South Western River Basin District

A Future For Our Waters


pettit


RPS Consulting Engineers


JE
JACOBS BABTIE

Contents

The Lakes of Killarney, the salmon-rich Munster Blackwater and the beautiful coastline of Counties Cork and Kerry are jewels in the crown of Ireland.

1 Introduction

1.1 Introduction

The Lakes of Killarney, the salmon-rich Munster Blackwater and the beautiful coast-line of Counties Cork and Kerry are jewels in the crown of Ireland. Tourists and local people value them and enjoy them. We use these and other waters in the South Western River Basin District to supply our drinking waters; we fish and swim in them; we draw water from them for our industries.

The Environmental Protection Agency (EPA) monitors the quality of Ireland's river water. Of the 13,000 km of river channel in the country it found that the quality of 70% is satisfactory, 17% is slightly polluted, 12% is moderately polluted and less than 1% is seriously polluted in the years 2001 to 2003.

This report introduces you, the reader, to a project that seeks to maintain and improve the quality of the waters of the rivers, lakes, estuaries, coastal waters and groundwaters of the South Western River Basin District, in accordance with the terms of the EU **Water Framework Directive** (WFD). The report is the first in a series that will build up to form a management plan for our waters. It summarises the initial assessment of our waters carried out by the project team. Full details of the assessment are available on the project website, *www.swrbd.ie*.

The project is being carried out by Pettit, in association with RPS Engineering Consultants and Jacobs Babtie, for Cork County Council. It is 100% funded by the National Development Plan. It will provide the baseline information and tools to launch the implementation of the WFD.

1.2 Overview of the Water Framework Directive

The Water Framework Directive came into force in December 2000 and was written into Irish law in December 2003. Ireland has been divided into eight River Basin Districts (RBDs), see Figure 1.1. Four are located entirely within the Republic of Ireland, one entirely within Northern Ireland and there are three cross border RBDs.

The Directive is intended to:

- Protect and enhance the status of all our waters.
- Encourage sustainable water use.
- Provide for sufficient supply of good quality surface water and groundwater.
- Reduce or phase out discharges of dangerous substances to waters.
- Protect territorial and marine waters and,
- Establish and maintain a register of 'protected areas'.

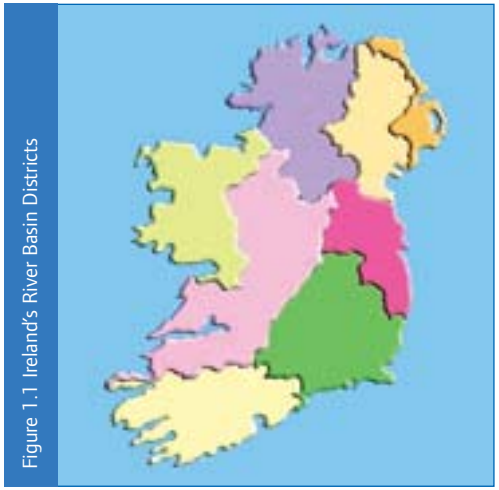


Figure 1.1 Ireland's River Basin Districts

The primary targets of the WFD are to achieve *good quality status in all waters by 2015* and *to maintain high status or good status of waters where they exist*. Good status is measured in quantity, quality and ecology for **surface water** and quantity and quality for **groundwater**.

1.3 South Western River Basin District

The South Western River Basin District covers a total area of approximately 15,000 km^2 and boasts a stunning coastline of over 1,800 km along the Atlantic Ocean and Celtic Sea. It comprises most of the land area of County Cork, including Cork City, most of County Kerry and small areas of Counties Waterford, Limerick and South Tipperary. In addition to the rivers, lakes and estuaries and their catch-ments it includes groundwaters, coastal waters

Water Framework Directive
It clarifies, collects and updates existing pieces of water legislation and provides for water management on the basis of River Basin Districts (RBDs).

Surface Water
Water located on the surface of the earth, in lakes, rivers, streams, ponds, wetlands and the ocean, i.e. all water naturally open to the atmosphere.

Groundwater
Water found below the surface of the earth, often occurring in natural reservoirs in per-meable rock layers. It provides the source for wells and natural springs. It is contained in the pores of sand and gravel and fractures of rock formations.

Surface Water Body
A discrete and significant element of surface water such as a lake, a reservoir, a stream, river or canal, part of a stream, river, canal, an estuary or a coastal water.

Estuaries and Coastal Waters
Estuaries (or transitional waters) are waters near river mouths which are saline as a result of being beside coastal waters, but which are influenced by fresh water flow. Coastal waters, under the WFD, are surface waters up to one nautical mile from the coast.

and their offshore islands. The principal river catchments are the Blackwater, the Lee, the Bandon, the Ilen, the Inny, the Maine and the Laune.

In the western half of the SWRBD the landscape is dominated by mountains, natural grasslands and peatlands. Agriculture and tourism are the most important activities. In the eastern part of the RBD there is a more cultivated landscape. Industrial activity is concentrated in Cork City and its hinterland, particularly at Little Island and Ringaskiddy which also supports important port facilities.

1.4 Implementation of the WFD in the SWRBD

On 22nd December 2003 the Minister for the Environment signed the Regulations which brought the Water Framework Directive into Irish Law. The regulations identify those tasked with managing the implementation of the Water Framework Directive and the targets that must be met.

Cork County Council was appointed the Co-ordinating Authority acting jointly with Cork City Council, Kerry County Council, Limerick County Council, Waterford County Council and South Tipperary County Council for the implementation of the Regulations in the SWRBD.

The SWRBD project commenced in September 2004 with the appointment of the project consultants. The first major task for the project team was to gather information on the rivers, lakes, **estuaries**, **coastal waters** and groundwaters and to outline the factors which could affect the quality of these waters in the future. The report which was compiled as a result of this work is called the Characterisation Report; this document is a summary of its contents. Similar reports were carried out for the other River Basin Districts in the country and they form a national report. The full contents of the national report are available from the Irish WFD website *www.wfdireland.ie*.

This summary report establishes baselines for future steps which will have to be taken to meet all the requirements of the WFD. The cost of producing water and its value to the community are also addressed.

Map 1.1 South Western River Basin District

2.1 Introduction

The WFD introduces the concept of River Basin Districts. Each river, estuary, coastal water and groundwater within the RBD is divided into water bodies while certain lakes form individual water bodies themselves. The Directive requires each of these water bodies to achieve good status by 2015. Hence the water body is the management unit i.e. standards will be set for the various water bodies and monitoring will be carried out to show whether or not these standards have been met.

2.2 River Water Bodies

All river catchments have been subdivided into river water bodies based primarily on the geology and slope of the land over which they flow. The geology of the land will affect the hardness of the river water while the slope will

River Water Body Types	No. of Water Bodies	Channel Length (km)	Channel Length (%)
Soft Water Low Slope	54	310.1	9.0
Soft Water Medium Slope	**272**	**1,000.9**	**29.2**
Soft Water High Slope	142	318.8	9.3
Soft Water Very High Slope	182	229.3	6.7
Medium Hardness Low Slope	26	208.3	6.1
Medium Hardness Medium Slope	56	333.1	9.7
Medium Hardness High Slope	15	53.4	1.6
Medium Hardness Very High Slope	10	24.8	0.7
Hard Water Low Slope	**57**	**562.6**	**16.4**
Hard Water Medium Slope	63	366.9	10.7
Hard Water High Slope	6	16.1	0.5
Hard Water Very High Slope	2	9.5	0.3

Table 2.1 Breakdown of River Water Body Types in the SWRBD

Map 2.1 River Water Bodies in SWRBD

determine how fast the water flows. Together they will affect the types of plants and animals that live in the rivers and along river banks.

The total length of river water channels within the SWRBD is approximately 3,428km. This length of river channel has been sub-divided into 885 river water bodies in accordance with the criteria outlined in the WFD.

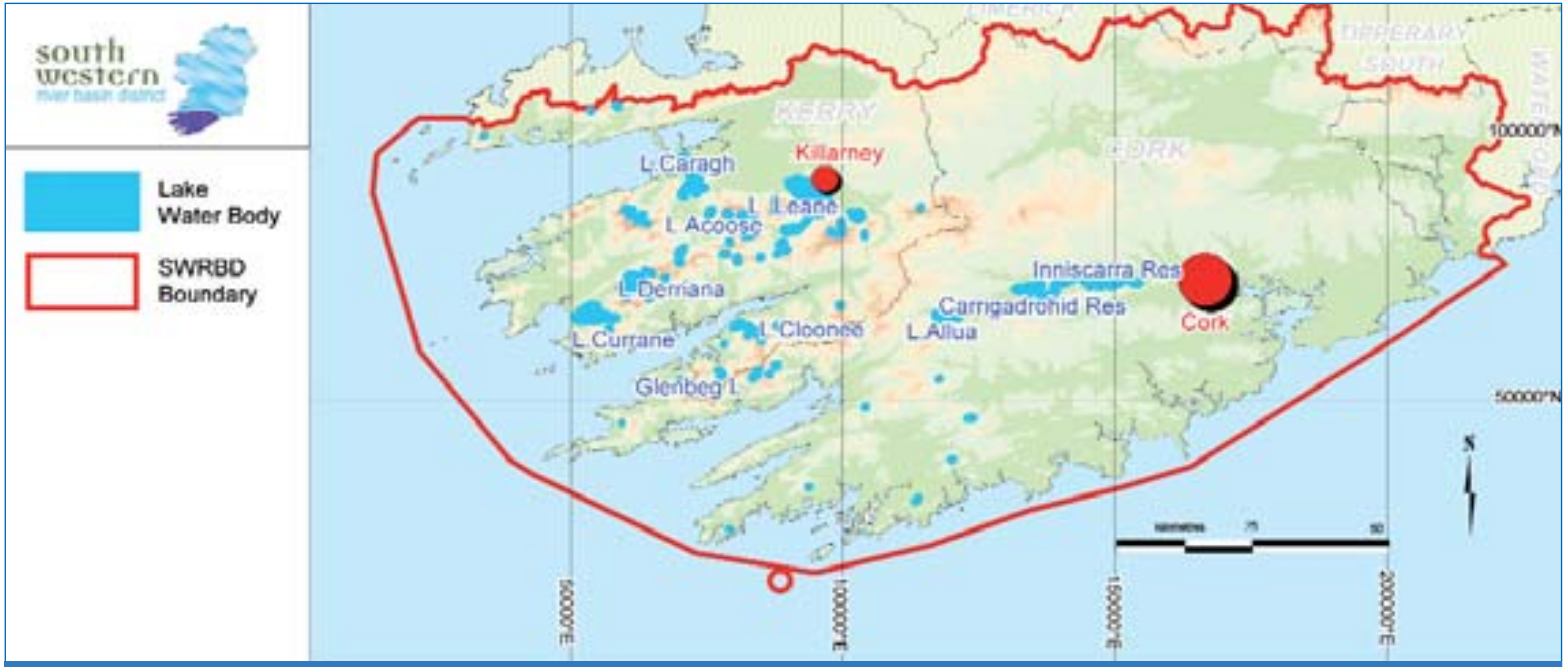
The most common type of river water body in the South Western RBD is soft water with medium slope (29.2%). The Lee, Bandon and Inny river basins which overlie sandstone are typical areas where such water bodies are found. The second most common type is the hard water with low slope (16.4%). This is found in the Blackwater and Laune River basins which overlie limestone.

2.3 Lake Water Bodies

It would not be practical to monitor and report on the water quality of all lakes in the SWRBD because there are so many of them, they are mostly very small and they are often inaccessible. The WFD requires that those in the following categories be considered.

- Lakes greater than 50 hectares (125 acres).
- Lakes from which drinking water is abstracted.
- A representative sample of lakes located in Special Areas of Conservation (SACs).

There are 20 lakes over 50 hectares in the SWRBD, the largest of which are Lough Leane (1,952 hectares) in County Kerry and Carrigadrohid (586 hectares) in County Cork. There are 22 lakes from which drinking water supplies are taken. 73 lakes from amongst the many in SACs were chosen, they are representative of the range of lake types found in SACs in the SWRBD. Many lakes fall into more than one of the three categories identified for reporting under the WFD.



Map 2.2 Lake Water Bodies in SWRBD

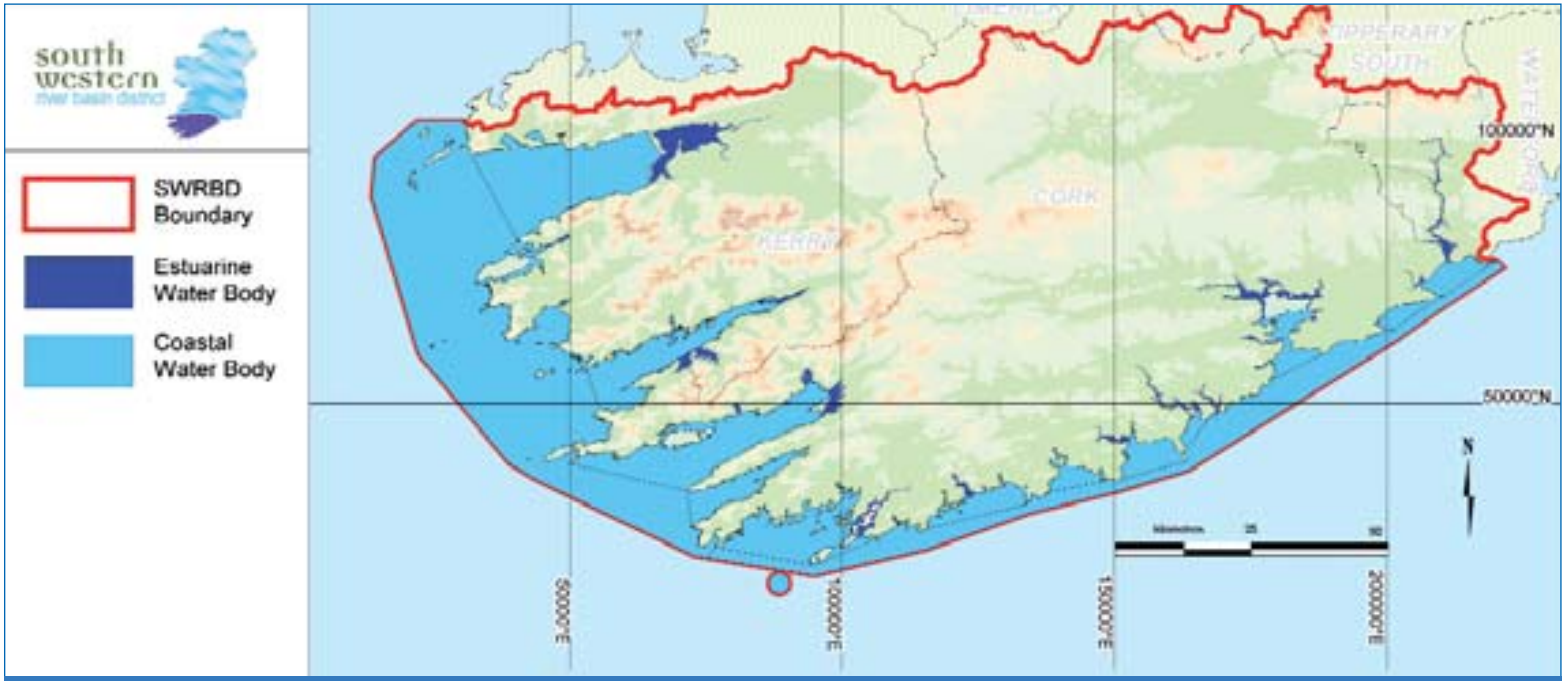
2.4 Estuarine & Coastal Water Bodies

Estuaries (or transitional waters) are waters near river mouths which are saline, but which are influenced by fresh water flows. Coastal waters are surface waters in the area between the coast and one nautical mile (1,852 metres) from the coast. Criteria such as the degree of salinity, the degree of exposure to the open ocean and tidal range were used to differentiate the different types of estuarine and coastal water bodies.

Two types of estuarine water bodies are found within the SWRBD, i.e. lagoons and brackish, sheltered estuaries with moderate tidal range; see Table 2.2. Four types of coastal water bodies are found in the SWRBD, see Table 2.2. Using these criteria, 43 estuarine water bodies and 27 coastal water bodies were identified in the SWRBD.

Type	No. of Water Bodies	(%) Number
Estuarine: Brackish, Moderate Tidal Range, Sheltered	29	67
Estuarine: Lagoons	14	33
Coastal: Average Salinity Sea Water, Moderate Tidal Range, Exposed	9	33
Coastal: Average Salinity Sea Water, Moderate Tidal Range, Moderately Exposed	9	33
Coastal: Average Salinity Sea Water, Moderate Tidal Range, Sheltered	3	12
Coastal: Lagoon	6	22

Table 2.2 Estuarine and Coastal Water Bodies by Type in the SWRBD



Map 2.3 Estuarine and Coastal Water Bodies in SWRBD

2.5 Groundwater

Groundwater is water found below the surface of the earth, often occurring in natural reservoirs in permeable rock layers. Bedrock formations or sand and gravel deposits which yield significant quantities of water are called aquifers. The type of rock affects the volume and chemistry of the water. In the SWRBD, the dominant sandstone and limestone rock types account for almost 85% of groundwater bodies.

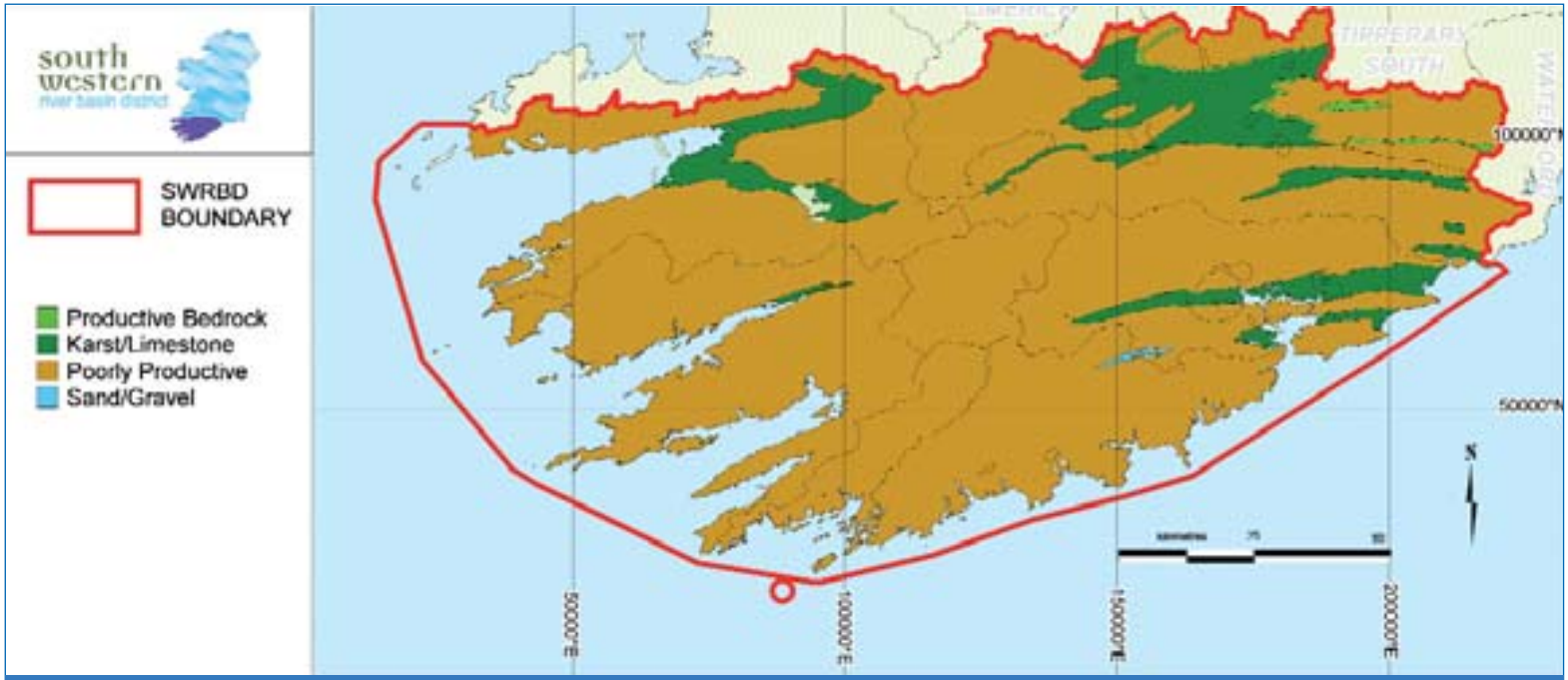
The criteria used to identify groundwater bodies are;

- Boundaries between the different rock types across which there is little or no flow of water.
- Boundaries of individual river catchments.
- Areas around major centres of population or significant or major sources of pollution.

On this basis 84 groundwater body types were identified, see Table 2.3 and Map 2.4. Karstic or limestone based groundwater bodies are found in the northern and eastern regions of the SWRBD. Gravel deposits are found at Brinny, north of Inishannon, Co. Cork. There is very little productive fissured bedrock in the SWRBD, the small amount that is found is located near Mitchelstown in North Co. Cork at the foot of the Galtee, Kilworth and Knockmealdown Mountains. Unproductive bedrock, primarily sandstone and mudstone, is found throughout the SWRBD.

Groundwater Body Types based on Flow Regime	No. of Water Bodies	% of number	% area of RBD
Karstic/Limestone	34	40.5	11.1
Gravel	3	3.6	0.9
Productive fissured bedrock	1	1.2	0.1
Unproductive bedrock	46	54.8	88.0

Table 2.3 Groundwater body types in the SWRBD



Map 2.4 Groundwater Bodies in SWRBD

2.6 Protected Areas

The WFD requires that a register of protected areas should be compiled which should contain:

- Areas from which waters are taken for public or private water supply schemes.
- Designated shellfish production areas.
- Bathing waters.
- Areas which are affected by high levels of substances most commonly found in fertilizers, animal and human wastes. These areas are considered nutrient sensitive.
- Areas designated for the protection of habitats or species e.g. Salmonid areas,
  - Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) for birds.

While only six rivers are designated for Salmonid species, it should be noted that the vast majority of the rivers and lakes in the SWRBD do support salmon and trout.

A register of Protected Areas has been compiled for the SWRBD. This is to ensure that both the surface waters and groundwaters within these areas are maintained and that species that are directly dependent upon these waters are protected.

Water Abstraction (Drinking Water)

321 sites

Shellfish Production

Bantry Bay	Glengarriff Harbour	Roaring Water Bay
Kilmakilloge Harbour	Cromane	

Bathing Waters

Barley Cove	Ballinskelligs	Claycastle, Youghal	Derrynane
Fountainstown	Garretstown	Garrryvoe	Inch
Inchydoney	Kells Bay	Main beach at Youghal	Owenahincha
Redbarn	Tragumna	The Warren	Ventry
White Strand at Cahersiveen	White Strand at Garrylucas	White Strand at Rossbeigh	

Nutrient Sensitive

Bandon Estuary	Blackwater Estuary	River Blackwater	Lough Leane
Owennacurra Estuary/North Channel		Lee Estuary/Lough Mahon	

Salmonid Waters

River Maine	River Argideen	River Blackwater	River Bride
River Brown	River Lee		

Special Areas of Conservation (SAC)

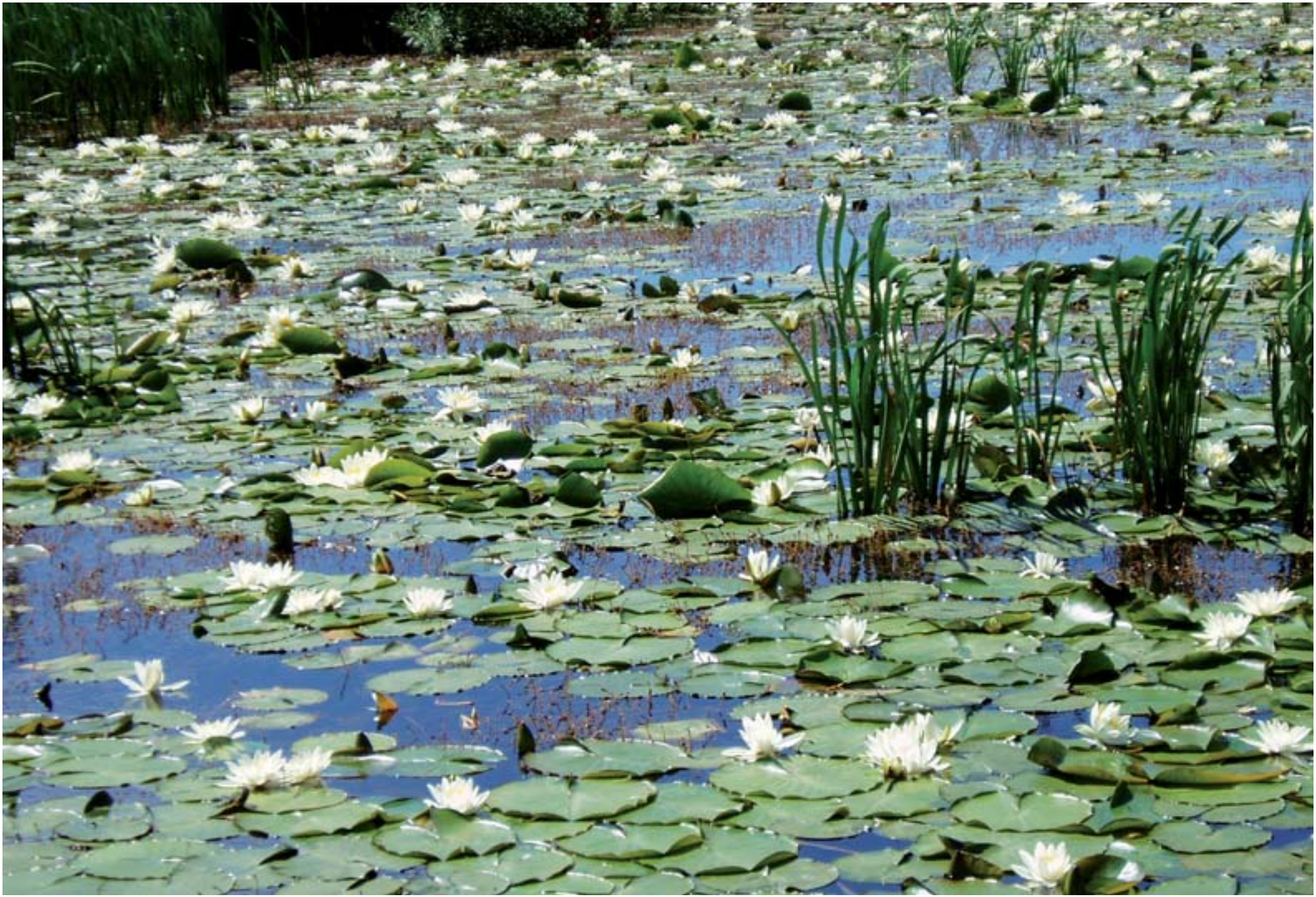
Bandon River	Blackwater River	Blackwater River (Kerry)	Drongawn Lough
Dunbeacon Shingle	Farranamanagh Lough	Maulagowna Bog	Ardmore Head
Mount Brandon	The Gearagh	Clonakilty Bay	Myross Wood
Ballyhoura Mountains	Sheheree (Ardagh) Bog	St. Gobnet's Wood	Courtmacsherry Estuary
Cleanderry Wood	Glanmore Bog	Kenmare River	Mucksna Wood
Castletownshend	Sheep's Head	Kilgarvan Ice House	Slieve Mish Mountains

Blasket Islands Caha Mountains	Ballinskelligs Bay & Inny Estuary
Kilkeran Lake & Castlefreke Dunes	Lough Hyne Nature Reserve & Environs
Cloonee & Inchiquin Loughs, Uragh Wood	
Killarney National Park, MacGillycuddy's Reeks & Caragh River Catchment	
Glengarriff Harbour & Woodland Derryclogher (Knockboy) Bog	

Special Protection Areas (SPA)

Castlemaine Harbour	Blasket Islands	Killarney National Park	Eirk Bog
Puffin Island	Skelligs	The Bull & The Cow Rocks	Kilcoman Bog
Blackwater Callows	Blackwater Estuary	Ballymacoda Bay	Cork Harbour
The Gearagh	Ballycotton Bay	Sovereign Islands	Clonakilty Bay
Old Head of Kinsale			

Table 2.4 Protected Areas in the SWRBD



3 Analysis and Classification of Water Bodies

3.1 Introduction

Human activities, if not properly managed, can cause deterioration in water quality. The pressures exerted by human activities which were considered for this report were as follows:

- Sewage and other effluents discharged to waters from **point** sources, e.g. pipes from treatment plants.
- Discharges arising from **diffuse** or dispersed activities on land.
- **Abstractions** from waters.
- **Structural alterations** to water bodies.

A **point** source pressure has a recognisable and specific location at which pollution may originate. Examples of significant point source pressures include direct discharges from waste water treatment plants, licensed discharges from industrial activities, landfills, contaminated lands (e.g. disused gas works) and mines.

A **diffuse** source pressure unlike a point source is not restricted to an individual point or location. The source of a diffuse pressure can be quite extensive. Significant examples of diffuse pressures include runoff from forestry and agricultural lands.

Water abstracted from surface waters and groundwater for drinking and industrial purposes was considered. Abstraction of too much water can create pressures on the ability of a water body to maintain both chemical and ecological status.

Structural alterations such as river straightening; construction of embankments, weirs, dams, port facilities and dredging can create conditions such that a water body is no longer able to support the natural ecology which would have existed prior to such modifications. These pressures are also referred to as morphological pressures.

3.2 Analysis of the Impact of Pressures

The objective of the WFD is to obtain good status in all waters by 2015. To achieve this, it is necessary:

- to assess the risk that water bodies may not achieve good quality status;
- to identify the pressures from human activities causing this risk;
- to develop strategies and management plans to minimise the risk.

Risk assessment procedures were developed to analyse the impact of the pressures referred to above. The risk assessments were predictive, i.e. they examined each pressure and predicted the magnitude which would be likely to have a negative impact. Two examples will help to explain the exercise. If a certain length of a river water body had a significant amount of flood protection work carried out on it, it was predicted that it would not achieve good status. Or if monitoring of an industrial discharge showed that it was not complying with its licence it was predicted that the water body which the effluent entered would not meet the WFD target. It was necessary to use predictive methods because there was insufficient data available on water bodies.

The risk assessment procedures were developed at national level such that a consistent approach would be applied across all River Basin Districts.

3.3 Risk Categories

The risk assessment procedures were based on the most up to date local and national data and, where appropriate, expert judgement. Furthermore, where information was not available a precautionary approach was taken to define an appropriate risk category. Because of the uncertainty which exists due to unavailable or unreliable data, four risk categories were created.

Not At Risk: Sufficient information is available to determine that the impact of the pressures on the water body is such that the water body is likely to achieve good status. In some cases monitoring data is available to confirm the good quality status of the water body. Measures must be considered here to ensure deterioration from good status does not occur.

Probably Not At Risk: Sufficient information is not available at present to determine whether the water body is at risk of failing to meet good status. However, based on existing available data, it is probable that the water body will be found to be not at risk when further information becomes available.

Probably At Risk: Sufficient information is not available at present to determine whether the water body is at risk of failing to meet good status. However, based on existing available data it is probable that the water body will be found to be at risk when further information becomes available.

At Risk: Sufficient information is available to determine that the impact of pressures on the water body is such that the water body is unlikely to achieve good quality status unless measures are taken to reduce the impact, thereby improving the water quality.

3.4 Surface Water Risk Assessments

The risk assessments for surface water bodies were undertaken for each of the pressures identified.

For abstraction pressures these included:

- Abstractions and discharges

For pressures arising from structural changes these included:

- Channelisation and dredging
- Flood Protection and embankments
- Dams
- Locks and weirs
- Intensive land use (land drainage)
- Built structures e.g. ports and harbours
- Deposition of dredge spoil
- Coastal defences

For point source pressures these included:

- Discharges from waste water treatment plants.
- Discharges licensed by the EPA.
- Discharges licensed by local authorities
- Overflows from sewerage systems that by-pass treatment plants, caused by rain storms, usually referred to as combined sewer overflows (CSOs).
- Discharges from water treatment plants.

For diffuse source pressures these included:

- Drainage from urban areas, grassland and arable areas (This included the pressures from dairy farming, cattle farming and the growing of crops.).
- Drainage from roads and railways
- Forestry
- Septic tanks
- Activities which use dangerous substances (forestry and agriculture).

In total 26 pressures on surface water quality status were assessed as part of the risk assessment. For each source of pressure, critria or thresholds were established to determine the level of risk.

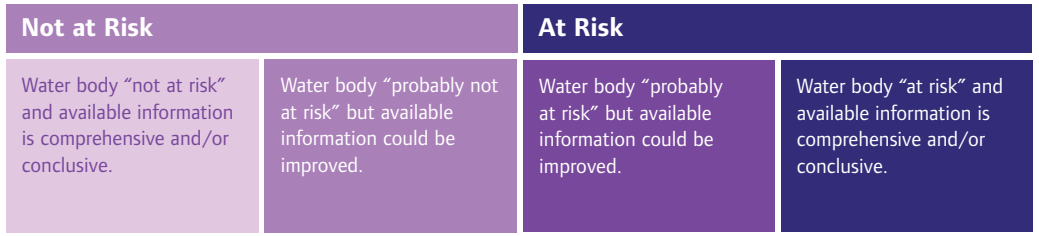


Figure 3.1 Risk Categories

3.4.1 Examples of Surface Water Risk Assessments

Example 1: Abstractions

Table 3.1 shows the thresholds which were adopted to determine the significance of abstractions from river water bodies. The total nett abstraction from each water body was compared to the quantity of water naturally in the water body during dry weather conditions.

A risk category is assigned to each water body based on the criteria shown in Table 3.1. The results for the risk assessment in relation to abstractions from river water bodies in the SWRBD are presented in Table 3.2 and Map 3.1.

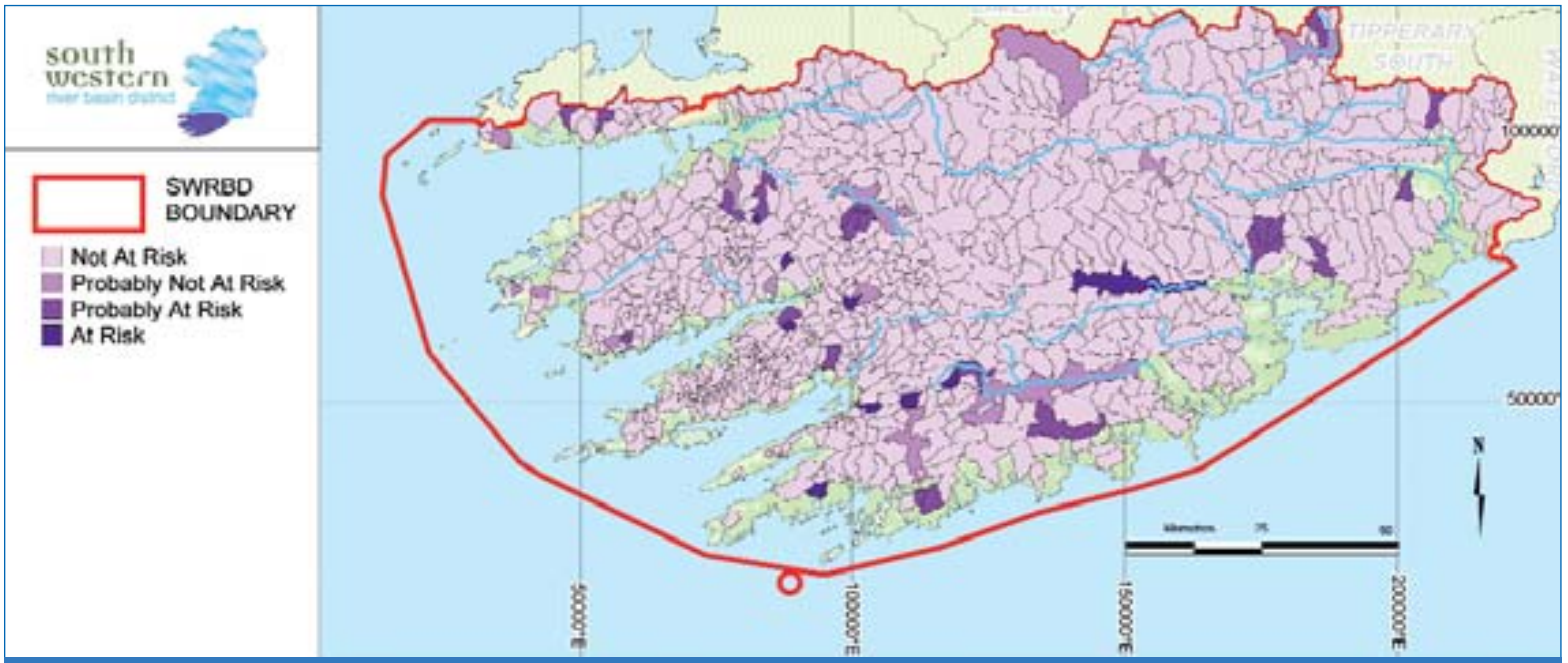
Full details of risk assessment procedures and results for each pressure category are available at *www.wfdireland.ie*

Criteria	"not at risk"	"probably not at risk"	"probably at risk"	"at risk"
Volume of abstraction as a percentage of Dry Weather Flow	<5%	5 – 10%	10 – 40%	>40%

Table 3.1 Thresholds adopted for Abstraction Risk Assessment for River Water Bodies

Risk Category	No. of River Water Bodies	% of River Water Bodies	Kilometres Affected	% of River Area
"not at risk"	832	94.0	3,101	91.3
"probably not at risk"	18	2.0	177	4.5
"probably at risk"	24	2.7	124	3.0
"at risk"	11	1.2	30	1.2

Table 3.2 SWRBD River Water Bodies Abstraction Risk Assessment Results



Map 3.1 SWRBD River Water Bodies Abstraction Risk Assessment Results

Example 2: Estuarine Structural Alterations due to Intensive Land Use

Human activities such as urban development, transport and agriculture can lead to the structural alteration of a river stretch, a lake shoreline or a stretch of coastline. These pressures were quantified by determining the stretch of bank or shoreline affected by the physical alteration. Examples of bank or shore structural alteration assessed include river straightening, flood embankments, dams, port facilities, dredging and intensive land use. Table 3.3 shows the thresholds which were adopted nationally to undertake the intensive land use risk assessment for estuarine water bodies.

Full details of risk assessment procedures and results for each pressure category are available at *www.wfdireland.ie*

Criteria	"not at risk"	"probably not at risk"	"probably at risk"	"at risk"
Proportion of water body shoreline with intensive land use e.g. urbanisation	<10%	10 – 30%	30 – 50%	>50%

Table 3.3 Thresholds Adopted for Intensive Land Use Risk Assessment for Estuaries

Risk Category	No. of Estuarine Water Bodies	% of Estuarine Water Bodies	% of Estuarine Area
"not at risk"	28	65.1	66.1
"probably not at risk"	7	16.2	23.5
"probably at risk"	6	14.0	9.7
"at risk"	2	4.7	0.7

Table 3.4 SWRBD Estuarine Intensive Land Use Risk Assessment Results

Map 3.2 SWRBD Estuarine Intensive Land Use Risk Assessment Results

3.4.2 River Water Body Results

The overall classification of river water bodies is obtained by combining the results of the individual risk assessments onto a single map. The worst case classification applies in the overall classification, except where overridden by EPA monitoring data.

For some river water bodies data was available which gave an indication of the current quality status of river water bodies. This data was principally in the form of the results of work carried out by the EPA as part of their national programme of river water quality monitoring. Taking this into consideration, the risk assessment results for point and diffuse pressures which were predictive were overridden by the EPA monitoring results. Referring back to the individual maps allows identification of the particular pressure which causes the river water body to be classified as "at risk" as shown in Figure 3.3.

There are 885 river water bodies in the SWRBD. Of these, 181 river water bodies were determined to be in the "at risk" category and 235 river water bodies in the "probably at risk" category as shown in Table 3.5 and Map 3.3. These account for 47% of the river water bodies in the SWRBD covering 60% of the catchment area of the RBD.

The most frequent cause of water bodies being "at risk" or "probably at risk" are the diffuse pressures and pressures caused by structural changes to the water bodies. Point pressures played a less significant role while abstraction pressures were the least widespread resulting in a relatively small number of river water bodies being classified as "at risk" as shown in Figure 3.2.

The majority of river water bodies assigned the "at risk" category are located in the eastern half of the RBD. The catchments of the Blackwater, Lee and Bandon rivers in particular show a high proportion of "at risk" water bodies.

Risk Category	No. of River Water Bodies	% of River Water Bodies	Kilometres Affected	% Length of Rivers
"not at risk"	232	26.2	762.2	22.1
"probably not at risk"	237	26.8	732.7	21.3
"probably at risk"	235	26.6	832.4	24.2
"at risk"	181	20.5	1,115.3	32.4

Table 3.5 SWRBD River Risk Assessment Results

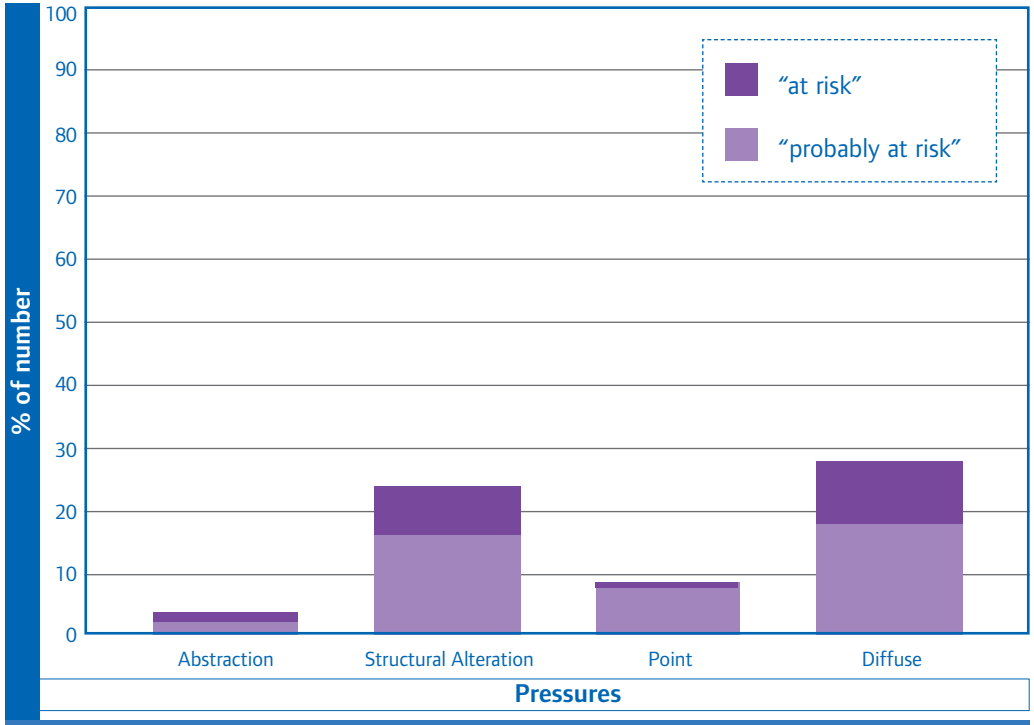


Figure 3.2 Pressures Causing River Water Bodies to be at Risk

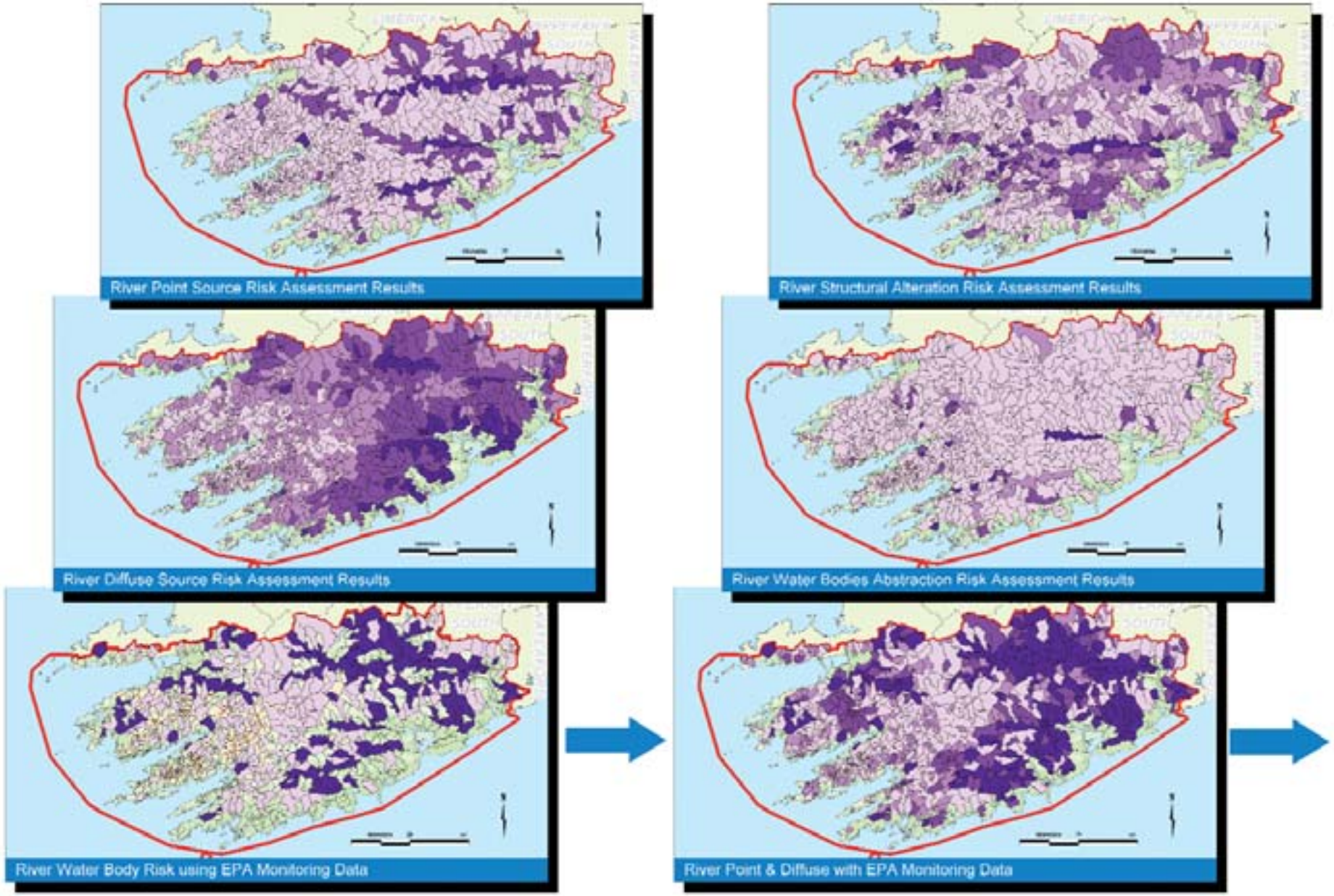
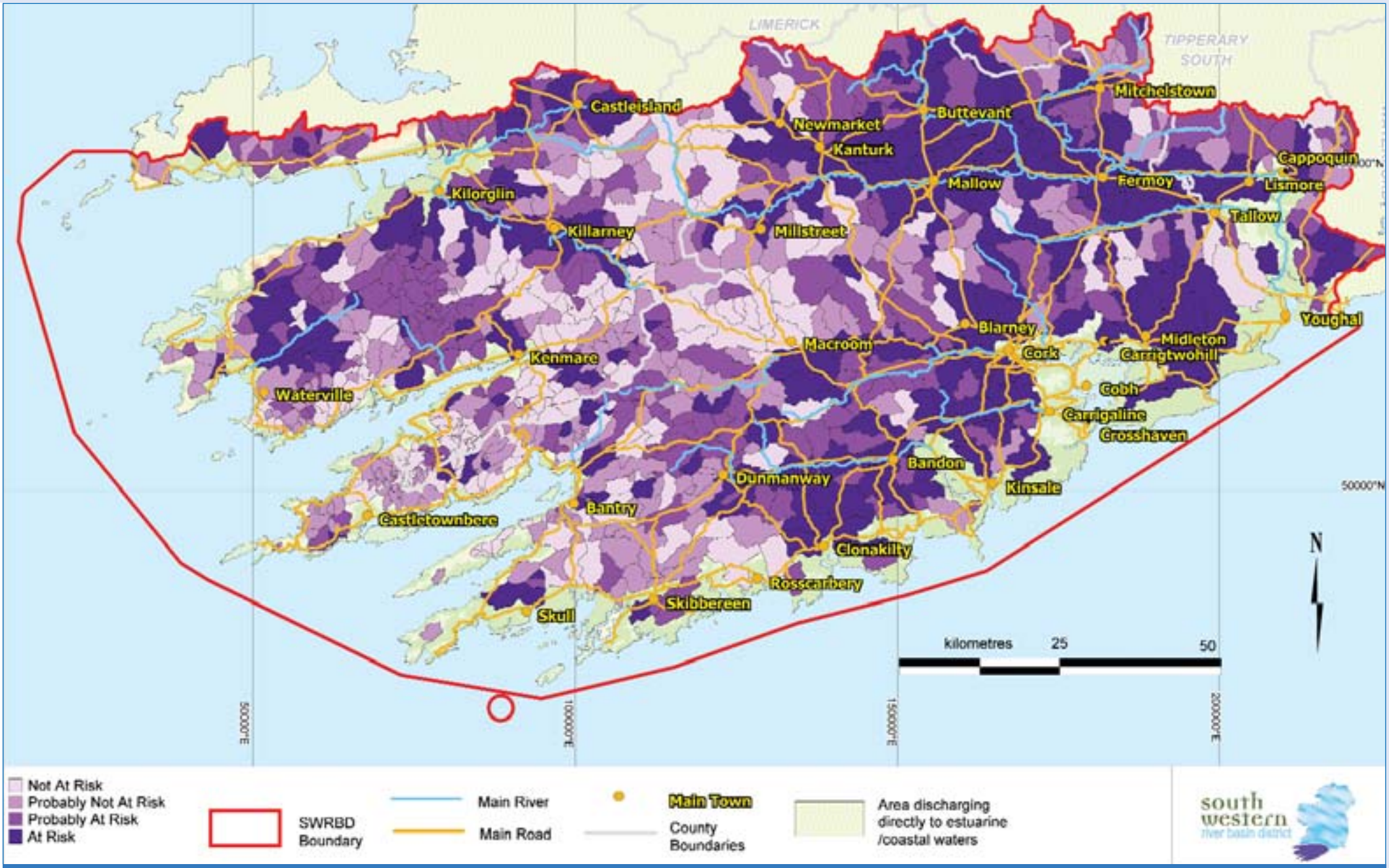


Figure 3.3 Individual River Risk Assesment Maps



Map 3.3 SWRBD Overall River Risk Assessment Result

3.4.3 Lake Water Body Results

The risk assessment procedure for lakes followed a similar approach to that applied to the river water bodies. The pressures within each risk category; point, diffuse, abstractions and structural changes were identified and appropriate thresholds and criteria were adopted to assign the risk classification.

The risk assessment for the lake water bodies took into consideration the pressures applied to the lake water body and, where necessary the river water bodies feeding into the lake. For example when considering abstractions, the quantity of water abstracted from the upstream river water bodies plus that from the lake water body itself was considered in the risk assessment.

The results of the risk assessment were based on the risk category pressures, which were predictive, but also on expert opinion which took into consideration local knowledge concerning impacts and observations of long-term trends in lake water quality. A worst case scenario approach was taken and the highest category of risk applying to a lake water body was assigned as the overall risk category.

When risk assessments were applied to 90 lake water bodies in the SWRBD, 24 lake water bodies were classified "at risk" and 14 lake water bodies were classified "probably at risk". These represent 42% of the lake water bodies in the SWRBD as shown in Table 3.6.

Lake water bodies designated as "at risk" were as a result of abstraction and structural alteration. Those designated as "probably at risk" were as a result of structural alterations but also for diffuse and abstraction pressures to a lesser extent as shown in Figure 3.4. In the case of Lough Leane expert opinion deemed that the impact of diffuse pressures should change the risk category from "probably at risk" to "at risk".

The lake water bodies designated as "at risk" following the risk assessment process include Carrigadrohid and Inniscarra reservoirs in County Cork and Lough Leane, Cloonaghlin Lough and Inchiquin Lough in County Kerry.

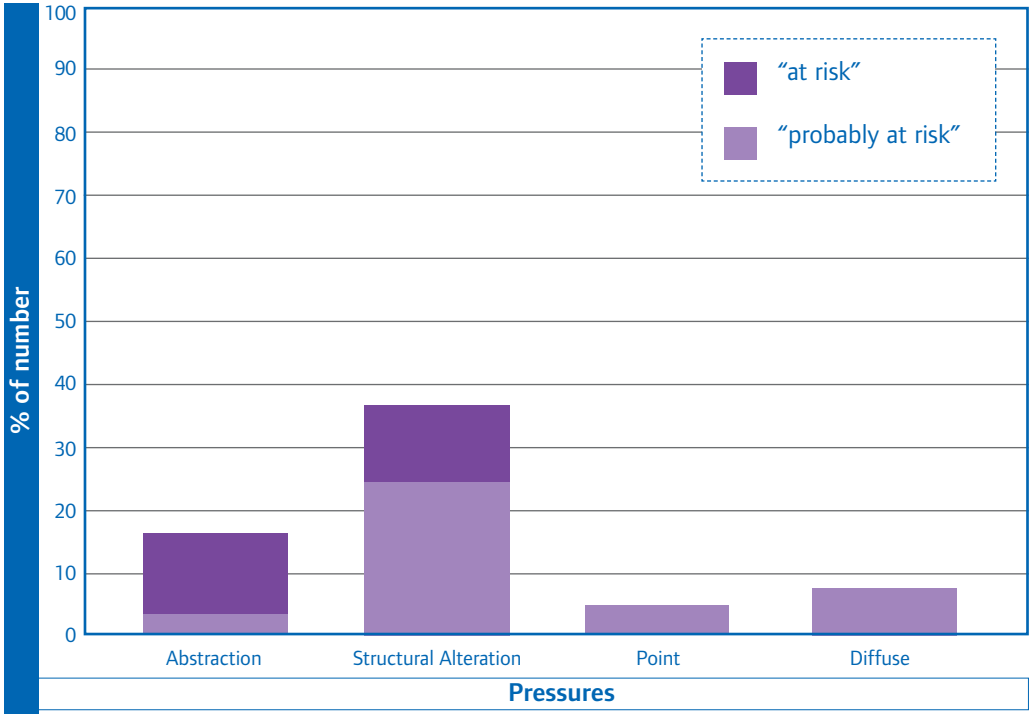
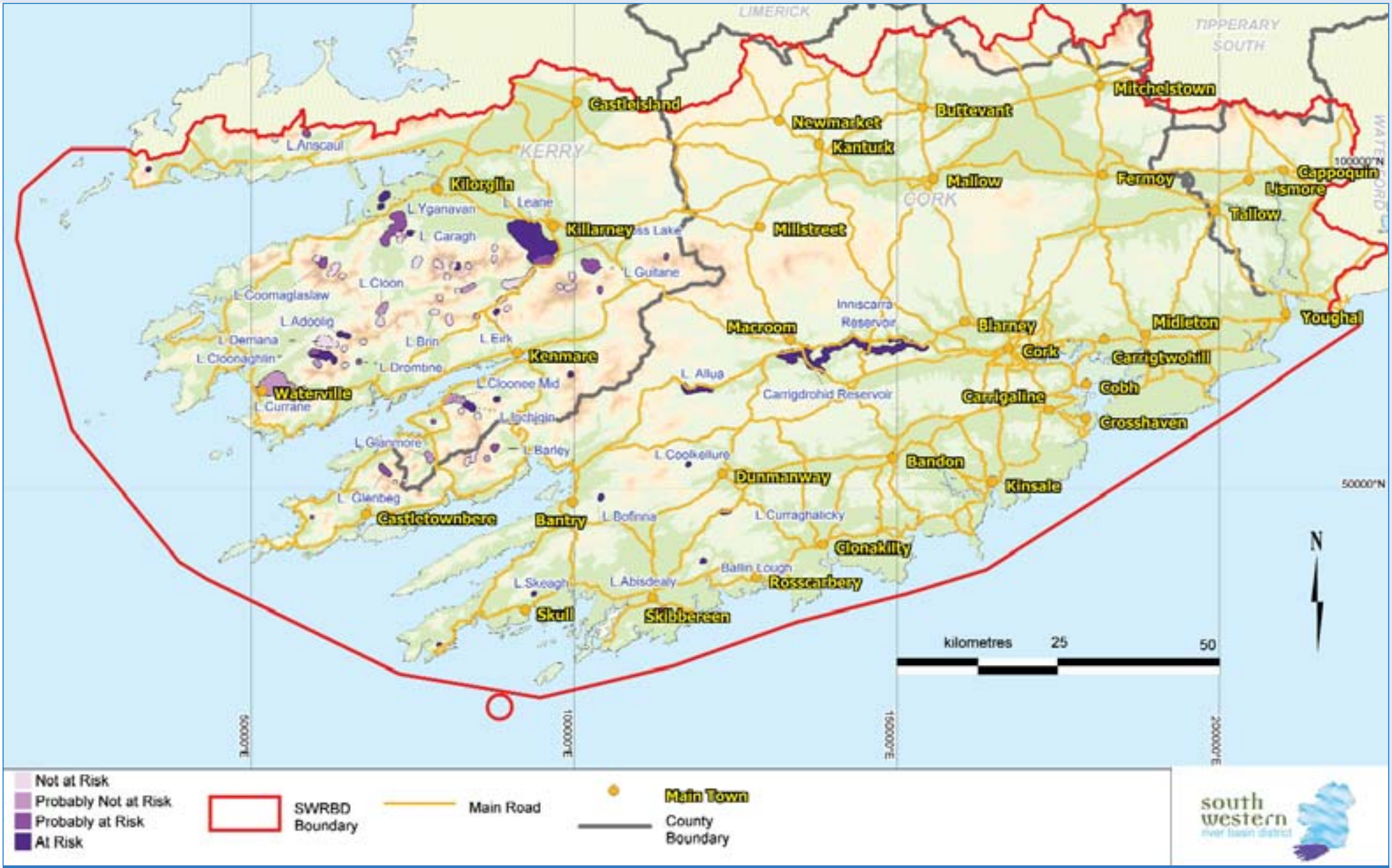


Figure 3.4 Pressures Causing Lake Water Bodies to be At Risk

Risk Category	No. of Lake Water Bodies	% of Lake Water Bodies	% of Lake Area
"not at risk"	42	46.7	14.0
"probably not at risk"	10	11.1	19.1
"probably at risk"	14	15.6	17.5
"at risk"	24	26.7	49.4

Table 3.6 SWRBD Lake Risk Assessment Results



Map 3.4 SWRBD Lake Risk Assessment Results

3.4.4 Estuarine and Coastal Water Body Results

The risk assessments were based on the risk category pressures but also on expert opinion and existing monitoring data of long-term trends in estuarine and coastal water quality. A worst case scenario approach was used, i.e. if a water body was found to be "at risk" for only one pressure and "not at risk" for others it was deemed to be "at risk".

In the case of estuarine water bodies the risk assessments included pressures from point sources, abstractions and structural changes.

There are 43 estuarine water bodies identified within the SWRBD. Of these 13 were considered to be "at risk" and 13 to be "probably at risk" as shown in Table 3.7. Overall, the significant causes of estuarine water bodies to be classified as "at risk" are existing monitoring data but also abstractions and structural alteration pressures as presented in Table 3.5. Point pressures and structural alteration pressures play the greatest roles in the assignment of "probably at risk" categories. Those to which the "at risk" category was assigned in the SWRBD include, the Lower Blackwater Estuary and Youghal Harbour, the estuarine waters in Cork Harbour, the Lower Bandon Estuary and Inner Bantry Bay as can be seen in Map 3.5.

Risk Category	No. of Estuarine Water Bodies	% of Estuarine Water Bodies	% of Estuarine Area
"not at risk"	2	4.7	5.5
"probably not at risk"	15	34.9	9.5
"probably at risk"	13	30.2	51.2
"at risk"	13	30.2	33.7

Table 3.7 SWRBD Estuarine Risk Assessment Results

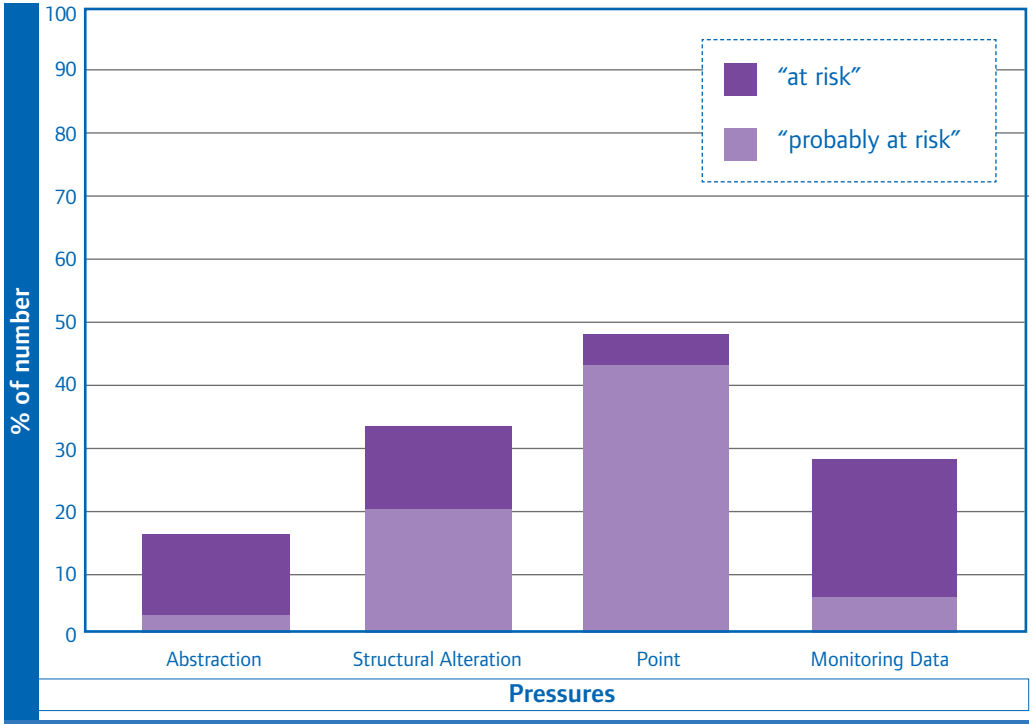
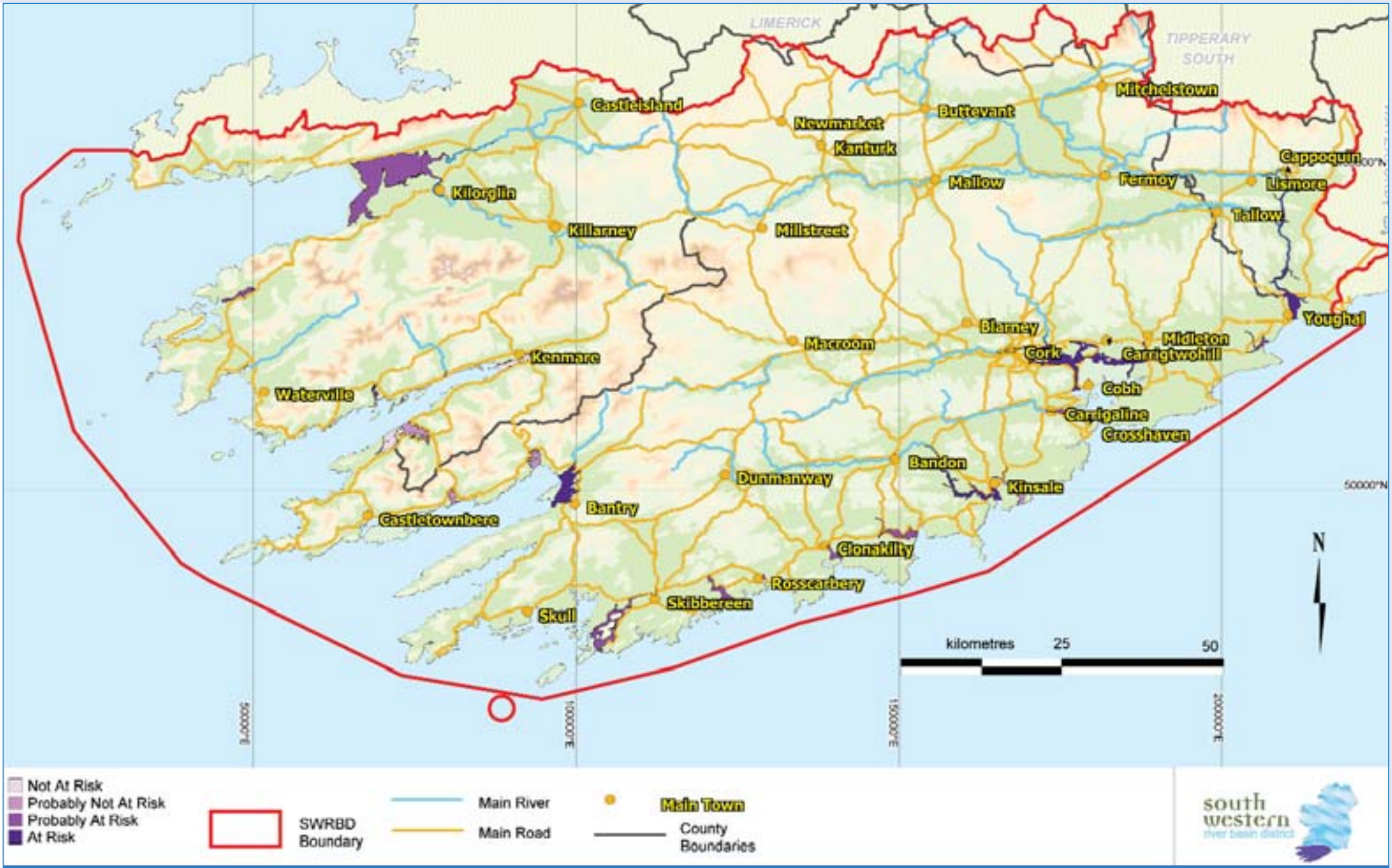


Figure 3.5 Pressures and Monitoring Data Causing Estuarine Water Bodies to be At Risk



Map 3.5 SWRBD Estuarine Risk Assessment Results

Risk Category	No. of Coastal Water Bodies	% of Coastal Water Bodies	% of Coastal Area
"not at risk"	16	59.3	91.2
"probably not at risk"	6	22.2	1.9
"probably at risk"	4	14.8	6.1
"at risk"	1	3.7	0.8

Table 3.8 SWRBD Coastal Risk Assessment Results

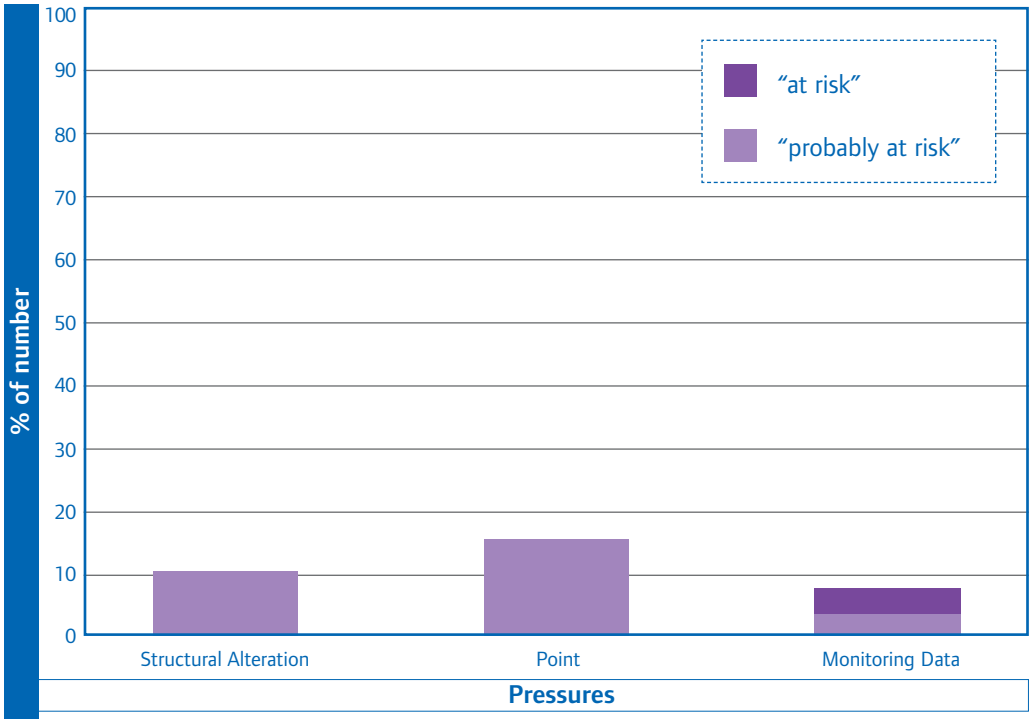
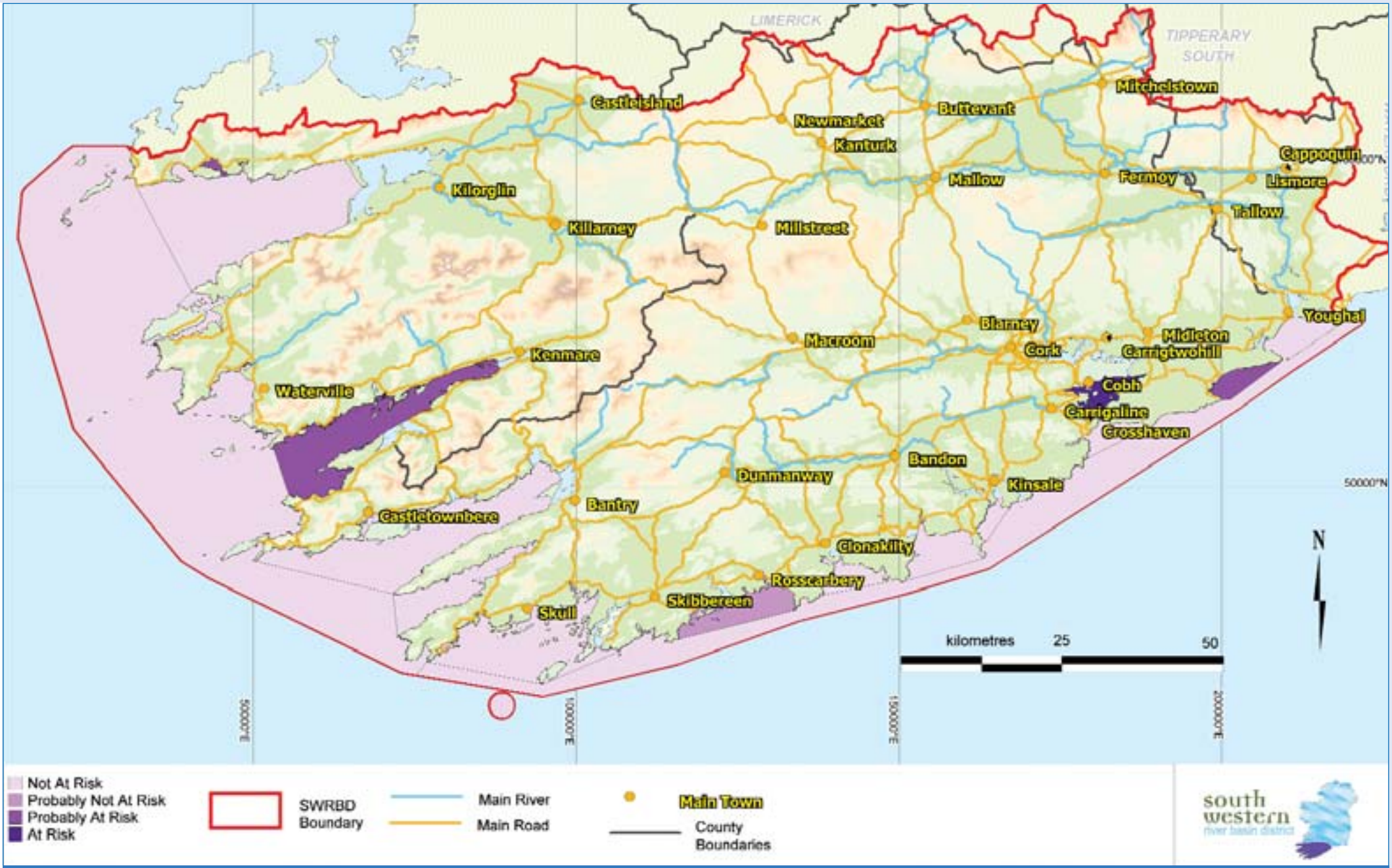


Figure 3.6 Pressures and Monitoring Data Causing Coastal Water Bodies to be At Risk

For coastal water bodies two predictive risk assessments were applied, pressures from point discharges and from structural changes. Of the 27 coastal water bodies, one was deemed to be "at risk" and four were deemed to be "probably at risk" as shown in Table 3.8 and Map 3.6. Existing monitoring data resulted in the designation of one water body as "at risk", i.e. Cork Harbour. While existing monitoring data, point pressures and structural alteration pressures resulted in the designation of the "probably at risk" category to water bodies as seen in Figure 3.6.



Map 3.6 SWRBD Coastal Risk Assessment Results

3.5 Groundwater Risk Assessments

Risk assessments were carried out on groundwaters within the SWRBD for the following pressures:

For abstraction pressures:

- Excessive pumping, e.g. from wells for water supplies, leading to the depletion of the water resource in the groundwater body.
- Saline intrusion (risk of over abstracting in coastal areas and pulling seawater into the groundwater body).

For diffuse pressures, assessments took into account agricultural activities, septic tanks and dangerous chemical usage in the form of the following pressures:

- Nutrients e.g. nitrates and phosphates
- Chemicals e.g. pesticides

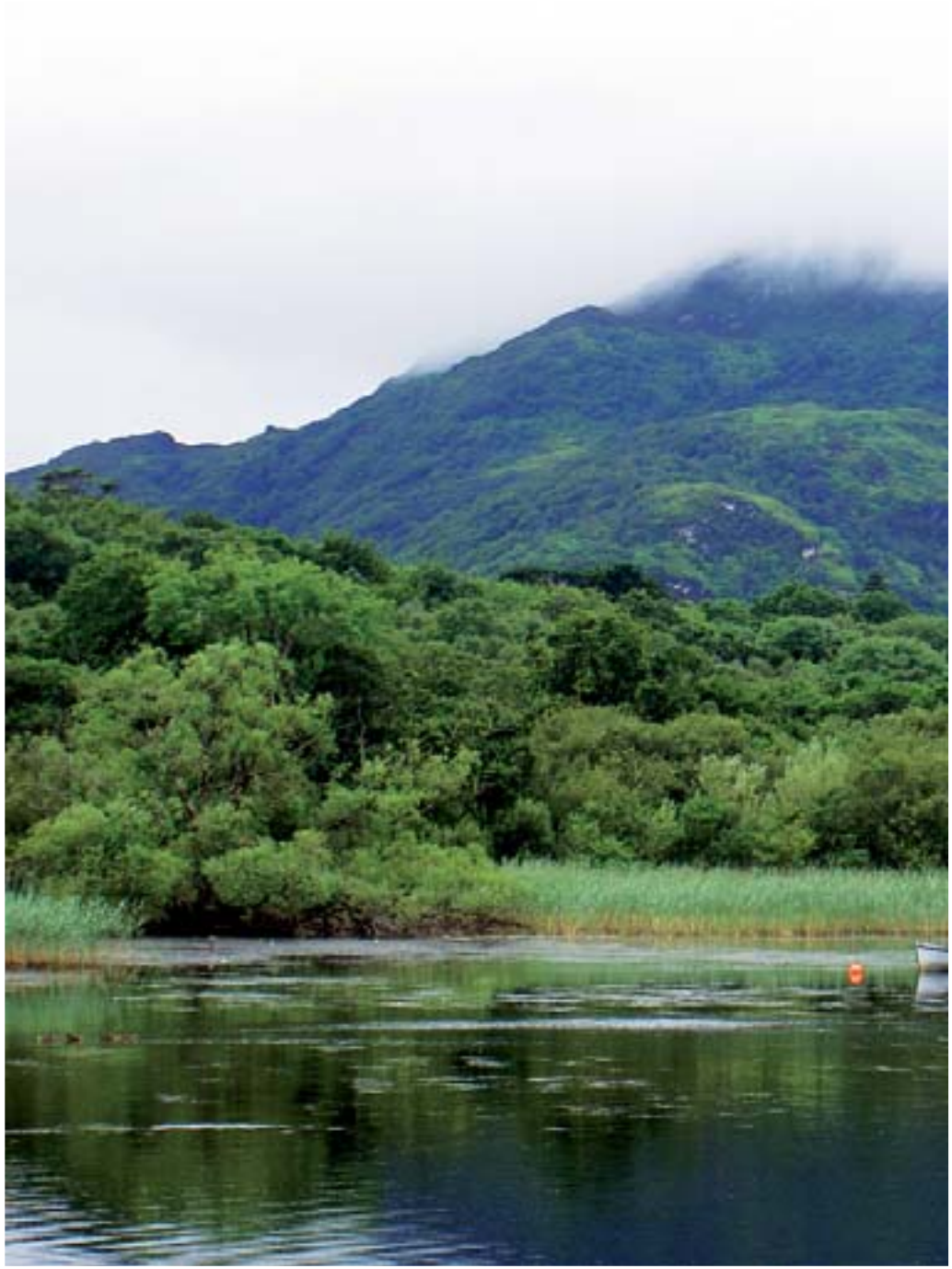
In terms of point pressure assessments the following were considered:

- Mines
- Quarries
- Contaminated land
- Landfills
- Oil industry infrastructure.
- Sites which have discharge licences from the EPA.
- Sites which have discharge licences from local authorities.
- Urban wastewater discharges.

Up to 30 risk assessments were carried out on groundwater bodies. They are more complex than the risk assessments carried out for surface waters. Additional factors which must be taken into consideration include;

- An assessment of the likelihood of pollutants reaching a groundwater body through the soil and subsoil,
- Assessment of the characteristics of pollutants which cause them to become absorbed in soil or pass through soil and
- An assessment of the groundwater body into which the pollutants were discharging.

Risk assessments were carried out not only on groundwater bodies but also on fens and other surface water systems which are dependent on groundwater as a source of water. These sytems are known as Groundwater Dependant Terrestrial Ecosystems.



3.5.1 Example of Groundwater Risk Assessment

In a similar manner to the surface water risk assessments, thresholds were set for groundwater risk assessment pressures. In assessing diffuse pressures, risk categories were assigned to groundwater bodies based on the extent of the pressures, the perceived risk posed by the pressure and areas where pollutants are likely to reach the groundwater relatively easily.

One of the diffuse risk assessments assessed the potential impacts associated with nitrates from certain activities including tillage and cattle and sheep farming. The proportion of the groundwater body identified as having a moderate to high potential for impact was used to designate a risk category.

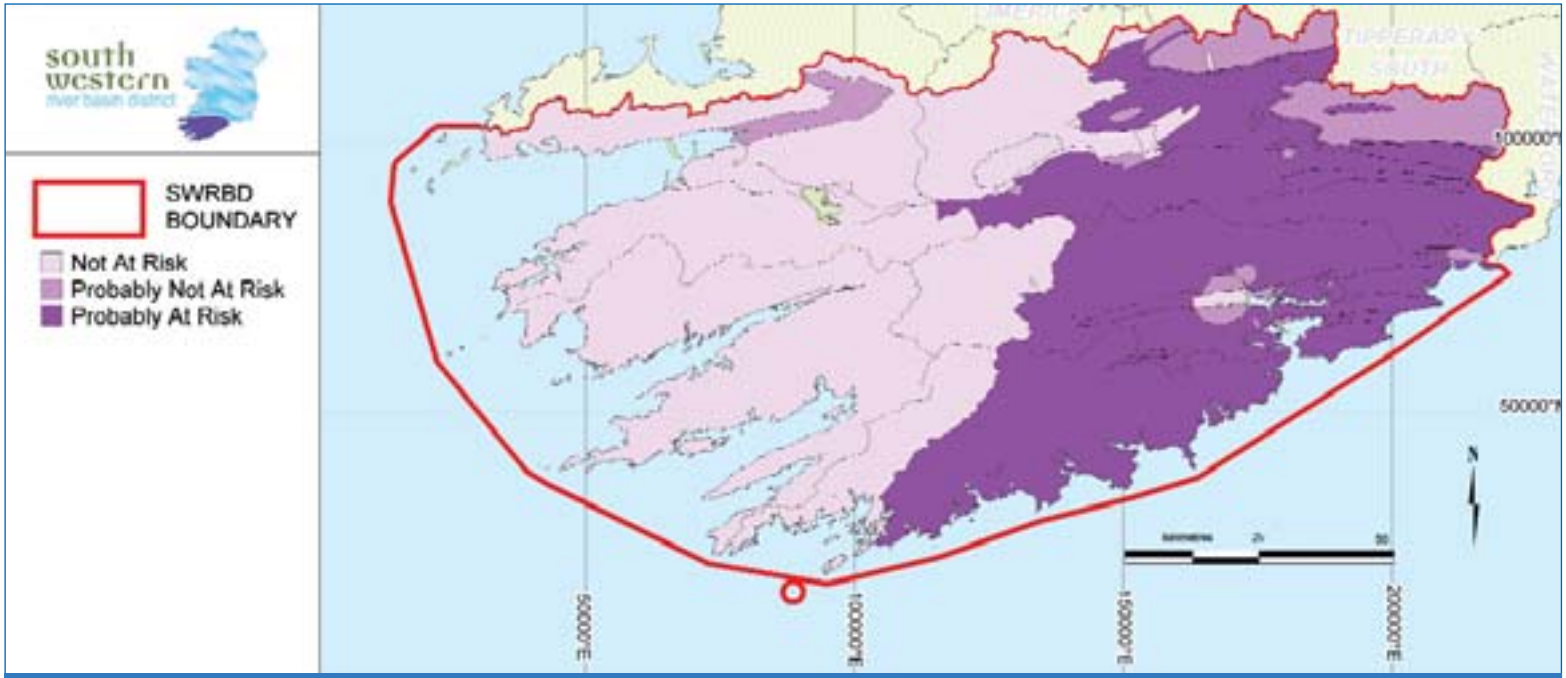
A risk category is assigned to each groundwater body based on the criteria in Table 3.9. Where monitoring data is available, the risk assessment categories were refined where necessary to reflect the known status of the groundwater. The results for the risk assessment in relation to nitrates in groundwater bodies in the SWRBD are presented in Table 3.10 and Map 3.7.

Criteria	"Not at risk"	" Probably not at risk"	"Probably at risk"	" At risk"
Proportion of water body with moderate or high impact potential	<10%	10 - 40%	> 40 %	>40% and monitoring data

Table 3.9 Thresholds adopted for Nitrate Risk Assessment

Risk Category	No. of Groundwater Bodies	% of Groundwater Water Bodies	% of Groundwater Area
"not at risk"	33	39.3	50.0
"probably not at risk"	31	36.9	14.2
"probably at risk"	20	23.8	35.8
"at risk"	0	0	0

Table 3.10 SWRBD Groundwater Diffuse - Nitrates Assessment Results



Map 3.7 Groundwater Bodies Nitrates Assessment Results

3.5.2 Groundwater Body Results

Having completed up to 30 risk assessments on each groundwater body, the worst case scenario was applied to determine the risk categories. When monitoring data was available for groundwater bodies, this data was used to determine if the risk level based on prediction was accurate. Where the predicted risk and monitoring data were noticeably different the final risk categories were adjusted to reflect the real monitoring data.

Initially the boundaries of groundwater bodies were based on natural conditions only, which resulted in quite large water bodies. When the risk assessments were applied, local point pressures such as landfills and mines were placing large groundwater bodies into unnecessarily high risk categories as these point source areas only made up a very small percentage of the area of the groundwater body, typically less than 1%. To address this anomaly, groundwater bodies were split and small groundwater bodies were delineated around point sources where necessary.

In the SWRBD, only 6 groundwater bodies were placed in the "at risk" category while 58 were placed in the "probably at risk" category. However, those "at risk" only account for 0.9% of the land area of the SWRBD as shown in Table 3.11.

The causes of the "at risk" designation of groundwater bodies were point discharges and abstractions, as seen in Figure 3.7.

The groundwater bodies designated "at risk" in the SWRBD are all located in the vicinity of Cork City and Cork Harbour as shown in Map 3.8. Those designated as "probably at risk" are for the most part, located in the eastern half of the SWRBD. This is consistent with the findings of the river risk assessment results.

Risk Category	No. of Groundwater Bodies	% of Groundwater Bodies	% Area of SWRBD
"not at risk"	15	17.9	48.5
"probably not at risk"	5	6.0	6.5
"probably at risk"	58	69.0	44.1
"at risk"	6	7.1	0.9

Table 3.11 SWRBD Groundwater Risk Assessment Results

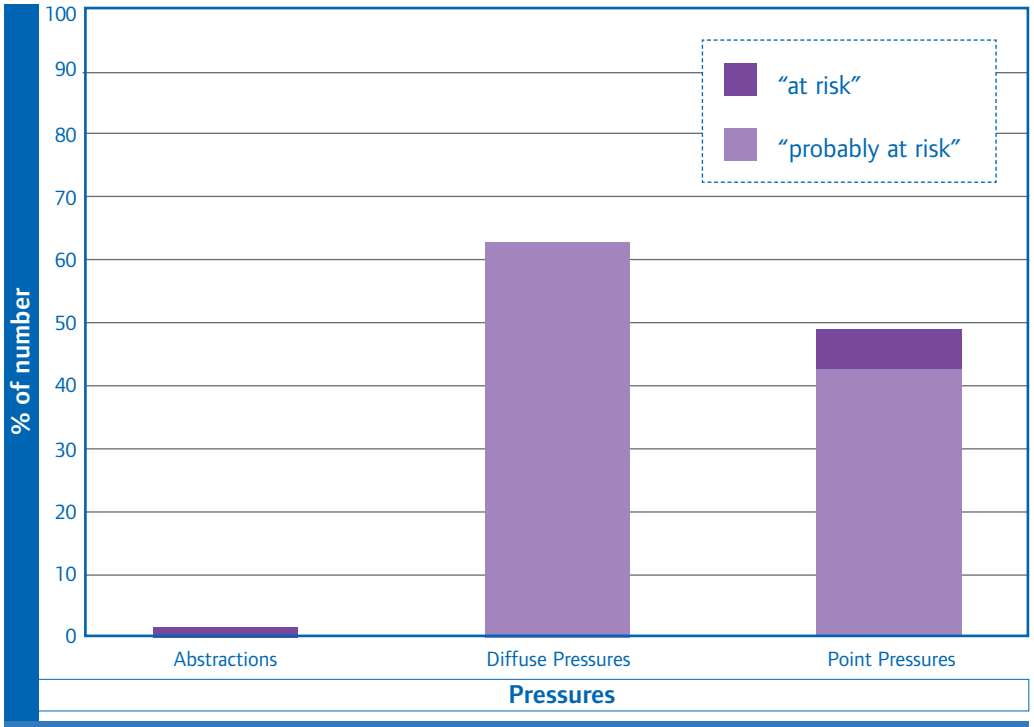
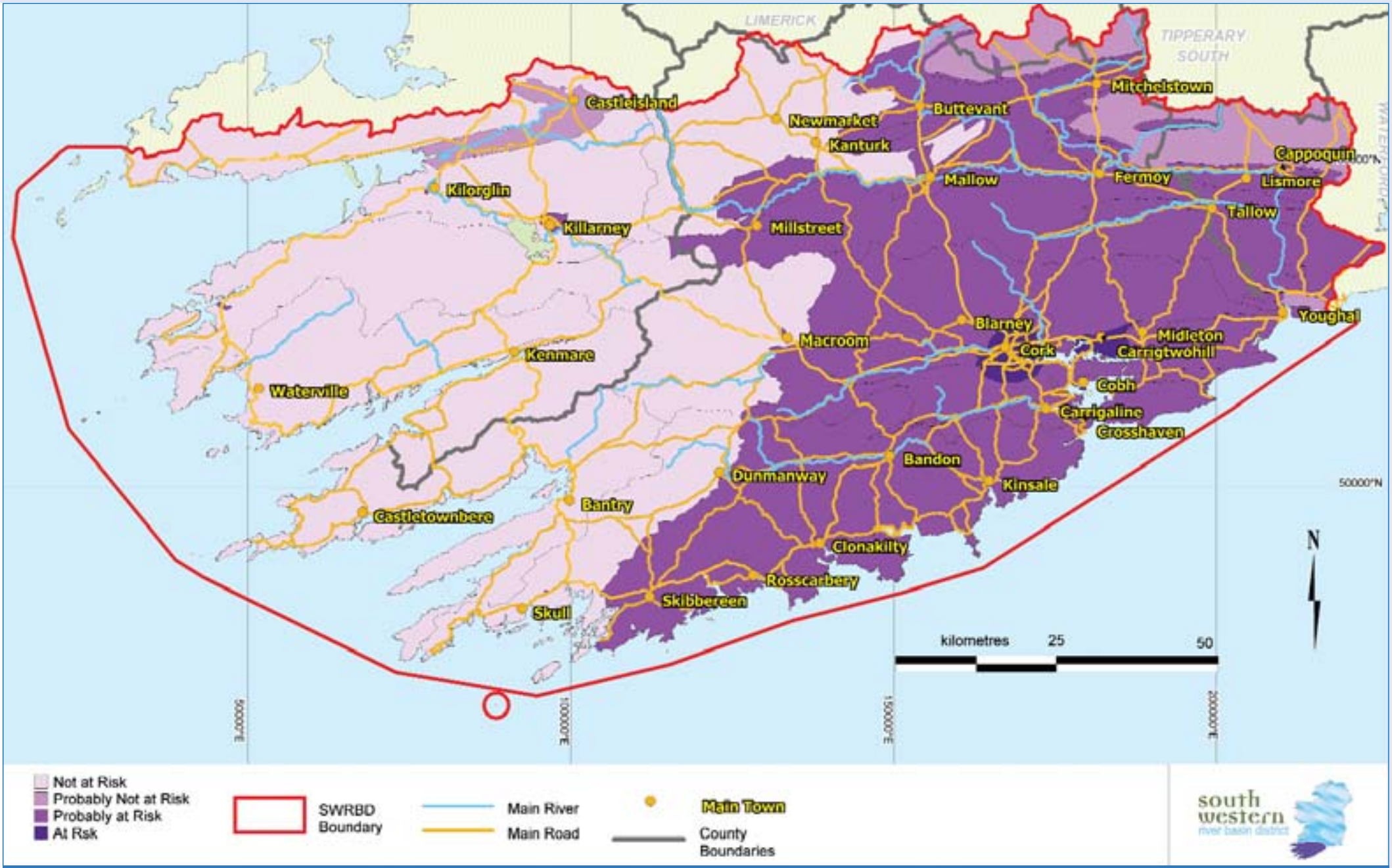


Figure 3.7 Pressures Causing Groundwater Bodies to be At Risk

3.5.3 Lower Objectives for Groundwaters

In some cases, a groundwater body may be so affected by human activities that it may not be possible for good chemical status to be achieved within the time scale outlined in the WFD. In the SWRBD, some groundwater bodies designated as "at risk" and "probably at risk" will be considered as water bodies for which less stringent or lower objectives might apply, for example the groundwater in the Cork City area. Such groundwater bodies will have to be evaluated and their inclusion as Less Stringent Objective (LSO) water bodies justified. While lower objectives may be set for these groundwater bodies, all realistic measures to prevent further deterioration in water quality should be undertaken.



Map 3.8 SWRBD Groundwater Risk Assessment Results

3.6 Other Risk Assessments

A number of additional risk assessments were carried out to provide extra information which may prove useful during the development of measures required under the WFD.

Alien Species

These are also known as invasive species. Where they survive in habitats where they aren't naturally found, they can become well established and in some cases overcome natural species and so pose a major threat to the native flora and fauna. The species of greatest concern were identified nationally by the EPA and a map was produced showing the location of these species. The water bodies under threat from the presence of alien species were assigned risk categories see Table 3.12.

Fishing

A fisheries risk assessment was undertaken to account for habitat damage which may result from certain commercial fishing activities within our estuarine and coastal waters. These activities were mapped for the country and their associated risk categories assigned by a group of experts led by the Marine Institute based both on the activity involved and the sensitivity of the habitat where the activity was taking place. As a result two coastal water bodies were identified as falling into the "probably at risk" category in the SWRBD. These are Berehaven and the Outer Kenmare River water bodies.

Bathing Waters

Risk categories were assigned to recognised bathing waters according to the results of monitoring carried out in these waters. Where a bathing water failed to meet the requirements of EU and National law an "at risk" designation was assigned. As all bathing waters in the SWRBD are deemed to have met with the requirements at EU and national level, no water body was placed in the "at risk" or "probably at risk" categories.

Risk Category	No. of Water Bodies "at risk" & "probably at risk"	% of Water Bodies	% Water Body Area
Rivers	155	17.5	35.2
Lakes	3	3.3	16.7
Estuarine	3	7.0	12.9
Coastal	6	22.2	75.9

Table 3.12 SWRBD Alien Species Risk Assessment Results

4 Heavily Modified Water Bodies and Artificial Water Bodies

4.1 Introduction

One of the goals of the Water Framework Directive is the achievement of 'good ecological and chemical status' in our surface waters by 2015. However, some water bodies may not achieve this objective for various reasons. This may be due to a water body being physically altered from its natural state for a specific human activity or because the water body has been man-made.

A Heavily Modified Water Body (HMWB) is defined as 'a water body which, as a result of physical alterations by human activity, is substantially changed in character and cannot, therefore, meet good ecological status '.

Examples of heavily modified water bodies include damming of a river for water supply, or the construction of a harbour for navigation and commercial purposes, or the dredging of a shipping channel to allow for ease of access for boat traffic.

An Artificial Water Body (AWB) is a 'water body created by human activity'.

An example is a man-made canal.

By designating a water body as a HMWB or AWB, the environmental objective for these water bodies will be good ecological potential (GEP), rather than good ecological status, which is required for all other water bodies. GEP will be defined for each HMWB and AWB.

Hydrological & Structural Alteration Risk Assessment Pressures	Does the pressure 'substantially change' Water Body character and warrant further pHMWB consideration?	
Rivers & Lakes		**Note**
Channelisation & Dredging	No	
Flood Protection & Embankments	Yes	If substrate is artificial
Impounding (dams)	Yes	If ecological effects observed
Locks & weirs	No	
Intensive Land Use	No	(Derogation for peatlands)
Abstractions	Yes	If ecological effects observed
Estuaries and Coastal Waters		
Dredging Dumping of Dredge Spoil Coastal Defence & Embankments Built Structures (ports, industrial intakes) Intensive Land Use Abstractions	Combined affect of marine pressures to be considered for designation on a case by case basis.	

Table 4.1 Hydrological and Structural Alteration Pressures Leading to pHMWB Designation

4.2 The Irish designation Process

HMWBs

Surface water bodies which were identified as being "at risk" due to structural alterations from the risk assessment described in Section 3 were short-listed for provisional HMWB designation (pHMWB). Expert opinion (EPA, Marine Institute and others) was then used to identify specific activities which would confirm provisional designation. Table 4.1 outlines the relevant activities leading to provisional designation.

AWBs

In the Irish context it was decided that any water body created in a place where no water body had previously existed, should be identified as a provisional AWB (pAWB).

4.3 SWRBD Provisional Heavily Modified Water Bodies

Five pHMWBs have been identified in the SWRBD – two lake water bodies, two estuarine water bodies and one coastal water body.

4.3.1 Lakes

Inniscarra and Carrigadrohid Reservoirs

These lakes are designated as pHMWB automatically in the Irish process due to presence of major impoundments. These dams are multi-purpose acting as a major water supply for Cork city and county, providing a renewable source of electricity, while also providing recreational and amenity areas, particularly for angling and rowing.

4.3.2 Estuarine and Coastal Waters

Two estuarine waters have been designated as pHMWBs – the Lee Estuary Lower and Lough Mahon. One coastal water body was also designated – Cork Harbour. The designation resulted from the presence of port activities in these water bodies. Designation was based on the volume of port traffic as represented by the tonnage of goods handled and the extent of port activities such as dredging. The total tonnage of goods handled in Cork Harbour in 2003 was 9,176,000 tonnes.

4.4 Provisional Artificial Water Bodies

One canal has been identified in the SWRBD for pAWB designation. The Lismore canal is 2.25 km in length. There is water in the canal all year round and it is fed by a small stream originating on the Obhanashead river. It is disused.

4.5 Further Assessment of pHMWBs and pAWBS

The final designation of water bodies as heavily modified or artificial will depend on further assessments which will consider restoration measures or other means to achieve the environmental quality objectives required under the WFD. The proposed final designation will be presented in the draft River Basin Management Plan for public consultation in 2008.

Inniscarra Dam, Lee Valley, Co. Cork

Ringaskiddy Deepwater and Ferry Terminals (Source: *www.portofcork.ie*)

5.1 Introduction

A key element of the Water Framework Directive is the integration of economics into sustainable water management and policy making. For this purpose a national report, 'Economic Analysis of Water Use', was prepared (see *www.wfdireland.ie*). This analysis will be considered when deciding on the actions necessary to achieve the objectives of the Directive; these actions together are called the **Programme of Measures**.

The directive also requires that the principle of recovery of the costs for water services (financial, environmental and resource costs) should be taken into account, having regard to the economic analysis and in accordance with the **Polluter Pays Principle**. The intent is to ensure that:

- Water pricing policies provide adequate incentives for the use of water resources efficiently, and thereby contribute to the environmental objectives.
- There is an adequate contribution from the different water using sectors to the costs of providing water services.

5.2 Overview of Socio-Economic Importance of Water Use

5.2.1 Key Water-Using Sectors in the SWRBD

The key water-using sectors are defined as those in which water-using activities are critical, due both to the volume of water used as well as the absence of suitable substitutes. The key non-domestic users in the SWRBD are shown in Table 5.1. It should be noted that more water is used in the home than either in agriculture or in industry.

Agricultural Sub-sectors	Industrial Sub-sectors	Miscellaneous Sub-sectors
Potatoes	Mining and quarrying	Forestry
Milk production and cattle	Food products and beverages	Inland commercial fishing
Sheep	Pulp, paper, and paper products	Seaweed harvesting
	Chemical and chemical products	Aquaculture
	Basic metals	Water-based leisure
	Machinery and equipment	
	Electrical and optical equipment	
	Transport equipment	
	Thermoelectric power generation	
	Hydroelectric power generation	

Table 5.1 Key Water-Using Sub-sectors in SWRBD

Programme of Measures
Actions set to achieve targets in River Basin Management Plans.

Polluter Pays Principle
The principle that a company or individual who causes pollution should pay for the cost of removing it, or provide compensation to those who have been affected by it.

5.2.2 Economic Impact of Water Users

Gross output value (GOV) is an indicator to measure the economic significance of different sectors. The Industrial sector has by far the highest estimated GOV when compared to Agriculture and the other miscellaneous sub-sectors.

- Industry – €13.6 billion per year.
- Agriculture – €0.56 billion per year.
- Miscellaneous – €0.095 billion per year.

The significant types of activities within industry are shown in Figure 5.1

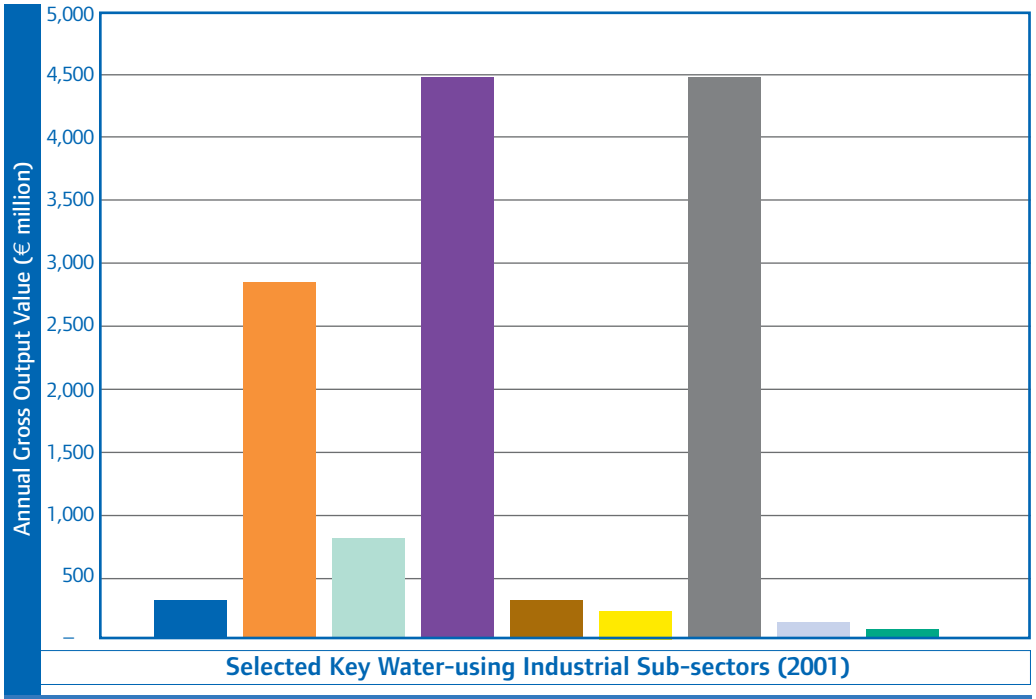


Figure 5.1 Estimated Annual Gross Output Values of Selected Key Water Using Industrial Sub-sectors in the SWRBD (2001)

- Mining and Quarrying
- Food Products and Beverages
- Pulp, Paper, and Paper Products
- Chemical and Chemical Products
- Basic Metals
- Machinery and Equipment n.e.c
- Electrical and Optical Equipment
- Transport Equipment
- Thermoelectric Power Generation
- Hydroelectric Power Generation

5.2.3 Value of Water Resources

Water is a valuable commodity with the primary uses being:

- Drinking water
- Raw material in industry
- Recreation

'Economic Analysis of Water Use' reported on the estimated water usage and thus the value of abstracted water delivered to the key water using sectors. In this case the value of abstracted water supplied to the agricultural sector far exceeded the value of water delivered to the industrial sector and is marginally greater than the value of water delivered to the domestic sector.

- Agriculture – €26m per year.
- Industry – €9m per year.
- Domestic – €25m per year.

The study also reported on an analysis carried out by the Economic and Social Research Institute on water-based leisure activities of

Irish residents, including those associated with domestic tourism in 2004. It states that the cost of using a water resource, e.g. travelling to a beach, is a measure of the value people place on that resource.

Values were estimated for angling, boating, going to the beach and other water-based leisure. Within the SWRBD going to the beach was found to be very highly valued (€38 m per year, 2003) with other uses generating lower values of between €5.6 and €8.2 m per year as shown in Figure 5.2.

Water also has a value in certain circumstances where there is no apparent human use of the resource. The creation and maintenance of Natural Heritage Areas, Special Protection Areas, Special Areas of Conservation and other wetlands demonstrate a willingness to pay for water resources which, therefore have a value. The estimated annual non-use value for protected areas in the SWRBD range between €2 and €19.3 m per year, and those for wetlands between €6.6 and €21 m per year.

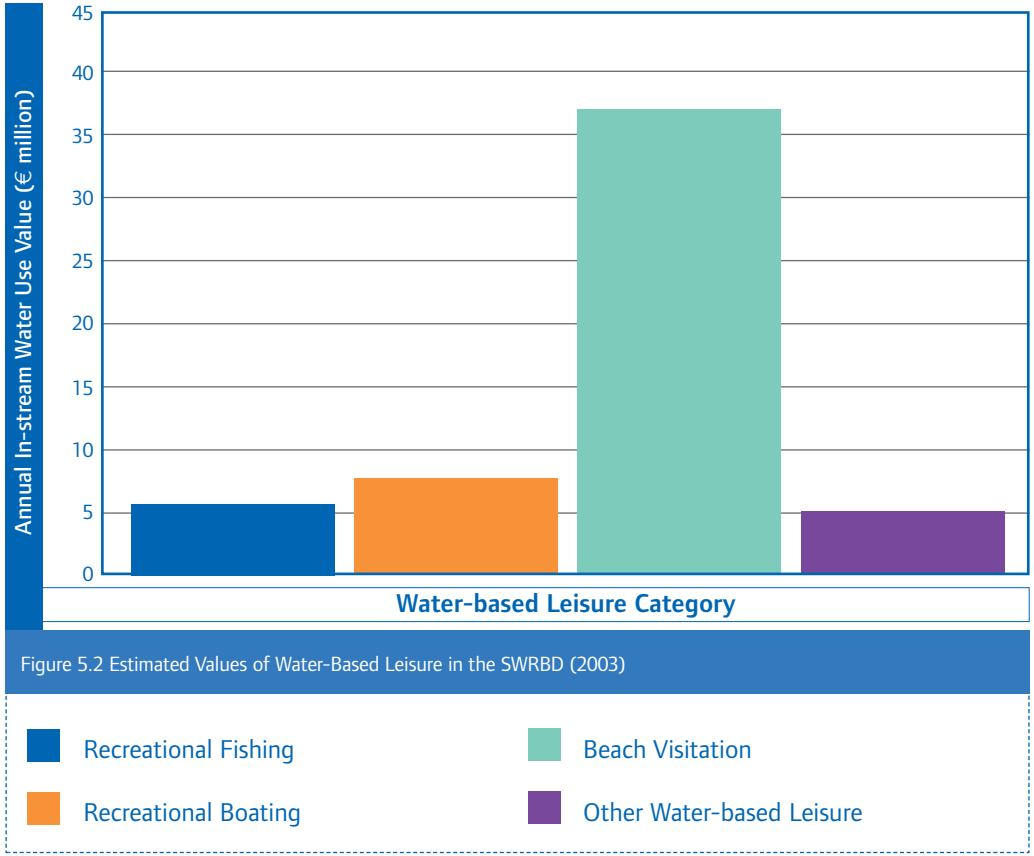


Figure 5.2 Estimated Values of Water-Based Leisure in the SWRBD (2003)

5.3 Assessment of Financial Cost and Cost Recovery of Water Services

There is not enough reliable information at (local) SWRBD level to measure accurately the cost of providing and maintaining water services. Nor is there sufficient information to know how much of these costs are being recovered by local authorities through charges. Therefore, we must use national data and trends to carry out our analysis.

5.3.1 Cost Recovery for Water Services

Cost recovery for water services is made up from charges on non-domestic users, development contributions, connection fees and Government subvention. In the SWRBD it is estimated that receipts for cost recovery of water services in 2003 were €24,588,195 with expenditures equalling €49,415,002. There is therefore a significant overall shortfall in the recovery of costs in the RBD estimated at approximately 50%. Cost recovery is lowest for public sewerage schemes (10%) and highest for private water supply schemes (95%) as shown in Table 5.2.

Water Services Investment Programme 2003	Receipts €	Expenditures €	Cost Recovery
Public Water Supply	21,512,651	27,764,663	77%
Public Sewerage Schemes	1,041,297	10,229,747	10%
Private Installation	260,977	273,677	95%
Administration and Miscellaneous	1,773,270	11,146,915	16%

Table 5.2 Partial Costs and Costs Recovery of Water Services in the SWRBD (2003)

5.4 Projections of Demand and Costs of Water Services

5.4.1 Projected Water Demand

The projected annual water demand from piped supplies for the SWRBD through to 2015, is expected to increase from 110,415 mega litres in 2005 to 116,869 mega litres in 2015, as shown in Figure 5.3. This represents an increase of almost 6% over the period. This includes **unaccounted** for water.

Unaccounted for water is the difference between the water supplied to a distribution system and the water that leaves the system for its intended use. It includes water loss from all underground distribution system pipes, illegal connections, leaks in private premises and inaccurate metering.

5.4.2 Projected Costs of Water Services

Funding for water services capital projects is provided through the Department of Environment, Heritage and Local Government (DEHLG) Water Services Investment Programme and the Rural Water Programme. Investment in water services in the SWRBD is expected to increase from just under €77 million in 2005 to just under €117 million in 2015. Under the Rural Water Programme investment is expected to rise from €8 million in 2005 to €16 million in 2015. Significant amounts will also come from development contributions which will be levied on new housing schemes and on commercial and industrial buildings.

5.5 Future Analysis

Much work has yet to be done to fully analyse the socio-economic impact of the direct and indirect use of water within the SWRBD. Further analyses will aim to develop methods to support programmes of measures, which will be a central part of the River Basin Management Plan. The measures when adopted, will assist in achieving the objectives of the Water Framework Directive.

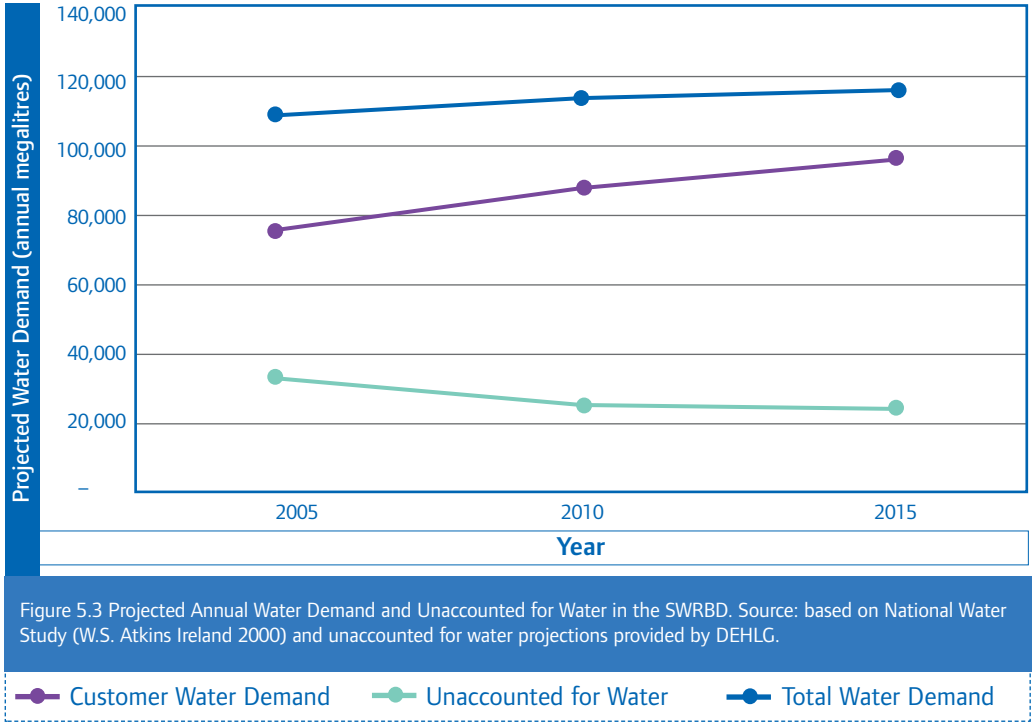


Figure 5.3 Projected Annual Water Demand and Unaccounted for Water in the SWRBD. Source: based on National Water Study (W.S. Atkins Ireland 2000) and unaccounted for water projections provided by DEHLG.

6.1 SWRBD Risk Assessment Results

The results of the risk assessments carried out on water bodies within the SWRBD are summarised in Table 6.1. Some water bodies may be at risk from one or more pressures, which explains why the sum of the percentages of the main pressures in Table 6.1 may exceed the overall percentage in the category.

It is important to note that the designation "at risk" is not necessarily an indication of the present quality of the water. The water quality may be good but the magnitude of the pressures which exist within the catchment, if not properly managed, poses a risk that the water body may not achieve good status in accordance with the WFD, or that the water quality is in danger of deterioration.

The outcome of the assessment of water bodies within the SWRBD follows the general trends found in other RBDs. Nationally, 64% of river water bodies were assessed in either the "at risk" or "probably at risk" categories compared to 47% in the SWRBD as shown in Figure 6.1.

Risk Category	Groundwater bodies % (by number)	River water bodies % (by number)	Lake water bodies % (by number)	Estuarine water bodies % (by number)	Coastal water bodies % (by number)
"not at risk"	18%	26%	47%	5%	59%
"probably not at risk"	**6%**	**27%**	**11%**	**35%**	**22%**
"probably at risk" Main pressures	**69%** Diffuse source pollution (62%) Point source pollution (43%)	**27%** Diffuse source pollution (19%) Structural alterations (17%)	**15%** Structural alterations (26%) Diffuse source pollution (7%)	**30%** Structural alterations (21%) Pollution impacts (5%)	**15%** Structural alterations (11%) Pollution impacts (4%)
"at risk" Main pressures	**7%** Point source pollution (6%) Abstractions and Intrusions (1%)	**20%** Diffuse source pollution (8%) Structural alterations (6%)	**27%** Abstractions (13%) Structural alterations (12%)	**30%** Pollution impacts (23%) Structural alterations (12%)	**4%** Pollution impacts (4%)

Table 6.1 SWRBD Summary of Risk Categories

The SWRBD was notable due to the high percentage of groundwater bodies found to be in the "at risk" categories, 76% compared to 61% nationally as shown in Figure 6.2. This occurs because groundwater bodies in the SWRBD are much larger and fewer in number than in the other RBDs. Point and diffuse sources of pollution were the significant pressures causing groundwater bodies to be in the "at risk" categories. Abstraction is not a significant pressure on groundwater bodies at present.

The percentage of lake water bodies in the SWRBD assessed in the "at risk" categories, 42%; is close to the national average of 38%. However, there is a wide variation in the significant pressures. Nationally abstractions were the predominant cause of the designation of lake water bodies being placed "at risk". However, abstractions tended to be significant in the context of the smaller lakes which are numerous whereas diffuse pollution is significant in the context of the larger lakes. In the SWRBD abstractions and structural alterations were found to be the significant pressures putting lake water bodies in the "at risk" category. However, Lough Leane has been assessed to be "at risk" due to diffuse source pressures.

For estuarine and coastal water bodies the assessment in the SWRBD was in line with the national trends. For estuarine water bodies 60% were in the "at risk" categories compared to 53% nationally. For coastal water bodies the results gave 19% in the SWRBD compared to 27% nationally. The significant pressures for estuarine and coastal water bodies were structural changes. However, in many cases water bodies were designated "at risk" from the review of existing monitoring data which indicated the water quality has been impacted.

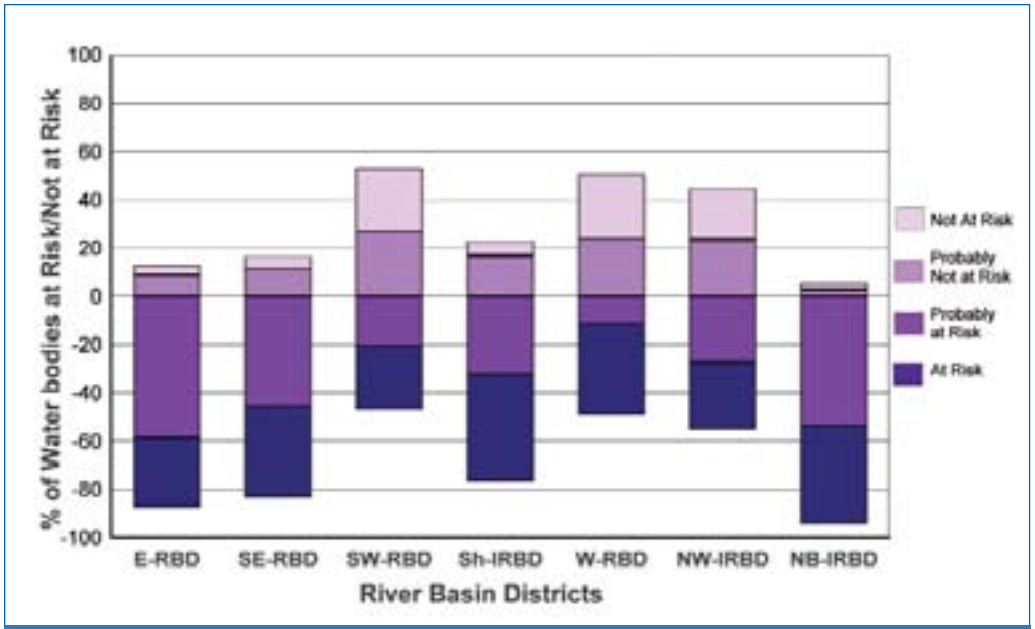


Figure 6.1 National River Water Body Risk Assessment Results

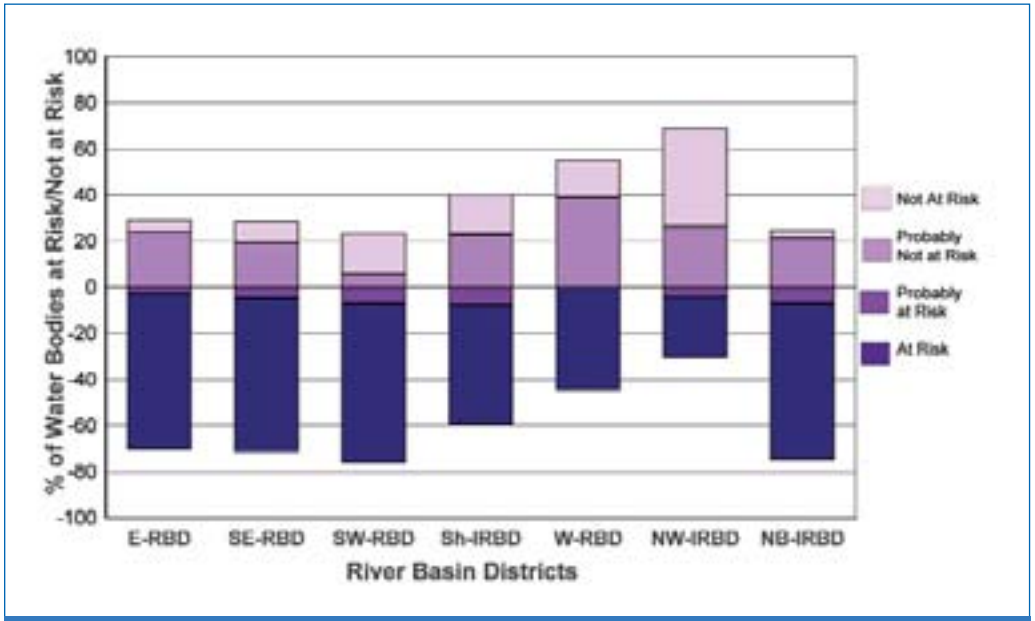


Figure 6.2 National Groundwater Body Risk Assessment Results

6.2 Next Steps

The work carried out to date in completing the risk assessments within the SWRBD will act as a baseline and it will direct future actions required under the WFD such as the monitoring programme and the programme of measures as shown in Figure 6.3. Work will also concentrate on filling the data gaps and thereby removing the uncertainty which exists concerning the water bodies assessed as "probably at risk" and "probably not at risk".

Monitoring and the use of mathematical models of water systems are some of the tools which will be used to remove these areas of uncertainty. It is intended that monitoring programmes will be operational by December 2006.

Once monitoring systems are in place, the next major reporting deadline under the WFD is the publication of a report on significant water issues in 2007. The report will further inform the public of the priorities in water management within the SWRBD. A draft of the first River Basin Management Plan (RBMP) for the SWRBD will be available for public consultation in 2008.

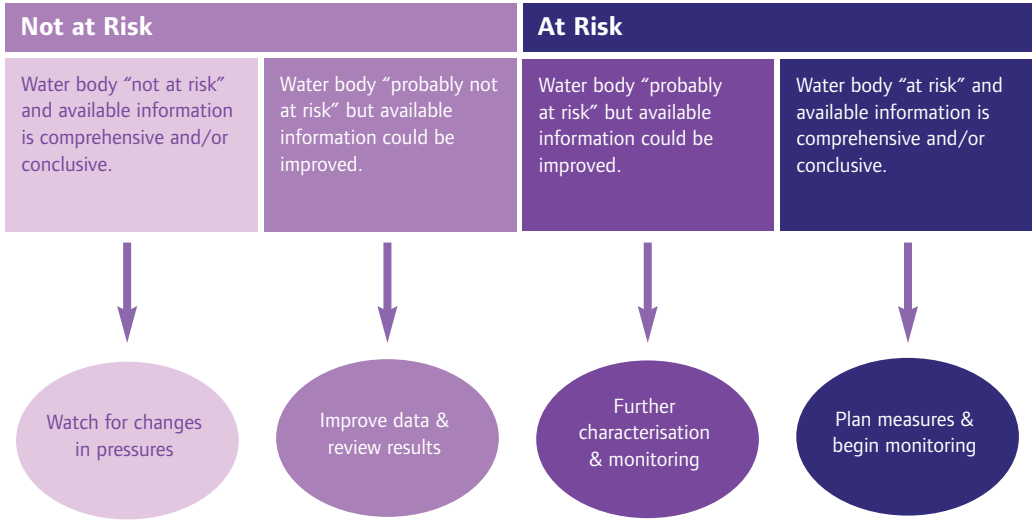


Figure 6.3 Next Steps

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