and demography of bird species which depend upon such food chains. Nutrient enrichment has the effect of increasing phytoplankton growth which in turn increases the biological oxygen demand, resulting in decreasing oxygen levels in the site. This would impact negatively on all aquatic life in the bay. The Cashen estuary is classed as 'Moderate' under the WFD for BOD. Prolonged wet weather may lead to increased BOD loading around the outfall; the estuary is very extensive at this location however, and such influence is considered to be very limited in duration and spatial extent; it is not considered significant in this case. Any increases in toxic substances resulting from contamination events during the operation phase could have negative direct impacts on all of the aquatic species for which the Lower River Shannon cSAC has been designated, in particular Atlantic salmon and Sea lamprey. The Ballyduff Imhoff tank releases a relatively low volume of effluent via a canal channel to the deep channel of the Cashen; this channel has been identified as having a very large dilution factor and assimilative capacity. Minor eutrophication and deoxygenation of the local conditions in the Crompaun River are likely to be occurring at present. However, it is not predicted that this is being transmitted to the receiving Cashen waterbody which has a large assimilative capacity. A degree of biological recovery is also likely to occur in the 7km between the discharge and the confluence with the Cashen. Other plans and projects in the vicinity which may act in combination with the discharge include: • Continued operation of Listowel WWTP and Kerry Group on-site WWTP removing significant levels of potentially enriching material upstream of Crompaun confluence • Implementation of Nitrates Directive: Reduction in eutrophying run-off to Feale Catchment and Shannon Estuary • Shannon River Basin District Plan: Overall improvement in river water quality within catchment • North Kerry Settlements Local Area Plan: Sustainable development of area with awareness of conservation interests of River Feale Overall, these are likely to have a beneficial cumulative effect on the Natura 2000 site.
Describe any likely changes to the site arising as a result of:	In the estuarine habitats, enrichment can potentially lead to increased phytoplankton concentrations which form the trophic base of the

Reduction of habitat area; Disturbance of key species; Habitat or species fragmentation; Reduction in species density; Changes in key indicators of conservation value; Climate change.	estuarine/marine food web. This may result in more extreme diurnal variation in dissolved oxygen, which may negatively impact upon the numbers of estuarine macroinvertebrates. Conversely, the overall increase in planktonic concentrations may lead to an increase in macroinvertebrates, though at the cost of a loss of diversity. Change in either direction will have impacts upon lamprey, salmon and otter in the catchment. Opportunistic macroalgae may also colonise estuarine habitats where eutrophication has occurred. The Ballybunnion effluent contains acceptably low levels of phosphorus and nitrogen and is not expected to lead to any such enrichment. Changes in the invertebrate communities of the Cashen estuary resulting from losses associated with temporary decreases in dissolved oxygen may have consequences for the structure and function of the estuary and mudflat habitats found therein. Any such effects will be highly localised and will not affect the overall integrity of the site. Migrating salmon pass through the Cashen estuary in order to spawn higher up in the Feale catchment. Salmon stocks in the catchment are currently considered to be in good condition and are a good indicator that the Cashen estuary continues to provide an unpolluted migration corridor. It is estimated that climate change will result in more extended but less frequent wet and dry periods and warmer water temperatures, as rainfall patterns in Ireland are changing. This could result in precipitation increases of over 10% in the winter months, and decreases of approximately 25% in the summer, and annual temperature increases. However, there is insufficient information to predict the effects on the site as these will be more closely related to localised rainfall events.
Describe any likely impacts on the Natura site as a whole in terms of: Interference with the key relationships that define the structure of the site; Interference with key relationships that define the function of the site.	Potential nutrient enrichment of receiving waters due to the discharge resultant from the operation of the existing WWTP has the capacity to adversely affect water quality. It may also potentially negatively impact on populations of the protected aquatic species for which the site has been designated. However, more significant negative impacts are likely to result to the Natura site in the event of the decommissioning of the WWTP and the subsequent release of untreated sewage to the Crompaun River.
Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale of magnitude of impacts is not known.	While the Causeway Imhoff tank is currently overloaded and discharging to a minor stream with low assimilative capacity, the final receiving waterbody (Cashen estuary) is an area of predicted high assimilative capacity with low nutrient pressures. Plans to increase the capacity of the Causeway system are described in the County Kerry Wastewater and Sludge Strategy Technical Assessment report. The screening exercise finds that there may be a local ecological impact within the stream and Crompaun River, but these are not within the cSAC boundary. There is also a 7km geographical separation of the discharge from the cSAC. Any local impacts in the stream and Crompaun River are not being transmitted to the Lower River Shannon cSAC as the Cashen estuary has a sizeable assimilative capacity. In conclusion, no further assessment is required.

Appendix 5 – Lixnaw Screening & Assessment

Project	
Location	Discharge associated with agglomeration of Lixnaw village, County Kerry.
Distance from designated site	0km: Outfall discharges to the tidal Lixnaw canal (River Brick), inside the cSAC boundary.
Brief description	Lixnaw is a small village in north Kerry, located on the R557 approximately 11km southwest of Listowel and 17km north of Tralee. The village provides a limited range of services to the rural hinterland, including a number of shops, a number of public houses, a Garda station, two funeral homes, a doctor's surgery, a church, two primary schools, and a community centre. The village acts as a dormitory village for Tralee, and to a lesser extent for Listowel. Wastewater from the village collection network flows by gravity to a pumping station approximately 100m downstream of the existing treatment plant at Lixnaw, which forwards flows for treatment. The pumping station has a storm water overflow to the Lixnaw Canal. Treatment consists of coarse screening and an Imhoff tank. The tank provides primary treatment, before discharging treated effluent to the Lixnaw Canal. A 2007 Preliminary Report stated that the design capacity of the Imhoff tank is 300PE, and that the tank is currently overloaded. The current population if Lixnaw is between 400 and 500 people.
Is the plan directly connected with or necessary to the Natura 2000 site management for nature conservation?	No.
Natura 2000 site	
Name	Lower River Shannon
Designation	Candidate Special Area of Conservation
Basis	EU Habitats Directive
Description	*From the NPWS Site Synopsis*: This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the subcatchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia. The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive.

	The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter. The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary. Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (*Zostera* spp.) and patches of green algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a *Macoma-Scrobicularia-Nereis* community. In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and Club-rushes (*Scirpus maritimus, S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triquetrus*), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*). Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Saltmarsh Rush (*Juncus gerardi*), Long-bracted Sedge (*Carex extensa*), Lesser Seaspurrey (*Spergularia marina*) and Sea Arrowgrass (*Triglochin maritima*). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the compass of Common Saltmarsh-grass (*Puccinellia maritima*) and Hard-grass (*Parapholis strigosa*). Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a National Inventory of Lagoons are Shannon Airport Lagoon and Cloonconeen Pool. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon

	includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa, Cerastoderma glaucum, Lekanesphaera hookeri, Palaemonetes varians, Sigara stagnalis* and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon (2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of Stonewort (*Chara canescens* and *Chara cf. connivens*). The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the cSAC. The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae. Other coastal habitats that occur within the site include the following: • Stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (*Fucus* spp., *Ascophyllum nodosum* and kelps). • Shingle beaches - the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (*Matricaria maritima*), Sea Campion and Curled Dock (*Rumex crispus*). • Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head. • Sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (*Ammophila arenaria*). Flowing into the estuaries are a number of tidal rivers. Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Floating river vegetation characterised by species of Water-crowfoot (*Ranunculus* spp.), Pondweeds (*Potamogeton* spp.) and the moss *Fontinalius antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to county Limerick. There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site.

	Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey. Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River. This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country.
Area	72138ha
Condition	There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through overgrazing and poaching. Much of the land adjacent to the river and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale. In the past, Cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds. Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats. Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.
Conservation interests	**SAC Qualifying Interests – Habitats** • Estuaries • Mudflats and sandflats not covered by seawater at low tide • Coastal lagoons

- Vegetated sea cliffs of the Atlantic and Baltic coasts
- Salicornia and other annuals colonizing mud and sand
- Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
- Mediterranean salt meadows (Juncetalia maritimi)
- Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
- Sandbanks which are slightly covered by sea water all the time
- Large shallow inlets and bays
- Reefs
- Perennial vegetation of stony banks
- Spartina swards (Spartinion maritimae)
- Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae)
- Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)

SAC Qualifying Interests – Species

- River lamprey
- Brook lamprey
- Sea lamprey
- Atlantic salmon
- Bottlenose dolphin
- European otter
- Freshwater pearl mussel

* Water-dependent habitats and species are underlined

Additional features/species of conservation interest

A number of plant species that are Irish Red Data Book species occur within the site, several are protected under the Flora (Protection) Order, 1999:
• Triangular Club-rush (*Scirpus triquetrus*) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary.
• Opposite-leaved Pondweed (*Groenlandia densa*) - this protected pondweed is found in the Shannon where it passes through Limerick City.
• Meadow Barley (*Hordeum secalinum*) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill.
• Hairy Violet (*Viola hirta*) - this protected violet occurs in the Askeaton/Foynes area.
• Golden Dock (*Rumex maritimus*) - noted as occurring in the River Fergus Estuary.
• Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon.
• Convergent Stonewort (*Chara connivens*) - presence in Shannon Airport Lagoon to be confirmed.

Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose (246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in 1993/94.

Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96),

	Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504;1995/96), Redshank (3228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank. A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987). Two additional fish of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon. Freshwater pearl mussels are also known from the Upper River Feale; a population was encountered during surveys for the N21 upgrade. No detailed survey of pearl mussels in the Lower Feale has taken place to date. The Feale is a designated salmonid river, and is also listed as a sensitive river by the UWWT regulations. The Feale, Galey and Brick rivers were all open rivers for salmon angling in 2010, indicating a harvestable surplus for the species.

Stage 1 - Screening	
Describe the individual elements of the plan (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 sites.	The Lixnaw agglomeration receives primary treatment only at an Imhoff tank, before discharging to the manmade and partially tidal Lixnaw canal which carries the flow of the River Brick to the River Cashen. The effluent then disperses in the tidal water column of the Cashen estuary. The plant is currently overloaded, as the design capacity of the tank is 300PE, while Lixnaw has a population of at least 400. Sampling data provided by Kerry county council indicates that the Imhoff tank effluent is non-compliant with the UWWT standards, and has particularly elevated levels for BOD and Suspended Solids. Slightly higher than acceptable levels of Ammonia in the waterbody downstream of the discharge were also reported. As the plant discharges to partially tidal environment, no EPA sampling data is available in relation to this waterbody. Further upstream in the River Brick, the river attains good quality (Q=4) ecological status at all sampling points. Field surveys indicated that the outfall discharges to a slow-moving section of the canal where tidal pressure from the north may hold effluent in suspension with low levels of biological absorption. However, the waterbody here is quite wide and deep, and is expected to have a reasonably high dilution factor which is likely to negate against localised eutrophication. The 2007 Preliminary Report calculated the dilution factor at 54; at present, this results in a BOD loading of almost 3mg/l in the Lixnaw Canal. This may be leading to deoxygenation of the watercolumn and estuarine

	substrate which may be impacting on the food web of the canal. The outfall effluent contains material and solutes which be having a eutrophying effect within the tidal stretch of the Lixnaw canal, but these are likely to exist in lower concentrations than if no treatment were to be applied. No response was received from Inland Fisheries Ireland during the consultation period. The River Brick remains an open salmon fishery, which is indicative of Inland Fisheries Ireland's opinion that there is a harvestable surplus of salmon using the river. This species migrates through the Lixnaw canal to utilise spawning grounds in the headwaters of the River Brick. The Water Framework Directive assigns 'Moderate' status to the Lixnaw Canal, due to moderate results for Physio-chemical and Ecological status indicators. Lixnaw WWTP is listed 'At Risk' for the site and is assigned Level 1 Priority recommending increase in capacity and upgrade to tertiary treatment of the re-location of the outfall. The confluence of the Lixnaw Canal with the River Cashen lies downstream of Listowel; the effluent from the WWTPs here also passes through the Feale system. Significant dilution of these discharges will have occurred before the River Cashen/Feale reaches the confluence, and any cumulative effects are considered unlikely. The Cashen estuary is an extensive site with a high assimilative capacity for nutrients.
Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of: Size and scale; Land-take; Distance from Natura 2000 site or key features of the site; Resource requirements; Emissions; Excavation requirements; Transportation requirements; Duration of construction, operation etc.; Others.	All potential impacts relate to the effluent of the WWTP entering the cSAC; no impacts will result from land-take, resource usage, excavation, construction or transportation. Disposal of effluent to river systems can lead to altered nutrient balance (eutrophication), increase in particulate matter, potential threat of toxicity, reduction in biological status and loss of habitat / species. Shifts in trophic status of estuarine systems due to nutrient changes may have consequent impacts upon marine/estuarine littoral invertebrate colony structure. This in turn may impact on feeding patterns and demography of bird species which depend upon such food chains. Nutrient enrichment has the effect of increasing phytoplankton growth which in turn increases the biological oxygen demand, resulting in decreasing oxygen levels in the site. This would impact negatively on all aquatic life in the bay. The Lixnaw Canal estuary is classed as 'Moderate' under the WFD for Physio-chemical and Ecological status. Any increases in toxic substances resulting from contamination events during the operation phase could have negative direct impacts on all of the aquatic species for which the Lower River Shannon cSAC has been designated, in particular Atlantic salmon and Sea lamprey. Otter have been recently filmed in the tidal waters of the Lixnaw canal. Given the slow nature of flows in the Lixnaw canal, eutrophication and deoxygenation of the water column and substrate is likely to be occurring to be occurring to some degree; this impact is occurring within the cSAC boundary. Other plans and projects in the vicinity which may act in combination with the discharge include: • Continued operation of Listowel WWTP and Kerry Group on-site WWTP removing significant levels of potentially enriching material upstream of Lixnaw Canal – River Cashen confluence • Implementation of Nitrates Directive: Reduction in eutrophying run-off to Feale Catchment and Shannon Estuary

	• Shannon River Basin District Plan: Overall improvement in river water quality within catchment • North Kerry Settlements Local Area Plan: Sustainable development of area with awareness of conservation interests of River Feale Overall, these are likely to have a beneficial cumulative effect on the Natura 2000 site.
Describe any likely changes to the site arising as a result of: Reduction of habitat area; Disturbance of key species; Habitat or species fragmentation; Reduction in species density; Changes in key indicators of conservation value; Climate change.	In the estuarine habitats, enrichment can potentially lead to increased phytoplankton concentrations which form the trophic base of the estuarine/marine food web. This may result in more extreme diurnal variation in dissolved oxygen, which may negatively impact upon the numbers of estuarine macroinvertebrates. Conversely, the overall increase in planktonic concentrations may lead to an increase in macroinvertebrates, though at the cost of a loss of diversity. Change in either direction will have impacts upon lamprey, salmon and otter in the catchment. Opportunistic macroalgae may also colonise estuarine habitats where eutrophication has occurred. The Lixnaw Canal displays slightly elevated levels of Ammonia downstream of the discharge. Changes in the invertebrate communities of the Cashen estuary resulting from losses associated with temporary decreases in dissolved oxygen may have consequences for the structure and function of the estuary and mudflat habitats found therein. Any such effects will be highly localised and will not affect the overall integrity of the site. It is estimated that climate change will result in more extended but less frequent wet and dry periods and warmer water temperatures, as rainfall patterns in Ireland are changing. This could result in precipitation increases of over 10% in the winter months, and decreases of approximately 25% in the summer, and annual temperature increases. However, there is insufficient information to predict the effects on the site as these will be more closely related to localised rainfall events.
Describe any likely impacts on the Natura site as a whole in terms of: Interference with the key relationships that define the structure of the site; Interference with key relationships that define the function of the site.	Potential minor nutrient enrichment and deoxygenation of receiving waters due to the discharge resultant from the operation of the existing WWTP has the capacity to adversely affect water quality. It may also potentially negatively impact on populations of the protected aquatic species for which the site has been designated. Low aeration of the slow-flowing waterbody means that biological recovery may be slow to occur. While the Lixnaw Canal has a relatively high dilution factor, the current effluent may still be contributing to a reduction in ecological diversity downstream of the discharge; this is likely to occur through the loss of macroinvertebrates and small fish species. These form the basis of the trophic webs of the canal and may thus lead to impacts upon the qualifying species of the site. As the Lixnaw Canal is also partially tidal, it may be reasonable to suggest that canal substrate is essentially estuarine in nature; this is a habitat for which the site is designated and may be utilised by wading birds.
Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale of magnitude of impacts is not known.	The Lixnaw Imhoff tank is currently overloaded and discharging to the slow-flowing Lixnaw canal which is likely to have a low assimilative capacity for BOD load. Plans to increase the capacity of the system are described in the County Kerry Wastewater and Sludge Strategy Technical Assessment report, though there are no plans currently to implement such an upgrade. The screening exercise finds that there may be an ecological impact within the Lixnaw canal channel; this is within the cSAC boundary. The screening exercise therefore concludes that further assessment should be carried out in Stage 2 below. This assessment considers the potential impacts of the discharge with specific reference to the species and/or habitats which may

	be impacted.

Stage 2 - Project Assessment	
Describe the elements of the project that are likely to give rise to significant effects on the site	Waste water treatment plants can contribute significant nutrient and organic loads to rivers. There is potential that the discharge from the Lixnaw WWTP is in combination with other activities within the Feale catchment leading to increased levels of nutrients within the system.
Set out the conservation objectives of the site	European and national legislation places a collective obligation on Ireland and its citizens to maintain at favourable conservation status areas designated as candidate Special Areas of Conservation. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites. According to the EU Habitats Directive, favourable conservation status of a habitat is achieved when its natural range, and area it covers within that range, is stable or increasing, and the ecological factors that are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable as defined below. The favourable conservation status of a species is achieved when population data on the species concerned indicate that it is maintaining itself, and the natural range of the species is neither being reduced or likely to be reduced for the foreseeable future, and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis. The generic conservation objectives of the Lower River Shannon cSAC are: **1.** To maintain the Annex I habitats for which the cSAC has been selected at favourable conservation status: Estuaries; Mudflats and sandflats not covered by seawater at low tide; Coastal lagoons; Vegetated sea cliffs of the Atlantic and Baltic coasts; Salicornia and other annuals colonizing mud and sand; Atlantic salt meadows (Glauco-Puccinellietalia maritimae); Mediterranean salt meadows (Juncetalia maritimi); Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation; Sandbanks which are slightly covered by sea water all the time Large shallow inlets and bays; Reefs; Perennial vegetation of stony banks Spartina swards (Spartinion maritimae); Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae); Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) **2.** To maintain the Annex II species for which the cSAC has been selected at favourable conservation status: *Lampetra fluviatilis; Lampetra planeri; Petromyzon marinus; Salmo salar; Tursiops truncates; Lutra lutra Margaritifera margaritifera* **3.** To maintain the extent, species richness and biodiversity of the entire site. **4.** To establish effective liaison and co-operation with landowners, legal users and relevant authorities. It should be noted that only a sub-sample of these qualifying interests are water-dependent, as identified in the screening process.
Describe how the project will affect key species and key habitats	The overloaded Lixnaw plant may be currently contributing to elevated oxygen demand loading in the canal; this will cause decreasing oxygen levels in the site. Species which could be directly affected by this are Atlantic salmon and sea lamprey. Pearl mussels are not found in this part of the cSAC. Otter may be indirectly affected by changes in fish stocks, but are also able

	to adjust their foraging behaviour to accommodate temporary changes in diet resources. Bottlenose dolphin are unlikely to be affected as they occur in the expansive Shannon estuary which is in excellent ecological condition and not susceptible to pressures from land-based WWTPs. Any increases in toxic substances resulting from contamination events during the operation phase could have negative impacts on all of the aquatic species for which the Lower River Shannon cSAC has been designated, in particular Atlantic salmon. Any impacts which could negatively affect salmonid populations in the river could have knock on effects on lamprey and otter populations all of which are dependent on salmonids. Pollution events are preventable through judicious plant management.
Describe how the integrity of the site (determined by structure and function and conservation objectives) is likely to be affected by the project or plan (e.g. loss of habitat, disturbance, disruption, chemical changes, hydrological changes etc).	The key ecological relationships that define the structure and function of the Lixnaw as part of the Lower River Shannon cSAC are likely to be impacted by ongoing deoxygenation of the water column and estuarine substrate of the Lixnaw Canal. The canal itself, while originally an artificial habitat, now carries the flow of the River Brick and is naturalised in character. Salmon, sea lamprey and otter are likely to be found in the immediate vicinity of the discharge. Mud substrate exposed at low tide is likely to contain macroinvertebrates which form a key part of the food chain; wading birds utilise this key dietary resource. Alteration of this food chain through loss of macroinvertebrate diversity may be considered a significant impact to the cSAC. The Lixnaw treatment system is currently overloaded and discharges an effluent that is non-compliant with the UWWT regulations. Only the main channel of the River Feale is subject to the restrictions contained in the Salmonid Waters Regulations. The Lixnaw River/River Brick is of Moderate Status for dissolved oxygen and ecological factors. The Lixnaw plant discharges to a point in the canal of slow flow with little natural oxygenation of the water column. Biological recovery from increased BOD loading is likely to be slow in nature in this type of estuarine habitat. Dilution factors in the canal, while high are not considered sufficient to deal with the current loading of the discharge. Migrating salmon pass through the Cashen estuary and Lixnaw Canal in order to spawn higher up in the Brick River. Salmon stocks in the catchment are currently considered to be in good condition and are a good indicator that moderate ecological conditions in the canal are not contributing to negative impacts to this species. Lampreys are generally considered to have similar water quality requirements to salmonids. Freshwater pearl mussels do not occur in the Lixnaw canal. Bottlenose dolphin records are from the main Shannon channel. Both species are not expected to be impacted. However, it is likely that overall catchment pressure on dissolved oxygen levels in the Lixnaw Canal/River Brick are contributing to a loss in overall ecological diversity within the canal. The surrounding land is topographically very flat and flows are slow to moderate. It reasonable to predict that direct BOD loading and possible nutrient enrichment of the Lixnaw canal is exacerbating this pressure on dissolved oxygen levels. This may be having an overall significant effect on the integrity of the Lower River Shannon cSAC within the Lixnaw/Brick sub-catchment. It is noted that impacts are not expected to be carried through the main Cashen estuary, which has a significantly larger assimilative capacity. In conclusion, it cannot be ruled out that the Lixnaw discharge is not having a significant effect on the conservation objectives of the Lower River Shannon cSAC.
Describe mitigation measures that are to be introduced to avoid,	The 2007 Preliminary Report for the Lixnaw agglomeration proposed the construction of a new 1760PE WWTP adjacent to the site of the existing

reduce or remedy the adverse effects on the integrity of the site	plant. It proposes the use of a compartmentalised aerated septic tank followed by reed beds as the most appropriate treatment system to achieve the effluent standard required. The Preliminary Report states that effluent BOD concentrations should be in the region of 30mg/l at plant capacity. The proposed wastewater treatment plant would consist of the following: • Storm water overflow chamber and storm water tank. • Preliminary and primary treatment using CAST (Compartmentalised Aerated Septic • Tank) unit – approximately 335m^3 • Secondary treatment using reed beds – approximately 3,500m^2 bed area required, to be provided in two beds. • Flow divider to split influent flow between two reed beds. • Pumping station to discharge final effluent. • Control building. There are no plans at present to carry out this upgrade work.

Appendix 6 – Kilfynn Screening

Project	
Location	Discharge associated with agglomeration of Kilflynn village, County Kerry.
Distance from designated site	9km: Outfall discharges to the River Shanow (River Brick), 9km upstream of the cSAC boundary.
Brief description	Kilflynn is a small village in north Kerry, located on the R557 approximately 11km southwest of Listowel and 17km north of Tralee. The village provides a limited range of services to the rural hinterland, including a post office and shop, two public houses, a church, a primary school, and a community centre. The village acts as a dormitory village for Tralee and Listowel. The collected wastewater is treated at a septic tank located southeast of the village centre on the banks of the Shanow River, approximately 90 m upstream of Kilflynn Bridge. Treated effluent from the works outfalls to the nearby Shanow River. The plant was constructed in the 1950's and the current site is overgrown, which presents difficulties in terms of access and maintenance. Kerry County Council report that the design capacity of the septic tank is 150PE and that it is currently overloaded. The plant receives sewage from a residential population of roughly 200.
Is the plan directly connected with or necessary to the Natura 2000 site management for nature conservation?	No.
Natura 2000 site	
Name	Lower River Shannon
Designation	Candidate Special Area of Conservation
Basis	EU Habitats Directive
Description	*From the NPWS Site Synopsis*: This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the subcatchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia. The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive.

	The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter. The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary. Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (*Zostera* spp.) and patches of green algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a *Macoma-Scrobicularia-Nereis* community. In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and Club-rushes (*Scirpus maritimus, S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triquetrus*), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*). Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Saltmarsh Rush (*Juncus gerardi*), Long-bracted Sedge (*Carex extensa*), Lesser Seaspurrey (*Spergularia marina*) and Sea Arrowgrass (*Triglochin maritima*). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the compass of Common Saltmarsh-grass (*Puccinellia maritima*) and Hard-grass (*Parapholis strigosa*). Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a National Inventory of Lagoons are Shannon Airport Lagoon and Cloonconeen Pool. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon

	includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa, Cerastoderma glaucum, Lekanesphaera hookeri, Palaemonetes varians, Sigara stagnalis* and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon (2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of Stonewort (*Chara canescens* and *Chara cf. connivens*). The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the cSAC. The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae. Other coastal habitats that occur within the site include the following: • Stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (*Fucus* spp., *Ascophyllum nodosum* and kelps). • Shingle beaches - the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (*Matricaria maritima*), Sea Campion and Curled Dock (*Rumex crispus*). • Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head. • Sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (*Ammophila arenaria*). Flowing into the estuaries are a number of tidal rivers. Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Floating river vegetation characterised by species of Water-crowfoot (*Ranunculus* spp.), Pondweeds (*Potamogeton* spp.) and the moss *Fontinalius antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to county Limerick. There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site.

	Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey. Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River. This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country.
Area	72138ha
Condition	There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through overgrazing and poaching. Much of the land adjacent to the river and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale. In the past, Cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds. Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats. Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.
Conservation interests	**SAC Qualifying Interests – Habitats** • Estuaries • Mudflats and sandflats not covered by seawater at low tide • Coastal lagoons

- Vegetated sea cliffs of the Atlantic and Baltic coasts
- Salicornia and other annuals colonizing mud and sand
- Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
- Mediterranean salt meadows (Juncetalia maritimi)
- Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
- Sandbanks which are slightly covered by sea water all the time
- Large shallow inlets and bays
- Reefs
- Perennial vegetation of stony banks
- Spartina swards (Spartinion maritimae)
- Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae)
- Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)

SAC Qualifying Interests – Species

- River lamprey
- Brook lamprey
- Sea lamprey
- Atlantic salmon
- Bottlenose dolphin
- European otter
- Freshwater pearl mussel

* Water-dependent habitats and species are underlined

Additional features/species of conservation interest

A number of plant species that are Irish Red Data Book species occur within the site, several are protected under the Flora (Protection) Order, 1999:
• Triangular Club-rush (*Scirpus triquetrus*) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary.
• Opposite-leaved Pondweed (*Groenlandia densa*) - this protected pondweed is found in the Shannon where it passes through Limerick City.
• Meadow Barley (*Hordeum secalinum*) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill.
• Hairy Violet (*Viola hirta*) - this protected violet occurs in the Askeaton/Foynes area.
• Golden Dock (*Rumex maritimus*) - noted as occurring in the River Fergus Estuary.
• Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon.
• Convergent Stonewort (*Chara connivens*) - presence in Shannon Airport Lagoon to be confirmed.

Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose (246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in 1993/94.

Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96),

	Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504;1995/96), Redshank (3228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank. A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987). Two additional fish of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon. Freshwater pearl mussels are also known from the Upper River Feale; a population was encountered during surveys for the N21 upgrade. No detailed survey of pearl mussels in the Lower Feale has taken place to date. The Feale is a designated salmonid river, and is also listed as a sensitive river by the UWWT regulations. The Feale, Galey and Brick rivers were all open rivers for salmon angling in 2010, indicating a harvestable surplus for the species.

Stage 1 - Screening	
Describe the individual elements of the plan (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 sites.	The Kilflynn agglomeration receives primary treatment only at a septic tank, before discharging to Shanow River (upstream name of the Brick River). The plant is currently overloaded, as the design capacity of the tank is 150PE, while Lixnaw has a population of around 200. Sampling data provided by Kerry county council indicates that the Imhoff tank effluent is non-compliant with the UWWT standards with elevated levels for BOD and Suspended Solids. Phosphorus and nitrogen levels in the effluent were reasonably low. EPA sampling data in relation to this waterbody indicates that the river attains good quality (Q=4) ecological status at all sampling points. The outfall effluent contains material and solutes which be having a eutrophying effect within the Shanow River, but these are likely to exist in lower concentrations than if no treatment were to be applied. No response was received from Inland Fisheries Ireland during the consultation period. The River Brick remains an open salmon fishery, which is indicative of Inland Fisheries Ireland's opinion that there is a harvestable surplus of salmon using the river. This species migrates through the Shanow/Brick River to utilise spawning grounds in the headwaters of the sub-catchment. The Water Framework Directive assigns 'Moderate' status to the River Brick, due to moderate results for Ecological status indicators. Kilflynn WWTP is listed 'At Risk' for the site and is assigned Level 2 Priority recommending increase in capacity and upgrade to tertiary treatment of

	the re-location of the outfall. The Kilflynn WTTP lies 9km upstream of the cSAC boundary. It is considerably likely that any deoxygenating effects will have been negated before this confluence. The EPA water quality sampling results report no evidence of eutrophication of the Shanow River.
Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of: Size and scale; Land-take; Distance from Natura 2000 site or key features of the site; Resource requirements; Emissions; Excavation requirements; Transportation requirements; Duration of construction, operation etc.; Others.	All potential impacts relate to the effluent of the WWTP entering the cSAC; no impacts will result from land-take, resource usage, excavation, construction or transportation. Disposal of effluent to river systems can lead to altered nutrient balance (eutrophication), increase in particulate matter, potential threat of toxicity, reduction in biological status and loss of habitat / species. No evidence of such enrichment has been reported from the Shanow. The EPA states that conditions are satisfactory. Given the narrow extent of the Shanow River at the site of outfall, some localised deoxygenation of the river may be occurring immediately downstream of the discharge. Full biological recovery is expected by the time the Shanow/Brick River meets the cSAC boundary. Other plans and projects in the vicinity which may act in combination with the discharge include: • Implementation of Nitrates Directive: Reduction in eutrophying run-off to Feale Catchment and Shannon Estuary • Shannon River Basin District Plan: Overall improvement in river water quality within catchment • North Kerry Settlements Local Area Plan: Sustainable development of area with awareness of conservation interests of River Feale Overall, these are likely to have a beneficial cumulative effect on the Natura 2000 site.
Describe any likely changes to the site arising as a result of: Reduction of habitat area; Disturbance of key species; Habitat or species fragmentation; Reduction in species density; Changes in key indicators of conservation value; Climate change.	cSAC qualifying species which may extend their ranges beyond the cSAC boundary are salmon, otter and lamprey. The salmon population is considered to be in harvestable excess for the catchment. Lamprey have broadly similar water quality requirements to salmon and are predicted to be unaffected by the discharge. Otter will forage over a more extensive area than the zone of influence of the discharge and will not be impacted. Pearl mussels do not occur in the sub-catchment while Bottlenose dolphins are restricted to the main Shannon estuary. Eutrophication of the Shanow is not considered to be a major issue. It is estimated that climate change will result in more extended but less frequent wet and dry periods and warmer water temperatures, as rainfall patterns in Ireland are changing. This could result in precipitation increases of over 10% in the winter months, and decreases of approximately 25% in the summer, and annual temperature increases. However, there is insufficient information to predict the effects on the site as these will be more closely related to localised rainfall events.
Describe any likely impacts on the Natura site as a whole in terms of: Interference with the key relationships that define the structure of the site; Interference with key relationships that define the function of the site.	Potential minor nutrient enrichment and deoxygenation of receiving waters due to the discharge resultant from the operation of the existing WWTP has the capacity to adversely affect water quality. It may also potentially negatively impact on populations of the protected aquatic species for which the site has been designated. Low aeration of the slow-flowing waterbody means that biological recovery may be slow to occur. While the Lixnaw Canal has a relatively high dilution factor, the current effluent may still be contributing to a reduction in ecological diversity

	downstream of the discharge; this is likely to occur through the loss of macroinvertebrates and small fish species. These form the basis of the trophic webs of the canal and may thus lead to impacts upon the qualifying species of the site. As the Lixnaw Canal is also partially tidal, it may be reasonable to suggest that canal substrate is essentially estuarine in nature; this is a habitat for which the site is designated and may be utilised by wading birds.
Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale of magnitude of impacts is not known.	The Kilflynn septic tank is currently overloaded and discharging to the moderate flow Shanow River. Nutrient levels are however quite low in the sampled effluent and are not considered to be contributing to any enrichment of the river. BOD loading may be causing minor deoxygenation of the river in the vicinity of the discharge, but this is not considered likely to be having a significant effect on the qualifying interests of the Natura 2000 site. Any such deoxygenation will be very limited in extent and will not be transferred to inside the cSAC boundary 9km downstream. The screening exercise therefore finds that any negative localised impacts will not be transferred to the qualifying habitats or species of the Lower River Shannon cSAC. In conclusion, no further assessment is required.

Appendix 7 – Tarbert Screening & Assessment

Project	
Location	Discharge associated with agglomeration of Tarbert village, County Kerry.
Distance from designated site	0km: Outfall discharges to the Tarbert Creek, part of the Tarbert Estuary, inside the cSAC boundary.
Brief description	Tarbert is a town in north Kerry located on the Shannon estuary on the border between the counties of Kerry and Limerick, and approximately 15km northeast of Listowel. Access to the national road network is via the N69 and the N67, and linear residential development is evident on the approach roads to the town. A ferry port in Tarbert, offers a ferry service to Killimer in Co. Clare providing an alternative route northwards, and attracting a significant amount of tourist and commercial through-traffic. The ESB have a 620MW oil fuelled power generating station to the north of the town on Tarbert Island. This was due to be decommissioned, but has been purchased by a private enterprise which has been granted planning permission to convert the plant to a gas-fired power station, with construction phases between 2011 and 2015. An EIS was published for this approved development. The village foul collection systems gravitate to two septic tanks located on the banks of Tarbert Creek. The tanks provide primary treatment before discharging treated effluent to the creek. Both outfalls discharge above the low tide mark. Kerry County Council report that the combined treatment capacity of the septic tanks is approximately 710PE, and that they are currently overloaded.
Is the plan directly connected with or necessary to the Natura 2000 site management for nature conservation?	No.
Natura 2000 sites	
Name	Lower River Shannon cSAC / River Shannon and River Fergus Estuaries SPA
Designation	Candidate Special Area of Conservation / Special Protection Area
Basis	EU Habitats Directive
Description	*From the NPWS Site Synopsis*: This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the subcatchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the

	Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia. The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter. The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary. Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (*Zostera* spp.) and patches of green algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a *Macoma-Scrobicularia-Nereis* community. In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and Club-rushes (*Scirpus maritimus, S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triquetrus*), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*). Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Saltmarsh Rush (*Juncus gerardi*), Long-bracted Sedge (*Carex extensa*), Lesser Seaspurrey (*Spergularia marina*) and Sea Arrowgrass (*Triglochin maritima*). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the compass of Common Saltmarsh-grass (*Puccinellia maritima*) and Hard-grass (*Parapholis strigosa*). Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a National Inventory of Lagoons are Shannon Airport Lagoon and Cloonconeen Pool. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by

	percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa, Cerastoderma glaucum, Lekanesphaera hookeri, Palaemonetes varians, Sigara stagnalis* and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon (2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of Stonewort (*Chara canescens* and *Chara cf. connivens*). The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the cSAC. The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae. Other coastal habitats that occur within the site include the following: • Stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (*Fucus* spp., *Ascophyllum nodosum* and kelps). • Shingle beaches - the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (*Matricaria maritima*), Sea Campion and Curled Dock (*Rumex crispus*). • Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head. • Sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (*Ammophila arenaria*). Flowing into the estuaries are a number of tidal rivers. Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Floating river vegetation characterised by species of Water-crowfoot (*Ranunculus* spp.), Pondweeds (*Potamogeton* spp.) and the moss *Fontinalius antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to county Limerick. There is a resident population of Bottle-nosed Dolphin in the Shannon

	Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site. Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey. Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River. This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country.
Area	72138ha
Condition	There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through overgrazing and poaching. Much of the land adjacent to the rivers and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale. In the past, Cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds. Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats. Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.
Conservation interests	**SAC Qualifying Interests – Habitats**

- Estuaries
- Mudflats and sandflats not covered by seawater at low tide
- Coastal lagoons
- Vegetated sea cliffs of the Atlantic and Baltic coasts
- Salicornia and other annuals colonizing mud and sand
- Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
- Mediterranean salt meadows (Juncetalia maritimi)
- Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
- Sandbanks which are slightly covered by sea water all the time
- Large shallow inlets and bays
- Reefs
- Perennial vegetation of stony banks
- Spartina swards (Spartinion maritimae)
- Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae)
- Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)

SAC Qualifying Interests – Species

- River lamprey
- Brook lamprey
- Sea lamprey
- Atlantic salmon
- Bottlenose dolphin
- European otter
- Freshwater pearl mussel

* Water-dependent habitats and species are underlined

SPA Conservation Interests

This site is of great ornithological interest, being of international importance on account of the numbers of wintering birds it supports. It also supports internationally important numbers of three species, i.e. Dunlin, Black-tailed Godwit and Redshank. In addition, there are 16 species that have populations of national importance. For several of the bird species, it is the top site in the country. Also of note is that three of the species which occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Whooper Swan, Golden Plover and Bar-tailed Godwit.

Additional features/species of conservation interest

A number of plant species that are Irish Red Data Book species occur within the site - several are protected under the Flora (Protection) Order, 1999:
• Triangular Club-rush (*Scirpus triquetrus*) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary.
• Opposite-leaved Pondweed (*Groenlandia densa*) - this protected pondweed is found in the Shannon where it passes through Limerick City.
• Meadow Barley (*Hordeum secalinum*) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill.
• Hairy Violet (*Viola hirta*) - this protected violet occurs in the Askeaton/Foynes area.
• Golden Dock (*Rumex maritimus*) - noted as occurring in the River Fergus Estuary.
• Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon.
• Convergent Stonewort (*Chara connivens*) - presence in Shannon Airport Lagoon to be confirmed.

	Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose (246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in 1993/94. Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96), Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504;1995/96), Redshank (3228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank. A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987). Two additional fish of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon. Freshwater pearl mussels are also known from the Upper River Feale.

Stage 1- Screening	
Describe the individual elements of the plan (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 sites.	The Tarbert agglomeration flows to a pair of septic tanks located on the east side of the village which discharge effluent to the estuarine habitats of Tarbert creek and estuary. Sampling carried out by Kerry County Council indicates that the effluent is not compliant with the standards required by the UWWT regulations. BOD, SS, Phosphorus and Nitrogen levels are all well above environmentally acceptable levels. The habitat at this location is a mosaic of estuarine channels which expose muddy substrate and rocky shore at low tide, and some extensive areas of saltmarsh at the interface between the estuary and artificial habitats at the head of the bay. This habitat mosaic is likely to provide valuable habitat to a wide range of bird species. As the discharge occurs within the estuarine environment, no EPA sampling has historically taken place downstream of the WWTP or discharge. Sampling of the freshwater habitat in the Tarbert Stream upstream of the estuary has historically indicated poor ecological conditions. However, the 2008 results indicated satisfactory river conditions, with good ecological quality, for the first time since surveys began.

	The outfall effluent contains material and solutes which may have a eutrophying effect within the estuarine habitat and greater area of the Shannon estuary, but these are likely to exist in significantly lower concentrations than if no treatment were to be applied. No response was received from Inland Fisheries Ireland during the consultation period. The present and proposed power stations on Tarbert Island feature a number of effluent discharges which are licensed under EPA IPPC protocol. These discharge to the main body of the Shannon estuary to the north and west of the island and are not expected to interact with the Tarbert septic tanks discharge. The proposed power plant will feature fewer discharges with significantly lower volumes of effluent. The main Lower Shannon Estuary has been attributed a 'Moderate' Status under the WFD classification. This is due entirely to the presence of specific pollutants, Zinc and Lead from probable industrial sources inland. Otherwise, the Shannon scores 'High' or 'Good' for all other variables. The Tarbert sewage system would not be contributing to these specific pollutants.
Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of: Size and scale; Land-take; Distance from Natura 2000 site or key features of the site; Resource requirements; Emissions; Excavation requirements; Transportation requirements; Duration of construction, operation etc.; Others.	All potential impacts relate to the effluent of the WWTP entering the cSAC; no impacts will result from land-take, resource usage, excavation, construction or transportation. Disposal of effluent to estuarine systems can lead to altered nutrient balance (eutrophication), increase in particulate matter, potential threat of toxicity, reduction in biological status and loss of habitat / species. Shifts in trophic status of estuarine systems due to nutrient changes may have consequent impacts upon marine/estuarine littoral invertebrate colony structure. This in turn may impact on feeding patterns and demography of bird species which depend upon such food chains. The Tarbert effluent contains notably elevated levels of phosphorus and nitrogen, as well as high concentrations for suspended solids and BOD. This may be contributing to organic and inorganic enrichment of the estuarine mudflats and littoral zone located within Tarbert estuary. Impacts are unlikely to be transferred to the main body of water of the Lower Shannon Estuary, as this receiving site has a large assimilative capacity. Nutrient enrichment has the effect of increasing phytoplankton growth which in turn increases the biological oxygen demand, resulting in decreasing oxygen levels in the site. This would impact negatively on all aquatic life in the estuary. Any increases in toxic substances resulting from contamination events during the operation phase could have negative impacts on all of the aquatic species for which the Lower River Shannon cSAC has been designated, in particular Atlantic salmon and Sea lamprey. Annex I Bird species for which the SPA is designated could also be significantly impacted. Other plans and projects in the vicinity which may act in combination with the discharge include: • Approved Tarbert Power Station upgrade: Possible improvement in water quality around Tarbert Island • Implementation of Nitrates Directive: Reduction in eutrophying run-off to Tarbert River • Shannon River Basin District Plan: Overall improvement in river water quality within catchment • Tarbert Local Area Plan: Sustainable development of area with awareness of conservation interests of Tarbert and Shannon estuaries

	Overall, these are likely to a beneficial cumulative effect on the Natura 2000 site. The approved Shannon Gas Terminal between Tarbert and Ballylongford will be subject to numerous detailed environmental mitigation measures. It is not expected to interact to any major degree with the Tarbert discharge.
Describe any likely changes to the site arising as a result of: Reduction of habitat area; Disturbance of key species; Habitat or species fragmentation; Reduction in species density; Changes in key indicators of conservation value; Climate change.	There will be no loss of our reduction in Annex I habitats as a result of the operation of the existing WWTP. However, the functional ecology of the estuarine mudflats in the littoral zone of Tarbert estuary may be being altered by nutrient enrichment. Enrichment can potentially lead to increased phytoplankton concentrations which form the trophic base of the estuarine/marine food web. This may result in more extreme diurnal variation in dissolved oxygen, which may negatively impact upon the numbers of estuarine macroinvertebrates. Conversely, the overall increase in planktonic concentrations may lead to an increase in macroinvertebrates. Change in either direction will have impacts upon lamprey, salmon and otter in the catchment. Opportunistic macroalgae may also colonise estuarine habitats where eutrophication has occurred. Changes to in the invertebrate communities of the Tarbert Estuary may have consequences for the structure and function of the estuary and mudflat habitats found therein. It is estimated that climate change will result in more extended but less frequent wet and dry periods and warmer water temperatures, as rainfall patterns in Ireland are changing. This could result in precipitation increases of over 10% in the winter months, and decreases of approximately 25% in the summer, and annual temperature increases. However, there is insufficient information to predict the effects on the site as these will be more closely related to localised rainfall events.
Describe any likely impacts on the Natura site as a whole in terms of: Interference with the key relationships that define the structure of the site; Interference with key relationships that define the function of the site.	Potential nutrient enrichment of receiving waters due to the discharge resultant from the operation of the existing WWTP has the capacity to adversely affect water quality. It may also potentially negatively impact on populations of the protected aquatic species for which the site has been designated.
Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale of magnitude of impacts is not known.	As the Ballylongford wastewater receives little to no treatment at present, there is the possibility that a significant degree of localised nutrient enrichment may be taking place within the Ballylongford Creek, which lies within both the cSAC and SPA boundaries. As there is the possibility of significant impacts, further assessment is carried out in Stage 2 below.

Stage 2 - Project Assessment	
Describe the elements of the project that are likely to give rise to significant effects on the site	Waste water treatment plants, can contribute significant nutrient and organic loads to rivers. There is potential that the discharge is leading to increased levels of nutrients within the local estuarine system.
Set out the conservation objectives of the site	European and national legislation places a collective obligation on Ireland and its citizens to maintain at favourable conservation status areas designated as candidate Special Areas of Conservation. The Government and its agencies are responsible for the implementation and enforcement

	of regulations that will ensure the ecological integrity of these sites. According to the EU Habitats Directive, favourable conservation status of a habitat is achieved when its natural range, and area it covers within that range, is stable or increasing, and the ecological factors that are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable as defined below. The favourable conservation status of a species is achieved when population data on the species concerned indicate that it is maintaining itself, and the natural range of the species is neither being reduced or likely to be reduced for the foreseeable future, and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis. The generic conservation objectives of the Lower River Shannon cSAC are: **1.** To maintain the Annex I habitats for which the cSAC has been selected at favourable conservation status: Estuaries; Mudflats and sandflats not covered by seawater at low tide; Coastal lagoons; Vegetated sea cliffs of the Atlantic and Baltic coasts; Salicornia and other annuals colonizing mud and sand; Atlantic salt meadows (Glauco-Puccinellietalia maritimae); Mediterranean salt meadows (Juncetalia maritimi); Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation; Sandbanks which are slightly covered by sea water all the time; Large shallow inlets and bays; Reefs; Perennial vegetation of stony banks; Spartina swards (Spartinion maritimae); Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae); Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) **2.** To maintain the Annex II species for which the cSAC has been selected at favourable conservation status: *Lampetra fluviatilis; Lampetra planeri; Petromyzon marinus; Salmo salar; Tursiops truncates; Lutra lutra Margaritifera margaritifera* **3.** To maintain the extent, species richness and biodiversity of the entire site. **4.** To establish effective liaison and co-operation with landowners, legal users and relevant authorities. It should be noted that only a sub-sample of these qualifying interests are water-dependent, as identified in the screening process.
Describe how the project will affect key species and key habitats	Nutrient enrichment has the effect of increasing phytoplankton growth which in turn increases the biological oxygen demand, resulting in decreasing oxygen levels in the site. Species which could be directly affected by this are Atlantic Salmon and Sea Lamprey. Otter and Bottlenose dolphin may be indirectly affected by changes in fish stocks. The potentially high levels of nutrients entering the Ballyline River/ Ballylongford Creek at this location has the potential to alter the functional ecology of the estuarine and littoral habitats, on which a wide range of bird species (for which the SPA is designated) can be found feeding, over-wintering and or breeding. Eutrophication may lead to a reduction in invertebrate species density, with a consequential increase in the numbers of high-nutrient specialist species. Where this happens, the diversity of feeding bird species is likely to be reduced, though numbers of birds which target the specialist invertebrates may also increase. A loss of overall species diversity within the cSAC/SPA will result in one of the key conservation objectives (3) not being fulfilled.

	It is likely that given the location of the discharge and the pattern of tidal flows in the bay that the vast majority of any nutrient enrichment would be restricted to the mudflats and estuaries of the Ballylongford inlet. Impacts to the trophic status of the main Shannon estuary will be imperceptible owing to vast assimilative capacity of this waterbody.
Describe how the integrity of the site (determined by structure and function and conservation objectives) is likely to be affected by the project or plan (e.g. loss of habitat, disturbance, disruption, chemical changes, hydrological changes etc).	The integrity of the cSAC/SPA water-dependent habitats that form the Tarbert estuary and mudflats are dependent on consistent trophic status of the contributing rivers and streams, as are the aquatic habitats of the rivers that provide food and migration corridors for the qualifying species. The Tarbert septic tanks are currently operating beyond their design capacity and generate a low quality effluent with notably high levels of phosphorus, nitrogen and organic solids. The discharge from these tanks may be leading to localised eutrophication of the Tarbert estuary, which is designated habitat of both the cSAC and SPA. This may be negatively impacting the integrity of the site by altering the trophic status of the area which can lead to changes in macroinvertebrate communities and bird species diversity. The assessment therefore concludes that the possibility of significant impacts to the Tarbert estuary, part of the Lower River Shannon cSAC and River Fergus/River Shannon SPA cannot be discounted at this stage.
Describe mitigation measures that are to be introduced to avoid, reduce or remedy the adverse effects on the integrity of the site	A preliminary design for a replacement sewage treatment system for Tarbert has been proposed. An assessment was carried out regarding the available dilution factor in the freshwater flows from the stream at Harold's Bridge during low-tide in the estuary. The assessment concluded that the dilution factor provided by the stream alone during low-tide conditions is insufficient. Consequently, it is proposed to construct a tidal tank at the proposed treatment plant to store effluent for discharge to the estuary around high tide time, to ensure maximum dilution. Based on the use of a tidal tank, it is proposed that secondary treatment is provided at Tarbert, treating effluent to the 25/35 discharge standards prescribed in Part 1 of the 2nd Schedule to the Urban Wastewater Treatment Regulations. Tarbert is listed on the 2010-2012 WSIP and is to be upgraded in the near future. Once this upgrade is completed, it is expected that any significant impacts to the Tarbert estuary will cease.

Appendix 8 – Ballylongford Screening & Assessment

Project	
Location	Discharge associated with agglomeration of Ballylongford village, County Kerry.
Distance from designated site	0km: Outfall discharges to the tidal stretch of the Ballyline river, inside the cSAC boundary.
Brief description	Ballylongford is a coastal village in north Kerry, located at the junction of the R551 and R552, approximately 16km east of Ballybunnion, 6km west of Tarbert, and 13km north of Listowel. Ballylongford provides a wide range of services to the local rural hinterland including a primary school, a church, three shops/supermarkets, a post office, three commercial offices, six public houses, a community centre, a Garda station, a fire station, two hairdressers/salons, and four service station/garages. There is currently no public wastewater treatment provided in Ballylongford, with collected wastewater being discharged directly to the Ballyline River, which is tidal at the village. The eastern network discharges by gravity directly to the river via a 150m long box culvert, which outfalls above the low tide mark. The western network discharges by gravity to a holding tank. During low tide conditions the holding tank discharges by gravity to the river, while pumping is required to affect discharge during high tide conditions.
Is the plan directly connected with or necessary to the Natura 2000 site management for nature conservation?	No.
Natura 2000 sites	
Name	Lower River Shannon cSAC / River Shannon and River Fergus Estuaries SPA
Designation	Candidate Special Area of Conservation / Special Protection Area
Basis	EU Habitats Directive
Description	*From the NPWS Site Synopsis*: This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the subcatchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia. The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for floating river vegetation, *Molinia* meadows,

	estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter. The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary. Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (*Zostera* spp.) and patches of green algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a *Macoma-Scrobicularia-Nereis* community. In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and Club-rushes (*Scirpus maritimus, S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triquetrus*), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*). Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Saltmarsh Rush (*Juncus gerardi*), Long-bracted Sedge (*Carex extensa*), Lesser Seaspurrey (*Spergularia marina*) and Sea Arrowgrass (*Triglochin maritima*). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the compass of Common Saltmarsh-grass (*Puccinellia maritima*) and Hard-grass (*Parapholis strigosa*). Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a National Inventory of Lagoons are Shannon Airport Lagoon and Cloonconeen Pool. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and

green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa, Cerastoderma glaucum, Lekanesphaera hookeri, Palaemonetes varians, Sigara stagnalis* and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon (2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of Stonewort (*Chara canescens* and *Chara cf. connivens*).

The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the cSAC.

The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae.

Other coastal habitats that occur within the site include the following:

• Stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (*Fucus* spp., *Ascophyllum nodosum* and kelps).
• Shingle beaches - the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (*Matricaria maritima*), Sea Campion and Curled Dock (*Rumex crispus*).
• Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head.
• Sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (*Ammophila arenaria*).

Flowing into the estuaries are a number of tidal rivers. Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Floating river vegetation characterised by species of Water-crowfoot (*Ranunculus* spp.), Pondweeds (*Potamogeton* spp.) and the moss *Fontinalius antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to county Limerick.

There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site.

	Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey. Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River. This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country.
Area	72138ha
Condition	There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through overgrazing and poaching. Much of the land adjacent to the rivers and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale. In the past, Cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds. Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats. Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.
Conservation interests	**SAC Qualifying Interests – Habitats** • Estuaries • Mudflats and sandflats not covered by seawater at low tide • Coastal lagoons • Vegetated sea cliffs of the Atlantic and Baltic coasts

- Salicornia and other annuals colonizing mud and sand
- Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
- Mediterranean salt meadows (Juncetalia maritimi)
- Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
- Sandbanks which are slightly covered by sea water all the time
- Large shallow inlets and bays
- Reefs
- Perennial vegetation of stony banks
- Spartina swards (Spartinion maritimae)
- Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae)
- Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)

SAC Qualifying Interests – Species

- River lamprey
- Brook lamprey
- Sea lamprey
- Atlantic salmon
- Bottlenose dolphin
- European otter
- Freshwater pearl mussel

* Water-dependent habitats and species are underlined

SPA Conservation Interests

This site is of great ornithological interest, being of international importance on account of the numbers of wintering birds it supports. It also supports internationally important numbers of three species, i.e. Dunlin, Black-tailed Godwit and Redshank. In addition, there are 16 species that have populations of national importance. For several of the bird species, it is the top site in the country. Also of note is that three of the species which occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Whooper Swan, Golden Plover and Bar-tailed Godwit.

Additional features/species of conservation interest

A number of plant species that are Irish Red Data Book species occur within the site - several are protected under the Flora (Protection) Order, 1999:
• Triangular Club-rush (*Scirpus triquetrus*) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary.
• Opposite-leaved Pondweed (*Groenlandia densa*) - this protected pondweed is found in the Shannon where it passes through Limerick City.
• Meadow Barley (*Hordeum secalinum*) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill.
• Hairy Violet (*Viola hirta*) - this protected violet occurs in the Askeaton/Foynes area.
• Golden Dock (*Rumex maritimus*) - noted as occurring in the River Fergus Estuary.
• Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon.
• Convergent Stonewort (*Chara connivens*) - presence in Shannon Airport Lagoon to be confirmed.

Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose

	(246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in 1993/94. Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96), Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504;1995/96), Redshank (3228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank. A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987). Two additional fish of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon. Freshwater pearl mussels are also known from the Upper River Feale.

Stage 1- Screening	
Describe the individual elements of the plan (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 sites.	The Ballylongford agglomeration discharges untreated effluent to the estuarine habitats of the Ballyline River. The estuarine habitats are known as Ballylongford Creek. Sampling carried out by Kerry County Council indicates that the effluent is not compliant with the standards required by the UWWT regulations. BOD, SS, Phosphorus and Nitrogen levels are all well above environmentally acceptable levels. As no settlement occurs, Suspended Solid values were particularly high (>2000mg/l). The habitat at this location is a mosaic of estuarine channels which expose muddy substrate and rocky shore at low tide, and some extensive areas of saltmarsh at the interface between the estuary and artificial habitats at the head of the bay. This habitat mosaic is likely to provide valuable habitat to a wide range of bird species. Observations made during the site visit recorded over 20 species of birds, including one Little Egret. As the discharge occurs within the estuarine environment, no EPA sampling has historically taken place downstream of the WWTP or discharge. Sampling of the freshwater habitat in the Ballyline River upstream of the estuary has historically indicated poor to moderate ecological conditions. An improvement at two of the three sampling locations was however observed at the last sample date, and the river now displays good ecological condition (Q=4) at the most downstream point. The outfall effluent contains material and solutes which may have a eutrophying effect within the estuarine habitat and greater area of the

	Shannon estuary, but these are likely to exist in significantly lower concentrations than if no treatment were to be applied. No response was received from Inland Fisheries Ireland during the consultation period. The main Lower Shannon Estuary has been attributed a 'Moderate' Status under the WFD classification. This is due entirely to the presence of specific pollutants, Zinc and Lead from probable industrial sources inland. Otherwise, the Shannon scores 'High' or 'Good' for all other variables. The Tarbert sewage system would not be contributing to these specific pollutants. The Shannon estuary to the north of Ballylongford is a designated Shellfish production area. The bulk of Shellfish production in the western Shannon estuary comprises bag and trestle cultured Pacific oysters. Monitoring for shellfish flesh classification indicates faecal contamination in this shellfish area. The Ballylongford discharge is likely to be significantly contributing to this issue.
Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of: Size and scale; Land-take; Distance from Natura 2000 site or key features of the site; Resource requirements; Emissions; Excavation requirements; Transportation requirements; Duration of construction, operation etc.; Others.	All potential impacts relate to the effluent of the WWTP entering the cSAC; no impacts will result from land-take, resource usage, excavation, construction or transportation. Disposal of effluent to estuarine systems can lead to altered nutrient balance (eutrophication), increase in particulate matter, potential threat of toxicity, reduction in biological status and loss of habitat / species. Shifts in trophic status of estuarine systems due to nutrient changes may have consequent impacts upon marine/estuarine littoral invertebrate colony structure. This in turn may impact on feeding patterns and demography of bird species which depend upon such food chains. The Tarbert effluent contains notably elevated levels of phosphorus and nitrogen, as well as high concentrations for suspended solids and BOD. This may be contributing to organic and inorganic enrichment of the estuarine mudflats and littoral zone located within the Ballylongford Creek. Impacts are unlikely to be transferred to the main body of water of the Lower Shannon Estuary, as this receiving site has a large assimilative capacity. Nutrient enrichment has the effect of increasing phytoplankton growth which in turn increases the biological oxygen demand, resulting in decreasing oxygen levels in the site. This would impact negatively on all aquatic life in the estuary. Any increases in toxic substances resulting from contamination events during the operation phase could have negative impacts on all of the aquatic species for which the Lower River Shannon cSAC has been designated, in particular Atlantic salmon and Sea lamprey. Annex I Bird species for which the SPA is designated could also be significantly impacted. Other plans and projects in the vicinity which may act in combination with the discharge include: • West Shannon Ballylongford Shellfish Area Pollution Reduction Programme • Implementation of Nitrates Directive: Reduction in eutrophying run-off to Ballyline River – Ecological recovery of the river has been noted in recent years • Shannon River Basin District Plan: Overall improvement in river water quality within catchment • Ballylongford Local Area Plan: Sustainable development of area with awareness of conservation interests of Tarbert and Shannon estuaries

	Overall, these are likely to a beneficial cumulative effect on the Natura 2000 site. The approved Shannon Gas Terminal between Tarbert and Ballylongford will be subject to numerous detailed environmental mitigation measures. It is not expected to interact to any major degree with the Ballylongford discharge.
Describe any likely changes to the site arising as a result of: Reduction of habitat area; Disturbance of key species; Habitat or species fragmentation; Reduction in species density; Changes in key indicators of conservation value; Climate change.	There will be no loss of our reduction in Annex I habitats as a result of the operation of the existing WWTP. However, the functional ecology of the estuarine mudflats in the littoral zone of Ballylongford Creek may be being altered by nutrient enrichment. Enrichment can potentially lead to increased phytoplankton concentrations which form the trophic base of the estuarine/marine food web. This may result in more extreme diurnal variation in dissolved oxygen, which may negatively impact upon the numbers of estuarine macroinvertebrates. Conversely, the overall increase in planktonic concentrations may lead to an increase in macroinvertebrates. Change in either direction will have impacts upon lamprey, salmon and otter in the catchment. Opportunistic macroalgae may also colonise estuarine habitats where eutrophication has occurred. Changes to in the invertebrate communities of the Ballylongford Creek may have consequences for the structure and function of the estuary and mudflat habitats found therein. It is estimated that climate change will result in more extended but less frequent wet and dry periods and warmer water temperatures, as rainfall patterns in Ireland are changing. This could result in precipitation increases of over 10% in the winter months, and decreases of approximately 25% in the summer, and annual temperature increases. However, there is insufficient information to predict the effects on the site as these will be more closely related to localised rainfall events.
Describe any likely impacts on the Natura site as a whole in terms of: Interference with the key relationships that define the structure of the site; Interference with key relationships that define the function of the site.	Potential nutrient enrichment of receiving waters due to the discharge resultant from the operation of the existing WWTP has the capacity to adversely affect water quality. It may also potentially negatively impact on populations of the protected aquatic species for which the site has been designated.
Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale of magnitude of impacts is not known.	As the wastewater within the Ballylongford agglomeration receives no treatment, there is the possibility that a significant degree of localised nutrient enrichment may be taking place within the Ballylongford Creek, which lies within both the cSAC and SPA boundaries. Flows in the Ballyline River are relatively slow and dilution/assimilative capacity at low tide is likely to be very small. As there is the possibility of significant impacts, further assessment is carried out in Stage 2 below.

Stage 2 - Project Assessment	
Describe the elements of the project that are likely to give rise to significant effects on the site	Waste water treatment plants, can contribute significant nutrient and organic loads to rivers. There is potential that the discharges from the WWTP are in combination with other activities within the Castlemaine Harbour catchment leading to increased levels of nutrients within the system.
Set out the conservation objectives of	European and national legislation places a collective obligation on Ireland

the site	and its citizens to maintain at favourable conservation status areas designated as candidate Special Areas of Conservation. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites. According to the EU Habitats Directive, favourable conservation status of a habitat is achieved when its natural range, and area it covers within that range, is stable or increasing, and the ecological factors that are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable as defined below. The favourable conservation status of a species is achieved when population data on the species concerned indicate that it is maintaining itself, and the natural range of the species is neither being reduced or likely to be reduced for the foreseeable future, and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis. The generic conservation objectives of the Lower River Shannon cSAC are: **1.** To maintain the Annex I habitats for which the cSAC has been selected at favourable conservation status: Estuaries; Mudflats and sandflats not covered by seawater at low tide; Coastal lagoons; Vegetated sea cliffs of the Atlantic and Baltic coasts; Salicornia and other annuals colonizing mud and sand; Atlantic salt meadows (Glauco-Puccinellietalia maritimae); Mediterranean salt meadows (Juncetalia maritimi); Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation; Sandbanks which are slightly covered by sea water all the time Large shallow inlets and bays; Reefs; Perennial vegetation of stony banks Spartina swards (Spartinion maritimae); Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae); Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) **2.** To maintain the Annex II species for which the cSAC has been selected at favourable conservation status: *Lampetra fluviatilis; Lampetra planeri; Petromyzon marinus; Salmo salar; Tursiops truncates; Lutra lutra Margaritifera margaritifera* **3.** To maintain the extent, species richness and biodiversity of the entire site. **4.** To establish effective liaison and co-operation with landowners, legal users and relevant authorities. It should be noted that only a sub-sample of these qualifying interests are water-dependent, as identified in the screening process.
Describe how the project will affect key species and key habitats	Nutrient enrichment has the effect of increasing phytoplankton growth which in turn increases the biological oxygen demand, resulting in decreasing oxygen levels in the site. Species which could be directly affected by this are Atlantic Salmon and Sea Lamprey. Otter and Bottlenose dolphin may be indirectly affected by changes in fish stocks. The potentially high levels of nutrients entering the Tarbert estuary at this location has the potential to alter the functional ecology of the estuarine and littoral habitats, on which a wide range of bird species (for which the SPA is designated) can be found feeding, over-wintering and or breeding. Eutrophication may lead to a reduction in invertebrate species density, with a consequential increase in the numbers of high-nutrient specialist species. Where this happens, the diversity of feeding bird species is likely to be reduced, though numbers of birds which target the specialist invertebrates may also increase. A loss of overall species diversity within

	the cSAC/SPA will result in one of the key conservation objectives (3) not being fulfilled. It is likely that given the location of the discharge and the pattern of tidal flows in the bay that the vast majority of any nutrient enrichment would be restricted to the mudflats and estuarine habitats of Ballylongford Creek. Impacts to the trophic status of the main Shannon estuary will be imperceptible owing to vast assimilative capacity of this waterbody.
Describe how the integrity of the site (determined by structure and function and conservation objectives) is likely to be affected by the project or plan (e.g. loss of habitat, disturbance, disruption, chemical changes, hydrological changes etc).	The integrity of the cSAC/SPA water-dependent habitats that form the Ballylongford estuary and mudflats are dependent on consistent trophic status of the contributing rivers and streams, as are the aquatic habitats of the rivers that provide food and migration corridors for the qualifying species. The effluent from Ballylongford receives no treatment and sampling has indicated notably high levels of phosphorus, nitrogen and organic solids. The discharge from these tanks may be leading to localised eutrophication of Ballylongford Creek, which is designated habitat of both the cSAC and SPA. This may be negatively impacting the integrity of the site by altering the trophic status of the area which can lead to changes in macroinvertebrate communities and bird species diversity. Significant BOD loading which also is likely to result around the discharge will exacerbate this problem, as only certain low-oxygen tolerant species will be able to thrive in such an environment. The assessment therefore concludes that the possibility of significant impacts to the Ballylongford Creek, part of the Lower River Shannon cSAC and River Fergus/River Shannon SPA cannot be discounted at this stage.
Describe mitigation measures that are to be introduced to avoid, reduce or remedy the adverse effects on the integrity of the site	A preliminary design for a sewage treatment system for Ballylongford has been proposed, featuring secondary level treatment. It is proposed to provide a treatment plant for the village at a site to the north of the village centre, to cater for a future (2028) design population equivalent of 1,200PE. If the discharge is released to the freshwaters of the Ballyline River, a maximum BOD concentration of 15mg/l would be required. Consequently, it is proposed to use a tidal tank to store treated effluent and only release the effluent to the river during periods of maximum dilution. A discharge standard of 35 mg/l is proposed for suspended solids in line with the Urban Wastewater Treatment Regulations for discharges from urban wastewater treatment plants. The assimilative capacity assessment shows that there is no requirement for specific phosphorus, nitrate, or ammonia removal if a tidal tank is used. Ballylongford is listed on the 2010-2012 WSIP and is to be upgraded in the near future. Once this upgrade is completed, it is expected that any significant impacts to the Ballylongford Creek portion of the cSAC/SPA will cease.

Appendix 9 – Moyvane Screening & Assessment

Project	
Location	Discharge associated with agglomeration of Moyvane (Newtown Sandes), County Kerry.
Distance from designated site	1.5km: Outfall discharges to Moyvane River, 1.5km upstream of cSAC boundary, at confluence with Galey River.
Brief description	Moyvane is a village in North Kerry, located on local roads off the N69 Listowel to Tarbert road. The village is approximately 10km northeast of Listowel, 8km from Tarbert and 4km from the Limerick County boundary. Wastewater flows by gravity to a treatment plant located to the west of the village. The plant consists of an Imhoff tank that provides primary treatment and a Klargester bio-cycle unit that provides secondary treatment. Treated effluent is discharged via a 20m long, 150mm diameter outfall to the Moyvane River, which is a tributary of the Galey River. The design capacity of the treatment plant is 450pe and is currently overloaded.
Is the plan directly connected with or necessary to the Natura 2000 site management for nature conservation?	No.
Natura 2000 site	
Name	Lower River Shannon
Designation	Candidate Special Area of Conservation
Basis	EU Habitats Directive
Description	*From the NPWS Site Synopsis*: This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the subcatchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia. The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Bottle-nosed

	Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter. The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary. Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (*Zostera* spp.) and patches of green algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a *Macoma-Scrobicularia-Nereis* community. In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and Club-rushes (*Scirpus maritimus, S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triquetrus*), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*). Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Saltmarsh Rush (*Juncus gerardi*), Long-bracted Sedge (*Carex extensa*), Lesser Seaspurrey (*Spergularia marina*) and Sea Arrowgrass (*Triglochin maritima*). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the compass of Common Saltmarsh-grass (*Puccinellia maritima*) and Hard-grass (*Parapholis strigosa*). Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a National Inventory of Lagoons are Shannon Airport Lagoon and Cloonconeen Pool. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa, Cerastoderma glaucum, Lekanesphaera hookeri, Palaemonetes varians, Sigara stagnalis* and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon (2 ha) is an artificial saline lake with an artificial barrier and sluiced

outlet. However, it supports two Red Data Book species of Stonewort (*Chara canescens* and *Chara cf. connivens*).

The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the cSAC.

The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae.

Other coastal habitats that occur within the site include the following:

• Stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (*Fucus* spp., *Ascophyllum nodosum* and kelps).
• Shingle beaches - the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (*Matricaria maritima*), Sea Campion and Curled Dock (*Rumex crispus*).
• Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head.
• Sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (*Ammophila arenaria*).

Flowing into the estuaries are a number of tidal rivers. Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Floating river vegetation characterised by species of Water-crowfoot (*Ranunculus* spp.), Pondweeds (*Potamogeton* spp.) and the moss *Fontinalius antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to county Limerick.

There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site.

Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its

	tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey. Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River. This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country.
Area	72138ha
Condition	There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through overgrazing and poaching. Much of the land adjacent to the rivers and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale. In the past, Cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds. Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats. Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.
Conservation interests	**SAC Qualifying Interests – Habitats** • Estuaries • Mudflats and sandflats not covered by seawater at low tide • Coastal lagoons • Vegetated sea cliffs of the Atlantic and Baltic coasts • Salicornia and other annuals colonizing mud and sand • Atlantic salt meadows (Glauco-Puccinellietalia maritimae) • Mediterranean salt meadows (Juncetalia maritimi) • Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation

- Sandbanks which are slightly covered by sea water all the time
- Large shallow inlets and bays
- Reefs
- Perennial vegetation of stony banks
- Spartina swards (Spartinion maritimae)
- Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae)
- Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)

SAC Qualifying Interests – Species

- River lamprey
- Brook lamprey
- Sea lamprey
- Atlantic salmon
- Bottlenose dolphin
- European otter
- Freshwater pearl mussel

* Water-dependent habitats and species are underlined

Additional features/species of conservation interest

A number of plant species that are Irish Red Data Book species occur within the site - several are protected under the Flora (Protection) Order, 1999:
• Triangular Club-rush (*Scirpus triquetrus*) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary.
• Opposite-leaved Pondweed (*Groenlandia densa*) - this protected pondweed is found in the Shannon where it passes through Limerick City.
• Meadow Barley (*Hordeum secalinum*) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill.
• Hairy Violet (*Viola hirta*) - this protected violet occurs in the Askeaton/Foynes area.
• Golden Dock (*Rumex maritimus*) - noted as occurring in the River Fergus Estuary.
• Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon.
• Convergent Stonewort (*Chara connivens*) - presence in Shannon Airport Lagoon to be confirmed.

Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose (246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in 1993/94.

Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96), Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504;1995/96), Redshank (3228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This

	is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank. A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987). Two additional fish of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon. Freshwater pearl mussel remains have been recorded in the Galey River; however, it is considered that the Galey population is now extinct. They are also known from the Upper River Feale; a population was encountered during surveys for the N21 upgrade. No detailed survey of pearl mussels in the Lower Feale has taken place to date. A survey of juvenile lamprey presence for the Feale catchment did not record any lamprey in the Galey River sub-catchment. The Feale is a designated salmonid river, and is also listed as a sensitive river by the UWWT regulations. The Feale, Galey and Brick rivers were all open rivers for salmon angling in 2010, indicating a harvestable surplus for the species.

Stage 1 - Screening	
Describe the individual elements of the plan (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 sites.	The Moyvane agglomeration receives primary and secondary treatment at the UWWTP site, before discharging to the Moyvane River. The effluent then disperses in the water column. The Moyvane River has a limited assimilative capacity. A site visit found that the Moyvane River displays very slow flows and that the river downstream of the discharge contained a notable amount of sediment. The most recent EPA water quality sampling data from 2007 indicates that the Galey River displays good ecological conditions immediately downstream of the confluence with the Moyvane River. However, it subsequently undergoes a progressive decrease in water quality as it travels west towards its confluence with the River Feale. This is likely to be attributable to farming practices along the course of the river leading to polluting and enriching run-off. Sampling data provided by Kerry County council indicates that the plant generates an effluent that is slightly above the standards required by the UWWT Regulations. The low levels of dilution in the Moyvane River may result in insufficient assimilative capacity in the waterbody. The outfall effluent contains material and solutes which may have a slight eutrophying effect within the Moyvane and Galey Rivers, but these are likely to exist in significantly lower concentrations than if no treatment were to be applied. No response was received from Inland Fisheries Ireland during the consultation period. The Water Framework Directive assigns 'Poor' status to majority of the Galey River, this being triggered by 'Poor' scores for macroinvertebrates

	and overall ecological status. Moyvane WWTP is listed as a source 'At Risk' for the WMU, owing to insufficient capacity and treatment level of the plant. It is assigned Priority Level 2 for remedial works.
Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of: Size and scale; Land-take; Distance from Natura 2000 site or key features of the site; Resource requirements; Emissions; Excavation requirements; Transportation requirements; Duration of construction, operation etc.; Others.	All potential impacts relate to the effluent of the WWTP entering the cSAC; no impacts will result from land-take, resource usage, excavation, construction or transportation. Disposal of effluent to river systems can lead to altered nutrient balance (eutrophication), increase in particulate matter, potential threat of toxicity, reduction in biological status and loss of habitat / species. Nutrient enrichment has the effect of increasing phytoplankton growth which in turn increases the biological oxygen demand, resulting in decreasing oxygen levels in the site. This would impact negatively on all aquatic life in the Moyvane and Galey Rivers. Any increases in toxic substances resulting from contamination events during the operation phase could have direct negative impacts on all of the aquatic species for which the Lower River Shannon cSAC has been designated, in particular salmon. Any impacts which could negatively affect salmonid populations in the river could have indirect effects on dependent species. Otter may be affected by decreases in fish populations which form a key dietary resource. Other plans and projects in the vicinity which may act in combination with the discharge include: • Shannon River Basin District Plan: Overall improvement in river water quality within catchment • Implementation of Nitrates Directive: Likely to lead to significantly lower fertiliser loading on lower stretches of Galey River • Moyvane Local Area Plan Overall, these are likely to have a beneficial cumulative effect on the Natura 2000 site.
Describe any likely changes to the site arising as a result of: Reduction of habitat area; Disturbance of key species; Habitat or species fragmentation; Reduction in species density; Changes in key indicators of conservation value; Climate change.	There will be no loss of our reduction in Annex I habitats as a result of the operation of the existing WWTP. Accelerated algae and plant growth within river water columns leads to shifts in diurnal oxygen concentrations. This in turn leads to loss of biological indicator macroinvertebrate species. These species form the bases of salmonid feeding patterns, and their loss may lead to alterations in river ecology as other less sensitive invertebrate species begin to dominate. Salmonid spawning grounds may be significantly impacted by the increased growth of plants on the river substrate. Such growth will also impede the movement of juvenile fish. It is estimated that climate change will result in more extended but less frequent wet and dry periods and warmer water temperatures, as rainfall patterns in Ireland are changing. This could result in precipitation increases of over 10% in the winter months, and decreases of approximately 25% in the summer, and annual temperature increases. However, there is insufficient information to predict the effects on the site as these will be more closely related to localised rainfall events.
Describe any likely impacts on the Natura site as a whole in terms of:	Potential nutrient enrichment of receiving waters due to the discharge resultant from the operation of the existing WWTP has the capacity to

Interference with the key relationships that define the structure of the site; Interference with key relationships that define the function of the site.	adversely affect water quality. It may also potentially negatively impact on populations of the protected aquatic species for which the site has been designated. However, more significant negative impacts are likely to result to the Natura site in the event of the decommissioning of the WWTP and the subsequent release of untreated sewage to the Moyvane River.
Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale of magnitude of impacts is not known.	Potential impacts noted above are considered to be generally minor in nature, while impacts are likely to be higher in the absence of the existing treatment process. However, given the fact that the WWTP discharges to river of low assimilative capacity within 2km of the cSAC boundary, the screening exercise concludes that further assessment should be carried out in Stage 2 below. This assessment considers the potential impacts of the discharge with specific reference to the species and/or habitats which may be impacted.

Stage 2 - Project Assessment	
Describe the elements of the project that are likely to give rise to significant effects on the site	Waste water treatment plants can contribute significant nutrient and organic loads to rivers. There is potential that the discharge from the Moyvane WWTP is in combination with other activities within the Galey catchment leading to increased levels of nutrients within the system.
Set out the conservation objectives of the site	European and national legislation places a collective obligation on Ireland and its citizens to maintain at favourable conservation status areas designated as candidate Special Areas of Conservation. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites. According to the EU Habitats Directive, favourable conservation status of a habitat is achieved when its natural range, and area it covers within that range, is stable or increasing, and the ecological factors that are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable as defined below. The favourable conservation status of a species is achieved when population data on the species concerned indicate that it is maintaining itself, and the natural range of the species is neither being reduced or likely to be reduced for the foreseeable future, and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis. The generic conservation objectives of the Lower River Shannon cSAC are: **1.** To maintain the Annex I habitats for which the cSAC has been selected at favourable conservation status: Estuaries; Mudflats and sandflats not covered by seawater at low tide; Coastal lagoons; Vegetated sea cliffs of the Atlantic and Baltic coasts; Salicornia and other annuals colonizing mud and sand; Atlantic salt meadows (Glauco-Puccinellietalia maritimae); Mediterranean salt meadows (Juncetalia maritimi); Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation; Sandbanks which are slightly covered by sea water all the time Large shallow inlets and bays; Reefs; Perennial vegetation of stony banks Spartina swards (Spartinion maritimae); Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae); Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) **2.** To maintain the Annex II species for which the cSAC has been selected at favourable conservation status: *Lampetra fluviatilis; Lampetra planeri;*

	Petromyzon marinus; Salmo salar; Tursiops truncates; Lutra lutra Margaritifera margaritifera **3.** To maintain the extent, species richness and biodiversity of the entire site. **4.** To establish effective liaison and co-operation with landowners, legal users and relevant authorities. It should be noted that only a sub-sample of these qualifying interests are water-dependent, as identified in the screening process.
Describe how the project will affect key species and key habitats	Nutrient enrichment has the effect of increasing phytoplankton growth which in turn increases the biological oxygen demand, resulting in decreasing oxygen levels in the site. Species which could be directly affected by this are Atlantic salmon and the three lamprey species. It is considered that a previously encountered pearl mussel population in the Galey River is now extinct. No lampreys were recorded in a 2005 survey of the Galey River. Otter may be indirectly affected by changes in fish stocks, but are also able to adjust their foraging behaviour to accommodate temporary changes in diet resources. Bottlenose dolphin are unlikely to be affected as they occur in the expansive Shannon estuary which is in excellent ecological condition and not susceptible to pressures from land-based WWTPs. Any increases in toxic substances resulting from contamination events during the operation phase could have negative impacts on all of the aquatic species for which the Lower River Shannon cSAC has been designated, in particular Atlantic salmon. Pollution events are preventable through judicious plant management. The River Galey is currently an open salmon fishery, as Inland Fisheries Ireland considers salmon to be in harvestable surplus in the Feale/Galey/Brick catchment.
Describe how the integrity of the site (determined by structure and function and conservation objectives) is likely to be affected by the project or plan (e.g. loss of habitat, disturbance, disruption, chemical changes, hydrological changes etc).	The key ecological relationships that define the structure and function of the River Galey as part of the Lower River Shannon cSAC are likely to be impacted by potential nutrient enrichment of the main channel and key tributaries. The Galey maintains good ecological status immediately downstream of the Moyvane River and despite poor results for ecological status, the Galey remains open for salmon angling, suggesting that this species is not being adversely impacted. However, despite this, it is likely that the Moyvane discharge, though minor in nature, is acting in conjunction with other diffuse pressures (predominantly agriculture) in the catchment to reduce overall water quality further downstream in the catchment through nutrient enrichment. The assessment therefore concludes that the possibility of significant impacts to the Galey River, part of the Lower River Shannon cSAC cannot be discounted at this stage.
Describe mitigation measures that are to be introduced to avoid, reduce or remedy the adverse effects on the integrity of the site	Given the lack of assimilative capacity, it is proposed that a replacement WWTP be constructed. Furthermore, it is proposed to combine the Moyvane treatment system with that for Knockanure village to south. It is therefore proposed that a common treatment plant be constructed near Anavoher Bridge to cater for the future wastewater requirements of both Moyvane and Knockanure. The proposed wastewater treatment plant is intended to cater

	for a design population equivalent of 1,070PE. Treated effluent will be discharged to the Galey River near Anavoher Bridge, approximately 1.8km south of the existing discharge to the Moyvane River. Based on the available dilution, it is proposed to provide secondary treatment to cater for existing and future wastewater discharges from Moyvane and Knockanure to meet the 25/35 discharge standards as prescribed in Part 2 of the Second Schedule to the Urban Waste Water Treatment Regulations. It is assumed that there is no requirement for incorporating specific nutrient removal into the process, given the available dilution factor, although this can only be stated with certainty following an assessment of the assimilative capacity of the water body based on current water quality data. Moyvane is not currently listed on the WSIP 2010-2012 programme of works.

Appendix 10 – Duagh Screening

Project	
Location	Discharge associated with agglomeration of Duagh, County Kerry.
Distance from designated site	1.5km: Outfall discharges to the Glasha River, 1.5km upstream of the cSAC boundary, where it flows for another 1km to the confluence with the River Feale.
Brief description	Duagh is a small village in north Kerry, located on the R555, approximately 9km southeast of Listowel. The village provides a range of services for the area, including two shops, a shop/service station, hardware store, and three public houses. The current treatment plant includes a bar screen, a 2-sided overflow manual, grit channels, and a 4.4m sided square Imhoff tank. The tank has an estimated settlement volume of 9m^3, suggesting a design capacity of 250pe. The tank provides primary treatment, before discharging treated effluent through a 15m long, 225mm diameter outfall to the Glasha River. Kerry County Council reports that the plant is currently overloaded.
Is the plan directly connected with or necessary to the Natura 2000 site management for nature conservation?	No.
Natura 2000 site	
Name	Lower River Shannon
Designation	Candidate Special Area of Conservation
Basis	EU Habitats Directive
Description	*From the NPWS Site Synopsis*: This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the subcatchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia. The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the

following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter.

The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary.

Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (*Zostera* spp.) and patches of green algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a *Macoma-Scrobicularia-Nereis* community.

In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and Club-rushes (*Scirpus maritimus, S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triquetrus*), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*).

Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Saltmarsh Rush (*Juncus gerardi*), Long-bracted Sedge (*Carex extensa*), Lesser Seaspurrey (*Spergularia marina*) and Sea Arrowgrass (*Triglochin maritima*). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the compass of Common Saltmarsh-grass (*Puccinellia maritima*) and Hard-grass (*Parapholis strigosa*). Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a National Inventory of Lagoons are Shannon Airport Lagoon and Cloonconeen Pool. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa, Cerastoderma glaucum, Lekanesphaera hookeri, Palaemonetes varians, Sigara stagnalis* and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon

	(2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of Stonewort (*Chara canescens* and *Chara cf. connivens*). The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the cSAC. The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae. Other coastal habitats that occur within the site include the following: • Stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (*Fucus* spp., *Ascophyllum nodosum* and kelps). • Shingle beaches – the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (*Matricaria maritima*), Sea Campion and Curled Dock (*Rumex crispus*). • Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head. • Sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (*Ammophila arenaria*). Flowing into the estuaries are a number of tidal rivers. Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Floating river vegetation characterised by species of Water-crowfoot (*Ranunculus* spp.), Pondweeds (*Potamogeton* spp.) and the moss *Fontinalius antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to county Limerick. There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site. Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys

	and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey. Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River. This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country.
Area	72138ha
Condition	There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through overgrazing and poaching. Much of the land adjacent to the rivers and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale. In the past, Cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds. Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats. Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.
Conservation interests	**SAC Qualifying Interests – Habitats** • Estuaries • Mudflats and sandflats not covered by seawater at low tide • Coastal lagoons • Vegetated sea cliffs of the Atlantic and Baltic coasts • Salicornia and other annuals colonizing mud and sand • Atlantic salt meadows (Glauco-Puccinellietalia maritimae) • Mediterranean salt meadows (Juncetalia maritimi)

- Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
- Sandbanks which are slightly covered by sea water all the time
- Large shallow inlets and bays
- Reefs
- Perennial vegetation of stony banks
- Spartina swards (Spartinion maritimae)
- Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae)
- Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)

SAC Qualifying Interests – Species

- River lamprey
- Brook lamprey
- Sea lamprey
- Atlantic salmon
- Bottlenose dolphin
- European otter
- Freshwater pearl mussel

* Water-dependent habitats and species are underlined

Additional features/species of conservation interest

A number of plant species that are Irish Red Data Book species occur within the site - several are protected under the Flora (Protection) Order, 1999:
• Triangular Club-rush (*Scirpus triquetrus*) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary.
• Opposite-leaved Pondweed (*Groenlandia densa*) - this protected pondweed is found in the Shannon where it passes through Limerick City.
• Meadow Barley (*Hordeum secalinum*) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill.
• Hairy Violet (*Viola hirta*) - this protected violet occurs in the Askeaton/Foynes area.
• Golden Dock (*Rumex maritimus*) - noted as occurring in the River Fergus Estuary.
• Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon.
• Convergent Stonewort (*Chara connivens*) - presence in Shannon Airport Lagoon to be confirmed.

Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose (246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in 1993/94.

Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96), Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504;1995/96), Redshank (3228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are

	also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank. A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987). Two additional fish of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon. Freshwater pearl mussels are also known from the Upper River Feale; a population was encountered during surveys for the N21 upgrade. No detailed survey of pearl mussels in the Lower Feale has taken place to date. The Feale is a designated salmonid river, and is also listed as a sensitive river by the UWWT regulations. The Feale, Galey and Brick rivers were all open rivers for salmon angling in 2010, indicating a harvestable surplus for the species.

Stage 1 - Screening	
Describe the individual elements of the plan (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 sites.	The Duagh agglomeration receives primary treatment at the WWTP site, before discharging to the Glasha River. The effluent then disperses in the water column. The Glasha meets the Feale River some 2km downstream. A site visit revealed that the Glasha River is relatively small waterbody, but with moderate to fast flows. No evidence of nutrient enrichment or poor water quality was observed downstream of the discharge. The most recent EPA water quality sampling data from 2007 indicates that the Feale River displays good ecological conditions throughout the vast majority of its course. Good quality is recorded at Shanacool, at the closest EPA sampling point downstream of the Glasha confluence. No sampling data for the discharge was available from Kerry County Council. The outfall effluent contains material and solutes which may have a slight eutrophying effect within the Glasha River, but these are likely to exist in significantly lower concentrations than if no treatment were to be applied. No response was received from Inland Fisheries Ireland during the consultation period. The Water Framework Directive assigns 'Good' status to the Glasha River; this is based entirely on ecological results.
Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of:	All potential impacts relate to the effluent of the WWTP entering the cSAC; no impacts will result from land-take, resource usage, excavation, construction or transportation. Disposal of effluent to river systems can lead to altered nutrient balance

Size and scale; Land-take; Distance from Natura 2000 site or key features of the site; Resource requirements; Emissions; Excavation requirements; Transportation requirements; Duration of construction, operation etc.; Others.	(eutrophication), increase in particulate matter, potential threat of toxicity, reduction in biological status and loss of habitat / species. Nutrient enrichment has the effect of increasing phytoplankton growth which in turn increases the biological oxygen demand, resulting in decreasing oxygen levels in the site. This would impact negatively on all aquatic life in the River Glasha. Despite being slightly overloaded, no evidence of negative impacts to Glasha River is discernable. Any increases in toxic substances resulting from contamination events during the operation phase could have direct negative impacts on all of the aquatic species for which the Lower River Shannon cSAC has been designated, in particular salmon and lamprey. Any impacts which could negatively affect salmonid populations in the river could have indirect effects on lamprey and pearl mussel populations all of which are dependent on salmonids in the parasitic phases of their life cycles. Otter may be affected by decreases in fish populations which form a key dietary resource. Other plans and projects in the vicinity which may act in combination with the discharge include: • Implementation of Nitrates Directive: Reduction in eutrophying run-off to Feale Catchment • Shannon River Basin District Plan: Overall improvement in river water quality within catchment • North Kerry Settlements Plan: Sustainable development of area with awareness of conservation interests of Feale Catchment Overall, these are likely to have a beneficial cumulative effect on the Natura 2000 site.
Describe any likely changes to the site arising as a result of: Reduction of habitat area; Disturbance of key species; Habitat or species fragmentation; Reduction in species density; Changes in key indicators of conservation value; Climate change.	There will be no loss of our reduction in Annex I habitats as a result of the operation of the existing WWTP. Accelerated algae and plant growth within river water columns leads to shifts in diurnal oxygen concentrations. This in turn leads to loss of biological indicator macroinvertebrate species. These species form the bases of salmonid feeding patterns, and their loss may lead to alterations in river ecology as other less sensitive invertebrate species begin to dominate. The plant is only slightly overloaded, and the Glasha River displays no signs of any such enrichment. Salmonid spawning grounds may be significantly impacted by the increased growth of plants on the river substrate. Such growth will also impede the movement of lamprey and juvenile fish. The Glasha River maintains an open channel with a stony substrate. It is estimated that climate change will result in more extended but less frequent wet and dry periods and warmer water temperatures, as rainfall patterns in Ireland are changing. This could result in precipitation increases of over 10% in the winter months, and decreases of approximately 25% in the summer, and annual temperature increases. However, there is insufficient information to predict the effects on the site as these will be more closely related to localised rainfall events.
Describe any likely impacts on the Natura site as a whole in terms of: Interference with the key relationships that define the structure of the site; Interference with key relationships that define the function of the site.	Potential nutrient enrichment of receiving waters due to the discharge resultant from the operation of the existing WWTP has the capacity to adversely affect water quality. It may also potentially negatively impact on populations of the protected aquatic species for which the site has been designated. However, more significant negative impacts are likely to result to the

	Natura site in the event of the decommissioning of the WWTP and the subsequent release of untreated sewage to the River Glasha.
Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale of magnitude of impacts is not known.	The Duagh treatment plant is slightly overloaded. However, the River Glasha is currently in good ecological condition, with no evidence of any negative impacts from the Duagh discharge. The receiving River Feale is also in good ecological condition downstream of the Glasha confluence. The screening exercise therefore concludes that no significant impacts to the Lower River Shannon cSAC are envisaged and therefore no further assessment is required.

Appendix 11 – Knocknagoshel Screening

Project	
Location	Discharge associated with agglomeration of Knocknagoshel village, County Kerry.
Distance from designated site	0km: Outfall discharges to an unnamed tributary of the Owveg River, inside the cSAC boundary.
Brief description	Knocknagoshel is a village in North Kerry, located at the junction of local roads off the N21, approximately 21km southeast of Listowel and 10km southwest of Abbeyfeale. Wastewater flows by gravity to a septic tank located approximately 670metres to the south of the village. The site is comfortably sized and there is adequate room to cater for a new treatment process within the site boundary. The tank provides primary treatment, before discharging treated effluent through a 165m long, 150mm diameter outfall to a local unnamed stream, a tributary of the Owveg River. The design capacity of the treatment plant is 200PE and it is currently overloaded.
Is the plan directly connected with or necessary to the Natura 2000 site management for nature conservation?	No.
Natura 2000 site	
Name	Lower River Shannon
Designation	Candidate Special Area of Conservation
Basis	EU Habitats Directive
Description	*From the NPWS Site Synopsis*: This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the subcatchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia. The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed

	on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter. The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary. Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (*Zostera* spp.) and patches of green algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a *Macoma-Scrobicularia-Nereis* community. In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and Club-rushes (*Scirpus maritimus, S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triquetrus*), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*). Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Saltmarsh Rush (*Juncus gerardi*), Long-bracted Sedge (*Carex extensa*), Lesser Seaspurrey (*Spergularia marina*) and Sea Arrowgrass (*Triglochin maritima*). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the compass of Common Saltmarsh-grass (*Puccinellia maritima*) and Hard-grass (*Parapholis strigosa*). Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a National Inventory of Lagoons are Shannon Airport Lagoon and Cloonconeen Pool. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa, Cerastoderma glaucum, Lekanesphaera hookeri, Palaemonetes varians,*

Sigara stagnalis and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon (2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of Stonewort (*Chara canescens* and *Chara cf. connivens*).

The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the cSAC.

The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae.

Other coastal habitats that occur within the site include the following:

• Stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (*Fucus* spp., *Ascophyllum nodosum* and kelps).
• Shingle beaches - the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (*Matricaria maritima*), Sea Campion and Curled Dock (*Rumex crispus*).
• Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head.
• Sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (*Ammophila arenaria*).

Flowing into the estuaries are a number of tidal rivers. Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Floating river vegetation characterised by species of Water-crowfoot (*Ranunculus* spp.), Pondweeds (*Potamogeton* spp.) and the moss *Fontinalius antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to county Limerick.

There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site.

Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite

	Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey. Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River. This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country.
Area	72138ha
Condition	There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through overgrazing and poaching. Much of the land adjacent to the rivers and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale. In the past Cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds. Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats. Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.
Conservation interests	**SAC Qualifying Interests – Habitats** • Estuaries • Mudflats and sandflats not covered by seawater at low tide • Coastal lagoons • Vegetated sea cliffs of the Atlantic and Baltic coasts • Salicornia and other annuals colonizing mud and sand • Atlantic salt meadows (Glauco-Puccinellietalia maritimae)

- Mediterranean salt meadows (Juncetalia maritimi)
- Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
- Sandbanks which are slightly covered by sea water all the time
- Large shallow inlets and bays
- Reefs
- Perennial vegetation of stony banks
- Spartina swards (Spartinion maritimae)
- Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae)
- Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)

SAC Qualifying Interests – Species

- River lamprey
- Brook lamprey
- Sea lamprey
- Atlantic salmon
- Bottlenose dolphin
- European otter
- Freshwater pearl mussel

* Water-dependent habitats and species are underlined

Additional features/species of conservation interest

A number of plant species that are Irish Red Data Book species occur within the site - several are protected under the Flora (Protection) Order, 1999:
• Triangular Club-rush (*Scirpus triquetrus*) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary.
• Opposite-leaved Pondweed (*Groenlandia densa*) - this protected pondweed is found in the Shannon where it passes through Limerick City.
• Meadow Barley (*Hordeum secalinum*) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill.
• Hairy Violet (*Viola hirta*) - this protected violet occurs in the Askeaton/Foynes area.
• Golden Dock (*Rumex maritimus*) - noted as occurring in the River Fergus Estuary.
• Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon.
• Convergent Stonewort (*Chara connivens*) - presence in Shannon Airport Lagoon to be confirmed.

Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose (246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in 1993/94.

Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96), Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504;1995/96), Redshank (3228; 1995/96), Greenshank (36;

	1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank. A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987). Two additional fish of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon. Freshwater pearl mussels are also known from the Upper River Feale; a population was encountered during surveys for the N21 upgrade. No detailed survey of pearl mussels in the Lower Feale has taken place to date. The Feale is a designated salmonid river, and is also listed as a sensitive river by the UWWT regulations. The Feale, Galey and Brick rivers were all open rivers for salmon angling in 2010, indicating a harvestable surplus for the species.

Stage 1 - Screening	
Describe the individual elements of the plan (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 sites.	The Knockanagoshel agglomeration receives primary treatment at the WWTP site, before discharging to the unnamed stream. The effluent then disperses in the water column. The stream meets the Owveg River some 1.2km downstream. A site visit revealed that the receiving stream is a relatively small waterbody, but with moderate to fast flows. Despite the present overloaded status of the septic tank, no evidence of nutrient enrichment or poor water quality was observed downstream of the discharge. The most recent EPA water quality sampling data from 2007 indicates that the Owveg River displays good ecological conditions throughout the vast majority of its course. Good quality is recorded at Bateman's Bridge, at the closest EPA sampling point downstream of the stream's confluence with the Owveg. Sampling data for the discharge provided by Kerry County Council indicated that the effluent contains non-compliant elevated concentrations for BOD and Suspended Solids. The outfall effluent contains material and solutes which may have a slight eutrophying effect within the receiving stream, but these are likely to exist in significantly lower concentrations than if no treatment were to be applied. No response was received from Inland Fisheries Ireland during the consultation period. The Water Framework Directive assigns 'Good' status to the Owveg River; this is based on 'Good' results for Macroinvertebrates, Fish, Physiochemical status and overall Ecological condition. Electrofishing of the Owveg carried

	out by the SHRFB found that the river contains both salmon and brown trout in good numbers, with the former being predominant. The WFD classification lists the Knocknagoshel plant as 'AT Risk' due to insufficient capacity.
Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of: Size and scale; Land-take; Distance from Natura 2000 site or key features of the site; Resource requirements; Emissions; Excavation requirements; Transportation requirements; Duration of construction, operation etc.; Others.	All potential impacts relate to the effluent of the WWTP entering the cSAC; no impacts will result from land-take, resource usage, excavation, construction or transportation. Disposal of effluent to river systems can lead to altered nutrient balance (eutrophication), increase in particulate matter, potential threat of toxicity, reduction in biological status and loss of habitat / species. Nutrient enrichment has the effect of increasing phytoplankton growth which in turn increases the biological oxygen demand, resulting in decreasing oxygen levels in the site. This would impact negatively on all aquatic life in the unnamed stream and receiving Owveg River. Despite being overloaded, no evidence of negative impacts to the receiving waterbodies is presently discernable. Any increases in toxic substances resulting from contamination events during the operation phase could have direct negative impacts on all of the aquatic species for which the Lower River Shannon cSAC has been designated, in particular salmon. Any impacts which could negatively affect salmonid populations in the river could have indirect effects on dependent species. Otter may be affected by decreases in fish populations which form a key dietary resource. Other plans and projects in the vicinity which may act in combination with the discharge include: • Implementation of Nitrates Directive: Reduction in eutrophying run-off to Feale Catchment • Shannon River Basin District Plan: Overall improvement in river water quality within catchment • North Kerry Settlements Plan: Sustainable development of area with awareness of conservation interests of Feale Catchment Overall, these are likely to have a beneficial cumulative effect on the Natura 2000 site. There is a pig farming Unit in Knocknagoshel. This is IPPC licensed and subject to regular inspections. It is not considered likely to interact with the Knocknagoshel discharge.
Describe any likely changes to the site arising as a result of: Reduction of habitat area; Disturbance of key species; Habitat or species fragmentation; Reduction in species density; Changes in key indicators of conservation value; Climate change.	There will be no loss of our reduction in Annex I habitats as a result of the operation of the existing WWTP. Accelerated algae and plant growth within river water columns leads to shifts in diurnal oxygen concentrations. This in turn leads to loss of biological indicator macroinvertebrate species. These species form the bases of salmonid feeding patterns, and their loss may lead to alterations in river ecology as other less sensitive invertebrate species begin to dominate. Although the plant is overloaded, neither the unnamed stream nor the Owveg River display any signs of any such enrichment. Salmonid spawning grounds may be significantly impacted by the increased growth of plants on the river substrate. Such growth will also impede the movement of juvenile fish. The receiving stream was observed to maintain an open channel with a stony substrate; this is indicative of a river unaffected by eutrophication.

	It is estimated that climate change will result in more extended but less frequent wet and dry periods and warmer water temperatures, as rainfall patterns in Ireland are changing. This could result in precipitation increases of over 10% in the winter months, and decreases of approximately 25% in the summer, and annual temperature increases. However, there is insufficient information to predict the effects on the site as these will be more closely related to localised rainfall events.
Describe any likely impacts on the Natura site as a whole in terms of: Interference with the key relationships that define the structure of the site; Interference with key relationships that define the function of the site.	Potential nutrient enrichment of receiving waters due to the discharge resultant from the operation of the existing WWTP has the capacity to adversely affect water quality. It may also potentially negatively impact on populations of the protected aquatic species for which the site has been designated. No evidence of such enrichment is currently apparent. More significant negative impacts are likely to result to the Natura site in the event of the decommissioning of the WWTP and the subsequent release of untreated sewage to the receiving unnamed stream.
Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale of magnitude of impacts is not known.	The Knocknagoshel treatment plant is currently overloaded. However, the Owveg River is currently in good ecological condition, with no evidence of any negative impacts from the Knocknagoshel discharge observed in the unnamed stream or in the Owveg itself. The receiving River Feale is also in good ecological condition downstream of the Glasha confluence. The only two qualifying interests for the cSAC found in this eastern extent of the Natura 2000 site (salmon and otter) are present in good numbers in the sub-catchment and are not predicted to be being impacted in any way by the present effluent. There are also preliminary plans to upgrade the Knocknagoshel agglomeration to compliant standards; this is to be carried as and when funding becomes available. The screening exercise concludes that no significant impacts to the Lower River Shannon cSAC are envisaged and therefore no further assessment is required.

Appendix 12 – Brosna Screening

Project	
Location	Discharge associated with agglomeration of Brosna village, County Kerry.
Distance from designated site	0km: Outfall discharges to an unnamed tributary of the Clydagh River, inside the cSAC boundary.
Brief description	Brosna is a village in northeast Kerry, approximately 2km from the county boundary with Limerick and 4km from the county boundary with Cork. The village is located at the junction of local roads, off the R576 approximately 21km southeast of Listowel, and 19km from Castleisland. Currently, waste water from Brosna flows by gravity to an Imhoff tank located on the eastern bank of the Clydagh River, to the northwest of the village. The tank provides primary treatment, before discharging treated effluent through a 20m long, 225mm diameter outfall to the Clydagh River, which is a tributary to the River Feale. Kerry County Council report that design capacity of the Imhoff tank is 250PE and that it is currently overloaded.
Is the plan directly connected with or necessary to the Natura 2000 site management for nature conservation?	No.
Natura 2000 site	
Name	Lower River Shannon
Designation	Candidate Special Area of Conservation
Basis	EU Habitats Directive
Description	*From the NPWS Site Synopsis*: This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the subcatchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia. The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the

following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter.

The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary.

Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (*Zostera* spp.) and patches of green algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a *Macoma-Scrobicularia-Nereis* community.

In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and Club-rushes (*Scirpus maritimus, S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triquetrus*), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*).

Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Saltmarsh Rush (*Juncus gerardi*), Long-bracted Sedge (*Carex extensa*), Lesser Seaspurrey (*Spergularia marina*) and Sea Arrowgrass (*Triglochin maritima*). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the compass of Common Saltmarsh-grass (*Puccinellia maritima*) and Hard-grass (*Parapholis strigosa*). Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a National Inventory of Lagoons are Shannon Airport Lagoon and Cloonconeen Pool. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa, Cerastoderma glaucum, Lekanesphaera hookeri, Palaemonetes varians, Sigara stagnalis* and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon

	(2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of Stonewort (*Chara canescens* and *Chara cf. connivens*). The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the cSAC. The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae. Other coastal habitats that occur within the site include the following: • Stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (*Fucus* spp., *Ascophyllum nodosum* and kelps). • Shingle beaches – the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (*Matricaria maritima*), Sea Campion and Curled Dock (*Rumex crispus*). • Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head. • Sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (*Ammophila arenaria*). Flowing into the estuaries are a number of tidal rivers. Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Floating river vegetation characterised by species of Water-crowfoot (*Ranunculus* spp.), Pondweeds (*Potamogeton* spp.) and the moss *Fontinalius antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to county Limerick. There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site. Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys

	and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey. Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River. This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country.
Area	72138ha
Condition	There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through overgrazing and poaching. Much of the land adjacent to the rivers and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale. In the past, Cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds. Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats. Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.
Conservation interests	**SAC Qualifying Interests – Habitats** • Estuaries • Mudflats and sandflats not covered by seawater at low tide • Coastal lagoons • Vegetated sea cliffs of the Atlantic and Baltic coasts • Salicornia and other annuals colonizing mud and sand • Atlantic salt meadows (Glauco-Puccinellietalia maritimae) • Mediterranean salt meadows (Juncetalia maritimi)

- Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
- Sandbanks which are slightly covered by sea water all the time
- Large shallow inlets and bays
- Reefs
- Perennial vegetation of stony banks
- Spartina swards (Spartinion maritimae)
- Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae)
- Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)

SAC Qualifying Interests – Species

- River lamprey
- Brook lamprey
- Sea lamprey
- Atlantic salmon
- Bottlenose dolphin
- European otter
- Freshwater pearl mussel

* Water-dependent habitats and species are underlined

Additional features/species of conservation interest

A number of plant species that are Irish Red Data Book species occur within the site - several are protected under the Flora (Protection) Order, 1999:
• Triangular Club-rush (*Scirpus triquetrus*) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary.
• Opposite-leaved Pondweed (*Groenlandia densa*) - this protected pondweed is found in the Shannon where it passes through Limerick City.
• Meadow Barley (*Hordeum secalinum*) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill.
• Hairy Violet (*Viola hirta*) - this protected violet occurs in the Askeaton/Foynes area.
• Golden Dock (*Rumex maritimus*) - noted as occurring in the River Fergus Estuary.
• Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon.
• Convergent Stonewort (*Chara connivens*) - presence in Shannon Airport Lagoon to be confirmed.

Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose (246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in 1993/94.

Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96), Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504;1995/96), Redshank (3228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are

	also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank. A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987). Two additional fish of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon. Freshwater pearl mussels are also known from the Upper River Feale; a population was encountered during surveys for the N21 upgrade. No detailed survey of pearl mussels in the Lower Feale has taken place to date. The Feale is a designated salmonid river, and is also listed as a sensitive river by the UWWT regulations. The Feale, Galey and Brick rivers were all open rivers for salmon angling in 2010, indicating a harvestable surplus for the species.

Stage 1 - Screening	
Describe the individual elements of the plan (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 sites.	The Brosna agglomeration receives primary treatment at the Imhoff tank, before discharging to the Clydagh River. The effluent then disperses in the water column. The stream meets the Owveg River some 1.2km downstream. A site visit revealed that the receiving stream is a relatively small waterbody, but with moderate to fast flows. Despite the present overloaded status of the septic tank, no evidence of nutrient enrichment or poor water quality was observed downstream of the discharge. The most recent EPA water quality sampling data from 2007 indicates that the Clydagh River displays good ecological conditions at Clydagh Bridge, 1.5km downstream of the discharge point. However, the sampling point immediately downstream of the Brosna plant (which was not sampled in 2007) has historically recorded poor to moderate status (Q=3-4 in 2005). Sampling data for the discharge provided by Kerry County Council indicated that the effluent contains non-compliant elevated concentrations for BOD and Suspended Solids. The outfall effluent contains material and solutes which may have a slight eutrophying effect within the receiving stream, but these are likely to exist in significantly lower concentrations than if no treatment were to be applied. No response was received from Inland Fisheries Ireland during the consultation period. The Water Framework Directive assigns 'Moderate' status to the Clydagh River; this is based on 'Moderate' results for Macroinvertebrates and overall Ecological condition.

Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of: Size and scale; Land-take; Distance from Natura 2000 site or key features of the site; Resource requirements; Emissions; Excavation requirements; Transportation requirements; Duration of construction, operation etc.; Others.	All potential impacts relate to the effluent of the WWTP entering the cSAC; no impacts will result from land-take, resource usage, excavation, construction or transportation. Disposal of effluent to river systems can lead to altered nutrient balance (eutrophication), increase in particulate matter, potential threat of toxicity, reduction in biological status and loss of habitat / species. Nutrient enrichment has the effect of increasing phytoplankton growth which in turn increases the biological oxygen demand, resulting in decreasing oxygen levels in the site. This would impact negatively on all aquatic life in the receiving Clydagh River. 2005 EPA sampling indicate slightly polluted levels in the river immediately downstream of the discharge. Any increases in toxic substances resulting from contamination events during the operation phase could have direct negative impacts on all of the aquatic species for which the Lower River Shannon cSAC has been designated, in particular salmon. Any impacts which could negatively affect salmonid populations in the river could have indirect effects on dependent species. Otter may be affected by decreases in fish populations which form a key dietary resource. Other plans and projects in the vicinity which may act in combination with the discharge include: • Implementation of Nitrates Directive: Reduction in eutrophying run-off to Feale Catchment • Shannon River Basin District Plan: Overall improvement in river water quality within catchment • North Kerry Settlements Plan: Sustainable development of area with awareness of conservation interests of Feale Catchment Overall, these are likely to have a beneficial cumulative effect on the Natura 2000 site.
Describe any likely changes to the site arising as a result of: Reduction of habitat area; Disturbance of key species; Habitat or species fragmentation; Reduction in species density; Changes in key indicators of conservation value; Climate change.	There will be no loss of our reduction in Annex I habitats as a result of the operation of the existing WWTP. Accelerated algae and plant growth within river water columns leads to shifts in diurnal oxygen concentrations. This in turn leads to loss of biological indicator macroinvertebrate species. These species form the bases of salmonid feeding patterns, and their loss may lead to alterations in river ecology as other less sensitive invertebrate species begin to dominate. The overloaded nature of the discharge may be contributing to a localised deoxygenation of the water column immediately downstream of the plant. This is likely to be resulting in reduced diversity of macroinvertebrates in the river at this location. However, the Clydagh is fast flowing river with an open stony substrate and numerous riffles which lead to very rapid biological recovery. The river is considered to be in overall satisfactory condition by the EPA water quality report. Salmonid spawning grounds may be significantly impacted by the increased growth of plants on the river substrate. Such growth will also impede the movement of juvenile fish. The receiving stream was observed to maintain an open channel with a stony substrate; this is indicative of a river generally unaffected by eutrophication. It is estimated that climate change will result in more extended but less frequent wet and dry periods and warmer water temperatures, as rainfall patterns in Ireland are changing. This could result in precipitation increases of over 10% in the winter months, and decreases of approximately 25% in the summer, and annual temperature increases. However, there is insufficient information to predict the effects on the site as these will be

	more closely related to localised rainfall events.
Describe any likely impacts on the Natura site as a whole in terms of: Interference with the key relationships that define the structure of the site; Interference with key relationships that define the function of the site.	Potential nutrient enrichment of receiving waters due to the discharge resultant from the operation of the existing WWTP has the capacity to adversely affect water quality. It may also potentially negatively impact on populations of the protected aquatic species for which the site has been designated. No evidence of such enrichment is currently apparent. The localised reduction in dissolved oxygen around the discharge point is considered to be rapidly negated by the fast flowing nature of the Clydagh over numerous riffles and low falls. More significant negative impacts are likely to result to the Natura site in the event of the decommissioning of the WWTP and the subsequent release of untreated sewage to the Clydagh River.
Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale of magnitude of impacts is not known.	The Brosna treatment plant is currently overloaded. However, the Clydgah River is currently considered to be in satisfactory ecological condition with good conditions prevailing 1.5km downstream of the discharge. Eutrophication does not appear to be a problem, and the nature of the river indicates that it possesses a relatively large assimilative capacity for BOD loading; biological recovery appears to be rapid. The receiving River Feale is also in good ecological condition downstream of the Clydagh confluence. The only two qualifying interests for the cSAC found in this eastern extent of the Natura 2000 site (salmon and otter) are present in good numbers in the sub-catchment and are not predicted to be being impacted in any way by the present effluent. No salmonid spawning gravels were observed along the stretch of the Clydagh downstream of the plant and therefore no impacts to salmon spawning or juvenile fish are expected. There are also preliminary plans to upgrade the Brosna agglomeration to compliant standards; this is to be carried as and when funding becomes available. The screening exercise concludes that no significant impacts to the Lower River Shannon cSAC are envisaged and therefore no further assessment is required.

Appendix 13 - NPWS Site Synopsis

SITE SYNOPSIS

SITE NAME : LOWER RIVER SHANNON

SITE CODE : 002165

This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the sub-catchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia.

The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter.

The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary.

Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (*Zostera* spp.) and patches of green

algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a *Macoma-Scrobicularia-Nereis* community.

In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and Club-rushes (*Scirpus maritimus, S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triquetrus*), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*).

Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Saltmarsh Rush (*Juncus gerardi*), Long-bracted Sedge (*Carex extensa*), Lesser Sea-spurrey (*Spergularia marina*) and Sea Arrowgrass (*Triglochin maritima*). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the compass of Common Saltmarsh-grass (*Puccinellia maritima*) and Hard-grass (*Parapholis strigosa*).

Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a National Inventory of Lagoons are Shannon Airport Lagoon and Cloonconeen Pool. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa, Cerastoderma glaucum, Lekanesphaera hookeri, Palaemonetes varians, Sigara stagnalis* and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon (2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of Stonewort (*Chara canescens* and *Chara cf. connivens*).

Most of the site west of Kilcredaun Point/Kilconly Point is bounded by high rocky sea cliffs. The cliffs in the outer part of the site are sparsely vegetated with lichens, Red Fescue, Sea Beet (*Beta vulgaris*), Sea Campion (*Silene maritima*), Thrift and Plantains (*Plantago* spp.). A rare endemic Sea Lavender (*Limonium recurvum* subsp.

pseudotranswallinum) occurs on cliffs near Loop Head. Cliff-top vegetation usually consists of either grassland or maritime heath. The boulder clay cliffs further up the estuary tend to be more densely vegetated, with swards of Red Fescue and species such as Kidney Vetch (*Anthyllis vulneraria*) and Bird's-foot Trefoil (*Lotus corniculatus*).

The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the pcSAC.

The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae.

Other coastal habitats that occur within the site include the following:

- stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (*Fucus* spp., *Ascophyllum nodosum* and kelps).
- shingle beaches - the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (*Matricaria maritima*), Sea Campion and Curled Dock (*Rumex crispus*).
- Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head.
- sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (*Ammophila arenaria*).

Flowing into the estuaries are a number of tidal rivers.

Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Semi-natural habitats, such as wet grassland, wet woodland and marsh occur by the rivers, however, improved grassland is most common. One grassland type of particular

conservation significance, *Molinia* meadows, occurs in several parts of the site and the examples at Worldsend on the River Shannon are especially noteworthy. Here are found areas of wet meadow dominated by rushes and sedges and supporting a diverse and species-rich vegetation, including such uncommon species as Blue-eyed Grass (*Sisyrinchium bermudiana*) and Pale Sedge (*Carex pallescens*).

Floating river vegetation characterised by species of Water-crowfoot (*Ranunculus* spp.), Pondweeds (*Potamogeton* spp.) and the moss *Fontinalius antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to county Limerick.

Alluvial woodland occurs on the banks of the Shannon and on islands in the vicinity of the University of Limerick. The woodland is up to 50m wide on the banks and somewhat wider on the largest island. The most prominent woodland type is gallery woodland where White Willow (*Salix alba*) dominates the tree layer with occasional Alder (*Alnus glutinosa*). The shrub layer consists of various willow species with sally (*Salix cinerea* ssp. *oleifolia*) and what appear to be hybrids of *S. alba* x *S. viminalis.* The herbaceous layer consists of tall perennial herbs. A fringe of Bulrush (*Typha* sp.) occurs on the riverside of the woodland. On slightly higher ground above the wet woodland and on the raised embankment remnants of mixed oak-ash-alder woodland occur. These are poorly developed and contain numerous exotic species but locally there are signs that it is invading open grassland. Alder is the principal tree species with occasional Oak (*Quercus robur*), Elm (*Ulmus glabra, U. procera*), Hazel (*Corylus avellana*), Hawthorn (*Crataegus monogyna*) and the shrubs Guelder-rose (*Viburnum opulus*) and willows. The ground flora is species-rich.

Woodland is infrequent within the site, however Cahiracon Wood contains a strip of old Oak woodland. Sessile Oak (*Quercus petraea*) forms the canopy, with an understorey of Hazel and Holly (*Ilex aquifolium*). Great Wood-rush (*Luzula sylvatica*) dominates the ground flora. Less common species present include Great Horsetail (*Equisetum telmeteia*) and Pendulous Sedge (*Carex pendula*).

In the low hills to the south of the Slievefelim mountains, the Cahernahallia River cuts a valley through the Upper Silurian rocks. For approximately 2km south of Cappagh Bridge at Knockanavar, the valley sides are wooded. The woodland consists of Birch (*Betula* spp.), Hazel, Oak, Rowan (*Sorbus aucuparia*), some Ash (*Fraxinus excelsior*) and Willow (*Salix* spp.). Most of the valley is not grazed by stock, and as a result the trees are regenerating well. The ground flora feature prominent Greater wood-rush and Bilberry (*Vaccinium myrtillus*) with a typical range of woodland herbs. Where there is more light available, Bracken (*Pteridium aquilinum*) features.

The valley sides of the Bilboa and Gortnageragh Rivers, on higher ground north east of Cappamore, support patches of semi-natural broadleaf woodland dominated by Ash, Hazel, Oak and Birch. There is a good scrub layer with Hawthorn, Willow, Holly and Blackthorn (*Prunus spinosa*) common. The herb layer in these woodlands is often open with a typically rich mixture of woodland herbs and ferns. Moss species diversity is high. The woodlands are ungrazed. The hazel is actively coppiced in places.

There is a small area of actively regenerating cut away raised bog at Ballyrorheen. It is situated approx. 5km north west of Cappamore Co. Limerick. The bog contains some wet areas with good moss (*Sphagnum*) cover. Species of particular interest include the Cranberry (*Vaccinium oxycoccos*) and the White Sedge (*Carex curta*) along with two other regionally rare mosses including *S. fimbriatum*. The site is being invaded by Birch (*Betula pubescens*) scrub woodland. Both commercial forestry and the spread of rhododendron has greatly reduced the overall value of the site.

A number of plant species that are Irish Red Data Book species occur within the site - several are protected under the Flora (Protection) Order, 1999:

- Triangular Club-rush (*Scirpus triquetrus*) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary.
- Opposite-leaved Pondweed (*Groenlandia densa*) - this protected pondweed is found in the Shannon where it passes through Limerick City.
- Meadow Barley (*Hordeum secalinum*) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill.
- Hairy Violet (*Viola hirta*) - this protected violet occurs in the Askeaton/Foynes area.
- Golden Dock (*Rumex maritimus*) - noted as occurring in the River Fergus Estuary.
- Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon.
- Convergent Stonewort (*Chara connivens*) - presence in Shannon Airport Lagoon to be confirmed.

Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose (246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in 1993/94.

Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96), Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504; 1995/96), Redshank (3228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank.

A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987)

There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site.

Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey.

Two additional fish of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon.

Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River.

There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through over-grazing and poaching. Much of the land adjacent to the rivers and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale.

In the past, Cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds.

Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats.

Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the

E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.

This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country. Most of the estuarine part of the site has been designated a Special Protection Area (SPA), under the E.U. Birds Directive, primarily to protect the large numbers of migratory birds present in winter.

17.05.2005