3.0 PHYSICAL DESCRIPTION

3.1 The Water Cycle

River Basins include streams, rivers, lakes, aquifers, estuaries and other brackish waters, together with the land that drains into these waters. The water cycle links all the parts of the river basin, by over ground and underground routes, from the hills and mountains to the sea (Figure 3.1). While the water cycle is often compartmentalised into different components, such as rivers, lakes, groundwater, etc., all are hydraulically connected. Consequently, the Water Framework Directive emphasises the need for integration of all water resources, combining fresh surface water and groundwater bodies, wetlands, and coastal water resources at the river basin scale.

Groundwater is the first component of the water cycle, as it generally discharges to wetlands/ ecosystems and surface water bodies. Continuing along the water cycle, rivers and lakes are followed by transitional waters and coastal waters. Emphasis needs to be placed on the interconnection and interdependencies between the various components to provide a broad conceptual understanding of the river basin as a 3-dimensional entity.

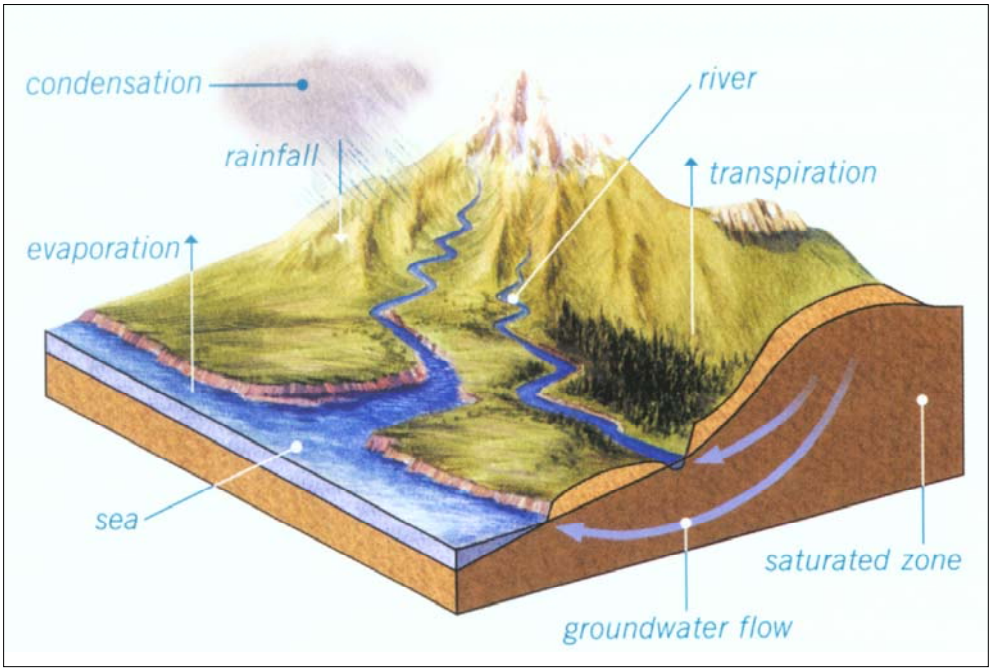

Figure 3.1 The Water Cycle

The water bodies are not yet delineated for the South Eastern River Basin District and water body maps are therefore not presented in this initial characterisation report, however the following sections describe the physical characteristics which influence the characterisation of the river basin district. Further work is also required to establish the linkages between ground and surface water bodies.

3.2 Key Statistics

The South Eastern River Basin District (SERBD) is defined as the area of land and sea made up from the neighbouring river basins lying within hydrometric areas 11 to 17 together with their associated groundwater, transitional and coastal waters (Map 3.1).

The South Eastern River Basin District has a land area of over 12,700 km^2. The principal rivers are the Slaney River and three sister rivers which drain to Waterford Harbour i.e. the Barrow, Nore and the Suir Rivers. The Suir, Barrow, Nore river system is the second largest in the Country (after the Shannon) with a combined catchment area of over 9,000 km^2. Hydrometric Areas 11 Owenavorragh, 13 Ballyteigue/Bannow and 17 Colligan-Mahon are smaller coastal areas drained by a network of minor rivers directly to the sea. The South Eastern River Basin District also includes over 1,200 km^2 of transitional and coastal waters.

Table 3.1 Hydrometric Areas

Hydrometric Area	Name	Area (km^2)
11	Owenavorragh (East County Wexford)	364.5
12	Slaney	1943.5
13	Ballyteigue-Bannow (South County Wexford)	670.3
14	Barrow	2983.2
15	Nore	2585.7
16	Suir	3545.4
17	Colligan-Mahon (South County Waterford)	651.8
SERBD	**Land Area**	**12744.4**

The principal urban areas in the South Eastern River Basin District are: Waterford City, Kilkenny, Carlow, Wexford, Clonmel, Portlaoise, Enniscorthy, Thurles, Dungarvan, New Ross, Tramore, Athy, Carrick-on-Suir, Tipperary, Kildare, Gorey, Portarlington, Mountmellick, Tullow, Muinebheag (Bagenalstown), Cashel, Monasterevin and Templemore (Map 3.2).

The South Eastern River Basin District includes parts of 13 Local Authorities namely Carlow, Cork, Kildare, Kilkenny, Laois, Limerick, Offaly, North Tipperary, South Tipperary, Waterford, Waterford City, Wexford and Wicklow.

Key Statistics

The physical conditions in the South Eastern River Basin District are such that the area is highly suitable for agricultural activities such as tillage and grassland enterprises. The central plains and low lying areas of the district are associated with well drained soils of medium texture. Rainfall is relatively low and temperatures moderate. Traditionally therefore the south east has had a relatively high uptake of tillage and grassland farming activities in comparison to national averages. In 1991 the tillage area within the South

Eastern River Basin District represented over 50 % of the tillage area in Ireland.
Agriculture and related food manufacture industries are significant sources of employment within the south east region.

The region is relatively densely populated, second only to the eastern region with includes the Greater Dublin area. The south east has experienced moderately high population growth over the past five years partially due to the widening influence of the Dublin Commuter Belt.

Characteristic	**Source**	**SERBD**	**National Average**
Average population density (per/km^2)	CSO, Census 2002	76.1	59.6
Average population growth (%)	CSO,Census 2002	9.3	8.0
Maximum elevation (mAOD)	EPA, DTM	925	1,040
Maximum monthly rainfall (mm/mth)	Met Eireann	196	402
Average potential evapotranspiration (mm/mth)	Met Eireann	518	507
Specific long term average runoff (m^3/s/km^2/yr)	EPA, Hydrometrics	17.7	21.1
Portion of land cover – arable (%)	CORINE 1990	16.7	12.1
Portion of land cover – pasture (%)	CORINE 1990	69.9	26.0
Livestock density (lu/ha farmed)	CSO,Census 1991	1.7	1.6
Portion of farmers in REPS (%)	DoA&F	24.5	30.8

Water Quality Management Plans have previously been prepared under the Water Pollution Act by the An Foras Forbartha for:

- the River Slaney Catchment and Estuary (1986);
- the River Barrow Catchment (1985);
- the River Nore Catchment (1985);
- the Suir River Catchment (1983);
- the Suir-Barrow-Nore Estuary (1990).

The River Suir was recently studied as part of the Three Rivers Project.

These plans and reports provide useful background information on the catchments.

3.3 Geographical Extent

Hydrometric Areas 11 (East County Wexford – Owenavorragh), 12 (Slaney) and 13 (South County Wexford – Ballyteigue – Bannow) (Maps 3.2 and 3.3)

The Slaney River catchment and east and south county Wexford comprise an area of 2,978 km^2 and include parts of the counties Wexford, Wicklow and Carlow. The northern watershed of the Slaney is in

the Wicklow Mountains with the Blackstairs Mountains forming the catchment boundary between the Slaney and Barrow/Nore catchments.

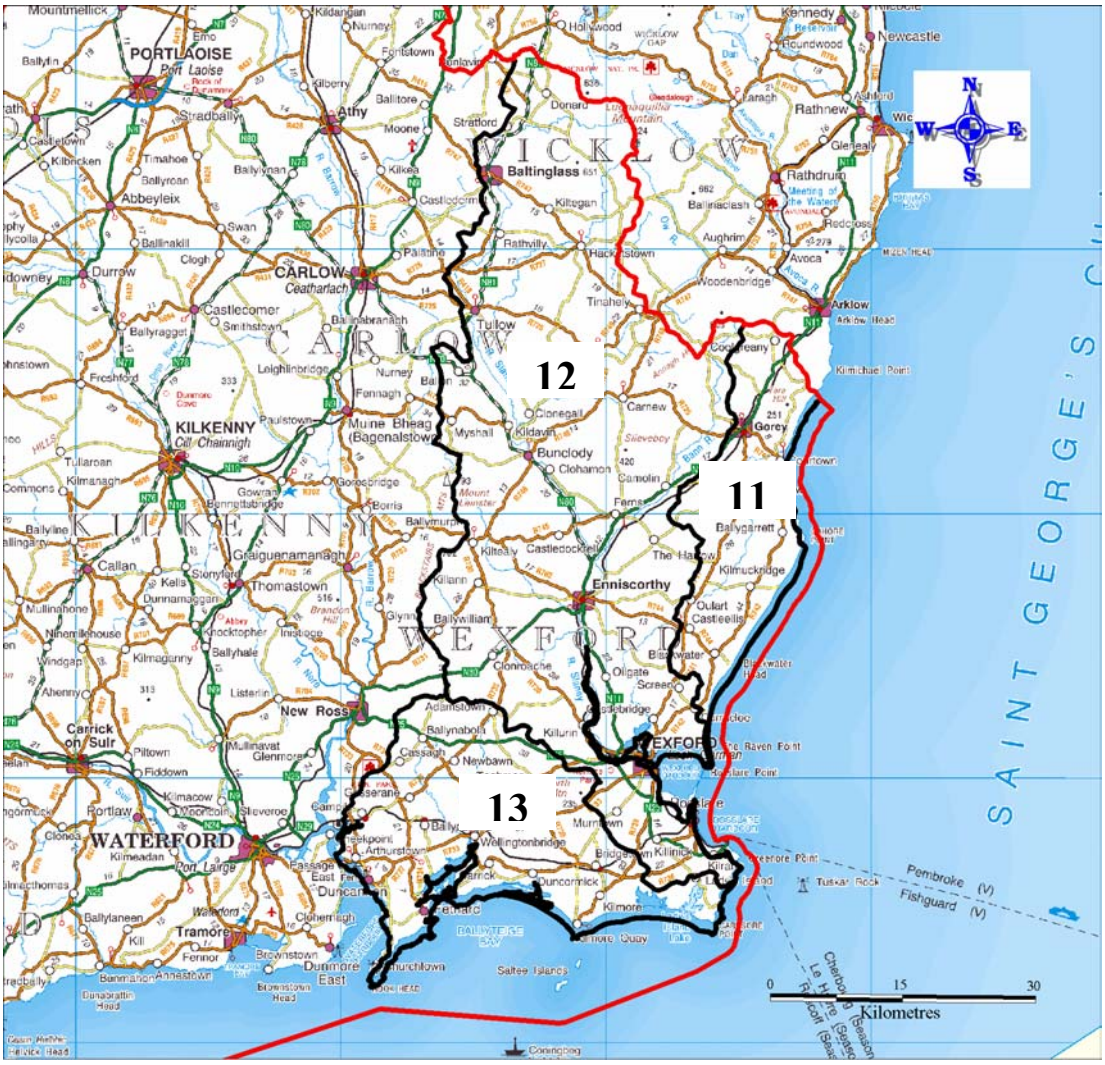

Figure 3.2 Hydrometric Areas 11, 12 and 13

The River Slaney rises in the Glen of Imaal near Lugnaquilla in the Wicklow mountains and flows in a westerly direction towards Stratford. From a point near Stratford, the river turns and flows in a southerly direction on the western side of the catchment passing through Baltinglass, Rathvilly and Tullow. Downstream of Tullow, the river flows south south-east through Bunclody to Enniscorthy and then south to Ferrycarrig where it turns east through Wexford Harbour to the sea. The total length of the main river from its source to Wexford Harbour is 117 km. The river is tidal to Enniscorthy.

Upstream of Enniscorthy, the principal tributaries are the Derreen, Derry and Bann rivers which rise in the mountains on the eastern boundary of the catchment and flow in a south westerly direction entering the Slaney river on the left bank side. The Douglas and Clody rivers rise near Mount Leinster and flow in a north-east and easterly direction respectively entering the right bank (west side) of the Slaney.

Downstream of Enniscorthy, the two main tributaries are the Urrin and Boro rivers which rise in the Blackstairs mountain range and flow from west to east. The Sow has its confluence with the Slaney estuary between Ferrycarrig and Wexford entering from the north on the left bank (east side) of the estuary.

The main rivers of east Wexford are the River Assaly, River Aughboy, River Blackwater, Cahore Canal, River Inch and River Owenavorragh. South Wexford is drained by the River Bridgetown, River Corock, River Duncormick and River Owenduff.

Hydrometric Area 14 (Barrow) (Maps 3.2 and 3.2)

Figure 3.3 Hydrometric Area 14

The Barrow river catchment includes parts of counties Laois, Offaly, Kildare, Carlow, Kilkenny, Wexford and Wicklow. The watershed of the Barrow basin consists of the Castlecorner Plateau and Slieve Bloom Mountains to the west, with the Curragh of Kildare and the foothills of the Wicklow Mountains and Blackstairs Mountains defining the east. The western watershed is less well defined following low lying eskers and bogs.

The River Barrow rises in the Slieve Bloom mountains in County Laois approximately 6 km south of Clonaslee. It flows north easterly until it reaches the Offaly county boundary at Monettia Bog where it turns to a south easterly direction. From near Mountmellick, it flows in an easterly direction through Portarlington forming part of the county boundary between Laois and Offaly, to Monasterevin. From Monasterevin the river flows generally in a southerly direction through Athy, Carlow, Leighlinbridge, Muinebheag, Graiguenamanagh and New Ross, to its confluence with the Suir at Cheekpoint.

The Barrow is joined by the Nore approximately 4 km upstream of New Ross and is tidal for about another 13 km upstream to St. Mullin's. The Barrow in conjunction with stretches of canal, provides a navigable channel between New Ross and the main Grand Canal system at Athy.

The main tributaries joining on the left bank (east side) are the Cushina, Figile and Slate, which form one tributary at Monasterevin and the Greese, Lerr, Burren, Mountain and Pollmounty, while on the right bank (west side) it is joined by the Owenass, Triogue, Stradbally, Douglas, Fushoge, Gowran, Powerstown and Duiske tributaries.

Hydrometric Area 15 (Nore) (Maps 3.2 and 3.3)

The River Nore incorporates parts of counties Kilkenny, Laois, South Tipperary, North Tipperary and Carlow. The watershed of the Nore is defined by the Slieve Bloom Mountains to the north and the Devil's Bit and Slieveardagh Hills to the north west and west. The Slievenamon range separates the Nore and Suir catchments to the south and south west. The eastern boundary of the Nore catchment is formed by the Castlecomer Plateau and the Brandon range which divide the Nore and Barrow Catchments.

The River Nore rises in the hills approximately 10 km south west of Roscrea in North Tipperary. It flows in a north easterly direction through Borris-in-Ossory to Castletown in County Laois where it turns to flow in a south easterly direction through Ballyragget, Kilkenny, Bennettsbridge and Thomastown to its confluence with the Barrow approximately 4 km upstream of New Ross.

The total length of the main river channel from its source to the confluence is about 141 km. The lower part of the river downstream of Inistioge is tidal.

The principal tributaries are the Delour which rises in Slieve Bloom, the Mountrath, Owveg and Dinin all of which flow in on the left bank (east side) of the river and the Gully, Erkina, Nuenna, King's, Little Arrigle and Arrigle which flow into the main river channel on the right bank (west side).

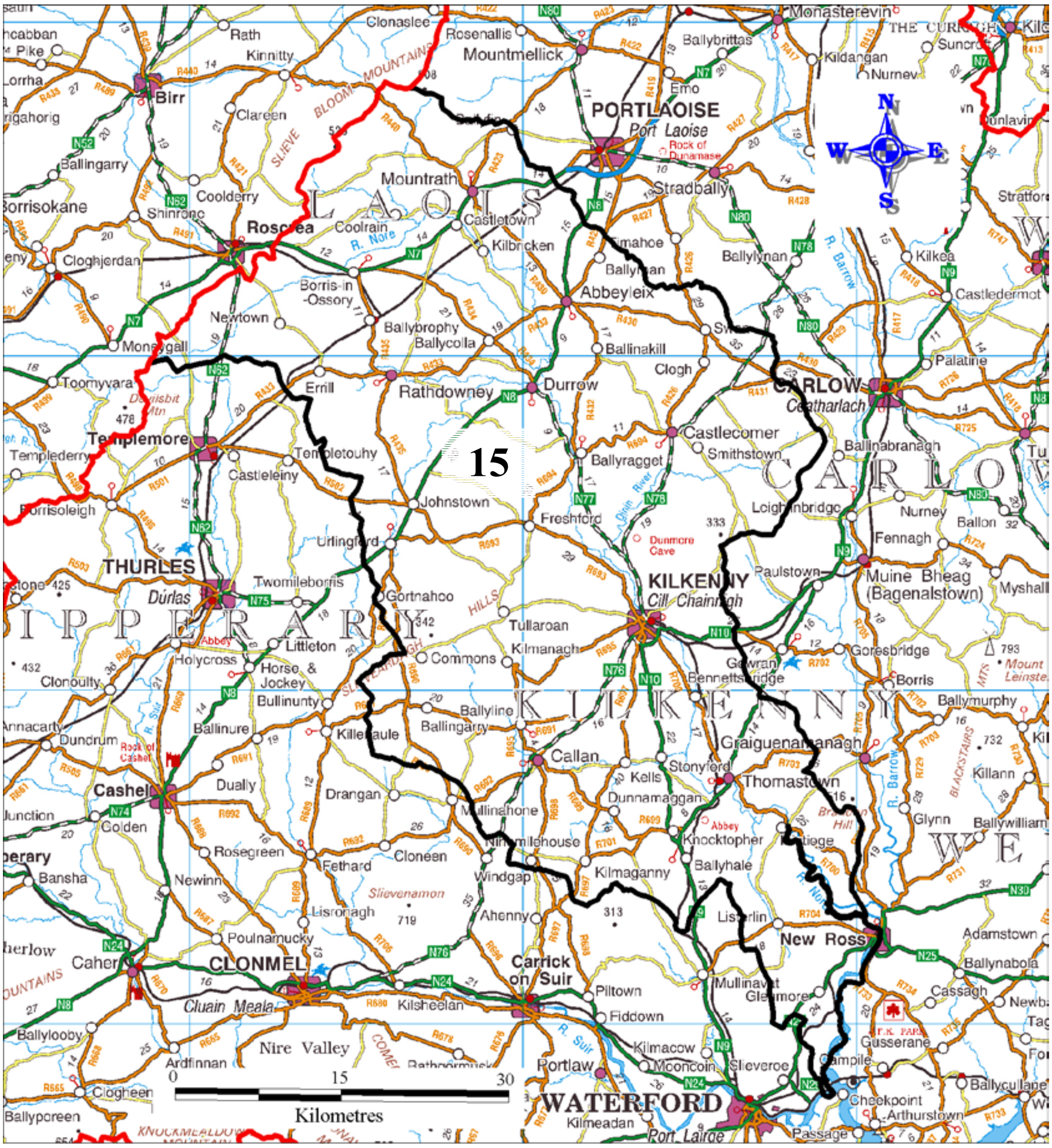

Figure 3.4 Hydrometric Area 15

Hydrometric Areas 16 (Suir) and 17 (South County Waterford - Colligan-Mahon) (Maps 3.2 and 3.3)

The Suir Catchment and south County Waterford comprise an area of 4,197 km^2 and includes parts of North Tipperary, South Tipperary, Kilkenny and Waterford (including Waterford city). There are also small parts of counties Limerick, Cork and Laois within the catchment. The western boundary of the catchment extends from the Devil's Bit Mountain at the northern end to the Galtee Mountains at the

south. The boundary between the Suir catchment and the south county Waterford area follows a west to east route through the Knockmealdown, Monavullagh and Comeragh Mountains.

The Suir River rises in the Devil's Bit near Moneygall in County Tipperary and flows in a southerly direction past Templemore which lies to the west, through Thurles and Cahir to the boundary between Counties Tipperary and Waterford near Newcastle. Cashel which is roughly midway between Thurles and Cahir lies 4 km to the east of the river. From a point near Newcastle the river flows north and then east through Clonmel, Carrick-on-Suir and Waterford to join the River Barrow at Cheekpoint. In this latter section the river forms the boundary between County Waterford on the right bank (north side) and Counties Tipperary and Kilkenny on the left bank (south side).

Figure 3.5 Hydrometric Areas 16 and 17

The total length of the main river channel from the source to Cheekpoint is about 174 km. The river is tidal to a point 2.5 km upstream of Carrick-on-Suir; the saline intrusion however does not penetrate this far.

The main tributaries of the Suir are the Clodiagh (Thurles), the Multeen, the Aherlow and Ara, the Tar, the Nier and the Clodiagh (Portlaw) all of which flow into the Suir on the right bank (west side) from the highlands and mountains which form the western and southern catchment boundary. The principal tributaries on the left bank (east side) of the river are the Drish, the Arglo and the Anner north of the river, and its tributary rivers, - the Clashawley and the Moyle. Other tributaries of some significance include the Aughnaglanny, the Blackwater, the Fidaghta, the Lingaun and the Rossestown. The total length of river channel in the catchment including the main river and the significant tributaries is about 530 km. The Suir is tidal to downstream of Clonmel.

South Waterford's main coastal rivers are the River Brickey, River Colligan, River Dalligan, River Mahon and River Tay.

River Basin District Boundary
The boundary of the River Basin District is being defined by ground truthing a catchment watershed identified using a DTM developed by the EPA.

Coastal & Transitional Waters

The South Eastern River Basin District boundary extends for 1 Nautical mile off territorial waters and encompasses the Saltee Islands off the Southern Coast. Coastal waters in the South Eastern River Basin District reach depths in the region of 50m. The Coastline incorporates Cahore Point, Wexford Harbour, Rosslare Harbour, Carnsore Point, Ballyteige Bay, Hook Head, Waterford Harbour, Tramore Bay, Dungarvan Harbour, Helvick Head, and Ardmore Bay. The main esturaies in the South Eastern River Basin District include the Suir Estuary and the Slaney estuary. The Southern Coastline also contains two coastal lagoons, Tacumshin Lake and Ladys Island Lake.

3.4 Population

The Census 2002 preliminary report has made available preliminary population statistics. The overall population within the South Eastern River Basin District has increased from 471,648 in 1996 to 516,117 in 2002. The distribution is presented in Table 3.2 and Map 3.4.

Table 3.2 Overall Population Statistics

Hydrometric Area	Name	Area km^2	1996 Population	2002 Population
11	East Co Wexford	364	13,390	16,702
12	Slaney	1943	78,888	86,743
13	South Co Wexford	670	21,390	23,116
14	Barrow	2983	128,438	145,561
15	Nore	2586	81,948	87,034
16	Suir	3545	119,723	125,979
17	South Co Waterford	652	27,871	30,982
Total		12743	471,648	516,117

Note: Based on % area of DED with catchment boundary.

Source: CSO, Census 2002 Preliminary Report

In general population has increased throughout the river basin district but most notably in the north eastern portion within the widening influence of the Dublin commuter belt as shown in Table 3.3 and Map 3.5.

Table 3.3 Population Trends within South Eastern River Basin District Participating Counties

County	% Area within SERBD	1996 Population	2002 Population	% increase/ decrease
Carlow	100	41,616	45,845	+10.2%
Cork	<0.1	293,323	324,843	+10.7%
Kildare	50	134,992	163,995	+21.5%
Kilkenny	100	75,336	80,421	+6.7%
Laois	96	52,945	58,732	+9.3%
Limerick	2	113,003	121,471	+7.5%
Offaly	19	59,117	63,702	+7.8%
North Tipperary	38	58,021	61,068	+5.3%
South Tipperary	89	75,514	77,914	+3.2%
Waterford	66	52,140	56,954	+9.2%
Waterford City	100	42,540	44,564	+4.8%
Wexford	99	104,371	116,543	+11.7%
Wicklow	28	102,683	114,719	+11.7%

Source: CSO, Census 2002 Preliminary Report

The census has also highlighted a shift in several counties from rural to urban populations with urban population centres increasing and decline in some rural areas (Table 3.4).

Human Population Statistics

Up to date population figures for towns will be released by CSO in July 2003.

Table 3.4 Main Population Centres (Urban DEDs and environs)

Threshold: 1996 Population > 1000

District	1996	2002	Change in population 1996-2002
	Persons	Persons	Percentage
Carlow County			
Carlow urban area	11,721	13,188	12.5
004 Hacketstown	1,003	1,027	2.4
033 +034 Muinebheag (Bagenalstown) Rural + Urban	3,118	3,200	2.6
048 Tullow Urban	2,665	2,817	5.7
Kildare County			
Athy urban area	5,306	6,058	14.2
013 Castledermot	1,154	1,122	-2.8
027 Monasterevin	2,820	3,158	12
053 Rathangan	1,339	1,525	13.9
065+066 Droichead Nua (Newbridge) Rural + Urban	7,485	9,858	24
071 Kildare	5,343	6,893	29
074 Kilmeage North	1,212	1,386	14.4
075 Kilmeage South	1,063	1,125	5.5
Kilkenny County			
Kilkenny urban area	8,507	8,594	1
005 Callan Urban	2,177	2,308	5.7
019 Pilltown	1,353	1,356	0.2
025 Ballyragget	1,270	1,272	0.2
026 Castlecomer	2,133	2,319	8.7
027 Clogh	1,112	1,245	12
030 Moneenroe	1,162	1,208	4
074 Graiguenamanagh	1,581	1,620	2.5
084 Thomastown	1,641	1,704	3.8
106 Kilculliheen (part)	1,613	2,149	33.2
109 Pollrone	1,000	1,020	2
111 Rathpatrick	1,622	1,217	-25
Laois County			
001 Abbeyleix	2,164	2,374	9.7
017 Durrow	1,142	1,161	1.7
026 Rathdowney	1,275	1,281	0.5
036 Stradbally	1,483	1,634	10.2
066 Mountmellick Urban	3,235	3,492	7.4
067 Mountrath	1,809	1,899	5
070 Portarlington South	2,630	3,263	24.1
071 + 072 Portlaoighise (Maryborough) Urban + Rural	9,854	12,395	20.5

District	1996	2002	Change in population 1996-2002
	Persons	Persons	Percentage
094 Graigue Rural	1,508	1,821	20.8
Offaly County			
065 Daingean	1,048	1,169	11.5
078 Portarlington North	1,487	1,640	10.3
Wexford County			
Enniscorthy urban area	3,788	3,742	-1.2
New Ross urban area	5,012	4,812	-4
Wexford urban area	9,533	9,443	-0.9
019 Clonroche	1,103	1,091	-1.1
022 Ferns	1,198	1,232	2.8
032 Newtownbarry	1,812	1,886	4.1
049 Courtown	1,533	2,031	32.5
051 Gorey Rural	2,361	2,828	19.8
052 Gorey Urban	2,150	3,093	43.9
067 Ballyhack	1,180	1,256	6.4
089 Tintern	1,190	1,256	5.5
092 Ardcavan	1,565	1,921	22.7
099 Carrick	1,245	1,360	9.2
111 Kilmore	1,800	1,908	6
117 Rathaspick	1,108	1,431	29.2
118 Rosslare	1,386	1,578	13.9
119 St. Helen's	1,698	1,777	4.7
121 Taghmon	1,004	1,044	4
Wicklow County			
Wicklow urban area	6,416	7,007	9.2
009 Baltinglass	1,694	1,976	16.6
014 Dunlavin	1,169	1,315	12.5
071 Carnew	1,382	1,409	2
082 Tinahely	1,160	1,224	5.5
North Tipperary			
Templemore urban area	2,115	2,152	1.7
Thurles urban area	6,603	6,874	4.1
Borrisoleigh	1,058	1,129	6.7
068 Holycross	1,334	1,425	6.8
071 Littleton	1,225	1,164	-5
South Tipperary			
Carrick-on-Suir urban area	5,172	5,543	7.2
082 Carrickbeg Urban	1,004	1,228	22.3
084 Cashel Urban	2,346	2,401	2.3
Tipperary urban area	4,640	4,560	-1.7
109 Killenaule	1,285	1,368	6.5

District	1996	2002	Change in population 1996-2002
	Persons	Persons	Percentage
115 Peppardstown	1,144	1,284	12.2
117 Ardfinnan	1,077	1,021	-5.2
125 Kilcommon	2,102	2,189	4.1
137 Kilsheelan	1,104	1,131	2.4
Waterford County			
Dungarvan urban area	7,175	7,218	0.6
010 Portlaw	1,149	1,080	-6
024 Clonea	1,125	1,417	26
034 Ringville	1,011	1,077	6.5
047 Kilmacthomas	1,132	1,181	4.3
072 Faithlegg (part)	1,513	1,815	20
073 Islandikane	1,359	1,669	22.8
083 Tramore	6,123	7,681	25.4

Source: CSO, Census 2002 Preliminary Report

Note - No major towns in Limerick County or Cork County within the South Eastern River Basin District

3.5 Topography

The topography of the South Eastern River Basin District is presented in Map 3.6. Elevated regions within the district include the Wicklow Mountains, Blackstairs Mountains, Castlecomer Plateau, Slieve Bloom Mountains, Comeragh, Knockmealdown and Galtees Regions, Monavullagh and Silvermines. Beyond the elevated catchment watershed the topography is mainly low lying, gently undulating plain.

A Digital Terrain Model of the South Eastern River Basin District has been created on behalf of the EPA based on 10 m interval contour and topographical information provided by Ordnance Survey Ireland. The DTM will be released by mid 2003 and will be utilized to refine river basin boundaries.

3.6 Geology and Hydrogeology

The regional bedrock geology and preliminary vulnerability of the South Eastern River Basin District is described in detail in the GSI Reports for Bedrock sheets 15, 16, 18, 19, 22 and 23 and shown on Map 3.7 and Map 3.8.

Geological Mapping

GSI are developing a consistent bedrock map and groundwater bodies map.

The Groundwater Section of the GSI has prepared Groundwater Protection Schemes for Kilkenny, Kildare Laois, Offaly, Tipperary North and South, Waterford and Wicklow which describe the

overburden and hydrogeological conditions. A hydrogeological evaluation of the individual groundwater bodies in each hydrometric area is currently being undertaken by the GSI. Pending the completion of this evaluation, only a very broad assessment of the hydrogeological properties of the various geological units in each Hydrometric Area has been prepared.

South Eastern River Basin District Subsoils

The subsoils overlying the bedrock were deposited during the Quaternary period from the beginning of the Ice Age approximately 1.6 million years ago to the present time. The origins of the subsoils are associated with the movement of ice sheets that extended from the north and across the Irish Sea Basin.

The deposits from the ice sheets in-filled or partially in-filled hollows and valleys in the pre-glacial topography. These deposits were laid down in three phases of glaciation (Meehan 1997). The finer grained materials such as clays silts and sands are generally associated with advancing ice-sheets while the coarser grained materials sands and gravels are generally associated with retreating ice sheets. More recently fine grained alluvium deposits can be found along the main river floodplains as a result of deposition after periods of high river flows.

South Eastern River Basin District Bedrock

In the western portion of the South Eastern River Basin District the higher ground generally comprises Devonian and Ordovician sandstones, siltstones, mudstones and conglomerates with progressively younger Carboniferous shales and limestones occupying the valley floors. The Slieve Bloom, Silvermines and Galtee Mountains define the northwestern and western margins of the basin while the Knockmealdown, Monavullagh and Commeragh Mountains define the south western margins of the basin. The southern and eastern margins of the basin are defined by the coastal areas of Waterford and Wexford.

The high ground in the central portion of the catchment is dominated by Castlecomer Plateau comprising Carboniferous sandstones, siltstones and shales interbedded with coal measures and the Slieve Ardagh Hills to the north of Roscrea comprising shales, sandstones and limestones with coal seams.

In the east the rocks are generally older with the oldest rocks occurring in the southeast corner of basin around Carnsore Point in Wexford. Much of the eastern area is dominated by the granites of the Leinster Batholith from the Wicklow Mountains to the Blackstairs Mountains between Carlow and Wexford. The south eastern area comprises Ordocian volcanic rock and sedimentary rocks that have been metamorphosed by the intrusion of the granites.

Table 3.5 Bedrock Groups

Bedrock Group	Area km^2	% of South Eastern River Basin District
Sub-Waulsortian Impure Limestones	1418.4	11.1
ORS Sandstones, Siltstones and Shales	689.7	5.4
Sub-Waulsortian Sandstones, Shales and Limestones	226.6	1.8
Waulsortian Type Limestone	558.9	4.4
Ordovician Sediments and Metamorphics	1781.1	13.9
ORS Conglomerates	467.5	3.7
Kiltorcan-type Sandstones	340.2	2.7
Ordovician Volcanics	874.4	6.8
Igneous Intrusive	1088.7	8.5
Igneous Extrusive	4.8	0.0
Dolomitised Limestone	318.1	2.5
Cambrian Sediments and Metamorphics	477.9	3.7
Pre Cambrian Mixed	71.2	0.6
Pure Bedded Limestones - Supra-Calp type	1585.9	12.4
Permo-Triassic Sandstones	14.8	0.1
Silurian Sediments and Metamorphics	602.4	4.7
Impure Calp-type Limestone	791.5	6.2
Namurian Shales	527.3	4.1
Silurian Volcanics	41.9	0.3
Namurian Undifferentiated	8.4	0.1
Pure Bedded Limestones - Sub-Calp type	372.9	2.9
Namurian Sandstones	203.3	1.6
Westphalian Sandstones	103.5	0.8
Westphalian Shales	203.4	1.6

Detailed information on the geology and hydrogeology of each of the Hydrometric Areas in the South Eastern River Basin District is presented in the Report on the Geology and Hydrogeology of the SERBD and is summarised in Appendix B. A summary table of the primary geological and hydrogreological characteristics of the hdyrometric areas within the river basin district is presented in Table 3.6

Table 3.6 Summary of the Geology and Hydrogeology of the South Eastern River Basin District

Hydrometric Area 11			
Subsoil	**Comment**	**Aquifer Classification**	**Aquifer Vulnerability**
Alluvium	There is alluvial deposition around the flood plains of Owenavarragh, Tinnock and Ballydesmond Rivers		
Sands and Gravels	In east Wexford, on the higher ground, the sands and gravels are 15-50m thick with yields ranging between 500-1500m^3/d.	Regionally Important	No Data Available
Bedrock Formation	**Composition**	**Aquifer Classification**	**Aquifer Vulnerability**
Cahore Group	Greywackes-They form the bedrock from the coast around Cahore Point running SW to Taghmon	P1	No Data Available
Newtown Fm	Grey-green greywacke and slates-form the bedrock from the coast around Cahore Pt running SW to Taghmon	L1	No Data Available
Ballyhoge Fm	Dark grey Slates with siltstone laminae-part of the lower and upper successions in the Ribband Group	L1	No Data Available

River Chapel Fm	Purple buff and green slates-underlies much of the central portion of the Hydrometric Area	Ll	No Data Available
Ballylane Fm	Green and grey Slate with thin siltstone-found in succession in the northern portion of the area	Pl	No Data Available
Oaklands Fm	Green, red-purple buff slate and siltstone-found in succession in the northern portion of the area	Ll	No Data Available
Campile Fm	Rhyolites and rhyolitic tuffs-these rocks stretch from Courtown in the east to Camolin in the west	Regionally Important	No Data Available
Ballymartin Fm	Carboniferous Limestones and calcareous shales- the youngest rocks in Area 11 at the southern end of Area 11	Regionally Important	No Data Available
Ballysteen Fm	Carboniferous Limestones and calcareous shales- the youngest rocks in Area 11 at the southern end of Area 11	Regionally Important	No Data Available
Wexford Fm	Carboniferous Limestones and calcareous shales- the youngest rocks in Area 11 at the southern end of Area 11	Rf	No Data Available
Hydrometric Area 12			
Subsoil	**Comment**	**Aquifer Classification**	**Aquifer Vulnerability**
Alluvium	Alluvial deposition is found around the flood plains of the Slaney, the Bann, the Urrin, the Boro and the Tinnacross Rivers and streams		
Sands and Gravels	Found along the River Slaney to the north and south of Enniscorthy, 10-20m thick with yields ranging between 500-1500m³/day.	Regionally Important	
Bedrock Formation	**Composition**	**Aquifer Classification**	**Aquifer Vulnerability**
Butter Mountain Fm	Dark slate, schist, quartzite and coticule-at the northern portion of Area 12	Ll	High-Extreme
Tullow Pluton	Granite-part of the Leinster Batholith-at the northern portion of Area 12.	Pl	High-Extreme
Newtown Fm	Grey-green greywacke and slates-form the bedrock from the coast around Cahore Pt running SW to Taghmon	L1	No Data Available
Cullenstown Fm	Grey-green metagreywackes and slates-form the bedrock to the SW of Wexford Harbour	P1	No Data Available
Cullentra Fm	Grey-green metagreywackes and slates -form the bedrock to the SW of Wexford Harbour	P1	No Data Available
Shelmaliere Fm	White, purple quartzites with slates-form the bedrock to the SW of Wexford Harbour	P1	No Data Available
Ballyhoge Fm	Dark grey slates with siltstone laminae-underlies much of the central portion of Area 12	L1	No Data Available
River Chapel Fm	Purple buff and green slate-underlies much of the central portion of Area 12	L1	No Data Available
Ballylane Fm	Green and grey slate with thin siltstone	Ll	Extreme
Oaklands Fm	Green, red-purple buff slate and siltstone-found in succession in the northern portion of the area	Ll	No Data Available
Maulin Fm	Dark grey-blue slate, phylite and schist	Ll	High-Extreme
Campile Fm	Rhyolites and rhyolitic tuffs-these rocks stretch from Courtown in the east to west Waterford	Regionally Important	No Data Available
Ballysteen Fm	Limestone and calcareous shales-in the southern end of Area 12	Regionally Important	No Data Available
Wexford Fm	Limestone and calcareous shales-dolomitised along the coast in Wexford Harbour	Regionally Important	No Data Available
Ballymartin Fm	Limestone and calcareous shales in the southern end of Area 12	L1	No Data Available
Hydrometric Area 13			
Subsoil	**Comment**	**Aquifer Classification**	**Aquifer Vulnerability**
Alluvium	Alluvial deposition is found around the flood plains of the Bridgetown, Battlestown, Cleristown, Corock, Duncormick, Mulmontry, Owenduff and Tintern Abbey Rivers and strems.		
Sands and Gravels	Gravel deposits in the higher ground are 10-20m thick with yields ranging between 500-1500m³/d.	Regionally Important	High

Bedrock Formation	Composition	Aquifer Classification	Aquifer Vulnerability
Campile Fm	Rholites and rhyolitic tuffs-these rocks stretch from Courtown in the east to west Waterford	Rf	No Data Available
Ballylane Fm	Green and grey slates-NW margins of the area	P1	No Data Available
Oaklands Fm	Green, purple and red buff slate-NW margins of the area	Ll	No Data Available
Ballyhoge Fm	Slates and siltstones-central portion of the area	L1	No Data Available
Newtown Fm	Grey-green greywasckes and slates-form the bedrock from the coast around Cahore Pt running SW to Taghmon		No Data Available
Ardenagh Fm	Grey-green greywackes with slate-to the east of the Ballyhoge Fm	P1	No Data Available
Cullenstown Fm	Grey-green metawackes and slates-form the bedrock to the SW of Wexford Harbour	P1	No Data Available
Cullentra Fm	Grey-green metawackes and slates-form the bedrock to the SW of Wexford Harbour	P1	No Data Available
Shelmaliere	White, purple quartzites and slates-form the bedrock to the SW of Wexford Harbour	P1	No Data Available
Ballymartin Fm	Limestones and calcareous shales-from the coast to the south of Wexford Harbour SW to Ballyteige Bay	Ll	No Data Available
Ballysteen Fm	Limestones and calcareous shales-from the coast to the south of Wexford Harbour SW to Ballyteige Bay	Rf	No Data Available
Wexford Fm	Dolomitised limestones and calcareous shales-from the coast to the south of Wexford Harbour SW to Ballyteige Bay	Regionally Important Aquifer	No Data Available
Greenore Pt Group	Amphibolites and shists-the oldest rocks in the SE region	P1	No Data Available
Kilmore Quay Group	Amphibolites and shists-the oldest rocks in the SE region	P1	No Data Available
Ballycogly Group	Metasediments-highly deformed	P1	No Data Available

Hydrometric Area 14			
Subsoil	**Comment**	**Aquifer Classification**	**Aquifer Vulnerability**
Marl	White sometimes shelly calcium carbonate found in the northwestern reaches of the catchment around Portarlington and east of Tullamore		
Lake Deposits	Fine silty alluvium in the northern portion of the catchment around Monasterevin		
Peat	Widespread in Co.Offaly and Co.Laois-blanket bog at Slieve Bloom and raised bog in low land areas with poor drainage.		
Alluvium	Around the flood plains of the River Barrow and associated tributaries		
Sand and Gravels	Sand and gravel deposits 10-20m thick with yields ranging between 400-1500m³/d in Daingean Co. Offaly and in South Laois and Carlow town along the River Barrow	Regionally Important	
Bedrock Formation	**Composition**	**Aquifer Classification**	**Aquifer Vulnerability**
Calp Fm	Dark, well bedded fine grained limestones and calcareous mudstones –central portion of the upper catchment	Ll	Moderate-High
Allenwood Fm	Poorly bedded coarse grained limestones-northwestern portion of the catchment	Rf	High
Edenderry Fm	Poorly bedded, oolitic limestone-northwestern portion of the catchment	Lm	Moderate
Lucan Fm	Well bedded fine grained limestones and calcareous mudstones-northwestern portion of the catchment	L1	Moderate-High
Cadamstown Fm	Medium to coarse grained pale coloured sandstones with red and green siltstones-bedrock of Slieve Bloom	Rf	Low-Moderate at the centre of the Fm, Extreme at the edges
Lower Lst Shales	Underlying the foothills of Slieve Bloom	Pu	Ranges from Moderate-Extreme
Waulsortian Fm	Pale grey, crystalline, fossiliferous fine grained limestone that is often dolimitised-central and north Laois	Ll-Rk	Moderate-High
Ballysteen Fm	Dark grey fine to coarse grained muddy limestone- in South Offaly and central and northern Laois	Pl	Low-High
Boston Hill Fm	Nodular and irregularly bedded limestones-NE of Area 14	Ll	Mainly High, Low at the centre of the Fm
Ballyadams Fm	Grey thick-bedded coarse grained fossiliferous limestone with thin clay layers-primarily found around Stradbally in Co.Laois	Rk	Low-Moderate at the north of the Fm, High-Extreme at the south of the Fm
Tullow Pluton	Granite-part of the Leinster Batholith.	PI	High
Maulin Fm	Dark grey-blue slate, phylite and schist-across the catchment from northeast to southeast	Ll	High-Extreme
Ballylane Fm	Green and grey slate with siltstone	P1	Extreme
Milford Fm	Varied limestone successions (partly dolomitised) dominantly coarse grained- extending from Kildare along the eastern margins of the catchment to Leighlinbridge in Co.Carlow	Regionally Important	Moderate-High
Butlersgrove Fm	Dark, grey argillaceous limestone	Rk	High-Extreme
Campile Fm	Rhyolites, rhyolitic tuffs and felsic volcanics-found in the SE of Area 14	Rf	No Data Available

Hydrometric Area 15			
Subsoil	**Comment**	**Aquifer Classification**	**Aquifer Vulnerability**
Marl	White sometimes shelly calcium carbonate material found in Offaly and South Tipperary		
Peat	Widespread in Counties Offaly and North and South Tipperary- blanket bog at Slieve Bloom and raised bogs in low land areas with poor drainage.		
Alluvium	Around the flood plains of the River Nore and associated tributaries		
Sand and Gravels	Sand and Gravel 10-20m thick are found at Roscrea in North Tipperary, The Nore Valley and Kilmanagh Aquifers in Co.Kilkenny, north, west and south of Camross in Co.Laois	Roscrea Gravel Aquifer: Rg Killeshin Gravel Aquifer :Lg Kilmanagh Aquifer: Rg	Roscrea Gravel Aquifer: H– L Killeshin Gravel Aquifer: High Kilmanagh Aquifer: High
Bedrock Formation	**Composition**	**Aquifer Classification**	**Aquifer Vulnerability**
Cadamstown Fm	Red and green siltstones and mudstones-bedrock of Slieve Bloom	Rf	High
Lower Lst Shales	Foothills of Slieve Bloom	Pu	Moderate
Ballyadams Fm	Grey thick-bedded coarse grained fossiliferous limestone with clay layers-lowlands to the south of Slieve Bloom	Rk	Moderate-High
Aghmacart Fm	Dark shaly micrite, peloidal limestone-to the NW of Slieve Ardagh extending from the southern foothills of Slieve Ardagh to the northern catchment boundary	Pl	Moderate-Extreme
Butlersgrove Fm	Dark, grey argillaceous limestone-SE of Kilkenny City around Bennetsbridge	Rk	Moderate-Extreme
Waulsortian Fm	Pale grey, crystalline, fossiliferous fine-grained limestone, often dolomitised-to the west of Slieve Ardagh around Rathdowney	Rk	Low-High
Ballysteen Fm	Dark grey fine to coarse grained muddy limestone-south of Slieve Bloom extending from north of Roscrea to the northern margins of the catchment in Co.Laois	Pl	High with patches of Low and Extreme Vulnerability
Porters Gate Fm	Devonian bedrock-south of the Ballysteen limestone around Thomastown	Rf	Low
Kiltorcan Fm	Devonian bedrock-south of the Ballysteen limestone around Thomastown	Rf	High-Extreme
Coolbaun Fm	Westphalian Coal Measure-core of the Castlecomer Plateau Syncline	Lm	Moderate at the centre of the Fm, Extreme at the edge
Bregaun Flagstone	Namurian Shales and sandstones-beneath the Coal Measures	Pl	Extreme with patches of Low Vulnerability
Kilsheelin Fm	Siltstones-beneath the Coal Measures	Rk	Extreme
Clogrenan Fm	Cherty bluish limestones–exposed along the margins of the Castlecomer Plateau	Rk	High-Extreme
Lickfinn Fm	Sandstone, shale, fireclay and coal seams-the core of Slieve Ardagh	Lm	Low-Extreme
Maulin Fm	Dark grey-blue slate, phyllite and schist-to the southern end of Area 15	Ll	High-Extreme
Ballylane Fm	Green and grey slates-to the southern end of Area 15	P1	Extreme
Oaklands Fm	Green, purple and red buff slate to the southern end of Area 15	Ll	Extreme

Hydrometric Area 16			
Subsoil	**Comment**	**Aquifer Classification**	**Aquifer Vulnerability**
Lake deposits	Fine silty alluvium, primarily in North Tipperary and Kilkenny		
Peat	Common in North Tipperary, also some peat deposits are found in West Waterford		
Alluvium	Around the flood plains of the River Suir and associated tributaries.		
Sand and Gravels	The Birdhill gravel aquifer extends from east of Silvermines in Tipperary to Co.Clare with an area of 38km². Other deposits occur along the River Suir and Lismore in Waterford and Newport along the Tipperary/Limerick border	Locally Important	
Bedrock Formation	**Composition**	**Aquifer Classification**	**Aquifer Vulnerability**
Cappagh White Fm	Red and white sandstones-northern margins of Area 16	Ll	High-Extreme
Kiltorcan Fm	Yellow and red sandstones and green mudstones-northern margins of Area 16	Rf	Extreme with small areas of Low
Galtymore Fm	Devonian thick-bedded pale red sandstones-western margins of Area 16 and foothills of the Knockmealdown Mountains	P1	Extreme
Inchacoomb Fm	Greywacke and dark green shale-western margins of Area 16		High-Extreme
Ballysteen Fm	Fossiliferous dark grey muddy limestones along the foothills of the Silvermines	L1	High-Extreme
Knockmealdown Fm	Medium grained pink-purple sandstones –the Knockmealdown Mountains	L1	High-Extreme
Waulsortian Fm	Massive unbedded limestone-underlies much of the northern portion	Rk	High
Aghmacart Fm	Dark shaly micrite, peloidal limestone-basin floor of the northern portion of Area 16	Pl	High
Ballyadams Fm	Grey thick-bedded coarse grained fossiliferous limestone with thin clay layers-lowland valley floors	Rk	Moderate-Extreme
Lagganstown Fm	Lowland valley floors	Pl	Moderate-Extreme
Ballindysert Fm	Grey slates and greywackes	L1	High-Extreme
Hollyford Fm	Sandstones and Shales	Pu	High-Extreme
Durrow Fm	Fossiliferous limestones, some oolitic, and shales	Pl	Moderate-High
Suir Fm	Pale-grey coarse limestones with shelly bands	Rk	Extreme with Moderate Vulnerability to the north of the Formation
Clogrenan Fm	Cherty bluish limestones–exposed along the margins of the Castlecomer Plateau	Rk	High-Extreme
Kilsheelan Fm	Siltstones-beneath the Coal Measures	Rk	Ranges from Low-Extreme
Hydrometric Area 17			
Subsoil	**Comment**	**Aquifer Classification**	**Aquifer Vulnerability**
Alluvium	Alluvial deposits are found around the flood plains of the Araglin, Brickey, Dalligan, Dunhill, Mahon and the Tay Rivers and streams.		
Clay and Tills	In coastal areas the Irish Sea till comprises a chocolate-brown calcareous matrix. Further inland the till varies from massive structure less stoney-sandy deposits to gravelly tills.	Not considered to be water bearing-of low permeability, they offer protection or confine underlying	

		bedrock aquifers	
Bedrock Formation	**Composition**	**Aquifer Classification**	**Aquifer Vulnerability**
Booley Bay	Dark grey to black mudstones and minor siltstones-between Tramore Bay and Waterford Harbour	Pl	High
Templetown Fm	Quartz conglomerates and minor sandstones	L1	High
Harrylock Fm	Red sandstones, siltstones and mudstones	L1	High
Campile Fm	Rhyolites, rhyolitic tuffs and felsic volcanics-much of the central portion of Area 17	Rf	High-Extreme
Bunmahon Fm	Basic to intermediate lavas, ash deposits (tuffs) and basic igneous intrusions-to the south of the Campile Fm	Rf	High-Extreme
Kilmacthomas Fm	Green and purple shales and siltstones- to the north of the Campile Fm	Rf	High
Croghan Fm	Quartz-rich pebbly conglomerates and coarse green pebbly sandstones-northern margins of Area 17	L1	Extreme
Coumshingaun Fm	Coarse boulder, cobble and pebble conglomerates with minor sandstone lens-at the foothills of the Monavullagh Mountains	L1	Extreme
Treanearla Fm	Thick-bedded conglomerates and conglomeritic sandstone-central and eastern parts of the Monavullagh Mountains	L1	Extreme
Sheskin Fm	Interbedded conglomeritic sandstone and sandstones-central and eastern parts of the Monavullagh Mountains	L1	Extreme
Kilnafrehan Fm	Silty mudstones-central and eastern parts of the Monavullagh Mountains	L1	Extreme
Knockmealdown Fm	Conglomerates and sandstones and yellow and white sandstones with interbedded purple mudstones-southwest portion of Area 17	L1	High-Extreme
Kiltorcan Fm	Yellow and red sandstones and green mudstones-southwest portion of Area 17	Rf	High-Extreme
Waulsortian Fm	Calcareous mudstones and coarser grained limestone-around the bay and extending west to the margins of the area	Rk	Moderate-High
Ballysteen Fm	Lower calcarenite beds overlain by silty muddy limestone-around the bay and extending west to the margins of the area	L1	Moderate-High
Gyleen Fm	Mudstones and sandstones-higher ground to the south of Dungarvan Harbour	L1	High-Extreme
Ballytrasna Fm	Pale, grey and red fine to medium grained sandstones-higher ground to the south of Dungarvan Harbour	L1	Extreme

3.7 Soils

The soils maps for the South Eastern River Basin District is presented in Map 3.9.

Soils Mapping

Teagasc are to prepare consistent national general soils and drift maps and identify sand and gravel boundaries.

The central plain and lowland areas of the South Eastern River Basin District are typically associated with well drained soils of medium texture. These soils have good moisture holding capacities and are good for tillage. The main soil associations encountered in the these areas include minimal grey brown

podzolics with associated, brown earths and basin peat and acid brown podzolics with associated gleys, regosols and podzols.

The upland areas are characterised by poorly drained soils. The main soil associations encountered in the upland areas include brown peaty podzolics with associated lithosols gleys.

The soil characteristics in the Slaney catchment are Grey Brown Podzolics and Brown Podzols. At the northern extremities there are peats present and in areas along the catchment boundary in Carlow and Wexford there are areas of Acid Brown Earths. Within the Barrow catchment Peats and Grey-Brown Podzolics dominate. The predominant soil types in the Nore catchment are gleys and grey-brown podzolics with smaller areas of brown podzolics. At the northern extremities there are peats present. The north-west of the Suir catchment has peat and rock outcrops with brown podzolics changing to gleys in the lower reaches. The north-east of the catchment is characterised by high levels of peat.

Table 3.7 General Soils by Association

Soil Type	Area km^2	% of South Eastern River Basin District
Grey Brown Podzolic	4212.7	33.1
Acid Brown Earth	3165.2	24.8
Gley	2495.3	19.6
Brown Podzolic	1537.9	12.1
Basin Peat	629.9	4.9
Peaty Podzol	349.5	2.7
Lithosol	151.7	1.2
High Level Blanket Peat	80.4	0.6
Peaty Gley	54.9	0.4
Podzol	39.8	0.3
Rendzina	2.0	0.0
Unclassified	21.3	0.2

Source: Teagasc

Grey-Brown Podzolics – Grey-Brown Podzols are generally formed from limestone parent material and are some of the most inherently fertile soils in the River Basin District. These well drained soils can be further sub-divided into light – medium textured or medium – heavy textured. The former represent good all-purpose soils and when appropriately managed are very productive. The latter are ideally suited to grassland but are also good tillage soils.

Acid Brown Earths – These are derived from parent material poor in lime or base-rich components and are, therefore, inherently acid. They can also develop on lime-rich parent materials under conditions conducive to excessive depletion of bases. Acid Brown Earths normally possess medium textures, a desirable structure and drainage characteristics, and a high degree of friability. They are generally good arable soils and with good management, they constitute high-quality grassland and are also ideally suited for a wide range of forest tree species.

Gleys – Gleys are soils where the effect of drainage impedance dominates and which have developed under conditions of permanent or intermittent waterlogging.

Brown Podzolics – Brown Podzols are generally formed from glacial till of predominantly sandstone-shale composition and are some of the most inherently fertile soils in the region. On account of their desirable texture, structure, drainage and friability, the Brown Podzolics are considered highly suitable for cultivating crops.

Peats – These soils in their undisturbed state are natural organic formations characteristic of the Central Plain of Ireland which have formed in depressed topography, on calcareous glacial drift (Conry et al., 1970). The soil type is always associated with excessively wet conditions. The land use range is very limited with rough grazing and meadows common and a large proportion of the uneven areas devoted to forestry.

3.8 Climate

The Irish Meteorological Service, Met Eireann, operates two synoptic stations within the South Eastern River Basin District. One station is located in Rosslare in the extreme south east of the river basin district and is generally representative of the coastal climatic conditions of the South Eastern River Basin District. The other synoptic station is situated centrally in the River Basin District in the Nore River Valley, two kilometres north of Kilkenny City. This synoptic station is generally representative of the wide river valleys in the South Eastern River Basin District.

Table 3.8 presents weather statistics from the Synoptic Station in the South East with other stations located in Ireland. The data are based on long term averages from 1961 to 1990. The data demonstrates that the Eastern and South Eastern Districts have lower long term averages in rainfall and higher sunshine duration than the rest of the country.

Table 3.8 Climatic Long Term Average Statistics

River Basin District	Observation Station	Temp (°C)	Relative Humidity (%)	Sunshine (Hr)	Rainfall (mm)	Wind (knots)
		Mean	mean at 0900UTC	mean daily duration	mean annual rainfall	mean annual speed
Eastern	Dublin Airport	9.6	82	3.9	732.7	9.9
South Eastern	Rosslare	10.1	84	4.33	877.1	11.5
South Eastern	Kilkenny	9.3	84	3.51	822.8	6.5
South Western	Valentia	10.4	83	3.39	1430.1	10.9
Shannon	Shannon	10.1	84	3.48	926.8	9.8
Western	Belmullet	9.6	83	3.5	1142.7	13.1
Northern	Malin Head	9.3	82	3.4	1060.6	16.3

Source: Met Eireann

There are 108 rainfall stations distributed throughout the South Eastern River Basin District. The rainfall stations location along with the long term average rainfall (1961-1990) are presented in Map 3.10. The rainfall ranges from 600 mm per annum to 1800 mm annually in the upland areas. Figure 3.6 demonstrates, using the long term average rainfall, that the west and north west of Ireland receives more rain than the dryer east and south eastern region.

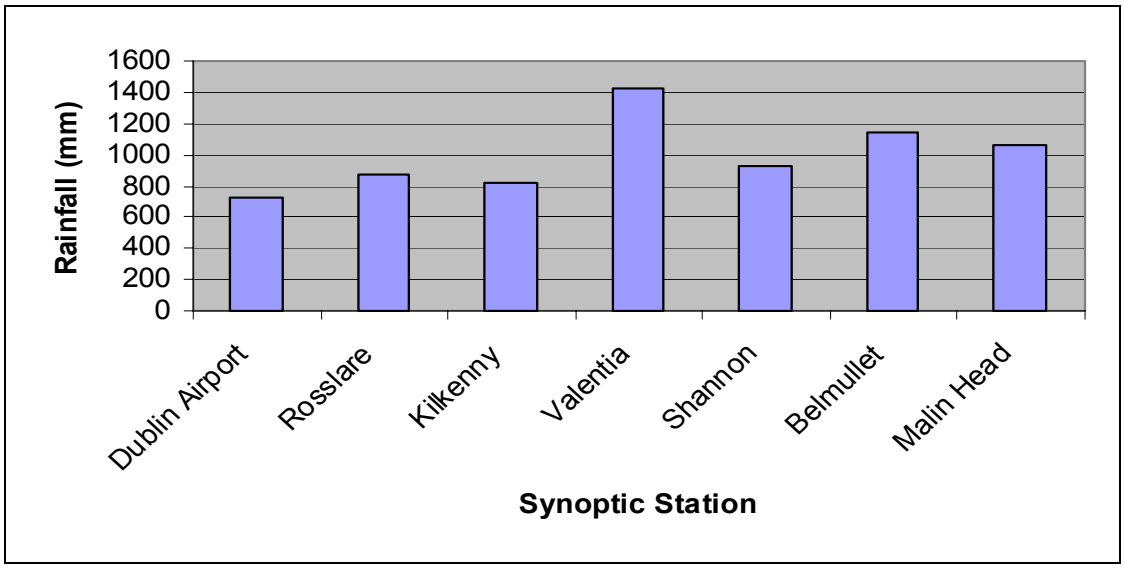

Figure 3.6 Long term averages for Rainfall across Ireland, Source : Met Eireann

Potential evapotranspiration data for the south east region has also been assessed, values range from approximately 75 mm from October to March and over 400 mm from April to September within the South Eastern River Basin District (Map 3.11).

The mean daily temperature is between 9.5 and 10.5^{o}C throughout the south east region. Generally the lowest average daily temperatures are recorded in January between 4.5 and 6.0^{o}C (with higher temperatures generally at coastal regions). The average daily temperature in July is over 15^{o}C throughout the region.

The prevailing wind is from the southerly to westerly sectors. This is demonstrated in the wind direction map produced by Met Eireann. The map shows the percentage frequency of wind direction with the circled number indicating the percentage of calm days.

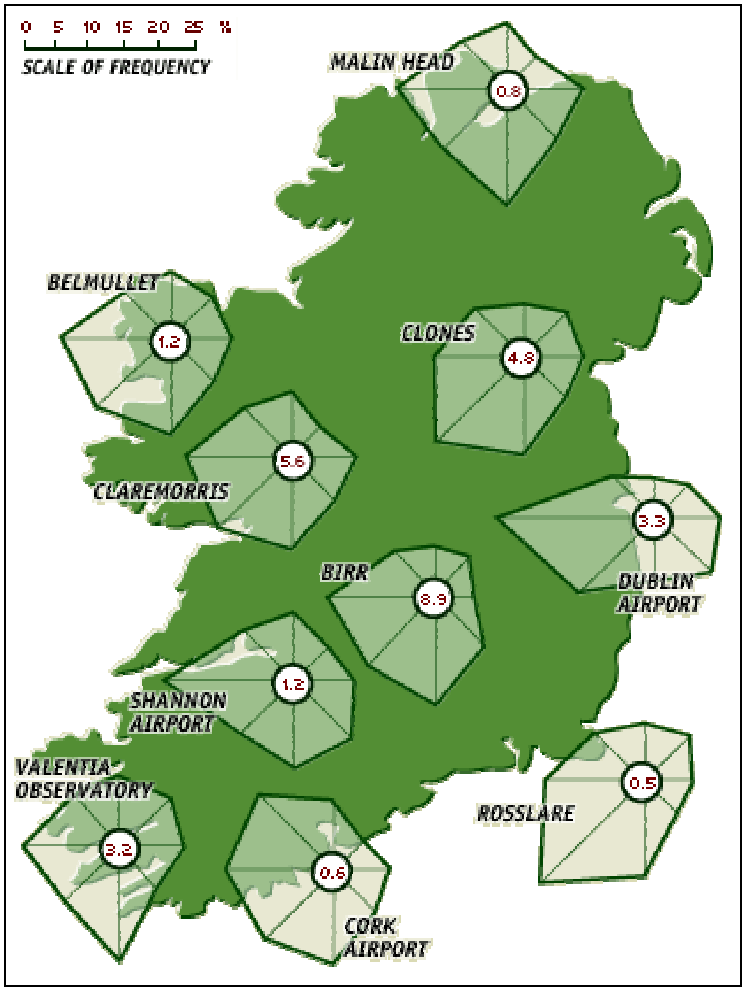

Figure 3.7 Wind Direction: Percentage frequency of wind direction, Source: Met Eireann

3.9 Water Resources

The Water Quality Management Plans for the Slaney, Barrow, Nore and Suir catchments presented analysis of hydrometric readings to estimate the long term average run off, 95% ile flow and dry weather flows of the main rivers and some of the principal tributaries at key population areas (Table 3.9 a – d).

Average outflow flow data calculated by EPA for each main basin is presented in Table 3.10.

The River Suir is the largest in the South Eastern River Basin District, and according to the available data the river discharge per unit area in this catchment is highest in the River Basin District at 21.3 l/sec/km^2. A similar rate of discharge per unit area was recorded in the River Slaney (21.2 l/sec/km^2). The higher discharge rates in these catchments are likely to be related to the catchment topography (mountainous) which results in a greater rainfall rate. The River Nore has a discharge per unit area of

17.0 l/sec/km^2. In the River Barrow basin the discharge per unit area is the lowest in the South Eastern River Basin District at 12.2 l/sec/km^2, which composes less than 60% of that in the River Suir.

Table 3.9 a Estimated Ninety Five Percentile and Dry Weather Flows at Towns in the Slaney Catchment

Town	River	Catchment (km^2)	Estimated 95 Percentile (m^3/s)	Estimated D.W.F. (m^3/s)	Specific D.W.F. (l/s/km^2)
Baltinglass	Slaney	165	1.4	0.6	3.6
Rathvilly	Slaney	192	1.6	0.68	3.5
Tullow	Slaney	260	1.8	0.78	3.0
Enniscorthy	Slaney	1325	4.4*	1.9*	1.4
Bunclody	Slaney	901	3.5	1.5	1.7
Wexford	Slaney	1860	7.8*	3.4*	1.8
Hacketstown	Derreen	63	0.04	0.017	0.3
Camolin	Bann	114	0.23	0.1	0.9
Ferns	Bann	161	0.3	0.14	0.9

*Freshwater Flow

Source: Water Quality Management Plans for the Slaney, Barrow, Nore & Suir catchments

Table 3.9 b Estimated Ninety Five Percentile and Dry Weather Flows at Towns in the Barrow Catchment

Town	River	Catchment (km^2)	Estimated 95 Percentile (m^3/s)	Estimated D.W.F. (m^3/s)	Specific D.W.F. (l/s/km^2)
Portarlington	Barrow	398	0.35	0.15	0.4
Monasterevin	Barrow	1096	1.47	0.8	0.7
Athy	Barrow	1592	3.5	1.6	1.0
Carlow	Barrow	2240	5.4	2.24	1.0
Portlaoise	Triogue	26	0.11	0.06	2.3
Leighlinbridge	Barrow	2374	5.5	2.4	1.0
Bagenalstown	Barrow	2415	6.5	2.4	1.0
Goresbridge	Barrow	2558	7.6	3.3	1.3
Graiguenamanagh	Barrow	2790	8.3	3.6	1.3
New Ross	Barrow	2964	15.0	7.0	2.4
Prosperous	Slate Trib	3	-	0	-
Kildare	Tully	10	0.12	0.05	5.0
Daingean	Phillipstown	34	0.07	0.03	0.9
Stradbally	Stradbally	81	0.16	0.07	0.9
Mountmellick	Owenass	91	0.05	0.02	0.2
Borris	Mountain	106	0.46	0.2	1.9
Rathangan	Slate	161	0.5	0.2	1.2

Source: Water Quality Management Plans for the Slaney, Barrow, Nore & Suir catchments

Table 3.9 c Estimated Ninety Five Percentile and Dry Weather Flows at Towns in the River Nore Catchment

Town	River	Catchment (km^2)	Estimated 95 Percentile (m^3/s)	Estimated D.W.F. (m^3/s)	Specific D.W.F. ($l/s/km^2$)
Borris-in-Ossory	Nore	111	0.13	0.07	0.6
Ballyragget	Nore	945	2.17	1.17	1.2
Kilkenny	Nore	1605	3.75	2.0	1.2
Bennettsbridge	Nore	1709	3.80	2.15	1.3
Thomastown	Nore	2276	4.0	2.87	1.3
Castlecomer	Dinin	141	0.21	0.11	0.8
Mountrath	Mountrath	45	0.11	0.05	1.1
Rathdowney	Erkina	129	0.25	0.13	1.0
Durrow	Erkina	387	0.75	0.40	1.0
Urlingford	Goul	43	0.07	0.04	0.9
Abbeyleix	Gloreen (Ballyroan)	37	0.10	0.05	1.4
Johnstown	Goul	82	0.13	0.07	0.9
Callan	King's	201	0.22	0.12	0.6

Source: Water Quality Management Plans for the Slaney, Barrow, Nore & Suir catchments

Table 3.9 d Estimated Ninety Five Percentile and Dry Weather Flows at Towns in the River Suir Catchment

Town	River	Catchment (km^2)	Estimated 95 Percentile (m^3/s)	Estimated D.W.F. (m^3/s)	Specific D.W.F. ($l/s/km^2$)
Templemore	Suir	154	-	0.05	0.3
Thurles	Suir	236	0.22	0.09	0.4
Beakstown	Suir	512	1.10	0.30	0.6
Cashel	Suir	895	3.41	0.90	1.0
Cahir	Suir	1588	6.05	3.20	2.0
Clonmel	Suir	2173	11.0	6.5	3.0
Carrick-on-Suir	Suir	2775	13.0	8.0	2.9
Tipperary	Ara	44	-	0.07	1.6
Portlaw	Clodiagh	124	-	0.30	2.4
Fethard	Clashawley	141	-	0.0	-

Source: Water Quality Management Plans for the Slaney, Barrow, Nore & Suir catchments

Table 3.10 OSPAR Riverine Inputs And Direct Discharges (RID) Study

	Annual Mean Flows (m^3/s)														
	EPA Catchment Area km^2	**Long Term Average (m^3/s)**	**Specific Long Term Average ($l/s/km^2$)**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
Avoca	652	20.2	31.0	17.3	19.2	15.3	24.4	18.6	15.1	20.2	19.3	25.4	20.4	24.2	20.2
Bandon	608	21.0	34.5	17.7	19.4	16.0	19.9	28.0	20.1	23.8	20.5	24.1	25.2	20.8	20.8
Barrow	**3067**	**37.4**	**12.2**	**38.5**	**40.8**	**32.9**	**52.8**	**60.2**	**NA**	**NA**	**40.1**	**52.3**	**43.5**	**50.4**	**38.4**
Blackwater	3324	89.1	26.8	79.3	76.9	69.0	91.5	106.5	90.5	93.4	85.7	94.9	90.1	91.1	62.8
Boyne	2695	38.8	14.4	40.7	42.9	38.5	48.6	52.3	46.5	41.3	35.6	52.2	45.6	48.2	28.2
Corrib	3138	104.8	33.4	109.8	109.8	121.6	114.0	94.6	NA	NA	85.1	119.4	109.9	113.3	79.0
Deel	486	7.5	15.4	7.0	6.6	6.7	6.8	8.6	7.7	6.7	7.2	8.5	7.9	8.8	5.7
Dodder	113	2.8	24.8	2.2	2.1	1.7	2.9	2.9	2.5	3.3	2.6	3.0	2.7	3.5	1.9
Erne	4372	101.7	23.3	110.7	99.1	118.4	100.7	121.6	111.0	90.9	83.5	130.5	130.5	122.3	75.9
Fergus	1042	18.7	17.9	22.6	21.3	22.6	19.7	28.7	24.0	16.8	16.8	23.8	23.2	22.6	14.0
Lee	1253	40.4	32.2	33.5	38.7	28.7	38.9	50.0	47.0	57.8	38.7	46.2	45.3	34.9	29.3
Liffey	1256	18.0	14.3	14.7	18.7	11.4	20.6	21.9	15.5	20.1	12.4	20.2	17.9	14.0	12.1
Maigue	1052	16.5	15.7	19.8	17.4	15.2	20.3	23.1	18.6	17.3	17.4	21.7	19.1	19.1	10.2
Moy	2086	61.5	29.5	67.6	66.1	73.3	66.4	75.1	58.6	44.8	48.7	73.6	77.9	74.5	49.9
Nore	**2530**	**42.9**	**17.0**	**40.3**	**41.8**	**33.4**	**48.5**	**48.5**	**43.7**	**52.2**	**44.9**	**51.9**	**40.6**	**48.0**	**33.5**
Shannon Oc				63.7	45.6	38.8	45.5	60.1	86.2	201.7	42.8	47.6	56.3	40.5	26.4
Shannon Tr	11628	208.1	17.9	147.1	166.8	169.5	161.3	196.9	130.5	164.5	159.1	201.0	184.5	127.3	127.3
Slaney	**1762**	**37.4**	**21.2**	**28.7**	**33.1**	**22.3**	**40.4**	**46.7**	**33.1**	**56.9**	**46.7**	**43.2**	**32.7**	**40.1**	**20.4**
Suir	**3610**	**76.9**	**21.3**	**71.6**	**74.2**	**63.2**	**88.3**	**100.9**	**81.3**	**81.2**	**77.5**	**88.0**	**70.3**	**78.1**	**58.2**
Tolka	146	1.7	11.6	1.6	1.7	1.5	2.3	1.8	NA	NA	NA	NA	NA	2.1	1.1

Table 3.11 Land Cover Trends within the South Eastern River Basin District

River Basin	Land Use Category	1990 % of Hydrometric Area	2000 % of Hydrometric Area	% increase/ decrease
East Wexford	Bogs	0		
	Marshes	0		
	Urban	0.7		
	Arable	18.2		
	Pasture	78.2		
	Forest	3.0		
	Water	0		
Slaney	Bogs	2.6		
	Marshes	0		
	Urban	0.7		
	Arable	24.8		
	Pasture	63.1		
	Forest	8.7		
	Water	0.2		
South Wexford	Bogs	0		
	Marshes	0.7		
	Urban	0.3		
	Arable	30.1		
	Pasture	66.0		
	Forest	2.3		
	Water	0		
Barrow	Bogs	7.4		
	Marshes	0		
	Urban	1.1		
	Arable	21.5		
	Pasture	61.9		
	Forest	7.9		
	Water	0.1		
Nore	Bogs	2.1		
	Marshes	0		
	Urban	0.7		
	Arable	11.5		
	Pasture	78.3		
	Forest	7.4		
	Water	0		
Suir	Bogs	4.1		
	Marshes	0.2		
	Urban	1.0		
	Arable	9.8		
	Pasture	73.4		
	Forest	11.4		
	Water	0.2		
South Waterford	Bogs	2.1		
	Marshes	0.3		
	Urban	1.1		
	Arable	12.6		
	Pasture	73.0		
	Forest	10.7		
	Water	0.2		
Total	Bogs	3.8		
	Marshes	0.1		
	Urban	0.9		
	Arable	16.6		
	Pasture	69.9		
	Forest	8.6		
	Water	0.1		

Source: CORINE 1990

3.10 Land Cover

The land cover with the South Eastern River Basin District produced as part of the Corine Land Cover 1990 project is presented in Map 3.11. A project is currently underway to process landcover images for 2000, the Project will also correct the classification of the 1990 Corine Image and provide a greater level of resolution and detail of land classification. The data for the basins within the South Eastern River Basin District are summarised in Table 3.11.

Land Cover Mapping
The Corine Land Cover image for 2000 will be made available by the EPA in Summer 2003.

3.11 Nature Conservation

Maps 3.13 to 3.15 show the sites/candidate sites designated as Natural Heritage Areas (NHA) (established under the Wildlife (Amendment) Act 2000), Special Protection Areas (SPA) (established under the Birds Directive), candidate Special Areas of Conservation (cSAC) (established under the Habitats Regulations) within the South Eastern River Basin District.

A register of the NHAs in the South Eastern River Basin District is presented in Register 3.15 and the SACs and SPAs are listed in Table 3.12. Appendix C presents a brief summary of protected flora and fauna species in the river basin district in particular highlighting key aquatic species.

There are seven listed wetlands under the Ramsar Convention within the South Eastern River Basin District. Under the Ramsar Convention wetlands which are recognized by the international community as being of significant value internationally in terms of ecology, botany, zoology, limnology or hydrology are listed. Ireland ratified the Ramsar Convention in 1985 and to date has designated 45 sites nationally. The seven Ramsar sites within the South Eastern River Basin District are Pollardstown Fen (Kildare), Slieve Bloom Mountains (Offaly/Laois), Dungarvan Harbour and Tramore Backstrand (Waterford), Bannow Bay, The Raven and Wexford Wildfowl Reserve (Wexford). All the Ramsar sites within the South Eastern River Basin District have overlapping cSAC or cSPA designations.

3.12 Protected Areas

Article 6 of the Water Framework Directive requires the establishment of a register of protected areas within each River Basin District by 2004. Protected sites include those which have been designated as requiring special protection under specific legislation for their surface water, groundwater or for the conservation of habitats and species directly depending on water (Annex IV) requires that the following type of protected areas are included.

a) Areas designated for the abstraction of Drinking Water i.e. bodies of water used for the abstraction of water for human consumption providing more than $10m^3$ per day or serving more than 50 people or intended for such future use.
b) Areas designated for the protection of economically significant aquatic species.
c) Bodies of water designated as recreational waters, including areas designated as bathing waters under Directive 76/160/EEC.
d) Nutrient-sensitive areas, including areas designated as vulnerable zones under the Nitrates Directive 91/676/EEC and under the Urban Waste Water Directive 91/271/EEC.
e) Areas designated for the protection of habitats and species where the maintenance or improvement of the status of water is an important factor in their protection, including relevant Natura 2000 sites designated under the Habitats Directive 92/43/EEC and the Birds Directive 79/409/EEC.

Table 3.12 identifies the National legislation corresponding to the European legislation listed above and the protected areas within the South Eastern River Basin District. There is currently no existing National legislation which designates areas for the abstraction of Drinking Water as Protected areas.

National legislation designating areas for the protection of economically significant aquatic species includes the European Communities (Quality of Salmonid) regulations 1988 (S.I. No. 293 of 1998) and the European Communities (Quality of Shellfish water) regulations 1994 (S.I. No. 200 of 1994) as amended by regulation S.I. No. 459 of 2001.

These regulations give effect to Council Directive on the quality of fresh waters needing protection or improvement in order to support fish life (78/657/EEC) and Council Directive on the quality required for Shellfish Waters (79/923/EEC)

Three of the 34 Salmonid waters designated Nationally are within the South Eastern River Basin District and these include the Aherlow, the Nore and the Slaney. The fresh waters specified in the Salmonid regulations are capable of supporting salmon (*Salmo salar*), trout (*Salmo trutta*), char (*Salvelinus sp.*) and whitefish (*Coregonus sp.*) for the purposes of the regulations.

There are currently 14 National shellfish water designations. Bannow Bay, County Wexford is only shellfish water designation in the South Eastern River Basin District.

Protected Areas

The EPA are currently establishing a register of Protected Areas in Ireland and the Project will assist with developing the register at river basin district level.

The EPA have commissioned a study to identify protected areas dependent on groundwater bodies.

A national programme of action under the Nitrates Directive is being prepared by the DELG.

Table 3.12 Register of Protected Areas

Protected Areas as required by the WFD (Article 6)	Reference to Existing National Legislation	Current Status in SERBD
Areas designated for the Abstraction of Drinking Water	Drinking Waters (Section 9 of the Water Pollution Act–Local Authorities to establish and maintain a register of abstractions	Offaly Co Co has included protected drinking water sources within its Byelaws
Areas designated for the protection of economically significant aquatic species	Salmonid Waters (S.I. No. 293 of 1988)	River Aherlow River Slaney River Nore
	Shellfish Waters (S.I. No. 2000 of 1994)	Bannow Bay
Recreational Waters	Bathing Water (S.I. No. 155 of 1992) & Amendments regulations.	The North Beach at Ballymoney The North Beach at Courtown The Beach at Curracloe (White Gap) The Beach at Duncannon The Beach at Morriscastle The Beach at Rosslare Strand The Beach at Ardmore The Beach at Bonmahon The Beach at Clonea Dunmore Strand, Dunmore East Counsellors Strand, Dunmore East The Beach at Tramore
Nutrient Sensitive Areas	SI No.213 of 2003 EC (Protection of Waters Against Pollution from Agricultural Sources)	National Territory Designation.
	Urban Waste Water Sensitive areas (UWWT Regs. S.I. No. 254 of 2001)	**River Barrow** Downstream of Portarlington sewage outfall to Graiguenamanagh bridge **River Triogue** Downstream of Portlaoise sewage outfall to confluence with River Barrow **River Nore** Downstream of Kilkenny sewage outfall to Inistioge Bridge **River Suir** Downstream of Thurles sewage outfall to Twofold Bridge **River Suir** Downstream of Clonmel sewage outfall to Coolnamuck Weir **Slaney Estuary (Upper)** From Enniscorthy railway bridge to Macmine **Slaney Estuary (Lower)** From Macmine to Drinagh/Big Island **Barrow Estuary** From the Weir at Bahana Wood to New Ross Bridge **Suir Estuary (Upper)** From Coolnamuck Weir to Mount Congreve
Areas designated for the protection of habitats or species	Special Areas of Conservation S.I. No. 94 of 1997 EC (Natural Habitats) Regulations	**candidate Special Areas of Conservation (cSAC)** River Barrow and River Nore (2162); Slaney River Valley (781); Derreen River (2146);

Protected Areas as required by the WFD (Article 6)	Reference to Existing National Legislation	Current Status in SERBD
		Blackstair Mountains (770); Kilcarren-Firville Bog (647); Kilduff-Devils Bit Mountain(934) ; Ballynafagh Bog (391) ; Ballynafagh Lake (1387) ;Pollardstown Fen; (396) Rye Water Valley, Loughans;(1398) Galtee Mountains;(646) Long Derries;(925) Slieve Bloom Mountains;(412) Ballyhack (695); Ballyteigue Burrow (696); Bannow Bay (697); Carnsore point (2269); Hook Head (764); Kilmuckridge-Tinnaberna sandhills (1741); Kilpatrick sandhills (1742); Ladys Island lake (794); Long Bank (1161); Raven Point Nature reserve (710); Saltee Islands (707); Screen Hills (708); Tacumshin Lake (709); Cullahill Mountain (831); Lower River Suir (2137); Spa hill and Clomantagh Hill (849); Loughans (401); Ballyprior Grassland (2256); Clonaslee Eskers & Derry Bog (859); Lisbigney Bog (869); Mountmellick – disused stretch of Grand Canal (2141); Aherlow River (2133); Anglesey Road (2125); Moanour Mountain (2248); Multeen Mountain (2248); Ardmore Head (2123); Comeragh Mountains (1952); Nier Valley woodlands (668); Tramore Dunes and Backstrand (671); Waterford Harbour (787); Tomnafinnoge Wood (1852); Wicklow Mountains (2122); Hugginstown Fen (404); Galmoy Fen (1858); Thomastown Quarry (2252); Helvick Head (665); Glendine Wood (2324); Cahore Polders and Dunes (700); Holdenstown Bog (1757).

Protected Areas as required by the WFD (Article 6)	Reference to Existing National Legislation	Current Status in SERBD
	Special Protected Areas S.I. No. 94 of 1997 EC (Natural Habitats) Regulations	**candidate Special Protection Areas** The Raven (4019) Wexford Nature Reserve (4001) Wexford Harbour (4076) Bannow Bay (4033) Ballyteigue Burrow (4020) Lady's Island Lake (4009) Tacumshin Lake (4092) Inish and Sgarbheen (2 designations) (4010) Keeragh Islands (4118) Saltee Islands (18 designations) (4002) Tramore Back Strand (4027) Dungarvan Harbour (2 designations) (4032) Helvick Head Coast (4112) Wicklow Mountains (4040)