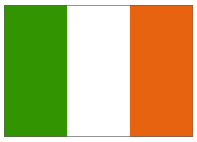

WFD Surface Water Morphological Risk Assessment Methodology

GUIDANCE ON THRESHOLDS AND METHODOLOGY TO BE APPLIED IN IRELAND'S RIVER BASIN DISTRICTS

Paper by the Working Group on Characterisation and Risk Assessment

Surface water guidance document

This is a guidance paper on the application of a proposed **Surface Water Morphological Risk Assessment** methodology. It documents the principles to be adopted by River Basin Districts and authorities responsible for implementing the Water Framework Directive in Ireland. This is a working draft describing a method that will evolve as it is trialled, and will be amended accordingly.

REVISION CONTROL TABLE

Status	Approved by National Technical Coordination Group	WFD Requirement	Relevant EU Reporting sheets	Date
Final	12th November 2004	Impacts and Pressures	SWB 3 – Provisional identification of artificial and heavily modified water bodies SWPI 6 - Significant water flow regulations and morphological alterations	November 2004

Table of Contents

1. Introduction

Risk Assessment is undertaken in accordance with the requirement, under Article 5 (1) of the water Framework Directive (WFD), for Member States to undertake, for each river basin district, "*a review of the impact of human activity on the status of surface waters and on ground waters*". Annex II provides technical specifications for the identification of pressures, section (1.4) listing, among others, the "*identification of significant morphological alterations to water bodies.*" Member States are required to "*carry out an assessment of the susceptibility of the surface water status of bodies to the pressures identified*" and of their likelihood of failing to meet the Article 4 environmental quality objectives.

Guidance

Guidance documents relevant to the pressure and impact analysis task of the characterisation process have been produced at a European Level by the IMPRESS working group under the Common Implementation Strategy (CIS). The CIS Guidance documents, the United Kingdom Technical Advisory Group's (UK TAG) guidance document on 'Morphological Alterations and the Pressures and Impacts Analyses', and Northern Ireland's Environment and Heritage Service's (EHS) 'Draft morphology risk assessment' document, were reviewed in the development of the Irish Morphological Risk Assessment methodology. Thresholds proposed for application in Ireland have been adapted from these guidance documents.

2. Aims and Scope

The aim of this document is to describe the methodology developed for undertaking Morphological Risk Assessment in Ireland ensuring a consistent approach across River Basin Districts.

The methodology outlines the drivers and associated pressures that present the potential for morphological risk to surface water bodies. For each pressure on each of the surface water categories, the risk assessment tables (Appendix I) identify the following:

- Dataset and information sources
- Data confidence*
- Measured attributes
- The threshold values for at risk, probably at risk, probably not at risk and not at risk.

* The data confidence field requires completion by each RBD. SERBD-specific data confidence is included in the tables for guidance only.

The Risk Assessment Working Group in Ireland agreed to the adoption of a four-category risk classification scheme:

1a	at risk
1b	probably at risk
2a	probably not at risk
2b	not at risk

For those water bodies identified as being at risk of failing the environmental quality objectives, further characterisation shall, where relevant, be carried out to optimise the design of both the monitoring programmes required under Article 8, and the programmes of measures required under Article 11.

Note

- Good Status = Good Chemical Status plus Good Ecological Status. Ecological Status comprises the following elements: biological elements; chemical and physico-chemical elements supporting the biological elements, hydromorphological elements supporting the biological elements, general elements and specific pollutants.
- This guidance document deals with morphological elements only; hydrological elements are dealt with by separate guidance.
- In addition to the morphological risk assessment, it should be noted that morphological alterations are also important in characterising Heavily Modified Water Bodies (HMWB). The Morphological and Hydrological Risk Assessment exercises combined comprise the screening steps for the designation process. Water bodies considered to be at significant risk of failing to reach the objectives of the WFD in 2015 (good ecological and chemical status) (i.e. 1a 'at risk' category), were considered further under the identification and designation of HMWB. The methodology for the identification and designation of HMWB is also covered by separate guidance.

3. Schedule of Drivers and Morphological Pressures

For the purpose of this guidance, the 'DPSIR' analytical framework, as identified in the European IMPRESS Guidance document, has been adopted to describe drivers and pressures where:

D = Driver **P** = Pressure **S** = State **I** = Impact **R** = Response

An example of the DPSIR model relevant to morphological pressures is:

Driver:	Navigation.
Pressure:	Dredging of a water body substrate.
State:	Altered depth, and alteration to quantity, structure and substrate of the bed.
Impact:	Changes to taxonomic composition and productivity of aquatic biota.
Response:	Consultation with National Parks and Wildlife on pressure minimisation.

Drivers with the potential for causing pressures on surface water morphology are listed below:

- Agriculture
- Coastal defence/protection
- Flood defence
- Forestry
- Infrastructure (e.g. ports, harbours)
- Marine fisheries and aquaculture
- Navigation
- Other industry (e.g. industrial intakes)
- Past activity, present purpose undefined (e.g. mill weirs)
- Power generation (incl. Hydro Electric Power)

- Urban development
- Water supply and treatment
- Peatland exploitation

Pressures associated with these drivers vary amongst the four surface water categories (rivers, lakes, coastal, transitional waters) and are described in Tables 1 to 4 below.

Table 1. Morphological Pressures on Rivers

Pressure	Description
Channelisation and dredging	**Silt and substrate removal for bed slope, side slope and depth of flow changes to the channel for drainage purposes.**
Flood protection and embankments	**The protection of lands adjacent to the water body from flooding by the presence of built embankments comprised of river bed and other material.**
Impounding	**Backing-up of water through the presence of constructed dams.**
Water regulation	**Regulation of water flow through the introduction of locks, weirs, sluices.**
Intensive land use	**Peat extraction areas, coniferous forests, arable land, urban areas.**

Table 2. Morphological Pressures on Lakes

Pressure	Description
Channelisation and dredging	**Silt and substrate removal for bed slope, side slope and depth of flow changes to the channel for drainage purposes.**
Flood protection and embankments	**The protection of lands adjacent to the water body from flooding by the presence of built embankments comprised of bed and other material.**
Impounding	**The presence of a constructed dam to prevent or control the outflow of water from a lake.**
Intensive land use	**Peat extraction areas, coniferous forests, arable land, urban areas.**

Table 3. Morphological Pressures on Transitional Waters

Pressure	Description
Channelisation and dredging	**Silt and substrate removal for bed slope, side slope and depth of channel changes for drainage and navigation purposes.**
Deposition of dredge spoil	**Deposition of dredged sediments or other material onto intertidal or sub-tidal bed for purposes of disposal or beach nourishment or beach feeding.**
Coastal defence, flood protection & embankments	**The protection of adjacent lands from flooding by the presence of built embankments; bank or coastline protection using rock armour, gabion baskets, sea walls etc.**
Impounding	**Backing up of water through the presence of constructed tidal barrages etc.**
Built Structures	**Constructed intertidal and sub-tidal structures for a range of purposes – e.g. jetties, ports, harbours, piers, slips etc.; water abstraction points for industrial and power station intakes.**
Intensive land use	**Peat extraction areas, coniferous forests, arable land, urban areas.**

Table 4. Morphological Pressures on Coastal Waters

Pressure	Description
Dredging	**Silt and substrate removal for increasing depth to facilitate navigation.**
Deposition of dredge spoil	**Deposition of dredged sediments or other material onto intertidal or sub-tidal bed for purposes of disposal or beach nourishment or beach feeding.**
Coastal defence, flood protection & embankments	**The protection of lands adjacent to the water body from flooding by the presence of constructed embankments; coastline protection using rock armour, gabion baskets, sea walls etc.**
Built Structures	**Constructed intertidal and sub-tidal structures for a range of purposes – e.g. jetties, ports, harbours, piers, slips etc.; water abstraction points for industrial and power station intakes, urbanisation.**

Datasets and information sources

To undertake the Morphological Risk Assessment, datasets and information relevant to the pressures described in the tables above were required. The following tables in Appendix I provide detail on the pressure datasets and information source requirements for each surface water category:

- rivers (Table A1.1)
- lakes (Table A1.2)
- transitional waters (Table A1.3)
- coastal waters (Table A1.4)

These tables provide thresholds for grading water bodies into risk categories according to pressure magnitudes, identified from the best available information and datasets, to determine the degree to which they place the water body at risk of not achieving Good Ecological Status. The thresholds proposed were adapted from UK and EHS Guidance incorporating Irish expert input.

4. Risk Assessment General Methodology

The Morphological Risk Assessment involved applying a set of thresholds to the pressure datasets. All of the assessments were considered on a 'water body' level, which is the key management unit. The thresholds and the measured attribute for each pressure are shown in the tables in Appendix I. Detailed steps for each assessment are provided in Appendix II.

The determination of risk category for a water body comprised two stages.

- **Stage 1:** determination of risk magnitude
- **Stage 2:** adjustment based on data confidence.

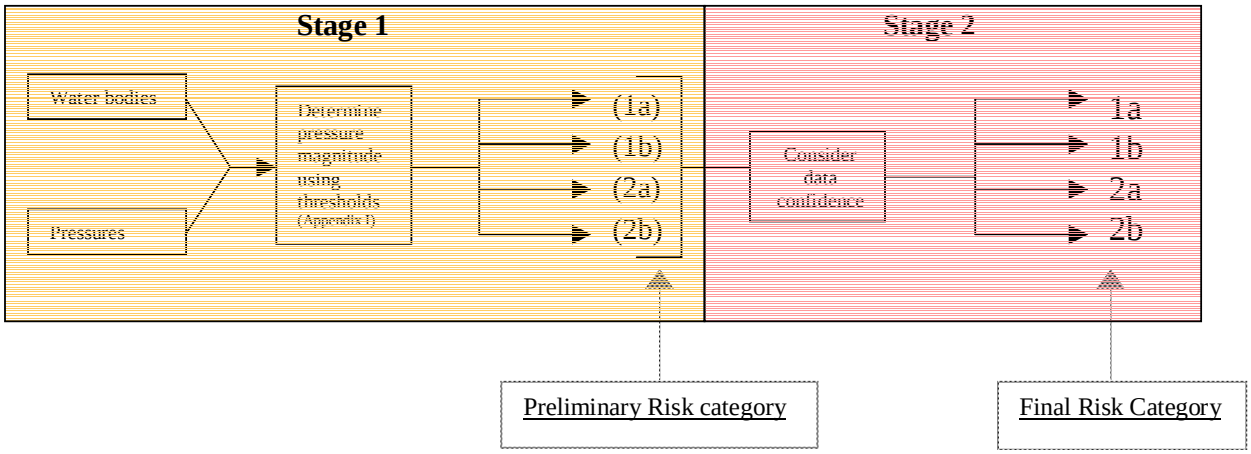

Figure 1: Determination of water Body Risk Category.

Stage 1: The application of the Appendix I thresholds to pressure datasets compiled for water bodies in the River Basin Districts placed each individual water body in one of four preliminary risk magnitude categories; (1a), (1b), (2a), (2b).

Stage 2: Each pressure assessment included an estimate of data confidence (high confidence, medium confidence, and low confidence). Determination of final risk category (1a, 1b, 2a, or 2b) considered the data confidence for each pressure. Data confidence was RBD-specific and was dictated by factors such as completeness, spatial coverage, degree of temporal information and dataset age. The following matrix summarises the approach (consistent with EHS) taken to finalise risk category:

Table 5. Risk Category Adjustment Matrix (based on data confidence levels)

Risk Magnitude (from threshold tables)	Data confidence	Risk category	Risk category	WFD Category
(1a)	HC	1.a	Water bodies at significant risk	1. Water body at risk of failing an environmental objective
(1a) (1a) (1b) (1b) (1b)	MC LC HC MC LC	1.b	Water bodies probably at significant risk (but for which further information will be needed to confirm)	
(2a) (2a) (2a) (2b)	HC MC LC LC	2.a	Water bodies not at significant risk on the basis of available information (confidence in the available information being comprehensive and reliable is low)	2. water body not at risk of failing an environmental objective
(2b) (2b)	HC MC	2.b	Water bodies not a significant risk on the basis of available information (confidence in the available information being comprehensive and reliable is high)	

5. Overall assumptions and limitations

Dataset availability

- It was noted that data availability relating to the extent of morphological alterations to rivers, lakes, transitional and coastal waters in Ireland was limited at the time of conducting the assessment. Techniques for describing and assessing surface water morphology had not been well developed in Ireland to-date. The River Habitat Survey in the UK standardises a procedure but there was no comparable survey in this country. Determining the effect that specific morphological pressures had on biological elements, therefore, relied heavily on expert judgement.
- As a trial, a mapping parameter examining sinuosity was utilised to identify river stretches that appeared to have been straightened. The concentration of 'probably straightened' water bodies showed a correlation with the OPW channelisation dataset. The tool was therefore not applied further on a national basis.
- For the intensive land use pressure, a strong correlation was identified between mapped Bord na Mona peat extraction areas and CORINE information. Only the CORINE dataset was therefore proposed for use in the assessment.
- Local knowledge was intended to constitute a significant information source in the identification of morphological alterations. This should be incorporated into the on-going assessments after 2004, as it becomes available, to improve data confidence.

Risk assessment tables

- The assessment framework provided sets of rules and threshold criteria for use in interpreting readily available national datasets. The UK TAG and EHS set threshold criteria deliberately high to take account of the difference between what may be indicated by national map based datasets and the reality on the ground.
- For any one water body, a range of pressures were encountered. The interactions between these pressures and how they vary in scale and time were examined on a case by case basis when considering the subdivision of water bodies.

Application

- The water body is the unit for assessment upon which all calculations were based. As each morphological parameter was measured, results were appended to the water body risk assessment table.
- 1st order stream stretches were excluded for the purposes of this assessment.
- Artificial water bodies were not included in the assessment.
- Morphological risk assessment applied to surface waters only. Ground waters were not included.
- Data confidence can cause the downgrading of the risk category of a water body, as per the matrix in Table 5 of this report.
- When results were assessed, expert opinion was permitted to override the determined risk category of a water body and result in upgrading or downgrading as was considered appropriate.

APPENDIX I

TABLE A1.1 RIVERS

	Pressure	Datasets & *Info sources*	Data Confidence (RBD Specific) (L/M/H)	Measured Attribute	(2b)	(2a)	(1b)	(1a)
1	**Channelisation & Dredging**	▪ OPW Channels	SE RBD: L	Proportion of water body stretch length affected by channelisation work within 500m of stretch.	<5%	5-15%	>15	-
2	**Flood Protection & Embankments**	▪ OPW Embankments	SERBD: M	Proportion of water body stretch bank length affected by embankments.	<5%	5-15%	15-60%	>60%
3	**Impounding (major dams)**	▪ *ESB Impoundments for power generation* ▪ *Local Authority Information*	SERBD: M	Presence or absence of major dams. Assessment refers to WB containing the dam plus the WB immediately downstream of the impoundment.	No dam(s)	-	-	Major dam(s) present- WB containing the dam plus the WB downstream are at risk.
4	**Water regulation (locks & weirs)**	▪ OPW Weirs layer ▪ OPW Sluices layer ▪ CFB Impassable Barriers (man-made) ▪ *IWAI navigation maps* ▪ *RBD Mill weirs-from local information* ▪ *RBD Locks layer-from OS maps* ▪ *Fisheries board input.*	SERBD: M	Number. of artificially placed structures per km per water body	<1	1-3	>3-5	>5
5	**Intensive Land Use**	▪ CORINE Urban fabric and industrial, commercial and transport units (1.1, 1.2) ▪ CORINE Peat Extraction Areas (exploited raised & blanket bog) ▪ CORINE Coniferous forests ▪ CORINE arable land	SERBD: H	Proportion of water body stretch length with intensive land use cover.	<10%	10-30%	30-70%	>70%

TABLE A1.2 LAKES

	Pressure	Datasets & *Info Sources*	Data Confidence (RBD Specific) (L/M/H)	Measured Attribute	(2b)	(2a)	(1b)	(1a)
1	**Channelisation & dredging**	▪ OPW Channels	SERBD: L	Proportion of inflowing stream length within 500m affected. (lakes >50ha: 500m buffer, lakes <50ha: 30m buffer)	<5%	5-15%	>15	-
2	**Flood Protection & embankments**	▪ OPW Embankments	SERBD: M	Proportion of lake shoreline length affected by embankments.	<10%	10-20%	20-30%	>30%
3	**Impounding (major dams)**	▪ *ESB Impoundments for power generation* ▪ *Local Authority Information*	SERBD: M	Presence or absence of major dams on lake outlet. Assessment refers to lake WB containing the dam plus the WB immediately downstream of the dam.	No dam(s)	-	-	Dam(s) present- WB containing the dam at risk.
4	**Intensive Land Use**	▪ CORINE Urban fabric and industrial, commercial and transport units (1.1, 1.2) ▪ CORINE Peat Extraction Areas (exploited raised & blanket bog) ▪ CORINE Coniferous forests ▪ CORINE arable land	SERBD: H	Proportion of lake shore length within 50m with intensive land-use.	<10%	10-30%	30-50%	>50%

TABLE A1.3 TRANSITIONAL WATERS

	Pressure	Datasets & *Info Sources*	Data Confidence (RBD Specific) (L/M/H)	Measured attribute	(2b)	(2a)	(1b)	(1a)
1	**Channelisation & Dredging**	▪ OPW Drainage Channels ▪ *DCMNR dredging location information from Applications to Dump at Sea.* ▪ BIM Aquaculture Licensed areas (bottom culture shellfish dredging)	SERBD: M	Proportion of water body area affected by dredging activity. For OPW works, assume full channel width affected plus full channel width 500m beyond terminus. Point/line dredge sites – assume full channel width affected or apply 500m buffer in estuaries >1km in width.	<5%	5-15%	15-60%	>60%
2	**Deposition of Dredge Spoil**	▪ *DCMNR Permits to Dump at Sea* ▪ *Applications for Permits to dump at sea.* ▪ *Marine Institute OSPAR-reported sea dumping locations.*	SERBD: M	Proportion of water body area affected by dumping. Point/line sites – apply 500 m buffer.	<5%	5-15%	15-60%	>60%
3	**Coastal defence, Flood Protection & Embankments**	▪ OPW Embankments ▪ *Coastal defence information from DCMNR National Coastline Survey images*	SERBD: M	Proportion of water body bank/shoreline length affected.	<5%	5-15%	15-60%	>60%
4	**Impounding (tidal barrages)**	▪ *Local Authority Information & local knowledge re: tidal barrages.* ▪ CFB Impassable Barriers (man made)	SERBD: M	Presence or absence of impoundments.	No Impoundments	-	-	Impoundment(s) present
5	**Built Structures**	Ports / Harbours ▪ *Structural information from DCMNR National Coastline Survey images* ▪ *CSO port and harbour statistics (cargo tonnage)* ▪ *Coastwatch Ireland INTERREG Clean Seas Project Report (SERBD only)*	SERBD: H	Gross annual cargo tonnage of port or harbour facilities present. (of individual facilities, not cumulative)	<1,350 tonnes or tonnage not available.	1,350-7,500 tonnes	7,500-13,500 tonnes	>13,500 tonnes
		Industrial / Power Station Intakes ▪ *EPA IPC Register* ▪ *RBD characterisation abstraction register & info gathered from Local Authorities, Power Stations.*	SERBD: L	Presence of Industrial or Power Station intake.	No industrial or power station intake.	Industrial or power station intake present	-	-
6	**Intensive land use**	▪ CORINE Urban fabric and industrial, commercial and transport units (1.1, 1.2) ▪ CORINE Peat Extraction (exploited raised & blanket bog). ▪ CORINE Coniferous forest ▪ CORINE arable land	SERBD: H	Proportion of water body bank/shoreline with intensive use.	<10%	10-30%	30-50%	>50%

TABLE A1.4 COASTAL WATERS

	Pressure	Datasets & *Info Sources*	Data Confidence (RBD Specific) (L/M/H)	Measured attribute	(2b)	(2a)	(1b)	(1a)
1	**Dredging**	▪ DCMNR dredging location information from Applications to Dump at Sea. ▪ BIM Aquaculture Licensed areas (for bottom culture shellfish dredging)	SERBD: M	Proportion of water body seabed area affected Point/line sites – apply 500m buffer.	<5%	5-15%	15-60%	>60%
2	**Deposition of dredge spoil**	▪ *DCMNR Permits to Dump at Sea* ▪ *Applications for Permits to dump at sea.* ▪ *Marine Institute OSPAR-reported sea dumping locations.*	SERBD: M	Proportion of water body seabed area affected. Point/line sites – apply 500m buffer.	<5%	5-15%	15-60%	>60%
3	**Coastal defence, Flood Protection & Embankments.**	▪ OPW Embankments ▪ *Coastal defence information from DCMNR National Coastline Survey images*	SERBD: H	Proportion of water body coastline affected	<5%	5-15%	15-60%	>60
4	**Built Structures**	Ports/Harbours ▪ *Structural information from DCMNR National Coastline Survey images* ▪ *CSO port and harbour statistics (cargo tonnage)* ▪ *Coastwatch Ireland INTERREG Clean Seas Project Report (SERBD only)*	SERBD: H	Gross annual cargo tonnage of port or harbour facilities present. (of individual facilities, not cumulative)	<1,350 tonnes or tonnage not available.	1,350-7,500 tonnes	7,500-13,500 tonnes	>13,500 tonnes
		Urbanisation ▪ CORINE Urban fabric and industrial, commercial and transport units (1.1, 1.2)	SERBD: M	Proportion of water body coastline affected	<5%	5-15%	15-60%	>60%
		Industrial / Power Station Intakes ▪ *EPA IPC Register* ▪ *RBD characterisation abstraction register & info gathered from Local Authorities, Power Stations.*	SERBD: H	Presence of industrial or power Station intake	No industrial or power station intake.	Industrial or power station intake present	-	-

APPENDIX II

Methodology

This section indicates steps taken and buffers applied during the trial phase of this risk assessment to select attributes and overcome some GIS issues.

Rivers

1. Channelisation and dredging

a) The Channels layer generated by the OPW was cut at water body boundaries and aggregated to a single entity for each water body.
b) A 500m meter buffer was applied to river stretches as some channelisation was indicated where no river stretch was delineated. Each water body then had a filtered length of OPW channel.
c) Thresholds were applied to the length of river stretch (river length based on stream orders of 2 and upwards) affected by OPW channelisation.
d) Risk category was assigned.
e) Risk category was confirmed following consideration of data confidence.

2. Flood protection and embankments

a) OPW embankments were cut at water body boundaries.
b) OPW embankments were aggregated based on water body ID, so that each water body had an associated total OPW channels length. Overall length was halved to allow for both river banks.
c) A 500m meter buffer was applied to river stretches as some embankments were indicated where no river stretch was delineated. Each water body then had a filtered length of OPW embankment.
d) Thresholds were applied to the length of river length affected by OPW embankments.
e) Risk category was assigned.
f) Risk category was confirmed following consideration of data confidence.

3. Impounding

a) No impoundments dataset was available for this pressure category. The presence of rivers dammed for power generation or other purposes were identified from RBD Local Knowledge, ESB and/or Local Authority information.
b) Risk category was assigned to water bodies based presence/absence information. The risk category related to the water body in which the impoundment was located and the water body immediately down stream of the impoundment, if a separate water body. Expert judgement reviewed this application in some cases.
c) Risk category was confirmed following consideration of data confidence.

4. Water regulation (locks and weirs)

a) The total number of lock and weir structures was ascertained from data sources listed.
b) The number of locks and weirs within each water body was determined. This number was divided by the total stretch length within the water body.
c) Risk category was assigned.
d) Risk category was confirmed following consideration of data confidence.

5. Intensive land use

a) The 'intensive land use' layer was compiled from CORINE. Categories used included: Bogs Exploited, Urban Fabric, Industrial Commercial Transportation, Coniferous Forestry and Arable land uses.
b) A 50m buffer was applied order to select Intensive Landuse adjacent to river stretches.
c) Risk category was assigned based on proportion of river stretch length flanked by intensive land use cover.
d) Risk category was confirmed following consideration of data confidence.

Lakes

1. Channelisation and dredging*

a) A 500m meter buffer was applied around the lake area. (500m buffer to lakes >50 ha, 30m buffer to lakes <50ha. This was to eliminate overlapping of buffers around clustered small lakes)
b) Inflowing streams within this buffer were identified.
c) The length of OPW channels affecting the inflowing streams was identified.
d) The proportion of inflowing stream length affected by channelisation within the buffer zone was calculated.
e) Risk category was assigned.
f) Confirm risk category following consideration of data confidence.

*an amendment was made to this following National Expert' meeting on the Outcome of the lakes Risk Assessment: see note at end of document.

2. Flood protection and embankments

a) Cut OPW embankments at water body boundaries.
b) Aggregate OPW embankments based on water body ID, so that each water body has an associated total OPW channels length.
c) Apply 50m buffer to lake water body boundary to select adjacent embankments.
d) Apply thresholds to the length of lake shoreline affected by OPW embankments.
e) Assign risk category.
f) Confirm risk category following consideration of data confidence.

3. Impounding

a) Lake water bodies that were affected by an impoundment from inventory of hydro power stations compiled from local knowledge and ESB information were identified.
b) Risk category was assigned based on this information.
c) Risk category was confirmed following consideration of data confidence.

*an amendment was made to this following National Expert' meeting on the Outcome of the lakes Risk Assessment: see note at end of document.

4. Intensive land use

a) The 'intensive land use' layer was compiled from CORINE. Categories used included: Bogs Exploited, Urban Fabric, Industrial Commercial Transportation, Coniferous Forestry and Arable land uses.
b) In order to select Intensive Landuse adjacent to lakes, a 50m buffer was applied.
c) Risk category was assigned based on proportion of lake shore length flanked by intensive land use cover.
d) Risk category was confirmed following consideration of data confidence.

Transitional waters

1. Channelisation and dredging

Note: where OPW drainage channels extended to transitional water bodies, it was assumed that the entire width of the water body, plus that of the channel 500m beyond the terminus (downstream end only)of the OPW works, was affected. For dredge locations where only point/line co-ordinates are available, it was also assumed that the entire channel width was affected. (where the channel was >1km wide, a 500m buffer was applied to the extent of the works)

a) A GIS layer of dredged areas was created.
b) Proportion of water body area affected was determined.
c) Risk category was assigned.
d) Risk category was confirmed following consideration of data confidence.

2. Deposition of dredge spoil

Note: Some dump locations were only available as a point features. In such instances a 500m buffer was applied.

a) A GIS layer of dump site areas was created.
b) Proportion of water body area affected was determined.
c) Risk category was assigned.
d) Risk category was confirmed following consideration of data confidence.

3. Coastal Defence, Flood Protection & Embankments

a) A GIS layer of embankments and coastal defence features was created.
b) A 20 m buffer was used to select coastal protection features along transitional water boundaries. This approach was adopted to allow for the use of different base mapping in the generation of the various datasets.
c) The proportion of water body shoreline length affected by these structures was determined.
d) Risk category was assigned.
e) Risk category was confirmed following consideration of data confidence.

4. Impounding (tidal barrages)

a) No dataset was available for impoundments or tidal barrages. In order to identify water bodies that were affected by significant structures, an inventory was compiled from Local Authority information and local knowledge.
b) The presence or absence determined risk category of the transitional water body.
c) Risk category was confirmed following consideration of data confidence.

5. Built Structures

Port structures and Facilities

a) An inventory of port and harbour structures from National Coastline Survey and available sources was compiled.
b) Gross tonnage statistics were compiled from CSO sources.
c) Risk category was assigned based on gross tonnage information (considering individual ports' gross tonnage and not cumulative water body tonnage).
d) Risk category was confirmed following consideration of data confidence.

Industrial and Power Station Intakes.

a) Presence or absence of an industrial or power station intake determined risk category.
b) Risk category was confirmed following consideration of data confidence.

6. Intensive Land Use

a) An 'intensive land use' layer was compiled from CORINE. Categories used included: Bogs Exploited, Urban Fabric, Industrial Commercial Transportation, Coniferous Forestry and Arable land uses.
b) A 50m buffer was applied in order to select Intensive Land Use adjacent to the transitional water body boundary.
c) Risk category was assigned based on proportion of water body shoreline flanked by intensive land use cover.
d) Risk category was conformed following consideration of data confidence.

*an amendment was made to this following National Expert' meeting on the Outcome of the Marine Risk Assessment: see note at end of document.

Coastal waters

1. Channelisation and dredging

Note: Some dredge locations were only available as a point/line feature; in such instances for coastal waters, a 500m buffer was applied.

a) A GIS layer of dredged areas was created.
b) Proportion of water body area affected was determined.
c) Risk category was assigned.
d) Risk category was confirmed following consideration of data confidence.

2. Deposition of dredge spoil

Note: Some dump locations were only available as a point/line feature; in such instances for coastal waters, a 500m buffer was applied.

a) A GIS layer of dump areas was created.
b) The proportion of water body area affected was determined.
c) Risk category was assigned.
d) Risk category was confirmed following consideration of data confidence.

3. Coastal Defence, Flood Protection & Embankments

a) A GIS layer of embankments and coastal defence features was created.
b) A 20 m buffer was used to select protection features along coastal waters. This approach was adopted to allow for the use of different base mapping in the generation of the various datasets.
c) The proportion of water body coastline length affected by these structures was determined.
d) Risk category was assigned.
e) Risk category was confirmed following consideration of data confidence.

4. Built Structures

Port structures and Facilities

a) An inventory of structures was compiled from National Coastline Survey and available sources.
b) Gross tonnage statistics were compiled from CSO sources.
c) Risk category was assigned based on gross tonnage information. (considering individual ports' gross tonnage and not cumulative water body tonnage)
d) Risk category was confirmed following consideration of data confidence.

Urban Centres

a) Urban Fabric was extracted from CORINE
b) A 50m buffer was applied to the coastal water body boundary in order to select urban fabric adjacent to the water body.
c) Risk category was assigned based on the proportion of the coastal water body affected by urban fabric.
d) Risk category was assigned following consideration of data confidence.

Industrial and Power Station Intakes.

a) Water body was determined to be probably not at risk if industrial or power station intake wass present.
b) Risk category was confirmed following consideration of data confidence.

Note

Lakes

Amendments were made to the Morphological Risk Assessment for lakes following National Expert' meeting on the Outcome of the Risk Assessment.

- The impact of Channelisation on lakes was reviewed and it was decided that this pressure on lakes should be assessed as 2A ("probably not at significant risk") unless specific evidence indicated that such works have a major impact on the water body.
- It was decided that impoundments which are used to control water level in lakes should be considered as placing the lake water body into the 1B category (probably at significant risk) as such impoundments require an element of future management to ensure good ecological status.

Marine

An amendment was made to the Morphological Risk Assessment for Lagoons following National Expert' meeting on the Outcome of the Risk Assessment.

- It was decided that all lagoons (coastal and transitional) should be subject to the intensive land use risk assessment. It was recommended that a 2A risk class be assigned and attributed to intensive land use, with a higher risk class assigned where so indicated by any of the other risk assessments.