Agglomeration details

Leading Local Authority	Galway County Council
Co-Applicants	
Agglomeration	Kinvara
Population Equivalent	1270
Level of Treatment	None
Treatment plant address	Not applicable
Grid Ref (12 digits, 6E, 6N)	000000 / 000000
EPA Reference No:	

Contact details

Contact Name:	Mr Liam Gavin
Contact Address:	Water Services Department Porch 2 Unit 17, Liosbaun Ind. Est, Tuam Rd. Galway
Contact Number:	091-509000
Contact Fax:	091-509010
Contact Email:	lgavin@galwaycoco.ie

Table D.1(i)(a): EMISSIONS TO SURFACE/GROUND WATERS (Primary Discharge Point)

Discharge Point Code: SW-1

Local Authority Ref No:		
Source of Emission:	Untreated Domestic Effluent	
Location:	Inner Kinvara Bay	
Grid Ref (12 digits, 6E, 6N)	137306 / 210489	
Name of Receiving waters:	Inner Kinvara Bay	
Water Body:	Transitional Body	
River Basin District	Western RBD	
Designation of Receiving Waters:	SAC	
Flow Rate in Receiving Waters:	0	$m^3.sec^{-1}$ Dry Weather Flow
	0	$m^3.sec^{-1}$ 95% Weather Flow
Additional Comments (e.g. commentary on zero flow or other information deemed of value)	For the purposes of submitting the application zero values have inserted for the Dry Weather Flow and 95 percentile flow figures as effluent is discharged to the sea at Kinvara Bay.	

Emission Details:

(i) Volume emitted			
Normal/day	286 m^3	Maximum/day	0 m^3
Maximum rate/hour	0 m^3	Period of emission (avg)	60 min/hr 24 hr/day 365 day/yr
Dry Weather Flow	0.00331 m^3/sec		

Table D.1(i)(b): EMISSIONS TO SURFACE/GROUND WATERS - Characteristics of The Emission (Primary Discharge Point)

Discharge Point Code: SW-1

Substance	As discharged			
	Unit of Measurement	Sampling Method	Max Daily Avg.	kg/day
pH	pH	Grab	= 0	
Temperature	°C	Grab	= 0	
Electrical Conductivity (@ 25°C)	µS/cm	Grab	= 0	
Suspended Solids	mg/l	Grab	= 0	0
Ammonia (as N)	mg/l	Grab	= 0	0
Biochemical Oxygen Demand	mg/l	Grab	= 0	0
Chemical Oxygen Demand	mg/l	Grab	= 0	0
Total Nitrogen (as N)	mg/l	Grab	= 0	0
Nitrite (as N)	mg/l	Grab	= 0	0
Nitrate (as N)	mg/l	Grab	= 0	0
Total Phosphorous (as P)	mg/l	Grab	= 0	0
OrthoPhosphate (as P)	mg/l	Grab	= 0	0
Sulphate (SO_4)	mg/l	Grab	= 0	0
Phenols (Sum)	µg/l	Grab	= 0	0

For Orthophosphate: this monitoring should be undertaken on a sample filtered on 0.45µm filter paper
For Phenols: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

Table D.1(i)(c): DANGEROUS SUBSTANCE EMISSIONS TO SURFACE/GROUND WATERS - Characteristics of The Emission (Primary Discharge Point)

Discharge Point Code: SW-1

Substance	As discharged			
	Unit of Measurement	Sampling Method	Max Daily Avg.	kg/day
Atrazine	µg/l	Grab	= 0	0
Dichloromethane	µg/l	Grab	= 0	0
Simazine	µg/l	Grab	= 0	0
Toluene	µg/l	Grab	= 0	0
Tributyltin	µg/l	Grab	= 0	0
Xylenes	µg/l	Grab	= 0	0
Arsenic	µg/l	Grab	= 0	0
Chromium	µg/l	Grab	= 0	0
Copper	µg/l	Grab	= 0	0
Cyanide	µg/l	Grab	= 0	0
Flouride	µg/l	Grab	= 0	0
Lead	µg/l	Grab	= 0	0
Nickel	µg/l	Grab	= 0	0
Zinc	µg/l	Grab	= 0	0
Boron	µg/l	Grab	= 0	0
Cadmium	µg/l	Grab	= 0	0
Mercury	µg/l	Grab	= 0	0
Selenium	µg/l	Grab	= 0	0
Barium	µg/l	Grab	= 0	0

For Orthophosphate: this monitoring should be undertaken on a sample filtered on 0.45µm filter paper
For Phenols: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

TABLE E.1(i): WASTE WATER FREQUENCY AND QUANTITY OF DISCHARGE – Primary and Secondary Discharge Points

Identification Code for Discharge point	Frequency of discharge (days/annum)	Quantity of Waste Water Discharged (m^3/annum)
SW-1	365	104390

TABLE E.1(ii): WASTE WATER FREQUENCY AND QUANTITY OF DISCHARGE – Storm Water Overflows

Identification Code for Discharge point	Frequency of discharge (days/annum)	Quantity of Waste Water Discharged (m^3/annum)	Complies with Definition of Storm Water Overflow

TABLE F.1(i)(a): SURFACE/GROUND WATER MONITORING

Primary Discharge Point

Discharge Point Code:	SW-1
MONITORING POINT CODE:	aSW-1a
Grid Ref (12 digits, 6E, 6N)	133970 / 213821 (Verifed using GPS)

Parameter	Results (mg/l)				Sampling method	Limit of Quantitation	Analysis method / technique
	01/01/00						
pH	= 0				Grab		
Temperature	= 0				Grab		
Electrical Conductivity (@ 25°C)	= 0				Grab		
Suspended Solids	= 0				Grab		
Ammonia (as N)	= 0				Grab		
Biochemical Oxygen Demand	= 0				Grab		
Chemical Oxygen Demand	= 0				Grab		
Dissolved Oxygen	= 0				Grab		
Hardness (as $CaCO_3$)	= 0				Grab		
Total Nitrogen (as N)	= 0				Grab		
Nitrite (as N)	= 0				Grab		
Nitrate (as N)	= 0				Grab		
Total Phosphorous (as P)	= 0				Grab		
OrthoPhosphate (as P)	= 0				Grab		
Sulphate (SO_4)	= 0				Grab		
Phenols (Sum)	= 0				Grab		

For Orthophosphate: this monitoring should be undertaken on a sample filtered on 0.45µm filter paper
For Phenols: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

Additional Comments:	Galway Co. Co. does not carry out any sampling or monitoring of the discharges. For the purposes of submitting the application zero values were inserted into the table for ambient monitoring parameters. Galway Co. Co. does not carry out any sampling or monitoring of the discharges. For the purposes of submitting the application zero values were inserted into the table for ambient monitoring parameters.

TABLE F.1(i)(b): SURFACE/GROUND WATER MONITORING (Dangerous Substances)

Primary Discharge Point

Discharge Point Code:	SW-1
MONITORING POINT CODE:	aSW-1a
Grid Ref (12 digits, 6E, 6N)	133970 / 213821 (Verifed using GPS)

Parameter	Results (µg/l)				Sampling method	Limit of Quantitation	Analysis method / technique
	01/01/00						
Atrazine	= 0				Grab		
Dichloromethane	= 0				Grab		
Simazine	= 0				Grab		
Toluene	= 0				Grab		
Tributyltin	= 0				Grab		
Xylenes	= 0				Grab		
Arsenic	= 0				Grab		
Chromium	= 0				Grab		
Copper	= 0				Grab		
Cyanide	= 0				Grab		
Flouride	= 0				Grab		
Lead	= 0				Grab		
Nickel	= 0				Grab		
Zinc	= 0				Grab		
Boron	= 0				Grab		
Cadmium	= 0				Grab		
Mercury	= 0				Grab		
Selenium	= 0				Grab		
Barium	= 0				Grab		

Additional Comments:	Galway Co. Co. does not carry out any sampling or monitoring of the discharges. For the purposes of submitting the application zero values were inserted into the table for ambient monitoring parameters. Galway Co. Co. does not carry out any sampling or monitoring of the discharges. For the purposes of submitting the application zero values were inserted into the table for ambient monitoring parameters.

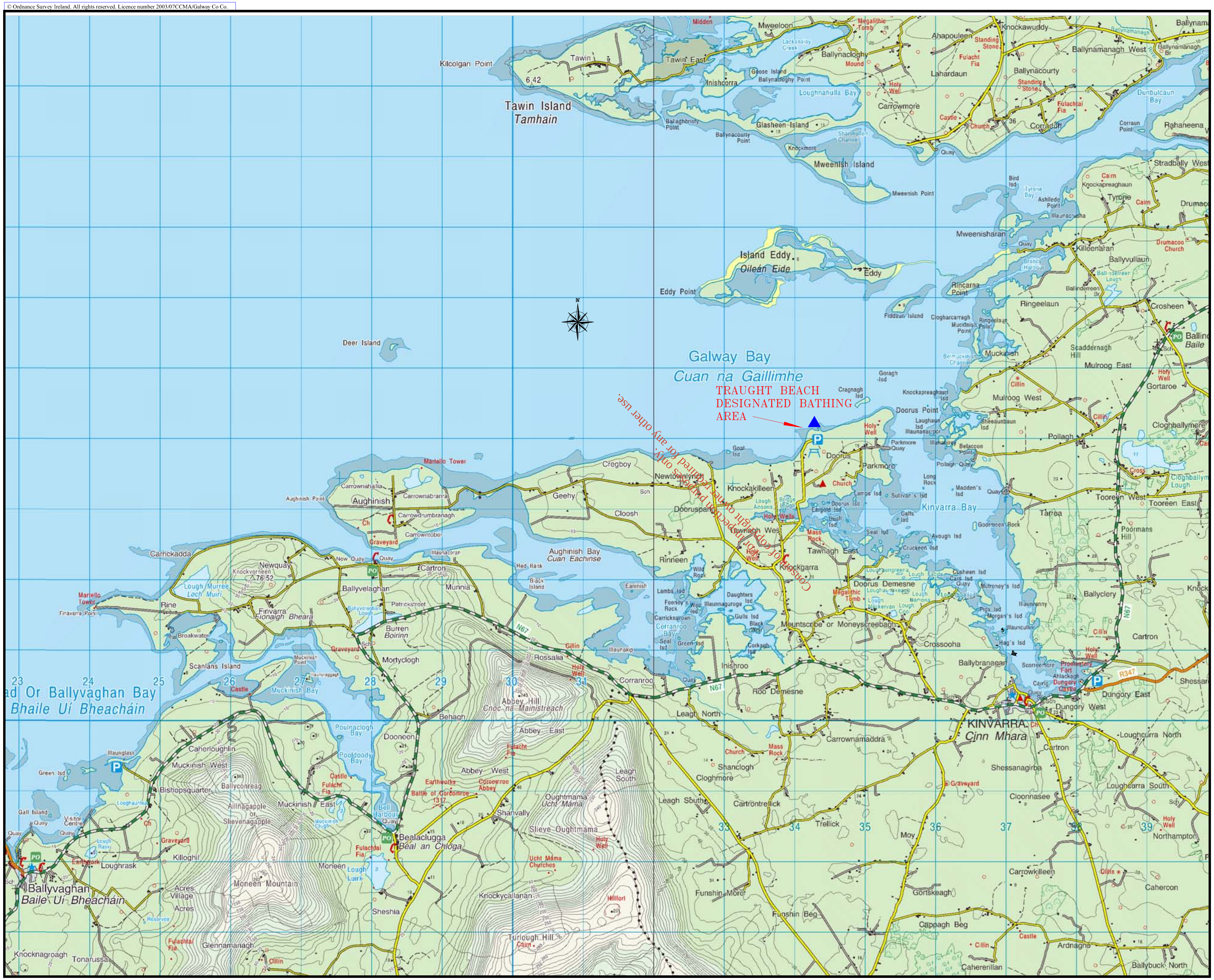
Annex 2: Check List For Regulation 16 Compliance

Regulation 16 of the waste water discharge (Authorisation) Regulations 2007 (S.I. No. 684 of 2007) sets out the information which must, in all cases, accompany a discharge licence application. In order to ensure that the application fully complies with the legal requirements of regulation 16 of the 2007 Regulations, all applicants should complete the following.

In each case, refer to the attachment number(s), of your application which contains(s) the information requested in the appropiate sub-article.

Regulation 16(1) **In the case of an application for a waste water discharge licence, the application shall -**		**Attachment Number**	**Checked by Applicant**
(a)	give the name, address, telefax number (if any) and telephone number of the applicant (and, if different, of the operator of any treatment plant concerned) and the address to which correspondence relating to the application should be sent and, if the operator is a body corporate, the address of its registered office or principal office,		Yes
(b)	give the name of the water services authority in whose functional area the relevant waste water discharge takes place or is to take place, if different from that of the applicant,		Yes
(c)	give the location or postal address (including where appropriate, the name of the townland or townlands) and the National Grid reference of the location of the waste water treatment plant and/or the waste water discharge point or points to which the application relates,		Yes
(d)	state the population equivalent of the agglomeration to which the application relates,		Yes
(e)	specify the content and extent of the waste water discharge, the level of treatment provided, if any, and the flow and type of discharge,		Yes
(f)	give details of the receiving water body, including its protected area status, if any, and details of any sensitive areas or protected areas or both in the vicinity of the discharge point or points likely to be affected by the discharge concerned, and for discharges to ground provide details of groundwater protection schemes in place for the receiving water body and all associated hydrogeological and geological assessments related to the receiving water environment in the vicinity of the discharge.		Yes
(g)	identify monitoring and sampling points and indicate proposed arrangements for the monitoring of discharges and, if Regulation 17 does not apply, provide details of the likely environmental consequences of any such discharges,		Yes
(h)	in the case of an existing waste water treatment plant, specify the sampling data pertaining to the discharge based on the samples taken in the 12 months preceding the making of the application,		Yes
(i)	describe the existing or proposed measures, including emergency procedures, to prevent unintended waste water discharges and to minimise the impact on the environment of any such discharges,		Yes
(j)	give particulars of the nearest downstream drinking water abstraction point or points to the discharge point or points,		Yes
(k)	give details, and an assessment of the effects, of any existing or proposed emissions on the environment, including any environmental medium other than those into which the emissions are, or are to be made, and of proposed measures to prevent or eliminate or, where that is not practicable, to limit any pollution caused in such discharges,		Yes
(l)	give detail of compliance with relevant monitoring requirements and treatment standards contained in any applicable Council Directives of Regulations,		Yes
(m)	give details of any work necessary to meet relevant effluent discharge standards and a timeframe and schedule for such work.		Yes
(n)	Any other information as may be stipulated by the Agency.		Yes
Regulation 16(3) **Without prejudice to Regulation 16 (1) and (2), an application for a licence shall be accompanied by -**		**Attachment Number**	**Checked by Applicant**
(a)	a copy of the notice of intention to make an application given pursuant to Regulation 9,		Yes
(b)	where appropriate, a copy of the notice given to a relevant water services authority under Regulation 13,		Yes
(c)	Such other particulars, drawings, maps, reports and supporting documentation as are necessary to identify and describe, as appropriate -		Yes
(c) (i)	the point or points, including storm water overflows, from which a discharge or discharges take place or are to take place, and		Yes
(c) (ii)	the point or points at which monitoring and sampling are undertaken or are to be undertaken,		Yes
(d)	such fee as is appropriate having regard to the provisions of Regulations 38 and 39.		Yes

Regulation 16(4) An original application shall be accompanied by 2 copies of it and of all accompanying documents and particulars as required under Regulation 16(3) in hardcopy or in an electronic or other format as specified by the Agency.		Attachment Number	Checked by Applicant
1	An Original Application shall be accompanied by 2 copies of it and of all accompanying documents and particulars as required under regulation 16(3) in hardcopy or in electronic or other format as specified by the agancy.		Yes
Regulation 16(5) **For the purpose of paragraph (4), all or part of the 2 copies of the said application and associated documents and particulars may, with the agreement of the Agency, be submitted in an electronic or other format specified by the Agency.**		**Attachment Number**	**Checked by Applicant**
1	Signed original.		Yes
2	2 hardcopies of application provided or 2 CD versions of application (PDF files) provided.		Yes
3	1 CD of geo-referenced digital files provided.		Yes
Regulation 17 **Where a treatment plant associated with the relevant waste water works is or has been subject to the European Communities (Environmental Impact Assessment) Regulations 1989 to 2001, in addition to compliance with the requirements of Regulation 16, an application in respect of the relevant discharge shall be accompanied by a copy of an environmental impact statement and approval in accordance with the Act of 2000 in respect of the said development and may be submitted in an electronic or other format specified by the Agency**		**Attachment Number**	**Checked by Applicant**
1	EIA provided if applicable		No
2	2 hardcopies of EIS provided if applicable.		No
3	2 CD versions of EIS, as PDF files, provided.		No



Location Plan

Scale: 1/50000

NOTES

LEGEND

Monitoring Point
Bathing Water Quality

Compliant with Guide Values	▲ (blue)
Compliant with Mandatory Values	▲ (green)
Non Compliant	▲ (red)

REV	DATE	DRN	DESCRIPTION	CHK	APD

REVISIONS

DRAWING STATUS

- ☐ PRELIMINARY ☐ CONTRACT ☐ TENDER
- ☐ PLANNING ☐ CONSTRUCTION ☐ FOR APPROVAL
- ☒ FOR YOUR INFORMATION ☐ AS CONSTRUCTED ☐ DRAFT

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CLIENT

Galway County Council

PROJECT

KINVARA WASTEWATER DISCHARGE LICENCE

TITLE

Location of Bathing Water in Vicinity of Kinvara

SCALE @ A3	DATE	DRAWN	CHECKED	APPROVED
1/2500 1/50000	Dec. 2008	F.G.	C.M.	

JOB No.	DRAWING No.	REV.
2041	10	

SITE SYNOPSIS

SITE NAME: INNER GALWAY BAY SPA

SITE CODE: 004031

Galway Bay SPA is a very large, marine-dominated, site situated on the west coast of Ireland. The inner bay is protected from exposure to Atlantic swells by the Aran Islands and Black Head. Subsidiary bays and inlets (e.g. Poulnaclough, Aughinish and Kinvarra Bays) add texture to the patterns of water movement and sediment deposition, which lends variety to the marine habitats and communities. The terraced Carboniferous (Viséan) limestone platform of the Burren sweeps down to the shore and into the sublittoral. The long shoreline is noted for its diversity, with complex mixtures of bedrock shore, shingle beach, sandy beach and fringing salt marshes. Intertidal sand and mud flats occur around much of the shoreline, with the largest areas being found on the sheltered eastern coast between Oranmore Bay and Kinvarra Bay. A number of small islands composed of glacial deposits are included, such as Deer Island, along with some rocky islets.

The southern part of Galway Bay holds a very high number of littoral communities. They range from rocky terraces to sandy beaches with rock or sand dunes behind. The intertidal sediments of Galway Bay support good examples of communities that are moderately exposed to wave action. A well-defined talitrid zone in the upper shore gives way to an intertidal, mid-shore zone with sparse epifauna or infauna. On the lower, flat part of the shore, the tubes of the deposit-feeding terebellid worm, *Lanice conchilega*, are common on the surface. Nereid and cirratulid polychaete worms (*Hediste diversicolor*, *Arenicola marina*), small crustaceans and bivalves (*Angulus tenuis*, *Cerastoderma edule* and *Macoma balthica*) are present. Sublittorally, the area has a number of distinctive and important communities. Of particular note is that Ireland's only reported piddock bed thrives in the shallows of Aughinish Bay. The rare sponge, *Mycale contarenii*, is also found here. Of additional interest is the presence of an extensive maerl bed of *Phymatolithon calcareum* which occurs in the strong tidal currents of Muckinish Bay. There is also maerl off Finavarra Point and in Kinvarra Bay (*Lithothamnion corallioides*, *Lithophyllum dentatum* and *Lithophyllum fasciculatum*). An oyster bed in Kinvarra Bay and seagrass (*Zostera* spp.) beds off Finavarra Point are also important features.

Salt marshes are frequent within this extensive coastal site, with the best examples located east of a line running between Galway City and Kinvarra. In this area the coastline is highly indented, thus providing the sheltered conditions necessary for extensive salt marsh development. Common salt marsh species present include Thrift (*Armeria maritima*), Red Fescue (*Festuca rubra*), Common Scurvygrass (*Cochlearia officinalis*), Lax-flowered Sea-lavender (*Limonium humile*), Common Saltmarsh-grass (*Puccinellia maritima*), Saltmarsh Rush (*Juncus gerardi*) and Sea Rush (*Juncus maritimus*). On the lower levels of the salt marshes and within pans is found Glasswort (*Salicornia europaea* agg.). Shingle and stony beaches occur throughout the site, with the best examples found along the more exposed shores to the south and

west of Galway City and to the north and east of Finnavara. In general, these shingle shorelines are sparsely vegetated, with such species as Curled Dock (*Rumex crispus*), Common Couch (*Elymus repens*), Sea Sandwort (*Honkenya peploides*) and Sea Beet (*Beta vulgaris*).

Galway Bay is one of the most important ornithological sites in the western region. It supports an excellent diversity of wintering wetland birds, with divers, grebes, cormorants, dabbling duck, sea duck and waders all well represented. There are internationally important wintering populations of Great Northern Diver (83) and Brent Goose (676), and nationally important populations of an additional sixteen species, i.e. Black-throated Diver (25), Cormorant (266), Mute Swan (150), Wigeon (1,157), Teal (690), Shoveler (88), Red-breasted Merganser (249), Ringed Plover (335), Golden Plover (2,030), Lapwing (3,969), Dunlin (2,149), Bar-tailed Godwit (447), Curlew (697), Redshank (505), Greenshank (20) and Turnstone (182) – all figures are average peaks for the 5 seasons 1995/96-1999/00. Of note is that the populations of Red-breasted Merganser and Ringed Plover represent 6.7% and 3.3% of the respective national totals. Black-throated Diver is a scarce species in Ireland and the Galway Bay population is the most regular in the country. Other species which occur in notable numbers include Little Grebe (35), Grey Heron (102), Long-tailed Duck (19) and Scaup (40). The bay is an important wintering site for gulls, especially Black-headed Gull (1,815), Common Gull (1,011) and Herring Gull (216). In addition, the following species also use the site: Red-throated Diver (13), Great Crested Grebe (16), Mallard (200), Shelduck (139), Common Scoter (79), Oystercatcher (575), Grey Plover (60), Black-tailed Godwit (45) and Great Black-backed Gull (124). The site provides both feeding and roost sites for most of the species, though some birds also commute to areas outside of the site. The wintering birds of Galway Bay have been monitored annually since 1980/81.

The site has several important populations of breeding birds, most notably colonies of Sandwich Tern (81 pairs in 1995) and Common Tern (99 pairs in 1995). A large Cormorant colony occurs on Deer Island – this had 205 pairs in 1985 and 300 pairs in 1989.

Inner Galway Bay provides good quality habitat for Common Seal, a species that is listed on Annex II of the E.U. Habitats Directive. In 1984, this seal colony was one of the top three sites in the country, with over 140 animals recorded. The seals use a range of haul-out sites distributed through the bay. The site provides optimum habitat for Otter.

While there are no imminent threats to the birds, a concern is that sewage effluent and detritus of the aquaculture industry could be deleterious to benthic communities and could affect food stocks of divers, seaduck and other birds. Bird populations may also be disturbed by aquaculture activities. Owing to the proximity of Galway City, shoreline habitats are under pressure from urban expansion and recreational activities.

This large coastal site is of immense ornithological importance, with two wintering species having populations of international importance and a further sixteen species having populations of national importance. The breeding colonies of Sandwich Tern, Common Tern and Cormorant are also of national importance. Also of note is that

seven of the regularly occurring species are listed on Annex I of the E.U. Birds Directive, i.e. Red-throated Diver, Black-throated Diver, Great Northern Diver, Golden Plover, Bar-tailed Godwit, Sandwich Tern and Common Tern.

22.2.2005

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National Parks & Wildlife Service
7 Ely Place
Dublin 2
IRELAND

Our Reference CM/CC/2041
Your Reference
Date 18th October 2008

Re: Kinvara Wastewater Discharge Licence Application
Consultation with NPWS

Dear Sirs,

We are in the process of preparing a Waste Water Discharge Licence Application to the EPA for the Kinvara Sewerage Scheme on behalf of Galway County Council in accordance with the Waste Water Discharge (Authorisation) Regulations, 2007 (S.I. No. 684 of 2007).

The EPA recommends that the determination of the likely effect on a European site shall be carried out in consultation with your service and to that end we are contacting your service.

There is one primary discharge point (SW1) from the Kinvara agglomeration. Untreated effluent from the Kinvara combined sewer collection network discharges to the existing primary discharge point, SW1 at Kinvara Bay.

From a review of the NPWS web mapping service, the waters of Kinvara Bay and associated foreshore are part of the Galway Bay Complex SAC (site code:: 000268) and Inner Galway Bay SPA (site code:: 004031). We wish to confirm these sites with you and wish to determine whether you have any other interests that may need to be taken into account.

Galway County Council plan to proceed with procurement of upgrade works to the Kinvara Agglomeration. The Stage 1 Works include the following;

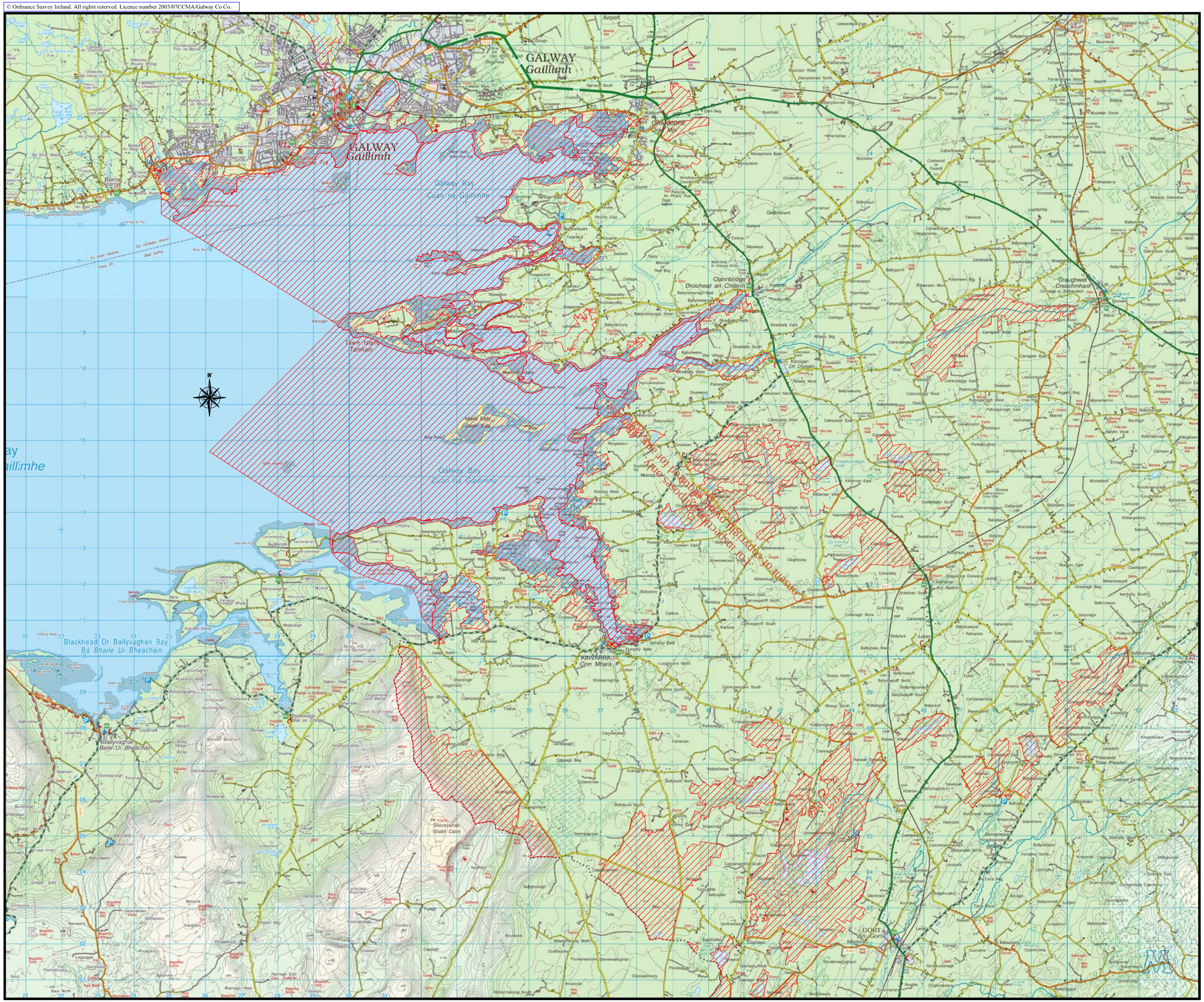
- the combined collection system will be routed and extended to the location of a new Waste Water treatment Plant (WwTP) in the townland of Ballybranagan with disposal of treated effluent via a new outfall to Kinvara Bay;
- existing combined sewers in the town to be retained and rehabilitated; and
- a new surface water system will be installed to the core town area to effect stormwater separation, hydraulically relieve the existing combined sewers and permit efficient pumping/ treatment at the works;

The proposed WwTP will be based on the extended aeration treatment process with preliminary treatment, stormwater holding facilities and ultra violet disinfection. The plant will also have continuous measurement and monitoring of the influent and effluent. The following drawings detail the location of the existing and proposed collection networks and the proposed treatment works for the Kinvara Agglomeration.

Drawing No.	Drawing Title
Fig 4.1	Existing Sewers to Kinvara
Fig 6.4	Proposed Extensions to Combine Collection System
Fig 7.1	Proposed Layout of WWTP

Yours sincerely,

CONOR MALONE
Encls



Location Plan

Scale: 1/100000

Key

Galway Bay SAC & Inner Galway Bay SPA

REV	DATE	DRN	DESCRIPTION	CHK	APD

REVISIONS

DRAWING STATUS

☐ PRELIMINARY	☐ CONTRACT	☐ TENDER
☐ PLANNING	☐ CONSTRUCTION	☐ FOR APPROVAL
☒ FOR YOUR INFORMATION	☐ AS CONSTRUCTED	☐ DRAFT

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CLIENT
Galway County Council

PROJECT
KINVARA WASTEWATER DISCHARGE LICENCE

TITLE
Location of European Sites Near Kinvara

SCALE @ A3	DATE	DRAWN	CHECKED	APPROVED
1/100000	Dec. 2008	F.G.	C.M.	

JOB No.	DRAWING No.	REV.
2041	11	

GALWAY COUNTY COUNCIL

CHOMHAIRLE CONTAE NA GAILLIMHE

KINVARA WWTP DISCHARGE

APPROPRIATE ASSESSEMENT

JANUARY 2009

RYAN HANLEY
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Quality Control

CLIENT	Galway County Council
PROJECT NO	2041
PROJECT TITLE	Kinvara Sewerage Scheme
REPORT TITLE	Appropriate Assessment: Outfall & Discharge

Rev.	Status	Author(s)	Reviewed By	Approved By	Issue Date
1	Issue	GH	CM	MJ	27.02.09

TABLE OF CONTENTS

1 Introduction

1.1 Background

1.1.1 Kinvara WWTP information & history

This document relates to the potential ecological impacts upon Natura 2000 sites caused by the construction, commissioning and operation of a new Waste Water Treatment Plant serving an agglomeration in the vicinty of Kinvara town, County Galway.

The town of Kinvara is located approximately 27km from Galway City on the south shoreline of Galway Bay. The town has an active harbour, numerous public houses, restaurants, a hotel and is a very popular summer destination for day-trippers and holidaymakers.

The population of Kinvara town and particularly its environs have over the past decade seen significant growth. This growth is related to the dramatic expansion of Galway city with settlers opting to commute to Galway from satellite towns like Kinvara.

Kinvara Bay is an important Shell Fishery Bay and is designated as a Shellfish Water by Statutory Instrument No. 2000 of 1994. The commercial/licensed shellfisheries (oysters and shellfish production) are located 2 to 3km into the bay and in recent years have suffered periodic bacterial pollution by sewage during the summer months. The bay is also forms part of the Galway Bay Compex cSAC/SPA which is designated for the presence of several habitats and species listed in the EU Habitats Directive.

Kinvara is currently served by a gravity system which gravitates to the centre of the town and discharges, ***without treatment***, approximately 100 metres off the end of the quay via a 300mm diameter outfall pipe to the existing Primary Discharge point in Kinvara Bay. The drainage catchment of the existing sewerage scheme comprises an area of approximately 15 Ha consisting primarily of a combined collection system, with the exception of estates to the Castleview Park and Convent Roads.

Collected surface water in Kinvara generally discharges to the combined system along Main Street and the Gort Road. Along Glebe Road and Courthouse Road sheet flow occurs with runoff flowing downhill towards and into the bay. Along the Quay and Castleview Park Road runoff occurs either directly to the bay or through short run dedicated surface water pipes to the bay.

Currently effluent from Kinvara receives no treatment prior to discharge. The source of effluent is primarily from domestic contributors with some effluent generated from the commercial and institutional sectors. There are no light or heavy industries in the area and therefore it is not envisaged that heavy metals or other dangerous substances are being discharged to the bay in high concentrations from the collection network. Effluent generated in Kinvara is classified as municipal effluent. Due to the lack of treatment, there is an ongoing risk of adverse effects to human health, the shellfish industry and the conservation status of the Galway Bay cSAC/SPA through organic enrichment and faecal contamination of the waters therein

It is proposed to construct a new WWTP, located to the north-west of Kinvara. The plant will be designed for a commissioning PE of 1750 on an area of 0.65 Ha which will include space for upgrading at a future stage to the full design PE of 2552. The outfall from this plant will project approximately 170 metres into Kinvara bay and consequently the Galway Bay Complex cSAC/SPA. The implementation of the outfall will be carried out under a Design-Build-Operate contract, but preliminary investigations suggest that it will be installed via the excavation of a trench in the rock substrate of the bay.

1.1.2 Appropriate Assessment – Legislative Context & DoEHLG Circular L8/08

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.

In September 2008, the Department of the Environment, Heritage and Local Government released a circular aiming to provide local authorities with basic guidance on the application of Appropriate Assessment to proposed Water Services Investment and Rural Water Programes (DoEHLG Circular L8/08). This contained a checklist for the pre-screening and screening of projects to facilitate the ready identification of projects requiring Appropriate Assessment. Where the potential for significant impacts to a Natura 2000 site cannot be excluded (be it direct, indirect and/or cumulative) an Appropriate Assessment must be carried out. This screening forms Part 1 of an Appropriate Assessment.

Appropriate Assessments entail the preparation of a full assessment and report relating to the potential impacts on a respective Natura 2000 site and its conservation objectives. The report must also include a detailed list of proposed mitigation measures that aim to eliminate or reduce said impacts. This report forms Parts 2 and 3 of an Appropriate Assessment.

Where impacts identified as a result of the Appropriate Assessment cannot be sufficiently mitigated against, a project will be subject to further examination of alternatives and consultation with the EU Commission in relation to potential compensatory measures. This final stage forms Part 4 of an Appropriate Assessment and generally applies to projects with Imperative Reasons of Overriding Public Interest.

1.2 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).

1.3 Scheme locations

The geographic location of the plant and any designated sites in the vicinity are shown in Figure 1.1. The approximate location of the proposed outfall for Kinvara is shown in Figure 1.2.

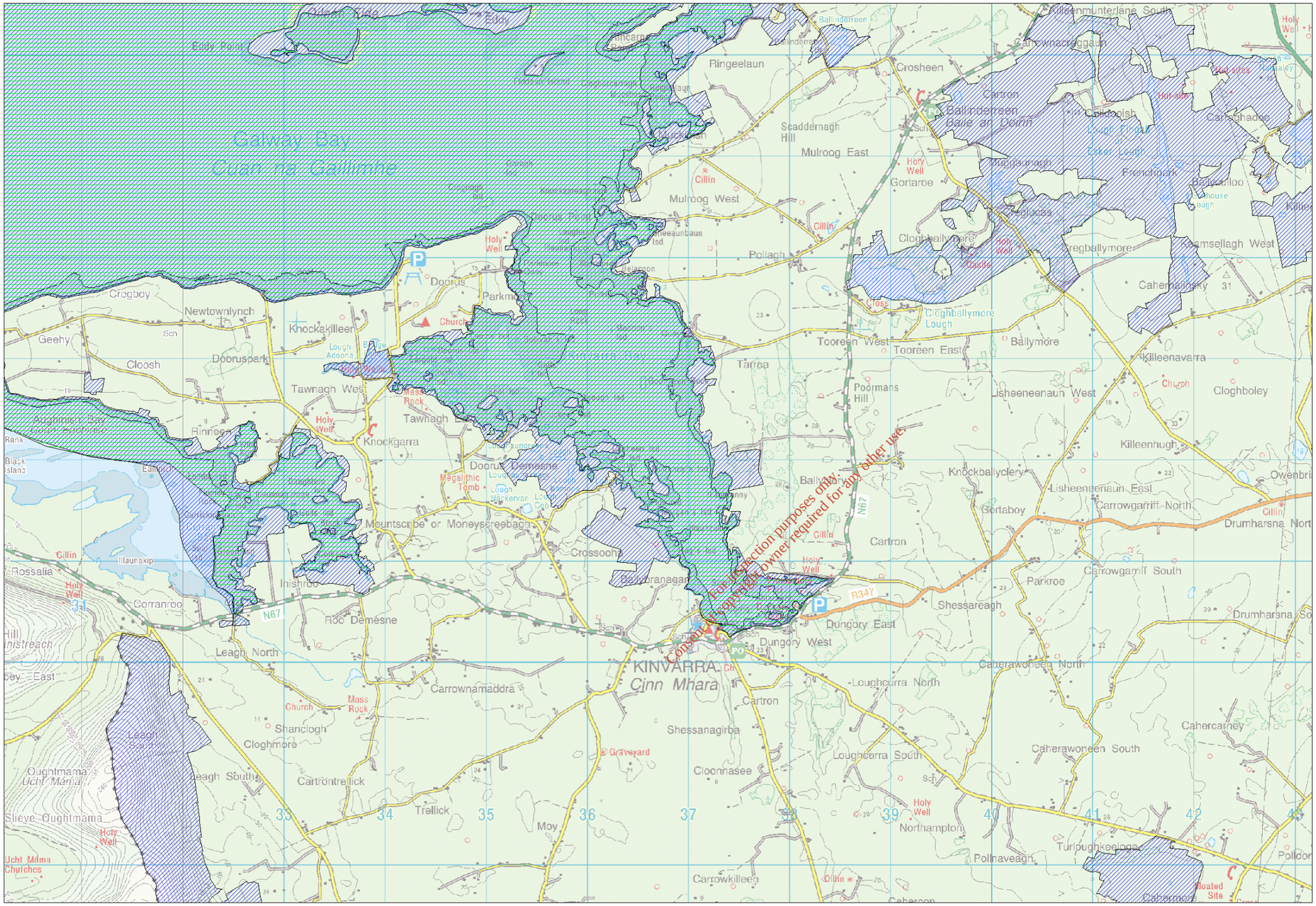

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Figure 1.1 – Geographic location of Kinvara and surrounding designated sites

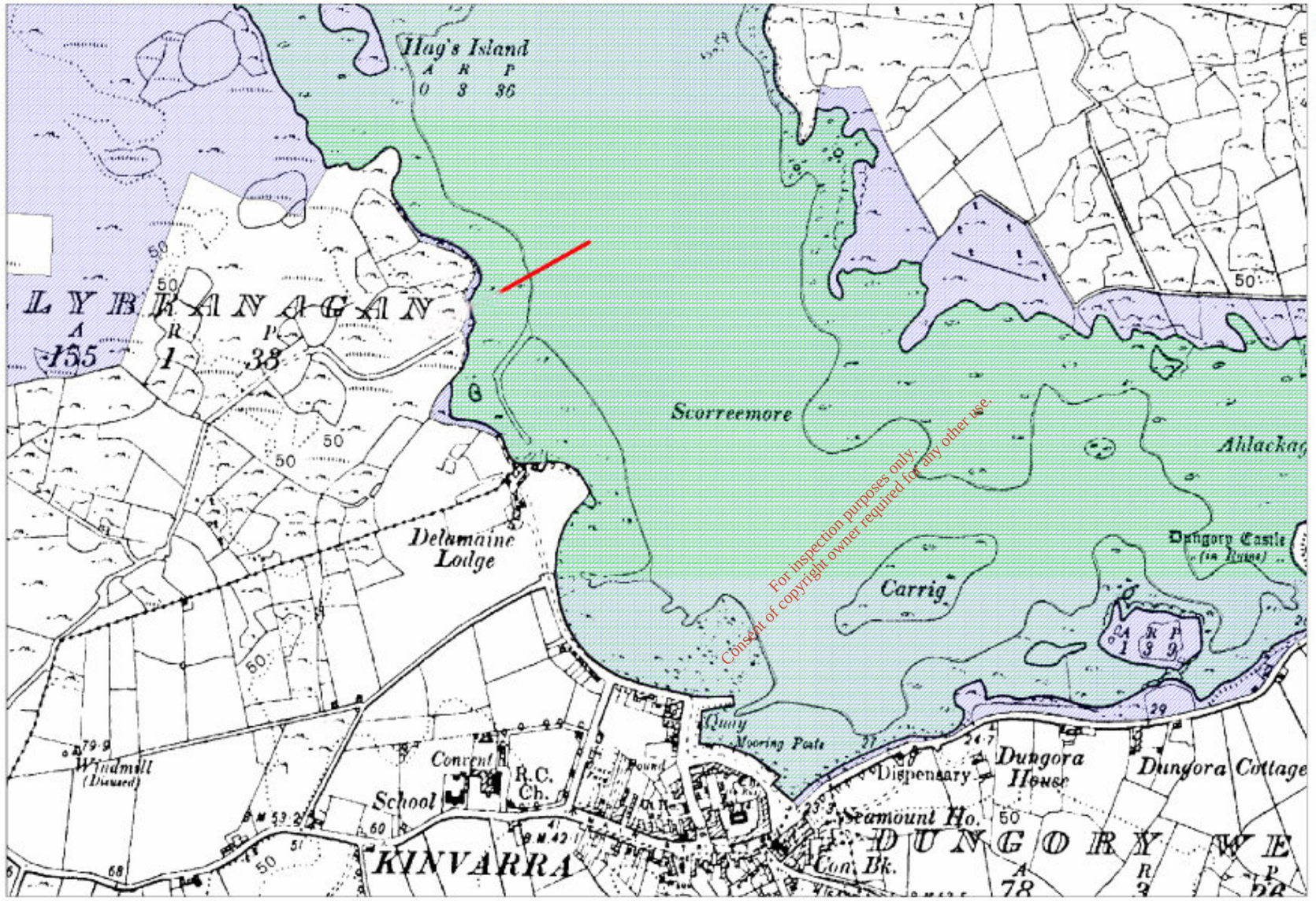

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Figure 1.2 – location of proposed outfall pipe within Kinvara Bay

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2 Screening (L8/08)

The screening and scoping of this project has been prepared in accordance with documents: European Commission (2000) Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC. European Commission (2001) Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC and European Commission (2007) Guidance document on Article 6(4) of the 'Habitats Directive' 92/49/EEC; clarification of the concepts of: Alternative solutions, Imperative reasons of overriding public interest, Compensatory Measures, Overall Coherence, Opinion of the Commission.

2.1 Application of Pre-Screening Questionnaire contained in DoEHLG Circular L8/08

Question	Response	Output
Is the development in or on the boundary of a nature conservation site NHA/SAC/SPA?	Yes	**Screen Project**
Will nationally protected species be directly impacted? Wildlife Acts (1976 and 2000), Flora Protection order (S.I. 94 of 1999)?	Potentially	**Screen Project**
Is the development a surface water discharge or abstraction in the surface water catchment[1], or immediately downstream of a nature conservation site with water dependant qualifying habitats/ species[2]?	Yes	**Screen Project**
Is the development a groundwater discharge or abstraction in the ground water catchment[1] or within 5 km of a nature conservation site with water-dependant qualifying habitats/species[2]?	No	-
Is the development in the surface water or groundwater catchment of salmonid waters?	No	-
Is the treatment plant in an active or former floodplain or flood zone of a river, lake, etc?	No	-
Is the development a surface discharge or abstraction to or from marine waters[3] and within 3km of a marine nature conservation site?	Yes	**Screen Project**
Will the project in combination with other projects (existing and proposed) or changes to such projects affect the hydrology or water levels of sites of nature conservation interest or the habitats of protected species?	No	-

[1] If there is a WFD sub basin plan for the sites or its protected habitats and the plan covers all potential receptors, i.e. habitats and species, this plan can be used as the basis for screening and impact assessment.
[2] Estuaries are considered part of a catchment.
[3] Any marine area including estuaries.

2.2 Application of Screening Protocol Flowchart contained in DoEHLG Circular L8/08

Step	Question	Response	Output
1	Is the development in a nature conservation site?	Yes	**ASSESS IMPACTS**
2a	(If the development involves a surface water abstraction/discharge) Is the development in the surface water catchment of a nature conservation site (or part of such a site)?	-	-
2b	(If the development involves a groundwater abstraction/discharge) Is the development in the groundwater catchment or within 5km of a nature conservation site (or part of such a site)?	-	-
3	Are the qualifying habitats and species of the site water dependent?	-	-
4	Is the development in the surface or groundwater catchment of other water dependent Annex II species, other rare or protected species or salmonid waters?	-	-
5	Is there a WFD sub-basin plan for the site or its protected habitats/species		-
6	Does this plan cover all potential receptors (habitats/species)?	-	-

The Natura 2000 sites concerned are the overlapping Galway Bay Complex cSAC and Inner Galway Bay SPA. The NPWS site synopses for these areas are reproduced in Appendix I.

The Galway Bay Complex cSAC is designated for the presence of several habitat types including lagoons, which are given priority status on Annex I of the Habitats Directive. The site is also selected for the presence of the Annex II species Common seal and Otter; the former is known to use haul-out sites within Kinvara Bay. The Inner Galway Bay SPA is selected for the presence of six species of birds listed on Annex I of the Birds Directive; Great northern diver, Black-throated diver, Golden plover, Bar-tailed godwit, Sandwich tern and Common tern.

The conservation status of the site is currently under threat from human activities. In particular, the site synopses note that "*[a] concern is that sewage effluent and detritus of the aquaculture industry could be deleterious to benthic communities*" and that "*[e]utrophication is probably affecting some of the lagoons and is a continued threat*".

2.3 Desktop study

In preparation for the Appropriate Assessment, a review of the literature relating to the respective cSAC/SPAs, engineering proposals and preliminary reports for the scheme was carried out. Further information was gleaned from several sources including the National Parks and Wildlife and Water Framework Directive websites.

3 Appropriate Assessment (AA Part 2)

The Appropriate Assessment reviews the potential impacts of a proposed development or project in light of the conservation objectives of a Natura 2000 site; such impacts may be direct or indirect, short or long term and may occur during the construction and/or the operational phases of a plan. The cumulative effects of a project combined with others in the vicinity of a Natura 2000 site are also to be taken into consideration.

3.1 Step One: Information required

3.1.1 Details of project

The proposed WwTP for Kinvara will be located to the north-west of Kinvara.. The plant will be designed for a commissioning PE of 1750 and will require an area of 0.65 Ha which will include space for upgrading at a future stage to the full design PE of 2552. The WwTP will incorporate the following structures:

- Main Pumping Station;
- Preliminary works incorporating automated screening and grit removal;
- Main Treatment process including nitrogen removal;
- Stormtanks;
- Sludge thickening and storage facilities;
- Control Building incorporating a panel room, office, canteen laboratory, workshop and toilet facilities;
- Ultraviolet Disinfection;
- Site Access Road; and
- Palisade fencing and associated planting fro screening.
- The plant will also incorporate a SCADA system and an emergency dial out facility.

Currently effluent from Kinvara receives no treatment prior to discharge. The source of effluent is primarily from domestic contributors with some effluent generated from the commercial and institutional sectors. There are no light or heavy industries in the area and therefore it is not envisaged that heavy metals or other dangerous substances are being discharged to the bay in high concentrations from the collection network. Effluent generated in Kinvara is classified as municipal effluent.

Galway County Council does not carry out sampling of discharges from the agglomeration and there is no flow meter monitoring the volume of discharges into the bay. Therefore the exact nature and quantity of existing emissions into the bay is unknown.

It is proposed that sewerage infrastructure and a new Wastewater Treatment Plant (WwTP) will be provided for Kinvara in a number of stages. The Stage 1 works proposed will provide for the discontinuance of existing combined sewage outfall, rehabilitation of the existing combined sewer network and the routing of new trunk collection sewers to a new treatment plant site prior to discharge of treated effluent to Kinvara Bay via a new outfall pipe.

The existing combined system for the town will be separated to the maximum possible extent by the provision of new stormwater collection network installed in parallel to the existing combined collection system. No stormwater overflows from the combined collection system will occur. This will remove the occurrence of untreated sewerage discharges to the bay.

The Stage 1 works proposed are confined to:

- discontinuance of existing combined sewage outfall, rehabilitation of the existing combined sewer network and the routing of new trunk collection sewers to a new treatment plant site prior to discharge of treated effluent to Kinvara Bay via a new outfall pipe; and

- provision of a parallel stormwater collection system discharging to Kinvara Bay via interceptors to effect stormwater separation, hydraulically relieve the existing combined sewers and permit efficient pumping/ treatment at the works

The existing combined system for the town will be separated to the maximum possible extent by the provision of new stormwater collection network installed in parallel to the existing combined collection system. No stormwater overflows from the combined collection system will occur. This will remove the occurrence of untreated sewerage discharges to the bay. The routing of new trunk collection sewer north-west along the shoreline to the treatment plant will obviate the need for a pumping station in the tidally prone and visually sensitive quay area.

Subject to approval by DEHLG, planning approval and the availability of finance, wastewater from Kinvara will discharge by gravity to the proposed WwTP, to be located to the north west of the town where it will be treated before discharging to Kinvara Bay at a point approximately 170 metres offshore (National Grid Ref: E137150, N210915). The proposed WwTP will have an initial design PE of 1,750 and be upgradeable to 2,552 as the need arises for increased capacity to service Kinvara.

The proposed WwTP will incorporate a high lift pumping station, preliminary treatment and a main treatment process with effluent receiving ultraviolet disinfection before discharging to the Kinvara Bay. Storm flows, in excess of 3 DWF, will be stored in onsite storm tanks with flows with flows in excess of the storage volume receiving preliminary treatment before bypassing the WwTP and be discharging to the sea outfall.

The WwTP will be capable of meeting the following discharge standards as set out in the Urban Waste Water Treatment Regulations, 2001 in addition to other treatment facilities:

PROPOSED TREATMENT PLANT EFFLUENT STANDARDS

PARAMETER	MINIMUM STANDARD
BOD_5	25mg/1
COD	125mg/1
Suspended Solid	35mg/1
Total Nitrogen	10mg/l
Faecal Coliforms	250 - 2000 mg/l (to be determined following consultation with the Dept of the Marine)

It is proposed that the WwTP, collection system and outfall would be procured under a single Design - Build Operate contract to enable the maximum efficiency and value for money to be obtained for Galway County Council.

No final design for the marine outfall pipe is yet in place, as the project is based on a Design-Build-Operate contract. However, the Hydro-Environmental (2002) marine outfall study suggests that a 335m long pipe would be laid in a trench cut in the bedrock underlying the bay substrate and filled-in upon completion. Protective concrete casing would also be installed in the littoral/surf zone. *A separate Appropriate Assessment will need to be carried out following the appointment of a contractor and the production a finalised design and installation for the marine outfall.*

3.1.2 Description of Natura 2000 sites potentially affected by project

Sections of the NPWS Site Synopsis for the respective cSACs that relate to the water-dependent qualifying habitats and species found therein are reproduced below:

GALWAY BAY COMPLEX cSAC

Situated on the west coast of Ireland, this site comprises the inner, shallow part of a large bay which is partially sheltered by the Aran Islands. The Burren karstic limestone fringes the southern sides and extends into the sublittoral. West of Galway city the bedrock geology is granite. There are numerous shallow and intertidal inlets on the eastern and southern sides, notably Muckinish, Aughinish and Kinvara Bays. A number of small islands composed of glacial deposits are located along the eastern side. These include Eddy Island, Deer Island and Tawin Island. A diverse range of marine, coastal and terrestrial habitats, including several listed on Annex I of the EU Habitats Directive, occur within the site, making the area of high scientific importance.

Galway Bay South holds a very high number of littoral communities (12). They range from rocky terraces, to sandy beaches with rock or sand dunes behind. The intertidal sediments of Galway Bay support good examples of communities that are moderately exposed to wave action. A well-defined talitrid zone in the upper shore gives way to an intertidal, mid-shore zone with sparse epifauna or infauna. On the lower, flat part of the shore, the tubes of the deposit-feeding terebellid worm, *Lanice conchilega*, are common on the surface. Nereid and cirratulid polychaete worms (*Hediste diversicolor*, *Arenicola marina*), small crustaceans and bivalves (*Angulus tenuis*, *Cerastoderma edule* and *Macoma balthica*) are present. The area has the country's only recorded example of the littoral community characterized by *Fucus serratus* with sponges, ascidians and red seaweeds on tide-swept lower eulittoral mixed substrata. This community has very high species richness (85 species), as do the sublittoral fringe communities on the Finavarra reef (88 species). The rare sea urchin *Paracentrotus lividus* and the foliose red alga *Phyllophora sicula* are present at Finavarra, whereas the red alga *Rhodymenia delicatula* and the rare brown alga, *Ascophyllum nodosum* var. *mackii,* occur in Kinvara and Muckinish Bays. Sublittorally, the area has a number of distinctive and important communities. Of particular note is that Ireland's only reported piddock bed thrives in the shallows of Aughinish Bay. The rare sponge, *Mycale contarenii,* is also found here. There is further interest in an extensive maerl bed of *Phymatolithon calcareum* which occurs in the strong tidal currents of Muckinish Bay. There is also maerl off Finavarra Point and in Kinvara Bay (*Lithothamnion corallioides*, *Lithophyllum dentatum* and *Lithophyllum fasciculatum*). An oyster bed in Kinvara Bay and seagrass (*Zostera* spp.) beds off Finavarra Point are also important features. Other significant habitats which occur include secondary maerl beds and communities strongly influenced by tidal streams.

Salt marshes are frequent within this extensive coastal site, with both Atlantic and Mediterranean marshes well represented. Most of the salt marshes are classified as the bay type, with the substrate being mud or mud/sand. There is one lagoon type and one estuary type. Lagoon salt marshes are the rarest type found in Ireland. The best examples of salt

marsh are located in inner Galway bay, east of a line running between Galway city and Kinvara. In this area the coastline is highly indented, thus providing the sheltered conditions necessary for extensive salt marsh development. Common salt marsh species include Thrift *(Armeria maritima)*, Red Fescue *(Festuca rubra)*, Common Scurvygrass *(Cochlearia officinalis)*, Sea Lavender *(Limonium humile)*, Common Saltmarsh-grass *(Puccinellia maritima)*, Saltmarsh Rush *(Juncus gerardii)* and Sea Rush *(Juncus maritimus)*. On the lower levels of the salt marshes and within pans there occurs Glasswort *(Salicornia europaea* agg.). A noteworthy feature of the salt-marsh habitat within this site is the presence of dwarfed brown seaweeds in the vegetation. These are also known as "turf fucoids" and typical species include *Fucus* spp., *Ascophyllum nodosum* and *Pelvetia canaliculata*. A number of locally rare vascular plant species also grow in salt-marsh areas within the site. These include *Puccinellia distans* and Sea Purslane (*Halimione portulacoides)*, which are both relatively rare in the western half of the country.

Shingle and stony beaches can be found throughout the site, with the best examples along the more exposed shores to the south and west of Galway city and to the north and east of Finnavara, Co. Clare. In general, these shingle shorelines are sparsely vegetated and frequently occur interspersed with areas of sandy beach and/or bedrock shore. The associated flora is dominated by plant species of frequently disturbed maritime habitats. To the south and west of Galway city, typical plants include Curled Dock (*Rumex crispus)*, Common Couch *(Elymus repens)*, Sea Sandwort *(Honkenya peploides)*, Sea Beet *(Beta vulgaris)*, Scentless Mayweed *(Matricaria maritima)*, Silverweed *(Potentilla anserina)* and *Atriplex* spp.. Two rare plant species are associated with the habitat: Fat Hen (*Hyoscyamus niger)*, a threatened species listed in the Irish Red Data Book, grows on shingle beach to the south of Lough Atalia; there are also old records for the threatened plant species Sea Kale (*Crambe maritima)*.

An excellent range of lagoons of different types, sizes and salinities occurs within the site. This habitat is given priority status on Annex I of the Habitat Directive. One unusual type of lagoon, karstic rock lagoon, is particularly well represented. This type of lagoon is common on the Aran Islands, but on mainland Ireland, all but one are confined to this one site including the best example of all karstic lagoons in the country (Lough Murree). The flora of the habitat is rich and diverse, reflecting the range of salinities in the different lagoons, and typically brackish with two species of Tasselweed (*Ruppia spp.*), two Red Data charophytes *Chara canescens* and *Lamprothamnion papulosum*, and *Chaetomorpha linum* (all lagoonal specialists). The fauna of the lagoon is also rich, diverse and lagoonal. At least 10 lagoonal specialist species were recorded in 1996 and 1998 from the combined habitat of all the lagoons which is one of the highest number for any lagoonal habitat in the country. Many of the species appear to be rare. The lagoons within this site are an excellent representative of the habitat type and of high conservation importance.

Inner Galway Bay provides extensive good quality habitat for Common Seals, a species listed on Annex II of the EU Habitats Directive. In 1984, this seal colony was one of the top three

sites in the country, with over 140 animals recorded. The seals use a range of haul-out sites distributed through the bay - these include inner Oranmore Bay, Rabbit Island, St.Brendan's Island, Tawin Island, Kinvara Bay, Aughinish Bay and Ballyvaughan. The site provides optimum habitat for Otter.

Galway Bay is a very important ornithological site. The shallow waters provide excellent habitat for Great Northern Divers (35), Black-throated Divers (28), Scaup (39), Long-tailed Duck (27) and Red-breasted Merganser (232). (Figures given are peak average maxima over the 3 winters 1994/95 to 1996/97). All of these populations are of national importance. The intertidal areas and shoreline provides feeding and roosting habitat for wintering waterfowl, with Brent Goose (517) having a population of international importance and a further 11 species having populations of national importance. Four of the regular wintering species are listed on Annex I of the EU Birds Directive - Golden Plover, Bar-tailed Godwit and the two diver species. Breeding birds are also of importance, with significant populations of Sandwich Terns (81 pairs in 1995) and Common Terns (99 pairs in 1995), both also being listed on Annex I of the EU Directive. A large Cormorant colony (c.300 pairs in 1989) occurs on Deer Island.

Fishing and aquaculture are the main commercial activities within the site. A concern is that sewage effluent and detritus of the aquaculture industry could be deleterious to benthic communities. Reef and sediment communities are vulnerable to disturbance or compaction from tractors accessing oyster trestles. The *Paracentrotus lividus* populations have been shown to be vulnerable to over-fishing. Extraction of maerl in Galway Bay is a threat. Owing to the proximity of Galway city, shoreline and terrestrial habitats are under pressure from urban expansion and recreational activities. Eutrophication is probably affecting some of the lagoons and is a continued threat. Drainage is a general threat to the turlough and fen habitats. Bird populations may be disturbed by aquaculture activities.

This large coastal site is of immense conservation importance, with many habitats listed on Annex I of the EU Habitats Directive, four of which have priority status (lagoon, *Cladium* fen, turlough and orchid-rich calcareous grassland). The examples of shallow bays, reefs, lagoons and salt marshes are amongst the best in the country. The site supports an important Common Seal colony and a breeding Otter population, both species that are listed on Annex II of the EU Habitats Directive, and six regular Annex I EU Birds Directive species. The site also has four Red Data Book plant species, plus a host of rare or scarce marine and lagoonal animal and plant species.

INNER GALWAY BAY SPA

Galway Bay SPA is a very large, marine-dominated, site situated on the west coast of Ireland. The inner bay is protected from exposure to Atlantic swells by the Aran Islands and Black Head. Subsidiary bays and inlets (e.g. Poulnaclough, Aughinish and Kinvara Bays) add texture to the patterns of water movement and sediment deposition, which lends variety to the marine habitats and communities. The terraced Carboniferous (Viséan) limestone platform of

the Burren sweeps down to the shore and into the sublittoral. The long shoreline is noted for its diversity, with complex mixtures of bedrock shore, shingle beach, sandy beach and fringing salt marshes. Intertidal sand and mud flats occur around much of the shoreline, with the largest areas being found on the sheltered eastern coast between Oranmore Bay and Kinvara Bay. A number of small islands composed of glacial deposits are included, such as Deer Island, along with some rocky islets.

The southern part of Galway Bay holds a very high number of littoral communities. They range from rocky terraces to sandy beaches with rock or sand dunes behind. The intertidal sediments of Galway Bay support good examples of communities that are moderately exposed to wave action. A well-defined talitrid zone in the upper shore gives way to an intertidal, mid-shore zone with sparse epifauna or infauna. On the lower, flat part of the shore, the tubes of the deposit-feeding terebellid worm, *Lanice conchilega*, are common on the surface. Nereid and cirratulid polychaete worms (*Hediste diversicolor*, *Arenicola marina*), small crustaceans and bivalves (*Angulus tenuis*, *Cerastoderma edule* and *Macoma balthica*) are present. Sublittorally, the area has a number of distinctive and important communities. Of particular note is that Ireland's only reported piddock bed thrives in the shallows of Aughinish Bay. The rare sponge, *Mycale contarenii*, is also found here. Of additional interest is the presence of an extensive maerl bed of *Phymatolithon calcareum* which occurs in the strong tidal currents of Muckinish Bay. There is also maerl off Finavarra Point and in Kinvara Bay (*Lithothamnion corallioides*, *Lithophyllum dentatum* and *Lithophyllum fasciculatum*). An oyster bed in Kinvara Bay and seagrass (*Zostera* spp.) beds off Finavarra Point are also important features.

Salt marshes are frequent within this extensive coastal site, with the best examples located east of a line running between Galway City and Kinvara. In this area the coastline is highly indented, thus providing the sheltered conditions necessary for extensive salt marsh development. Common salt marsh species present include Thrift (*Armeria maritima*), Red Fescue (*Festuca rubra*), Common Scurvygrass (*Cochlearia officinalis*), Lax-flowered Sea-lavender (*Limonium humile*), Common Saltmarsh-grass (*Puccinellia maritima*), Saltmarsh Rush (*Juncus gerardi*) and Sea Rush (*Juncus maritimus*). On the lower levels of the salt marshes and within pans is found Glasswort (*Salicornia europaea* agg.). Shingle and stony beaches occur throughout the site, with the best examples found along the more exposed shores to the south and west of Galway City and to the north and east of Finnavara. In general, these shingle shorelines are sparsely vegetated, with such species as Curled Dock (*Rumex crispus*), Common Couch (*Elymus repens*), Sea Sandwort (*Honkenya peploides*) and Sea Beet (*Beta vulgaris*).

Galway Bay is one of the most important ornithological sites in the western region. It supports an excellent diversity of wintering wetland birds, with divers, grebes, cormorants, dabbling duck, sea duck and waders all well represented. There are internationally important wintering populations of Great Northern Diver (83) and Brent Goose (676), and nationally important populations of an additional sixteen species, i.e. Black-throated Diver (25), Cormorant (266), Mute Swan (150), Wigeon (1,157), Teal (690), Shoveler (88), Red-breasted

Merganser (249), Ringed Plover (335), Golden Plover (2,030), Lapwing (3,969), Dunlin (2,149), Bar-tailed Godwit (447), Curlew (697), Redshank (505), Greenshank (20) and Turnstone (182) – all figures are average peaks for the 5 seasons 1995/96-1999/00. Of note is that the populations of Red-breasted Merganser and Ringed Plover represent 6.7% and 3.3% of the respective national totals. Black-throated Diver is a scarce species in Ireland and the Galway Bay population is the most regular in the country. Other species which occur in notable numbers include Little Grebe (35), Grey Heron (102), Long-tailed Duck (19) and Scaup (40). The bay is an important wintering site for gulls, especially Black-headed Gull (1,815), Common Gull (1,011) and Herring Gull (216). In addition, the following species also use the site: Red-throated Diver (13), Great Crested Grebe (16), Mallard (200), Shelduck (139), Common Scoter (79), Oystercatcher (575), Grey Plover (60), Black-tailed Godwit (45) and Great Black-backed Gull (124). The site provides both feeding and roost sites for most of the species, though some birds also commute to areas outside of the site. The wintering birds of Galway Bay have been monitored annually since 1980/81.

The site has several important populations of breeding birds, most notably colonies of Sandwich Tern (81 pairs in 1995) and Common Tern (99 pairs in 1995). A large Cormorant colony occurs on Deer Island – this had 205 pairs in 1985 and 300 pairs in 1989.

Inner Galway Bay provides good quality habitat for Common Seal, a species that is listed on Annex II of the E.U. Habitats Directive. In 1984, this seal colony was one of the top three sites in the country, with over 140 animals recorded. The seals use a range of haul-out sites distributed through the bay. The site provides optimum habitat for Otter.

While there are no imminent threats to the birds, a concern is that sewage effluent and detritus of the aquaculture industry could be deleterious to benthic communities and could affect food stocks of divers, seaduck and other birds. Bird populations may also be disturbed by aquaculture activities. Owing to the proximity of Galway City, shoreline habitats are under pressure from urban expansion and recreational activities.

This large coastal site is of immense ornithological importance, with two wintering species having populations of international importance and a further sixteen species having populations of national importance. The breeding colonies of Sandwich Tern, Common Tern and Cormorant are also of national importance. Also of note is that seven of the regularly occurring species are listed on Annex I of the E.U. Birds Directive, i.e. Red-throated Diver, Black-throated Diver, Great Northern Diver, Golden Plover, Bar-tailed Godwit, Sandwich Tern and Common Tern.

Impacts on the cSAC/SPA may result during the preparatory, construction and operational phases of the WWTP. However, given that the design and construction of the marine outfall have yet to be finalised under a Design-Build-Operate contract, this Assessment primarily deals with the impacts caused by the effluent from the proposed marine outfall.

Table 3.1 – Qualifying Water-dependent Species and Habitats for Natura 2000 site

Habitat / Species	Potential impacts from changes to Kinvara Bay
Lagoon (cSAC)	Yes
Otter (cSAC)	Yes
Common Seal (cSAC)	Yes
Great Northern Diver (SPA)	Yes
Black-throated Diver (SPA)	Yes
Golden plover (SPA)	Yes
Bat-tailed Godwit (SPA)	Yes
Common Tern (SPA)	Yes
Sandwich Tern (SPA)	Yes

3.1.3 Description of habitats and wildlife where potential impacts may occur

Kinvara Bay essentially forms a micro-ecosystem within the greater scheme of Galway Bay. Subterranean rivers emerge as several springs in the south-east corner of the bay, driving a net flow in a north-westerly direction to the mouth of the bay where it opens out into Inner Galway Bay. Habitats in Kinvara bay include a diverse range of littoral types and at least two salt marshes. Maerl and oyster beds are also found within the bay, the latter forming a commercial enterprise. The qualifying species listed in Table 3.1 may use Kinvara Bay to varying degrees, but it is likely to provide valuable breeding, resting or feeding habitat to the majority of them at some point during the year. Common seal are known to use several haul-out locations within Kinvara Bay.

Disturbance to some or all of these species is possible during the construction of the marine outfall. A discrete Appropriate Assessment and development of mitigation measures will be carried out following the finalisation of the design of this section of the project. Given that the proposed outfall involves the transposition from an untreated sewage outfall at the inland end of the bay to a treated outfall in deeper water, the most significant effect will be notable in the waters immediately offshore from Kinvara village. Depending on tidal and spring flows, there will be a net flow of treated effluent north-west out of Kinvara Bay into Galway Bay.

No final design for the marine outfall pipe is yet in place, as the project is based on a Design-Build-Operate contract. However, the Hydro-Environmental (2002) marine outfall study suggests that the pipe would be laid in a trench excavated from the bay substrate and filled-in upon completion. Protective concrete casing would also be installed in the littoral/surf zone.

3.1.4 Existing water quality in Kinvara Bay

At present, municipal sewage from Kinvara and its environs is discharged to Kinvara Bay without treatment. As previously stated, the conservation status of the site is currently under threat from human activities. In particular, the site synopses note that "*[a] concern is that sewage effluent and detritus of the aquaculture industry could be deleterious to benthic communities*" and that "*[e]utrophication is probably affecting some of the lagoons and is a continued threat*". Faecal coliform counts in the Bay are generally compliant with the Shellfish Regulations, but have been seen to fluctuate above the guide levels on some occasions. The Designated Bathing Waters at Traught on the north side of the Doorus peninsula are also compliant with EU Regulations.

3.1.5 Existing and proposed infrastructure in area that may impact in conjunction with Kinvara WWTP on Natura 2000 site

No other major infrastructural projects are planned for the area immediately around Kinvara Bay. Another Waste Water Treatment Plant in planned at Clarinbridge, which will discharge to the Lavally/Clarinbridge River, which in turn flows into Inner Galway Bay. These two schemes taken in conjunction with each other will significantly reduce the degree of untreated sewage entering the eastern extent Galway Bay. Other county schemes such as the Athenry Sewerage Scheme and the Ballinasloe Main Drainage Scheme also aim to improve the quality of water entering Galway Bay.

3.2 Step Two: Prediction of Impacts

3.2.1 Introduction

Impact prediction in relation to Natura 2000 sites is difficult to quantify.

As previously stated, impacts on the cSAC/SPA may result during the preparatory, construction and operational phases of the WWTP. However, given that the design and construction of the marine outfall have yet to be finalised under a Design-Build-Operate contract, this Assessment primarily deals with the impacts caused by the effluent from the proposed marine outfall. This long-term discharge to Kinvara Bay has the potential to impact on the Natura 2000 site.

- Poor plant management has the potential to cause a release of untreated sewage and/or eutrophying pollutants to Kinvara Bay, for example in the case of storm tank overflows or prolonged loss of power. This would mirror the situation as it currently stands in the bay.

- The outflow plume from the discharge under normal operating conditions may differ from the receiving waters slightly in regard to temperature and nutrient balance. Tidal flows and rapid dilution around the point discharge at the outfall will rapidly assimilate any differences

- At optimum efficiency, the Waste Water Treatment Plant will improve the water quality of Kinvara Bay through the removal of untreated sewage entering the bay. This has beneficial consequences for the overall long-term conservation aspects of Kinvara Bay and the Galway Bay cSAC.

3.2.2 Predicted indirect impacts on the qualifying habitats and species with recommended mitigation measures

Table 3.5 below covers the potential effects on the qualifying interests for the Galway Bay cSAC/SPA from the proposed marine outfall discharge. As previously stated, a discrete Appropriate Assessment will be implemented for the construction of the Treatment Plant and Marine Outfall which will have a different range of potential impacts.

Table 3.5 - Predicted indirect impacts of marine outfall discharge on the qualifying habitats and species with recommended mitigation measures

Occurrence	Impact	Impacted species/habitats	Mitigation
Release of untreated sewage to Kinvara Bay via new outfall during power failure or due to poor plant management	Major negative	Lagoon (cSAC) Otter (cSAC) Common Seal (cSAC) Great Northern Diver (SPA) Black-throated Diver (SPA) Golden plover (SPA) Bat-tailed Godwit (SPA) Common Tern (SPA) Sandwich Tern (SPA)	Stringent plant design and operational parameters. Detailed contingency plan covering maximal flows and prolonged power loss. Implementation of long-term monitoring programme at site of plant and around outfall.
Difference in nutrient and temperature characteristics of outfall plume to receiving waters	Neutral		Siting of outfall pipe at optimal location in bay to ensure maximum dilution and mixing via tidal flow
Improvement the water quality of Kinvara Bay and consequently Galway Bay	Major positive	Lagoon (cSAC) Otter (cSAC) Common Seal (cSAC) Great Northern Diver (SPA) Black-throated Diver (SPA) Golden plover (SPA) Bat-tailed Godwit (SPA) Common Tern (SPA) Sandwich Tern (SPA)	None.

4 Mitigation measures (AA Part 3)

4.1 Mitigation measure matrix

Table 4.1 details the prescribed mitigation measures for the scheme and what they aim to achieve, together with when they will be applied and how they will be monitored.

Table 4.1 - Mitigation measures for Kinvara marine outfall discharge

Mitigation measure	How will the mitigation measure avoid adverse effects on the Natura 2000 site?	How will the mitigation measure reduce adverse effects on the Natura 2000 site?	How will this measure be implemented and by who?	What is the likely degree of success of the mitigation measure?	When will the mitigation measure be implemented?	How will the mitigation measure be monitored?
Treat sewage effluent to acceptable standard	Eliminate flow of untreated sewage to Kinvara Bay	Ensure maximum water quality output to Kinvara Bay	Operation of Kinvara WWTP under stringent design and operational parameters	Modern plant can accurately maintain the discharge within regulatory standards	Operational phase	Implementation of long-term monitoring programme at site of works and downstream
Prevention of pollutant release during emergency situations such as storm flows and power failures	Eliminate risk of release of untreated sewage to Kinvara Bay	Reduce risk of toxic or eutrophying pollutants entering watercourse	Detailed contingency plan covering maximal flows and prolonged power loss inclusive in plant design and operation	Such situations fully taken into account during design stages	Operational phase	Ecological monitoring of discharge standards
Maximise assimilation of outfall discharge	Prevent localised changes to nutrient loading and temperature around outfall	Reduce localised changes to nutrient loading and temperature around outfall	Siting of outfall pipe at optimal location in bay to ensure maximum dilution and mixing via tidal flow	Proposed outfall location follows detailed hydrographic survey to select optimal location	Operational phase	Ecological monitoring of discharge around outfall

4.2 Assessment of cumulative impacts on respective Natura 2000 sites

As previously stated, no other major infrastructural projects are planned for the area around Kinvara Bay. Another Waste Water Treatment Plant in planned at Clarinbridge, which will discharge to the Lavally/Clarinbridge River, which in turn flows into Inner Galway Bay. These two schemes taken in conjunction with each other will significantly reduce the degree of untreated sewage entering the eastern extent of the Galway Bay cSAC/SPA. Other capital investment schemes on water management such as the Athenry Sewerage Scheme and Ballinasloe Main Drainage Scheme will also contribute to an improvement to river and coastal water quality in the greater Galway Bay area.

5 Conclusions

The current situation involving an indeterminate volume of untreated sewage entering Kinvara Bay on a daily basis is unsustainable and is likely to be causing significant environmental impacts to a Natura 2000 site. The construction of new Waste Water Treatment Plant will facilitate the transposition of the marine outfall to a location which maximises dilution, and will produce a treated effluent with significantly lower associated ecological impacts.

Water quality will be seen to improve rapidly in the bay following the construction and commissioning of the plant and outfall. This has beneficial consequences for the numerous qualifying species and habitats found in the cSAC/SPA. It is predicted that if strict protocols are adhered to regarding the operation of the plant and outfall, no deleterious effects on the Natura 2000 site will occur.

In conclusion, once appropriate mitigation measures are agreed upon, the marine outfall discharge is not predicted to have a significant negative impact on the Natura 2000 site; in contrast, it is predicted to have n advantageous effect on the Kinvara Bay ecosystem. Therefore the discharge should be licensed.

6 Recommendations

Following approval of this report, it is hereby recommended that the aforementioned mitigation measures be proposed within a consultation framework with NPWS. Any agreed upon mitigation measures must be included in any subsequent documents relating to the operation of the outfall.

A subsequent Appropriate Assessment will be required as and when the design and construction methods for the treatment plant and marine outfall are finalised.

Ryan Hanley Consulting Engineers - Ecology Division

February 2009

SECTION 3 – RECEIVING WATER AND DISCHARGE STANDARDS

3.1 INTRODUCTION

The existing outfall from the wastewater treatment plant for Kinvara discharges to the bay approximately 100 metres off the Quay Wall. Currently the effluent receives no treatment prior to discharge and plumes are an occasional occurrence at the outfall location.

In order to identify the level of treatment the effluent should be receiving prior to discharge it is first necessary to assess the recipient waters to determine classifications to the existing environment.

3.2 RECIPIENT WATERS

3.2.1 Quality of Recipient Waters

The inner seashore of Kinvara Bay is very rocky and muddy and as a consequence no beaches occur in close proximity to the existing outfall location. The nearest designated bathing area, under the Quality of Bathing Water Regulations, is located at Traught Beach, approximately 5 kilometres from the site, as shown on Figure 3.1. Results of water quality sampling for the years 2005 to 2008 are reproduced in Appendix C. Traught Beach is a designated Blue Flag Beach and has held this status in 2006, 2007 and 2008.

3.2.2 Designated areas of Ecological Importance

The National Parks and Wildlife Service is the competent authority with the responsibility to designate areas as National Heritage Areas (NHAs), Special Protection Areas (SPAs), or Special Areas of Conservation (SACs). The legal basis by which SACs are selected and designated is the EU Habitats Directive, transposed into Irish law by the European Union (Natural Habitats) Regulations 1997 as amended in 1998 and 2005. The Directive lists certain habitats and species that must be protected within SACs. Irish habitats include raised bogs, blanket bogs, turloughs, sand dunes, machair (flat sandy plains on the north and west coasts), heaths, lakes, rivers, woodlands, estuaries and sea inlets. The 25 Irish species which must be afforded protection include Salmon, Otter, Freshwater Pearl Mussel, Bottlenose Dolphin and Killarney Fern.Such sites are legally protected from damage from the date they are formally proposed for designation under the Wildlife Amendment Act (2000)

The waters to Kinvara Bay and associated foreshore are part of the Galway Bay Complex SAC and Inner Galway Bay SPA. Site synopses produced by the NPWS are included to Appendix D with extracts provided as follows:

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Galway Bay Complex SAC

The closest proposed candidate cSAC is the Galway Bay Complex which comprises numerous shallow and intertidal inlets on the eastern and southern sides of Galway coast including Muckinish, Aughinish and Kinvarra Bays.

This large coastal site is of immense conservation importance, with many habitats listed on Annex I of the EU Habitats Directive, four of which have priority status lagoon, Cladium fen, turlough and orchid-rich calcareous grassland). The examples of shallow bays, reefs, lagoons and salt marshes are amongst the best in the country. The site supports an important Common Seal colony and a breeding Otter population, both species that are listed on Annex II of the EU Habitats Directive, and six regular Annex I EU Birds Directive species. The site also has four Red Data Book plant species, plus a host of rare or scarce marine and lagoonal animal and plant species.

In addition, Galway Bay is a very important ornithological site. Four of the regular wintering species are listed on Annex I of the EU Birds Directive. Breeding birds are also of importance, with significant populations being listed on Annex I of the EU Directive.

Inner Galway Bay SPA

This large coastal site is of immense ornithological importance, with two wintering species having populations of international importance and a further sixteen species having populations of national importance. The breeding colonies of Sandwich Tern, Common Tern and Cormorant are also of national importance.

Also of note is that seven of the regularly occurring species are listed on Annex I of the E.U. Birds Directive, i.e. Red-throated Diver, Black-throated Diver, Great Northern Diver, Golden Plover, Bar-tailed Godwit, Sandwich Tern and Common Tern.

Development in NHAs and SACs are only to be permitted where it can be shown that such developments would not have an adverse impact on these areas.

Figure 3.1 - Location of Bathing Waters in the vicinity of Kinvara

Figure 3.2 - Location of Galway Bay Complex Special Area of Conservation

3.3 Wastewater Discharge Standards

The final wastewater effluent, produced at the Kinvara Wastewater Treatment Plant will be discharged via a sea outfall to the coastal waters in the harbour as indicated on Figure 8.1.

The final effluent discharge standards are determined by reference to Irish legislation, European directives and best management guidelines. The ability of the wastewater treatment plant to comply with a possible future tightening of the regulations, in light of new research into the coastal environment, was also considered.

3.3.1 Relevant Legislation and Guidelines

1. SI No. 254, Urban Waste Water Treatment Regulations 2001, specifies the minimum discharge standards required of municipal wastewater treatment plants. This act gives affect to the Urban Waste Water Treatment Directive 91/271/EEC. The regulations were amended in 2007 by the Urban Wastewater Treatment (Amendment) Regulations which include standards for discharges to sensitive areas.

   The instrument indicates that in respect of all discharges from agglomerations with a population equivalent (PE) of between 2000 and 5000 PE secondary treatment or an equivalent treatment shall be provided. Secondary treatment is defined in the Urban Waste Water Treatment regulations as the "treatment of urban wastewater by a process generally involving biological treatment with secondary settlement or other process in which the requirement of the regulations are respected".

   The Urban Waste Water Treatment Amendment Regulations (2007) set standards for total phosphorous and nitrogen discharge levels to sensitive waters as listed in the third schedule of the regulations. The waters in Kinvara Bay are not included, as sensitive waters, in this schedule.

   The Marine Outfall Water Quality Study (Hydro Environmental Ltd, 2002) noted that eutrophication was occurring to the inner Bay. Although enrichment of the inner bay by nitrogen from Kinvara Town is shown not to be significant, however, nitrogen removal by incorporation of nitrification/denitrification in the treatment process should be included in any new proposed Kinvara WwTP.

2. SI No. 155, the Local Government Water Pollution Act, 1977, (Quality of Bathing Waters) Regulations, 1992, which specifies the water quality required for bathing waters.

   The beach at Traught is classified as a designated bathing area in accordance with the above regulations. Summary sheets indicating the bathing water quality of the beach at Kinvara for 2005 to 2006 are included in Appendix C.

3. The criteria for Blue Flag designation are based on FEEE interpretation of the Bathing Water Directive (76/160/EEC). The Foundation for Environmental Education in Europe (FEEE), is the awarding body for Blue Flags in Europe. In Ireland the FEEE is represented by the National Trust for Ireland "An Taisce". The criteria used for Blue Flag designation includes meeting prescribed standards in the area of water quality (based on water quality results over two years with an ongoing assessment thereafter); the availability of environmental education and information on the beach and the presence of environmental management and safety services. Traught Beach is a designated Blue Flag Beach and has held this status in 2006, 2007 and 2008.

   FEEE is expected to update its criteria in line with an anticipated new Bathing Water Directive and the World Health Organisation's guidelines for safe recreational water environments.

Galway County Council maintains the highest water quality standards at bathing areas designated under the Bathing Waters Regulations (1992) to allow for the retention and future acquisition of Blue Flag status.

4. SI No. 200, the Local Government Water Pollution Act, 1977, (Quality of Shellfish Waters) Regulations, 1994, which specifies the water quality required for Shellfish Waters.

   Shellfish removed from high quality shellfish waters designated under the Quality of Shellfish Waters Regulations (1994) are deemed suitable for human consumption without undergoing any further purification process. The waters in Kinvara Bay and Clarinbridge Bay are classified under Schedule 1 of these regulations as subject to the water quality regulations contained in the instrument. However, elevated levels of coliforms in these waters mean they are currently non-conforming and as such shellfish removed for consumption are subject to production and marketing regulations as set down in Irish and European legislation for bivalve molluscs.

   Licensed shellfishery sites exist in Kinvara Bay and adjoining Bays. Figure 3.3 presents the location of Dept. of the Marine licensed shellfish production sites in the bay. The fishery activities are oyster and mussel both trestle and bottom culture cultivations. Other fishery activities in the region are the production of winkles, lobster and shrimps. Kinvara Harbour also acts as a local harbour for angling and drift net fishing in Galway Bay.

Figure 3.3 - Location of Licensed Shellfish Production Areas in Ireland

5. SI No. 147, European Communities (Live Bivalve Molluscs) (Health Conditions For Production And Placing On The Market) Regulations, 1996. This statutory instrument gives effect to Council Directive (91/492/EEC) laying down the health conditions for the production and the placing on the market of live bivalve molluscs.

   The coastal waters in Kinvara Bay are designated as a Class B shellfish region under these regulations. As such, shellfish removed from the area can only be placed on the market for human consumption after relaying for at least two months, undergoing purification or a combination of both in accordance with Directive 91/492/EEC.

   Relaying, as defined in the directive, is the removal of shellfish to a new location i.e. sea, estuarine or lagoon, which has been approved by the competent authority, with boundaries clearly marked and indicated by buoys, posts or any other fixed means, and used exclusively for the natural purification of live bivalve molluscs. The recommended two month relaying period reflects the fact that microbial and in particular viral contamination may be present in the original waters.

6. The World Health Organisation (WHO) draft Guidelines for Safe Recreational-Water Environments in Coastal and Freshwater (1998) addresses the coastal environment in terms of beach safety, water quality and beach management. This report and its subsequent conclusions are based on a correlation of independent research, from around the world, into the costal environment.

   Table 3.1, taken directly from the WHO guidelines, indicates the correlation between the presence of indicator organisms (faecal coliforms and faecal streptococci) the mean indicator count (per 100ml) and the incidence rate for illness (per 1,000 population) among bathers immersed to various degrees in the waters. From the table, the rate of gastrointestinal symptoms and respiratory illness reported for bathers who immersed themselves, while bathing to waist level are approximately 61 no per 1000. The mean incidence rate for faecal streptococci and faecal coliforms in these waters was found to be 20 No. per 100ml.

Table 3.1: Relationship between Indicator Organism and Illness for Bathing Waters

Exposure	Indicator	Mean Indicator Count (per 100ml)	Incidence Rate (per 1,000)	Health Outcome
Face immersion	Faecal coliform	642 130 51	14 6 14	Skin complaints
Entering water up to or beyond waist	Faecal Streptococci, Faecal Coliforms	10.4 (0-163)* 0.8 (0-28) 21.9 (0-436) 3.8 (324)	61	Gastrointestinal symptoms Respiratory illness
Head, immersion, splashing, swallowing	Faecal Streptococci	40 (31-51)	131	Gastrointestinal symptoms Respiratory illness

* Figures in brackets indicate the range of the counts.

Given the possible correlation between illness and the presence of indicator organisms at low concentrations, more stringent standards governing the presence of coliforms and other indicator organisms, can be expected in future Bathing Water Directives emanating from Europe.

Based on the above assessment the required standards for Kinvara WwTP are outlined in Table 3.2 below:

Table 3.2: Relevant Water Quality Criteria for the Coastal Waters off Kinvara

	Wastewater Treatment Directive	Bathing Waters	Blue Flag Requirements	Shellfish Regulations
Physico – Chemical Parameters				
pH	-	> 6 and < 9	> 6 and < 9	> 7 and < 9
BOD5	25mg/1	-	-	-
COD	125mg/1	-	-	-
Suspended Solids	35mg/1	-	-	< 20% increase
Total Ammonia as N	-	-	-	-
Colour	-	No Abnormal 1 Change	No Abnormal Change	-
Colouration	-	+/- 10mg/1		+/- 10mg/1
Mineral Oils	-	No visible film	No visible film	
Salinity	-	-	-	< 40% and < 10% increase in salinity
Transparency	-	95% > 1m	> 1m	-
Bacteria and Viruses				
Total Coliforms (per 100ml)	-	80% < 5,000 or 95% < 10,000	95% < 10,000 80% <500 (G)	-
Faecal Coliforms (per 100ml)	-	80% < 1,000 or 95% < 2,000	95% < 2,000 80% < 100 (G)	< 300
Faecal Streptococci (per 100ml)	-	< 300	90% < 100 (G)	-
Salmonella (per 100ml)	-	0	-	-
Enteroviruses (per 100ml)		0	-	-

The following points should be borne in mind regarding the above summary:

- The values quoted above are, unless otherwise indicated, imperative and as such have to be met to comply with the relevant standards.
- Guideline values (G) have been quoted in the above table for coliforms and streptococci standards. Guideline values, unlike imperative values, have no legislative significance.
- The relevant percentile value indicates the percentage of samples that need to comply with the relevant imperative value in order to meet the relevant standards.
- FEEE's standards for Blue Flag designation are based on the European Bathing Water Directive (76/160/EEC). Both imperative and guideline values are quoted for total and faecal coliforms.

The details above summarise the water quality parameters, which are affected by the final effluent discharge. There are a number of other parameters that are not listed, as they are not applicable, as follows.

- Parameters such as temperature and dissolved oxygen are not affected by the final effluent discharge, since the wastewater treatment process operates at ambient temperature, and any problems with the dissolved oxygen levels would be as a result of problems with other parameters, such as BOD_5.

- Parameters such as the concentrations of particular metals, and industrial chemicals. None of these parameters are indicated as being significant at present. However should a particular constituent present a problem, the treatment would have to be provided at the source location, prior to discharge to the sewer system.

3.3.2 Factors affecting selection of Discharge Standards

The following conclusions can be drawn with regard to the proposed discharge:

- The minimum wastewater treatment requirements for allowable BOD_5 and suspended solid levels in the final effluent discharge are dictated by the Urban Waste Water Treatment Regulations (2001).

- The waters off Kinvara coast are not classified as sensitive in the Urban Waste Water Treatment regulations (2001). As such, no legislative requirement exists for the provision of advance treatment for nitrogen removal. However as there is an observed problem with green algae blooms within the bay which indicates a eutrophic tendency a process addition such as an anoxic tank for nitrogen removal should be included at the WwTP to reduce total nitrogen.

- The microbial standards for faecal and total coliforms in the receiving water are selected with consideration to two different requirements.

  – The requirements for shellfish waters as dictated by SI No. 147/1996 and the classification of the waters off Kinvara as a Class C shellfishery. The Dept of the Marine in consideration of the foreshore licence application may enforce a effluent discharge standard as low as 250 faecal coliforms per 100ml; and

  – The requirements for bathing waters as dictated by the Bathing Water Regulations (1992) and FEEE's interpretation of these standards for award of Blue Flag status. In addition consideration must also be given to the possibility of future stricter standards in response to ongoing research into suitable coliform levels for recreational waters.

The outfall pipeline and diffuser arrangement will require a minimum water cover of 1m at Lowest Astronomical Tide (LAT) to be compliant with the requirements of the Department of the Marine and Natural Resources.

3.3.3 Proposed Discharge Standards

Consequently the wastewater discharge standards for the proposed final effluent outfall are recommended as follows:

- The final effluent should have a BOD_5 standard of 25mg/l, assessed in accordance with the Fifth Schedule of the Urban Waste Water Treatment Regulations, 2001;
- The final effluent should have a COD standard of 125mg/l, assessed in accordance with the Fifth Schedule of the Urban Waste Water Treatment Regulations, 2001;
- The final effluent should have a suspended solids standard of 35mg/l, assessed in accordance with the Fifth Schedule of the Urban Waste Water Treatment Regulations, 2001;
- The final effluent should have a total nitrogen standard of 10mg/l as N assessed in accordance with the Fifth Schedule of the Urban Waste Water Treatment Regulations, 2001; and
- The final effluent will have a maximum faecal coliform level which will be determined following negotiations with the Dept of the Marine and Natural Resources on the Foreshore Licence application. It is expected based on previous experience that the maximum. faecal coliforms level per 100ml, assessed on a 95 percentile basis will be between 250 and 2,000 No,

3.4 Stormwater Discharges from the Wastewater Treatment Works

Currently the Department of the Environment recommend that there should be no more than three overflows into identified bathing waters and no more than seven overflows into recreational waters, during any one bathing season in both cases, which is defined as mid-May to August. This recommendation is contained in their paper on the Criteria for Storm Water Overflows, in the context of the EU Urban Waste Water Treatment Directive (91/271/EEC(UWWTD). The context is specific to overflows from sewerage systems before the flow reaches the treatment works, however it also provides guidance for storm overflows from treatment plants.

The discharge standards for storm overflows require a limited number of discharges to curtail the visual nuisance caused. At Kinvara WwTP absence of a visual nuisance will be ensured by passing storm flows through the preliminary processes at the plant, which will remove both screenings and grit.

The Wastewater Treatment Plant at Kinvara will be designed on the basis of 3 DWF with stormflows in excess diverted to storm balancing tanks. Stormwater discharge from the wastewater treatment plant, via the outfall pipeline, will only occur after screening and following the storm balancing tanks been filled to capacity.

COMHAIRLE CHONTAE NA GAILLIMHE
GALWAY COUNTY COUNCIL

Kinvara Sewerage Scheme
Marine Outfall Water Quality Study

November 2002

Hydro Environmental Ltd.

TABLE OF CONTENTS

1.0 General

1.1 INTRODUCTION

1.1.1.1 Hydro Environmental Ltd. was commissioned by Galway Co. Council to perform an outfall site selection and water quality impact assessment study for the proposed Kinvara Sewerage Scheme.

1.1.1.2 Kinvara town is located 27km from Galway City on the inner south shoreline of Galway Bay. The town has a present day PE of 1250 which is collected and discharged untreated into inner Kinvara Bay at a sewer outfall adjacent to Kinvara Harbour. The projected 2022 PE for the town is 2125. It is proposed to provide sewage treatment to the secondary level and to discharge the treated effluent to a new sea outfall adjacent to the proposed WWTP site at Ballybranagan.

1.1.1.3 The water quality concerns are in regard to bacterial contamination of Shellfishery sites in the outer bay area and the potential for nutrient enrichment by nitrogen in the sluggish Inner Bay area.

1.1.1.4 This report examines the level of sewage treatment required for the Bay using the Kinvara Bay 2-Dimensional depth averaged hydrodynamic and water quality model (Hydro Environmental Ltd, 1999). The water quality parameters of interest in this study are faecal coliforms and total nitrogen.

1.2 NATURE OF KINVARA BAY

1.2.1.1 Kinvara Bay is located in the southeast corner of Galway Bay. It is a shallow bay approximately 5km long and on average 1km wide at high tide (refer to Figure 1.1). It's principal axis is orientated in a north-northwest – south southeast direction. It is a reasonably sheltered bay protected by a narrow inlet (300m in width at low water) at Doorus point separating it from the Doorus Straits and the Galway Bay area. The inner Kinvara Bay area located south of Mulroney's Island is about 500m wide having a low water channel width of 100 to 200m. The total wetted area of the bay is approx. 550ha at highwater mean spring tide and 280ha at low water mean spring tide. This indicates that approximately 50% of the embayment area is inter-tidal. The hydraulic flushing times for the bay are about 8hours and 17hour for mean spring and neap tides respectively.

1.2.1.2 The inner bay area is very shallow with depths in the low water channel of less than 1m and typically 0.5m at lowest astronomical tide. Ebb and flood flows in this inner bay area are quite sluggish particularly during neap tides.

1.2.1.3 The coastline of Kinvara, Ballyvaughan and North Clare, Clarinbridge and Oranmore have numerous karst springs both onshore and submarine. Recent studies of the Gort flooding problem have shown that the Kinvara area is a major emergence zone for karst groundwater flow from the greater Gort area. Coole Lough, Gort has been linked via dye tracing to the Kinvara springs (Drew & Daly, 1993). Annual Freshwater contribution to the bay is difficult to estimate (without detailed salinity data) but could be between 2 and 5cumec.

1.3 FISHING ACTIVITIES IN AND AROUND KINVARA BAY

1.3.1.1 Licensed shellfishery sites exist in Kinvara Bay and adjoining Bays. Figure 1.2 presents the location of Dept. of the Marine licensed shellfish production sites in Kinvara Bay. The fishery activities are oyster and mussel both trestle and bottom culture cultivations.

1.3.1.2 Other fishery activities in the region are the production of winkles, lobster and shrimps. Kinvara Harbour would also act as a local harbour for angling and drift net fishing in Galway Bay.

1.3.1.3 The licensed Shellfisheries shown in Figure 1.2 all have class B (conditional) shellfish production status, which means that they cannot be placed on the market for human consumption without undergoing purification in accordance with EC Council Directive 91/492/EEC.

1.3.1.4 Bacteriological sampling of the Bay carried out by the Galway Environmental Health Officers Department, Western Health Board, Galway show the waters within the bay area and at the shellfish sites to have significant faecal contamination, particularly during the summer period. Results from the bacteriological monitoring of shellfish at the licensed fishery sites in the outer Bay showed levels approaching the upper limits of the conditional classification (230 to 4,600 E-Coli/100g) and on a number of occasions concentrations were found to exceed this limit.

1.3.1.5 In terms of bacteriological quality of the water column the sampled results were generally within the conditional production classification but did not meet approved production standard, using as an equivalent the United States Food and Drug

Administration (USFDA) Shellfish sanitation program water quality standard (2000) for restricted shellfish areas (faecal coliform geometric mean < 88 No./100ml (67.5 E-Coli / 100ml) and 90% < 260 No./100ml). Because of the tidal variability, single water quality samples taken every two weeks to 1 month are unlikely to reflect the true quality status of the Bay.

1.3.1.6 Clarinbridge and Kinvara Bays are, under statutory Instrument 200 of 1994 referring to the "Quality of Shellfish Waters Regulations", designated as schedule 1 shellfish waters. The SI 200 states that

"*where shellfish waters do not conform with the quality standards prescribed in these regulations, the Minister shall, in consultation with the local authority or sanitary authority, establish as far as possible the reasons for non-conformity whether due to chance, natural factors or to discharges of trade effluent, sewage effluent or other polluting matter, and shall adopt an action programme comprising necessary measures where appropriate to ensure conformity with the standards; in particular a local authority or sanitary authority shall, on foot of such action programme, take all necessary steps as may be appropriate in discharge of their functions under the Principal Act to secure conformity with the standards.*"

1.3.1.7 Conformity with the standard for this bay is to achieve the "Approved" shellfish production status of < 300 faecal coliforms/100g flesh at licensed shellfish sites in the Bay, both at existing and future potential sites. The SI 200 does not define specific production areas within designated waters and therefore the SI is being interpreted as essentially applying to Kinvara Bay in its entirety.

1.3.1.8 At the present time the licensed shellfish production areas do not meet "Approved" shellfish production standards and therefore do not comply with SI 200 of 1994.

1.4 SOURCES OF POLLUTION

1.4.1.1 The primary sources of bacteriological and biological pollution of Kinvara Bay are from:

1) Kinvara town sewage discharge (direct point discharge)
2) agricultural runoff (ground water inflow via subterranean streams)
3) septic tank systems (ground water inflow)

1.4.1.2 It is clear that the existing untreated Kinvara sewage discharge is having a significant impact on the water quality of the bay, particularly the inner bay area.

Surface sewage slicks in the vicinity of the outfall, harbour area and Duguaire Castle are a common occurrence. The contribution of faecal contamination is significant, particularly in the vicinity of the outfall but also at the licensed shellfish sites in outer Kinvara Bay.

1.4.1.3 Recent studies of the Gort Flooding have shown the Kinvara Area to be a major emergence zone for karst groundwater flow from the Greater Gort Catchment. Agricultural runoff from slurry spreading activities on the contributing catchment can make its way rapidly with little attenuation into Kinvara Bay via underground connecting fissures and conduits. Flushing events producing spike loadings on the bay can occur when heavy rainfall follows a prolonged dry period.

1.4.1.4 Septic tank contribution from the surrounding hinterland is also felt to be significant due to the relatively high density of dwelling houses with conventional septic tank systems combined with the high infiltration characteristics of the topography and rapid transmission to the bay (poor soil overlying weathered, fissured, clean limestone bedrock.

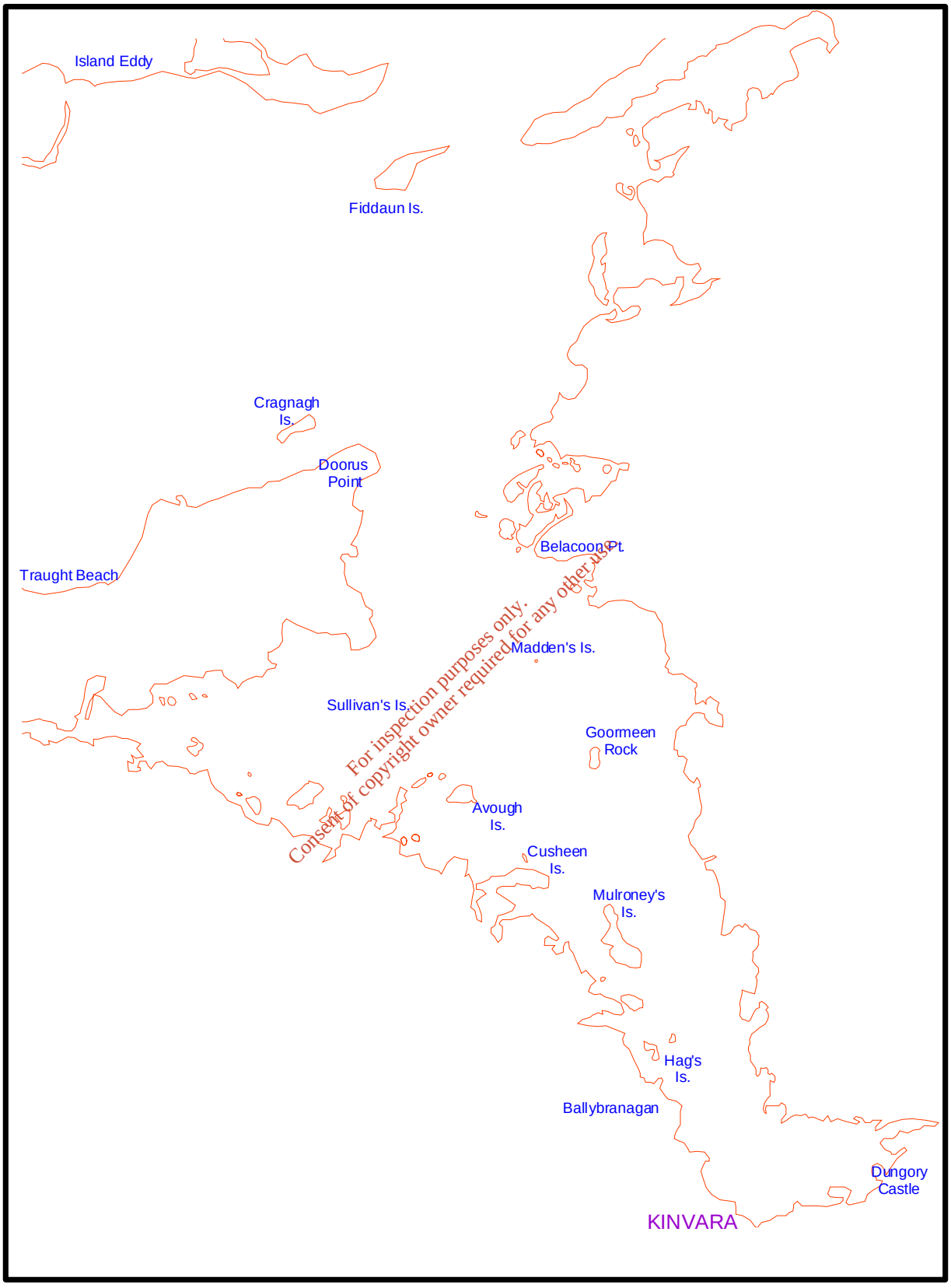


Figure 1.1 Kinvara Bay

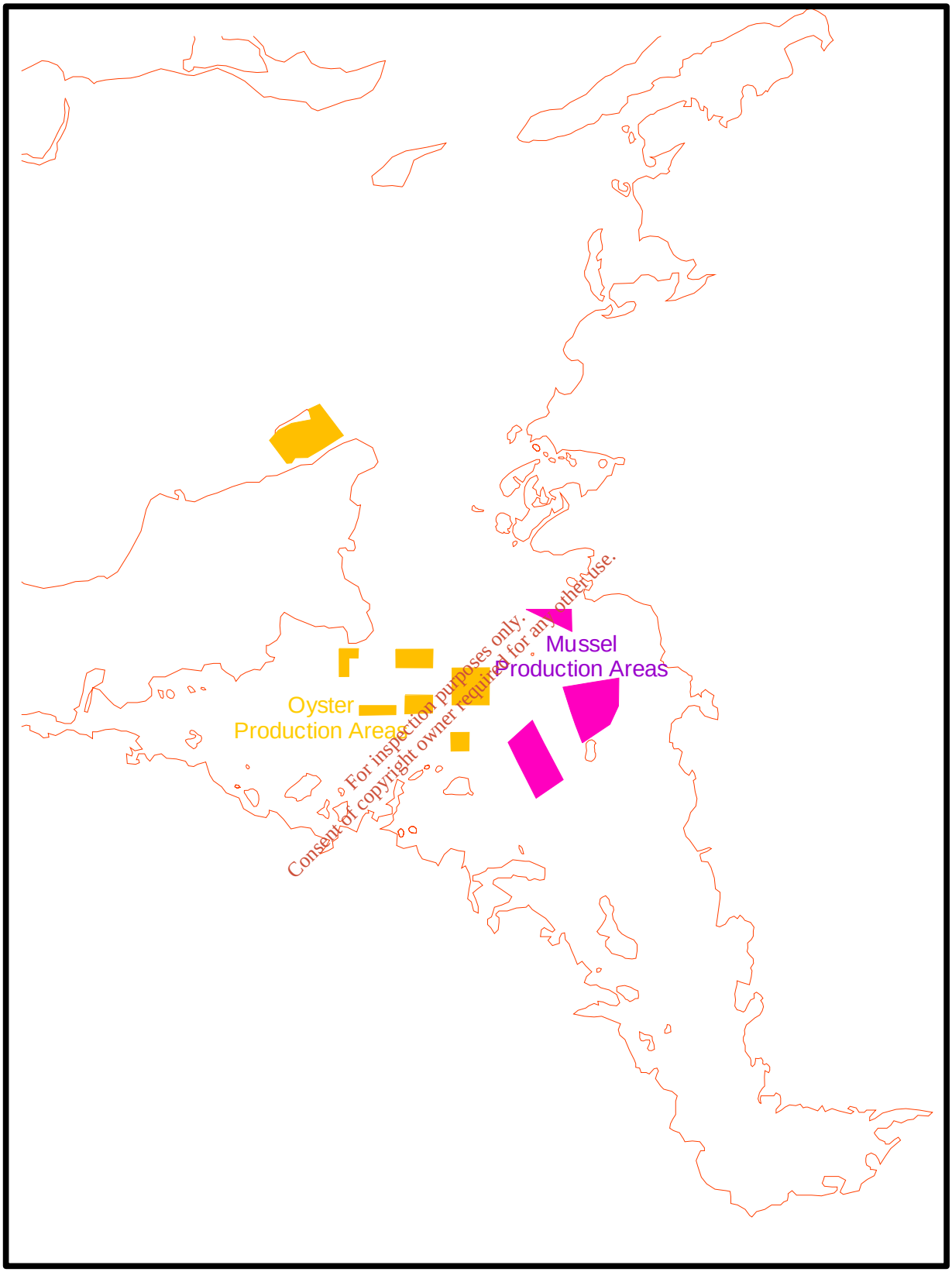


Figure 1.2 Licensed Shellfish Production sites (Dept. of the Marine July 2002)

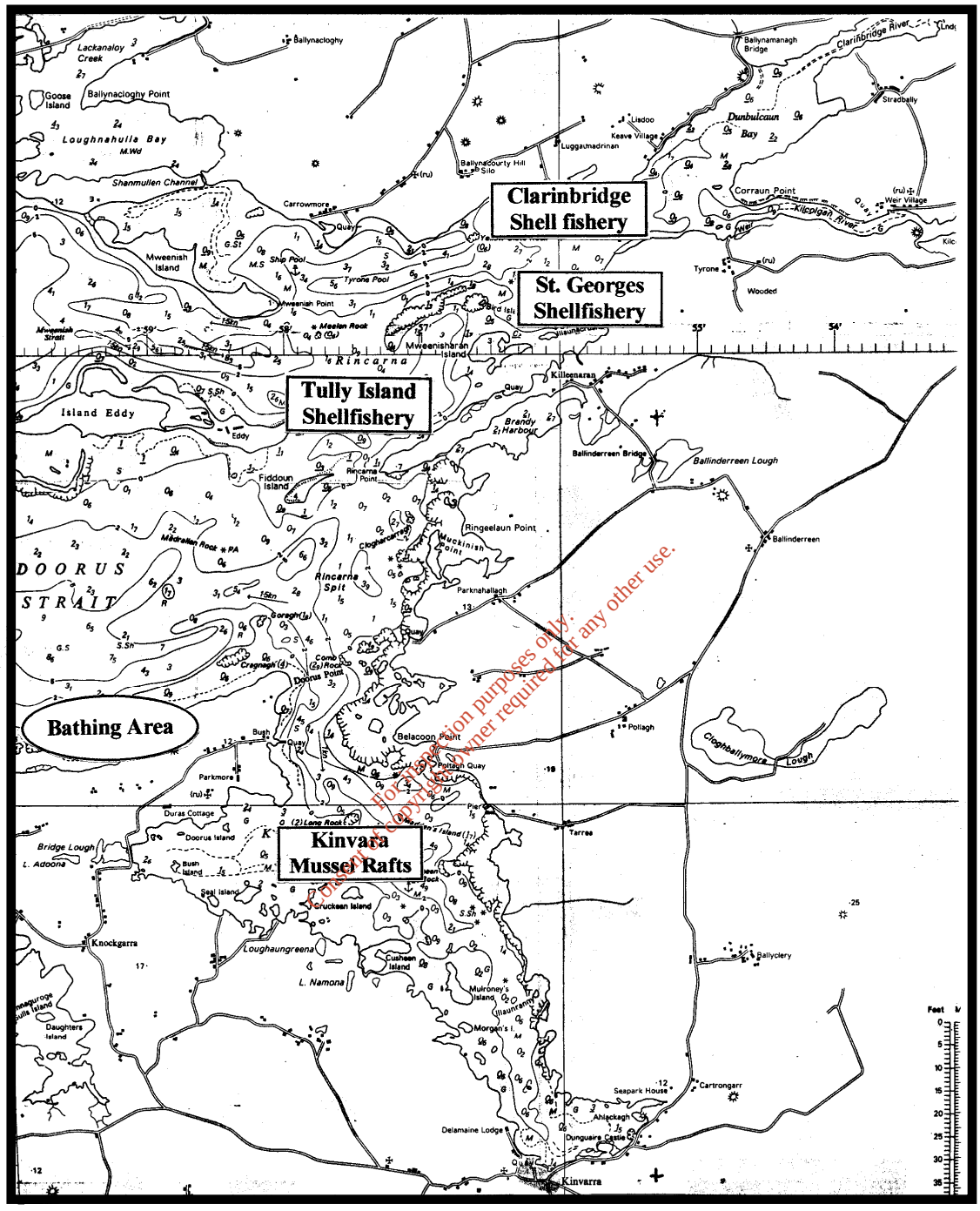


Figure 1.3 Location of Shellfisheries in the adjoining bays

2.0 HYDROGRAPHIC INVESTIGATIONS

2.1 INTRODUCTION

2.1.1.1 A detailed hydrographic survey of the proposed outfall site comprising a bathymetric survey, drogue release survey and current metering survey was carried out by Hydrographic Surveys Ltd from 27th May to 30th May 2002. Observations of tide and wind speed/direction were also carried out during the survey period. Please refer to Annex 2 of this report for the marine survey results.

2.2 BATHYMETRIC SURVEY

2.2.1.1 The bathymetric survey concentrated on the inner Kinvara Bay area extending from Mulroney's Island to eastwards of Kinvara harbour. A more refined survey was carried out immediately north of Delamaine headland adjacent to the proposed WWTP site at Ballybranagan.

2.2.1.2 The bathymetry was determined using a Ceeducer high frequency digital Echo Sounder interfaced to Hypack. Horizontal control was provided by Hypack Differential GPS to 1m horizontal resolution. The echo sounder was calibrated before and after survey using the standard bar chart method. Soundings are presented in metres and decimetres, reduced to OD Poolbeg (2.71m below O.D. Malin) and tidally corrected from automatic tide gauge readings at Galway Harbour.

2.2.1.3 The bathymetry is presented in the accompanying drawings HS 66A/02 & 66B/02 at scales of 1:2000 and 1:1000 respectively. The surveyed area consists mostly of drying area when plotted to datum (Poolbeg). For the most part the "channel" through the inner bay varies in depth from 0.1m to 0.8m at lowest astronomical tide (LAT). The bathymetric levels presented in the 1:30,000 Admiralty Chart No. 1984 are reasonably consistent with the survey results.

2.2.1.4 The low water channel within the survey region has a width typically of 80m with water depths below LAT varying from 0.1m to 0.8m. The channel increases its width in the seaward direction and is 250m wide opposite Hag's Island and 320m wide opposite Mulroney's Island. The sea bed levels along this low water channel remain practically the same and only start to deepen 300m north of Mulroney's Island.

2.2.1.5 In order to reach to this low flow channel from the proposed WWTP at Ballybranagan an outfall length of just over 120m is required from the high water mark at the shore.

2.3 TIDAL ELEVATIONS

2.3.1.1 Because of the shallow nature of Kinvara Bay and the fact that it dries out, it was not possible to install a tide gauge at Kinvara to cover the entire tidal range. Tide levels for the full survey period were recorded at Galway Harbour using a Valeport model 740 tide gauge (27th to 30th May 2002). The tide condition was spring tides.

2.4 TIDAL CURRENT MEASUREMENTS

2.4.1.1 Velocity measurements were required to assess both Eulerian Flow (velocity and direction at a fixed location) and Lagrangian flow (track and speed of flow) in the vicinity of the proposed outfall. These are required for the determination of the initial dilution of discharge, as well as the speed and direction of advection of the effluent plume.

2.4.2 Current Metering

2.4.2.1 Direct reading current metering was carried out using an Aanderaa 3500 acoustic Doppler current meter during spring tides at sites A and B, refer to Diagram 3 of Annex 2 for current metering locations. Measurements were taken at three depths in the water column, surface –1m, mid-depth and bottom +1m. Results are tabulated showing velocity in metres per second and degrees magnetic north. Note direction is given as that which the tide flows towards. Time series plots of current speed and direction are also presented in Annex 2 of this report.

2.4.2.2 Results of the direct reading current meter survey suggest a rectilinear circulation pattern north northeast on the ebbing tide and southwest on the flooding tide, following the same orientation as the channel. Velocities at the sites are reasonably consistent, albeit weak, with Site B showing marginally greater velocities than Site A. At Site A velocities are generally 0.1 to 0.15m/s on the ebb tide and slightly less on the flood tide, closer to 1.0m/s. At site B located further out in the low water channel this same pattern is observed with velocity magnitudes only slightly higher (10%). Velocities at these sites are expected to be considerably weaker on neap tides, two to three times slacker.

2.4.3 Drogue Tracking

2.4.3.1 Lagrangian flow was determined by releasing 1m cruciform drogues from the proposed outfall site at HW+1hr, HW+2hr and HW+3hr and tracking them for 6hours on a spring tide (27th May 2002). A fourth drogue release was performed on the flooding tide from a release point in the main channel 100m inside Doorus Point. All drogues were set at mid-depth and where drogues grounded, they were immediately recovered and redeployed in the main channel adjacent to the grounding point.

2.4.3.2 The drogue tracks are presented in Drawings HS 66C/02 and HS 66D/02.

2.4.3.3 High Water +1 Hour drogue release

Initially the drogue was sluggish, heading into a West North West breeze. One hour after release the velocity increased to approximately 0.25m/s and was maintained until approximately two and a half hours after release. Shortly after this, the drogue grounded and was re-released into the channel. Thereafter the drogue headed seawards reaching a velocity of 0.77m/s between three and four hours after release. The drogue was recovered approximately four hours and twenty minutes after release (high water + 5hrs, 20mins), travelling northwards, but heading into rough waters in Galway Bay. The drogue passed seaward of Doorus Point 3hrs 26mins after its release and reached Goormeen Rock in 2hrs 37mins.

2.4.3.4 High Water +2 Hours drogue release

This release was continuous throughout the tracking period and initial track velocities were of the order of 0.25 to 0.3 m/s south of Goormeen Rock. In the outer section of the bay (i.e. north west of Goormeen Rock) velocities generally exceeded 0.5m/s. The drogue passed seaward of Doorus Point 2hrs and 52mins after its release and reached Goormeen Rock in only 1hr 49mins.

2.4.3.5 High Water +3 Hours drogue release

This release covers the half ebb through low water and the early part of the flood tide. Apart from grounding, and possible dragging, ebb velocities were quite reasonable, in excess of 0.25m/s, until the turn of the tide. Flood velocities seem to be quite consistent for most of the release, in excess of 0.2m/s, until slowing in the inner part of the bay. The furthest seaward point the drogue reached before the tide turned was 100m north of Madden's Island and reached Goormeen Rock in 1hr 44mins.

2.4.3.6 Low Water drogue release

A low water release took place off Doorus Point. In general, velocities were consistent in the channel at over 0.2 m/s, allowing for shallow waters, possible dragging and grounding. The total tracking period was over four hours and the drogue reached just south of Morgan's Island.

2.4.4 1999 Current Metering Survey

2.4.4.1 In April 1999 for the purposes of calibrating the hydrodynamic model current metering was carried out at four sites, two sites (A and B) located in the outer Bay north of Madden's Island, a third site (C) located in the channel opposite Cusheen Island and a fourth site (D) located in the channel opposite Morgan's Island. Sites A and B were monitored over a spring tide and C and D over a neap tide. Site A located in the flow channel had velocities of 0.5 to 0.6 m/s on both ebb and flood flows. Site B located to the right of the flow channel generally had velocities of the order of 0.2m/s. Sites C and D located in the flow channel exhibited fluctuating velocities between 0.1 to 0.2m/s over both ebb and flood flows of a neap tide. Refer to 1999 Kinvara Sewage Outfall Water Quality Study Report for full details.

2.5 DISCUSSION

2.5.1.1 The bathymetric survey defines clearly the inter-tidal region and the low flow channel. This provides the necessary information to select the optimum outfall route to the deeper faster moving waters. The bed levels of the low flow channel within the inner bay area (i.e. south of Mulroney's Island) are practically equal having water depths at low water mean spring tide of 0.9 to 1.4m.

2.5.1.2 Direct reading current metering over a spring tide at two potential sites A and B show relatively low velocity magnitudes of 0.12 to 0.15m/s, with site B located further out in the low flow channel having marginally higher magnitudes. It is likely in the absence of wind that neap tide velocity magnitudes could be as low as 0.05m/s at these sites. A previous survey carried out in April 1999 recorded neap tide velocity magnitudes of 0.15m/s in the Channel opposite Morgan's Island (500m seaward of sites A and B). On that occasion a force 5 south-easterly wind was blowing which may have increased currents particularly surface currents.

2.5.1.3 Spring ebb tide drogue releases from the proposed outfall site show that within 2.5 to 3hours travel time they are north of Doorus Point and clear of Kinvara Bay. These drogues reach the Shellfish sites north of Goormeen Rock within 1 to 2

hours of release. These drogue results suggest a reasonably short flushing time for the Bay during spring tides.

2.5.1.4 In the inner Bay Area for both ebb and flood tide releases the drogue velocities slacken considerably. This is expected as the area for tidal inundation reduces as we travel upstream and therefore the flooding and ebbing volume that passes in and out reduces.

3.0 WATER QUALITY MODELLING

3.1 BACKGROUND

3.1.1.1 A 2-dimensional depth averaged hydrodynamic and water quality model of Kinvara Bay was developed by Hydro Environmental Ltd. in 1999. This was model was used to assess the water quality impact of Kinvara Town sewage discharge on the receiving waters. The model hydrodynamics was calibrated and validated against current metering survey described in section 2.4.4. This modelling exercise simulated faecal coliform and BOD concentrations in the bay from the existing and future untreated effluent discharges.

3.1.1.2 Refer to Hydro Environmental Ltd. report entitled "Kinvara Sewage Outfall Water Quality Study" December 1999 for full details of the model and water quality simulations.

3.1.1.3 The main findings from this modelling were as follows:

- Water quality impact from the Kinvara sewage discharge is confined to Kinvara Bay and has negligible impact on the adjoining bays.
- The BOD biological impact from the sewage discharge is not significant and is practically negligible in the outer bay area.
- The bacterial impact in the form of faecal coliform concentration from the sewage outfall is found to be significant, with levels in the inner bay exceeding guideline levels for both bathing waters and shellfish waters, and levels in the outer bay area in the vicinity of the shellfish production area sufficiently high to cause shellfish quality to get a conditional production classification.

3.1.1.4 The recommendations from the 1999 study were that the sewage discharge from Kinvara Village be treated to a secondary level as this will safeguard the conditional classification for shellfish production at the existing shellfish sites, and will significantly reduce the nearfield impact at the outfall site.

3.2 MODEL SIMULATION RUNS

3.2.2.1 The Preliminary Engineering report November 2002 prepared by Hydro Environmental Ltd. recommends a WWTP at Ballybranagan with a new sea outfall located 450m seaward of the existing outfall, refer to Figure 3.1.

3.2.2.2 The following water quality parameters were modelled to quantify the water quality impact of the proposed outfall on the receiving waters.

1. Faecal Coliforms, (effluent concentration $1.0x10^6$ No./100ml, T90 =24hours) for spring and neap tide hydrodynamic conditions.
2. Total nitrogen modelled as a conservative solute (no decay/settlement), effluent concentration 40mg/l for mean tide hydrodynamic conditions.

3.2.2.3 The above parameters were simulated for a continuous effluent discharge of 4.91 l/s equivalent to a PE of 2123 at 200 litres per PE per day.

3.3 MATHEMATICAL MODELLING APPROACH

3.3.1.1 The 1999 Hydro Environmental Kinvara Bay Water Quality Model was used to predict the far field impact of the proposed new outfall and make recommendations as to the requirement of additional treatment above secondary treatment (disinfection, nitrogen removal).

3.3.1.2 The Kinvara model has a relatively coarse grid resolution of 100m by 100m with respect to the bathymetry, shoreline geometry and low flow channel. The 100m resolution is sufficient to provide a general assessment of far field effects and possible build up of pollutants in the inner bay area. A comparison of measured and modelled current speeds and direction show reasonable agreement (refer to 1999 report). Model velocity predictions for the more recent current metering survey at the proposed outfall give ebb and flood velocity magnitudes of 0.12m/s (refer to Figure 3.2), which are in reasonable agreement with the observed velocities.

3.3.1.3 At the commencement of each model run, the study area is assumed filled with clean water and as the simulation proceeds, a build up of concentration levels develops throughout. Eventually a steady state condition is reached whereby the rate of increase in concentration levels due to the sewage discharge is in balance with the rate of decrease in concentration levels due to the transport out of the domain via the open sea boundary and by pollutant die-off/decay. The simulation time required for equilibrium concentrations to be attained depends on the decay rate of the pollutant and on the tidal exchange characteristics of the water body. In modelling faecal coliforms it was found that a repetition of 8 tidal cycles (approximately 4 days simulation time) ensured that equilibrium concentrations were attained at all sites within the model domain.

3.3.1.3 In the model simulations the background concentration of the pollutant (from other sources) being investigated was set to zero, so that computed concentrations represent the net effect of the modelled source.

3.4 MODEL OUTPUT

3.4.1.1 In order to assess the impact of the outfall discharge on various locations in the bay, a total of 12 model output sites were chosen at which time series of predicted pollutant concentration from each model run was produced. This allows statistical analysis of the time series results computing the mean, median and percentile concentrations at each site. Figure 3.1 shows the locations of these sites and Table 3.1 describes the significance and location of these sites.

3.4.1.2 Colour contour plots of faecal coliform concentration are also produced for each model run at the four principal stages of the tidal cycle (mid-ebb, low water, mid-flood and high water).

3.4.1.3 The contour and time series plots for the model runs are presented in Annex 1 of this report.

TABLE 3.1 Description of Model Reference Sites

Ref	Easting	Northing	Description
Outfall	137150	210915	Proposed Outfall Site at Ballybranagan
Site 1	137400	210450	In vicinity of existing outfall adjacent to Kinvara quay
Site 2	137900	210650	Inner bay area adjacent to Dungaire Castle
Site 3	137200	211250	In Flow channel opposite Hag's Island
Site 4	137100	211650	In Flow channel immediately southeast of Mulroney's Island
Site 5	136800	212150	In Flow channel opposite Cusheen Island
Site 6	136300	212550	In Mussel site opposite Avough Island
Site 7	136500	212850	In Mussel site at Goormeen rock
Site 8	135900	213050	Middle of Oyster sites southeast of Sullivan's Island
Site 9	135800	213550	In flow channel opposite Belacoon Point and north of Long rock.
Site 10	135600	214350	Opposite Doorus Point at exit from Kinvara Bay
Site 11	135300	214750	Just northeast of Cragnagh Island in the Doorus Straits

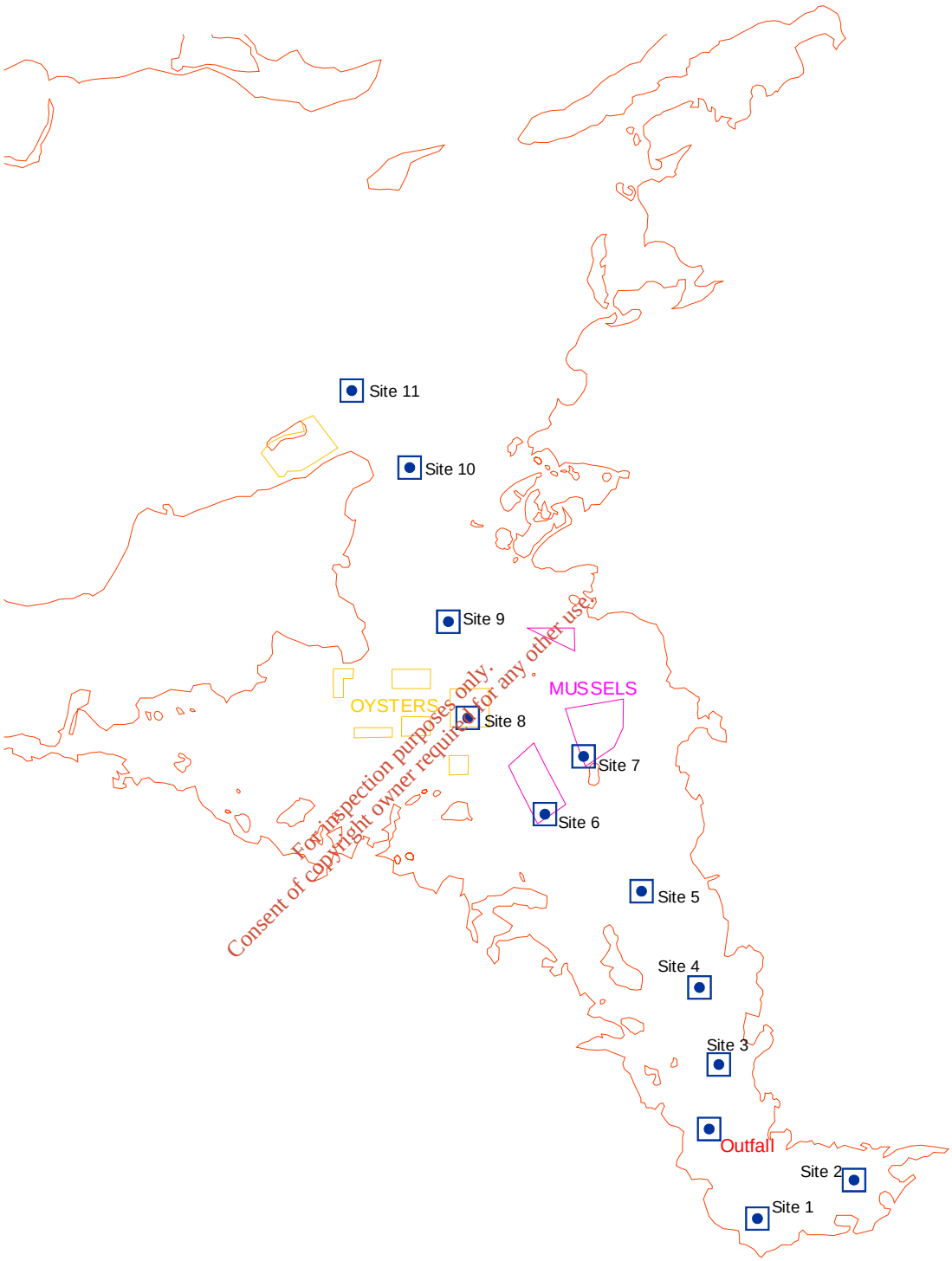
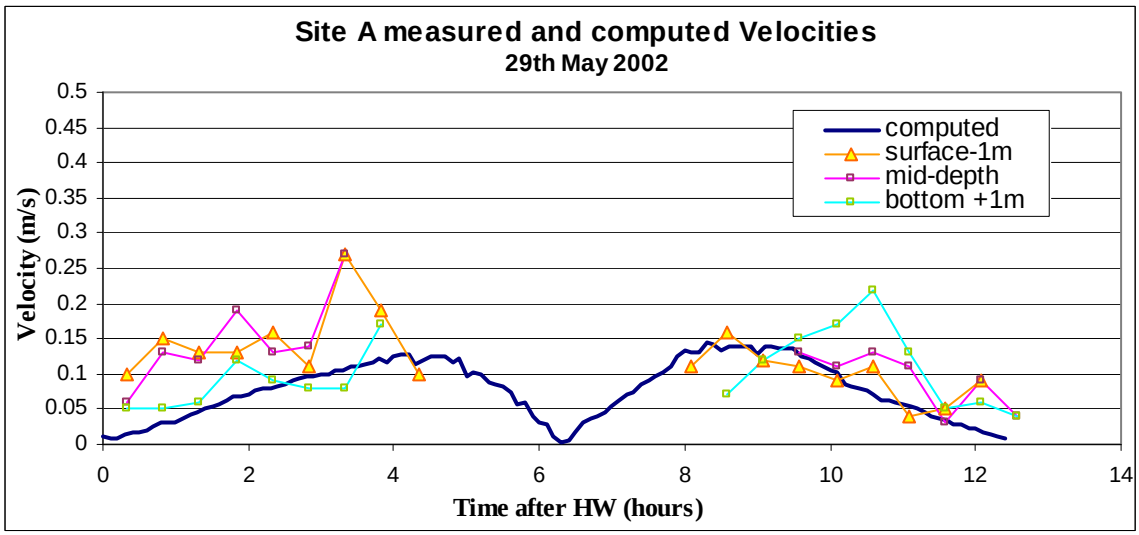


Figure 3.1 Location of Model Output Reference Sites



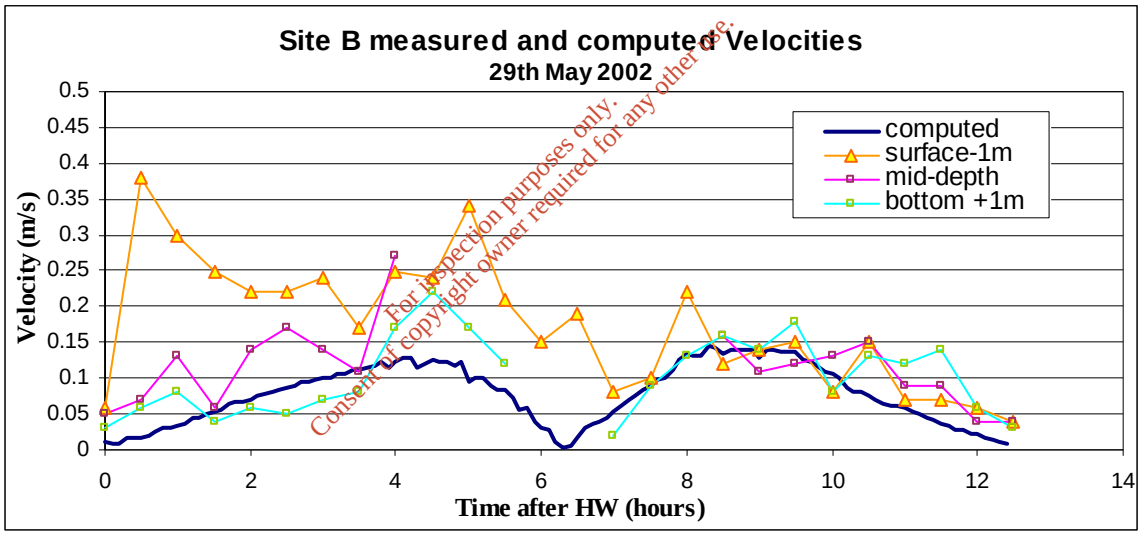


Figure 3.2 **Computed versus Measured current speeds in vicinity of proposed outfall site**

3.5 FAECAL COLIFORM SIMULATION RESULTS

3.5.1.1 Model simulations were carried out for mean spring and neap tide hydrodynamic conditions. An effluent discharge faecal coliform concentration of $1.0x10^6$ No. /100ml representing secondary treated effluent was modelled.

3.5.1.2 The die-off rate of pathogens (bacteria and viruses) among other factors is a function of solar radiation, temperature, predation and sedimentation. The decay rate is usually specified in terms of a T_{90} value, which is the time taken for 90% to die-off. Hence the larger the T_{90} value, the greater to possibility of pathogens existing in the bay a long distance from the outfall. In predicting the spread and fate of faecal coliforms in the marine environment, the mortality rate (specified as a T_{90}) can be the most critical parameter, particularly at sites remote from the source (travel time greater than 4 hours). Numerous studies (Neville-jones and Dorling (1986), Gameson (1985), Fujioka et al. (1981)) have reported T_{90}'s of the order of 4 hours or less for daylight hours and in bright sunshine of the order of 1 to 2 hours (Fujioka et al., 1981). A recommended design figure for marine outfall studies is a T_{90} of between 5 and 10hours (Gameson, 1985). T_{90}'s have been shown to increase with turbidity and water depth (i.e. reduction in short wavelengths). Research has shown that night time mortality rates are very low (mortality due to starvation only), of the order of 60 to 80 hours (Gameson, 1985).

3.5.1.3 Because of the sensitivity of the waters in regard to shellfish a relatively conservative daily average T_{90} of 24 hours was used in modelling faecal coliform concentrations.

3.5.2 Spring Tide Faecal Coliform Simulation

3.5.2.1 The spring tide faecal coliform simulation results are presented in Annex 1 of this report. The time series statistics at each of the model reference sites are presented below in Table 3.2.

3.5.2.2 The model results show an ability for the sewage plume from the proposed outfall to pass out of the bay into the Doorus straits on a single ebb flow excursion. In terms of impact to existing shellfish production sites in outer Kinvara Bay the spring tide is the critical tide allowing effluent to arrive at these sites in a relatively short period 2 to 3hours.

3.5.2.3 The USFDA Approved Shellfish Production Water Quality median standard of 14 No./100ml is exceeded at the outfall site and sites 1 through to 6 when compared to the predicted tidal average concentration and at the outfall and sites 1 to 3 when compared to the predicted median concentration. Sites 1 to 6 and the outfall do not satisfy the USFDA 90-percentile standard of 43 No./100ml. Significantly site 6 is located in the most southerly of the licensed shellfish production areas (i.e. nearest shellfish site to the outfall).

Table 3.2 Computed Faecal Coliform Concentrations Spring Tide Simulation

Ref. Site	Tidal Average Concentration No./100ml	median Concentration No./100ml	90-percentile concentration No./100ml	Maximum Concentration No./100ml
Outfall	239	132	572	1108
Site 1	91	52	214	337
Site 2	92	77	132	174
Site 3	68	27.4	172	246
Site 4	41	8.9	98	117
Site 5	27	4.8	71	74.5
Site 6	16	1.4	48	50.3
Site 7	6.5	0.7	16.4	19.5
Site 8	4.8	0.6	16	21.7
Site 9	5.1	0.9	21	25.7
Site 10	2.6	0.4	11	15.3
Site 11	1.3	0.2	5.5	8.3

3.5.3 Neap Tide Faecal Coliform Simulation

3.5.3.1 The neap tide faecal coliform simulation results are presented in Annex 1, time series and contour plots. The time series statistics at each of the model reference sites are presented below in Table 3.3. The simulation results show more localised impact as a result of the poor tidal flows associated with neap tides.

3.5.3.2 The USFDA Approved shellfish production median standard is not satisfied at sites 1 to 4 and at the outfall in respect to both predicted tidal averaged and predicted median neap concentrations. The outfall and sites 1 to 4 do not satisfy the USFDA 90-percentile standard of 43 No./100ml. The poor transport characteristics of neap tides ensure that the polluting plume remains localised within the inner bay area and is unable to arrive in significant numbers in the outer bay area within a single ebb tide excursion, by the time it does arrive there mortality and hydrodynamic mixing will have reduced considerably the concentrations.

Table 3.3 Computed Faecal Coliform Concentrations – Neap Tide Simulation

Ref. Site	Tidal Average Concentration No./100ml	median Concentration No./100ml	90-percentile concentration No./100ml	Maximum Concentration No./100ml
Outfall	253	229	374	397
Site 1	85	82.3	126	131
Site 2	49	45	72	74
Site 3	65	60.5	120	122
Site 4	32.5	16.2	82.5	87
Site 5	11.3	5.2	33.8	38.4
Site 6	1.9	0.7	5.6	6.1
Site 7	0.9	0.5	2.4	2.7
Site 8	0.2	0.03	0.7	0.8
Site 9	0.1	0.04	0.3	0.34
Site 10	0.03	0.02	0.08	0.09
Site 11	0.01	0.01	0.03	0.04

3.5.4 Discussion

3.5.4.1 When we combine both the spring and neap simulation results it is clear that an "Approved" shellfish production standard will not be achieved in the inner bay area, at the outfall and sites 1 to 5, as a result of the proposed outfall discharge. This inner bay area does not include any licensed shellfish production sites at the present time.

3.5.4.2 If we factor in the contribution of faecal pollution from other sources, namely agricultural runoff and septic tank systems, it is most likely that "Approved" production standard will not be achieved over a larger area of the bay including a number of the existing shellfish sites (site 6 and site 7). Another factor that may result in the occasional wider impact of the sewage discharge is low mortality rates during overcast days and dark hours giving rise to potential spikes.

3.5.4.3 The conclusion from this analysis is that secondary treatment is unlikely to achieve the desired results of "Approved" shellfish production standards at the existing shellfish sites and will not achieve it in the Inner Bay area (south of Mulroney's Island.

3.4.5.4 Moderate UV Disinfection producing $\log_2$ to $\log_3$ kill (i.e. effluent faecal coliform concentration reduced to 10,000 No./100ml to 1000 No. /100ml respectively) would substantially improve the bacteriological quality of Kinvara Bay both outer and inner bay areas and would meet approved shellfish standards generally everywhere except the initial mixing zone of the outfall. This is of course excluding the contribution from other sources of faecal pollution.

3.6 TOTAL NITROGEN SIMULATION RESULTS

3.6.1 General

3.6.1.1 Total nitrogen was modelled to assess the contribution from Kinvara sewage discharge to nutrient enrichment in Kinvara Bay and in particular, the more sluggish Inner Bay area in the vicinity of the discharge point.

3.6.1.2 Nitrogen and phosphorous are the primary nutrients which if present in sufficient quantities will result in the eutrophication of a water body, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned.

3.6.1.3 In the marine environment (both coastal and estuarine) nitrogen is generally the limiting nutrient, whereas, phosphorous is generally the limiting nutrient in freshwater systems.

3.6.2 Assessment of Nutrient Enrichment in Coastal Bays and Estuaries

3.6.2.1 The Irish EPA have produced a report entitled " An assessment of the Trophic Status of Estuaries and Bays in Ireland" (EPA 2001) which sets out quantitative criteria for eutrophication in Irish Bays and Estuaries and in the immediately adjacent coastal waters.

3.6.2.2 The criteria are for the purposes of assessing whether or not estuaries are eutrophic specifically in the context of the urban waste water directive and the nitrates directive. There are three categories of criteria:

(a) criteria for enrichment
(b) criteria for accelerated growth, and
(c) criteria for "undesirable disturbance".

Assessment of eutrophication requires all three.

3.6.2.3 The criteria of enrichment is of relevance to this study as it sets out standards of enrichment in regard to nitrogen (Dissolved Inorganic Nitrogen (DIN) mg/l N) and phosphorous concentration limits (Ortophosphate (MRP) μg/l P). These enrichment standards vary with salinity as follows:

Table 3.4 Variation of Water Quality Criteria with Salinity (EPA 2001)

Median Salinity psu	DIN Mg/l	MRP µg/l P	Median Chlorophyll A Mg/m^3	90-percentile Chlorophyll A Mg/m^3	5-perc D.O. % sat	95-perc D.O. % sat
0	2.60	60	15.0	30.0	70.0	130.0
5	2.25	60	15.0	30.0	70.0	130.0
10	1.89	60	15.0	30.0	70.0	130.0
15	1.54	60	15.0	30.0	70.0	130.0
20	1.21	57	14.2	28.3	70.0	130.0
25	0.89	51	12.8	25.6	74.4	125.6
30	0.57	46	11.4	22.8	77.2	122.8
35	0.25	40	10.0	20.0	80.0	120.0

3.6.2.4 Median Salinity in the inner Kinvara bay area is likely to be of the order of 33 psu which gives a DIN concentration of 0.38 mg/l N. Concentrations above this level would be considered suggestive of potentially eutrophic waters.

3.6.3 Mean Tide Total Nitrogen Simulation

3.6.3.1 Total nitrogen was modelled using an effluent concentration of 40 mg/l N. It would be expected that secondary treatment would reduce the nitrogen concentration/load by 25% through settlement of organic nitrogen and nitrification and denitrification within the activated sludge process.

3.6.3.2 In the model simulation total nitrogen was assumed to be completely in its dissolved inorganic form and that denitrification in the receiving environment does not occur. Conversion to organic nitrogen through algal / plant uptake was not included. Therefore the simulation results present the maximum build up of dissolved inorganic nitrogen in the Bay.

3.6.3.3 The hydrodynamic condition specified in the analysis was that of a repeating mean tide condition and the simulation was carried out for 1000hr simulation period, so as to achieve equilibrium concentrations throughout the bay. The contour and time series plots are presented in Annex 1 and a summary of the time series results are presented below in Table 3.5.

3.6.3.4 The computed average total nitrogen concentration in the inner bay area (defined by concentrations at the outfall, sites 1, 2 and 3) gave a value of 0.031 mg/l (N). When compared to the EPA Dissolved Inorganic Nitrogen (DIN) enrichment indicator for a salinity of 33psu (DIN = 0.38 mg/l N) the predicted mean total nitrogen concentration is a factor of 12 times lower and consequently does not

represent significant enrichment. Furthermore, the 25% reduction in nitrogen loading as a result of secondary treatment was not included for in the modelling, which would essentially reduce the mean concentration in the inner bay by 25%, giving a mean concentration of 0.023 mg/l N (i.e. 16 times lower than the EPA enrichment indicator level).

3.6.3.5 Predictions for the outer bay show significantly lower nitrogen concentrations (0.004 to 0.005 mg/l N) due to the greater tidal flushing

Table 3.5 Computed Total Nitrogen Concentrations – Mean Tide Simulation

Ref. Site	Tidal Average Concentration mg/l	median Concentration mg/l	90-percentile concentration mg/l	Maximum Concentration Mg/l
Outfall	0.033	0.0218	0.0383	0.049
Site 1	0.032	0.0290	0.0321	0.0328
Site 2	0.036	0.0349	0.0360	0.0360
Site 3	0.023	0.0107	0.0340	0.0353
Site 4	0.018	0.0077	0.0307	0.0321
Site 5	0.013	0.0033	0.0248	0.0268
Site 6	0.008	0.0026	0.0151	0.0182
Site 7	0.006	0.0025	0.0090	0.0085
Site 8	0.005	0.0025	0.0083	0.0091
Site 9	0.004	0.0034	0.0061	0.0092
Site 10	0.003	0.0006	0.0046	0.0066
Site 11	0.002	0.0002	0.0037	0.0049

3.6.3.6 Enrichment of the inner bay by nitrogen from Kinvara town is shown not to be significant and consequently nitrogen removal by incorporation of nitrification/denitrification in the treatment process is not required for the Kinvara estimated future PE of 2123 (to the year 2022).

4. CONCLUSIONS

4.1 OUTFALL DISCHARGE POINT

4.1.1.1 It is recommended that the proposed outfall discharge point be located at grid reference E137150, N210915. This will ensure that it is located in the tidal low flow channel having a minimum water depth of 0.6m at lowest astronomical tide and 1.2m at low water mean spring tides. Tidal velocities at the discharge point will be of the order of 0.15m/s during spring ebb and flood flows and 0.06m/s during neap ebb and flood flows.

4.1.1.2 The proposed outfall discharge point will be located in the navigation channel and therefore a vertical riser diffuser will not be appropriate given the shallow navigation depths available. A conventional single outfall point fitted with a tideflex valve to enhance jet velocities is recommended.

4.1.1.3 The outfall line must be protected from external corrosion and from physical damage caused by wave action and vessels. The pipe material used should be of high durability against corrosion from seawater, backfilled and where necessary and close to the shore protected by a concrete supporting cradle and cover.

4.2 WASTE WATER TREATMENT

4.2.1.1 Faecal Coliform model simulations show that secondary treatment is unlikely to achieve the desired results of “Approved” shellfish production standards at the existing shellfish sites and will not achieve it in the Inner Bay area (south of Mulroney’s Island)

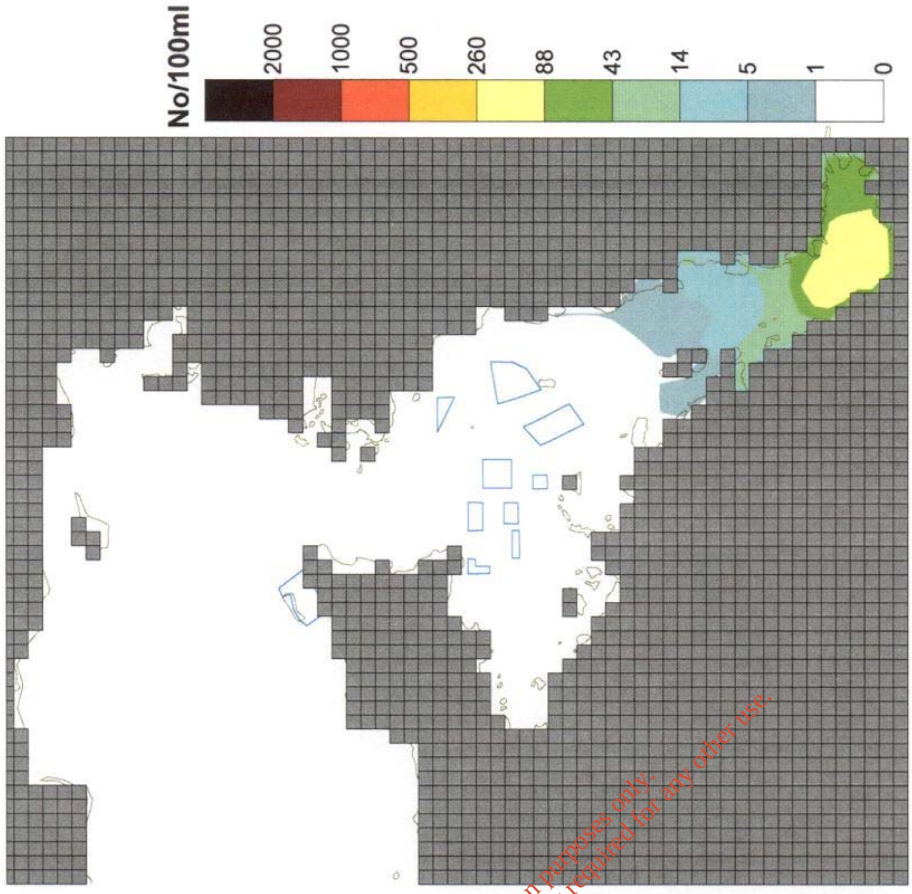
4.2.1.2 The proposed waste water treatment standard should be such that outside of its mixing zone it does not endanger shellfish production. To achieve this UV disinfection is required. The extent of the mixing zone should be agreed with the shellfishery section of the Department of the Marine. This will influence the rate of disinfection required ($\log_2$ or $\log_3$ reduction).

4.2.1.3 Enrichment of the inner bay by nitrogen from Kinvara town is shown not to be significant and consequently nitrogen removal by incorporation of nitrification/denitrification in the treatment process is not required for Kinvara.

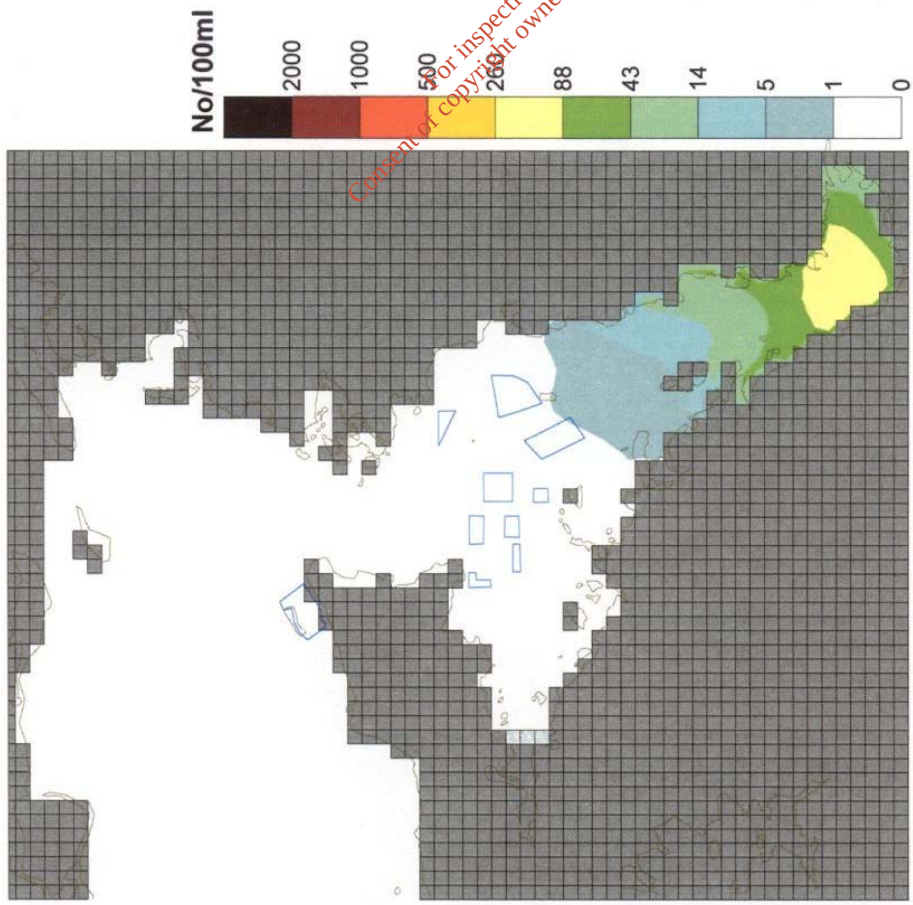
ANNEX 1

WATER QUALITY SIMULATION RESULTS

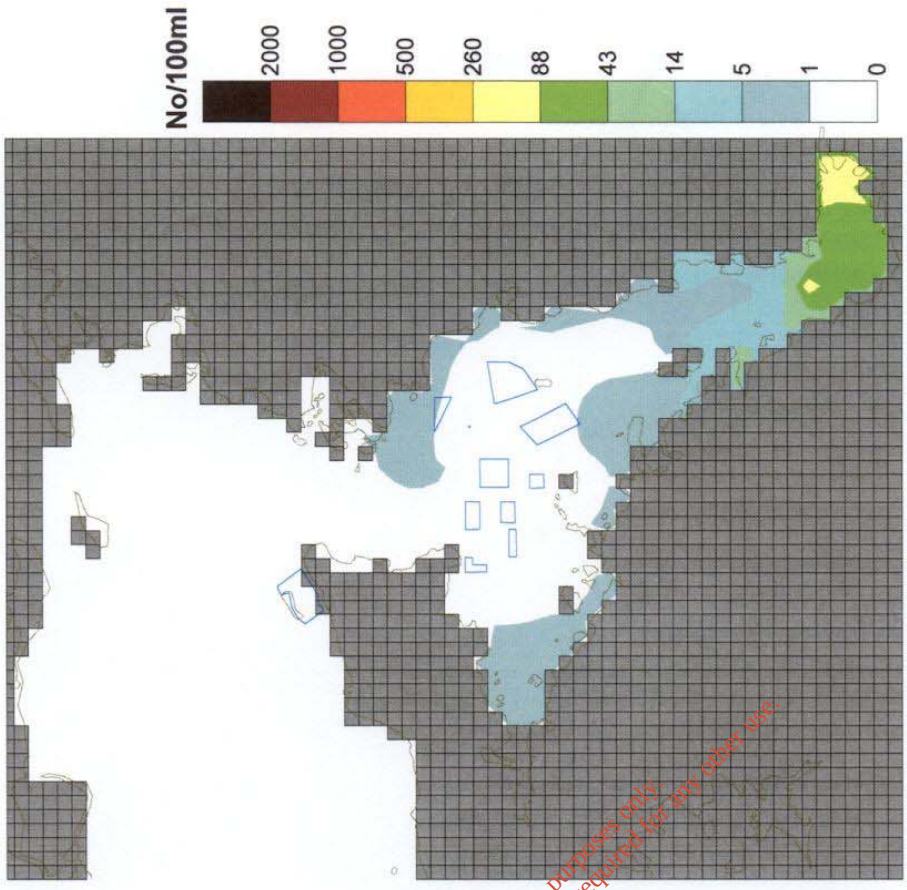
Faecal Coliform Simulation – Spring Tide



Faecal Coliform Simulation - Highwater Mean Neap Tide



Faecal Coliform Simulation - Mid-Flood Mean Neap Tide



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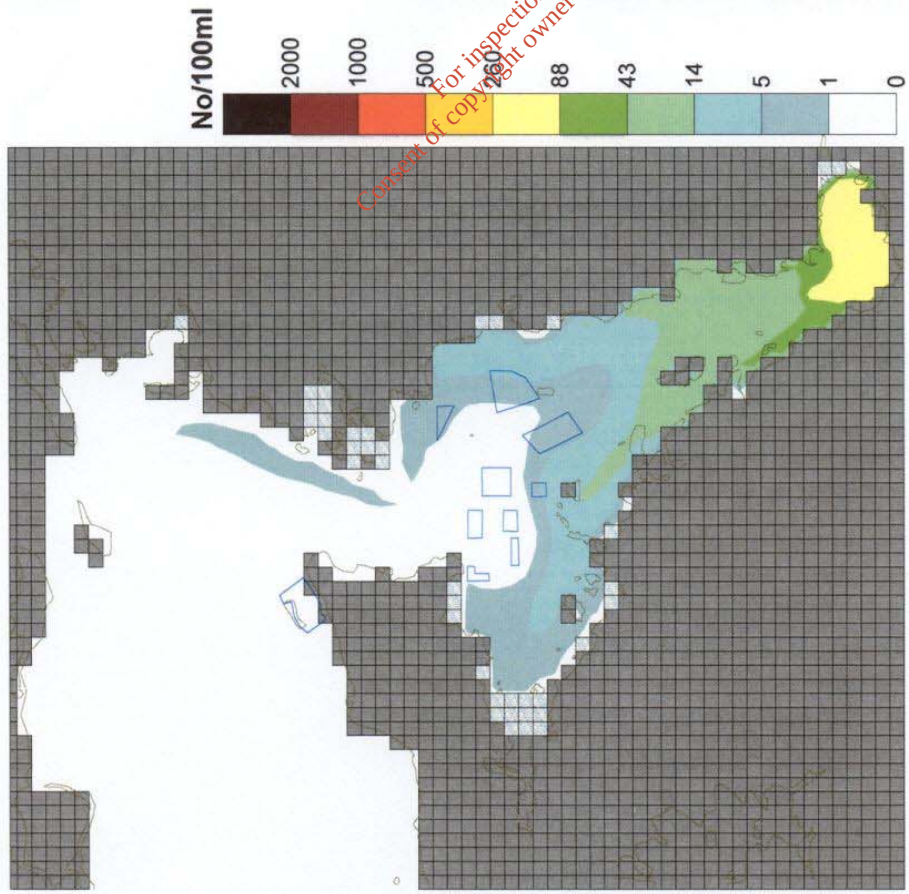
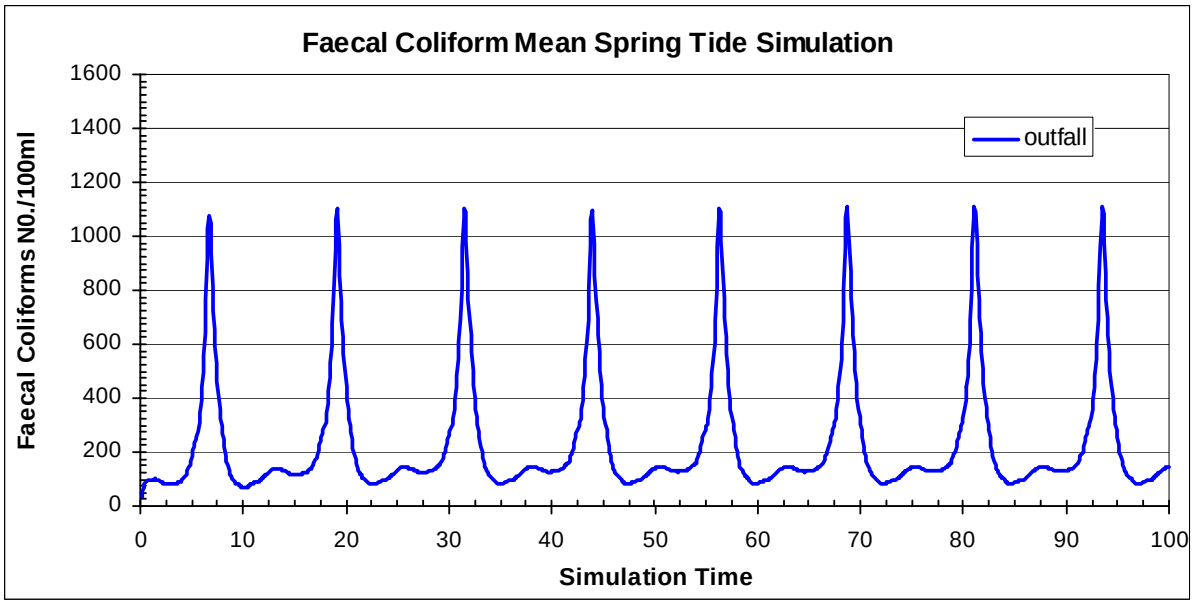
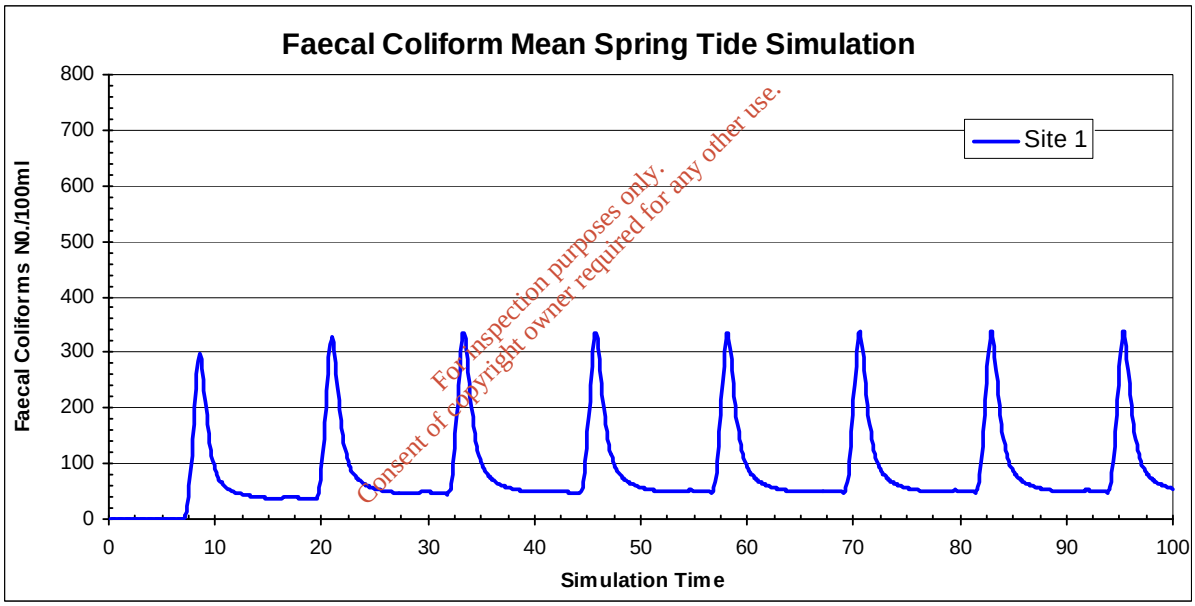
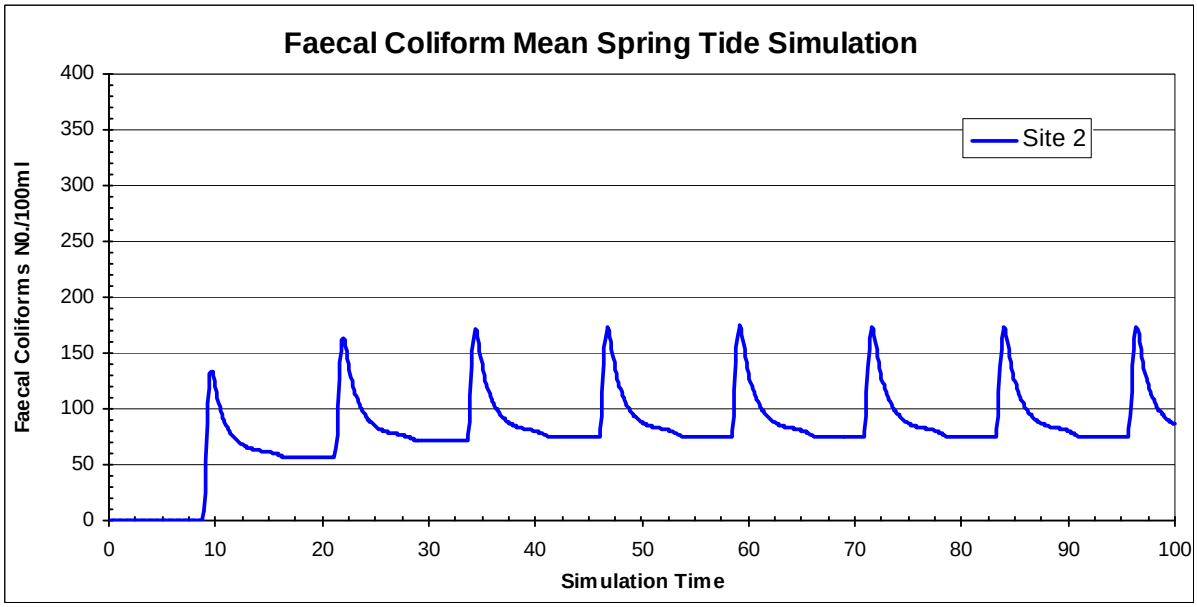
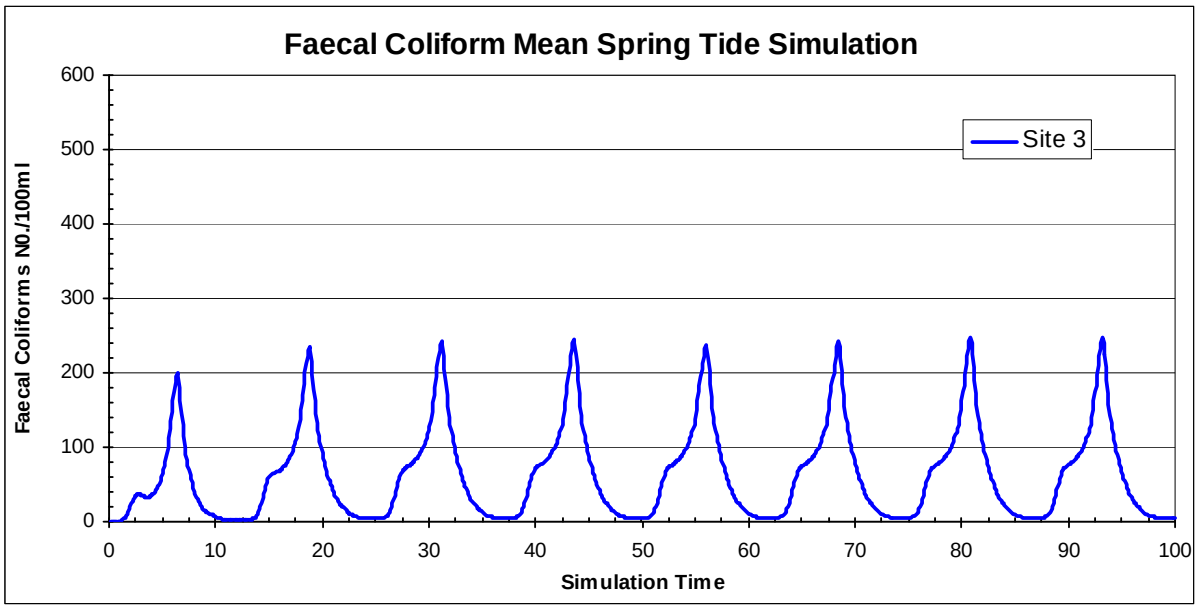


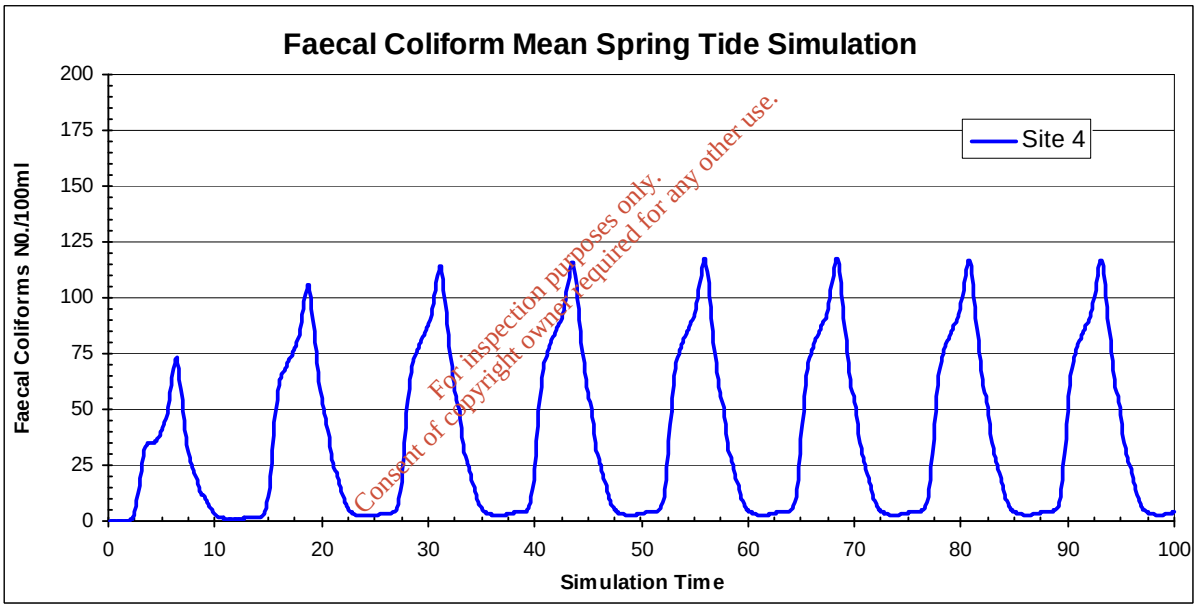
Faecal Coliform Simulation - Mid-Flood Mean Spring Tide

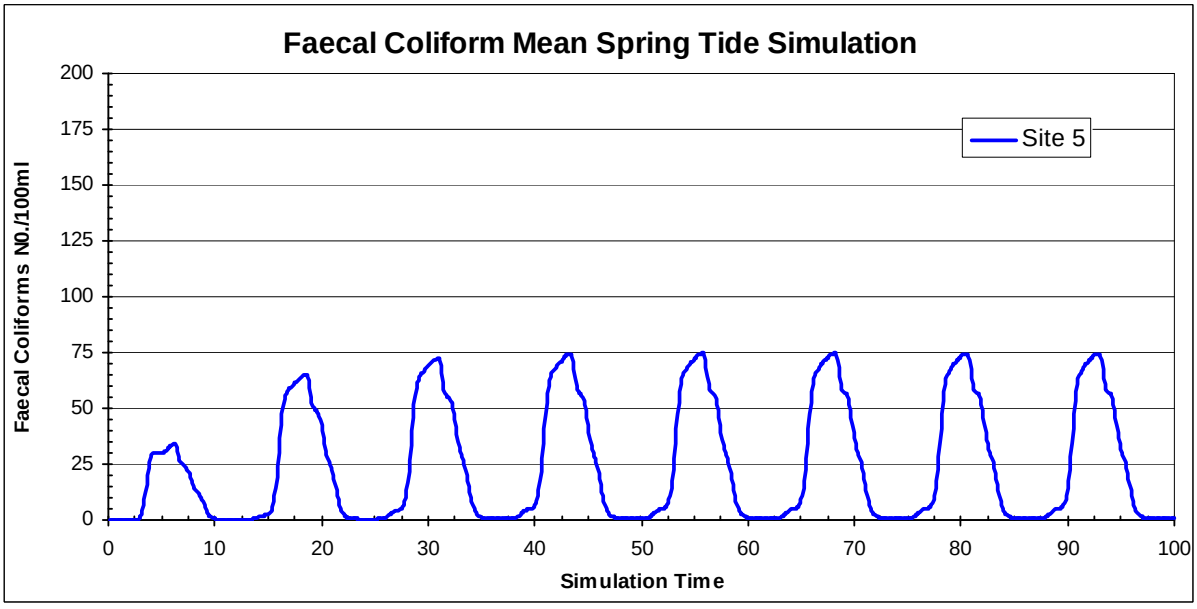


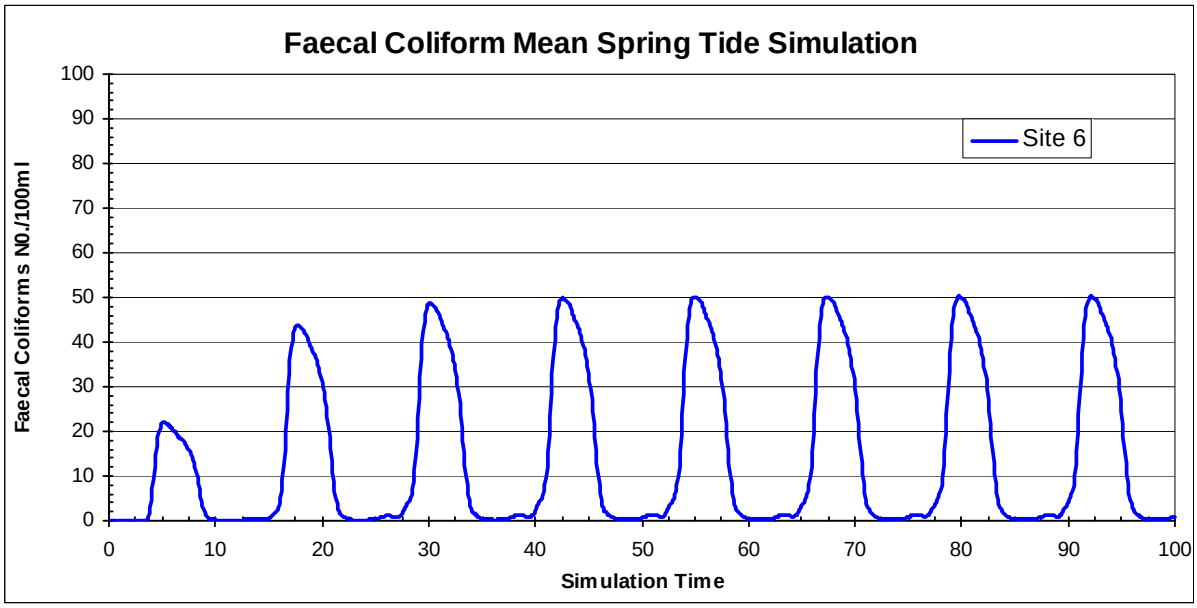


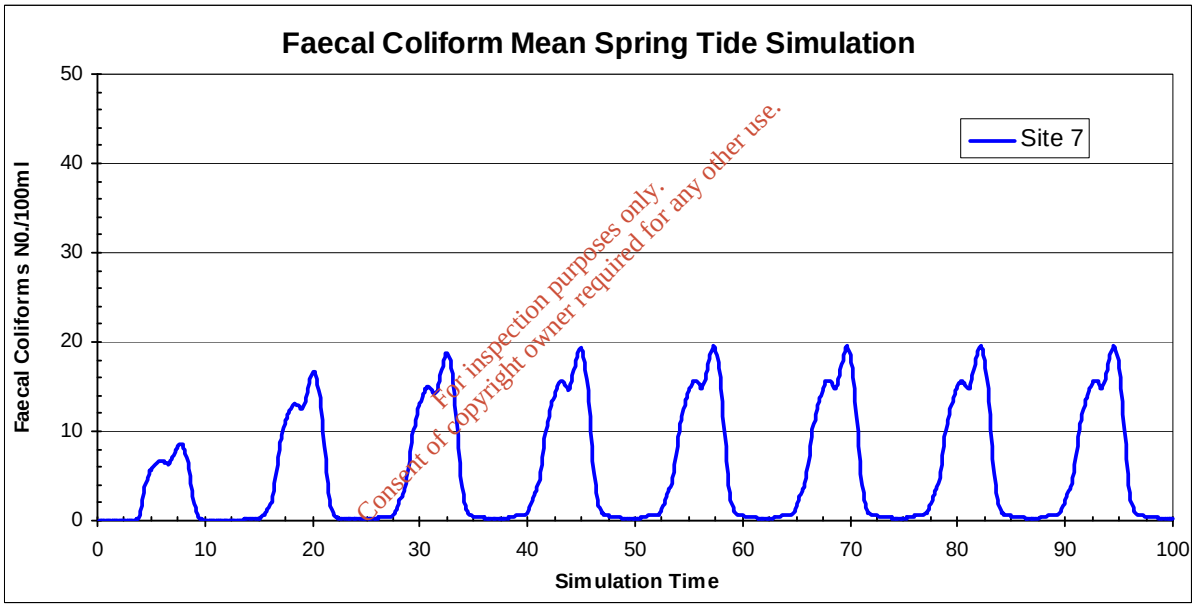


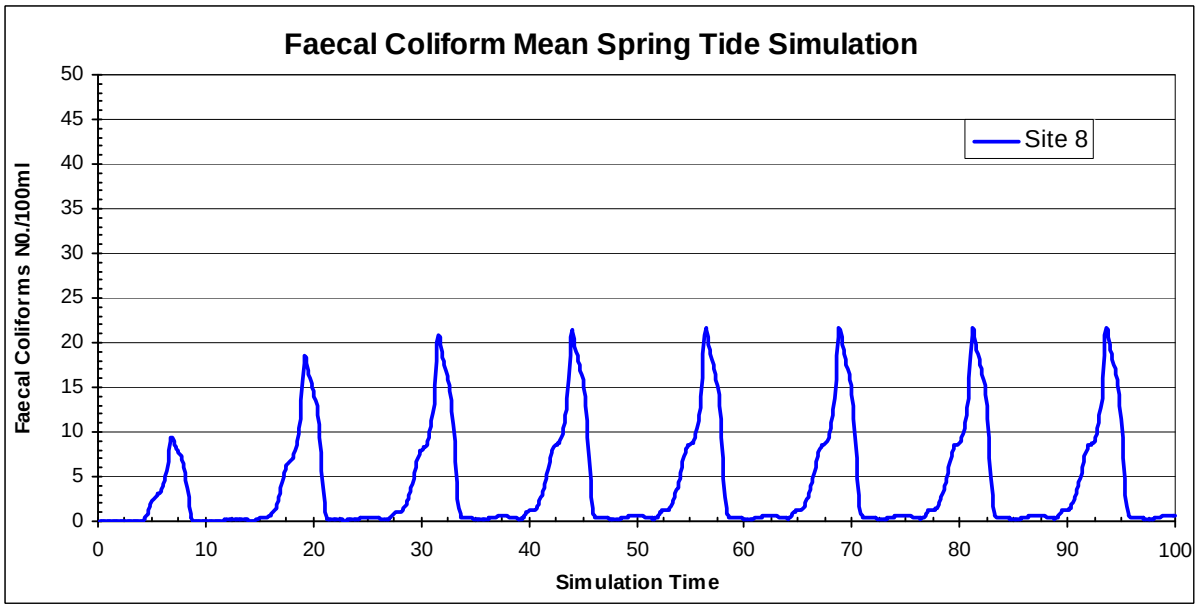


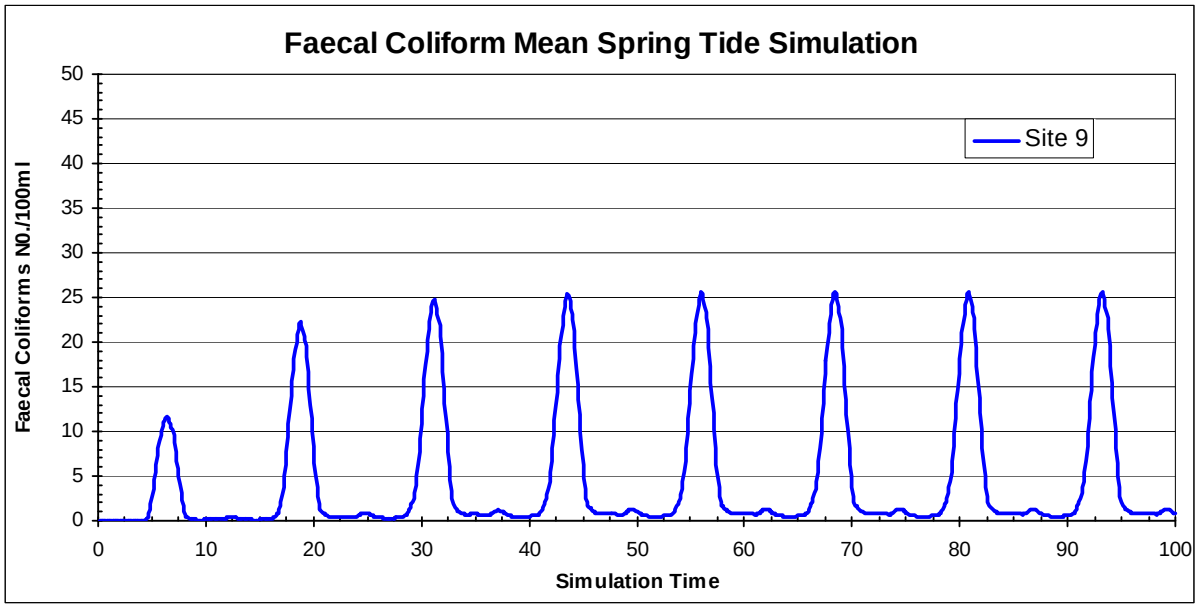


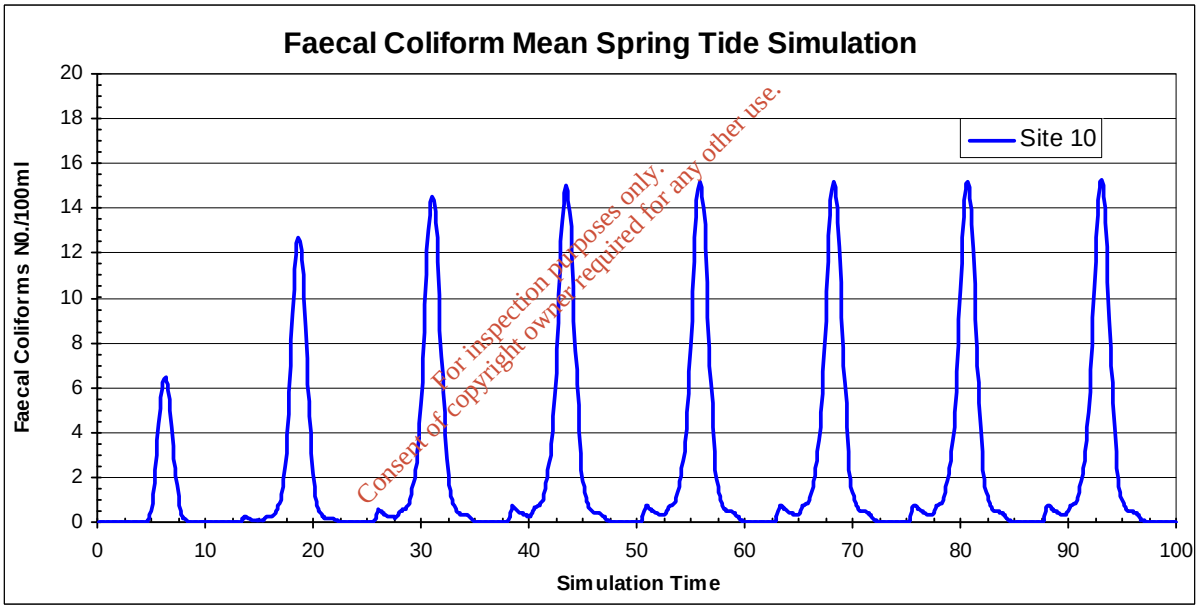


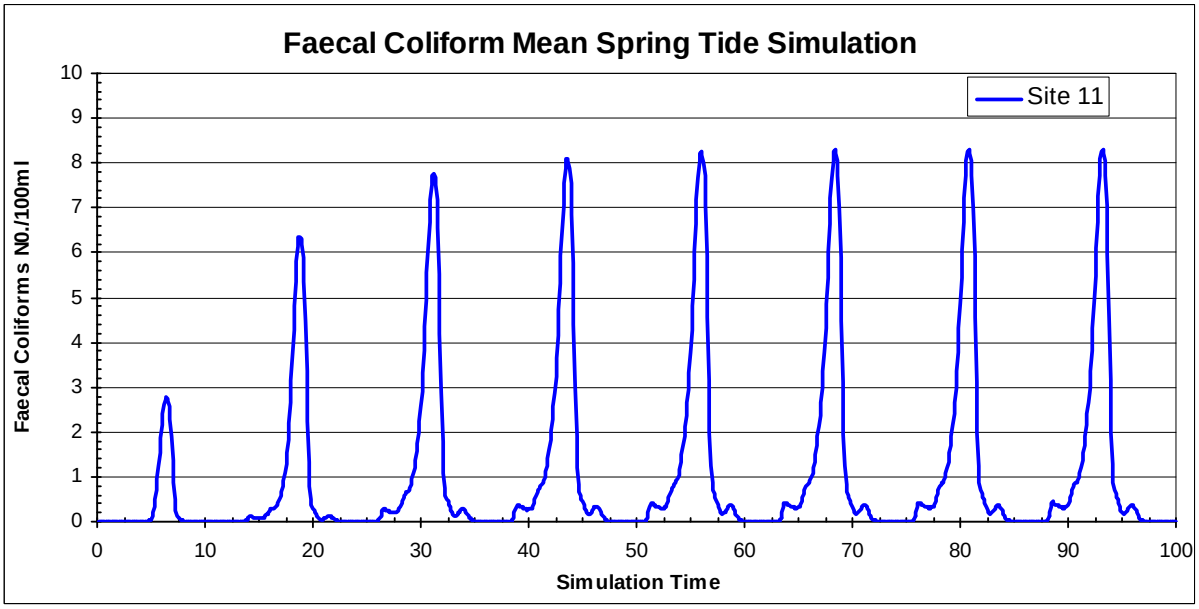




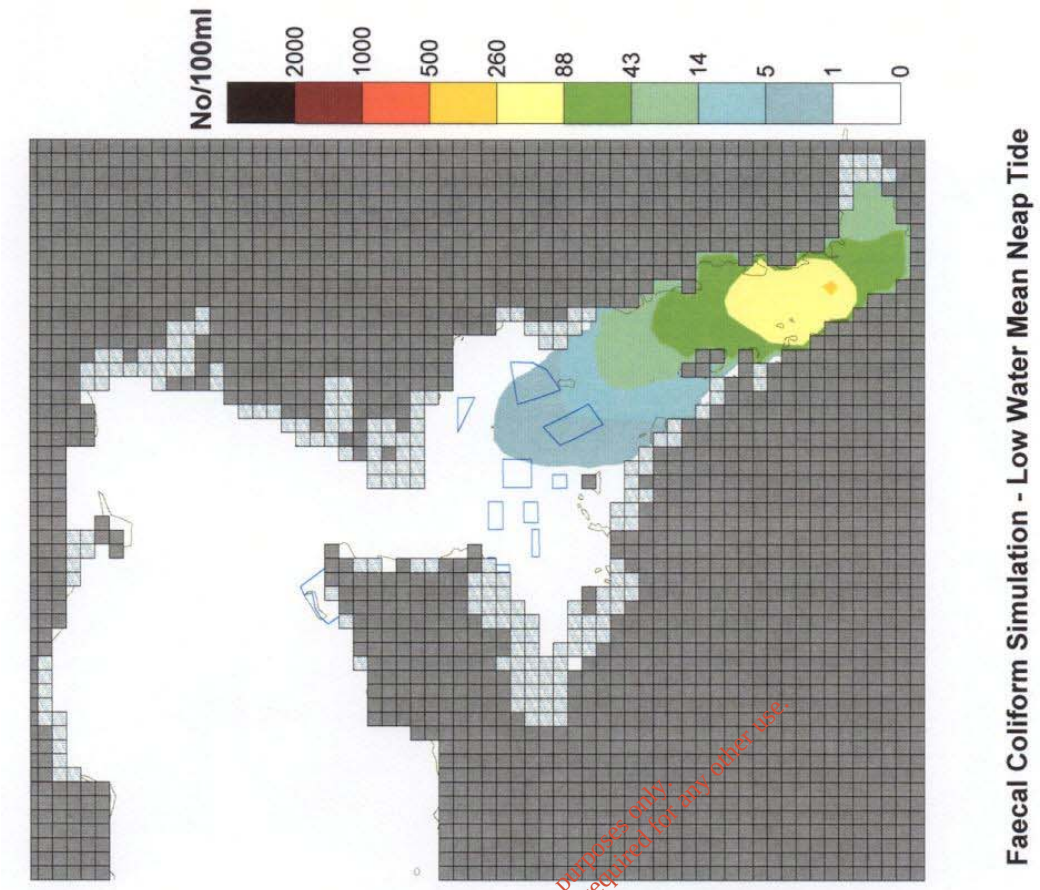




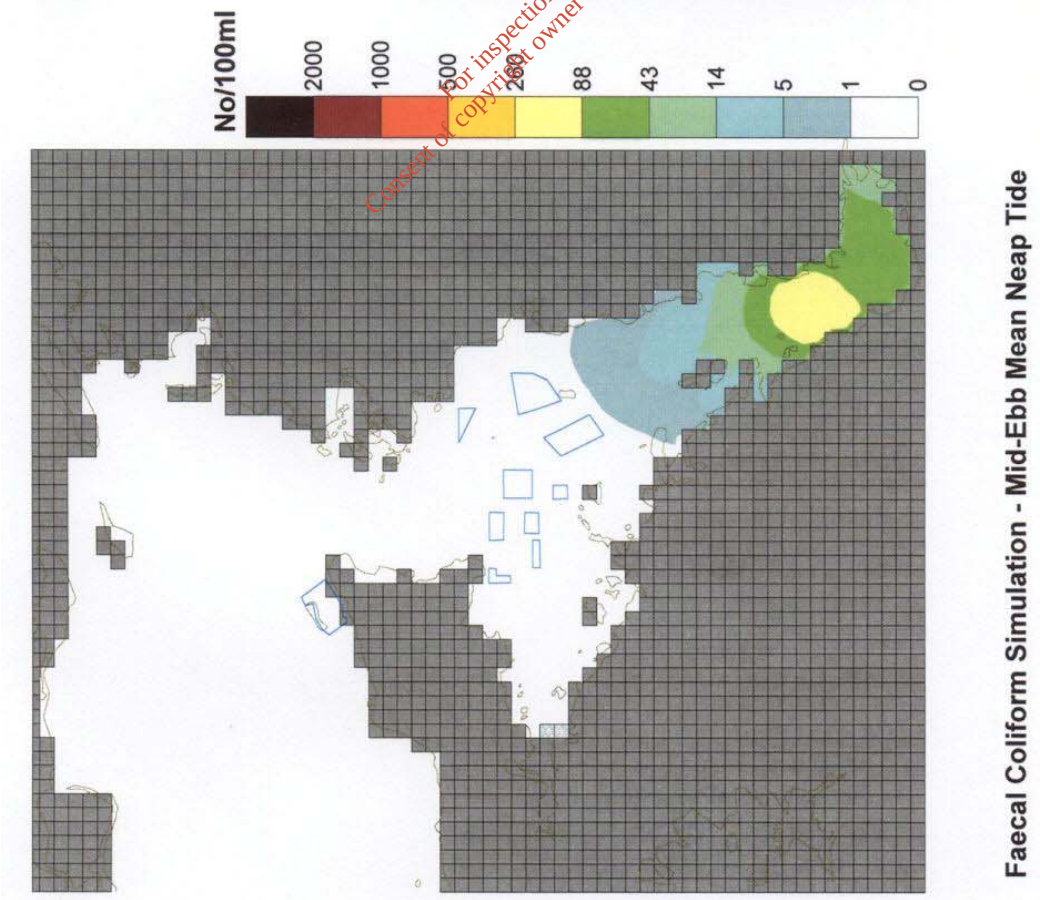




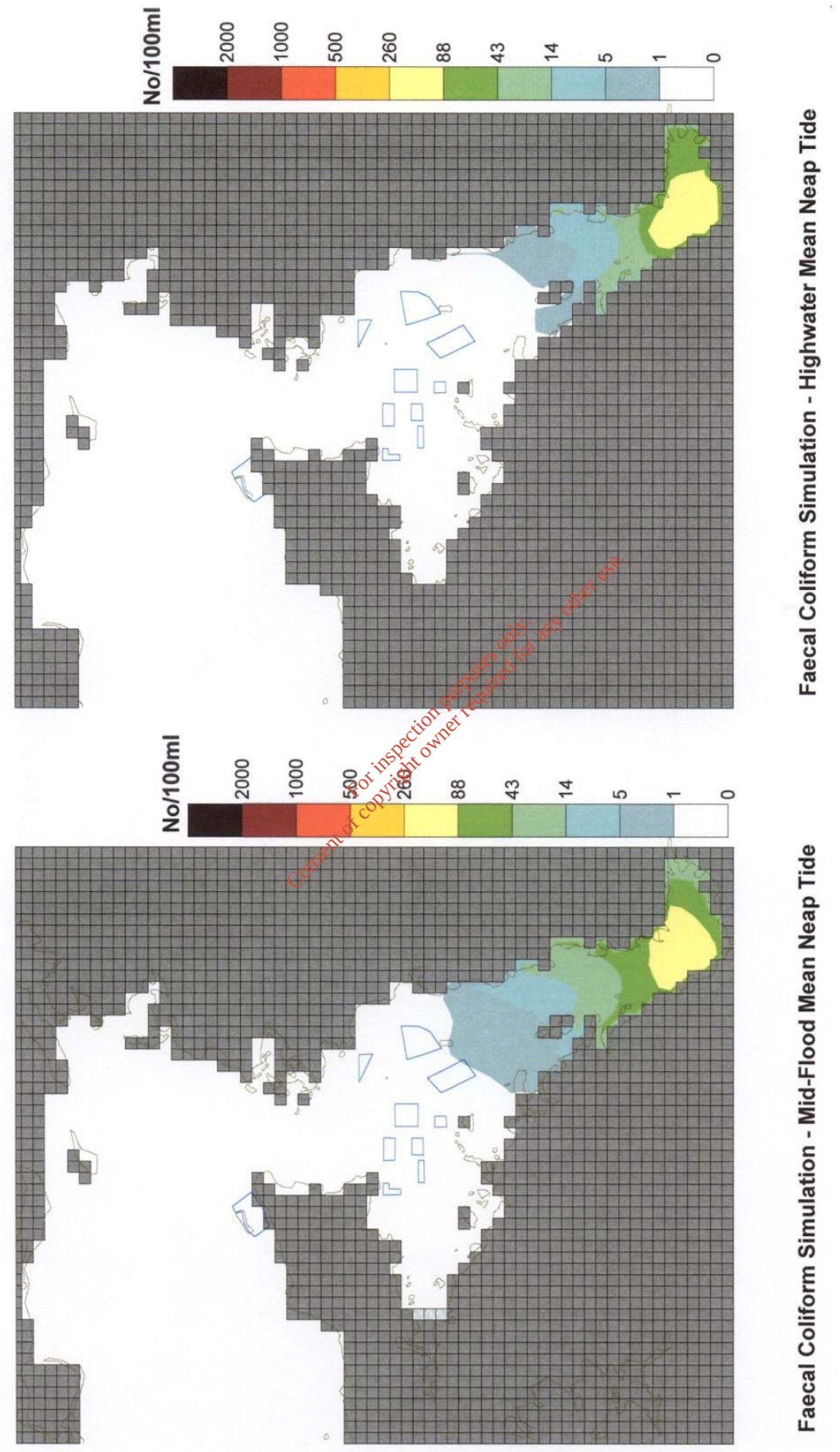
Faecal Coliform Simulation – Neap Tide

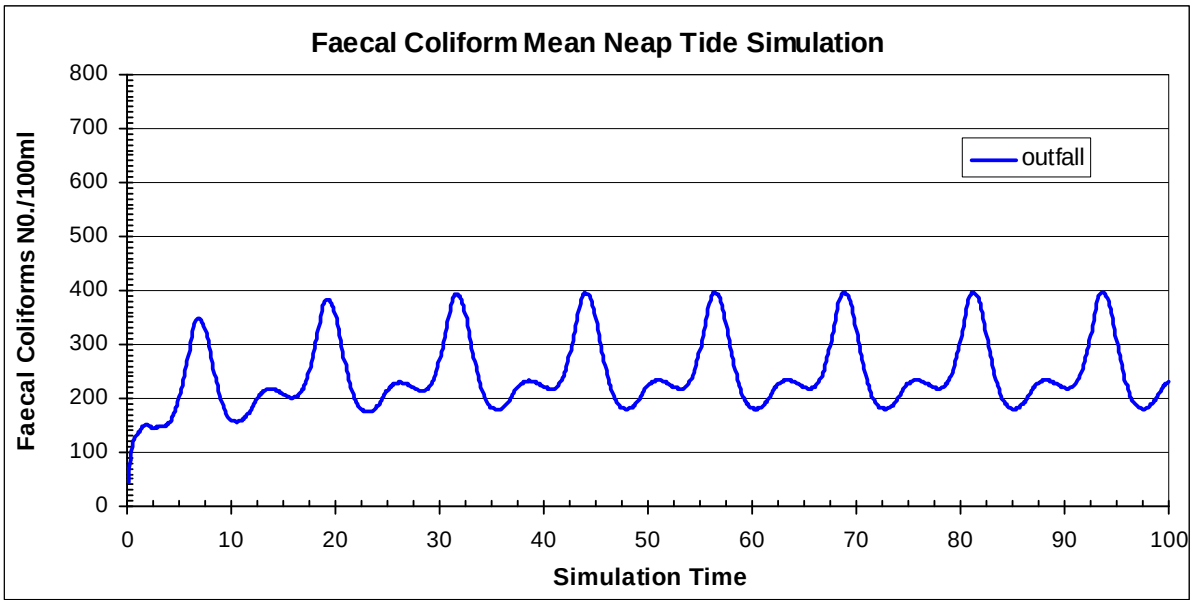


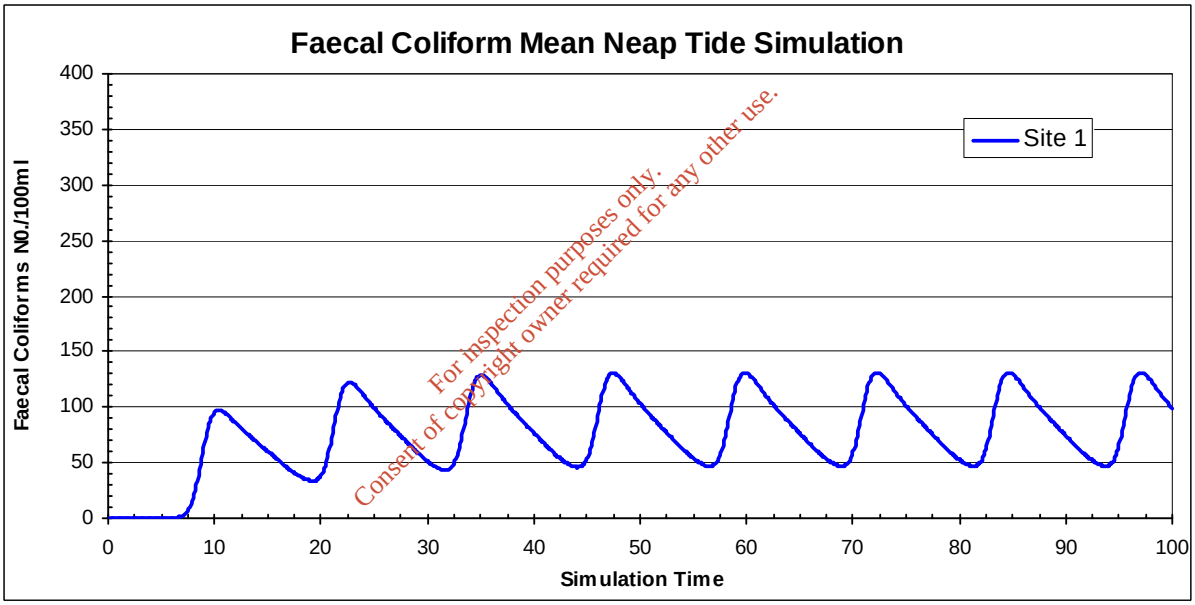
Faecal Coliform Simulation - Low Water Mean Neap Tide

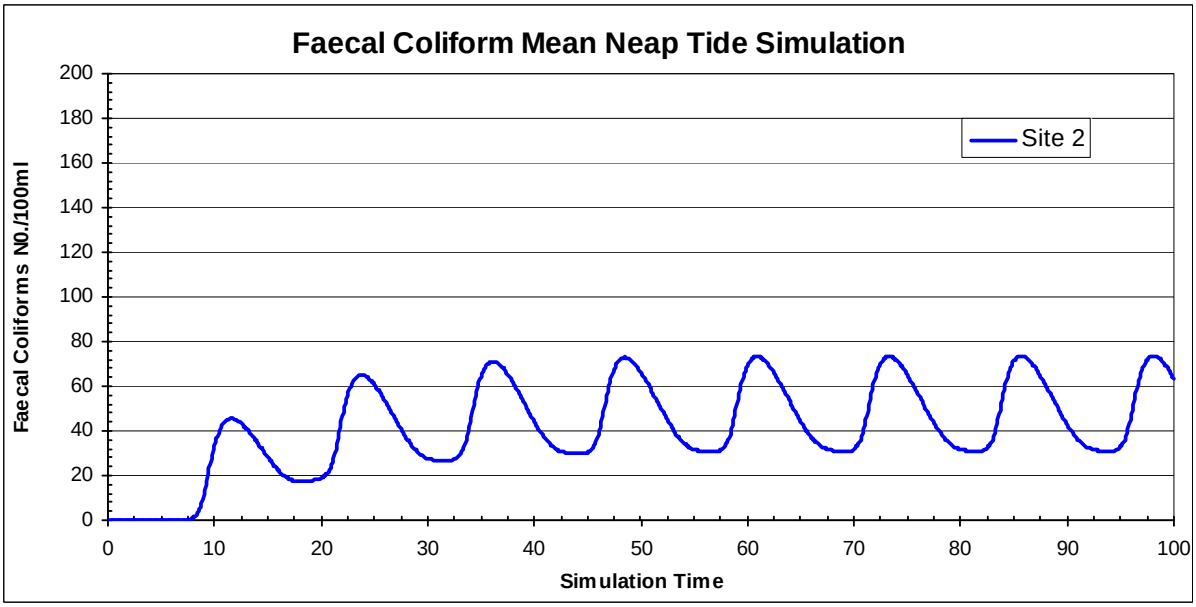


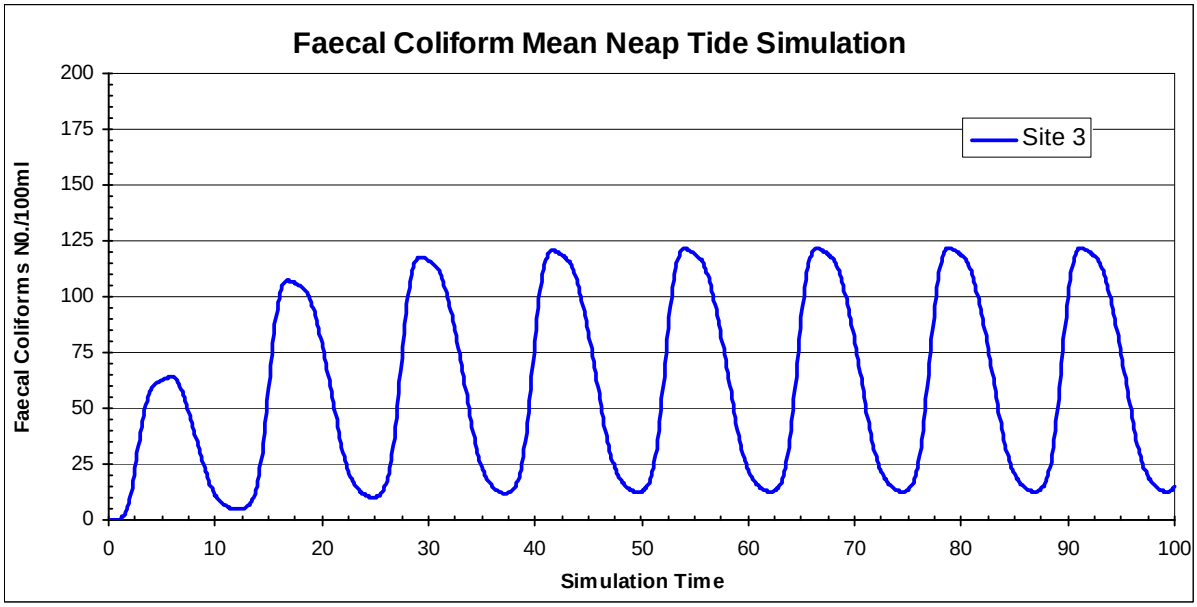
Faecal Coliform Simulation - Mid-Ebb Mean Neap Tide

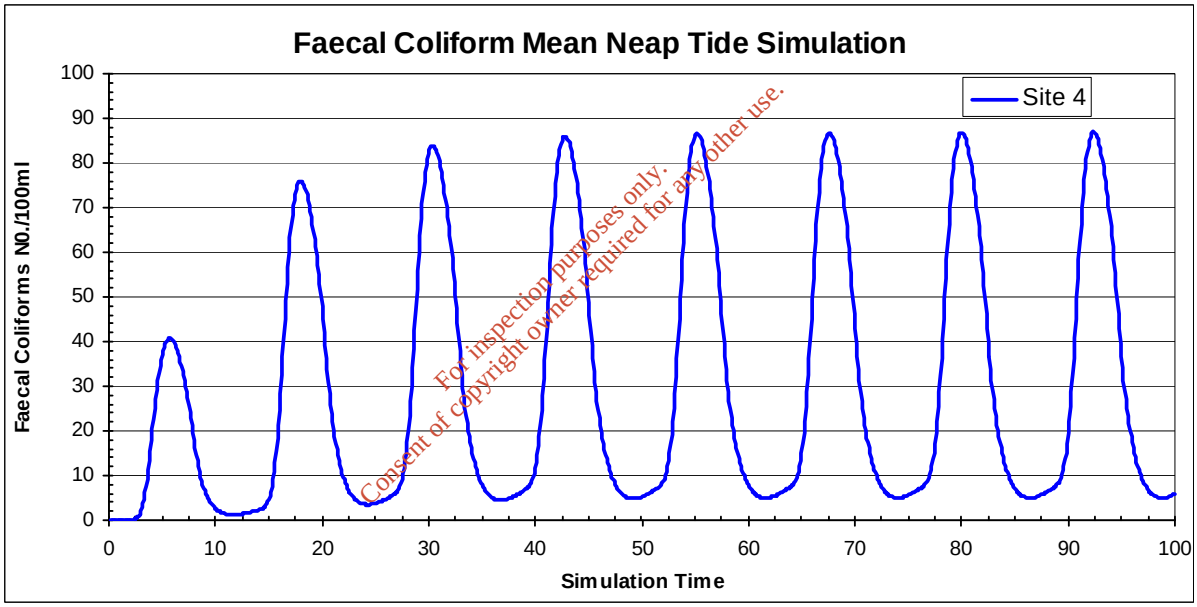


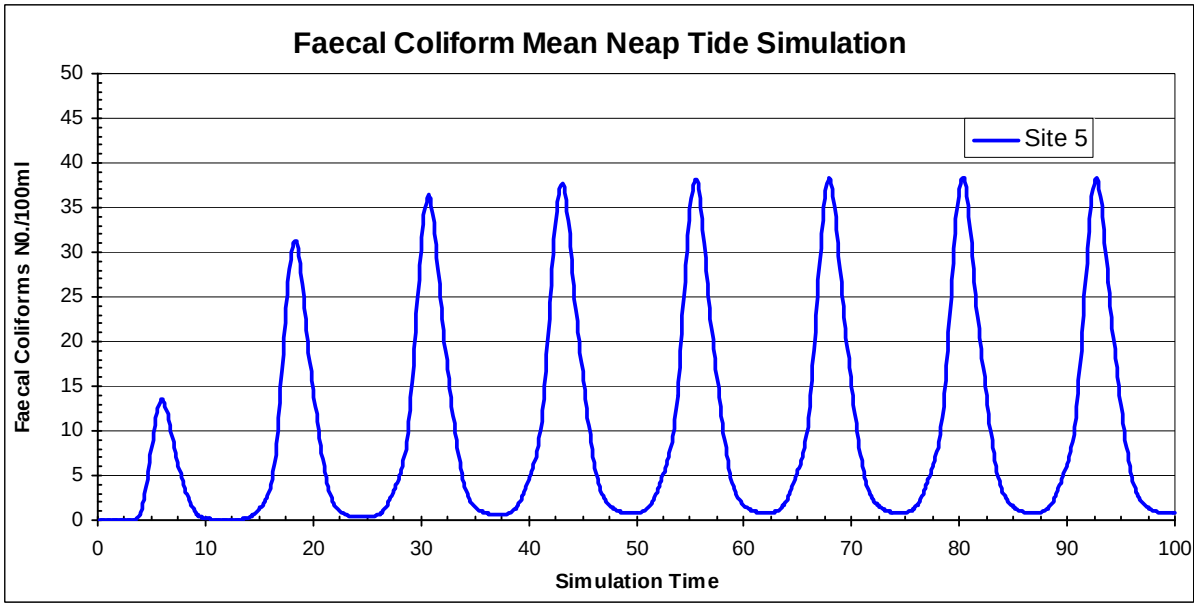


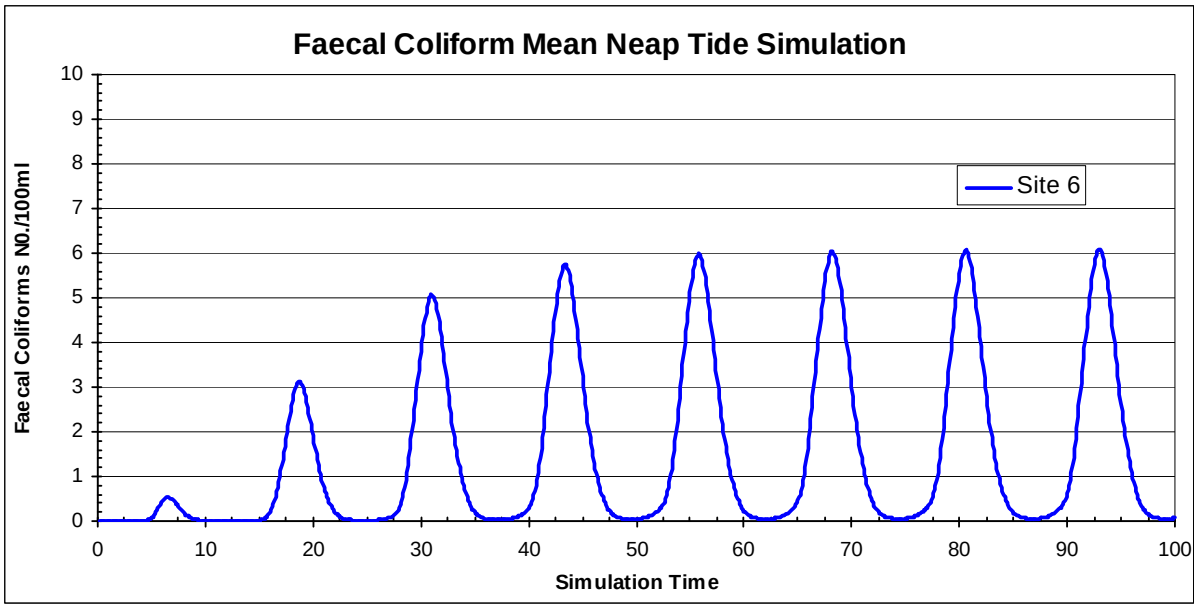


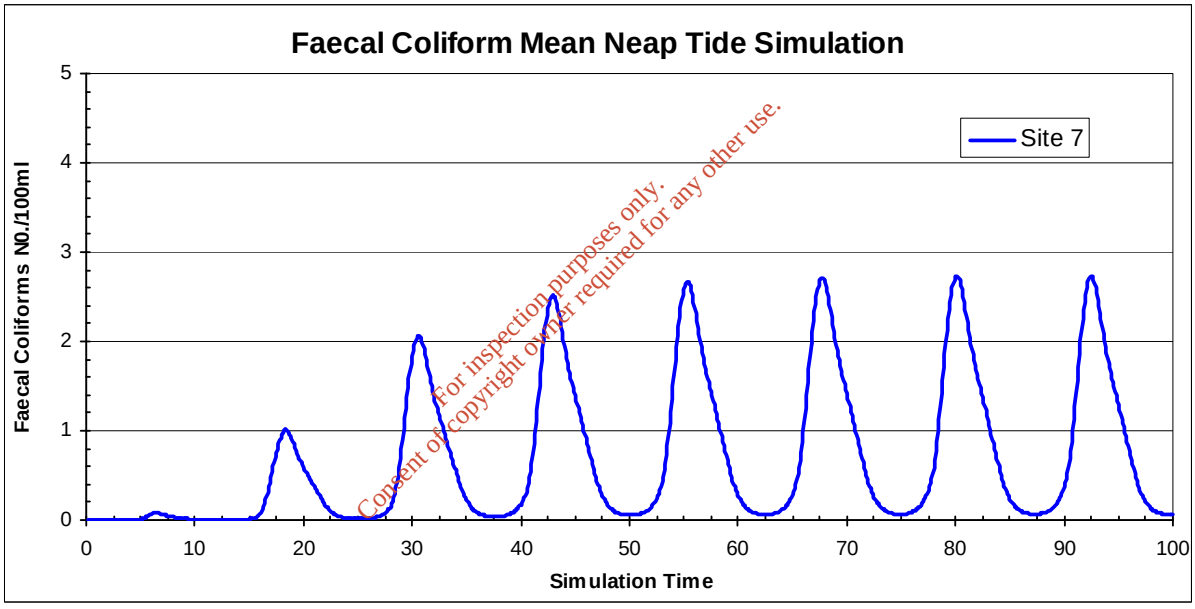


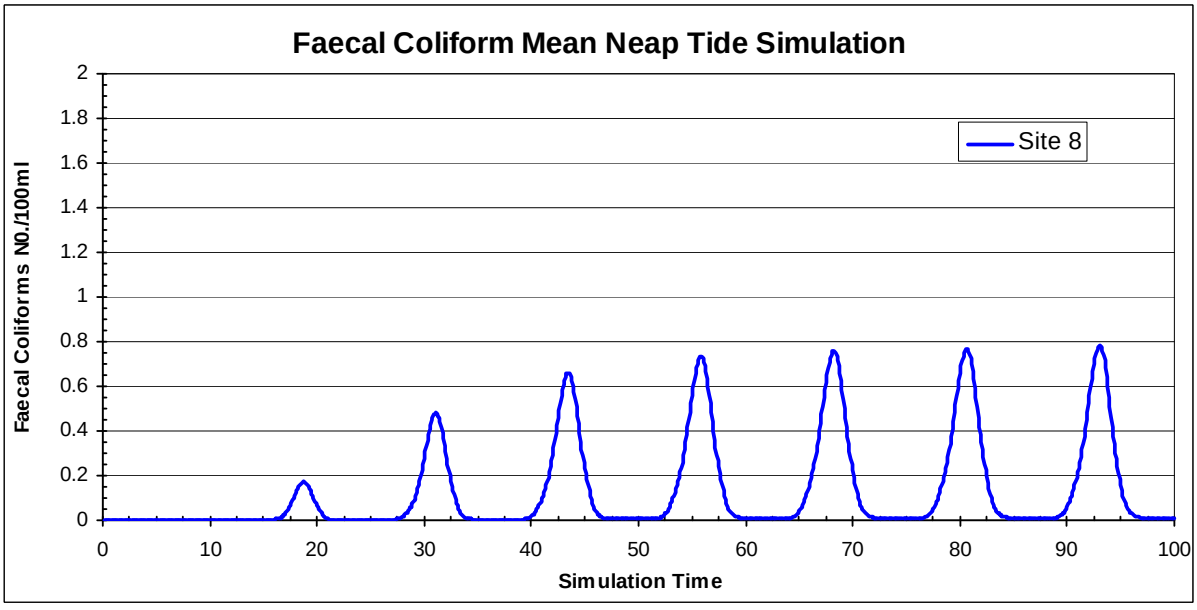


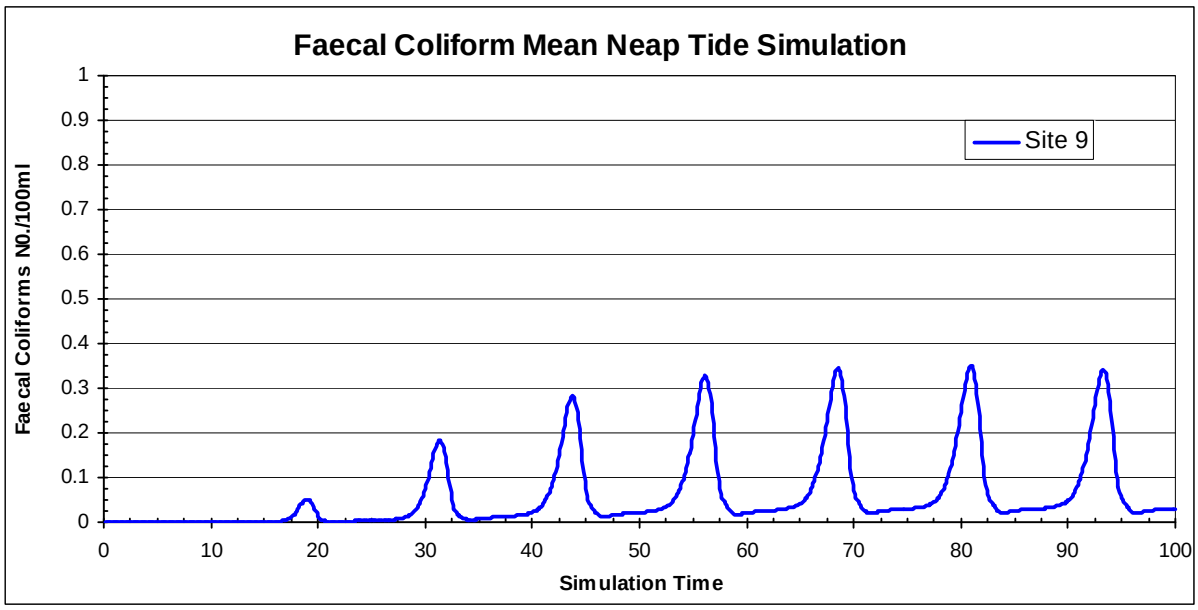


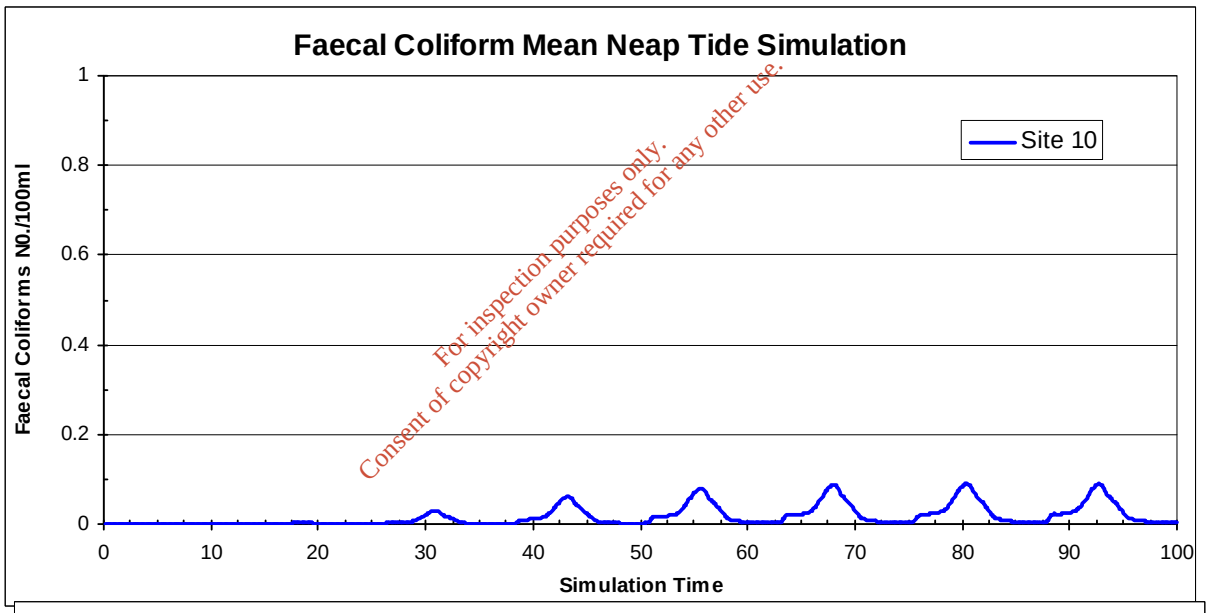


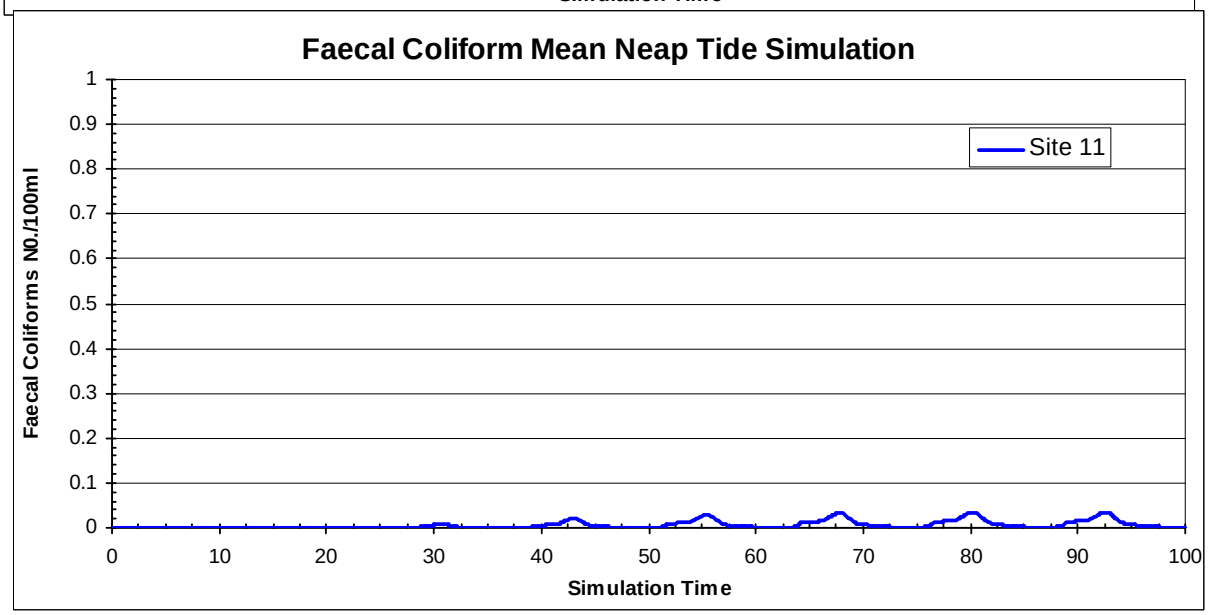




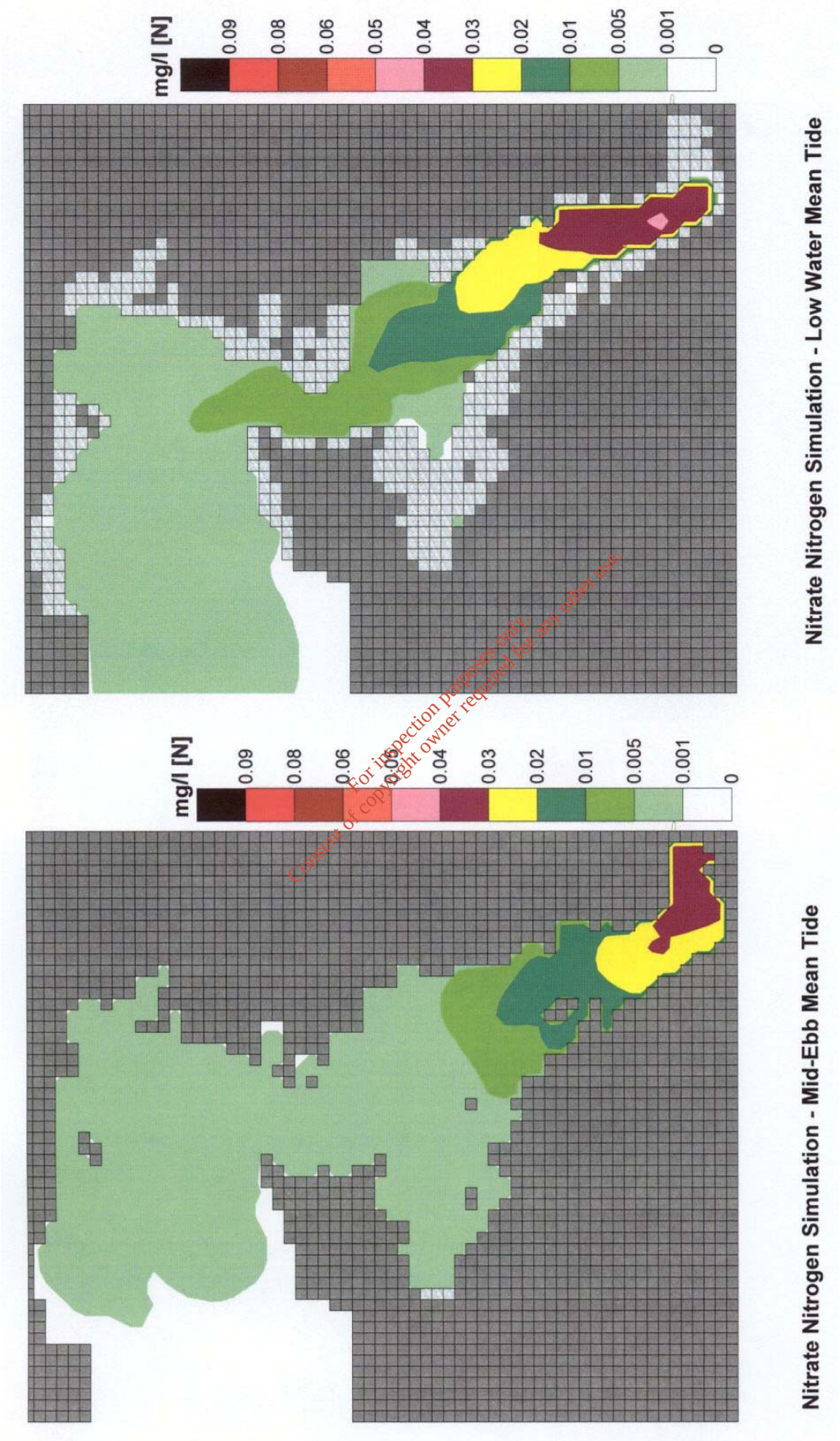


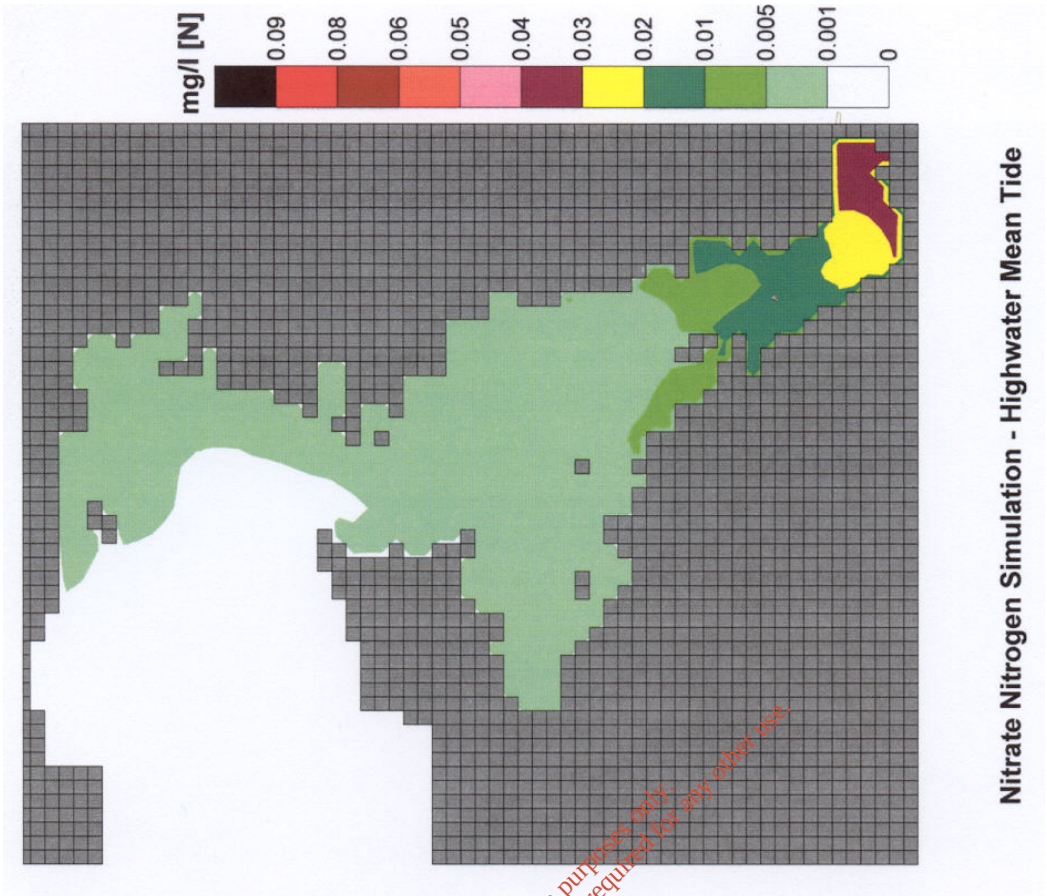


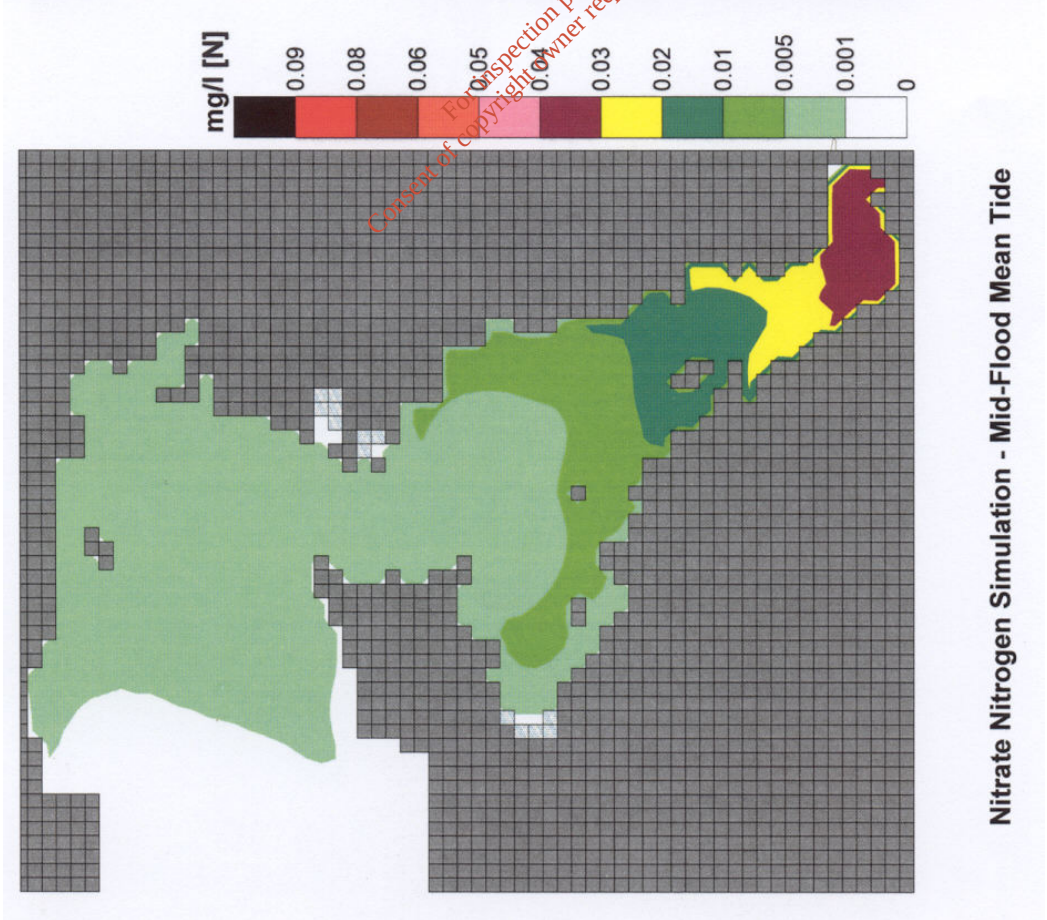


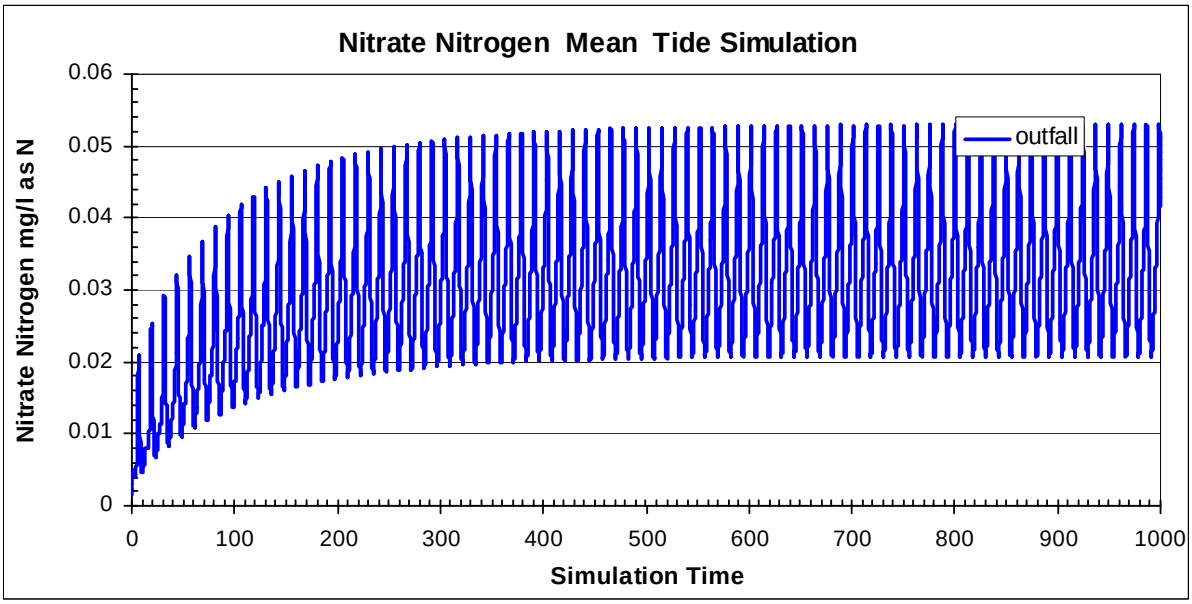


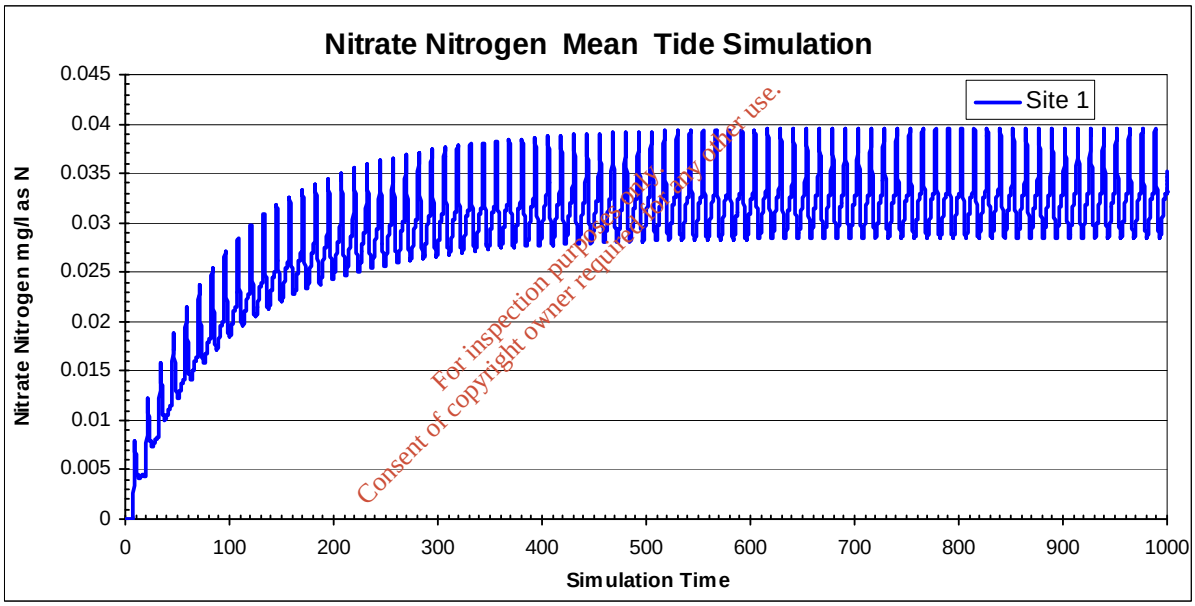
Total Nitrogen Simulation – Mean Tide

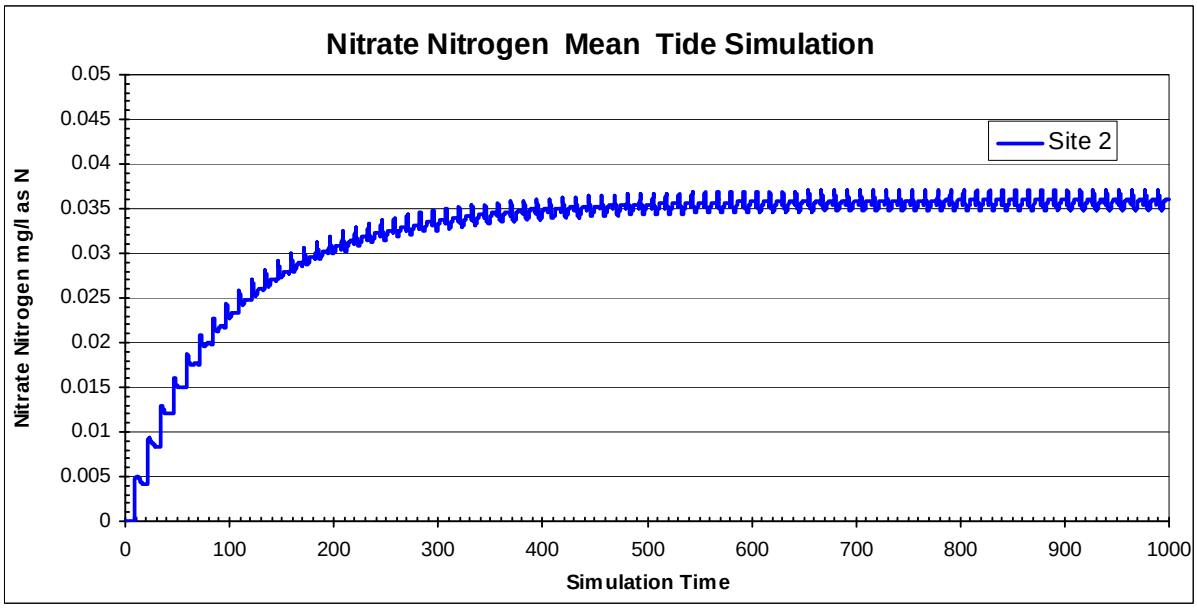


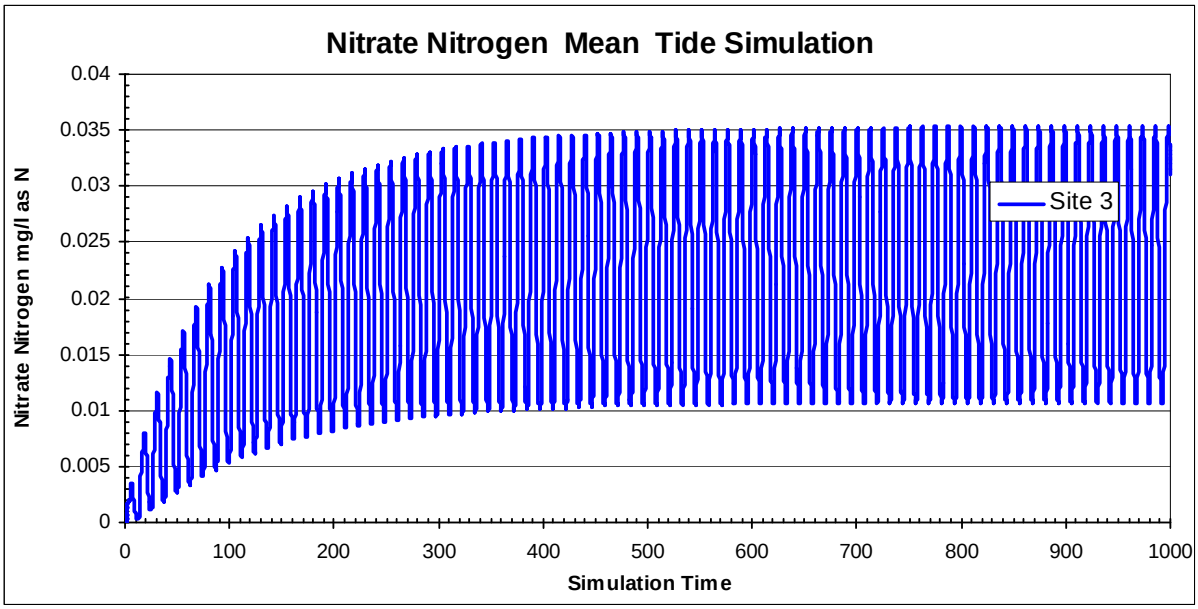


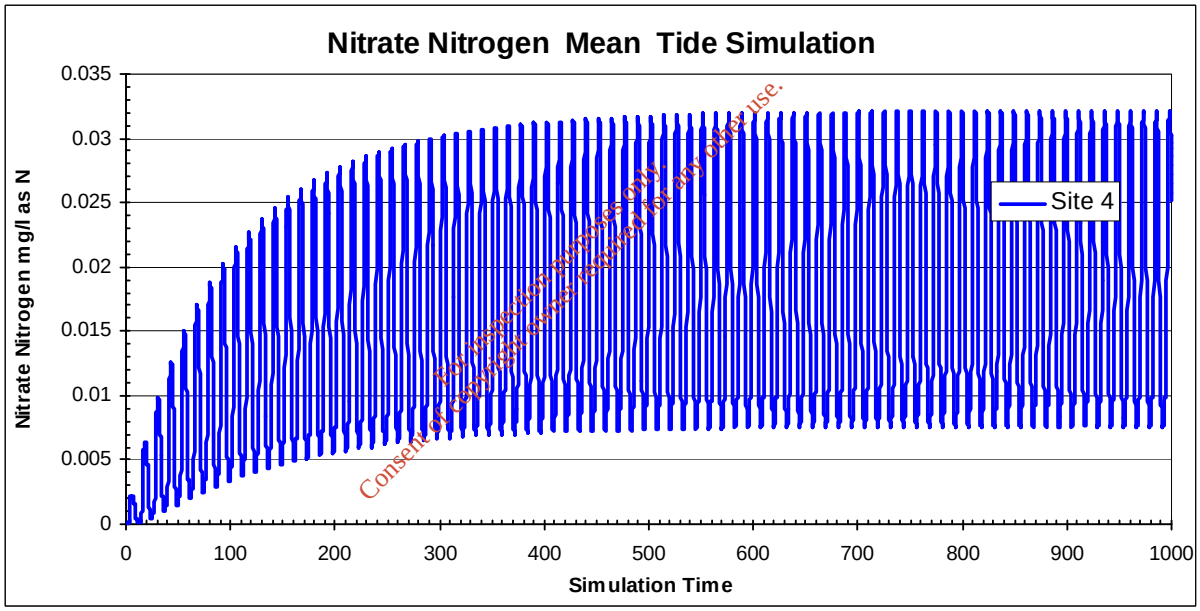


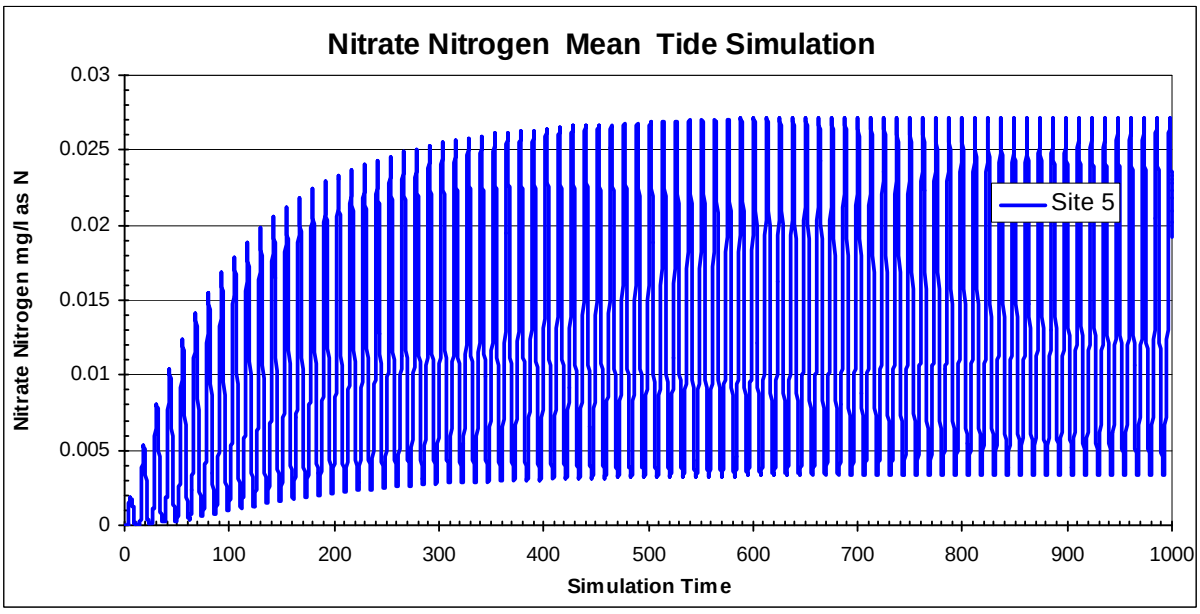


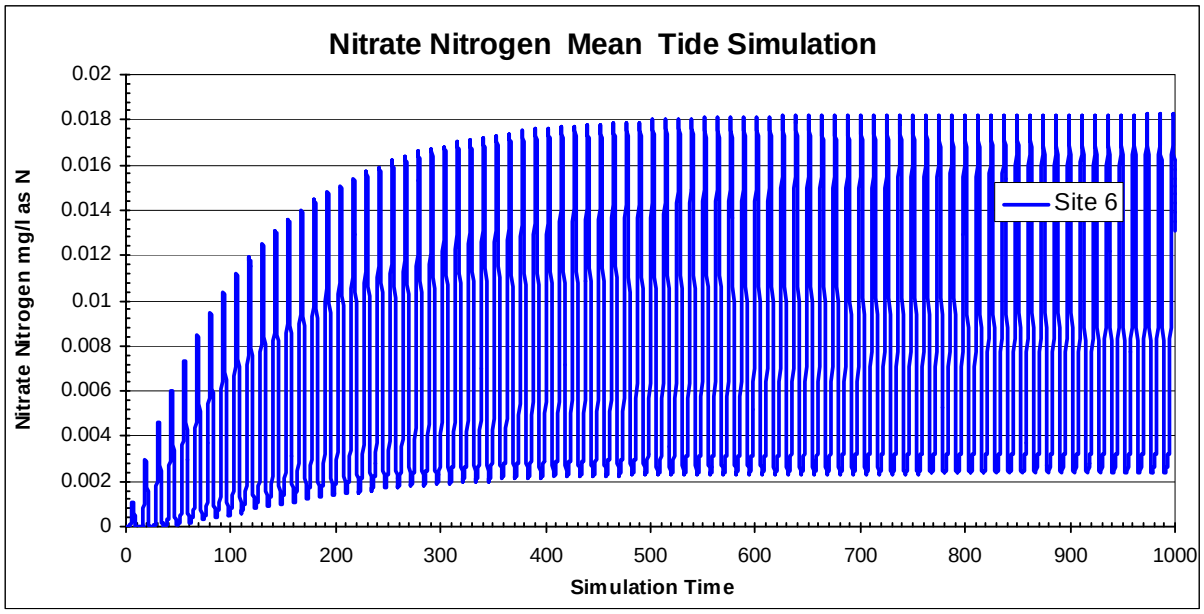


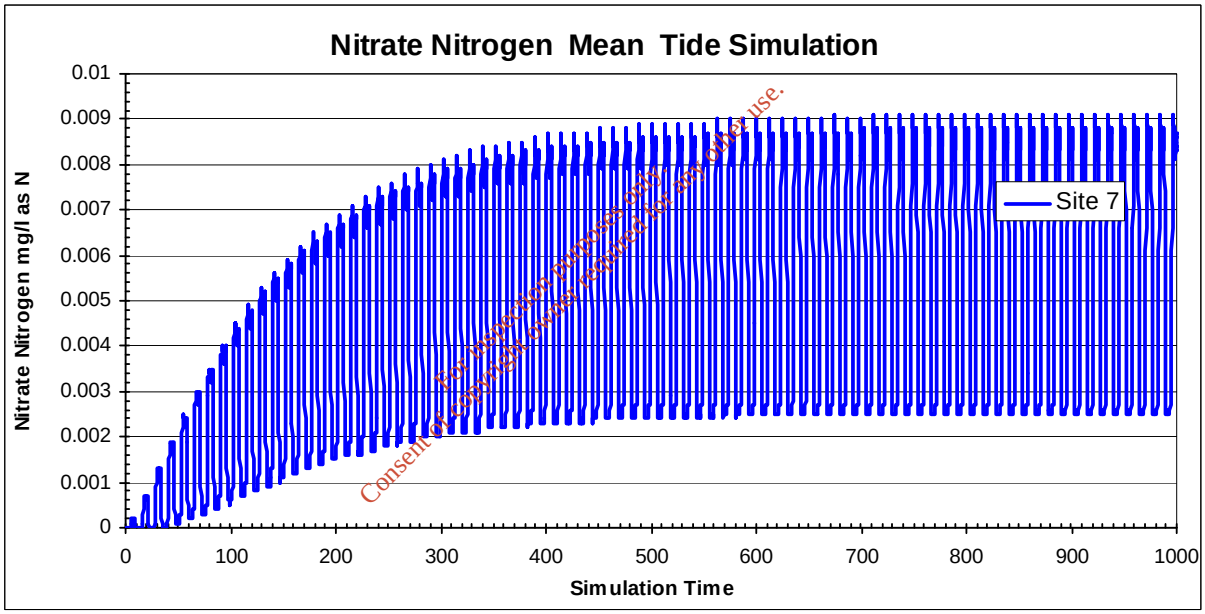


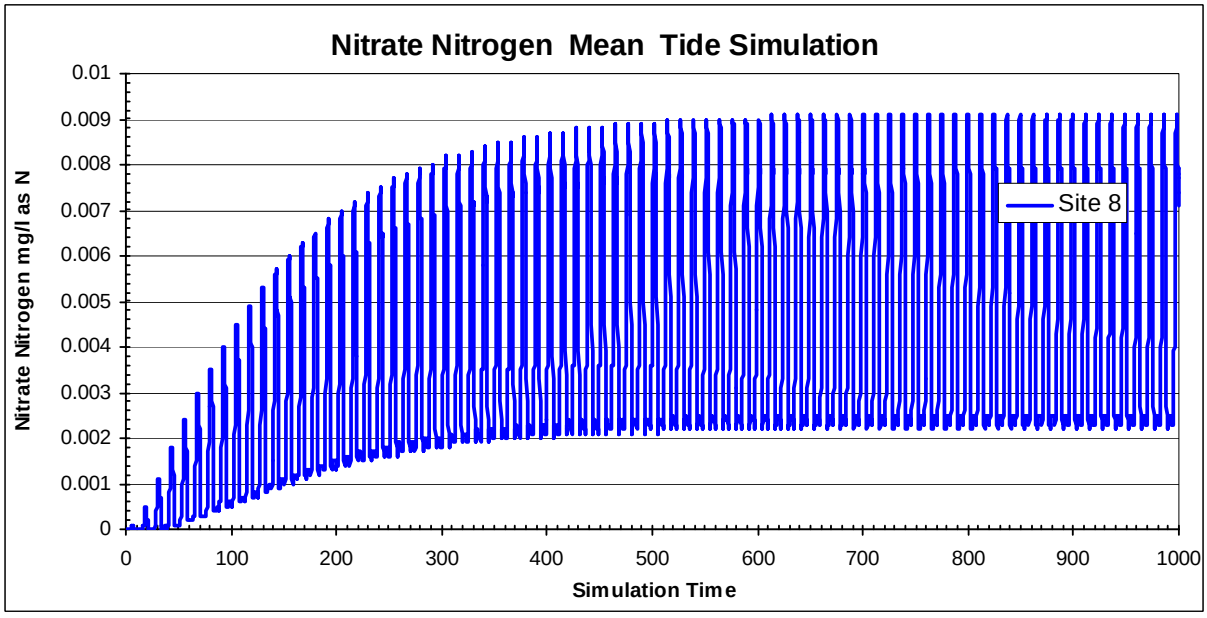


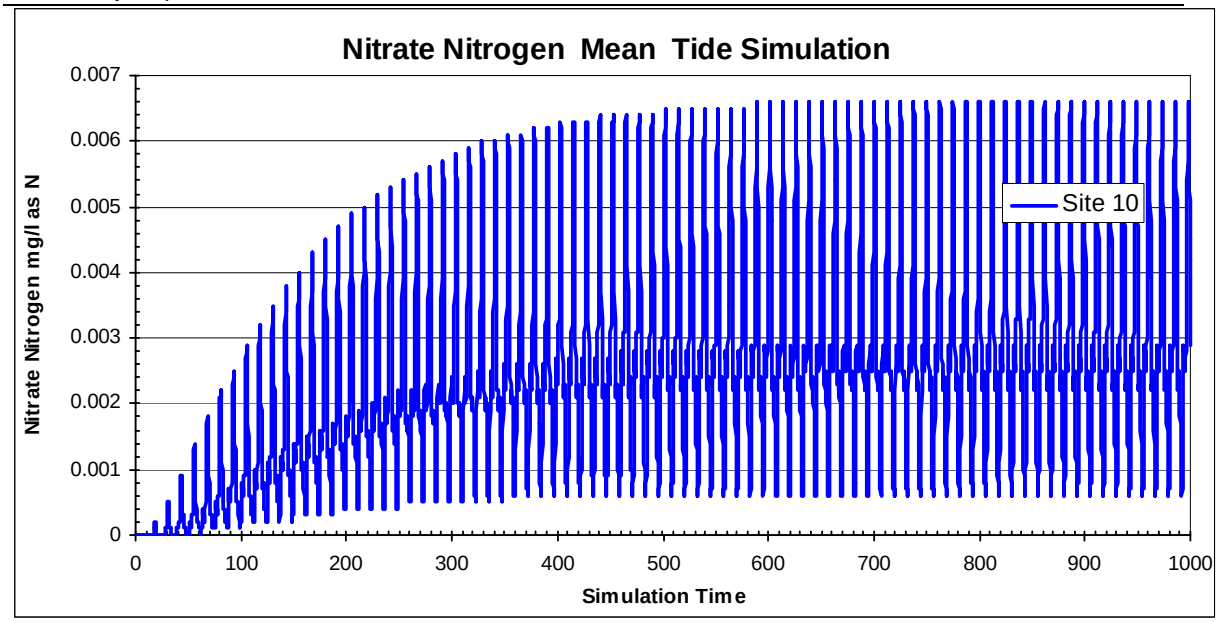


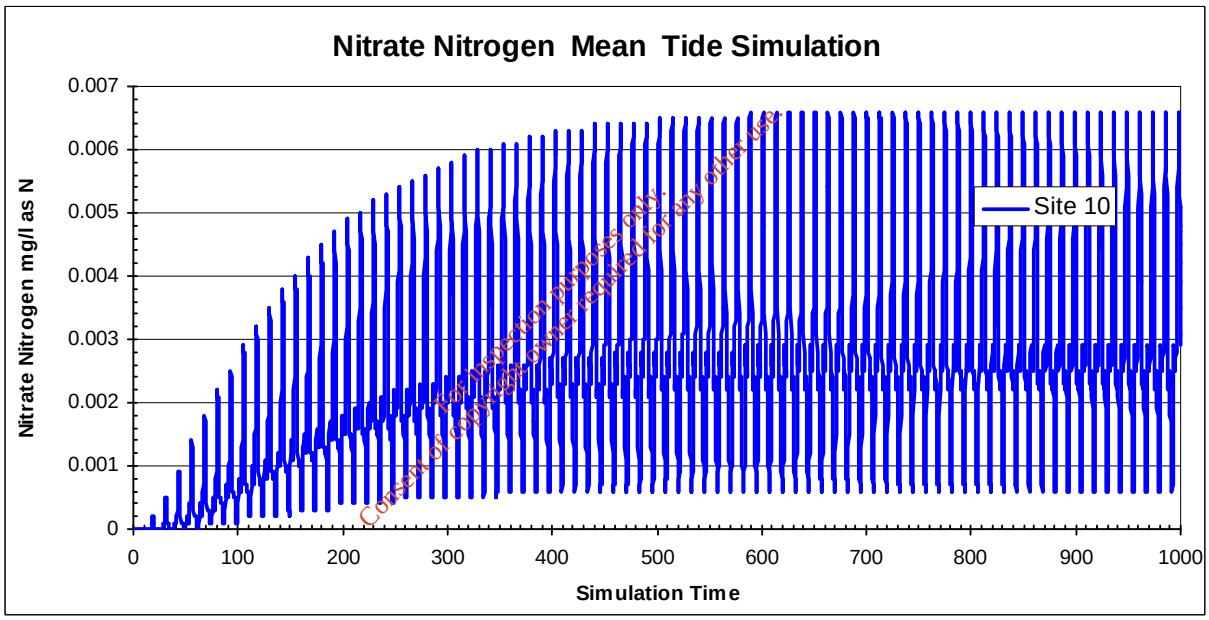


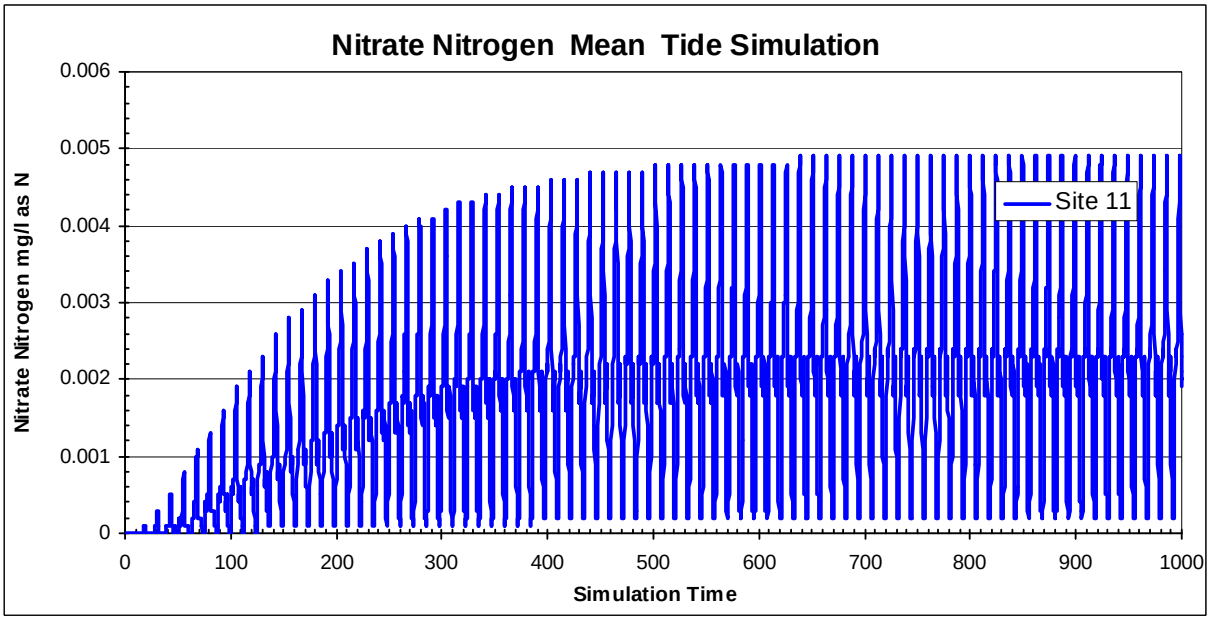












SITE SYNOPSIS

SITE NAME : GALWAY BAY COMPLEX

SITE CODE : 000268

Situated on the west coast of Ireland, this site comprises the inner, shallow part of a large bay which is partially sheltered by the Aran Islands. The Burren karstic limestone fringes the southern sides and extends into the sublittoral. West of Galway city the bedrock geology is granite. There are numerous shallow and intertidal inlets on the eastern and southern sides, notably Muckinish, Aughinish and Kinvarra Bays. A number of small islands composed of glacial deposits are located along the eastern side. These include Eddy Island, Deer Island and Tawin Island. A diverse range of marine, coastal and terrestrial habitats, including several listed on Annex I of the EU Habitats Directive, occur within the site, making the area of high scientific importance.

Galway Bay South holds a very high number of littoral communities (12). They range from rocky terraces, to sandy beaches with rock or sand dunes behind. The intertidal sediments of Galway Bay support good examples of communities that are moderately exposed to wave action. A well-defined talitrid zone in the upper shore gives way to an intertidal, mid-shore zone with sparse epifauna or infauna. On the lower, flat part of the shore, the tubes of the deposit-feeding terebellid worm, *Lanice conchilega*, are common on the surface. Nereid and cirratulid polychaete worms (*Hediste diversicolor*, *Arenicola marina*), small crustaceans and bivalves (*Angulus tenuis*, *Cerastoderma edule* and *Macoma balthica*) are present. The area has the country's only recorded example of the littoral community characterized by *Fucus serratus* with sponges, ascidians and red seaweeds on tide-swept lower eulittoral mixed substrata. This community has very high species richness (85 species), as do the sublittoral fringe communities on the Finavarra reef (88 species). The rare sea urchin *Paracentrotus lividus* and the foliose red alga *Phyllophora sicula* are present at Finavarra, whereas the red alga *Rhodymenia delicatula* and the rare brown alga, *Ascophyllum nodosum* var. *mackii,* occur in Kinvara and Muckinish Bays. Sublittorally, the area has a number of distinctive and important communities. Of particular note is that Ireland's only reported piddock bed thrives in the shallows of Aughinish Bay. The rare sponge, *Mycale contarenii,* is also found here. There is further interest in an extensive maerl bed of *Phymatolithon calcareum* which occurs in the strong tidal currents of Muckinish Bay. There is also maerl off Finavarra Point and in Kinvara Bay (*Lithothamnion corallioides*, *Lithophyllum dentatum* and *Lithophyllum fasciculatum*). An oyster bed in Kinvara Bay and seagrass (*Zostera* spp.) beds off Finavarra Point are also important features. Other significant habitats which occur include secondary maerl beds and communities strongly influenced by tidal streams.

Salt marshes are frequent within this extensive coastal site, with both Atlantic and Mediterranean marshes well represented. Most of the salt marshes are classified as the bay type, with the substrate being mud or mud/sand. There is one lagoon type and

one estuary type. Lagoon salt marshes are the rarest type found in Ireland. The best examples of salt marsh are located in inner Galway bay, east of a line running between Galway city and Kinvara. In this area the coastline is highly indented, thus providing the sheltered conditions necessary for extensive salt marsh development. Common salt marsh species include Thrift *(Armeria maritima),* Red Fescue *(Festuca rubra),* Common Scurvygrass *(Cochlearia officinalis),* Sea Lavender *(Limonium humile),* Common Saltmarsh-grass *(Puccinellia maritima),* Saltmarsh Rush *(Juncus gerardii)* and Sea Rush *(Juncus maritimus*). On the lower levels of the salt marshes and within pans there occurs Glasswort *(Salicornia europaea* agg.*).* A noteworthy feature of the salt-marsh habitat within this site is the presence of dwarfed brown seaweeds in the vegetation. These are also known as "turf fucoids" and typical species include *Fucus* spp., *Ascophyllum nodosum* and *Pelvetia canaliculata*. A number of locally rare vascular plant species also grow in salt-marsh areas within the site. These include *Puccinellia distans* and Sea Purslane (*Halimione portulacoides)*, which are both relatively rare in the western half of the country.

Shingle and stony beaches can be found throughout the site, with the best examples along the more exposed shores to the south and west of Galway city and to the north and east of Finnavara, Co. Clare. In general, these shingle shorelines are sparsely vegetated and frequently occur interspersed with areas of sandy beach and/or bedrock shore. The associated flora is dominated by plant species of frequently disturbed maritime habitats. To the south and west of Galway city, typical plants include Curled Dock (*Rumex crispus),* Common Couch *(Elymus repens),* Sea Sandwort *(Honkenya peploides),* Sea Beet *(Beta vulgaris),* Scentless Mayweed *(Matricaria maritima),* Silverweed *(Potentilla anserina)* and *Atriplex* spp.. Two rare plant species are associated with the habitat: Fat Hen (*Hyoscyamus niger),* a threatened species listed in the Irish Red Data Book, grows on shingle beach to the south of Lough Atalia; there are also old records for the threatened plant species Sea Kale (*Crambe maritima).*

An excellent range of lagoons of different types, sizes and salinities occurs within the site. This habitat is given priority status on Annex I of the Habitat Directive. One unusual type of lagoon, karstic rock lagoon, is particularly well represented. This type of lagoon is common on the Aran Islands, but on mainland Ireland, all but one are confined to this one site including the best example of all karstic lagoons in the country (Lough Murree). The flora of the habitat is rich and diverse, reflecting the range of salinities in the different lagoons, and typically brackish with two species of Tasselweed (*Ruppia spp.)*, two Red Data charophytes *Chara canescens* and *Lamprothamnion papulosum*, and *Chaetomorpha linum* (all lagoonal specialists). The fauna of the lagoon is also rich, diverse and lagoonal. At least 10 lagoonal specialist species were recorded in 1996 and 1998 from the combined habitat of all the lagoons which is one of the highest number for any lagoonal habitat in the country. Many of the species appear to be rare. The lagoons within this site are an excellent representative of the habitat type and of high conservation importance.

Other terrestrial habitats within this site which are of conservation importance include Saw Sedge (*Cladium mariscus*)-dominated fen and Black Bog-rush (*Schoenus nigricans*)-dominated alkaline fen at Oranmore, a turlough of moderate size at Ballinacourty, limestone pavement mainly along the southern shore, dry calcareous

grassland with orchids (best examples occurring east of Salthill), wet grassland and an area of deciduous woodland at Barna.

Inner Galway Bay provides extensive good quality habitat for Common Seals, a species listed on Annex II of the EU Habitats Directive. In 1984, this seal colony was one of the top three sites in the country, with over 140 animals recorded. The seals use a range of haul-out sites distributed through the bay - these include inner Oranmore Bay, Rabbit Island, St.Brendan's Island, Tawin Island, Kinvarra Bay, Aughinish Bay and Ballyvaughan. The site provides optimum habitat for Otter.

Galway Bay is a very important ornithological site. The shallow waters provide excellent habitat for Great Northern Divers (35), Black-throated Divers (28), Scaup (39), Long-tailed Duck (27) and Red-breasted Merganser (232). (Figures given are peak average maxima over the 3 winters 1994/95 to 1996/97). All of these populations are of national importance. The intertidal areas and shoreline provides feeding and roosting habitat for wintering waterfowl, with Brent Goose (517) having a population of international importance and a further 11 species having populations of national importance. Four of the regular wintering species are listed on Annex I of the EU Birds Directive - Golden Plover, Bar-tailed Godwit and the two diver species. Breeding birds are also of importance, with significant populations of Sandwich Terns (81 pairs in 1995) and Common Terns (99 pairs in 1995), both also being listed on Annex I of the EU Directive. A large Cormorant colony (c.300 pairs in 1989) occurs on Deer Island.

Fishing and aquaculture are the main commercial activities within the site. A concern is that sewage effluent and detritus of the aquaculture industry could be deleterious to benthic communities. Reef and sediment communities are vulnerable to disturbance or compaction from tractors accessing oyster trestles. The *Paracentrotus lividus* populations have been shown to be vulnerable to over-fishing. Extraction of maerl in Galway Bay is a threat. Owing to the proximity of Galway city, shoreline and terrestrial habitats are under pressure from urban expansion and recreational activities. Eutrophication is probably affecting some of the lagoons and is a continued threat. Drainage is a general threat to the turlough and fen habitats. Bird populations may be disturbed by aquaculture activities.

This large coastal site is of immense conservation importance, with many habitats listed on Annex I of the EU Habitats Directive, four of which have priority status (lagoon, *Cladium* fen, turlough and orchid-rich calcareous grassland). The examples of shallow bays, reefs, lagoons and salt marshes are amongst the best in the country. The site supports an important Common Seal colony and a breeding Otter population, both species that are listed on Annex II of the EU Habitats Directive, and six regular Annex I EU Birds Directive species. The site also has four Red Data Book plant species, plus a host of rare or scarce marine and lagoonal animal and plant species.

15.10.2001

Environmental Protection Agency

Bathing Water Quality Details

Print | Adobe | Close

Code	PA3_0065
Name	Traught, Kinvara
Location	Galway
Local Authority	GALWAY COUNTY COUNCIL
Easting	133970.00000000
Northing	213821.00000000

2007 Compliance	2006 Compliance	2005 Compliance	2004 Compliance	2003 Compliance	2002 Compliance
Compliant with Guide Values	Compliant with Guide Values	Compliant with Guide Values	Compliant with Guide Values	Compliant with Guide Values	Compliant with Guide Values

In Ireland, monitoring of water quality at designated bathing areas is undertaken by Local Authorities in accordance with Bathing Water Regulations (S.I. 155 of 1992). The EPA reports the compliance results of these 131 sites annually. There are three compliance categories: non compliant sites fail to meet the necessary quality criteria, sites compliant with mandatory values meet the minimum quality criteria and sites compliant with guide values meet all the recommended quality criteria. (Go to What we do > Environmental Assessment > Bathing Water for more information)

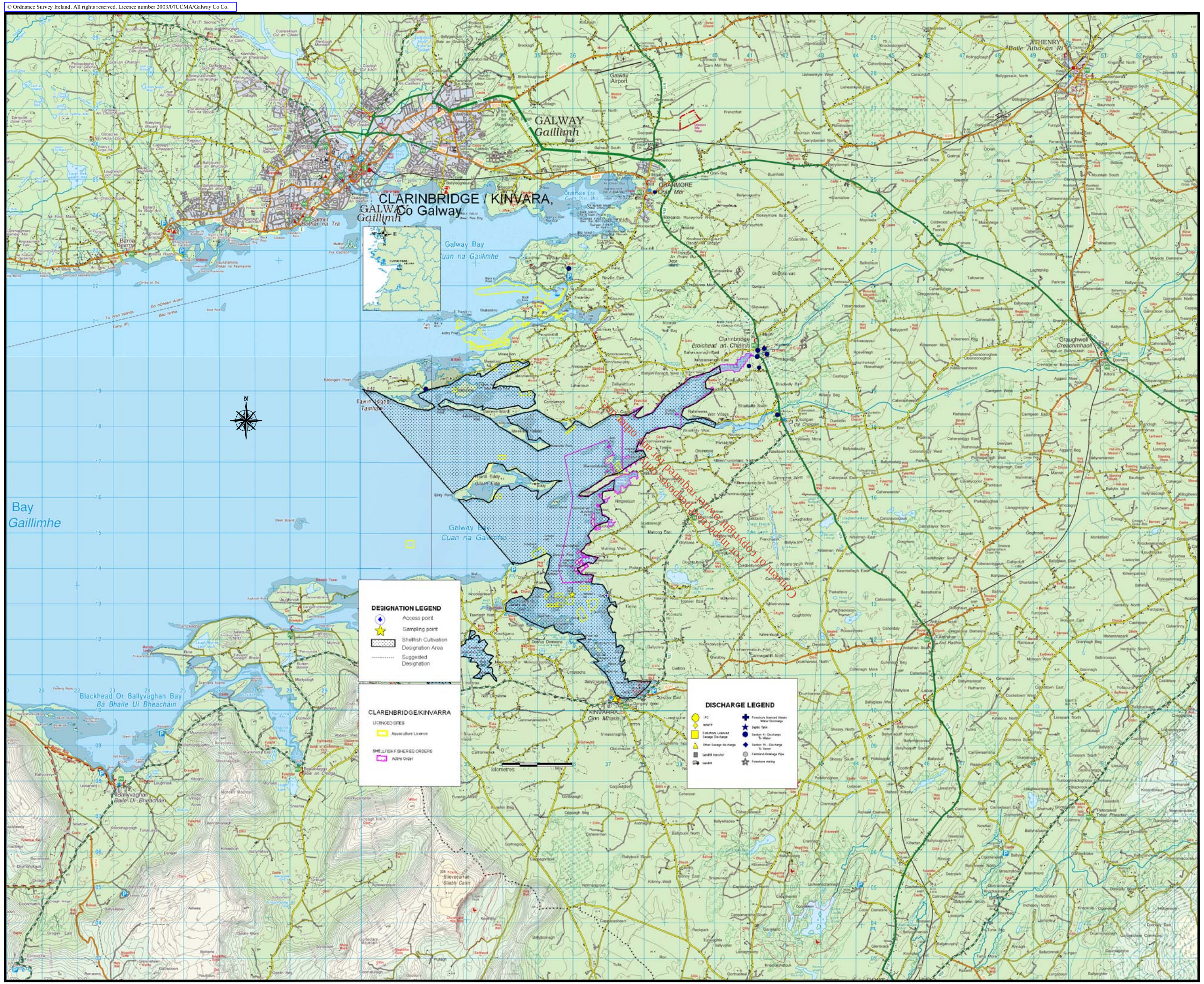
Disclaimer EPA Home Page

If you have a query about this mapping tool, contact the Environmental Protection Agency,
GIS Unit, Office of Environmental Assessment, PO Box 3000, Johnstown Castle Estate, Co. Wexford.
Tel: Locall 1890 33 55 99 or 053 91 60600; Fax 053 91 60699.
Email queries should be directed to info@epa.ie for the attention of the GIS Unit.

Attachment F.1 Traught Beach, Co. Galway - Bathing Water Quality Results 2006 - 2008

Year	SampleDate	TotalColi	FaecalColi	FaecalStreps	pH	Colour	MineralOils	SAS	Phenols	Transparency	DisOxygen	TRFM
	EU Guideline Values	≤500	≤100	≤100	6-9					≥1m	80-120	
2006	15-May-06	0	0	0	8	3.2	C	C	ND	1.1	105	C
	31-May-06	1	1	0	8	9.9	C	C	ND	1.1	105	C
	12-Jun-06	10	10	0	8.1	2.4	C	C	ND	1.1	100	C
	26-Jun-06	0	0	0	8.1	3.2	C	C	ND	1.1	110	C
	10-Jul-06	0	0	0	7.9	3.7	C	C	ND	1.1	94	C
	24-Jul-06	0	0	0	8.1	<2.0	C	C	ND	1.1	98	C
	08-Aug-06	3	3	0	8.1	2.2	C	C	ND	1.1		C
	22-Aug-06	6	5	0	7.9	<2.0	C	C	ND	1.1	96	C
	04-Sep-06	0	0	1	7.7	2.2	C	C	ND	1.1	88	C
Year	SampleDate	TotalColi	FaecalColi	FaecalStreps	pH	Colour	MineralOils	SAS	Phenols	Transparency	DisOxygen	TRFM
	EU Guideline Values	≤500	≤100	≤100	6-9					≥1m	80-120	
2007	22-May-07	230	230	50	7.4	9.9	C	C	ND	0.9	87	C
	25-May-07	66	40	8						0.9		
	05-Jun-07	0	0	0	8	3.4	C	C	ND	1.1	112	C
	18-Jun-07	1	0	0	8	<2.0	C	C	ND	1.1	91	C
	04-Jul-07	320	320	160	7.9	4.4	C	C	ND	0.9	90	C
	09-Jul-07	36	36	3						0.9		
	16-Jul-07	18	11	0	7.8	5.9	C	C	ND	1.1	90	C
	30-Jul-07	8	6	6	8	7.3	C	C	ND	1.1	96	C
	15-Aug-07	8	7	1	7.8	6.9	C	C	ND	1.1	87	C
	28-Aug-07	20	14	1	7.8	8	C	C	ND	1.1	119	C
	10-Sep-07	4	4	0	8.1	2.7	C	C	ND	1.1	92	C
Year	SampleDate	TotalColi	FaecalColi	FaecalStreps	pH	Colour	MineralOils	SAS	Phenols	Transparency	DisOxygen	TRFM
	EU Guideline Values	≤500	≤100	≤100	6-9					≥1m	80-120	
2008	19-May-08	0	0	0	8.2	2.9	C	C	ND	1.1	105	C
	03-Jun-08	110	110	8	7.9	2.3	C	C	ND	1.1	91	C
	06-Jun-08	8	8	3						1.1		
	16-Jun-08	1	1	0	8.2	<2.0	C	C	ND	1.1	92	C
	30-Jun-08	0	0	0	8.1	3.1	C	C	ND	1.1	93	C
	14-Jul-08	9	9	2	8.2	4.8	C	C	ND	1.1	91	C
	28-Jul-08	1	1	1	8	<2.0	C	C	ND	1.1	91	C
	11-Aug-08	4	4	10	8	5.9	C	C	ND	0.9	85	C
	25-Aug-08	10	8	5	7.8	10	C	C	ND	0.9	7.8	C
	08-Sep-08	19	8	0	8.1	3.5	C	C	ND	1.1	93	C

			Total Coliforms/100ml	Faecal Coliforms/100ml	Faecal Streps/100ml	% Compliance	
	EU Guideline Values		500	100	100		80%
	EU Mandatory Values		10,000	2,000	0		95%
National Mandatory Values (S.I. No. 155/1992)			5,000	1,000			90%
					300		95%



Location Plan

Scale: 1/100000

REV	DATE	DRN	DESCRIPTION	CHK	APD

REVISIONS

DRAWING STATUS

☐ PRELIMINARY	☐ CONTRACT	☐ TENDER
☐ PLANNING	☐ CONSTRUCTION	☐ FOR APPROVAL
☒ FOR YOUR INFORMATION	☐ AS CONSTRUCTED	☐ DRAFT

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CLIENT
Galway County Council

PROJECT
KINVARA WASTEWATER DISCHARGE LICENCE

TITLE
Location of Licensed Shellfish Production Sites

SCALE @ A3	DATE	DRAWN	CHECKED	APPROVED
1/100000	Dec. 2008	F.G.	C.M.	

JOB No.	DRAWING No.	REV.
2041	12	

Kinvara Online Submission Tables - Comments

Table D.1(i)(a)
For the purposes of submitting the application zero values were inserted into the table for flow rate of receiving waters, Dry Weather Flow and 95 percentile flow figures as effluent is discharged to the sea at Kinvara Bay.

For the purposes of submitting the application zero values were inserted into the table for volume of emissions (Max/day and Max/hour) as there is no flow meter on the outlet from the combined connection network.

Table D.1(i)(b)
Currently effluent from the Kinvara Agglomeration does not receive any treatment prior to discharge to the bay. Galway Co. Co. does not carry out any sampling or monitoring of the discharges. For the purposes of submitting the application, zero values were inserted into the table for all parameters.

Table D.1(i)(c)
Currently effluent from the Kinvara Agglomeration does not receive any treatment prior to discharge to the bay. Galway Co. Co. does not carry out any sampling or monitoring of the discharges. For the purposes of submitting the application, zero values were inserted into the table for all dangerous substances parameters.

Table F.1(i) (a) & (b) – aSW1a
Currently effluent from the Kinvara Agglomeration does not receive any treatment prior to discharge to the bay. Galway Co. Co. does not carry out any sampling or monitoring of the discharges. For the purposes of submitting the application zero values were inserted into the table for ambient monitoring parameters.