WFD Rivers Diffuse Pollution 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 **Rivers Diffuse Pollution 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	SWPI 4 Signifiant diffuse source pollution on surface waters	November 2004

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1. Introduction

Risk Assessment was 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*".

The main potential sources of guidance from other EC countries included the Impress working group convened as part of the Common Implementation Strategy (C.I.S.), and particularly the United Kingdom Technical Advisory Group (UK TAG), on which the Republic of Ireland participated at an observer level.

Whilst many of the other Pressures and Impacts quality elements, such as hydromorphology and point sources for example, were the subject of guidance documents, the complexity and differing potential approaches to the problem resulted in a lack of guidance on diffuse pollution risk to surface waters, and thus a number of potential methodologies were trialled to attempt to produce meaningful maps of potential risk.

The pressures and impacts analysis utilised existing information, to identify areas that were at risk of failing to meet the required standard of "good ecological status" by 2015. This required a practical analysis of existing land use patterns, physical/topographical relationships, and water quality data (quality and quantity), to make some general assumptions on where risk to water lay from pollutants ascribed to particular land use.

Many European nations utilised an "off the shelf" modelling solution, for example products such as "MIKE BASIN" to model diffuse pollution inputs. Other countries either developed their own models, or combination of models (for example Northern Ireland), or as an interim perfectly acceptable to the WFD, use of land-use, impact data and "expert judgement", as in the recent SEPA approach.

2. Aims and Scope

This document, and the associated GIS layers and spreadsheets attached to it, was intended to provide a toolkit for the practitioner to provide a risk analysis for each RBD utilising nationally available datasets which were consistent to each RBD.

Lack of data to represent many pressures and impacts was also an issue, and so pressures, and the tests to represent them, were selected to attempt to present a realistic and achievable result.

The methodological information regarding data sources, measured attributes and relevant threshold values are summarised in tabular form.

For each identified pressure on the river water bodies, the risk assessment methodology practitoners sheets (Appendix I - XII) identify the following:

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

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 will, 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.

An important decision was reached at National Level on the Risk Assessment Working Group (RAWG) with regard to the use of impact data that differed significantly from the approach used by the UK TAG. The RAWG decided that impact data would have primacy over predictive models, but that the impact data would lead to *improvements* over predictive result, *not just dis-improvements*, as in the UK TAG methodology.

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 diffuse pollution risk to rivers only; diffuse pollution risk to other categories of water body is addressed by other guidance.

3. Schedule of Drivers and Diffuse Pollution Pressures

For the purpose of this guidance, the 'DPSIR' analytical framework, as identified in the European IMPRESS Guidance document, was 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 diffuse pollution pressures is:

Driver: Urbanisation.

Pressure: Sewage disposal.

State: Increased levels of nutrients, ammonia, metals and priority substances.

Impact: Eutrophication, other changes to taxonomic composition and productivity of aquatic biota.

Response: Consultation with planning and legislative authorities on best practice regarding development, and enforcement of appropriate license conditions.

Drivers with the potential for causing pressures from diffuse pollution of rivers include:

- Agriculture
- Forestry
- Transport infrastructure (e.g. roads, railways)
- Urban development
- Rural drainage (septic tanks)

Some of the main effects of activities considered as part of the risk tests are shown in Table 1.

Table 1. Diffuse Pollution Risk to Rivers

Driver/Pressure	Description
Agriculture	**Nutrients from organic and inorganic fertilisers, pesticides, siltation from grazing, ammonia from silage or slurry, agricultural fuel oils**
Forestry	**Acidification from plantations on acid sensitive catchments, sedimentation from clear fell, harvesting, new plantations road construction and erosion on steep catchments. Eutrophication from fertilisation on steep catchments, and peat soils. Risk from synthetic pyrethroids from treatment of pine weevil.**
Transport Infrastructure	**Drainage from roads containing hydrocarbons, metals and suspended solids. Hydrocarbons and priority substances from accidental spillage. Pesticides from maintenance. Rail – oils from routine leakage, accidental spillage and maintenance. Pesticides from track weed control.**
Urban development	**Solids, bacteria, metals, hydrocarbons and organic loading from urban run-off.**

Rural drainage	Nutrient, ammonia, organic and bacterial loading.

Datasets and information sources

To undertake the Diffuse Pollution to Rivers Risk Assessment, datasets and information relevant to the pressures described in the tables above were required. The data sources are included in the Practitoners Sheets (Appendices I to XII).

These methodologies provided 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 placed the water body at risk of not achieving Good Ecological Status. The thresholds proposed were adapted from existing WFD guidance or legislation where available, derived from other sources such as relevant Codes of Practice, or assessed using expert judgement.

4. Risk Assessment General Methodology

The diffuse pollution risk assessment involved applying a set of thresholds to the pressure datasets. All of the assessments are considered on a 'water body' level, which is the key management unit. The thresholds and methodologies are shown in Appendices I to XII.

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

- **Stage 1:** determination of risk magnitude
- **Stage 2:** adjustment based on impact data (where available).

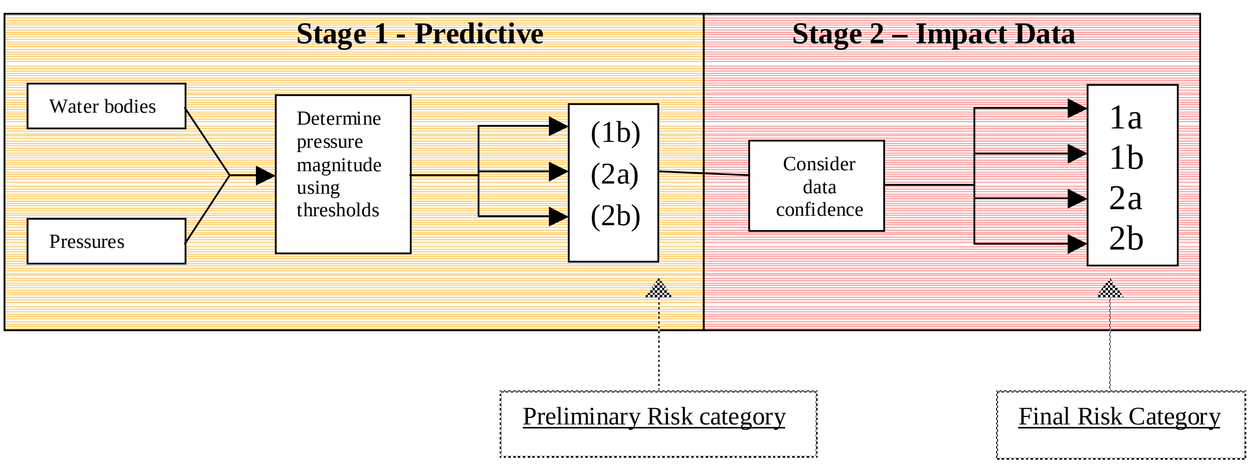

Figure 1: **Determination of Water Body Risk Category.**

Stage 1: The application of the appropriate thresholds to pressure datasets compiled for river water bodies in the River Basin Districts placed each individual water body in one of three preliminary risk magnitude categories; (1b), (2a), (2b). It is important to note that due to the nature of these tests, water bodies were not placed in the 1a (at risk) category based on the Stage 1 test alone. The 2b category was retained to allow for a "negative" assessment, for example, there would be little chance of there being large sheep numbers in the middle of an urban area, so a risk score of 2a (possibly at risk) would be unrealistic in this circumstance.

Stage 2: Each pressure assessment included an estimate of data confidence based on the availability of impact data. Water bodies were only considered 1a (at risk) if both the Stage 1 risk assessment and appropriate impact data confirmed its status.

5. Overall assumptions and limitations

Dataset availability

- It was noted that data availability relating to the extent of pressures and activities related to rivers in Ireland was limited at the time of conducting the assessment. Techniques for describing and assessing diffuse pollution of rivers had not been developed by the UK TAG, and thus no existing methodology could be assessed for suitability. Determining the effect that specific diffuse pollution pressures had on biological elements, therefore, relied heavily on expert judgement.
- Difficulties existed in applying main datasets such as CSO Census data which was reported at a DED level to water body level. Spatial representation of pressures had to be realistic. It was attempted to attribute data based on land-use information, but the statistical significance of this was inconclusive.
- Water quality data was unavailable for the higher catchments, for which many of the tests were most relevant, e.g. forestry and sheep dip tests. However, there were pre-established statistically significant relationships between some land use types (grassland, urban and arable) and biological status, represented by Q-value. An early assumption of the National Working Group was that Q4 could be used to act as a proxy for good ecological status for the purposes of this characterisation.
- Temporal difficulties with datasets created a challenge in that some datasets used, such as FIPS or CORINE for example, constantly changed due to changing cropping and development patterns. This was acknowledged and in all cases, the most suitable nationally available and inclusive datasets were included.

Risk assessment tables

- The assessment framework provided sets of rules and threshold criteria for use in interpreting readily available national datasets. Although the WFD operates on the precautionary principle, the risk tests set out to offer a common sense and not overly prescriptive set of thresholds, designed to identify risk areas for further investigation during the next phase of the WFD.

- For any one water body, a range of pressures were be encountered. The interactions between these pressures and how they vary in scale and time should be 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 diffuse pollution test was applied, 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.
- These diffuse pollution tests were applied to river water bodies only.
- Data confidence can cause both upgrading AND downgrading of the risk category of a water body. This was the case for both diffuse and point source elements of the risk assessment, but not the hydrology and morphological elements.
- When results were assessed, expert opinion was permitted in some case, to override the determined risk category of a water body and result in upgrading or downgrading as was considered appropriate.

Surface Water Diffuse Risk Assessment Practitioners' Sheets

Practitioners Sheet – Test SD1 (General Diffuse)

TEST	CODE
General diffuse	SD1
Type	Quantitative / predictive (critical landcover areas)
SOURCES	
Methods	
EPA diffuse model	In press
Data	
EPA EPA EPA EPA	Corine Landcover 2000 sub basin boundaries Q Values Riverine N and P data

Digital Components

Attached to this method are the files: (see below for discussion and usage)

- Swstatus_131004.dbf
- Biol_qvals.dbf
- National_n_p.dbf
- Rwb_sd7_sum.dbf - statistics for river water bodies

Methodology

A predictive model to estimate the likelihood or river waters attaining a Q value >=4 has been developed by the EPA. This model was developed from the relationship between the area proportion of different landcover classes and measured q values. Different mapping information (landcover, soil type, agricultural statistics etc) were evaluated for inclusion in the model - the final model is based on the most statistically significant factors which were the Corine landcover classes - pasture, arable and urban.

The original model was developed & validated on the basis of the percentage coverage within the catchment area u/s of the monitoring stations with in the EPA biological monitoring survey.
For the SD1 test, the Corine landcover proportions of the relevant Corine classes were determined for the (4466) national river water body sub-basin areas, and for each of which the statistical likelihood of achieving >= Q4 was determined by application of the EPA model statistical formula (a presentation of the complete EPA model methodology has been submitted to a peer review journal and is likely to be published in 2005. In the interim an overview of the method may be available from the EPA on request).

Results of the application of the model and associated datasets provided to RBD projects are set out below:

a. **swstatus_131004.dbf** - prediction of likelihood of attaining a minimum of Q4 for river water bodies. A record is provided for each river water body (4466 nationally)

'eco_risk_d' - EPA Model - prediction of likelihood of achieving Q4
' pred_risk' - risk classes based solely on predictions (Note that these cut-offs are now revised from earlier drafts)
>.75 - 2b
0.6-.75 - 2a
0.25 -0.6 - 1b
< 0.25 - 1a

Land use Thresholds.

Table 2 indicates the threshold values above which water bodies had a ≥ 0.75 likelihood of not achieving Q4.

Land use type	Arable	Intensive grassland	Urban
Threshold % area	1.3%	37%	0.03%

Impact Data

Impact WQ summaries were developed by 1) determining which EPA station(s) were on which river water body 2) for the one or many stations on each water body, determining the minimum and maximum value of each parameter and the count. A nominal mean is also provided, but for Q values this is just to indicate the predominant Q value as an arithmetic mean of Q is unreal - Qs are only determined as discrete values! Where no stations occur along a water body for the relevant parameter, a value of -99 is recorded.

risk summaries (q_risk, p_risk)

Q_RISK

where Q_min < 4 - Q_risk of "1a" is recorded
where Q _min >= 4 - Q_risk of "2b" is recorded
On rwbs where Q is not recorded, a nominal Q_risk has been determined as per the EPA predictive approach- using the same categories as in 'pred_risk' above. This now means that a rwb can be classed as '1a' or '2b' based on the predictive model alone. EPA have indicated that the chance of a misprediction of Q4, where the prediction is > 0.75 or <.25 should not be greater than 10%.

This revised classification more closely approximates EPA national survey results than earlier draft schemes i.e. some 1751 (39%) rwbs now in 1a/b and 2715 (61%) in 2a/b categories.

P_RISK for **P** - the threshold value of 30ug/l cut-off (P Regs) is applied to indicate a nominal risk - and applied this to the MRP_MAX values. Note - This is not formally part of the predictive test and serves as additional information for evaluation.

The swstatus table can be joined to the draft river water bodies for assessment and visualisation. Note that this only contains records for those river water bodies where stream order >=3 or = 2 & sub basin area >= 10km2. Thus there may be no values for some of your (smaller) river water bodies are these are currently excluded from the risk assessment/ characterisation

b. biol_qvals.dbf - source table of Q values in the period from 1994 to 2002. These were provided as separate tables by EPA for 1994-2000 and 2000 - 2002. It is understood that these 2000-2002 data (supplied in May 2004) are draft and may be subject to some modifications. No values yet provided for 2003.

Field - LAST_Q records the most recent Q value recorded.
Field - LASTQ_YEAR indicates the relevant year (xx is recorded for a small number of sites where no Q values provided).
Field - LASTQ_SIMP is a simplification of the Q value (e.g. 3* = 3 or 2-3/0 = 2-3).

c. **national_n_p_0804.dbf** - source table of P, N and ammonia as supplied by EPA in August 2004.
Also provided as river water body summaries (min, max, mean and count) in file swstatus_131004.dbf

Use of Impact Data

Test SD1 – Prediction of achieving Q4

Data Source	**Measured Attribute**	**Predicted score**			
Predictive assessment	Predicted likelihood	**2b** >0.75	**2a** 0.6-0.75	**1b** 0.25-0.6	**1a** 0-0.25
WQ Data	Q>= 4	2b	2b	2b	2b
	Q < 4	1a	1a	1a	1a

Practitioners Sheet – Test SD2 (Road Transport)

Test a – Road Drainage (soluble copper)

TEST	CODE
Road Drainage	SD2(a-c)
Type	Quantitative (excedence of EQS)
SOURCES	
Methods	
CIRIA Report 142 (1994)	' road run off loads
Data	
EPA EPA EPA MetEireann GSI Ordnance Survey (1:50k) NRA National Roads Traffic Flow 2002 (RT610) NRA, Road Geometry Handbook, NRA TD 27/00	Corine Landcover 2000 sub basin boundaries Hydrometric Gauges and 95%ile flows ESRI Grid -' Annual' - long term annualised average rainfall National geology map Road Lines and Classification Road Traffic volumes Major Road Types - Design Widths
EPA	Acid sensitive waters

Digital Components

Attached to this method are files consisting

a) 'Road_Event' - Reclassification of MetEirean long tem rainfall grid

b) Acid geology map - 'nat_geol_acid_setting.shp'. All shapes in file represent acidic environments - either acidic geology only or acidic geology in combination with organic soils

c) Excel calculation examples

d) National Roads Traffic Flow 2002 (RT610)

Methodology

Stage 1 – Initial Screening

This step identifies potential problem areas that an EQS test is to be carried out on.

Step 1 - Create a map layer using both CORINE Urban and OS 1:50,000 showing urban areas, overlay CSO data to eliminate sewered areas (which will be covered under “urban” with regard to risk assessment. Select out the motorways and major “A” (county) roads. Or check with Nat Urban Waste Water Study.

Step 2. Determine AADT values for Roads in RBD. This information can be obtained from the National Road Authority report, "National Roads Traffic Flow 2002 (RT610) which is attached, and is available from the following internet link:
http://www.nra.ie/Transportation/DownloadableDocumentation/d1058.PDF.

Step 3. Select road stretches that have **>30,000 AADT** volumes of traffic. Research by CIRIA and the NRA, backed by the EPA, has suggested that road run-off is extremely unlikely to pose a risk below this threshold and is unlikely to produce any problem in day to day operation, i.e. excluding accidents.

Step 4. Overlay river water body sub basin boundaries to determine length of road within a particular river water body sub basin that pass the qualifying threshold. Apply the methodology given below to the qualifying road stretches and their associated water bodies. Where one basin contains more than one stretch of qualifying road, each stretch of road should be considered separately.

Stage 2 – EQS Test WBs Traffic AADT .30,000

This test is designed to simulate the discharge of substances from roadways into a water body in its low flow condition, from a rainfall event of 24 hours intensity following a 5-day dry period. In most cases, measured values will not exist, and thus assumptions are made regarding background concentrations being half of EQS value.

In the case of metals EQS where EQS is reliant on hardness, and where hardness is not available, it can be proxied using the acid geology map.

Step 1 – Calculate a background concentration for the receiving water body at the assumed road discharge point (Cb)

A) If measured impact data for soluble copper available, use annual average mean. IF NOT follow steps B) to D) to calculate assumed value.

B) Calculate relevant EQS (soluble copper) for water body.
Hardness <100mg/l CaC03 = 40ug/l
Hardness >100mg/l CaC03 = 112ug/l
C) If measured hardness not available, use map Figure 1 – "Acid Geology", if water body >70% acid geology, assume EQS = 40ug/l, if not assume EQS = 112ug/l
D) Assume background concentration to equal 50% of EQS value, i.e. either 20ug/l (acid) or 56ug/l (non acid). This value = Cb

Step 2 – Calculate area of road to drain to each WB.

The calculated length of road draining to each water body from the DTM map should be multiplied by the width to generate an area in square metres.

Motorway
hard areas = 23m

Standard dual carriageways
hard areas = 21m

Wide single carriageway
hard areas = 15m

Step 3 – Calculate amount of pollutant built up on calculated road area for a 5 day period (M)
The figures used in Table 2 can be used to calculate M by multiplying the area in hectares generated in step 2.

Table 2 - Pollutant Build up rates (kg/ha)

Traffic Flow AADT	**Total Solids**	**COD (Kg02)**	**Nh4 - N**	**Total Cu**	**Soluble Cu**	**Total Zn**	**Soluble Zn**	
>30,000	10000	700	4.0	3.0	1.2	5.0	2.5	Yearly
	140	9.6	0.055	0.041	0.016	0.068	0.034	5-days

Step 4 – Calculate Q-95 low flow value for receiving water body

Calculate Q95 for stretch of water at assumed discharge point. This was done for the ERBD by utilising measurements for the nearest applicable gauging station and applying an area weighting. Alternatively, the derived Q95 map utilised in other risk assessments might also be used.

Step 5 – Calculate Total Run off Volume (V)

Total runoff volume (V) = road area (m2)* x runoff coefficient** x rainfall (m/day)***

* from Step 2

** = 0.5 for soluble copper

***Allow daily rainfall figure from Figure **2 "Adjusted Rainfall"**. This will range from 8-16mm per day, measured at the crossing point of road and water body. **<u>CONVERT TO METRES/DAY</u>**

Step 6 - Calculate d/s in river concentrations (Cr) for pollutant.

The following formula should be used to calculate the concentration in the receiving water body

$$Cr = \{(Cb \times Q95) + (1000 \times M)\} / (Q95 + V)$$

Summary Table Test SD2a – Road Drainage (Soluble Copper) Predictive

Data Source	Measured Attribute	Predictive Risk Class			
Corine Landcover 2000	Qualifying traffic thresholds; predictive run off concentration in water body,	**2b**	**2a**	**1b**	**1a**
sub basin boundaries		Traffic <30,000 AADT	Non-failure of EQS,	Failure of EQS (0.04 mg/l)	-
Road Lines and Classification					
Road Traffic volumes					

Use of Impact Data

If suitable measured values for soluble copper downstream of the assumed discharge point exist, they can be used to adjust the risk score as shown below.

Test SD2a – Road Drainage (Soluble Copper) Impact Data

Data Source	Measured Attribute	Predicted score			
Predictive assessment		**2b**	**2a**	**1b**	**1a**
WQ Data	Failure of EQS Level	1b	1b	1a	1a
	Achieved EQS	2b	2a	2a	1b

Practitioners Sheet – Test SD2 (Road Transport)

Tests B&C – Road Drainage(total zinc and total hydrocarbons)

TEST	**CODE**
Road Drainage	SD2(a-c)
Type	Quantitative (exceedance of EQS)
SOURCES	
Methods	
CIRIA Report 142 (1994)	' road run off loads
Data	
EPA EPA Ordnance Survey (1:50k) NRA National Roads Traffic Flow 2002 (RT610) NRA, Road Geometry Handbook, NRA TD 27/00	Corine Landcover 2000 DTM (for sub basin boundaries) Road Lines and Classification Road Traffic volumes Major Road Types - Design Widths
EPA	Acid sensitive waters

Digital Components

Attached to this method are files consisting

a) Derived rainfall map
b) Acid geology map
c) Excel calculation examples
d) National Roads Traffic Flow 2002 (RT610)

Methodology

Identical to SD2a) apart from

1) Substitute new EQS Values for total zinc and total hydrocarbons into Stage 2, Step 1. (Note EQS values for these substances do not change with acidity so adjustment for hardness element does not apply.)
2) Substitute pollutant build up rate shown below for previous value in Stage 2, Step 3 (calculation of M)
3) Substitute run-off coefficient in Stage 2, Step 5 **FROM** 0.5 to 0.2 **TO** reflect the reduced mobility of the substance.
4) Substitute new EQS values to Step 7 to generate predictive score.

Determinand	**Total Zinc**	**Total hydrocarbons**
EQS	0.3 mg/l	0.5 mg/l
Run-off Co-eff	0.2	0.5
Build-up rate (5 day)	0.068 kg/ha/5-day	1.380 kg/ha/5-day

Practitioners Sheet – Test SD3 (Transport)

Test a – Diffuse pollution from railways

TEST	**CODE**
Type	Expert Judgement

Digital Elements

None

Methodology

Table 2 – Risk Assessment Matrix for Diffuse pollution from Railways

Risk Score	**1a**	**1b**	**2a**	**2b**
Observed presence of pressure	-	-	Water body contains marshalling yard or maintenance depot near water body	All other water bodies

Practitioners Sheet – Test SD4 (Forestry)

Test a – Acidification

TEST	CODE
Acidification from forestry	SD4a
Type	Quantitative / predictive - (relationship between % forestry, and acid sensitivity of catchment
SOURCES	
Methods	
EPA Research – J Bowman; M.Kelly-Quinn	Acid Sensitive Surface Waters in Ireland
Data	
Forest Service EPA EPA EPA EPA GSI	FIPS Forest Parcel database sub basin boundaries- River pH values River Q Data Soils & Subsoils National Geology map

Digital Components

Attached to this method are files consisting

Critical Loads on actual acidity of soils - 'nat_geol_acid_setting.shp'. All shapes in file represent acidic environments

Methodology

Step 1 – Generate map of Critical Forestry from FIPS data. In the ERBD this classification consists of FIPS categories

FIPS database field	Elements
Class_genus	Larch Pine Pine/Spruce mix Spruce Other Conifers Unknown (in clear fell areas)
Class_category	Cleared (assume in coniferous rotation)

Step 2 – Overlay map of critical forestry on Acidic Critical Load Map This will generate an impact potential layer of critical forestry on acid sensitive geology.

Step 3 – Overlay Step 2 with sub-basin boundaries to ascertain extent within individual river water body catchments

The risk score can be expressed as a percentage of the **total area of the buffered area** adjacent to the watercourse.

Table 3 – Risk Assessment Matrix for acidification from Upland Forestry

Risk Score	1a	1b	2a	2b
% Area of water body with "critical forestry" overlying acid setting	-	>20% critical forestry overlying critical load area OR >10% overlying in a catchment where 75% of entire catchment is on critical load area	>10% critical forestry overlying critical load area	All remaining water bodies

Impact Data

It is important to allow for naturally acidic conditions, thus expert judgement must be used if necessary to allow for particular local conditions.

Predictive Result	Impact Data	Re-designate
Designated 1b	Annual av hardness < 8mg/l $CaCO_3$	1a
Designated 2a		1b
Designated 2b		2a

Practitioners Sheet – Test SD4 (Forestry)

Test b – Suspended Solids

TEST	**CODE**
Diffuse siltation from forestry	SD4b
Type	Quantitative / Predictive - (relationship between % forestry, and erosion risk of catchments
SOURCES	
Methods	
COFORD	Guidance notes
Data	
Forest Service EPA EPA EPA EPA EPA/Teagasc	FIPS Forest Parcel database sub basin boundaries Slope (percent) from EPA DTM River SS values River Q Data Soils & Subsoils

Methodology

Step 1 – Areas of high erosion potential should be identified using peat soil and sandstone derived soils layers' from the Teagasc National Soil Maps. In ERBD the following parent materials were utilised:

TCSsS
TDSS
IRSTLS
GGR
GLPSsS
BKTPT
CUT
FENPT
GCSsS
TNSSs
IRSTLPSsS
IRSTCSsS
TLPSsS

Step 2 - Generate critical slope map from the DTM. Critical slope is >= 15 percent slope

Step 3 - Extract critical forestry types (see test SD2a) from FIPS database

Step 4 - Generate 60m buffer (either side) of river water bodies

Step 5 - Union of Steps 1-4 (commercial forestry on sensitive soils and steep slopes within proximity buffer)

Areas covered by FIPS coniferous forest within the 60m buffer area should be assessed using the impact potential matrix below (**Table 2**). The impact potential contains factors that lead to the creation of a potential for erosion, namely vulnerable soils, steep slopes, proximity to watercourses and presence of coniferous forest.

Table 2 – Impact Potential Matrix for Erosion from Upland Forestry

	Peat soil, sandstone derived soils	**Non-peat soil, non sandstone derived soils**
Slope >15% (1in7) @60m	H	L
Slope <15%	L	N

The risk score can be expressed as a percentage of the **total area of the buffered area** adjacent to the watercourse.

Table 3 – Risk Assessment Matrix for Erosion from Upland Forestry

Risk Score	**1a**	**1b**	**2a**	**2b**
% Area of water body buffer rated impact potential "H"	-	>5%	1-5%	<1%

Impact Data

It is difficult to assess upland catchments in terms of solids as the large size and heavy rainfall means that even on well managed, low impact catchments, significant solids can be mobilised in storm conditions. However, if monitoring data is available for water bodies, the EQS identified below might be used to amend the predictive risk scores as shown.

Predictive Result	**Impact Data**	**Re-designate**
Designated 1b	Annual av SS > 25mg/l	1a
Designated 2a		1b
Designated 2b		2a

Practitioners Sheet – Test SD4 (Forestry)

Test c – Eutrophication

TEST	**CODE**
Diffuse eutrophication from forestry	SD4b
Type	Semi - Quantitative / Predictive - (relationship between % forestry on peat soils, and eutrophication risk of catchments
SOURCES	
Methods	
COFORD	Guidance notes
Data	
Forest Service EPA EPA EPA EPA/Teagasc	FIPS Forest Parcel database sub basin boundaries River MRP values River Q Data Soils & Subsoils

Methodology

Step 1 – Areas of high leaching potential for P should be identified using peat soil and appropriate soils layers' from the Teagasc National Soil Maps.

BKTPT
CUT
FENPT
RSPT
PODPT
AMINPDPT
BMINPDPT

Step 2 - Extract critical young forestry types (see test SD6c) from FIPS database

Step 3 - Union of Steps 1-2 (commercial forestry on sensitive soils)

Areas covered by FIPS coniferous forest within the water body area should be assessed using the matrix below (**Table 2**). The risk assessment contains factors that lead to the creation of a potential for P-loss, namely acid nutrient poor soils and presence of young coniferous forest.

Table 2 – Risk Assessment Matrix for Eutrophication from Forestry

Risk Score	**2a**	**2b**
% Area of water body critical forest on sensitive soils	>10%	<10%

Impact Data

It is difficult to assess upland catchments in terms of eutrophication as the large size and heavy rainfall means that even on well managed, low impact catchments, significant loads of nutrients can be mobilised in storm conditions. However, if monitoring data is available for water bodies, the standard identified below might be used to amend the predictive risk scores as shown.

Predictive Result	**Impact Data**	**Re-designate**
Designated 2a	Annual av. “max” MRP > 0.02mg/l	1b

Practitioners Sheet – Test SD5 (un-sewered areas)

Test a – Septic tank cluster test

TEST	**CODE**
Diffuse pollution from unsewered areas	SD5
Type	Cluster Point – identification of concentration of unsewered properties
SOURCES	
Methods	Expert judgement / pseudo quantitative
EPA	Corine Landcover 2000
EPA	sub basin boundaries
Ordnance Survey (1:50k)	Road Lines and Classification
CSO	National Census of Population 2002

Methodology

Step 1 – Create map layer of urban areas by overlaying the 1:50,000 O.S. Sheet with:-

a) CORINE "urban" layer
b) OS "built up areas

This will produce a map with all identified urban areas.

Step 2 –Link DED map dataset with CSO Census of Population data on Sewered households & Septic Tank households

Step 3 – Overlay NUWWS to blank out urban areas known to be served by foul sewers

Step 4 – Identify (most likely small) household clusters (in villages) which may not be sewered.

- Where a household cluster is identified and CSO data indicates no/few sewerage connections this is likely to represent an un-sewered cluster.

- Where CSO data indicates partial sewerage and this can be linked to a mapped sewered area or there is a larger urban area within or directly adjacent to the DED, residual small clusters should be identified as candidate 'un-sewered' areas.

Step 5 – The location of candidate 'unsewered clusters' identified in Step 4 should be recorded within a point shapefile.

Step 7 - Assign 2a category to water bodies containing one or more 'un-sewered' cluster point. All other water bodies to be 2b.

Step 8 - Consult with relevant Local Authorities concerning the sewerage facilities within the identified candidate sites

Table 2 – Risk Assessment Matrix for Erosion from Unsewered Areas

Risk Score	**1a**	**1b**	**2a**	**2b**
Presence of 'candidate 'un-sewered' cluster points	-	-	Water body contains cluster point	Water body contains no cluster point

Practitioners Sheet – Test SD6 (Priority Substances from Agriculture)

Test a – Arable Land

Priority Substances from Agriculture – Arable

TEST	**CODE**
Priority Substances from Agriculture	SD6a
Type	Pseudo-quantitative
SOURCES	
Methods	
EPA Land use Study	Land use/Q-Value relationship
Data	
EPA Teagasc / CSO EPA	Q-values Enumerated areas of crop types 'total cereals', potatoes', 'sugar beet', 'other crops' sub-basin boundaries

Methodology

Step 1 - Generate Pressure Magnitude by normalising CSO Agricultural Census Data (ha of particular crop /area farmed - as percentage) for the CSO types, “total cereals”, “potatoes”, “sugar beet” and “other crops” .

Step 2 – Overlay DED data on river water body sub-basin layer to Area Weight the Step 1 DED crop area estimates. Assume that the proportion of the CSO crop type areas within a particular river body sub-basin is proportional to the proportion of the DED within the sub-basin.

Step 3 – Generate risk status for water bodies using Table 2.

Table 2 – Risk Classes Based on Proportions of Water bodies under Certain Crop Types

“2a” designation	1a	2a
% Area of water body “cereals”	-	>7%
% Area of water body “sugar beet”	-	> 10%
% Area of water body “potatoes”	-	> 10%
% Area of water body “Other”	-	>7%
% Area of summed cereals/pots/beet	-	>10%

Impact Data

The EPA Q-value system has a toxicity element represented by a “/0” that is a possible indicator of agro-chemical and other toxic incidents. However the low sample frequency significantly reduces the reliability of biological sampling to detect this type of incident. In addition, 2 other factors can affect Q-values in a similar way, for example acification and old mine drainage. Thus if Q values are available in 1b/2a water bodies, the site history should be looked at to determine the likelihood of this type of pollution having occurred.

Data Source	Measured Attribute	Predicted score	
		2b	2a
Predictive assessment	“/0” toxic effect Q value + expert judgement, OR agro - chemicals in WQ analysis	2a	1b
WQ Data/Expert judgement			

Practitioners Sheet – Test SD6 (Priority Substances from Agriculture)

Test b – Sheep Dip

Priority Substances from Agriculture – Sheep Dip

TEST	**CODE**
Priority Substances from Agriculture	SD6b
Type	
SOURCES	
Methods	
EPA Land use Study	Stocking density/Q-Value relationship
Data	
EPA Teagasc / CSO EPA	Q-values Estimates for stocking density (sheep) sub-basin boundaries

Methodology

Step 1 - Generate Pressure magnitude by normalising CSO Agricultural census Data for Livestock Units (Sheep) to CSO “area farmed” figure for DEDs.

Step 2 – Identify DEDs where the livestock unit (sheep) density is >0.5 LU/ha. (approximately 15% DEDs nationally)

Table 2 – Pressure Magnitude for Potential Sheep Dip Pollution related to Sheep Numbers

Metric threshold	Magnitude
>0.5 LU/ha sheep	High
<0.5 LU/ha sheep	Medium
zero sheep	Low

Stage 3 – Determine proportion of river water body area with high risk (DED) coverage

Step 4 – Generate risk status for water bodies using Table 3.

	1a	1b	2a	2b
Predictive Step	-	-	>90% sub-basin Pressure Magnitude High	<90% sub-basin Pressure Magnitude High

Impact Data

The EPA Q-value system has a toxicity element represented by a “/0” that is a possible indicator of sheep dip incidents. However the low sample frequency significantly reduces the reliability of biological sampling to detect this type of incident. In addition, 2 other factors can affect Q-values in a similar way, acification and old mine drainage. Thus if Q values are available in 1b/2a water bodies, the site history should be looked at to determine the likelihood of sheep dip pollution having occurred.

Data Source	Measured Attribute	Predicted score	
		2b	2a
Predictive assessment	“/0” toxic effect Q value + expert judgement, OR detected sheep dip chemicals in WQ analysis	2a	1b
WQ Data/Expert judgement			

Practitioners Sheet – Test SD6 (Dangerous Substances from agriculture)

Test c – Forestry

TEST	CODE
Dangerous Substances from Forestry	SD6c
Type	Quantitative / Predictive - (relationship between % forestry, and risk
SOURCES	
Methods	
COFORD	Guidance notes
Data	
Forest Service EPA EPA	FIPS Forest Parcel database sub basin boundaries River Q Data

Methodology

Step 1 – Generate map of Critical Forestry from FIPS data. In the ERBD this classification consists of FIPS categories

FIPS database field	Elements
Class_genus	Larch Pine Pine/Spruce mix Spruce Other Conifers Unknown (in clear fell areas)
Class_category	Cleared
Class Maturity	Young

Step 2 – Overlay Step 2 with sub-basin boundaries to ascertain extent within individual river water body catchments

Table 3 – Risk Assessment Matrix for Priority Substances from Upland Forestry

Risk Score	**2a**	**2b**
% Area of water body containing high risk forest areas	>10%	<10%

Impact Data

The EPA Q-value system has a toxicity element represented by a "/0" that is a possible indicator of synthetic pyrethroid incidents. However the low sample frequency significantly reduces the reliability of biological sampling to detect this type of incident. In addition, 2 other factors can affect Q-values in a similar way, acification and old mine drainage. Thus if Q values are available in 1b/2a water bodies, the site history should be looked at to determine the likelihood of SP pollution having occurred.

<table>
<tr><th>Data Source</th><th rowspan="2">Measured Attribute</th><th colspan="2">Predicted score</th></tr>
<tr><td rowspan="2">Predictive assessment</td><th>2b</th><th>2a</th></tr>
<tr><td rowspan="2">"/0" toxic effect Q value + expert judgement, OR detected SP chemicals in WQ analysis</td><td rowspan="2">2a</td><td rowspan="2">1b</td></tr>
<tr><td>WQ Data/Expert judgement</td></tr>
</table>