north western international river basin district

North South Shared Aquatic Resource (NS SHARE)

neagh bann international river basin district

North South Shared Aquatic Resource (NS SHARE)

north eastern river basin district

North South Shared Aquatic Resource (NS SHARE)

North South Shared Aquatic Resource (NS Share)

Further Characterisation Studies – WP1 3, WP2 6, WP 3 3 & WP4 6. Application of point, diffuse, abstraction and morphological risk assessments to small & cross border waterbodies.

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AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

INTERREG IIIA

Project part financed by the European Union

North **S**outh **Sh**ared **A**quatic **Re**source (NS Share)

Water Framework Directive

A Directive establishing a new framework for Community action in the field of water policy (2000/60/EC) came into force in December 2000. This Water Framework Directive (WFD) rationalises and updates existing legislation and provides for water management on the basis of River Basin Districts (RBDs). The WFD was transposed into national law in Northern Ireland by the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003 and in the Republic of Ireland by the European Communities (Water Policy) Regulations 2003. The primary objective of the WFD is to maintain the "high status" of waters where it exists, prevent deterioration in existing status of waters and to achieve at least ***"good status"*** in relation to all waters by 2015.

NS Share Study Area

NS Share is a cross border project and incorporates three River Basin Districts as set out in the joint North/South Consultation paper *Managing our Shared Waters*:

1. North Western International River Basin District (NWIRBD);
2. Neagh Bann International river Basin District (NBIRBD);
3. North Eastern River Basin District (NERBD).

The NW and NB are International River Basin Districts as they share their waters between Northern Ireland (NI) and Republic of Ireland (ROI). The NERBD is contained wholly within NI.

NS Share Project

The overall objective of the project is to strengthen inter-regional capacity for environmental monitoring and management at the river basin district level, to improve public awareness and participation in water management issues, and to protect and enhance the aquatic environment and dependent ecosystems.
The NS Share project aims to facilitate delivery of the objectives of the WFD within the project area between August 2004 and March 2008.

The NS Share project is funded by the EU INTERREG IIIA Programme for Ireland / Northern Ireland. The Department of the Environment (NI) and the Department of the Environment, Heritage and Local Government (ROI) are implementing agents for the project. Donegal County Council is the project promoter. Technical support is provided by the Environment and Heritage Service an agency within the Department of the Environment (NI), and the Environmental Protection Agency (ROI). RPS Consulting Engineers in association with Jennings O'Donovan are the principal consultants.

Assistance was also provided by the Marine Institute, Central Fisheries Board, Geological survey Ireland, Geological survey Northern Ireland, Loughs Agency, North West Regional Fisheries Board, and Cavan, Leitrim, Longford, Louth, Meath, Monaghan, and Sligo County Councils.

Project publications are available at www.nsshare.com/publications

PREFACE

The work presented in this paper was carried out as part of the NS SHARE project, which is funded by the European Union INTERREG IIIA programme for Ireland/Northern Ireland. The implementing agents for the NS SHARE project are the Department of Environment (DOE), Northern Ireland, and the Department of Environment Heritage and Local Government (DEHLG), Republic of Ireland. Donegal County Council (DCC) is the project promoter.

All data, drawings, reports, documents, databases, software and coding, website and digital media and publicity material produced as part of this project shall be the property of the DOE/DEHLG who will use, reproduce and distribute same as they see fit.

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NS SHARE

Brief for Further Characterisation Studies – WP1 3, WP2 6, WP3 3 & WP4 6. Application of point, diffuse, abstraction and morphological risk assessments to small & cross border waterbodies.

This report details the proposed project specification for application of the point, diffuse, abstraction & morphological risk assessments to small & cross border waterbodies within the NS Share area under Task 11, Further Characterisation, of the NS Share Brief.

REVISION CONTROL TABLE

Rev.	Description of Changes	Prepared by	Checked by	Approved by	Date
A	Issued for internal review	SD	GG	GG	03-07-2007
B	Issued for Comment and Approval	SD	TMcN/LC	LC	15-07-2007
C	Uploaded to document tracker for review by EHS & EPA	SD	TMcN/LC/DP	LC	20-07-2007
D	Document revised following comments from EHS	SD	TMcN/LC/DP	LC	15/10/2007
E	Document revised following comments from EPA	SD	TMcN/LC/DP	LC	31/10/2007
F	Document revised following final comments from the EHS	SD	LC/DP	LC/DP	19/12/2007
G	Final comments received from Mary Bailie - EHS	SD	LC		03/03/2008

The User is Responsible for Checking the Revision Status of this Document

Table of Contents

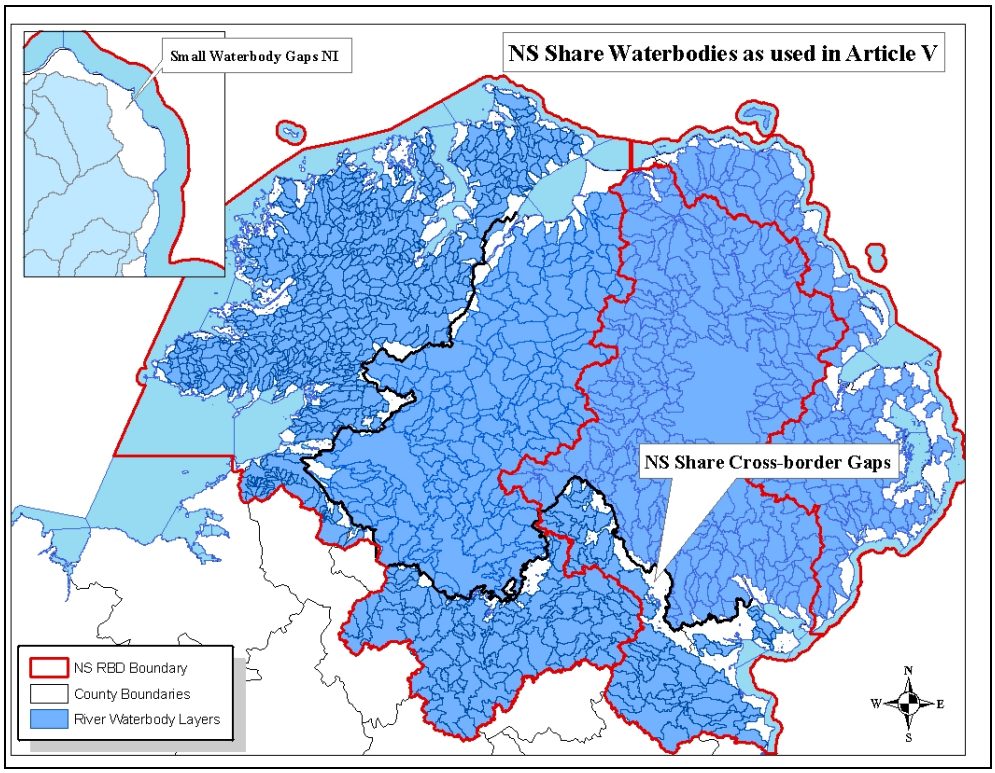
1.0 Introduction

Following completion of the initial characterization report in 2005, a need was identified to further characterize the significant water management issues, through refining the Pressures and Impacts analysis. Under this task the delineation of small and cross border water bodies was addressed together with the process of applying Point, Diffuse, Abstraction and Morphological Risk Assessments.

2.0 Objective

The overall objective of this NS Share task is to refine the risk assessments undertaken for the Article 5 reports submitted to the EU in March 2005. The River water body datasets utilised by the EHS and EPA for the preparation of the WFD Article V Characterisation Report did not provide seamless or integrated cross border mapping of the features. **(See Figure 1)** These datasets were developed in 2004. Following this in 2005, Compass Informatics was given the task of establishing a seamless and integrated Cross Border River Water body Layer. In 2006, the final step in this process was completed, whereby, water body channel features were created or in some instances it was only necessary to delineate revised water body catchments areas.

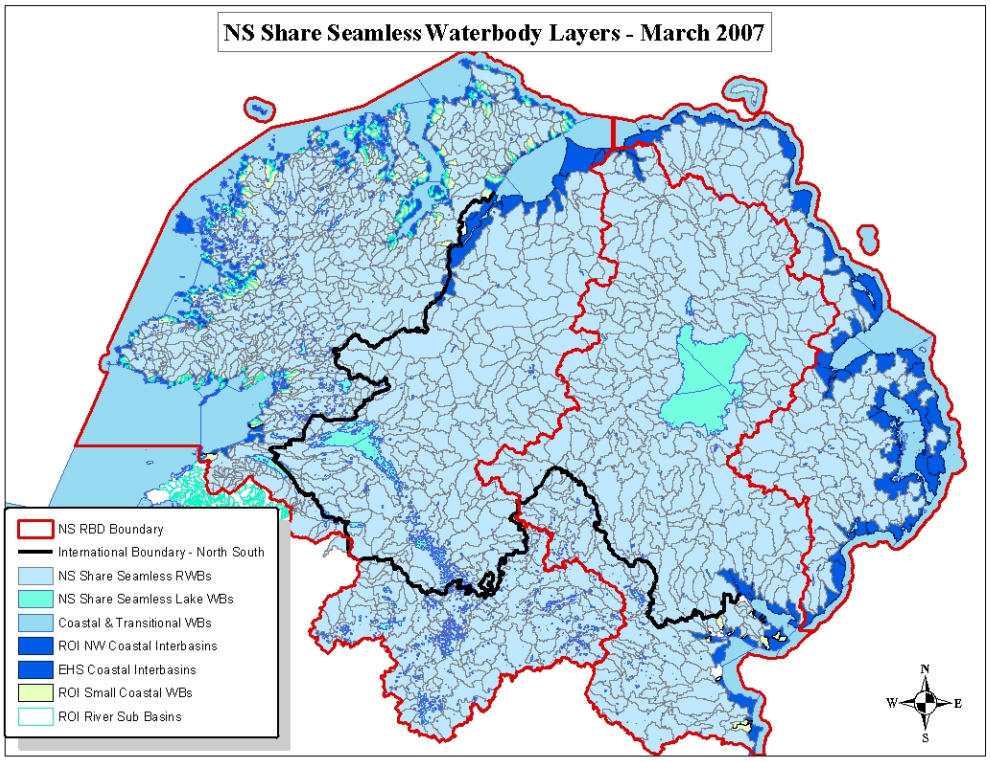
Figure 1. NS Share Water bodies used in Article V



Step 1.

- The initial step in the application of all further characterisation risk assessments involved the full integration of the cross border water bodies with the existing EHS and EPA River Water body layers. **(See Figure 2).**

Figure 2. NS Share Seamless water body layers



- This required some deletion of new water bodies along the boundary where overlaps existed with the new chain of x-border water bodies and the old EHS, EPA water body layers.

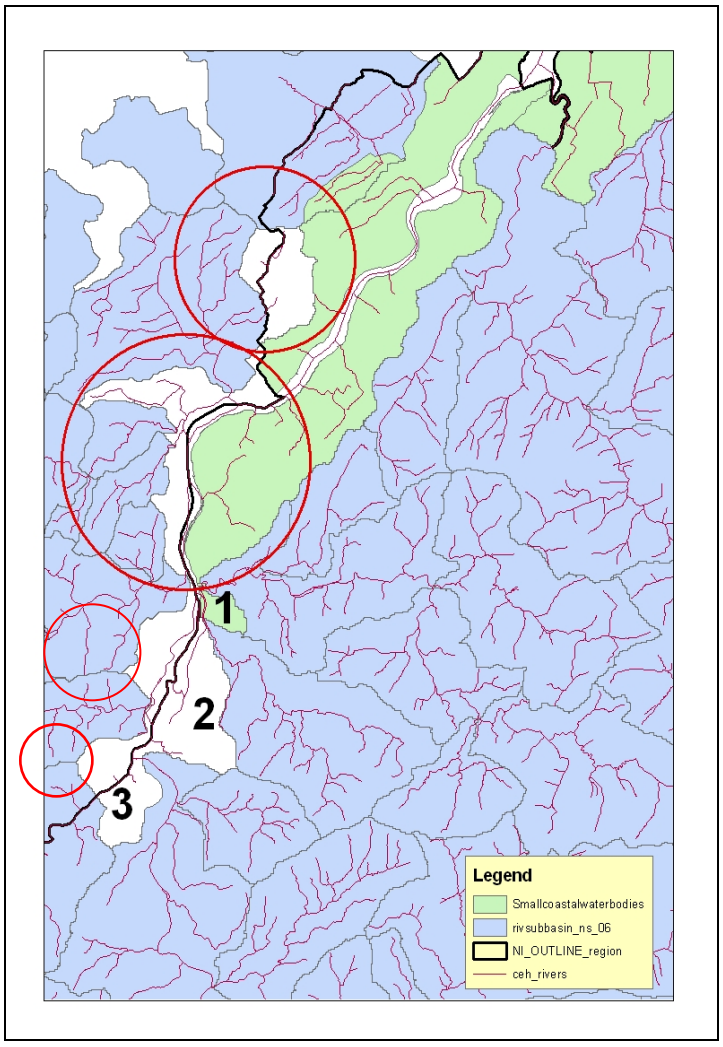
Step 2.

- This involved the integration of the coastal interbasins on the ROI side and the small water bodies (Coastal Inter Basins) on the NI side which were delineated by Compass Informatics and the EHS respectively.
- These lie along the coast line between the river water bodies and the coastal & transitional water bodies.

Step 3.

- On the NI side the EHS delineated and approved their coastal interbasins (i.e small water body layer) along the coast.
- Further to this delineation, 4 gaps (as indicated by the red circles in figure 3.0) were identified on the ROI side along the border near the Foyle and Faughan estuaries. These four gaps were also delineated and integrated by the NS Share project team. Those listed 1-3 in figure 3.0 were additional water bodies which were delineated by the EHS River Basin Planning Team.

Figure 3. Further Water body Gaps



3.0 Edits to Datasets

Rivsubbasin_ns_06.shp

Update to river water body polygons for NS-SHARE. One change made to XB_01_12 to better fit with EHS Coastal Interbasins.

Coastal_small_nw.shp

These are the small 2nd order water bodies along coast. One additional feature was made in HA 01. Some minor edits were also made to this layer in order for it to better fit with the EHS Coastal Interbasins.

Coastal_small_nb.shp

Small 2nd order water bodies along coast. One additional feature was made in HA 06. Some minor edits were also made to this layer in order for it to better fit with the EHS Coastal Interbasins.

NW_coastal_ibas.shp

These are the coastal interbasins in the North Western IRBD. Addition of features in HA 01. (ROI only)

NB_coastal_ibas.shp

These are the coastal interbasins in Neagh Bann IRBD. Addition of features in HA 06. (ROI Only)

Coastal_Inter_basins_NI.shp

Original file received from the EHS no edits made.

4.0 Risk Assessment Application

Appendix 1.0 outlines the decisions taken by the EHS and EPA on which Risk Assessments were to be applied by the Project Team. During the application of the 2005 risk assessments a large data collection process was carried out by the project team. Due to the lapse in time since the initial characterisation together with the fact that these areas were not previously delineated it was felt that a further data collection process should be carried out.

4.1 Point Source Risk Assessment

4.1.1 Introduction

- Leitrim, Sligo, Longford, Cavan, Meath, Louth, Monaghan and Donegal local authorities were all contacted and requests made for up-dates to their point source information specifically within the newly delineated areas. Up-dates to the EHS datasets were also requested by the project team from the EHS River Basin Planning Team.

- The project team collated the 2004 point data with the new and up-dated information.

- In regards to the application of risk assessments to the cross border waterbodies it was decided to use the ROI methodology. In running these methodologies some decisions were taken in consultation with the EHS River Basin Planning Team. Some of the following points should also be kept in mind when viewing the results.

    - Where monitoring was non-compliant for the river contained in the water body but no data existed for discharge compliance we assumed the worst case of 1b for ROI Rivers only. This was a precautionary approach which was deemed the most appropriate
    - In the case of Waste Water Treatment Plants the worst case risk assessment result from NI, the expert judgement process, or the ROI results was taken as this was the methodology applied during the Article V process for each water body.
    - Where new cross border water bodies subsumed old cross border water bodies, the worst case result of the old water body and the new water body was adopted.
    - The results for plants < 250 p.e from the EHS were not applied to the cross border water bodies nor the NI Coastal Interbasins in order to keep the application

of the ROI methodology consistent. It is evident from applying the risk assessments that the results would differ if these were used.

In NI specific decisions on point source risk assessments for industrial consents made by the EHS Industrial Consents Team included:

- Any point source discharges with no discharge data were categorised as a "2a"
- Any non-failing discharges were categorised as "2a"
- Discharges with no compliance data were categorised as "2a"
- Failing discharges in the magnitude categories site drainage and <5 m^3/day were categorised as "2a", not putting the water body at significant risk.

These decisions were derived from specific methodology developed for Pressures and Impacts assessments under Article 5 of the WFD.

It was noted by EHS that the rule of categorising 'failing discharges in the magnitude categories site drainage and <5 m^3/day' as a '2a' should be reviewed and all failing sites in these categories be individually assessed by expert opinion.

It was not possible for EHS to provide expert opinion for failing sites that were categorised as 'site drainage' or had a discharge or less than 5m^3 / day in this work package.

4.1.2 Methodology

- The following point source risk assessments were applied to the cross border water bodies using the ROI methodology by the NS Share Project Team.

ROI Field	Risk Test description ROI	NI Field	Risk Test description NI
RP1	point - waste water treatment plants	WWTW	Waste Water Treatment Works (PE>250)
RP2	point - combined sewer overflows & treatment plant overflows	CSO's	Combined sewage overflows
RP3	point - IPPC	ICL	Industrial Consent Licenses
RP4	point - Section 4 (Local Authority licensed discharges)	PS	Priority Substances consented discharges
RP5	point - Water Treatment Plants / Mines/ Quarries / Landfills	WTW	Water Treatment Works (WTW) (PE>250)

Table 1. Point source Risk Assessments applied to Cross Border Waterbodies

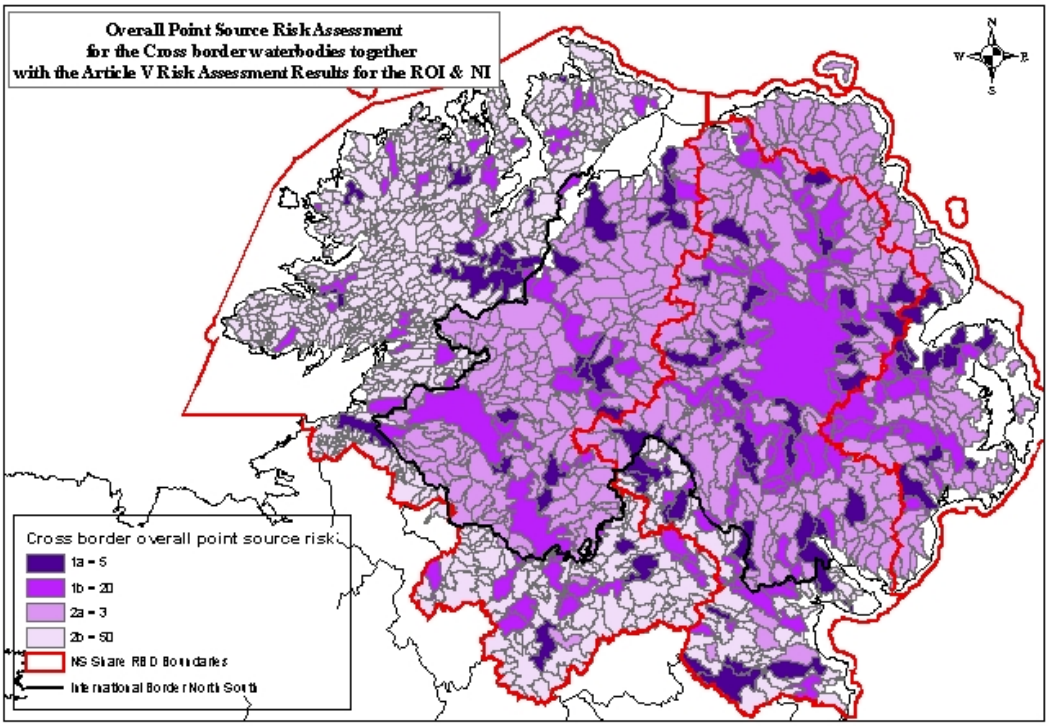
- The results from these assessments are tabulated in **Appendix 2** together with the following accompanying shapefile.

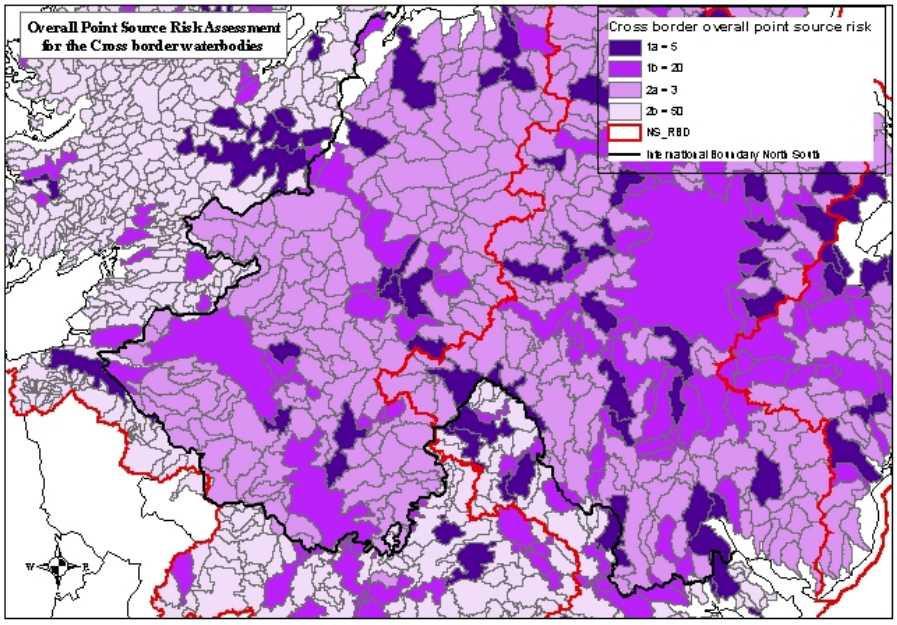
- It was not possible for EHS to provide expert opinion on failing industrial consent discharges located within cross border water bodies.

  Cross_Border_Water_Bodies.shp

- All point source risk assessments were also to be applied to the small coastal interbasins in NI by the EHS River Basin Planning Team. Risk assessments were received for WWTW and WTW. It was not possible to obtain expert opinion assessment of risk for failing industrial consents within the coastal inter basins. No information or expert opinion on CSOs within these areas was available either. Therefore risk assessments for industrial consents and CSOs were not included in the risk assessment application process for Coastal Inter Basins in Northern Ireland.

Figure 4 & 4.1 Overall Cross Border Point source Risk Assessment results together with the Article V results.





4.2 Diffuse Risk Assessments

4.2.1 Introduction

During 2005/2006 cross Border River waterbodies were developed in collaboration with the EPA and the EHS. This task derived a set of polylines to represent the river water bodies and polygons for their catchment areas. The polygons created were seamless along the border. However, downstream water bodies with headwaters in the cross border region were not adjusted to account for the revisions along the border. Thus their 'nested' or complete drainage area polygons were constrained by the earlier incomplete mapping along the border. These nested catchments are needed for the correct application of the hydrological abstraction and diffuse (water quality predictive model) Risk Assessment tests used in the ROI.

4.2.2 Method

Nested Water body Polygons

An integrated polygon shapefile of nested cross border waterbodies is provided as '**xb_nested.shp'**.

Field name	Example	Note
Seg_cd	XB_35_4	New cross border feature code (common with cross-border waterbody polyline issue 2005)
ROI_CD_OLD	35_1720	Original EPA code. variants: "(01_650)" – if in brackets then not included as Article V waterbody due to 10km^2 size limit "'new" – feature not in original waterbody dataset
NI_CD_OLD	GBNI1NW353502005	If "n.a." then not in original EHS dataset
NEST_AREA	105.25	Nested or 'complete catchment' area
LOCAL_AREA	18.05	Local drainage area – excludes area within u/s waterbodies. Where 'NEST_AREA' = 'LOCAL_AREA' then waterbody is headwater feature.
ROI_NOTE	'Replace'	If 'Replace' then feature is Article V waterbody now modified. If 'New' then feature was not in Article V report

Table 2 Field definitions

Diffuse Risk Assessment

In the RoI a predictive water quality model (Donohue *et. al* 2006) developed by the EPA was applied as a Risk Assessment test to the river waterbodies. It was decided through consultation with the EPA & EHS that this test be applied to the:

- revised cross border water bodies (78 features)
- small 2nd order coastal catchments in RoI (247 features)
- coastal interbasin areas in RoI (426 features)
- coastal interbasin areas in NI (56 features)

The water quality model predicts an element of waterbody status on the basis of a simple catchment landcover statistical summary that is considered a proxy representation of diffuse pressure.

In the strict sense the model predicts the probability that a waterbody would attain an EPA Biological Q rating of 4, which has been taken as an indicator of good status while methods for other WFD waterbody status elements are under development. In Northern Ireland the biological assessment used is the GQA – General Quality Assessment. Although the methodologies for determining the scores are different the sampling techniques and final values assigned are based on the same criteria for determining degrees of pollution. Therefore a Biological Q rating of 4 equates to a GQO value of B. The model does not predict a risk of failure to attain good status according to the convention used in the Article V Risk Assessment process, but has been adapted to approximate the Risk Assessment convention as:

Model Statistic (probability to attain BiolQ >= 4)	Risk Score equivalent
0 – 0.25	1a
0.25 – 0.6	1b
0.6 – 0.75	2a
> 0.75	2b

Table 3 RoI predictive water quality model statistics

Landcover mapping

The original water quality model was developed through analysis of the Corine Landcover database (EPA, 2000). Extension of the model to include Northern Ireland required the use of an equivalent landcover dataset. The available dataset for Northern Ireland is the Centre for Ecology (CEH) and Hydrology Land Cover Map 2000 which was provided by EHS. The Corine and CEH datasets are derived by different methods and utilize a different nomenclature or set of landcover classes. For the purposes of the application of the EPA water quality diffuse risk assessment test the correspondence of classes has been made.

Landcover category	Corine Class	CEH Class(es)
Arable	211	4.1 (Arable cereals)
		4.2 (Arable Horticulture)
		4.3 (Non-rotational horticulture)
Pasture	231	5.1 (Improved grassland)
		5.2 (Setaside grass)
		6.1 (Neutral grass)
		7.1 (Calcareous grass)
		8.1 (Acid grass)
Urban	1.1, 1.2, 1.3, 1.4	17.1 (Suburban/rural developed)
		17.2 (Continuous Urban)

Table 4 Corine Landcover 2000 Risk Assessment Units

The diffuse risk assessment (predictive water quality model) results are provided in file '**nss_diffuse_risk_2007.dbf'**.

Field name	Example	Note
CAT_TYPE	ROI_small_coastal ROI_coastal Cross border NI coastal	
CAT_ID		
ARABLE	43.26	% arable in catchment as per Table 3
PASTURE	35.47	% pasture in catchment as per Table 3
URBAN	2.95	% urban in catchment as per Table 3
ECO_RISK_D	0.062	Probability to attain Biol Q >= 4 (set as 0.75 probability)
PRED_RISK	1A	Predicted Article V Risk (as per Table 2)

Table 5 Field Definitions

NI landcover variation

Given that the creation of a correspondence between Corine and CEH landcover classes is somewhat subjective, a second version of the diffuse risk assessment was run that excluded the following CEH classes from the pasture category – 6.1; 7.1 & 8.1. The results of the revised test are provided in '**nss_diffuse_risk_2007_reduced.dbf'**. This test was only applied to the 'NI Coastal' & 'Cross Border water bodies.'

The results from these tests have been applied to the following water bodies:

- revised cross border water bodies (78 features)
- small 2nd order coastal catchments in RoI (247 features)
- coastal interbasin areas in RoI (426 features)
- coastal interbasin areas in NI (56 features)

Table 6 List of accompanying shapefiles showing the results of these tests

• **ROI_Coastal_ibas.shp**	• **ROI Coastal Interbasins with the ROI Diffuse Test applied.**
• **ROI_Coastal_ibas_Reduced.shp**	• **ROI Coastal Interbasins with the ROI Diffuse Test applied excluding CEH classes 6.1,7.1 & 8.1**
• **NI_Coastal_ibas.shp**	• **Northern Ireland Coastal Interbasins with ROI Diffuse Test applied.**
• **NI_Coastal_ibas_Reduced.shp**	• **Northern Ireland Coastal Interbasins with ROI Diffuse Test applied excluding CEH classes 6.1, 7.1 & 8.1.**
• **Cross_border_waterbodies.shp**	• **Newly delineated waterbodies along the border with ROI Diffuse Test applied**
• **Cross_border_waterbodies_Reduced.shp**	• **Newly delineated waterbodies along the border with ROI Diffuse Test applied excluding CEH classes 6.1, 7.1 & 8.1**
• **ROI_2nd order_coastal_catchments.shp**	•

Figure 5. EPA Diffuse Risk test applied to ROI & NI Coastal Interbasins

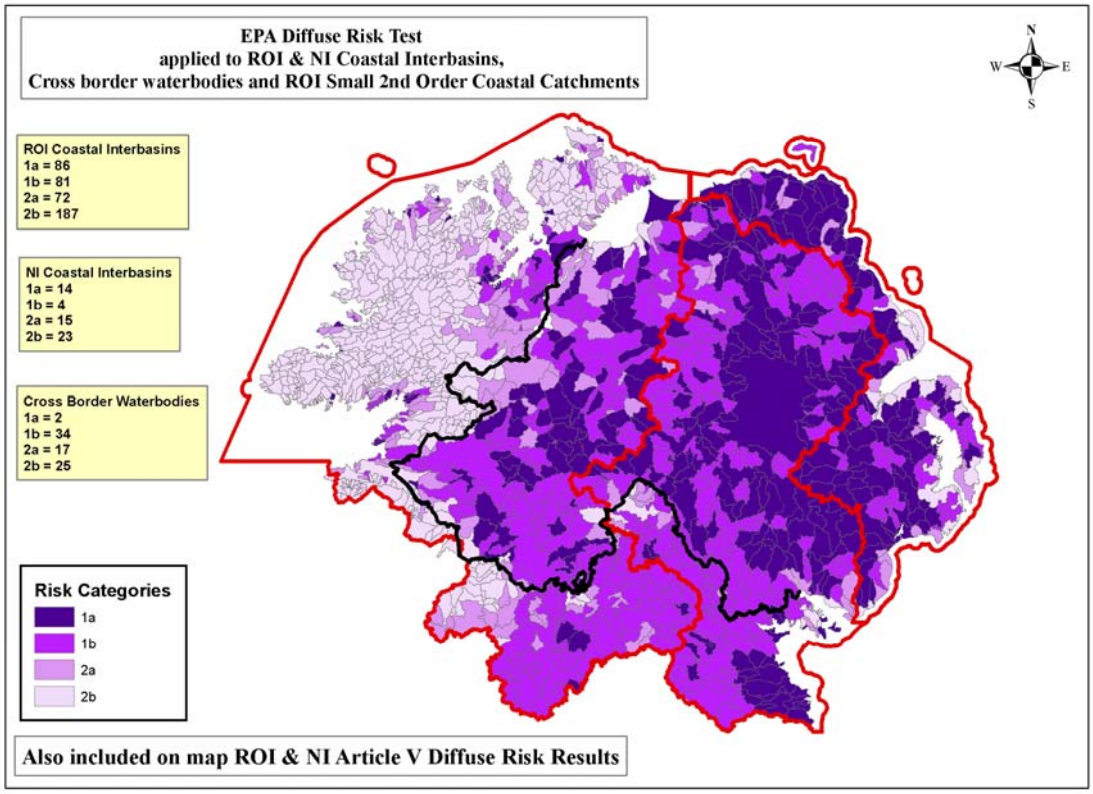
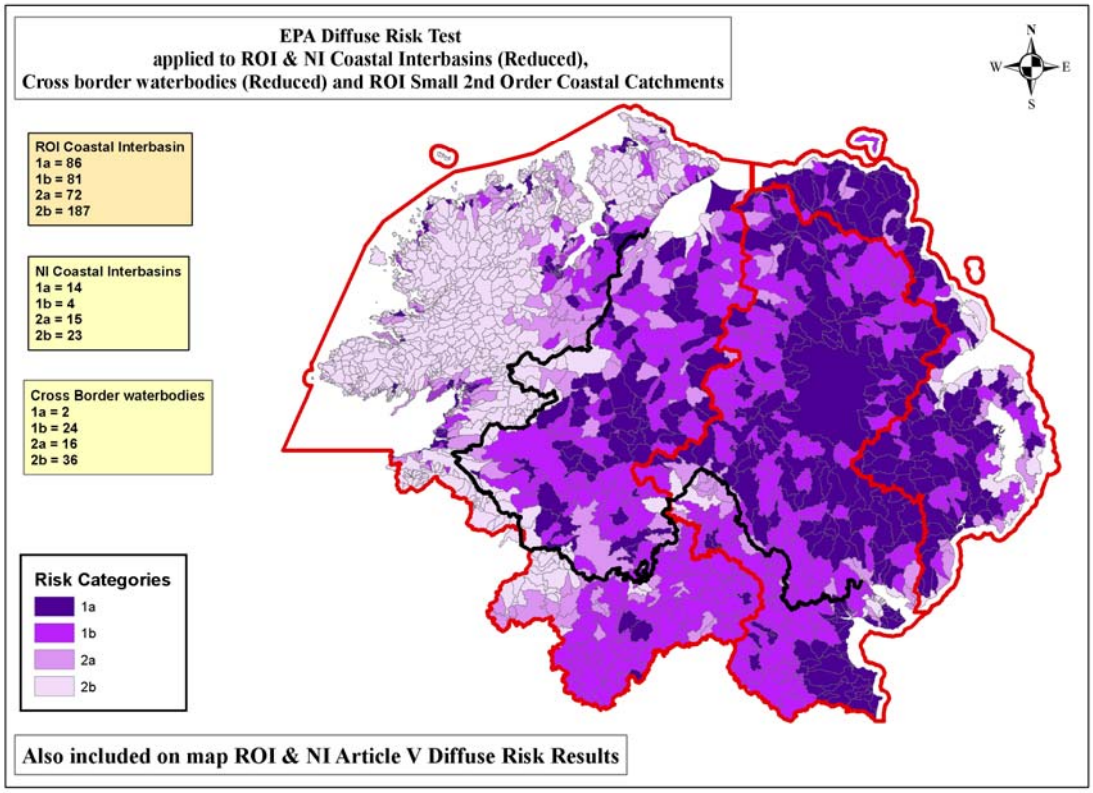


Figure 6. EPA Diffuse Risk Test applied to ROI & NI Coastal Interbasins (Reduced – Excluding CEH pasture classes 6.1, 7.1 & 8.1)



ROI Coastal Interbasins		
Risk Categories	**Diffuse Risk Test (No. of waterbodies at risk)**	**Reduced Diffuse Risk Test. (No. of waterbodies at risk)**
1a	86	86
1b	81	81
2a	72	72
2b	187	187

The application of this sensitivity test was to ascertain whether using two different landcover

NI Coastal Interbasins		
Risk Categories	**Diffuse Risk Test (No. of waterbodies at risk)**	**Reduced Diffuse Risk Test. (No. of waterbodies at risk)**
1a	14	14
1b	4	4
2a	15	15
2b	23	23

Cross Border Waterbodies		
Risk Categories	**Diffuse Risk Test (No. of waterbodies at risk)**	**Reduced Diffuse Risk Test. (No. of waterbodies at risk)**
1a	2	2
1b	**34**	**24**
2a	**17**	**16**
2b	**25**	**36**

Table 7 Comparison of waterbodies placed at risk from the Diffuse Risk Test with those of the Reduced Diffuse Risk Test

GIS layers leads to a significant difference in risk. From the results outlined in table 7 we can see it causes no change in risk for the coastal interbasins in both NI & the ROI. In regards the cross border waterbodies the exclusion of the pasture categories – 6.1, 7.1 & 8.1 has a significant difference on the number of waterbodies which are “probable at risk”. Ten of the

waterbodies drop from a “1b” to a “2b” – not at risk. However it must be remembered that this is a predictive model on the probability that a waterbody would attain an EPA Biological Q rating of 4 (GQA – B). The assessment is only as good as the available data and field surveys may over ride this assessment.

4.3 Abstraction Risk Assessment

4.3.1 Introduction

The risk assessment methodology used in the ROI for the impact of water abstractions and impoundments does not include a screening assessment equivalent to the tier 1 assessment used in Northern Ireland. However, the risk assessment does follow the same principles as the Northern Ireland assessment and applies the same thresholds provided in the UKTAG guidance document “Abstraction and Flow Regulation Pressures on Surface Water”. The principal difference is the method by which the low flow estimate is derived.

4.3.2 Methodology

As was the case in Northern Ireland, the Irish methodology involves the compilation of a database of abstractions, discharges and major impoundments and the preparation of a model to derive an estimation of low flows. The low flow statistic used was the 95th percentile flow which was calculated for each water body at the furthest downstream point of the water body. The Q95%ile flows were estimated from the normalised Q95%ile flow map based on hydrometric summary data for 471 gauging stations on rivers throughout the EPA and Rivers Agency hydrometric networks.

The discharge and abstraction databases were used to derive a water balance and the deviation from the estimated natural low flow was established. The same thresholds used for the Northern Ireland risk assessment were applied and are consistent with the UKTAG guidance.

Rivers – 95%ile flow, high sensitivity	2b	2a	1b	1a
	<5%	<10%	10-40%	>40%

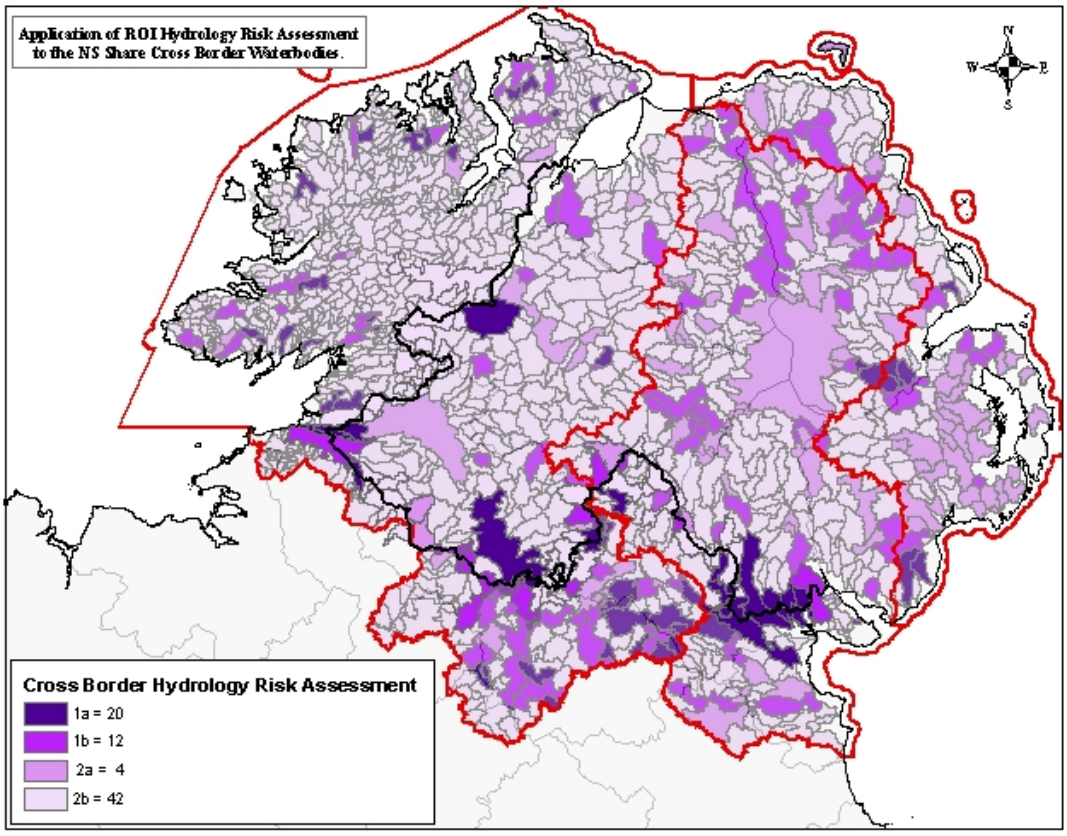
Table 8 The percentage of the 95%ile flow that is abstracted was determined for each of the 78 cross border water bodies and the following thresholds were applied.

The results of this test are available in the accompanying shapefile

Cross border hydrology. shp

Figure 7 shows the results from the 2007 application of the hydrology test together with the Article V results for the NS Share area.

Figure 7. Hydrology Risk Assessment

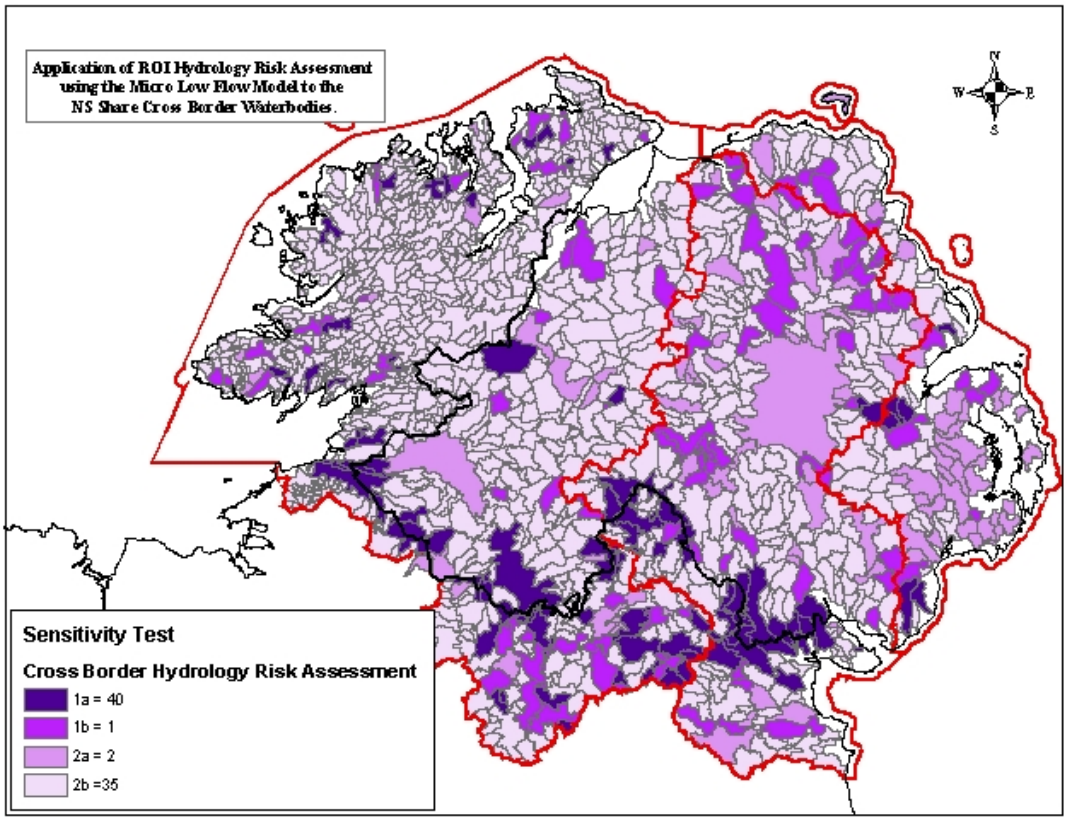


4.3.3 Hydrology Sensitivity Test

In Northern Ireland the 95 percentile low flow (Q95) was used to assess natural low flow and estimates of this parameter were based on the Micro Low Flow model which was developed by the CEH (Formerly Institute of Hydrology) to generate natural Mean Flows and Q95 (low flow) estimates. The tier 2 assessment looked at deviation from natural Q95 (low flow) due to net abstraction effect (abstractions less discharges) in accordance with UKTAG guideline thresholds and risk category applied. As a sensitivity test, the EHS abstraction team populated the Mean Daily Flows (MF) and the Q95 flows for the cross border water bodies. They were unable to calculate some discharge points within the cross border water bodies as EHS does not have access to the required catchment descriptor data. In many cases this is due to the water body downstream and upstream points lying totally within ROI. Also, the Micro Low Flow model only reflects the river network within the hydrometric areas 201- 206 and 236.

Figure 7. shows the results from the application of the hydrology test using the Micro Low Flow model together with the Article V results for the NS Share area.

Figure 7. Hydrology Risk Assessments (Sensitivity Test)



4.4 Morphology Risk Assessment

4.4.1 Introduction

In the morphology risk assessment both jurisdictions used the same principles in applying methods for the determination of risk.

In Northern Ireland, River Habitat Surveys (RHS) have been carried out on selected rivers. For the morphological risk assessment of rivers the Habitat Modification Score (HMS) of the RHS has been used to assess the risk. The HMS reflects the degree to which a natural stream channel and its banks have been altered. The Habitat Modification Index (HMI) can be assigned based on the HMS and the risk to a water body determined from this. The level of confidence is dependent on the frequency of the RHS along a water body. The risk categories are then based on the risk classification and the level of confidence associated with the data.

Where RHS were not available or where the frequency of RHS sites was less than 0.25 per km the risk assessment was based on the use of various different datasets including:

- Rivers Agency's datasets - flood embankment and culverts dataset. Threshold values are based upon the bank length affected or the overall length of culverts and have been classified as high risk, medium risk and low risk (>15% of either bank – 1a,);
- Datasets on the location of impoundments – the presence, and significance of an impounding structure on a water body determines the level of risk as high, medium and low (major impoundment present on water body line – 1a, impoundment present but not on water body line – 1b).

In the event where there are no datasets relating to a water body a map screening tool was used as outlined in the UKTAG guidance document WP7c, '*Guidance on Morphological Alterations*.' This screening tool is based principally on the manual interpretation of 1:50,000 scale OS maps, and land use maps. The different pressures considered include:

- River straightening (>15 % length affected - 1b);
- Bed and bank reinforcement (>15% of either bank - 1b);
- Presence of flow manipulation structures (>3 - 1b);
- Land use pressures – five land use classifications have been used to assess the risk from intensive land use; coniferous woodland, improved grassland, arable and horticultural, suburban and rural development and continuous urban. The LCM 2000

dataset has been used to determine the land use percentages (>30% intensive land-use - 1b).

The confidence level assigned to these datasets is low for the OS map risk assessment and medium for the land use mapping. The level of risk determined from set thresholds are reviewed based on the level of confidence assigned to the dataset and a risk category applied in accordance with UKTAG guidance.

In the Republic of Ireland, five datasets are used in assessing the morphological risk to river water bodies; these are sourced from a number of different organisations. The pressure dataset and information sources are detailed below;

- *Channelisation and Dredging* – OPW dataset
- *Flood Protection and Embankments* – OPW dataset
- *Impounding* – ESB impoundments for power generation and Local Authority Information;
- *Water Regulation (locks and weirs)* – OPW weirs and sluices layer, Central Fisheries Board impassable barriers, IWAI navigation maps, Locks layer from OS mapping, mill weirs from local knowledge;
- *Intensive Land-use* – CORINE land use dataset layers; peat extraction, coniferous forests, arable land, urban fabric.

The same impact thresholds were applied to the pressure datasets as those used in Northern Ireland where the datasets are similar. Confidence limits were assessed by each individual RBD depending on the completeness and reliability of the datasets used and is RBD specific.

4.4.2 Methodology

The ROI methodology uses Automated GIS techniques to assess the impact of the five morphological pressures on river waterbodies. These techniques are based on the proportion of water body stretch length affected by the pressure in the case of channelisation, embankments and intensive land use. Impoundments and water regulation are based on a presence/absence figure. Methodologies for the ROI assessment can be found on the WFD Ireland web-site.[1]

[1] http://www.wfdireland.ie/

The results of the tests can be found in **Appendix 2** and also in the accompanying shapefile **Cross_Border_Water_Bodies.shp**

The Intensive Landuse risk assessment for the cross border water bodies has been covered as a separate assessment in conjunction with the Freshwater Morphology task for which the results can be found in the report "*Further Characterisation Activities, Freshwater Morphology Work Package 4, Activity 3 - Morphological Risk Assessment - Intensive Land Use*"[2]

Figure 8 and **9** illustrate the overall results for morphology including the sensitivity test of including/excluding improved grassland as a unit in the intensive landuse test.

As part of this further characterisation task the Intensive Landuse risk assessment for the small waterbodies in Northern Ireland was applied using the same methodology as that used for the cross border water bodies.

4.4.3 Intensive Landuse Methodology

Data Collation and Generation of Layers

1. The 'Intensive Landuse (ILU)' layer was compiled from the CEH Land Cover Map 2000 categories.

2. The following categories were extracted from Land Cover Map 2000:

- Bog (12.1)
- Coniferous woodlands (2.1)
- Arable cereals (No features) (4.1)
- Arable Horticulture (4.2)
- Non-rotational horticulture (No features)(4.3)
- Continuous urban (17.2)
- Improved grassland (5.1)

3. A buffer polygon (50m) was prepared for river water bodies. The features have been buffered as individual features, with small buffer overlaps at river confluences.

[2] http://www.nsshare.com/doctracker

4. Intensive landcover features were extracted within the buffer of each river water body.

5. Statistical summaries of the intensive landuse within each river water body buffer were recorded.

6. The RoI morphological risk assessment methodology used the following thresholds with respect to intensive land use pressures :

    - < 10% = (2b)
    - 10-30% = (2a)
    - 30-70% = (1b)
    - >70% = (1a)

    However, for the purposes of this risk assessment, to enable comparison of the Article 5 results obtained for NI river water bodies, it is necessary to use the same thresholds that were used by EHS. These are as follows:

    - <10% = (2b)
    - 10-30% = (2a)
    - >30% = (1b)

    The category “1a” was not assigned to water bodies with respect to intensive land use due to the low confidence of the manual map screening method used in the risk assessment.

    The automated GIS risk assessment method applied in this task may refine the assessment results in terms of calculated lengths of water body within intensive land use zones, but does not refine the actual thresholds used. It is considered that site assessments are required for this, and that ground-truthing will override risk assessment results.

Figure 8. Cross Border Morphology Risk Assessment results (Excluding Improved Grassland in the Intensive Landuse Risk Test), together with the Article V Risk results.

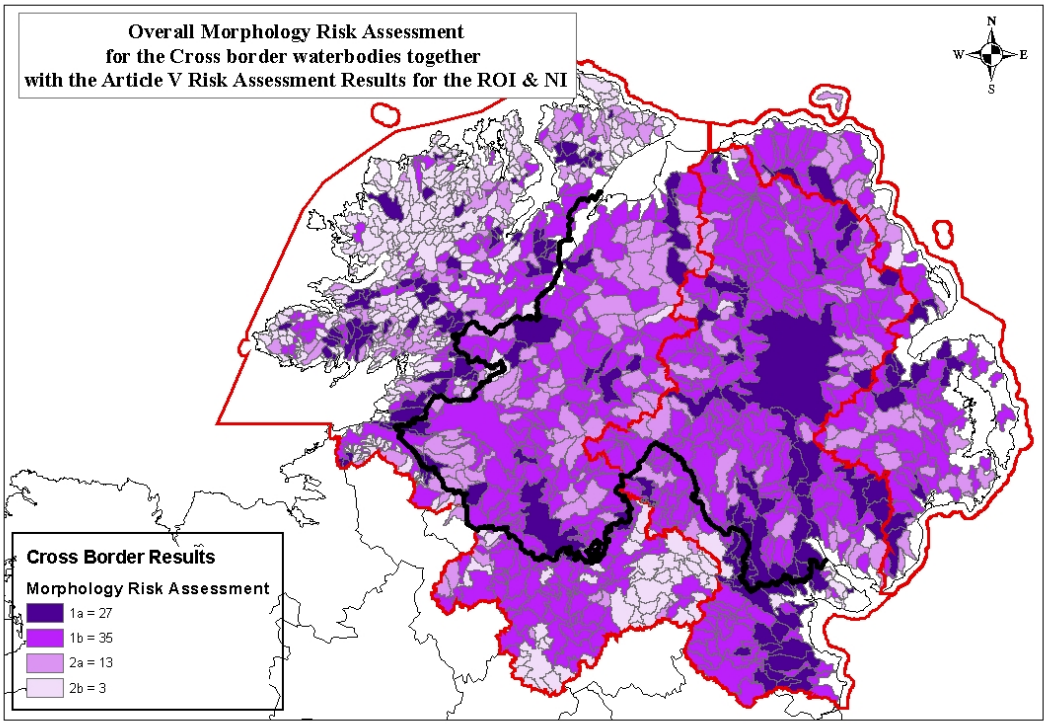


Figure 9. Cross Border Morphology Risk Assessment results (Including Improved Grassland in the Intensive Landuse Risk Test), together with the Article V Risk results.

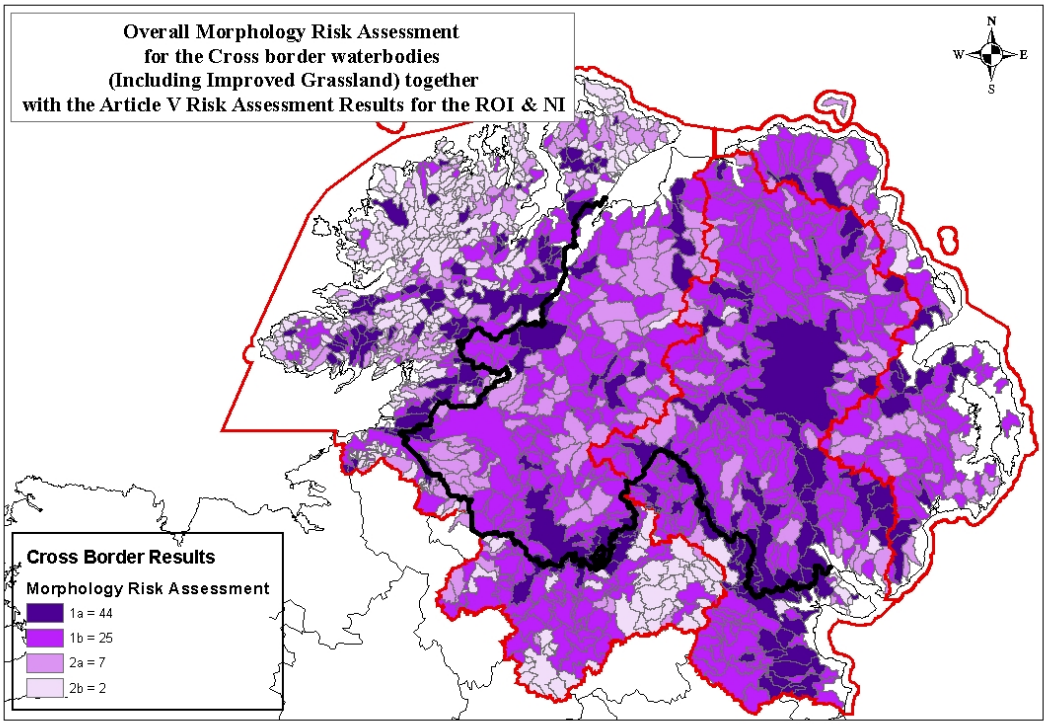


Figure 10. NI Coastal Interbasin Morphology Risk Assessment results (Excluding Improved Grassland in the Intensive Landuse Risk Test).

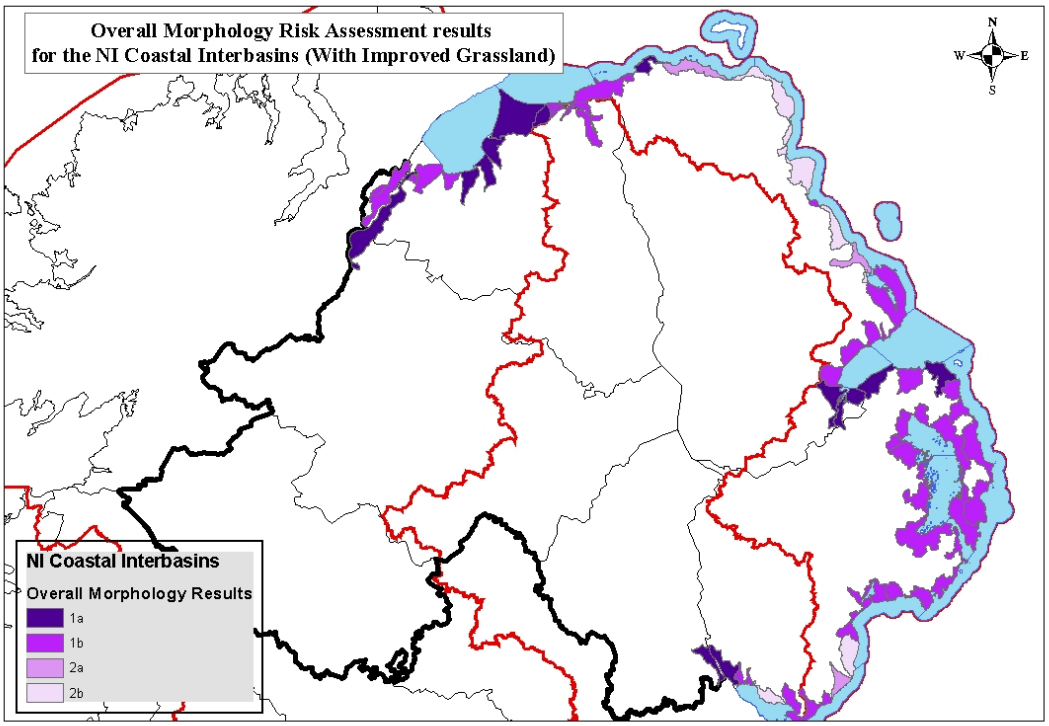
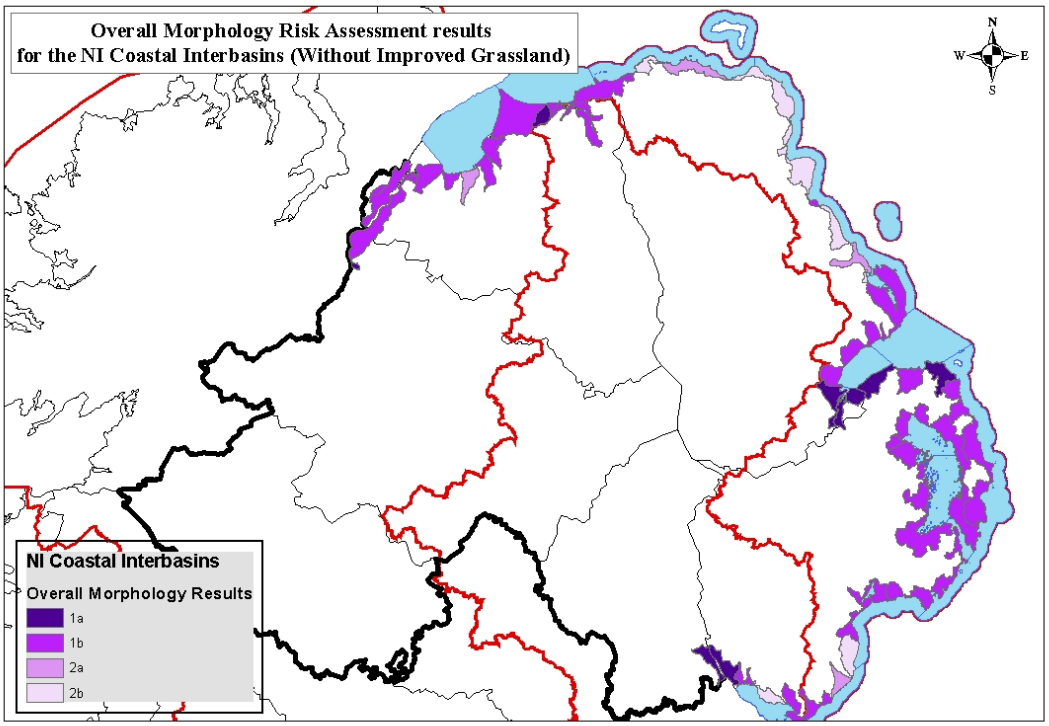


Figure 11. Coastal Interbasin Morphology Risk Assessment results (Including Improved Grassland in the Intensive Landuse Risk Test).



5.0 Q-Class, Pollution and overall risk assessment results

In the Republic of Ireland the Q values are given precedence over both other impact data and the pressure assessment. Where a Q value exists a Q4 or Class B is assigned the "Not at Risk" category based on the Article V data. Where Q values were used as the impact data and if the Q value was good this over-ruled the pressure assessments, and was reported as 2b regardless of the category predicted through the pressure assessments.

Protected Areas

In the Republic of Ireland the risk assessment in relation to protected areas has not been widely implemented. Information collected by the NPWS indicates the current state of knowledge of the conservation status of the populations of *Margaritifera margaritifera.* Given that *Margaritifera* is a long-lived species, a population is considered to be unfavourable if it is failing to recruit, as well as if the population is declining. Based on available survey and monitoring data the NPWS has assigned these rivers 1a, 1b and 2a risk categories according to the scheme outlined in Table 9.

Risk Category	Criteria
1a	Unfavourable conservation status
1b	Unfavourable conservation status
2a	Favourable conservation status or no data available regarding conservation status
2b	No 2b risk categories have been assigned due to limited available data on recruitment rates and population profiles, and also due to the extreme sensitivity of the Freshwater Pearl Mussel to siltation and eutrophication

Table 9 NPWS Conservation Risk Assessment Categories

For each water body, the *Margaritifera* risk class should be compared to the Q-Value risk class. Of the two, the worst case of risk should be applied and entered as the pollution risk class for that water body, and those up-stream. (For example, where Q = 1a and *Margaritifera* = 1a, a 1a risk class is assigned. Where Q = 2b and *Margaritifera* = 2a, a 1a risk class is assigned). This assessment was included with the impact data used in the pollution assessment so as to mask the distribution of *Margaritiera spp.* As they are a "critically endangered" species.

Margaritifera impact data was not available for the cross border waterbodies.

6.0 Datasets to be issued with this report

- Cross_Border_Water_Bodies.shp
- ROI_Coastal_ibas.shp
- ROI_Castal_ibas_Reduced.shp
- NI_Coastal_ibas.shp
- NI_Coastal_ibas_Reduced.shp
- Cross_border_waterbodies.shp (Diffuse Results)
- Cross_border_waterbodies_Reduced.shp (Diffuse Results)
- ROI_2nd order_nested_coastal_catchments.shp
- Cross_border_hydrology.shp
- Cross_border_Hydrology_Sen_Test.shp

The datasets outlined in section 3.0 of this report should have previously been supplied to the EHS Information Management Team from Compass Informatics however as there has now been some edits to these datasets the NS Share Project will also supply copies of the following files:

- Rivsubbasin_ns_06.shp
- Coastal_Inter_basins_NI.shp
- rivsubbasin_nested_coastal_small_nss. (Small 2nd order nested coastal catchments or interbasins ROI only)

Appendix 1. Cross Border Point Source, Morphology, Diffuse and Hydrology Risk Assessment Results

MS_CD	WWTP	WTP	Section 4*	IPC / Industrial Consents	CSO	Landfills	Mines	Quarries	Point Overall	Channelisation	Embankments	Impoundments	Water Regulation	Intensive Landuse	Intensive Landuse with Improved Grassland	Morph Overall (ROI Approach)	Morph Overall with Improved Grassland (NI Approach	Diffuse (Agricultural Test.)	Hydrology Overall	Overall Results (ROI Approach)	Overall Results (NI Approach)
XB_01_1	1b		1b		1b	1b		1b	1b	2b	2b	2b	2b	1b	1a	1b	1b	2a	2b	1b	1b
XB_01_2	2b	2b		2b					2b	1b	2a	2b	1a	2a	1a	1a	1b	2a	2b	1a	1a
XB_01_3									2b	2a	2a	2b	2b	2a	1a	2a	1b	2b	2b	2a	1b
XB_01_4									2b			2b	2b	2a	1b	2a	1b	2b	2b	2a	1b
XB_01_5									2b		2b	2b	2b	1b	1b	1b	1b	2b	1a	1b	1b
XB_01_6									2b			2b	2b	1b	1b	1b	1b	2b	2b	1b	1b
XB_01_7									2b			2b	2b	1b	1b	1b	1b	2b	2b	1b	1b
XB_01_9									2b			2b	2b	1b	1b	1b	1b	2b	2b	1b	1b
XB_01_10									2b			2b	2b	2b	1b	2b	1b	2a	2b	2a	1b
XB_35_1									2b			2b	1a	1b	1b	1a	1b	2a	2b	1a	1a
XB_35_2									2b			2b	1a	1a	1a	1a	1b	2a	2b	1a	1a
XB_35_3									2b			2b	1a	1a	1a	1a	1b	1b	2b	1a	1a
XB_35_4	1a			2b					1a	2a		2b	2b	2a	2a	1a	2a	2a	1b	1a	1a
XB_35_5									2b	1b		2b	1a	2b	2b	1a	1b	2b	2a	1a	1a
XB_35_6	2b							1b	1b	2a		2b	1b	2a	2a	1b	1b	2b	2a	1b	1b
XB_26_1									2b			2b	2b	2a	2a	2a	2a	2b	1b	1b	1b
XB_36_west_1									2b			2b	2b	2b	2b	2b	2b	2a	2b	2a	2a
XB_36_west_2									2b			2b	2b	2b	2b	2b	2b	2b	2b	2b	2b
XB_36_west_3									2b			2b	2b	2b	2a	2a	2a	2b	2b	2a	2a
XB_36_west_4									2b	2b		2b	2b	1b	1a	1b	1b	2b	1b	1b	1b
XB_36_west_5									2b			2b	2b	2a	2a	2a	2a	2b	1a	1a	1a
XB_36_west_6									2b			2b	2b	2b	2a	2a	2a	2b	2b	2a	2a
XB_36_west_7				2b					2b	1b		2b	2b	2a	1b	1b	1b	2a	1b	1b	1b
XB_36_west_8		2b	1b						1b			2b	2b	1a	1a	1a	1b	1b	2b	1a	1a
XB_36_west_9	1b			2b					1b	1b		2b	1a	2b	2b	1a	1b	1b	1a	1a	1a
XB_36_west_10									2b	2b		2b	2b	2a	2a	2a	2a	2b	1a	1a	1a
XB_36_west_11									2b	2a		2b	2b	2a	2a	2a	2a	2b	1a	1a	1a
XB_36_west_12									2b			2b	2b	1b	1b	1b	1b	2b	2b	1b	1b
XB_36_west_13	1a	2a		2b					1a	2b		2b	2a	2b	1b	1a	1b	2a	2b	1a	1a
XB_36_west_14				2b					2b	2b		2b	2a	1b	1b	1b	1b	2b	2b	1b	1b
XB_36_west_15									2b	1b		2b	1b	2a	1b	1b	1b	2b	1a	1b	1b
XB_36_west_16				2a					2a			2b	1b	2a	1b	1b	1b	2a	1a	1a	1a
XB_36_west_17									2b	1b		2b	2b	2b	1b	1b	1b	2a	1a	1a	1a
XB_36_east_1									2b			2b	2b	2a	1a	2a	1b	1b	1a	1a	1a
XB_36_east_2	2a		1b	2a					1b	1b		2a	1a	2b	1a	1a	1b	1b	1a	1a	1a
XB_36_east_4	1b	1b	1b		1b				1b			2b	1b	1b	1b	1b	1b	1b	1a	1a	1a
XB_36_east_5	2a		1b	2b				1b	1b	2a		2b	1b	1b	1a	1b	1b	2a	1a	1a	1a
XB_36_east_6									2b			2b	1b	1a	1a	1b	1b	1b	1a	1a	1a

MS_CD	WWTP	WTP	Section 4*	IPC / Industrial Consents	CSO	Landfills	Mines	Quarries	Point Overall	Channelisation	Embankments	Impoundments	Water Regulation	Intensive Landuse	Intensive Landuse with Improved Grassland	Morph Overall (ROI Approach)	Morph Overall with Improved Grassland (NI Approach)	Diffuse Test.	Hydrology Overall	Overall Results (ROI Approach)	Overall Results (NI Approach)
XB_36_east_7									2b			2b	2b	2a	1a	2a	1b	2a	2b	2a	1b
XB_36_east_8									2b	1b		2b	2b	2a	1b	1b	1b	2b	1a	1a	1a
XB_36_east_9									2b	2b		2b	1b	2a	1b	1b	1b	2a	1a	1a	1a
XB_36_east_10	2b								2b	1b		2b	1a	1b	1a	1a	1b	1b	1a	1a	1a
XB_36_east_11									2b	2a		2b	2b	2b	1b	2a	1b	1b	2b	2a	1b
XB_36_east_12	1b								1b	1b		2b	2b	2b	1a	1b	1b	1b	1a	1a	1a
XB_36_east_13									2b	1b		2b	2b	2b	1a	1b	1b	1b	1b	1b	1b
XB_36_east_14									2b			2b	1b	1b	1a	1b	1b	2a	2b	1b	1b
XB_36_east_15			1b						1b			2b	2b	1b	1b	1b	1b	2b	1a	1a	1a
XB_39_1	1b			2b				1b	1b	1b	2b	2b	2b	1b	1a	1b	1b	1a	2b	1b	1b
XB_01_8									2b			2b	2b	1b	1b	1b	1b	2b	2b	1b	1b
XB_01_11			1b						1b			2b	2b	1a	1a	1a	1b	2b	2b	1a	1a
XB_03_1				2b					2b	2b		2b	1b	2a	1b	1b	1b	2a	1b	1b	1b
XB_03_2	2a			2b					2a	1b	2a	2b	2a	2b	1a	1b	1b	1b	2b	1b	1b
XB_03_3									2b	2a		2b	1b	1b	1b	1b	1b	2b	1a	1b	1b
XB_03_4				2b					2b	1b	1b	2b	2b	2a	1a	1b	1b	1b	2b	1b	1b
XB_03_5	2b		1b						1b	1b	2a	2b	2b	1b	1a	1b	1b	1b	1b	1b	1b
XB_03_6									2b	2a		2b	2b	2a	1b	2a	1b	2b	1b	1b	1b
XB_03_8									2b	2a		2b	1a	1a	1a	1a	1b	1b	1b	1a	1a
XB_03_9			1b						1b	2a		2b	2b	1b	1a	1b	1b	1b	2b	1b	1b
XB_06_1	1b	1b	1b	2b					1b	1b		1b	1b	2a	1a	1b	1b	1b	2b	1b	1b
XB_06_2	1a		1b						1a	1b		2b	1a	1b	1a	1a	1b	1b	1b	1a	1a
XB_06_3									2b			2b	1a	1b	1b	1a	1b	1a	2b	1a	1a
XB_06_4									2b			2b	1a	2b	1a	1a	1b	1b	2b	1a	1a
XB_06_7	1b			2a					1b	1b	2b	2b	1a	2a	1a	1a	1b	1b	2b	1a	1a
XB_06_9			1b						1b			2b	1a	1a	1a	1a	1b	1b	2b	1a	1a
XB_06_12			1b						1b			2b	1a	2a	1b	1a	1b	1b	2a	1a	1a
XB_06_13									2b	1b		2b	1a	2a	1b	1a	1b	2a	2a	1a	1a
XB_06_14									2b			2b	1a	1b	1a	1a	1b	1b	1b	1a	1a
XB_06_15	1b								1b	2a		1a	2b	2b	1b	1a	1b	1b	1b	1a	1a
XB_06_16									2b			2b	2b	1b	1a	1b	1b	1b	2b	1b	1b
XB_06_17									2b			2b	2b	1b	1a	1b	1b	1b	2b	1b	1b
XB_06_6	1b								1b	1b		2b	1a	2a	1b	1a	1b	1b	2b	1a	1a
XB_06_5	2b			2b					2b	1b		2b	1a	2a	1a	1a	1b	1b	2b	1a	1a
XB_06_8	2b	2b	1b						1b	1b		2b	1a	1b	1a	1a	1b	1b	2b	1a	1a
XB_06_11	2b	1b							1b	2a		2b	2b	1b	1a	1b	1b	1b	2b	1b	1b
XB_03_7									2b	1b		2b	1b	1b	1a	1b	1b	1b	2b	1b	1b
XB_03_10									2b	2a		2b	2a	2a	1a	2a	1b	1b	2b	1b	1b
XB_01_12	2b	2a							2a	1b		2b	2b			1b	1b	1b	1a	1b	1b
XB_36_east_3				2b					2b	1b		2b	2b	1b	1a	1b	1b	1b	2b	1b	1b

*** Section 4 – discharges from trade and industrial premises are licenced by Local Authorities under section 4 of the Local Government water pollution act.**

Appendix 2 – NI Coastal Interbasin Morphology and Point Source Risk Assessment Results

CIB	Channelisation	Embankment	Impoundment	Water Regulation	Intensive Landuse	Intensive Landsue (With Improved Grassland)	Morphology Overall	Morphology Overall (Including Improved Grassland)	Water Treatment Works	Waste Water Treatment Works	Point Overall	Overall Results (ROI Approach)	Overall Results (NI Approach)
1	1b		2b	2a	2b		1b	1b	1b		1b	1b	1b
2	1b		2b	2a	2b		1b	1b				1b	1b
3	1b		2b	1b	1b		1b	1b				1b	1b
4			2b	2b	2b		2b	2b				2b	2b
5	1b		2b	2a	2b		1b	1b				1b	1b
6	2a		2b	2b	2b		2a	2a				2a	2a
7			2b	2b	2b		2b	2b				2b	2b
8	2b		2b	2b	2b		2b	2b				2b	2b
9	2b		2b	2b	2b		2b	2b				2b	2b
10			2b	2b	2b		2b	2b				2b	2b
11	2a		2b	2b	2b		2a	2a				2a	2a
12			2b	2b	2b	1a	2b	1b				2b	2b
13	1b		2b	2b	2b		1b	1b				1b	1b
14	1b		2b	2a	2b		1b	1b	1a		1a	1a	1a
15			1a	2a	2a	1a	1a	1b				1a	1a
16	1b	1b	2b	2a	2a	1a	1b	1b				1b	1b
17	1b	2a	2b	2b	2a	1a	1b	1b				1b	1b
18	2a	2b	2b	2a	2b	1a	2a	1b				2a	1b
19	1b		2b	2b	2b		1b	1b				1b	1b
20	1b	2a	2b	2a	2a		1b	1b				1b	1b
21	1b	1a	2b	2b	2b		1a	1b				1a	1a
22	1b	2a	2b	2b	2a	1a	1b	1b				1b	1b
23	1b		2b	1a	1b		1a	1b				1a	1a
24	2a		1a	1a	1b		1a	1b	2b		2b	1a	1a
25	1b		2b	2a	1b		1b	1b				1b	1b
26	2a		1a	2b	1b		1a	1b				1a	1a
27	1b		2b	2b	2b		1b	1b				1b	1b
28	1b		2b	2b	2b		1b	1b		1b	1b	1b	1b
29	1b		2b	2b	2b		1b	1b				1b	1b
30	1b		2b	2b	2b		1b	1b				1b	1b
31	1b		2b	2a	2a		1b	1b	1a		1a	1a	1a
32	1b		2b	2b	2a		1b	1b		1a	1a	1a	1a
33	1b		2b	2b	2a		1b	1b				1b	1b
34	1b		2b	2b	2b		1b	1b				1b	1b
35	1b		2b	2b	2b		1b	1b				1b	1b
36	1b		2b	2b	2b		1b	1b				1b	1b
37	1b		2b	2b	2a		1b	1b				1b	1b

CIB	Channelisation	Embankment	Impoundment	Water Regulation	Intensive Landuse	Intensive Landsue (With Improved Grassland)	Morphology Overall	Morphology Overall (Including Improved Grassland)	Water Treatment Works	Waste Water Treatment Works	Point Overall	Overall Results (ROI Approach)	Overall Results (NI Approach)
38	1b		2b	2b	2a		1b	1b				1b	1b
39	1b	2b	2b	2b	2b		1b	1b				1b	1b
40	1b		2b	2b	2a		1b	1b				1b	1b
41	1b	2a	2b	2b	2b		1b	1b				1b	1b
42	1b		2b	2a	1b		1b	1b				1b	1b
43			2b	2b	2b		2b	2b				2b	2b
44	2a		2b	2b	1b		2a	2a				2a	2a
45	1b		2b	2b	2a		1b	1b				1b	1b
46	1b		2b	2a	2b		1b	1b				1b	1b
47	2b	2b	2b	2b	2b		2b	2b	2a			2b	2b
48	1b		2b	2b	2b		1b	1b				1b	1b
49	1b		2b	2b	2b		1b	1b				1b	1b
50	1b	1a	2b	2a	2a		1a	1b				1a	1a
51	1b	1b	2b	2b	2b		1b	1b				1b	1b
52	1b		2b	2b	2b		1b	1b				1b	1b
53	1b	2b	2b	2b	1b		1b	1b		1a	1a	1b	1b
54	1b		2b	2b	2b		1b	1b				1b	1b
55	1b		2b	2b	2b		1b	1b				1b	1b
56			2b	2b	2b		2b	2b				2b	2b